

Research on the Analysis of Obstacle Factors in Medium - and Low - Yield Farmland and Its Improvement Countermeasures

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ABSTRACT

This paper systematically analyzes the main obstacle factors affecting the productivity of medium - and low - yield farmland in China, aiming at the current situation of such farmland. Through literature research and field investigations, it explores the impacts of natural factors such as poor soil fertility, poor drainage, salinization, acidification, and shallow soil layers, as well as human - induced factors such as improper tillage management and unreasonable fertilization on farmland productivity. The study finds that the obstacle factors in medium - and low - yield farmland are complex and regionally different, and targeted improvement measures are required. Based on the analysis results, this paper puts forward comprehensive improvement countermeasures such as soil improvement, construction of water conservancy facilities, scientific fertilization, and rational crop rotation, in order to provide a theoretical basis and practical guidance for improving the productivity of medium - and low - yield farmland and ensuring food security.

KEYWORDS

Medium - and Low - Yield Farmland; Obstacle Factors; Soil Improvement; Productivity; Sustainable Agriculture.

1. INTRODUCTION

Medium - and low - yield farmland refers to the farmland whose yield level is lower than the local average due to the limitations of natural conditions and human factors. In China, the area of medium - and low - yield farmland accounts for approximately two - thirds of the total cultivated land area. Its improvement and utilization are of great significance for ensuring national food security and promoting the sustainable development of agriculture. In recent years, with the growth of the population and economic development, cultivated land resources have become increasingly scarce, and the improvement and utilization of medium - and low - yield farmland have become the focus of attention in the agricultural field. This study aims to systematically analyze the main obstacle factors of medium - and low - yield farmland, explore their causes and impact mechanisms, and propose targeted improvement countermeasures. By deeply analyzing the problems existing in medium - and low - yield farmland, it provides theoretical support and practical guidance for formulating scientific

farmland management strategies and improving land productivity, which has important practical significance for achieving the sustainable development of agriculture[1].

2. ANALYSIS OF OBSTACLE FACTORS IN MEDIUM - AND LOW - YIELD FARMLAND

The obstacle factors of medium - and low - yield farmland can be divided into two major categories: natural factors and human - induced factors. Natural factors mainly include poor soil fertility, poor drainage, salinization, acidification, and shallow soil layers. Poor soil fertility is manifested as low organic matter content and nutrient deficiency, which restricts crop growth. Poor drainage can lead to poor soil aeration, affecting root development and nutrient absorption. Salinization and acidification change the chemical properties of the soil, inhibiting crop growth. Shallow soil layers limit the space for root expansion, reducing the stress resistance and productivity of crops. Human - induced factors mainly include improper tillage management and unreasonable fertilization[2]. Unreasonable tillage methods can lead to the destruction of soil structure and nutrient loss. Excessive or improper use of chemical fertilizers can cause soil compaction and nutrient imbalance, while insufficient application of organic fertilizers will exacerbate soil degradation. In addition, unreasonable irrigation methods and planting systems can also have a negative impact on soil quality. These human - induced factors often interact with natural factors, exacerbating the degree of obstacles in medium - and low - yield farmland[3].

3. REGIONAL CHARACTERISTICS AND IMPACTS OF OBSTACLE FACTORS IN MEDIUM - AND LOW - YIELD FARMLAND

The obstacle factors in medium - and low - yield farmland show obvious differences in different regions of China. In the Northeast region, the main obstacle factors include black soil degradation, low - temperature chilling injury, and poor drainage. The North China Plain faces problems such as salinization, water shortage, and decline in soil fertility. In the southern region, soil acidification, gleying, and soil erosion are the main obstacles. The Northwest region is severely affected by drought, salinization, and wind erosion. These regional characteristics reflect the combined effects of natural conditions and human activities. The obstacle factors in medium - and low - yield farmland have multiple impacts on agricultural production. First, they directly limit crop growth, resulting in low yields and poor quality. Second, the obstacle factors increase the cost of agricultural production and reduce economic efficiency[4]. Third, the long - term existence of obstacle factors can lead to soil degradation, threatening the sustainable development of agriculture. In addition, some obstacle factors such as salinization and acidification may also cause environmental pollution problems. Therefore, in - depth analysis of the regional characteristics and impacts of obstacle factors in medium - and low - yield farmland is crucial for formulating targeted improvement strategies[5].

4. IMPROVEMENT COUNTERMEASURES AND SUGGESTIONS FOR MEDIUM - AND LOW - YIELD FARMLAND

In response to the main obstacle factors in medium - and low - yield farmland, the following improvement countermeasures are proposed: First, implement soil improvement projects, including applying organic fertilizers, using lime to improve acidic soil, and using gypsum to improve alkaline soil, etc., to improve soil fertility and soil structure. Second, strengthen the construction of water conservancy facilities, improve the drainage system, and improve the drainage conditions of farmland. At the same time, promote water - saving irrigation technologies to improve water resource utilization efficiency. In terms of agricultural management, promote scientific fertilization technologies, implement soil - testing and formula fertilization, balance nutrient supply, and improve fertilizer

utilization efficiency. At the same time, promote a reasonable crop rotation system. Through crop rotation with leguminous crops and green manure planting, improve the physical and chemical properties of the soil and increase soil fertility. In addition, it is also necessary to strengthen the popularization of agricultural technologies and the training of farmers to improve farmers' soil management and tillage techniques. For medium - and low - yield farmland in different regions, targeted improvement measures should be taken according to the characteristics of their obstacle factors. For example, in the Northeast region, focus on implementing the black soil protection project; in the North China Plain, strengthen the improvement of saline - alkali land and water resource management; in the southern region, pay attention to the improvement of acidic soil and soil and water conservation; in the Northwest region, focus on drought resistance, water conservation, and wind - sand prevention. Through the comprehensive application of engineering measures, biological measures, and agronomic measures, the continuous improvement of medium - and low - yield farmland and the increase of productivity can be achieved.

5. CONCLUSION

This study systematically analyzes the main obstacle factors in medium - and low - yield farmland, including natural factors and human - induced factors, and explores their regional characteristics and impacts on agricultural production. The research shows that the obstacle factors in medium - and low - yield farmland are complex and regionally different, and comprehensive measures are needed for improvement. In response to different obstacle factors, improvement countermeasures such as soil improvement, construction of water conservancy facilities, scientific fertilization, and rational crop rotation are proposed. The improvement of medium - and low - yield farmland is a long - term and complex systematic project that requires the joint efforts of the government, scientific research institutions, and farmers. In the future, further in - depth research on the obstacle factors in medium - and low - yield farmland should be strengthened, more efficient and environmentally friendly improvement technologies should be developed, and at the same time, the relevant policy support system should be improved to promote the continuous development of the improvement work of medium - and low - yield farmland. Through scientific management and technological innovation, continuously improve the productivity of medium - and low - yield farmland, and contribute to the realization of sustainable agricultural development and the guarantee of national food security.

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REFERENCES

- [1] Zhang, M. Y., & Li, H. M. (2020). Improvement Technologies and Practices of Medium - and Low - Yield Farmland. China Agriculture Press.
- [2] Wang, L. X., Chen, X. W., & Liu, C. J. (2019). Research Progress on Obstacle Factors and Improvement Countermeasures of Medium - and Low - Yield Farmland in China. *Acta Pedologica Sinica*, 56(3), 521 - 532.
- [3] Zhao, Y. Q., Sun, X. M., & Huang, G. Q. (2018). Research on the Improvement Modes of Region - specific Medium - and Low - Yield Farmland. *Scientia Agricultura Sinica*, 51(10), 1912 - 1924.
- [4] Li, Y., Zhang, Q., & Wang, R. (2021). Sustainable improvement strategies for low-yield farmland in China: A review. *Agricultural Systems*, 186, 102959.
- [5] Chen, X., & Liu, H. (2022). Integrated approaches for improving low-productivity farmland in developing countries. *Land Degradation & Development*, 33(5), 689-702.