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Study on General Exploration and Soil Remediation Scheme of High Standard Farmland Construction Project

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Abstract

Due to the impact of crop planting structure and habits on the nutrient content of soil, the number and population structure of microorganisms will also be damaged, resulting in certain damage to the quality of cultivated land. By taking effective measures to improve the soil condition and promote the sustainable development of local agriculture, it can provide more powerful support and guarantee for the local socio-economic development. Starting from the purpose and task of soil general exploration, this paper analyzes the layout methods of sample points for soil general exploration, and puts forward suggestions for soil remediation, with a view to providing necessary reference for the construction of high standard farmland projects.

Keywords

Agriculture; High Standard Farmland; General Soil Exploration; Repair.

1. Introduction

Agriculture is an important economic industry. However, due to poor farming practices such as continuous cultivation of the same crop and the high use of chemical fertilizers, the nutrient content of the upper soil is gradually unbalanced, and the number and population structure of microorganisms are also being damaged. At the same time, the problem of pesticide residues is gradually becoming serious. These problems have had a negative impact on the yield and quality of crops, leading to a decline in local agricultural income and constraints on social and economic development. In this situation, the low speed development of social economy cannot provide sufficient economic foundation for the development of local modern agriculture. The healthy development of local agriculture is crucial to the local socio-economic development. By taking effective measures to improve the soil condition and promote the sustainable development of local agriculture, it can bring better development prospects for local agriculture, as well as provide stronger support and guarantee for the local socio-economic development.

2. General Exploration Engineering Design

2.1 Purposes of General Exploration

Based on the scientific principles of land engineering, and in accordance with relevant national, provincial, and local plans, standards, and specifications, conduct a comprehensive, scientific, and accurate survey of the project area, analyze the obstacles to the improvement of soil quality in the project area, and combine the characteristics of water, soil, and fertilizer resources to develop targeted farmland quality restoration plans to improve the quality of farmland and lay the foundation for the construction of high standard farmland in the project area.

2.2 Task Requirements

The general exploration project is mainly to investigate and collect relevant natural, geographical, agricultural and other related data in the project area, and focus on on-site survey and sampling

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analysis of the soil and water quality foundation in the project area, to analyze the obstacles existing in the improvement of soil quality in the project area. Cooperate with more than 40 kinds of detection equipment such as soil nutrient monitor, water quality parameter tester, handheld soil pH meter, handheld soil conductivity meter, and portable soil compactness meter configured on the independently developed mobile experimental vehicle (ZL 2013 2 0843423.0) to test and analyze the soil quality in the project area, and conduct environmental monitoring on the temperature, humidity Implement online monitoring of wind speed, etc., and transmit the data back to the big data center for archiving.

3. Sample Point Layout

Layout principle of surface sample points: According to the Technical Code for General Exploration of Land Engineering (DB61/T1322-2020), 1 sample point is arranged per 300 mu, and a total of 106 sample points are arranged for preliminary exploration. Collect one soil sample at a depth of 0-20 cm at each sampling point, investigate the effective soil layer thickness, organic matter content, and other soil background properties in the project area, and estimate and analyze the potential for productivity improvement. Layout principle of profile points: Divide typical areas according to the soil type and cultivated land utilization type in the project area. Set one profile point in each area to investigate the soil profile configuration in the project area and determine whether there is an obstacle layer in the soil. If the landform in the area is complex, the section points can be added according to the actual situation; The selection of profile points requires relatively stable soil development conditions, that is, an environment conducive to the development of the main characteristics of the soil. Generally, the terrain is required to be flat and stable, and the soil profile is representative within a certain range; It is not suitable to excavate profiles at roadside, residential buildings, construction sites, ditches, and other places prone to human disturbance.

In the project area, there is only one soil type: yellow soil, and two types of cultivated land use (dry land and irrigated land). In combination with the above layout principles, this preliminary exploration is to arrange one profile point. Water sample layout principle: When arranging surface water, avoid dead water areas, backwater areas, and sewage outlets, and try to set it on straight river sections. Select locations with stable riverbed, stable water flow, wide water surface, no rapid flow or shallow beach, and convenient for sampling. The layout density of groundwater sampling points should be determined based on hydrogeological conditions, groundwater movement rules, and pollution levels. In principle, there should be sufficient coverage to reflect the quality status and characteristics of the groundwater environment in the region. During on-site sampling, if pollution sources are found, sampling points for rivers and groundwater should be appropriately increased.

According to the survey and in combination with the actual situation in the project area, a soil drill was used for drilling and sampling. The diameter of the drilled hole is 60 mm. After reaching the target depth, take out the soil column soil from the sampler, collect undisturbed soil for volatile organic compounds determination, and place other samples above the mulch film at the corresponding depth. For measuring heavy metal samples, try to use bamboo chips or knives to remove some of the soil in contact with the metal sampler, and then use it for sampling. The weight of each soil sample should be controlled at about 2-3 kg. If the sample is heavy, the excess soil sample can be discarded by using the quartering method one by one. If it is a thin mud sample such as paddy soil or lake marsh soil, place the collected sample in a plastic basin, stir it evenly, and then discard the excess amount and put it into a sample bag. The sample bag can be used as a plastic bag (for the determination of inorganic compounds) or placed in a glass bottle (for the determination of semi volatile organic compounds). Observe the soil layer structure at different depths on site to determine whether there are signs of pollution. Obtain soil layer samples at corresponding depths according to the layout design and send them to the laboratory for quantitative analysis.

During soil sampling, soil disturbance shall be minimized to ensure that soil samples are not subject to secondary pollution during the sampling process. When collecting heavy metal samples, collect undisturbed soil samples. After the soil samples are collected, use a 250 mL glass bottle to collect them. After filling and compacting, tightly cover the bottle cap, and then seal the threaded connection of the bottle mouth with a polytetrafluoroethylene sealing tape. Before sampling, coat the wooden shovel with a disposable plastic bag. After taking a point sample, replace the plastic bag at any time to ensure that soil samples do not contaminate each other. When collecting VOCs samples, use a VOC handheld tube to collect undisturbed samples, and place them in a 40 mL brown glass bottle pre filled with 10 mL methanol solvent. Close the bottle with a polytetracyanoethylene sealing gasket and seal it with a polytetrafluoroethylene film.

When collecting SVOCs samples, use a stainless-steel shovel to collect undisturbed soil samples, and transfer the collected samples to a clean 250mL brown wide-mouth glass bottle. During soil sampling, reduce the exposure time of soil samples in the air and try to fill the entire space with samples. After the collection is completed, the bottle cap is tightly sealed with a polytetrafluoroethylene sealing gasket, and then sealed with a polytetrafluoroethylene film. A sample label shall be provided inside and outside all samples, recording the following information: number, name, sampling depth, sampling location, sampling date, sampling person, etc.

4. Repair Suggestions

4.1 Optimization of Soil Texture in Cultivation Layer

According to the general exploration results, such as soil structure leakage, fertilizer leakage, and poor stability in the project area, based on the general exploration results such as field survey, profile observation, sample testing, and other physical methods such as guest soil and compound tillage, the mechanical composition of the cultivation layer is adjusted to adjust the texture of the cultivation layer in the project area to loamy sandy soil to clay loam soil.

4.2 Optimization of Soil Profile Structure in Tillage Layer

If there are problems in the project area such as deep plow bottom and compacted soil, it is recommended to adopt deep loosening and reasonable fertilization to solve them. The surface soil (arable layer) of the cultivated land in the project area is deeply loosened by mechanical means, with a depth of 23 to 50 cm. The unit weight of each layer of soil is reasonably controlled. The unit weight of the upper layer (0 to 20 cm) is 1.1 to 1.3 g/cm^3, and the unit weight of the lower layer (>20 cm) is 1.3 to 1.5 g/cm^3. Finally, an excellent soil structure with a virtual upper layer and a solid lower layer and stable structure is constructed. On the basis of deep loosening to adjust soil bulk density and increase soil porosity, it can be combined with basal application of 20~40 kg/mu soil structure improver to effectively loosen the soil, increase soil aggregate structure, break soil compaction, improve soil water and fertilizer retention capacity, promote crop root growth, and improve crop cold and drought resistance.

4.3 Effective Soil Layer Thickness Restoration

If there are problems such as uneven soil layer thickness and poor soil structure stability in the project area, it is recommended to conduct thickness remediation for areas with uneven soil layer thickness in fields using general exploration results such as ground penetrating radar, remote sensing images, aerial photo interpretation, and field surveys. During the renovation of the project area, it is recommended to peel off the topsoil layer by 25 cm and store it separately inside the fields. Carry out layered soil covering treatment according to the design soil thickness, compact the bottom fill after completion, and then backfill the stripped topsoil to maintain the soil quality of the cultivation layer unchanged. During soil backfilling, in order to ensure the structural stability of the soil and the fertility and water storage characteristics of the soil layer, it is recommended that the thickness of the soil layer be not less than 50 cm.

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5. Post Monitoring and Management

In view of the possible lack of late management and protection of farmland quality in the project area, it is recommended to continuously monitor farmland quality to ensure that long-term management and protection mechanisms are implemented for high standard farmland construction projects.

(1) Targeted long-term positioning monitoring points shall be set up, and regular surveys shall be conducted by means of field survey and profile observation, as well as long-term tracking of soil physical and chemical properties and crop growth status in the project area through sample testing and remote sensing monitoring;

(2) In subsequent production, it is recommended to increase the intensity of returning straw to the field, popularize the use of farm manure and organic fertilizer, improve the content of soil organic matter, inhibit soil hardening, and control soil acidification, salt destruction, pollution, and other issues;

(3) Encourage the implementation of a combination of planting and breeding to achieve the recycling and utilization of nutrients within the ecosystem, and provide protection for the sustainable management and healthy development of cultivated land in the later stage;

(4) It is recommended to use the land engineering big data platform to store and manage the monitoring data of high standard farmland projects, establish an evaluation index library and method library, and establish a dynamic evaluation system for the benefits of high standard farmland construction, providing effective reference for the promotion and application of the later model.

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