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A Review of Research on Obstacle Factor Reduction Techniques for Medium and Low Yield Fields

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Abstract

The proportion of low yield fields in China is large, and there are problems such as extensive utilization, low output rate, and poor soil quality. It is crucial to reduce obstacles and improve soil fertility and productivity in low yield fields. At present, the main obstacles to reducing soil acidification, salinization, nutrient imbalance, shallow tillage layer, continuous cropping obstacles, and soil erosion can improve soil quality and increase crop yield and quality. Future research should focus on developing more precise and efficient reduction technologies, introducing intelligent agricultural technologies for real-time monitoring and precise management, promoting soil nutrient management and integrated water and fertilizer technologies, and developing sustainable agricultural technologies to enhance farmland production potential and achieve efficient resource utilization.

Keywords

Medium and Low Yield Fields; Obstacle Factor Reduction; Research Progress.

1. Introduction

China has relatively sufficient reserve resources for arable land, but the arable land is mainly composed of medium and low yield fields, mostly dry land. The utilization of arable land is extensive, with low output rates, heavy use and light cultivation. In some areas, soil erosion is severe, manifested by low organic matter content, weak fertilizer supply capacity, low precipitation utilization efficiency, overall poor quality, and insufficient total grain production[1] . Therefore, it is of great significance for China to reduce obstacles in low yield and newly added arable land, and to enhance the synergy of land fertility and production capacity, in order to ensure national food security.

The low quality of farmland soil, the decline in soil fertility, and the deterioration of soil structure are mainly due to obstacles that affect the improvement of soil quality[2] . By taking targeted measures to reduce soil quality and using soil quality improvement techniques, factors that affect soil quality can be accurately reduced, reducing the use of fertilizers and pesticides, and achieving efficient resource utilization. By reducing obstacles, soil quality can be improved, soil productivity can be enhanced, and crop yield and quality can be improved[3].

2. Types of Obstacle Factors

The soil barrier factors mainly include soil acidification, salinization, nutrient imbalance, shallow plow layer, continuous cropping obstacles, soil erosion, and trace element deficiency.

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These obstacles seriously affect the production capacity of soil, leading to a decrease in crop yield and quality. Scientists have developed a series of effective mitigation techniques to address these soil issues, aimed at restoring soil health and increasing crop yields.

3. Obstacle Factor Reduction Technology

3.1. Soil Acidification Reduction Technology

Regarding soil acidification, the application of lime or soil conditioners can significantly increase the pH value of the soil, thereby alleviating soil acidification and creating a more suitable growth environment for crops. In addition, the alternative application of organic fertilizers is also an important means to neutralize soil acidity, provide nutrients, and improve soil structure. Organic fertilizer can not only neutralize acidity, but also promote the reproduction and activity of soil microorganisms, further improving soil quality.

3.2. Salinization Reduction Technology

Soil salinization is another major challenge affecting crop growth. By implementing a reasonable irrigation system and using fresh water to flush away salt from the soil, the salt content in the soil can be effectively reduced. At the same time, selecting crop varieties that are tolerant to salt and alkali for planting is also an effective method to improve crop stress resistance and reduce the impact of salinization.

3.3. Nutrient Imbalance Reduction Technology

Imbalance of soil nutrients can lead to stunted crop growth. Therefore, soil testing and formula fertilization have become key technologies for achieving precise fertilization, avoiding nutrient waste, and soil pollution. Based on the results of soil nutrient testing, develop a scientific fertilization plan to ensure that crops receive the necessary nutrients. In addition, the combined application of organic fertilizer and chemical fertilizer is also an important way to achieve nutrient complementarity and improve soil fertility.

3.4. Shallow Plowing Layer Reduction Techniques

Shallow plowing layers can limit the development of crop roots. Through deep plowing and deep loosening techniques, the soil plow layer can be broken, the soil thickness can be increased, the soil structure can be improved, and a deeper root growth space can be provided for crops[4]. Meanwhile, returning straw to the field is also an effective method to increase soil organic matter content and improve soil physical properties.

3.5. Continuous Cropping Obstacle Reduction Technology

Continuous cropping obstacles are an important issue affecting the continuous planting of crops. Through crop rotation and intercropping techniques, soil continuous cropping barriers can be broken, the incidence of pests and diseases can be reduced, and soil fertility can be improved. In addition, soil disinfection is also an important means of reducing continuous cropping obstacles. Using physical, chemical, or biological methods to disinfect the soil can kill pathogens and pests in the soil, creating a healthier growth environment for crops[5].

3.6. Soil Erosion Reduction Technology

Soil erosion is an important factor threatening the sustainable development of agriculture. By using biological slope protection and vegetation restoration techniques, planting vegetation on slopes can increase soil coverage and effectively reduce soil erosion. Meanwhile, constructing terraced fields and horizontal ditches for soil and water conservation is also an effective method to slow down water flow, increase soil permeability, and reduce soil erosion.

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With the development of the economy and society, new requirements have been put forward for the transformation of medium and low yield fields. Future research should start from the following four points.

1) Targeting different types of soil barrier factors, utilizing biotechnology, chemical technology, and physical technology to improve soil structure, enhance soil fertility, and develop more precise and efficient reduction techniques..

2) Introduce intelligent agricultural technologies such as the Internet of Things, big data, and artificial intelligence to achieve real-time monitoring and precise management of soil barrier factors.

3) Promote soil nutrient management and integrated water and fertilizer technologies, develop rapid improvement technologies for low yield fields, strengthen research on agricultural ecosystems, enhance the production potential of farmland, and achieve efficient utilization of farmland resources.

4) Develop sustainable agricultural technologies such as organic agriculture, ecological agriculture, and circular agriculture, strengthen research on the resource utilization of agricultural waste, turn agricultural waste into treasure, and reduce the negative impact of agriculture on the environment.

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