

Advances in Rice Direct Seeding Technology

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Abstract: With the decline of rural labor force in recent years, the cost of employment has increased. Direct sowing rice developed rapidly with the advantages of time-saving, labor-saving, simple and efficient, low labor cost and high benefit. In this paper, the varieties selection, cultivation management measures and mechanized seeding of direct seeding rice in China were summarized, and the development direction of direct seeding rice was pointed out.

1. Introduction

Rice, is one of the most important food crops in China, its adaptation area wide, biological potential and high biological productivity; In our country south to north to heilongjiang all can be planted in Hainan. In recent years, the main research on direct seeding rice in China has been focused on breeding and screening new varieties suitable for direct seeding, research and development and improvement of direct seeding machinery, research on lodging resistance and new environment-friendly cultivation. In this paper, the situation of rice direct seeding variety selection, cultivation management and mechanization research was described, hoping to be helpful for the following research.

2. Breeding of Direct Seeding Varieties of Rice

The seedling emergence rate of sown rice was not high and the uniformity was low. In seed selection and breeding, high-quality varieties with high vigor, strong topsoil capacity, deep sowing resistance, good quality, good resistance, developed root system and resistance to fertilization should be cultivated, such as suxiejing, 8169-22 and shanyou 63 single-season rice, jiazao 105, zhi922 and shanyou 207 double-season rice in southern China[1]. Wu yuejin et al. used ion beam mutagenesis technology to develop a direct seeding rice variety anhui rice 143 with high yield, high quality and early maturity. In the experiment of anhui rice 143, it showed that the seedlings were orderly, cold resistant, suitable for early sowing, strong root activity, lodging resistance, and the average yield per unit area of 6387kg/hm² was 10.82% higher than that of the control variety[2]. Zhenjiang 21 was developed by jiangsu zhenjiang agricultural research institute. It is a variety with high yield, good quality, good resistance, good fertilizer resistance and suitable for dense planting. The average yield per unit area of 10050 was 6.05% higher than the control kg/hm², and the average growth period was 158.2d, 2.4d earlier than the control[3]. In addition, direct rice varieties that adapt to local conditions can be selected according to the region and conditions. For example, salt-resistant varieties in northwest China, such as shengdao 14, shengdao 19, yanfeng series, jinyuan E28, jinyuan 89, jindao 105 and so on[4]. High-yielding varieties wanyou 66 and wanyou 481 in hilly areas are also suitable for hilly cultivation and mechanical harvest of japonica rice

varieties zhongke 8, 1505 and 1503[5]. The varieties with medium and early maturity, strong low temperature tolerance, multiple effective tillers, moderate growth period and fast grouting speed in cold areas, such as xianglongjing 26, kendao 13 and hesuan 99-22, are all suitable for cold areas[6].

3. Research on Rice Direct Seeding Cultivation Technology

In recent years, with the continuous expansion of direct seeding rice planting area, domestic and foreign scholars have conducted a large number of studies on direct seeding rice cultivation technology, including different sowing methods, seeding amount, fertilizer application amount, field management measures, etc.

Wang Fangming basic situation and others based on the field investigation to determine the application of no-till planting in normal sowing time delay can be obtained under the condition of good production[7]. Zeng xinyu studied shallow ditch sowing and ridging point sowing[8], and tang lei studied spot sowing and strip sowing of rice[9], and found that different sowing methods showed the same performance among different varieties, and that rice spot sowing had higher yield, which was mainly reflected in good air and light permeability, lodging resistance, strong photosynthesis and dry matter accumulation, as well as beneficial to the processing quality and nutritional composition of rice. In rice direct seeding, the performance of point-to-point direct seeding is > direct seeding, while the no-tillage direct seeding method can only show high yield if it takes management measures such as disease prevention, insect control, weeding, etc., and the performance of management is not as good as that of conventional seeding. In the future, direct seeding method may choose no-tillage direct seeding, which means higher requirements for rice varieties, direct seeding machines, tillage machines, fertilizer applicators, weeding methods and herbicides.

Under normal circumstances, the relation between yield and density of sown rice is that the higher the density is, the higher the yield will be. Reasonable close planting and optimization of population structure are the basic measures to ensure high yield of rice. Zeng xinyu studied different planting methods and planting densities, carried out field experiments on six varieties, including early rice variety conventional rice Zhongjiazao 17 and hybrid rice strain liangyou 819, and investigated the population development and quality[10], lodging resistance, variety characteristics and yield formation characteristics, and concluded that the yield of direct seeding rice was determined by the number of basic seedlings in the field. Conventional early rice had the highest yield at the maximum seeding amount Zhongjiazao 17 (60kg/hm²), and hybrid rice strain liangyou 819 also had the best yield at the maximum density (45kg /hm²). Cheng jianping carried out seed sowing with different plant spacing (18cm, 21cm, 23cm) with the built-in stalls of the direct seeding machine. By measuring chlorophyll, photosynthetic efficiency, dry matter and yield, etc., the population with plant spacing of 21cm had the best performance and highest yield among the three densities. The group of 18 performed well in the early stage, but the group was small, so the yield was insufficient. However, the population of 25 was shielded from each other, with insufficient effective tillering and relatively low yield. In does not affect the normal photosynthesis, within the scope of the appropriate reasonable density can improve the yield. Under the same density, the yield of conventional species was worse than that of hybrid species, and the factors affecting the yield were grain number per ear among different varieties. Among the same varieties, the effective tiller per unit area was higher, and the higher the effective tiller number was, the higher the corresponding yield was.

Excessive use of fertilizers is the environment a big burden, while our country is fertilizer consumption power; About how to reduce fertilizer use, reasonable and efficient use of fertilizer research one of the important direction.Li wei studied different amounts of fertilizer and determined that different amounts of fertilizer had no significant effect on the growth period and total number of leaves of rice[11], but the higher the amount of fertilizer, the higher the yield. Item decorated, etc, the research on applying pure nitrogen content and fertilizer proportion respectively 150 kg/hnm² ShiChun nitrogen, 187.5 kg/hn² and 225 kg/hm², 262.5 kg/hm², seedling fertilizer, rice fertilizer, fertilizer, earing fertilizer fertilization ratio for 3:3:3:1, 3:2:3:2, 3:2:4:1, the investigation of basic

seedlings, seed setting rate and effective tiller number to determine found in use, the more but after three fertilizer levels without Ming gap, fertilizer proportion in 3:2:3:2, best but there is no significant difference between different fertilizer proportion to see[12]. There was no significant relationship between fertilization ratio and yield. Live on rice yield and fertilizer, how much is directly related to the application, the more the better production, the reasonable ratio of fertilizer can increase rice production at the same time, reduce fertilizer use, reduce costs and improve profitability.

4. Study on Direct Sowing Mechanization of Rice

4.1 Research Status of Rice Direct Seeding Machinery at Home and Abroad.

Mechanization of rice direct seeding rice cultivation is to use modern machinery, reduce artificial labor intensity, improve efficiency, save the resource consumption of a kind of way of planting, can be an effective way to increase rice production efficiency and output.

Researchers at home and abroad continue to research and develop and improve the direct seeding machine. Foreign direct seeding machines are mainly developing towards compound, which can precisely sow seeds and apply base fertilizer at the same time on the seed surface to ensure germination rate and improve soil structure. The direct seeding mode of rice, represented by the United States and Australia, mainly USES large agricultural machinery, while the direct seeding mode represented by the United States and Europe adopts the method of plane-seeding and mechanical seeding combined with land preparation technology and field management supporting, with low cost and high yield, and the rice yield per unit area ranks among the top in the world.

Domestic direct seeding machines are mainly developing towards safety and efficiency. Luo xiwen, academician of south China agricultural university is the first researcher on rice direct seeding machinery in China and has made a breakthrough. Luo xiwen developed a 2bdxz-10s self-propelled precision rice hill-seeding direct seeding machine with simple operation, low cost, saving seed and labor and high relative efficiency[13]. The technology of simultaneous ridging and ridging precision acupoint sowing, also proposed by Luo xiwen's team, has developed the corresponding machine, which can now simultaneously ridging, stubble pressing sowing, precision sowing (1-3 grains), reduce the seed damage rate; In recent years in the field experiment was carried out at the same time also to continue to improve machine. Since 2002, tiantianqing agricultural machinery co., ltd. in anqing city began to research on the direct seeding machine, and promoted it as a demonstration field for free, and improved the direct seeding machine according to the needs of farmers. The next step is to study a four-wheel drive rice direct seeder, which is also a simple multiple seeder. It can be used as a medicine while sowing, or as a fertilizer machine, and improves the flexibility when walking on uneven ground[14]. Model 2BF s-8 rice sprout seeding and fertilizing machine can be used for furrowing, ridging, precision seeding, fertilizing and covering soil at the same time. At present our country mechanical research breakthrough“Three synchronization”rice precise hole live technology (synchronous open ditch, ridging, synchronous furrow ridging fertilizer and synchronous spraying rice precise hole furrow ridging broadcast technology), invented for rice precise hole broadcast technology, mechanical and pneumatic type two kinds big three metering device and one kind of synchronous deep fertilization outfit, has proven the forming mechanism of precise hole on the rice yield and physiological characteristics, invented the rice precise hole live high yield cultivation techniques[15]. Agricultural machinery research direction: Chinese rice planter are temporarily in the development of multi-function, high efficiency, precise sowing machines; The future research direction is intelligent, automatic and precise agricultural equipment, which is necessary for us to be in line with the international standards.

4.2 The Problems Existing in Rice Direct Seeding Machinery and the Next Development Direction.

Live now, rice cultivation more tend to mechanization and automation, from sowing to

harvesting treatment all can replace with machinery, such as arable land, sowing, fertilizing, weeding, irrigation, prevention and treatment of disease, are corresponding mechanized harvesting, drying equipment. In China, mechanical seeder is still used in the research and development of direct seeding machine, which can improve the seeding precision and reduce the injury rate. However, there are still some problems that need to be solved. The precision of light and small instruments is not high, and the working efficiency is low. The planter used with wheel tractor is complicated in structure and high in cost. The direct seeding machine used with high-speed transplanting head has high requirements on the field and cannot be widely used in the field. Relatively speaking, water direct seeding also has a matching direct seeding machine, while dry direct seeding mostly uses wheat seeding machine for seeding, which is low in operating efficiency and serious in seed injury. At present, our country lacks is the work efficiency is high, to the seed harm small even does not harm, at the same time sets the preparation, the stubble replanting, the fertilization, opens the ditch to be a body duplicate machinery.

To decrease along with labor, the rising cost of labor, live mechanization of rice cultivation of rice cultivation is a new choice, and this need rice varieties, tools, cultivation mode will need to choose to cooperate with mechanized farming, to increase production. In the future, direct rice planting will become the mainstream, which will promote the research on direct rice varieties, technology and machinery. Mechanized direct seeding of rice into slices will be the main form of rice cultivation, and it will become an environmentally friendly and efficient cultivation method integrating the highly excellent ideas of improved seeds, cultivation management and agricultural machinery.

5. Summary

At present, rice cultivation is mainly focused on seedling raising and transplanting, but due to the comprehensive influence of various factors, direct rice cultivation is the development trend of rice in the future . The development of direct seeding rice in China is very rapid, but there are still some problems, such as precise sowing, lodging, pest control, herbicide and so on. In the future, the quality of direct seeding rice, cultivation management methods (seeding density, application of organic fertilizer, biological control of rice field, research and development of highly effective herbicide), improvement and optimization of direct seeding machinery and other aspects need to be further improved and further studied, laying a solid theoretical foundation for the promotion of direct seeding rice.

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