

Discussion on Technical Measures for High Standard Farmland Construction

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Abstract

The construction of high-standard farmland is an important measure to improve the quality of cultivated land and ensure the national grain. In this context, this paper discusses the concept, connotation and objectives of high-standard farmland construction through the literature method and combined with years of experience in high-standard farmland construction engineering technology, summarizes the technical points of high-standard farmland construction, and looks forward to the development trend of high-standard farmland construction technology in China in the future, in order to provide methods and references for China's high-standard farmland construction.

Keywords

High Standard Farmland; Construction; Goals; Technical Points; Development Trend.

1. Introduction

Low-standard agricultural land is the product of the current mode of extensive land resource management and utilization. It is a type of agricultural land formed due to lagging planning, unfavorable regional management measures, illegal occupation, relocation, etc. The specific characteristics of this type of agricultural land are: low land utilization rate, low degree of intensification, lagging supporting facilities, unreasonable industrial structure planning, serious pollution, etc. [1]. With the acceleration of social and economic development and urbanization, the demand for construction land is increasing day by day, and the quantity and quality of cultivated land are faced with serious challenges [2]. In order to ensure national food security and coordinate economic and social development with sustainable and efficient agricultural development, it is increasingly urgent for low-standard agricultural land to become high-standard farmland, and high-standard farmland construction is the product of this demand. The transformation of low-standard agricultural land into high-standard farmland will be conducive to the optimal allocation and rational utilization of land resources, and promote the transformation of land from extension to connotation and potential exploitation, and take the road of economical and intensive use of land, which has important theoretical value and practical significance.

The construction of high-standard farmland is a major decision made after China has acquired the basic output function after a long period of basic transformation of medium and low-yield farmland and farmland infrastructure construction, and it is a situation in which China's

economic structure, economic aggregate and grain production level have undergone qualitative changes. In order to meet the needs of agricultural modernization, major changes have been made to the land output model of major grain-producing areas in China [3]. At present, the average equality of cultivated land in China is low, and the basic farmland demarcated according to the actual situation of high protection rate of basic farmland cannot be all excellent and high-grade land. Only through land improvement projects such as the construction of high-standard basic farmland can most of the cultivated land meet the requirements of high and stable yield. The construction of high-standard basic farmland is the focus of current research on cultivated land protection, a major measure to promote sustainable agricultural development, and an important systematic project to ensure food security, accelerate the development of modern agriculture and promote the construction of new countryside under the new situation. According to statistics, from 1999 to 2010, the country built 13 million hm² of high-standard basic farmland through land renovation, and added about 3.4 million hm² of cultivated land, which increased the yield of farmland by 10% to 20% and significantly improved agricultural production conditions [4].

At present, the construction of high-standard farmland is a new field of concern in Chinese academic circles. Many scholars have done a lot of research in the fields of basic farmland protection and farmland remediation, and the results have provided theoretical support and methodology reference for the construction of high-standard farmland. According to the characteristics of high-standard basic farmland remediation in China, the current basic theoretical research on high-standard basic farmland remediation mainly focuses on guiding its development direction [5,6], and there is still a lack of basic theoretical research with technical guidance. In view of the problems in practice, it is of great significance to strengthen the basic theoretical research of the construction project of high-standard basic farmland and establish and perfect the engineering technical support system for the construction of high-standard basic farmland. Therefore, the author believes that in the future, in the study of the basic theory of high standard basic farmland regulation, we should strengthen the study of high standard basic farmland regulation technology.

2. High Standard Farmland Construction Content

High-standard farmland refers to the agricultural land built in a certain period of time through the rectification of rural land, which is water-saving, high-efficiency, high-yield and stable yield, strong disaster resistance, good ecology, supporting facilities, and compatible with modern agricultural management mode and production. The objectives of high standard agricultural land construction include increasing the effective arable land area and improving the quality of agricultural land; Improve the field infrastructure construction, steadily improve the comprehensive grain production capacity; Strengthen the construction of ecological environment, give full play to the integrated functions of production, ecology and landscape, and ensure good use and harmonious coexistence [7]. The construction of high-standard farmland is the concentrated embodiment of the construction of high-standard agricultural land, which is an important measure and method for China's cultivated land protection to realize the transformation from quantity protection to quantity, quality and ecological protection. It is also an innovation in the cultivated land protection system under the new situation, which lays a solid foundation for ensuring national food security.

High-standard farmland construction is the comprehensive treatment of rural land fields, roads, forests, mountains and water, so that the field supporting infrastructure in the treatment area can be comprehensively improved and improved, and the basic requirements for the development of modern agriculture can be reached or basically achieved. The construction of high-standard agricultural land includes land leveling project, field integration project,

drainage and irrigation project, road and field infrastructure construction project, farmland protection and ecological environment protection project. High-standard agricultural land construction requirements should be scientific and reasonable to carry out the construction of various projects, reasonable layout of farming plots, to achieve complete field infrastructure, to meet the needs of field management and agricultural mechanization, large-scale production. The service life of the infrastructure after the completion of agricultural land should not be less than 15 years, and the quality should reach the higher level of the county where it is located [8].

3. Technical Measures for High Standard Farmland Constructio Projects

3.1. Land Leveling

Land leveling is the main engineering and technical measures for the construction of high-standard farmland. It is an engineering measure for soil capacity maintenance and field construction to meet the needs of modern farmland cultivation, protection, irrigation and drainage, including soil capacity maintenance engineering and tillage field construction engineering (field length, width, direction, shape, height difference, etc., to meet certain standards). It is necessary to carry out reasonable planning and layout of the fields, so that the farming fields can be relatively concentrated and connected, so as to facilitate irrigation and mechanization operation. Through the analysis of high standard farmland construction standards, it is concluded that natural factors, social and economic factors and physical and chemical properties of soil affect land formation engineering, including the thickness of effective soil layer, surface soil texture, soil organic matter content, soil pH value, slope, terraced status, etc. Social and economic factors related to it include land utilization rate, field regularity, and field fragmentation [9].

The factors affecting the formation of paddy field include soil layer thickness, field elevation difference and so on, including strip field construction and field ridge merging. Field merging is mainly to cut and bend the adjacent fields of the same table to straighten, repair or cut the field back to the field, the field construction needs to be carried out according to local conditions. In principle, the horizontal terrace only merges and plows the adjacent fields on the same table surface, and does not carry out large-scale field leveling for paddy fields. The main measures are to repair the collapsed ridges, cut and straighten the ridges, reduce the ridges with a wide area to return to the field, and merge the corner lands and small fields [10].

Other agricultural land includes dry land, irrigated land, including slope and ridge leveling, such land has been formed by farmers in the long-term cultivation process, according to the basic farmland, vegetable base, standard orchard planting requirements, moderate slope and ridge, can achieve field leveling. The sloping land with a land slope of $5^{\circ} \sim 25^{\circ}$ is suitable for terracing, and the terracing rate should reach 90% or above. The surface height difference in the irrigated land is less than ± 5 cm, which is conducive to irrigation and mechanization [11].

In the dry land, the slope transformation technology is adopted. The 20cm thick topsoil layer of the original slope farmland is first peeled off, and then the field ridge is built. The design standard of the field ridge is designed according to the 6-hour maximum rainstorm once in 10 years. The field sill is mainly made of earth sill, which is rammed with clay, and some areas prone to collapse are made of stone sill, which is laid on hard soil. The field sill is flat with the surface of dry land after leveling, and the soil is relaxed by blasting in the areas where the slope soil moves, the excavation is high and the filling is low, and the soil layer is thin. After finishing, the direction of the field is basically parallel with contour lines, and rectangle or trapezoid is the best, followed by ring or fan. After leveling, the thickness of soil layer ≥ 80 cm, and the thickness of effective soil layer ≥ 40 cm.

3.2. Cultivation Layer Quality Improvement

If the soil in the region is dominated by coarse yellow soil and belongs to limestone soil, the soil fertility level of this kind of soil is moderate or lower, and the nutrient element is often missing in agricultural production. Therefore, the increase of organic fertilizer and balanced fertilization, supplemented by necessary field drainage and irrigation facilities can be improved. If the region has more clay and poor drainage, resulting in difficult cultivation and poor soil permeability, the soil pH is low and there are different degrees of deviation. Therefore, it can be improved by using the guest soil method, increasing the application of organic fertilizer, and constructing field drainage and irrigation facilities [12].

3.3. Irrigation and Drainage

Irrigation and drainage engineering refers to various engineering measures taken to eliminate flood and drought disasters, regulate the water condition of farmland and the change of regional water conditions, and prevent farmland damage and saline-alkali disasters. According to the needs of agricultural production in the project area, farmland water conservancy facilities shall be constructed, including irrigation projects, water source facilities projects, spray/micro-irrigation projects, drainage projects, channels and field buildings projects, pumping stations and transmission and distribution projects. Irrigation is related to drainage engineering, irrigation scale, hydrological conditions, landform, soil type and so on. Due to the different ways of water storage, water diversion and irrigation and drainage, the method of storage, diversion, extraction and collection is adopted according to the actual needs. For the utilization of water resources, the exploitation of deep groundwater should be strictly controlled, and the use of untreated sewage for irrigation should be prohibited. Surface water should be the main use of water resources, with groundwater as a supplement. Based on the analysis of high-standard farmland construction standards, indicators related to irrigation and drainage engineering include irrigation guarantee rate and access index of waterlogging facilities [13].

3.4. Field Road Engineering

The field road project makes the life and production of residents convenient, and its main function is to connect the road between the field and the field, the settlement and the field. Field road engineering plays a major role in the maintenance of existing roads, followed by the use of new roads to connect the broken road and improve the road system, the road presents a "main - trunk - branch" network layout, mainly divided into production roads and field roads. The needs of agricultural operations determine the width of the field road, the width of the roadbed 4m~5m is appropriate, the width of the road is 3.5m~4.5m is appropriate, in order to facilitate the future consolidation of farming fields, the road material is generally mud bound gravel, according to the need to improve the level of road material, such as concrete pavement. The subgrade drainage system of the field road is combined with the surrounding ditch, channel and forest to protect the stability of the slope and subgrade. The width of the subgrade of the production road is 1.5m~3m, the road width is 1.5m~2.5m, the transverse time interval of the production road is between 100m~300m, the longitudinal time interval of the production road is between 200m~500m, and the plain soil pavement is generally used.

Through the analysis of high-standard farmland construction standards, it is found that the main index affecting field road engineering is field road access index, which refers to the ratio of the number of fields reached by field roads in the total number of fields when the cultivated fields are concentrated and contiguously. For plain areas, it should reach 100%, and for hilly areas $\geq 90\%$, and the field road density should be reasonably determined. Meet the needs of agricultural mechanization and convenience of production and life [14].

3.5. Farmland Protection Project

Farmland protection engineering is to protect the farming area from natural disasters and ecological protection engineering, related to soil, terrain, landform and other natural conditions, the main engineering measures for the construction of berm, slope repair ditch and planting protection forest. The embankment engineering mainly refers to the embankment engineering which is easy to be washed by river and built to protect farmland, mainly to the reconstruction and reinforcement of old levees. Shelterbelt construction, when the slope of the cultivated land is not less than 25° , the farmland should be returned to forest, so as to reduce the surface runoff, protect the soil layer, and increase the water infiltration into the soil, which plays a role in conserving water sources. When the slope of the cultivated land is not less than 15° , planting grass should be implemented, the construction of shelterbelts next to the road, the use of a combination of fruit and forest on the mountainside, the use of trees on the top of the mountain, and the distance between the rows and trees is 2m. Slope in cultivated land $< 15^\circ$, roadside and field shelterbelts are mainly used, and the main afforestation belt is built on steep slopes and steep ridges, and the distance between rows and plants is 2m. High-quality tree species suitable for local planting should be selected to plant different tree species between fields, so that one kind of tree can be planted on one road, with two lines planted on the main road, and a single line planted on the side of the approach canal and the field production road, so as to form a mixed forest network and prevent the occurrence of crop diseases and pests [15].

4. Development Trend of High-Standard Farmland Construction Technology

4.1. Fine Land Leveling Technology

According to the land leveling requirements of high standard basic farmland, the land leveling technical requirements of different optimized fields were studied, the leveling elevation design methods of different optimized fields were established, and the process flow and methods of fine land leveling were determined. The process flow and method of topsoil stripping and backfilling of ripe soil are studied. The development of fine and smooth shovel, bulldozer, etc., to solve the current use of large construction machinery to smooth farmland caused by soil compaction and compaction phenomenon; The laser leveling technology for thin dew irrigation was studied, and the laser probe instrument combined with fine leveling bulldozer was developed. Establish a production base for fine farmland leveling and practical machinery and equipment [16].

4.2. New Materials for High-standard Farmland Remediation

In view of the lack of high strength, ecological materials and design and construction standards of field roads, the design, construction and acceptance specifications of field roads in different engineering types are studied. The ecological materials, the ecological design technology and the construction method of the field road are developed. Aiming at the problems such as low strength, short service life, poor water saving or drainage capacity of ditch engineering materials, high-strength, impermeable and environmentally friendly channel materials, finished product technology and finished product machinery are developed, applicable materials and life cycle of materials used in different climate types are studied, forms and structures of ecological channels are studied, and production bases for road ditch materials and finished products are established [17].

4.3. High-standard Farmland Conservation Technology

Aiming at the problems of poor water retention in some basic croplands, secondary salinization and low ripening degree of newly added croplands, soil water retention agents, moisturizers and highly absorbent resins that can adjust the function of soil water and fertilizer have been developed, engineering technologies such as alkali conversion in dark pipes and water and land saving have been studied, and new degradable materials and technologies have been developed for soil ripening and farmland landscape greening in different types of micro-differences [18]. To screen plants, varieties and cultivation methods suitable for farmland ecological conservation, put forward optimized technological processes and land conservation programs, and build high-standard basic farmland conservation engineering test bases and production bases, including materials, finished products, reagents and equipment, so as to improve the overall conservation capacity of high-standard farmland in China and enhance the sustainable use of high-standard farmland.

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