A Preliminary Study on Several New Modes of Rice Cultivation

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Abstract

This paper discussed the current situation and existing problems of rice planting in China and the policy direction of rice development in the future. It discussed three new rice planting modes: direct seeding rice, regrowing rice and combination of planting and breeding, which laid a foundation for future research.

Keywords

Rice; The new pattern; to discuss.

1. INTRODUCTION

Rice is one of the most important food crops in the world and has made a great contribution to the world food security. The UN's department of economic and social affairs estimates that the world's population will exceed 10 billion by 2050, so the world will still face severe food security problems in the future. Since the 1960s, the yield per unit area and the total yield of rice have increased significantly, mainly due to the improvement of varieties and the development of cultivation techniques. However, the long-term improvement of rice yield through the input of large fertilizer, large water and a large number of pesticides has caused serious impacts on the environment, such as soil acidification, water eutrophication and biodiversity reduction. The emergence of these new problems and challenges means that China's rice production is facing a major transformation, which requires fundamental changes in variety cultivation strategies and innovative cultivation practices.

The agricultural production mode of "high input, high output, high pollution and low efficiency" has not only made great contribution to ensuring China's food supply, but also led to serious resource and environmental problems. As the cost of production means and labor increases year by year and planting efficiency decreases year by year, the sustainable production of rice is facing great challenges. Large-scale, mechanization and light simplification are the important development directions of future rice production. "high yield, high quality, high efficiency, ecology and safety" are the goals of future rice production. From 2005 to 2018, the main technical change trend promoted by the ministry of agriculture and village indicates that since the 21st century, China's agricultural production has begun to transform to mechanization, light simplification and high yield and efficiency. Future rice cultivation needs by optimizing mode innovation and management measures in the light of local conditions to solve high yield and high efficiency, high yield and high quality, land use and the contradiction between the ground and coordinate environmental factors and the mutual relationship between high-yield, high-quality, safe, so as to realize "little play less pesticide, fertilizer," high quality and high yield of water-saving and drought, green goals.

With the development of economic construction, the contradiction between man and land becomes increasingly acute. Therefore, high yield is the eternal theme of rice production in China. With the continuous improvement of people's living standard, the demand has changed from satiety to good food, which puts forward new requirements for rice quality. The realization

of high yield and high quality requires both green development, namely, high efficiency, ecology and safety. This goal is the premise of mechanization and simplify light (especially the crops to build links), under the premise of not reduce or increase in total output, reduce the labor input, and reduce labor intensity, not increase agricultural capital investment, steady profits, rice production through multiple crop index or harvest frequency to reduce or even eliminate the pressure of the quarterly pursuit of super-high-yield crops and risk. Future rice cultivation, therefore, need to adjust measures to local conditions by optimizing mode innovation and management measures to solve the high yield and high efficiency, high yield and high quality, land use and the contradiction between the ground and coordinate environmental factors and the mutual relationship between high-yield, high-quality, safe, so as to realize "little play less pesticide, fertilizer," high quality and high yield of water-saving and drought, green goals.

2. DIRECT SEEDING RICE

From the end of the 20th century to the beginning of the 21st century, with the decrease of organic fertilizer application in rice production and the large increase of chemical fertilizer application, the large transfer of rural labor force and the continuous development of agricultural machinery manufacturing technology, the rapid development of rice light simplification, mechanization and high-yield and efficient cultivation technology. Direct seeding cultivation is a planting method in which seeds or seeds soaked for germination are directly sown in the levelled paddy field or dry land by manpower, machinery, aircraft and other tools, and the corresponding scientific management is carried out. Direct seeding rice can be divided into manual direct seeding, mechanical direct seeding and aircraft direct seeding according to seeding power, and water direct seeding, wet direct seeding and dry direct seeding according to water condition of rice field. Rice production in the United States, Australia and Europe was almost completely mechanized since the 1970s. As the main production area of rice, the area of direct seeding rice in Asia has reached 29 million hm2 at the beginning of the 21st century, accounting for about 21% of the total rice area in Asia. Japan and South Korea regard mechanized direct seeding rice as one of the main development directions of labor-saving, low-cost and intensive rice farming. After 2000, the area of direct seeding rice in China increased rapidly. The area of direct seeding rice in Anhui, Zhejiang and other provinces accounted for about 30% of the total seeding area. The proportion of direct seeding rice in Hunan reached 70% and that in Ningxia reached 95%. However, due to certain risks in the production of direct seeding rice planting technology, none of the major rice technologies promoted by the ministry of agriculture and village from 2005 to 2018 is related to direct seeding technology.

The main risks in direct rice production include colony establishment, weed control and lodging. Many experimental studies have proved that compared with traditional planting or mechanical transplanting, direct seeding cultivation method has higher yield ratio, lighter labor consumption, less centralized labor, and can achieve high yield even in field management at that time. In addition, as an environment-friendly low-carbon agricultural technology for energy conservation and emission reduction in rice fields, direct seeding cultivation mode will become a new technological path for greenhouse gas emission reduction in rice fields and coping with global climate change, and also one of the hot research issues at home and abroad. As a result, can adapt to the current low carbon agriculture development direction, strengthen the cultivation mode of live with the low carbon agricultural key technology research and development, matching the paddy fields of carbon and nitrogen and the dynamic change of library and its long-term monitoring, rice paddies biodiversity response to global change research, the paddy fields of the greenhouse gases (CH4, N2O and CO2) emission flux, dynamics and its regulation factors of research, find new breakthrough point of research.

3. REGROWING RICE

After harvest in finger season, regenerative rice is a planting mode in which the dormant buds surviving on rice stubble are used to germinate into regenerative tillers by certain cultivation and management measures, and then ear, blossom and bear fruit, and then harvest another season of rice. This mode is an ideal planting mode in areas where the temperature and light resources are abundant for one season but insufficient for two. The yield in the first season is the same as that in the first season, and the yield in the second season can reach more than 50% in the first season, which is beneficial to increase the total yield and promote the income of farmers. In 2017, the Peng shaobin's team carried out a field experiment in Huaqiao town, Wutang city, Hubei province, comparing the yields of three rice systems (rice-wheat, rice-rapeseed and rice-fallow) and three rice systems (rice-rapeseed, rice-fallow and seeded rice-feed rapeseed). The results showed that the yield of regenerated rice in the first season was 8.80t /hm2 on average, while the yield in regenerated season was 4.74t /hm2 on average, and the yield in regenerated season was 53.8% of that in the first season. In addition, the planting of regenerated rice is also an effective measure for disaster reduction in disastrous years. Regenerated rice can avoid frequent high temperature hazards in the middle and lower reaches of the Yangtze river in the first season when it is heading and flowering, so as to ensure high and stable yield in the first season.

The regenerated rice cultivation technology was listed as the main cultivation technology by the ministry of agriculture and village from 2009 to 2010 and from 2015 to 2018, and its technical characteristics also changed over time. From 2009 to 2010, it was "high-yield cultivation technology of regenerative rice"; from 2015 to 2016, it was "comprehensive cultivation technology of regenerative rice"; from 2017 to 2018, it was "high-yield cultivation technology of machine-harvested regenerative rice". The yield of regenerated rice in Fujian high yield area can reach 8.81t /hm2 in the regenerated season, and the total yield in the two seasons can reach 19.31t /hm2. Under the condition of artificial harvesting in the first season, the output in the regeneration season in Hubei province can also reach 6.62t /hm2 in a large area, and the total output in the two seasons exceeds 15.0t /hm2. However, the labor input of manual harvesting in the first season is large, and farmers' enthusiasm to plant regenerated rice is not high. However, mechanical harvesting in the first season of rice reduced the yield in the regeneration season due to the large crushing failure area of rice piles. The Peng shaobin's team has carried out a lot of research on this issue and integrated the cultivation technology of "machine-harvested regenerated rice with high yield and increased efficiency". The other major advantage of regenerated rice is the suitable temperature, low amount of fertilizer and basically no pesticides during the grouting period in the regenerated season. Therefore, the cooking and eating quality of regenerated season rice is excellent and safe and of high quality.

4. COMBINATION OF PLANTING AND BREEDING IN THE RICE FIELD

Rice-fish symbiosis is a traditional ecological agriculture mode in China. Before 2000 years ago, farmers put the remaining fish seedlings in rice paddies for temporary cultivation. However, in some southeast Asian countries, the rice-fish symbiosis mode can be traced back to 6000 years ago. After the founding of the People's Republic of China, the rice paddy planting and breeding area increased rapidly, and the original traditional, small scale, single breeding mode gradually developed into a model of scale, specialization, mechanization and breeding diversification. "Rice and duck co-breeding production technology" was listed as the main push technology of the ministry of agriculture in 2008 and 2009, while "rice field comprehensive breeding technology" has been listed as the main push technology for three consecutive years since 2016. Based on the integrated planting and breeding technology of paddy fields, academician Zhang qiqi put forward the concept of "double water and double green", aiming to

make full use of the advantages of paddy fields and water resources in the plain and lake areas to carry out rice planting and breeding, so as to realize the coordinated development of "green rice" and "green aquatic products". In recent years, the Hubei province took the lead in the rice paddy, the "rice - shrimp", "rice and fish" and "rice - turtle", "rice - crab", "rice - 鳅" wait for a variety of paddy planting and raising mode, in 2016 the national integrated rice planting area of 600000 hm2, Hubei paddy planting area of 333000 hm2, especially rice - shrimp as a model. Studies have shown that aquatic animals occupy about 10% of the rice field space (such as furrows and pits) in the integrated breeding and breeding system of the rice field, but these Spaces can make rice plants produce side-row effect, thus making up for the loss of yield, so the rice yield has not been significantly reduced. Ren conducted a meta-analysis on the international papers published in the past 20 years on the relationship between rice-fish system and rice yield, and found that compared with the rice mono-cropping system, the rice-fish system had a significant positive effect on rice yield under different conditions (for example, different types of aquatic organisms). The study on rice-shrimp co-cropping showed that rice yield increased by 4.6%-14.0% compared with the traditional rice planting mode. Paddy farming not only improves the economic benefits of agriculture, but also provides great opportunities and potentials for the green and sustainable development of agriculture. For example, in the "shrimp-rice" mutualism system, rice straw rot promotes the growth of water plankton, which not only provides food for shrimps, but also effectively solves the contradiction of straw returning to the field. It is not only beneficial to the digestion and utilization of rice straw, but also helpful to kill the remaining pests, reduce the insect sources in the next year and reduce the pests. Shrimp waste provides organic fertilizer for rice, limiting the heavy use of pesticides and fertilizers in rice fields. A long-term study of the rice-fish co-cropping pattern in southern Zhejiang province also showed that, compared with the rice monoculture system, the use of pesticides and fertilizers in the rice-fish system was reduced by 68% and 24%, respectively, when the yield was not reduced. Rice integrated breeding and breeding system can also improve the utilization efficiency of nutrients in rice. For example, in the rice-fish co-cropping model, 75-85% of nitrogen in fish excreta exists in the form of ammonium ion, that is, fish can change the nitrogen form in the environment that is not easy to be absorbed and utilized by rice into an effective nitrogen form that is easy to be absorbed and utilized by rice. Therefore, the combined planting and cultivation mode of paddy field is a kind of green and high-yield cultivation mode, which can effectively realize resource conservation, environmental friendliness and ecological balance.

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