ISSN: 2710-0723

Analysis of the Current Situation of Medium and Low Yield Fields in China

Jing Zhang[1,2,3,4], Yanan Li[1,2,3,4]

[1] Shaanxi Provincial Land Engineering Construction Group Co.,Ltd., Xi'an, China

[2] Institute of Land Engineering and Technology, Shaanxi Provincial Land Engineering Construction Group Co.,Ltd., Xi'an, China

[3] Key Laboratory of Degraded and Unused Land Consolidation Engineering, the Ministry of Natural Resources, Xi'an, China

[4] Shaanxi Provincial Land Consolidation Engineering Technology Research Center, Xi'an, China

Abstract

The area of medium to low yield farmland in China is huge and widely distributed. As a strategic reserve farmland resource, it is of great significance for ensuring food security. This article systematically reviews the problems of declining fertility, organic matter content, and biodiversity in China's medium and low yield fields, and clarifies the focus on the development of ecological improvement materials in the future. This helps to explore the path to improve green, high yield, and efficient production capacity in low to medium yield fields, and promote the achievement of food security and sustainable development goals.

Keywords

Low Yield Fields; Present Situation; Analysis.

1. Introduction

The arable land area in China is 2.024 billion acres, with medium to low yield fields accounting for 68.76%[1,2]. As a strategic reserve arable land resource, enhancing the production capacity and ecological function of medium to low yield fields is an important measure to ensure national food security strategy. Scholars at home and abroad have conducted extensive research on the transformation of medium and low yield fields, mainly focusing on the interrelationships between land consolidation and local economic, social, ecological environment, and rural development. Since the 1980s, research on comprehensive land consolidation in China has gone through four stages: initiation, development, evolution, and extension. It has become a comprehensive platform and important lever for serving the top-level strategy of the country, coordinating modernization construction, ecological civilization construction, rural revitalization, and urban-rural integration[3,4]. At present, the improvement of the quality of medium and low yield farmland is more limited to engineering and technical attributes, mainly focusing on expanding the scale of farmland, improving the quality of farmland, optimizing village layout, and other material aspects. Therefore, it is urgent to clarify the research and development direction of biological improvement materials for improving medium and low yield fields from the perspective of land science, explore the application efficiency and technology of improvement materials, form engineering models and promote their application, and steadily improve the soil quality of medium and low yield fields.

ISSN: 2710-0723

2. Problem

In recent years, due to continuous high intensity utilization, imbalance in use and nutrition, imbalance in fertility, serious degradation, rational utilization of straw resources, agricultural non-point source pollution, water and soil loss and other reasons, China's cultivated land quality is facing severe difficulties. The area of cultivated land degradation accounts for more than 40% of the total area of cultivated land, the black soil layer in the east and north is thinner, the soil in the south is acidified[5], the cultivated layer in the North China Plain is shallower[6], and the problem of farmland salinization and desertification in the northwest is prominent[7]; Especially in Shaanxi Province, there are various challenges such as decreased fertility, decreased soil organic matter content, decreased biodiversity, and soil texture damage. ; Rena et al.[8] analyzed the effects of different returning materials on soil water storage, nutrient content, plant height, corn yield, and water use efficiency, and measured the most suitable returning materials for improving summer corn farmland in hollow villages on the Loess Plateau; Huang Yunxin et al.[9] preliminarily demonstrated that soil layer mixing is a feasible and rapid method for creating high-quality soil; Liu Yansui et al.[10] conducted geographical engineering experiments and optimized soil fertility improvement technologies for high-quality agricultural development in the loess hilly and gully region as an example. From this, it can be seen that domestic and foreign scholars have conducted research on soil quality improvement measures for medium and low yield fields from the perspectives of soil texture, crop selection, and returning materials. However, they mainly explore soil quality improvement techniques for medium and low yield fields from the micro perspective of soil science and macro measures of soil layer compounding, and have not conducted in-depth research on soil quality improvement materials, especially ecological improvement products.

Fertilizers play an important role in improving the quality of cultivated land. The long-term excessive application and low utilization rate of chemical fertilizers in China have gradually weakened the basic soil fertility, causing environmental pollution, soil compaction, soil fertility decline, ecological deterioration, and declining agricultural product quality, affecting the sustainable development of agriculture and high and stable crop yields in China. The single application of inorganic fertilizers results in the loss of organic nutrients and trace elements in the soil, thereby disrupting the balance of soil nutrients and deteriorating soil quality. In the past decade, due to the implementation of soil testing and formula fertilization, the fertilizer utilization rate has improved, but the utilization rates of nitrogen, phosphorus, and potassium fertilizers for the three major grain crops have only reached 33%, 24%, and 42%, respectively. The fertilizer variety structure is unreasonable, the scientific fertilization technology level is low, and the pressure on agricultural product quality and environmental protection demand is constantly increasing. Traditional fertilizers can no longer meet the needs of agricultural development. Therefore, developing efficient and environmentally friendly fertilizers, improving fertilizer utilization efficiency, reducing fertilizer usage, and controlling pollution are necessary considerations for exploring modern agriculture with high output efficiency, product safety, resource conservation, and environmental friendliness. Introducing exogenous materials (such as straw and organic fertilizers) significantly increases soil organic matter content and expands nutrient storage capacity such as carbon, nitrogen, and phosphorus[11]. Microorganisms drive soil organic matter decomposition and humus synthesis, breaking through barriers to carbon, nitrogen, and phosphorus cycling processes, enhancing the "physique" of medium and low yield soil, and inducing crops to produce various antibiotic substances to strengthen their resistance to biological stress and tolerance. The number of microbial genes is much greater than that of plant genomes, known as the second genome of plants. Crop microbial soil interaction and collaboration are a new trend in the research of "improving quality and efficiency" in medium and low yield fields. The deep fusion and

ISSN: 2710-0723

matching assembly of plants and the second genome provide a more efficient technical approach to increase production capacity and reduce nutrient barriers in medium and low yield fields, which is beneficial for reducing fertilizer application, agricultural waste consumption Improving soil fertility and protecting the ecological environment are of great significance[12]. However, the exploration of functional microbiomes with high nutrient efficiency and their synergistic effects in medium and low yield fields has only just begun, especially the mechanism of core microorganisms involved in nutrient efficiency and their reduction barriers, as well as the synergistic mechanisms between microbial communities and other microorganisms, are still poorly understood, which limits the potential for crop and functional microbiome interaction and efficiency enhancement. It is still difficult to meet the new needs of "storing grain in the ground and storing grain in technology" in medium and low yield fields.

3. Expectation

Ecological improvement materials are an important component of improving the quality of medium and low yield farmland. Exploration is needed in the following areas: firstly, the development of ecological improvement materials; The second is the verification of the application effect of ecological improvement materials; The third is the widespread promotion of improved materials.

Acknowledgments

This research was funded by Shaanxi Provincial Land Engineering Construction Group (DJNY-YB-2023-25).

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