

Exploration into the Improvement of High Standard Farmland Quality Grades in Xi'an City

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Abstract

High standard farmland construction projects are a rare historical opportunity for economic and social development. Practice has proven that high standard farmland projects are a key measure for developing modern agriculture, increasing farmers' income, and promoting the construction of new rural areas. After the project is completed, it will play an important role in economic and social development and make outstanding contributions. This article combines the actual situation to study the quality level of high standard farmland in Xi'an, analyze the important factors for improving the quality level, and analyze the impact of evaluation indicators involved in the construction of high standard farmland, which has certain reference value for future high standard farmland construction.

Keywords

High standard farmland, Farmland quality, Grade evaluation.

1. Quality grade of cultivated land

1.1. Geographic location

Xi'an is located in the Guanzhong Basin in the central part of the Weihe River Basin, between 107.40 ° E and 109.49 ° E longitude and 33.42 ° N and 34.45 ° N latitude. It borders the Weihe River and the Loess Plateau to the north, and the Qinling Mountains to the south. To the east, bounded by the Zero River and Bayuan Mountains, it borders Huazhou District, Weinan City, Shangzhou City, and Luonan County in Weinan City; To the west, it is bordered by the Taibai Mountains and the Qinghua Loess Plateau, and shares borders with Meixian and Taibai counties; South to the main ridge of the North Qinling Mountains, bordering Foping County, Ningshan County, and Zhashui County; It stretches north to the Wei River, crosses the Wei River to the northeast, and is adjacent to Xianyang City, Yangling District, Sanyuan, Jingyang, Xingping, Wugong, Fufeng, Fuping and other counties. The jurisdiction is approximately 204 kilometers long from east to west and 116 kilometers wide from north to south, with a total area of 10108 square kilometers.

1.2. Topography and Geomorphology

The geological structure of Xi'an spans two major units: the Qinling orogenic belt and the southern margin of the North China Plate. About 130 million years ago, during the Yanshan Movement, the Qinling Mountains' northern foothills were crossed by the Great Fault. Since the late Tertiary period about 3 million years ago, the new tectonic movement in the Qinling orogenic belt south of the Great Fault has been extremely active, and the mountain has risen sharply from north to south, creating the Qinling Mountains. At the same time, the Wei River fault depression, which belongs to the North China Plate to the north of the major fault, continued to settle, forming the Wei River Plain under the combined action of wind blown loess cover and Wei River alluvial deposits.

2. Workflow

According to the "Evaluation Specification for High Standard Farmland Construction" (GB/T 33130-2016) and the "High Standard Farmland Construction Standard" (NY/T 2148-2012), the farmland plots within the project construction scope are used as evaluation units to carry out the evaluation of farmland grades for high standard farmland projects. One is data collection; Secondly, based on the collected basic information such as the administrative division map and land use status map of the project, sample points will be set up for on-site investigation and sample testing. Thirdly, utilize the national land resource relationship system to classify the quality levels of cultivated land and calculate the production capacity of cultivated land before and after construction. The fourth step is to inspect and verify the results of the farmland grading assessment in the project area, ultimately determine the farmland grading results, prepare a farmland grading assessment report for the project area, establish a farmland grading assessment layer, and draw a farmland grading distribution map. The detailed work steps are as follows: (1) Collect data; (2) Sample point layout, field site survey, and sample collection; (3) Soil sample testing; (4) Calculate the comprehensive index of cultivated land quality; (5) Classification of cultivated land quality levels; (6) Calculate the production capacity of cultivated land before and after construction; (7) Results verification; (8) Establish a database of cultivated land quality grades; (9) Create a level chart; (10) Information reporting; (11) Organize and submit the results.

3. Determination of evaluation indicators

The investigation and evaluation of the quality level of cultivated land in the 2022 high standard farmland construction project area in Xi'an City refer to the evaluation factors of cultivated land quality level, and the regional division is based on the national standard "Cultivated Land Quality Level" (GB/T 33469-2016). The first agricultural division of Xi'an City is the Loess Plateau area, and the second agricultural division is the Fenwei Valley agricultural area. According to the Notice on Conducting Quality Level Investigation and Evaluation of High Standard Farmland Construction issued by the Agriculture and Rural Department of Shaanxi Province (Shaanxi Agriculture Office [2021] No. 4) and the Notice on Conducting Quality Level Investigation and Evaluation of High Standard Farmland Construction issued by the Shaanxi Provincial Farmland Quality and Agricultural Environmental Protection Workstation (Shaanxi Farmland Environmental Protection [2021] No. 2), multiple factors such as terrain location, farmland forest network, altitude, effective soil layer thickness, texture configuration, plow layer texture, obstacle factors, soil bulk density, organic matter, available potassium, available phosphorus, pH, biodiversity, irrigation capacity, drainage capacity, cleanliness, etc. have been finally determined as evaluation factors for the 2022 high standard farmland construction project area in Xi'an City.

4. Obtaining and assigning evaluation units

Overlay and intersect the current land use status map (cultivated land), soil map, administrative division map, and high standard farmland project area map as the base map to form an evaluation unit. When overlapping images from different sources, the image spots may be segmented into small parts, resulting in small area spots. Merge small polygons to eliminate polygons with excessively small areas based on the survey accuracy of different scales.

According to the determined evaluation indicators, assign the attribute data of the cultivated land quality survey point map to the cultivated land resource management unit map. The indicators of acidity and alkalinity, organic matter, available phosphorus content, and available potassium content are assigned to the evaluation units through spatial interpolation and gridding; The altitude index is assigned by overlaying DEM raster maps; The texture configuration, effective soil layer thickness, and soil bulk density indicators are associated and assigned values using a soil type map; The terrain location indicators are assigned values by overlaying and merging with the landform type map.

5. Classification of cultivated land quality levels

Calculate the comprehensive cultivated land quality index for each evaluation unit using the cumulative method.

$$IFI = \sum (Fi \times Ci)$$

In the formula: IFI - Integrated Fertility Index; F_i - membership degree of the i -th evaluation factor; C_i - the combined weight of the i -th evaluation factor.

Based on the assigned arable land resource management unit chart, according to the standard of "Farmland Quality Grade" (GB/T 33469-2016), the comprehensive index of arable land quality is calculated using the accumulation method.

Based on the calculated comprehensive index of cultivated land quality, the cumulative frequency curve method is used to determine the grading standards, and the cultivated land quality is equally divided into 10 cultivated land quality levels in descending order. The higher the comprehensive index of cultivated land quality, the higher the level of cultivated land quality. First class cultivated land has the highest quality, while tenth class cultivated land has the lowest quality.

6. Discussion

6.1. Overall Improvement of High Standard Farmland Quality in Xi'an City from 2020 to 2022

The implementation scale of the high standard farmland construction project in Xi'an City from 2020 to 2022 is 263000 mu, and the actual construction area is 263945.19 mu. From 2020 to 2022, the average quality level of high standard farmland before construction was 3.09, and after construction it was 2.84, with an increase of 0.25 in farmland quality level. Before construction, the quality level of cultivated land was concentrated between first-class and seventh class. Among them, the first-class land area is 4930.01 acres, accounting for 1.87% of the total project area; The second-class land area is 87816.41 acres, accounting for 33.27% of the total project area; The third class land area is 78685.55 acres, accounting for 29.81% of the total project area; The fourth class land area is 67125.76 acres, accounting for 25.43% of the total project area; The fifth class land area is 22920.77 acres, accounting for 8.68% of the total project area; The sixth class land area is 2173.93 acres, accounting for 0.82% of the total project area; The final seventh grade land area is 291.78 acres, accounting for 0.11% of the total project area. After construction, the quality level of cultivated land is concentrated between first class

and sixth class. Among them, the first-class land area is 14773.81 acres, accounting for 5.60% of the total project area; The second-class land area is 105046.06 acres, accounting for 39.80% of the total project area; The third class land area is 64342.57 acres, accounting for 24.38% of the total project area; The fourth class land area is 66566.78 acres, accounting for 25.22% of the total project area; The fifth class land area is 12695.2 acres, accounting for 4.81% of the total project area; The sixth class land area is 520.77 acres, accounting for 0.20% of the total project area.

6.2. Improvement of High Standard Farmland Quality in Xi'an City in 2022

The 2022 high standard farmland construction project in Xi'an involves Lantian County, Lintong District, Yanliang District, and Chang'an District. The implementation scale is 78000 acres, and the actual construction area is 78635.15 acres. In 2022, the quality level of high standard farmland was 3.00 before construction and 2.62 after construction, with a 0.38 increase in farmland quality level. Before the construction of high standard farmland in Xi'an, the quality level of cultivated land was concentrated between first-class and seventh class. Among them, the first-class land area is 827.75 acres, accounting for 1.05% of the total project area; The area of second-class land is the largest, at 28307.88 acres, accounting for 36.00% of the total area of high standard farmland projects in Xi'an in 2022; It is a third class land with an area of 26264.59 acres, accounting for 33.40% of the total project area; The fourth class land area is 18105.86 acres, accounting for 23.03% of the total project area; The fifth class land area is 4179.26 acres, accounting for 5.31% of the total project area;; The sixth class land area is 658.12 acres, accounting for 0.84% of the total project area; The final seventh grade land area is 291.78 acres, accounting for 0.37% of the high standard farmland project area. Xi'an

6.3. Improvement of High Standard Farmland Quality in Xi'an City in 2021

The implementation project of high standard farmland construction in Xi'an in 2021 involves an area of 160310.16 acres of high standard farmland. The quality level of farmland before the construction of high standard farmland was 3.18, and after the construction of high standard farmland, the quality level of farmland was 2.98, with an increase of 0.20 in various evaluation parameters of farmland quality level. Before the construction of high standard farmland in Xi'an, the quality level of cultivated land was concentrated between first class and sixth class. Among them, the area of second-class land is the largest, at 52965.19 acres, accounting for 33.04% of the total project area in Xi'an city; Next is third class land, with an area of 43793.32 acres, accounting for 27.31% of the total project area; The fourth class land area is 43472.38 acres, accounting for 27.12% of the total project area; The fifth class land area is 18197.59 acres, accounting for 11.35% of the total project area; The sixth class land area is 1262.44 acres, accounting for 0.79% of the total project area; The first-class land area is 619.24 acres, accounting for 0.39% of the total project area. After the construction of high standard farmland in Xi'an, the quality level of cultivated land is concentrated between first class and sixth class. Among them, the area of second-class land is the largest, at 61653.02 acres, accounting for 38.47% of the total project area in Xi'an city; Next is fourth class land, with an area of 47305.96 acres, accounting for 29.51% of the total project area; The third class land area is 36873.53 acres, accounting for 23.00% of the total project area; The fifth class land area is 10090.80 acres, accounting for 6.29% of the total project area; The first-class land area is 4320.14 acres, accounting for 2.69% of the total project area. From the perspective of land use types, the evaluation area in Xi'an City consists of dry land, paddy fields, and irrigated land.

6.4. Improvement of High Standard Farmland Quality in Xi'an City in 2020

The implementation project of high standard farmland construction in Xi'an in 2020 covers a total of 25000 acres, involving three parts: Qinhan New City, Yanliang District, and Fengxi New City in Xixian New Area. The quality level of farmland before the construction of high standard

farmland in the early stage is 2.76, and the quality level of farmland before the construction of high standard farmland in the later stage is 2.64, with an increase of 0.12 in the evaluation parameters of farmland quality level. Before the construction of high standard farmland in Xi'an, the quality level of cultivated land was concentrated between first class and sixth class. Among them, the area of third class land is the largest, at 8627.71 acres, accounting for 34.52% of the total project area in Xi'an city; Next is second-class land, with an area of 6543.34 acres, accounting for 26.17% of the total project area; The fourth class land area is 5548.52 acres, accounting for 22.19% of the total project area. The first-class land area is 3483.02 acres, accounting for 13.93% of the total project area. From the perspective of cultivated land use types, there are no dry land or paddy fields in the evaluation area of Xi'an City, and all areas within the evaluation area are irrigated land. After the construction of high standard farmland in Xi'an, the quality level of cultivated land is concentrated between first class and sixth class. Among them, the third class land has the largest area, at 8573.2 acres, accounting for 34.29% of the total area of the Qinhan New City project in Xixian New Area, followed by the second class land, with an area of 6460.88 acres, accounting for 25.84% of the total project area. The area of fourth class land is similar to that of first class land, with 4857.03 acres and 4397.38 acres, accounting for 19.43% and 17.59% respectively. The areas of fifth and sixth class land are both less than 1000 acres. From the perspective of cultivated land use types, there are no dry land or paddy fields in the evaluation area of Xi'an City, and all areas within the evaluation area are irrigated land.

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