

# The Key Points of Rice Cultivation Technology and Integrated Pest Management Research in Dongtai City, Jiangsu Province

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## ABSTRACT

Effective monitoring and control of diseases and pests are crucial for ensuring and improving the quality of rice, as well as stabilizing rice yields. Correctly identifying the characteristics of diseases and pests, understanding their occurrence patterns, and their impact on rice production are essential for developing scientific, environmentally friendly, and efficient control measures. By adopting various rice cultivation techniques and integrated pest management strategies in Dongtai City, Jiangsu Province can effectively increase rice yield while ensuring food production safety. Comprehensive prevention and control of rice diseases and pests require the scientific application of multiple knowledge areas and measures to achieve better results in disease prevention while increasing rice productivity to unify social benefits with economic benefits.

## KEYWORDS

Rice cultivation technology; Disease pest control; Dongtai City

## 1. INTRODUCTION

The key points of rice cultivation technology and the comprehensive control of diseases and pests in Dongtai City, Jiangsu Province involve many aspects, including planting technology, pest control technology and the application of green control technology. The key points of rice cultivation technology and the research on comprehensive pest control in Dongtai City cover the whole process from seedling treatment to field management to pest control. By adopting green prevention and control technologies, we can not only effectively reduce the use of chemical pesticides, but also promote the sustainable development of the rice industry. At the same time, in the face of the challenges of the new situation, it is necessary to continuously explore and optimize the prevention and control strategies to ensure the yield and quality of rice.

## 2. ORGANIZATION OF THE TEXT

### 2.1. Key Points of Rice Cultivation Technology in Dongtai City

#### 2.1.1. Analysis of Rice Variety Selections & Improvements

Dongtai City is located in a transition zone from subtropical to temperate climate regions with a humid monsoon climate influenced by sea airflows from the Lixia River basin. The unique climatic conditions promote excellent genetic traits expression in paddy fields during critical periods such as grain filling between September-October each year. In terms of soil composition, it mainly consists

of alluvial deposits from the Lixia River Basin which provides fertile soil suitable for high-quality paddy cultivation due to its water retention properties. Given these conditions, it is advisable to cultivate medium-late maturing varieties that exhibit strong resistance against adverse conditions such as moisture tolerance or cold resistance. Currently "Nanjing 46" and "Yangliangyou" series have shown good performance locally.

### 2.1.2. Technical points of key links of rice planting in Dongtai City

The application of mechanization and automation technologies to comprehensively enhance the overall mechanization level of rice production. This includes precision land preparation techniques, mechanical seeding for hybrid rice, efficient machine transplanting, and direct seeding technology. Additionally, the introduction of "Internet of Things (IoT) combined harvesters" enables precise cultivation management and the use of automated equipment for sowing, spraying pesticides, and harvesting to improve production efficiency while reducing labor costs. In terms of ecological management practices, scientific water management based on different growth stages is implemented to avoid prolonged flooding or premature dehydration during the reproductive stage to ensure increased yield and grain quality. Organic fertilizers are applied along with a combination of physical and biological pest control methods as part of green pest management using "green pesticides" to minimize adverse effects on rice quality caused by chemical fertilizers and pesticides. Furthermore, meticulous field management involves selecting superior varieties coupled with efficient fertilization practices alongside timely weeding operations ensuring clean fields with good ventilation. Emphasis is placed on proper crop rotation scheduling along with enhanced precision land preparation techniques to maintain high-quality soil conditions. Adhering to appropriate planting schedules at optimal densities ensures effective fertilizer distribution while regular monitoring allows for timely adjustments in crop management strategies.

## 2.2. Comprehensive Prevention and Control Strategy of Rice Diseases and Insect Pests

### 2.2.1. Establish a monitoring and early warning system for pests and diseases

Using GIS and WebGIS technology, the GIS-based crop disease and pest early warning system can realize the spatial analysis function of pests and diseases, transform the abstract data into clear and concise electronic maps, and intuitively display the occurrence degree and spatial distribution of pests and diseases. In addition, the early warning system of crop diseases and insect pests based on WebGIS can provide a powerful data management platform to support large-scale and macro-scale insect data analysis and judgment, as well as short-term early warning [1].

The combination of IoT technology and big data-driven technology can reduce agricultural input costs, reduce losses, and increase yields. Collect data through sensors, cameras and drones to establish a model of the relationship between the farm environment and pests and diseases, so as to achieve effective monitoring and early warning of pests and diseases.

The use of automated systems for dynamic monitoring and early prediction, such as the automatic system based on the web GIS platform, can achieve the development of national-level dynamic monitoring and early prediction products for pests and diseases. At the same time, technologies such as automatic trap detection can also be used to improve the efficiency of integrated pest management (IPM).

### 2.2.2. Biological control of pests and diseases

According to the specific types and occurrence of pests and diseases, select appropriate pesticides and pesticide application techniques to avoid excessive or inappropriate Dongtai City's latest research results in modern biotechnology to improve crop resistance to pests and diseases mainly focus on the following aspects:

First, in terms of the application of genetic engineering and molecular marker technology, through the use of genetic engineering technology, especially gene editing tools such as CRISPR-Cas9, the genetic information of crops can be precisely modified, so as to enhance their resistance to pests and diseases. This approach not only allows for the rapid identification and integration of genes with disease or insect resistance, but also accelerates the breeding process through molecular marker-assisted selection.

The second is the development of biological control strategies, and in recent years, Dongtai City has also explored the use of microorganisms or microbial-based products as biological control methods. These strategies include the use of beneficial microorganisms, microbial metabolites, and methods to induce host resistance to reduce the use of chemical pesticides while increasing the natural resistance of crops.

The third is the application of new sensors and remote monitoring technologies, with the advancement of science and technology, Dongtai City has begun to adopt innovative sensors based on host response assessment, phage display biosensors, and systems combined with photonics, which can achieve highly spatial data processing, which can help early identification and effective control of disease infections, thereby reducing the use of systemic fungicides and promoting the development of a sustainable environment.

The fourth is soil microbiota management, and by optimizing the structure of soil microbial communities, Dongtai City is trying to develop a low-cost and environmentally friendly crop protection strategy. This includes the development of microbial-based antagonist strategies to improve the production conditions of crops in an open field environment, using the relationship between soil microbiota and crops for agricultural purposes.

### 2.2.3. Scientific and rational use of chemical pesticides

Reduced application: Applying pesticides according to the detection and reporting of diseases and insects in the field can effectively reduce the use of chemical pesticides. For example, by reducing the amount of pesticides at a time by 25 to 50 percent, it is possible to reduce the use of chemical pesticides without significantly affecting yields.

Combined with biological pesticides: the use of biological pesticides to replace some chemical pesticides can not only reduce the use of chemical pesticides, but also improve the control effect. For example, in the process of 4 times of medication, 1~2 times can use biological pesticides, which can not only maintain a good control effect, but also reduce the use of chemical pesticides.

Use high-efficiency and low-toxicity pesticides: choose high-efficiency and low-toxicity pesticides that have good effect on rice pest control and have little impact on the environment and human body. For example, the use of 20% chlorantraniliprole suspension, 25% pymetrozine wettable powder, etc., these pesticides can effectively control pests and diseases, while reducing environmental pollution.

Implement precise pesticide application: through the use of pesticides that are necessary for the disease. For example, using a small measuring cylinder made of plastic bottles to accurately proportion and apply pesticides can control the dosage more precisely.

Promote green prevention and control technologies: non-chemical methods such as seed treatment and ecological regulation, which can not only reduce the use of chemical pesticides, but also improve the resistance of crops to diseases and pests, thereby reducing dependence on chemical pesticides.

Strengthen agricultural measures: such as deep tillage, transplanting with medicine, spraying plant activating proteins, etc., these measures can effectively reduce the occurrence of weeds and pests and diseases, thereby reducing the need for chemical pesticides.

Through the comprehensive application of the above methods, the scientific and rational use of chemical pesticides can be realized while ensuring the yield and quality of rice, and the green and precise prevention and control of rice diseases and insect pests can be promoted.

### 2.3. Specific case studies

Dongtai City has implemented the "rice-shrimp co-cropping" model, which combines rice cultivation with crayfish farming. This model not only improves land utilization, but also increases farmers' incomes, and promotes the "rice-duck co-cropping" model, which reduces the number of pests through duck activities in the field, and at the same time uses duck excrement as organic fertilizer to improve soil structure. Biological control techniques, such as the use of predatory predators, are also used to control pest populations. Implement precise fertilization and irrigation to reduce the occurrence of pests and diseases. Conduct regular field inspections and monitoring to detect signs of pests and diseases and take control measures in a timely manner. In recent years, the rapid development momentum of green prevention and control in Dongtai City, the scientific and rational use of pesticides has made the amount of pesticide application in Dongtai City decrease year by year, the coverage rate of green prevention and control technology for rice has exceeded 60%, and the application area of non-chemical control technology has exceeded 40%.

In terms of rice seedlings, Yancheng Daoyuanxiang Agricultural Development Co., Ltd. is committed to exploring green and efficient seedling raising methods, using bowl seedlings to plant, so as to reduce the amount of nutrient soil used, do not slow down seedlings, early maturity and high yield, and the nutritional content of rice has also been improved. Bowl planting technology has many advantages such as small amount of seeds, good seedling quality, not slow seedlings after transplanting, fast tillering, more effective tillering, increased yield, and improved rice quality, according to the survey, bowl breeding planting can save about 40% of seeds than conventional planting, seedlings have reached the seedling standard 4.1~4.5 leaves before planting, with tillers under the ground when transplanting, the roots are strong, the seedlings are not planted after planting, and the seedlings are not slow after transplanting, and the seedlings are 5~6d earlier than the conventional transplanting seedlings, because the bowl seedlings are of good quality, it is more conducive to the early growth and rapid growth of tillerers, and the tillering rate of low nodes is improved. The number of tillers per plant was about 3.5, which was about 1.6 more than the conventional production, which was conducive to improving the yield and increasing the rice yield by about 2%.

Focusing on the characteristics of the ecological environment in Dongtai region, Yancheng Daoyuanxiang Agricultural Development Co., Ltd. has established a green prevention and control of rice diseases and pests and a cultivation management technology system in accordance with the technical model of "rice-wheat rotation + ecological regulation and control + precise fertilizer use + real-time monitoring".

(1) Rice-wheat rotation: Rice-wheat rotation is mainly adopted, with rice-green (fertilizer) rotation and rice-fish, rice-duck co-cropping system. Through the crop rotation system, we should innovate and develop efficient cultivation of paddy fields, and actively explore ecological cycle planting and breeding modes such as "rice-crab" and "rice-duck", so as to improve the comprehensive benefits of paddy fields.

(2) Precision fertilizer: Mechanized variable fertilization, as a representative key technical basis of precision agriculture, is the application of advanced high-tech in modern agricultural production, which opens up a new and effective way to meet the above on-demand input and balanced fertilization of modern agricultural green planting concept, and achieves the maximum grain output with the least fertilizer input and achieves the optimal production ratio. For rice, the nitrogen uptake capacity was not the same at different growth stages, and the dry matter accumulation at jointing stage and heading stage increased with the increase of nitrogen. The increase of nitrogen at tillering stage and heading stage was conducive to tillering formation and effective panicle number. Appropriately reduce the amount of basal fertilizer application, increase the amount of topdressing in the middle and late stages of rice growth, can effectively improve the yield and quality of rice, in actual production, the amount of tillering fertilizer topdressing generally accounts for about 30% of the total amount of nitrogen

fertilizer, the amount of heading fertilizer topdressing generally accounts for about 20%, and the overall amount of topdressing accounts for about 50% of the amount of nitrogen fertilizer. Therefore, combined with the characteristics of nitrogen fertilizer demand under the new situation of high yield and high efficiency of rice production, the dynamic monitoring of crop growth process and the topdressing according to the nutrient requirements of rice at different growth stages can reasonably optimize the application of nitrogen fertilizer in rice, scientifically improve the management of nitrogen fertilizer in the field, and play a positive role in improving nitrogen use efficiency, increasing the yield of cash crops, reducing the loss of nutrient resources, and improving the disorder of environmental system.

### (3) Ecological regulation:

a) Reasonable dense planting. The transplanting of the seedling machine was used to expand the row, the transplanting density was reasonable, the permeability of the plant population was improved, the humidity between the plants was reduced, and the occurrence of diseases and insects was reduced.

b) Artificially assisted prevention and control. The first is to remove weeds in paddy fields and surrounding areas, deteriorate the environment for pests, reduce the occurrence base of gray planthoppers and leafhoppers, and reduce the occurrence of pests in paddy fields. The second is to manually salvage the slag after the paddy field is prepared to remove the sclerotia of the remaining pathogens on the rice stubble, which can reduce the occurrence of rice sheath blight. The third is to manually remove the residual weeds in the paddy field after chemical removal.

c) Sexual attractant booby-trapping. In the demonstration area, 1 trap of large borer and 1 trap of rice longitudinal leaf roller borer is placed per mu to trap and kill its adults and reduce the amount of eggs in the field.

d) Release the red-eyed bee. It is mastered that 10,000 red-eyed bees are released each time per mu at the beginning of the pest emergence period, and 10,000 red-eyed bees are released each time to control lepidopteran pests such as the dimorphic borer, the large borer, and the longitudinal leaf roller borer.

e) Planting vetiver. A hole of vetiver is planted on the ridge according to about 1 meter to attract large borer and two borer.

(4) Real-time monitoring: It mainly includes three components: field intelligent irrigation system, 24-hour real-time monitoring, and 24-hour real-time monitoring. Through the real-time collection of air data, pest and disease monitoring, and real-time monitoring and analysis of the paddy field environment, it provides farmers with accurate meteorological information and uploads it to the cloud platform for real-time viewing, helping farmers better grasp the growth status of paddy fields and improve agricultural production efficiency.

As one of the main food crops, the production of rice is directly related to national food security and social stability. In the future, we will continue to explore, with the help of the municipal agricultural technology promotion system and the plant protection service organization network, up and down linkage, to point to area, vigorously promote new and practical green prevention and control technology, precise force, and strive to overcome the problems of individual farmers' excessive dependence on chemical pesticides and excessive application, to ensure that the green prevention and control of rice pests and diseases and pesticide reduction and control work continues to advance, research and promote efficient rice cultivation technology and pest control strategies, which will help to achieve sustainable utilization of agricultural resources and significantly improve rice yield and quality. Increase the economy of farmers and protect the ecological environment.

### 3. SUMMARY

In terms of research methods, the team used the survey method, the control variable method, and the analysis and comparison method, starting from the key factors affecting the occurrence of pests and diseases, such as climatic conditions, planting management methods, field water and fertilizer management, and variety categories, and carefully explored the advantages of the integrated pest control system in rice pest control compared with the traditional pesticide application and other methods in rice pest control. Through continuous practice and repeated research, it is found that compared with the traditional method of using chemical pesticides to control pests and diseases, the comprehensive prevention and control system explored by our team that organically combines reasonable dense planting, intelligent monitoring, artificial assisted control, biological control, and chemical control not only greatly reduces the difficulty of treatment, but also reduces the pollution caused to farmland and water environment, and improves resource utilization. With the help of high-quality rice integrated control technology, Jiangsu Dongtai has ensured the stability of the rice growth environment to a certain extent, effectively improved the quality and yield of rice, and achieved high rice yield for many years, which provides a reference for the green development of rice planting in other regions, and is of great significance for the sustainable development of agricultural production. In addition, in the process of rice planting in Dongtai, Jiangsu, some precautions for carrying out comprehensive pest control and pest control, as well as the limitations of this prevention and control system, were summarized. All in all, the range of environmentally friendly strategies included in the Green Integrated Pest Management technology shows the importance of incorporating ecological principles into modern agriculture.

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