

Rice production mechanization

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Oct. 2019





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Outline

1. Outline
2. The importance of rice production mechanization
3. Introduction of rice production mechanization
4. Developing trend of rice production mechanization



1. Outline

Rice Production Mechanization:

The application, organization and implementation of Mechanization Science and Technology in the whole process of rice production. It not only includes the technological process of agricultural machinery operation in all links of ploughing, transplanting, field management, harvesting, drying and straw returning to the field, but also includes the technology of combining agricultural machinery with rice growth and agronomy.

1. Outline



**Key
Equipment**

2. The Importance of Rice Production Mechanization

➤ Rice is the main food crop in China. Rice production plays an important role in the food security of our country. It is the most important to develop the whole process mechanization of rice production.

➤ **Note:** The annual rice planting area is about 30 million ha, accounting for 27% of the total grain planting area, and the total output is about 200 million tons, accounting for 35% of the total grain output.

2. The Importance of Rice Production Mechanization

➤ The whole process mechanization of rice production is an effective way to increase rice production and farmers' income.

➤ **Note :** Compared with the manual operation, the mechanized operation in various production links, such as tillage, transplanting, field management, harvesting, drying, straw treatment, has significantly improved the effect.

2. The Importance of Rice Production Mechanization

➤ Example:

The paddy field is more flat, the sowing is more uniform, the density of transplanting is more suitable for the growth of rice, and the field (water, fertilizer, medicine) management is more scientific.

As a result, the yield is high, the efficiency of mechanized operation is high, and the overall income will be higher

2. The Importance of Rice Production Mechanization

- The whole process mechanization of rice production has become an urgent need of agriculture and rural development
- **Note:** In the process of industrialization of rural and urban chemical industry, after the land transfer and when farmers want to improve their working conditions, they need to develop mechanization.

3. Introduction of Rice Mechanization Production

- I. Mechanization of paddy field cultivation
- II. Rice planting mechanization
- III. Mechanization of rice field management
- IV. Mechanization of rice harvest
- V. Rice drying mechanization
- VI. Straw returning mechanization

3. Introduction of Rice Mechanization Production

I. Mechanization of paddy field cultivation

In order to meet the needs of rice planting, direct seeding and other planting production, appropriate paddy field tillage machinery shall be selected, and rice dry and paddy tillage shall be completed in accordance with the agricultural requirements.

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Current Status of China's paddy field tillage machinery:
multi-functional, multi machine, multi machine situation.

Type	Paddy Tillage	Tractor (rolling) Boat	Walking Tractor	Large & Medium Tractors
Category	Ride Mode Walking Style	Ride Mode	Walking Style Step Farming	Ride Mode
Structure	Single wheel Double wheel	Hull Steering Wheel	Double wheel	Four wheel Steering Wheel
Operational Method	Ploughing Rotary Tillage Harrow Farming	Roll Farming Rotary Tillage Ploughing	Ploughing Harrow Farming	Ploughing Harrow Farming Roll Farming Rotary Tillage

3. Introduction of Rice Mechanization Production

- **Types & Functions tend to be diversified**



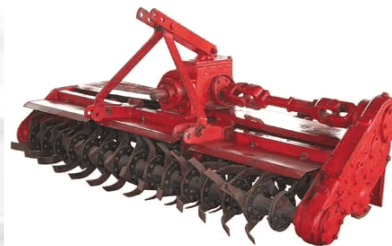
Gasoline Micro Cultivator



Diesel Rotary Cultivator



Paddy Field Harrow



Stubble Rotary Cultivator



Stubble Rotary Cultivator

3. Introduction of Rice Mechanization Production

➤ **Mechanization Technology of Paddy Field Ploughing:**

1) Single Operation of Multiple Links

Water ploughing – watering – soaking – ploughing - stubble killing – fertilization – leveling - sedimentation

Dry cultivation & water consolidation – dry - farmland ploughing & stubble elimination - sunken ridge – irrigation & field soaking – fertilization – leveling - sedimentation

2) Multiple Operation

Irrigating & soaking – rotary cultivation – stubble cutting-fertilization – pulping – leveling - sedimentation

**Multiple Operation of tillage
and land preparation**

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➤ Current Characteristics

Intelligent technologies, such as driverless rotary tillage and laser leveling, are gradually applied to paddy field tillage machinery



Unmanned Rotary Cultivator



Paddy Field Laser Grader

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II. Rice Planing Mechanization

Mechanization of seedling raising:

Under the condition of artificial control of water, fertilizer, soil, temperature, humidity and air, it provides the most suitable growth conditions for seeds and seedlings, makes the seedlings uniform, robust and tidy, and provides high-quality seedlings for farmers.

3. Introduction of Rice Mechanization Production

➤ **The Main Technological Process:** seed drying → awning removal → seed selection → seed soaking → germination → dehydration → sowing → soil covering → seedling emergence → seedling refining → transportation and transplanting.

➤ **Current Technical Characteristics:** Integrate subsoil, sowing, watering and covering

3. Introduction of Rice Mechanization Production



Hand Seeder



Seedling Line



**Self-propelled
Swing Plate**



3. Introduction of Rice Mechanization Production



**Factory
Seedling
Raising**

**Standardized
High Production
High Efficiency**



3. Introduction of Rice Mechanization Production

2、Transplanting Mechanization:

High performance transplanter is used to replace the transplanting technology of artificial transplanting.

The basic principle of transplanter: the principle of evenly cutting the tray is adopted to realize the division of seedling and transplanting, so as to achieve the purpose of fixed row, fixed depth, fixed hole and fixed seedling transplanting.

When the transplanter is working, after the needle is inserted into the tray, the fixed amount of seedling block is grabbed and moved down. When it is moved to the set planting depth, the transplanter will insert the seedling into the soil to complete a transplanting process. At the same time, through the floating plate and hydraulic system, the transplanting depth is basically the same.

3. Introduction of Rice Mechanization Production



Hand Machine Transplanter



Mechanized Transplanter

3. Introduction of Rice Mechanization Production

➤ **Advantages:**

- The planting depth, spacing and number of trees per hole can be adjusted.
- Can fully meet the agricultural requirements.
- It has a hydraulic profiling system to ensure the machine balance and the same insertion depth.
- High operation efficiency, saving labor, saving cost and increasing efficiency.

➤ **Key Elements:**

Man, machine, seedling, field, and water

3. Introduction of Rice Mechanization Production

➤ **Current Technical Characteristics:**

1) **multiple operation**: multiple operations such as side fertilization and spraying medicine can be carried out at the same time of transplanting seedlings.

2) **intelligent transplanting**: use the navigation technology to plan the row and path of transplanting, or even all driverless transplanting.

3. Introduction of Rice Mechanization Production

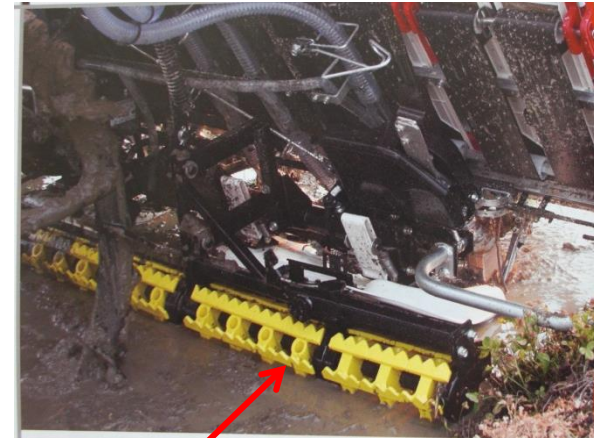


Signal
Receiving

2ZG-6DFA Auto
Drive Side Deep
Fertilizer Applicator



Unmanned
Transplanter



Harrow Wheel



Fertilizing Device

3. Introduction of Rice Mechanization Production

III. Mechanization of rice field management

Direct seeding is a kind of cultivation method that seeds are directly sown in the field. Direct seeding of rice can save a lot of labor. However, compared with transplanting of rice, direct seeding of rice has three major problems: difficult whole seedling, heavy grass damage and easy lodging.

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- **Water direct seeding method**: after the field is well prepared, the shallow water shall be left, and the rice seeds which are soaked and driven to break white shall be directly seeded in the field by the water direct seeding machine.
- **Dry direct seeding method**: after wheat harvest, rice seeds are directly sown into the field by dry direct seeding machine without whole field.

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Broadcast



Row Transplanting



Precision Transplanting

**Direct
Water
Seeding**

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**Dry
Seeding**

3. Introduction of Rice Mechanization Production

III. Mechanization of Rice Field Management

1、Mechanization of Fertilization:

- **Fertilization techniques and methods:** surface fertilization before ploughing, fertilization while ploughing, fertilization while transplanting seedlings.
- **Base fertilizer application:** before sowing, spread fertilizer on the soil surface and turn it into the soil when ploughing.
- **Seed fertilizer application:** the fertilizer and seeds are sown into the soil at the same time.
- **Topdressing:** apply fertilizer near the root of rice plant during crop growth.

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**Organic Fertilizer
Spreader**



**Granular
Fertilizer
Swinging
Spreader**



Liquid Fertilizer Sprayer



**Side Deep
Fertilizer
Transplanter**

3. Introduction of Rice Mechanization Production

III. Mechanization of Rice Field Management

2、Mechanizatin of Rice Pest Control

Control methods of rice diseases, insect pests and weeds: agricultural control, chemical control, biological control, physical control and weed control.

Chemical control is the main means of rice diseases, insect pests and weeds, and the effect of comprehensive control is better.

The main application methods of chemical control: powder spraying and spraying.

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➤ **Chemical Control machinery:**

- Manual or electric sprayer
- Mobile spray duster
- Power sprayer
- Sprayer stick sprayer
- Wind blowing sprayer
- Fixed wing aircraft sprayer
- UAV sprayer

3. Introduction of Rice Mechanization Production



**Mobile
Sprayer**



**Mobile
Sprayer**



**Boom
Sprayer**



**Boom
Sprayer**



**Wind Driven
Remote Sprayer**



**Aircraft Spray
Operation**



**Large Boom
Sprayer**

3. Introduction of Rice Mechanization Production

➤ UAV Field Management



Unmanned Sprayer

3. Introduction of Rice Mechanization Production

IV: Mechanization of Rice Harvesting

Rice mechanical harvesting includes:

Harvesting, threshing, cleaning and other operations.

There are three ways to harvest rice:

Section harvest method, joint harvest method, section + joint harvest method.

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➤ Rice Harvest Machinery Type:

- Half feed combine
- Grain combine
- Multifunctional grain combine
- Small harvester
- Full Feed Combine

Self-propelled wheel type

Self-propelled rotary type

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Knapsack Mower



Swather



Threshing Machine



Small Harvester

3. Introduction of Rice Mechanization Production



Half Feed Harvester



Small Scale Harvester



Full Feed Harvester



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➤ **Full Feed Combine Harvester:**

- The crawler type has good anti sinking performance for wet and soft fields
- Poor performance of rice with severe harvest lodging
- Crop is easy to block when it is wet

➤ **Half Feed Combine Harvester:**

- It can harvest serious lodging rice and has good performance
- Small volume, light weight, convenient operation, especially suitable for small fields in hilly areas.

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V. Rice Drying Mechanization:

The drying of rice is a process that the moisture on the surface of rice is taken away by drying medium.

Conventional drying method:

- Natural drying
- Mechanical drying
- Hot air drying
- Far infrared drying
- Solar drying

Hot air drying is the most commonly used method

3. Introduction of Rice Mechanization Production

➤ Basic working principle of hot air drying:

- The heat source generated by the heating equipment is used to heat the air, and then the air is fully contacted with the rice and the rice grain is heated.
- The water on the surface of the rice is taken away while activating and accelerating the water molecules
- Using low temperature circulation hot air drying technology

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■ Main Category



5HTJ-2.0 Drying Machine:
Production Rate: Rice: 20 t/day,
Raining Ratio: 2.5-3%



NP-60H Circular Drying Machine:
Production Rate: Rice:2500~
6000kg/batch, start/end time:30/41min,
Max burning volume :13.5L/h, dryness
reduction rate:0.5~1.0%/h

3. Introduction of Rice Mechanization Production

■ Main Category



5HSG.60 drying machine
: 6t; drying capability:
4000kg·%h; burning energy:
≤6kg/h;
electricity consumption: <4.2度
/h



SNH10 small scale drying
machine production rate:
100~1200 t / day;
Raining ratio 3~16%。

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- It is difficult to adapt to the drying of high moisture rice with moisture content over 25%
- The method of rice drying with fuel as the heat source of air heating has the advantages of high energy consumption, high operation cost and environmental pollution.

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➤ Regenerative hear pump drying technology

With electric energy as driving force, it can fully precool and reheat the drying medium without external heat source by using the heat transfer characteristics of low thermal resistance of the regenerator.

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➤ Heat recovery pump rice drying machine



Induced draft fan

Hoist

Grain circulation control mechanism

Drying box

Heat pump unit

Electric control

Grain drain pipe

Feeding hopper

- 30% reduction in energy consumption
- 40% reduction in operating costs

The drying efficiency is increased by >10%

3. Introduction of Rice Mechanization Production

VI. Straw Returning Technology:

Rice straw smashing & returning technology

- 1) It can increase the accumulation and renewed of soil organic matter in farmland, which is conducive to the development of green agriculture and sustainable agriculture
- 2) The existing technology and equipment can be used, with low investment and easy operation, and can be widely promoted
- 3) It can deal with a large number of crop straw effectively, and fundamentally solve and serious air pollution problem caused by straw burning

3. Introduction of Rice Mechanization Production



Rice straw returned to the field

4. Developing trend of rice production mechanization

- 1) Multifunctional multiple operation
- 2) New machinery combined with new agronomy and technology
- 3) Intelligent auxiliary system to all driverless operation
- 4) Intelligent agriculture based on the Internet of things

4. Developing trend of rice production mechanization



Rotary cultivation, stubble cutting, fertilization, pulping and leveling (at once)



Flat land, transplanting, side deep fertilization (at once)



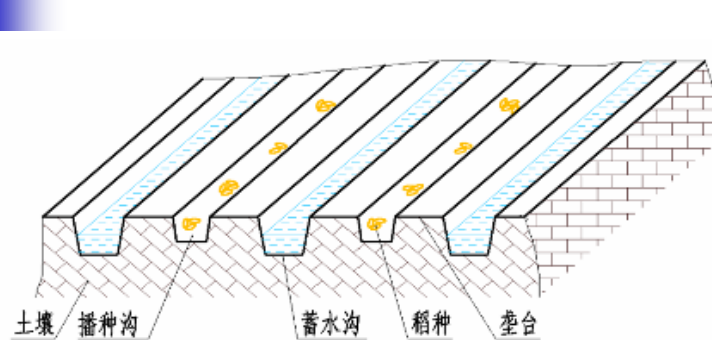
Spread soil, sow seeds, sprinkle water, cover soil, (self walking and swinging at once)

4. Developing trend of rice production mechanization

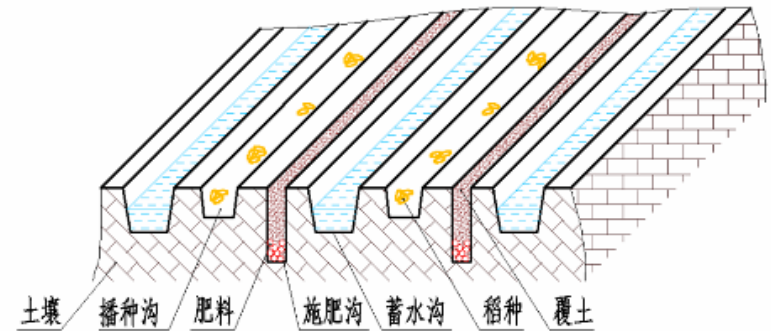
➤Rice direct seeding machine

- Technology of precision hole direct seeding of rice with simultaneous furrow and ridging
- Technology of precision hole direct seeding of rice with simultaneous furrow and ridge fertilization
- Technology of precision hole direct seeding of rice

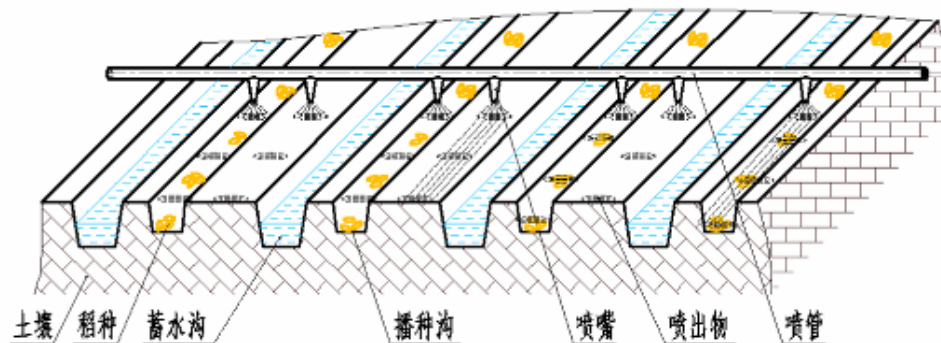
4. Developing trend of rice production mechanization



Technology of precision hole direct seeding of rice with simultaneous furrow and ridging



Technology of precision hole direct seeding of rice with simultaneous furrow and ridge fertilization



Technology of precision hole direct seeding of rice



Direct seeding fertilizer

4. Developing trend of rice production mechanization

➤ Application of rice precision technology

In rice plant protection operation, precise application technology is used to improve the application accuracy of pesticides, reduce the amount of pesticides, reduce pollution and residue while ensuring the control effect.

4. Developing trend of rice production mechanization

➤ Precise application technology of rice



Variable rate spraying machine



Automatic target spraying



Low pesticide sprayer



Electrostatic sprayer

4. Developing trend of rice production mechanization

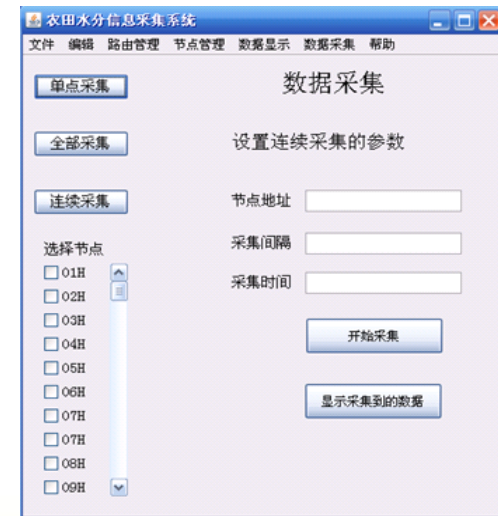
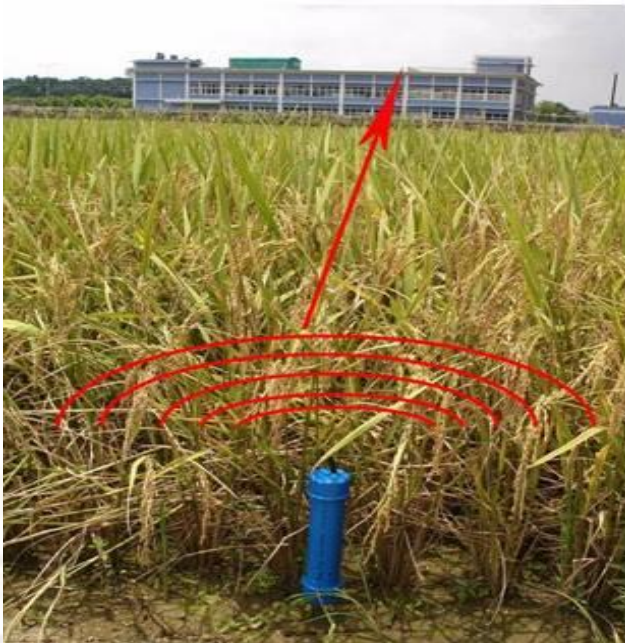
Intelligent mechanical weeding technology



It refers to the technology that the weeding machine has the function of intelligent recognition, which can recognize or perceive the distribution information, position, density and other growth conditions of weeds, and then instruct the weeding executive parts to remove weeds accurately.

4. Developing trend of rice production mechanization

- The wireless sensor network system of rice field water level and soil moisture content can be used for precise management of field water content



4. Developing trend of rice production mechanization

Smart Agriculture:

Generally, it refers to the use of Internet of things technology, "5S" technology, big data and other information technology to realize the digitalization, intelligence, low-carbon and ecological development of "agriculture, rural areas and farmers" industry, integrating the existing agricultural infrastructure, communication equipment and information facilities from space, organization and management, so as to realize the harmonious development of agriculture and realize the "efficient, intelligent, intelligent, fine" and sustainable ecological development. The practice and application of science and technology integration in the field of agricultural development.



