

Research on Green High-yield Cultivation Techniques of Rice and Their Application

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Abstract: Rice is one of the major food crops in China, undertaking the important mission of safeguarding national food security and meeting people's dietary needs. Its yield and quality directly affect the sustainable development of agriculture. With the continuous improvement of people's living standards, the demand for green, safe, and high-quality rice is growing day by day. The traditional rice cultivation mode is plagued by low resource utilization efficiency, environmental pollution, and unstable yield, which can no longer adapt to the requirements of agricultural development in the new era. As a new cultivation mode that balances yield, quality, and ecological benefits, green high-yield rice cultivation techniques can realize the greening, high yield, and high quality of rice production through scientific planting management, ecological prevention and control, and efficient resource utilization. It is also an important way to promote the high-quality development of the rice industry. Based on the reality of rice planting and combined with the current agricultural development trend, this paper analyzes the application status of green high-yield rice cultivation techniques, expounds their application significance, and explores feasible application paths, aiming to provide a theoretical reference and practical basis for the popularization of green high-yield rice cultivation techniques, and help China's rice industry achieve quality improvement, efficiency increase and green development.

Keywords: Rice; Green high yield; Cultivation techniques; Application research

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1. Introduction

Rice is a food crop with a long planting history and wide planting area in China, occupying a pivotal position in China's grain production system. It is not only the staple food of people's daily life, but also the core support for national food security. In recent years, with the continuous growth of China's population and the upgrading of dietary structure, higher requirements have been put forward for the yield and quality of rice. The produced rice must not only ensure sufficient yield to meet food supply, but also be green, safe, and high-quality to meet people's demand for a healthy diet. Against the backdrop of high-quality agricultural development in the new era, green agriculture and ecological agriculture have become the mainstream of development, and green high-yield rice cultivation techniques have emerged as the times require. Centering

on the core concepts of environmental friendliness, high yield and high quality, as well as conservation and high efficiency, relevant techniques integrate a series of advanced technologies, including variety selection, strong seedling cultivation, scientific fertilization, water-saving irrigation, and green pest and disease prevention and control. They can not only effectively improve rice yield and quality and reduce environmental pollution, but also realize efficient resource utilization. Meanwhile, they serve as an important means to overcome the drawbacks of traditional cultivation modes and promote the transformation and upgrading of the rice industry.

2. Application status of green high-yield rice cultivation techniques

In recent years, with the national attention and support for agricultural green development, green high-yield rice cultivation techniques have been gradually popularized and applied. All regions have actively explored locally suitable green high-yield cultivation modes combined with actual rice planting conditions and achieved phased results. However, from the overall application perspective, there are still many prominent problems restricting the full play of technical advantages ^[1].

First, the popularization of techniques is unbalanced. The techniques are widely applied in suburban and agriculturally developed areas, while their popularization in remote rural and underdeveloped agricultural areas is relatively low. Many growers still adopt traditional cultivation modes with insufficient understanding and mastery of green high-yield cultivation techniques ^[2].

Second, the application of techniques is non-standard. Although some growers have adopted green high-yield cultivation techniques, they operate irregularly in links such as variety selection, strong seedling cultivation, fertilization and irrigation, as well as pest and disease prevention and control due to a lack of professional technical guidance, resulting in failure to give full play to technical effects.

Third, the technical promotion system is imperfect. The grassroots agricultural technology promotion team is weak in strength, and the professional competence of promoters is insufficient to meet growers' technical demands. Meanwhile, the promotion method is single, lacking pertinence and effectiveness ^[3].

Fourth, growers' ideological concepts are relatively backward. Some growers excessively pursue short-term economic benefits and lack understanding of the long-term benefits of green high-yield cultivation techniques. They believe that the adoption of such techniques increases labor intensity and initial investment, and are unwilling to take the initiative to apply them.

Fifth, supporting services for green high-yield cultivation techniques are imperfect. The supply of supporting materials such as seeds, fertilizers, and pesticides is insufficient, with high prices, which increases growers' planting costs and reduces their enthusiasm for adopting the techniques ^[4].

3. Significance of the application of green high-yield rice cultivation techniques

3.1. Safeguarding food security and stabilizing rice yield supply

Food security is an important foundation of national security. As China's major food crop, the steady growth of rice yield is of great significance to national food security. The traditional rice cultivation mode suffers from unstable yield and poor stress resistance, and is greatly affected by the natural environment, pests, and diseases, making it difficult to meet the growing food demand ^[5]. By adopting scientific variety selection, strong seedling cultivation, and field management measures, green high-yield rice cultivation techniques can

effectively improve rice stress resistance and pest and disease resistance, optimize rice growth environment, and realize steady growth of rice yield. In addition, the techniques can improve rice quality to meet people's current demand for green and healthy consumption, enhance market competitiveness, and provide solid support for food security ^[6].

3.2. Improving rice quality and meeting people's health needs

With the continuous improvement of people's living standards, people's dietary structure has changed significantly, and higher requirements have been placed on rice quality. People demand not only good taste and rich nutrition, but also green, safe, and pesticide-free rice. In the traditional rice cultivation mode, excessive application of chemical fertilizers and pesticides leads to excessive pesticide residues and declined rice quality, which not only endangers people's physical health, but also reduces the market competitiveness of rice ^[7]. Adhering to the concept of environmental friendliness, high quality, and high efficiency, green high-yield rice cultivation techniques strictly control the application amount of chemical fertilizers and pesticides, and adopt technologies such as soil testing and formulated fertilization, biological control, and physical control to reduce pesticide residues and soil pollution and improve rice quality ^[8]. At the same time, this mode balances ecological safety and sustainable resource utilization, enabling rice production to reduce negative impacts on soil, water sources, and biodiversity while ensuring supply.

4. Application paths of green high-yield rice cultivation techniques

4.1. Strengthening variety selection to lay a foundation for green and high yield

Variety selection is the foundation of green high-yield rice cultivation. Selecting suitable rice varieties can effectively improve rice stress resistance and pest and disease resistance, and guarantee high yield and high quality of rice. In the process of variety selection, researchers should adhere to the principles of green, high yield, high quality, and stress resistance, and select varieties suitable for local planting combined with local climatic conditions, soil status, and planting habits ^[9].

Firstly, select varieties with strong disease and stress resistance to effectively resist the impact of pests, diseases, and natural disasters, reduce pesticide application, and lower planting risks ^[10].

Secondly, select high-yield and high-quality varieties to ensure the improvement of rice yield as well as taste and nutritional quality to meet public demands. Attention should also be paid to variety adaptability and ecological coordination during planting, so as to ensure varieties steadily exert their high-yield potential under local ecological conditions and avoid maladjustment or ecological imbalance caused by blind introduction. For example, in the middle and lower reaches of the Yangtze River, priority can be given to varieties such as Nanjing 46 and Huanghuazhan with rice blast resistance and good eating quality; in southern double-cropping rice areas, early rice varieties such as Zhongjiazao 17 and late rice varieties such as Taiyou 390 with suitable growth period, heat resistance, lodging resistance and above Grade III national rice quality standard can be popularized to ensure the consistency and market competitiveness of regional rice quality.

Finally, select varieties with strong adaptability to adapt to local climate and soil conditions and improve the planting success rate. At the same time, attention shall be paid to selecting approved improved varieties and avoiding unapproved ones to guarantee variety purity and quality. Before sowing, seed treatment is required: plump and disease-free seeds are selected for sun drying, seed soaking, and disinfection to improve

germination rate and survival rate, and lay a foundation for cultivating strong seedlings ^[11].

In addition, efforts should be made to strengthen the popularization of improved varieties by establishing demonstration bases and holding variety exhibitions to enable growers to understand the advantages of improved varieties and guide their selection, so as to lay a solid foundation for green high-yield rice cultivation.

4.2. Standardizing cultivation management to improve the technical level

Standardized cultivation management is the key to realizing green and high-yielding rice. It is necessary to complete all management links, including strong seedling cultivation, rational close planting, scientific fertilization, and water-saving irrigation around the rice growth cycle, and improve the cultivation technical level.

In terms of strong seedling cultivation, adopt scientific seedling raising methods, select seedling fields with flat terrain, fertile soil, and convenient drainage, rationally configure seedling raising substrate, and control seedling density. Meanwhile, strengthen temperature and humidity management during seedling raising, timely prevent and control seedling pests and diseases, and cultivate strong seedlings ^[12].

During transplanting, grasp the appropriate transplanting time according to the variety characteristics and climatic conditions to avoid premature or delayed transplanting, which can affect rice growth.

Adopt rational close planting during cultivation, determine appropriate planting density according to variety characteristics and soil fertility, so as to ensure sufficient growth space for rice and fully utilize land and light resources to increase population yield.

In terms of scientific fertilization, adhere to the principle of dominated organic fertilizer and supplemented inorganic fertilizer, adopt soil testing and formulated fertilization technology, rationally match nitrogen, phosphorus, potassium, and other fertilizers according to soil fertility and rice growth demand, and avoid blind fertilization ^[13]. Combine base fertilizer and topdressing application: ensure sufficient base fertilizer and timely topdressing. Growers should apply topdressing rationally according to the nutritional needs of rice at different growth stages to promote rice growth and development.

In terms of water-saving irrigation, adopt water-saving irrigation technologies, rationally control irrigation volume according to the water demand of rice at different growth stages, and avoid extensive flood irrigation to reduce water resource consumption. In the early growth stage of rice, maintain a shallow water layer in the field steadily to promote seedling recovery and tillering; in the late tillering stage, properly dry the field to control ineffective tillering and promote root growth; in the heading and flowering stage, keep a shallow water layer to ensure normal heading and flowering of rice; in the grain filling stage, adopt alternate wet and dry irrigation to promote grain filling and effectively increase 1000-grain weight ^[14].

4.3. Strengthening green prevention and control to ensure rice growth safety

Pests and diseases are important factors affecting rice yield and quality. Although traditional chemical prevention and control can quickly control pests and diseases, they are prone to pesticide residues and environmental pollution, failing to meet the requirements of green high-yield cultivation. Therefore, it is necessary to strengthen green pest and disease prevention and control, adopt agricultural control, physical control, biological control, and other means to replace traditional chemical prevention and control, and ensure rice growth safety ^[15].

In terms of agricultural prevention and control, strengthen field management, timely remove field weeds, diseased plants, and residues to reduce the breeding and spread of pests and diseases. Adopt rational crop rotation to avoid continuous cropping problems in traditional modes and improve the soil environment to reduce pest and disease occurrence. Popularize and plant disease and insect-resistant varieties, and utilize ecological regulation means such as natural enemy insects and biological pesticides to enhance the self-regulation capacity of the paddy field ecosystem. For example, growers can plant nectar plants such as sesame and cosmos around paddy fields to attract natural enemies such as ladybugs and lacewings to inhabit and reproduce, so as to build a complete ecological balance system for paddy fields.

In terms of physical prevention and control, adopt light trapping and color plate trapping to lure and kill adult pests and reduce their reproduction; combine manual catching to effectively eliminate field pests and diseases and reduce their occurrence rate.

In terms of biological prevention and control, popularize the application of biological pesticides such as bacillus and matrine to replace chemical pesticides and reduce pesticide residues. In addition, strengthen pest and disease monitoring and early warning, establish and improve the monitoring system, timely grasp the occurrence dynamics of pests and diseases, and achieve early discovery and early prevention. Growers can improve the effect of pest and disease prevention and control by reasonably selecting prevention timing and means, effectively reducing the harm of pests and diseases to rice, and ensuring rice growth safety and quality.

5. Conclusion

Green high-yield rice cultivation techniques serve as an important support for the high-quality development of the rice industry in the new era. Their popularization and application are of great significance for safeguarding national food security, improving rice quality, promoting agricultural green development, and increasing farmers' income. Centering on the core concepts of environmental friendliness, high yield and high quality, as well as conservation and high efficiency, the techniques integrate a series of advanced technologies, including variety selection, cultivation management, and green pest and disease prevention and control. They can effectively solve the problems of low resource utilization efficiency, environmental pollution, and unstable yield existing in traditional rice cultivation modes, and realize the greening, high-yield, and high-quality rice production. In the future, with the continuous development of agricultural science and technology and the improvement of relevant techniques, green high-yield rice cultivation techniques will be continuously optimized and upgraded with expanding popularization scope, effectively promoting the quality improvement, efficiency increase, and green development of China's rice industry, and providing strong support for safeguarding national food security, promoting agricultural sustainable development, and boosting rural revitalization.

Disclosure statement

The authors declare no conflict of interest.

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