Central Agricultural
Broadcasting and Television School
中央农业广播电视学校

FULLY MECHANIZED RICE AND WHEAT PRODUCTION WITH A FOCUS ON LOSS REDUCTION

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PART.04

Mechanization of Field Management

Mechanization in Plant Protection Management

1. Traditional methods and their limitations

- **Knapsack Sprayers**

  Limited coverage, inefficient, and physically demanding.

- **Wide-Range and Long-Distance Sprayers**

  Increased coverage but still not fast enough for large fields.

- **Manual Tube Spraying**

  Faster than knapsack sprayers but labor-intensive and challenging in muddy or uneven fields.

- **Existing problems**

  Low efficiency or tiring operation.

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2. Paddy Field Self-propelled Boom Sprayer

Operational efficiency

- Significantly improves the **efficiency** of **plant protection operations** in rice fields.

Advantages of large models

- **Effective spraying width** over **30 meters**, with **uniform spraying** and **wide coverage**.
- **Large-flow spraying** effectively **controls pests and diseases** in the **middle and lower** layers of rice plants.

Equipment features

- Equipped with **special wheels for paddy fields**, offering **strong mobility**.
- **Adapts to complex field conditions**, allowing **flexible operation** and **reducing labor demands**.

Key Role

- Serve as **crucial equipment** for **modern paddy field plant protection**.

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3. Wheat Field Self-propelled Boom Sprayer

- **Advantages**
  - **Important tool** because of its **high efficiency** and **adaptability**.
- **Tool features**
  - Operates autonomously without tractor traction.
  - Flexible operation and high operational efficiency.
  - Wide spraying width and uniform droplets.
- **Control effect**
  - Effectively **covers the middle and lower layers** of crops, ensuring control effect.
  - Significantly improves the **efficiency and quality of pest control**.

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4. Plant protection drones

Significant advantages

- **Low-altitude operation** with minimal drift.
- **Hover and fly autonomously** without requiring runways.
- **Rotor-generated airflow** enhances **spray penetration** and **effectiveness**.
- **Eliminate the need for walking in paddy fields**, preventing seedling damage.
- Ensures **safe operation** by **separating humans, machinery, and chemicals**.

Comprehensive benefits

- **Reduces pesticide usage by 20%** and **water consumption by 90%**.
- Delivers **equal or better pest control outcomes**.

Overall assessment

- **A new**, **efficient**, and **environmentally friendly** option for plant **protection**.

Mechanization in Fertilization Management

1. Need for precision fertilization

Current fertilization situation

- Rely on **manual fertilizer-spreading** or **surface-spreading** methods → **low fertilizer utilization rate** and **serious waste**.
- Only around **30% of farmland** is **fertilized using mechanized equipment**.

Existing problems

- Fertilizer usage per acre far exceeds the global average.
- Leads to soil compaction, acidification, and even water pollution.

Solution

- Promote **mechanized precision fertilization** technologies.
- **Intelligent fertilizer applicators** precisely apply fertilizers based on crop needs.

→ Reduces waste and costs.

→ Protects soil and the environment, enabling efficient and sustainable agriculture.

Mechanization in Fertilization Management

2. Dual-disc centrifugal spreader with an adjustable spreading width

Working principle

- **Disperses fertilizer** using **centrifugal force** generated by **two high-speed rotating discs**.

Key advantages

- **An built-in adjustment mechanism** enables flexible control of **spreading width (8–20 meters)** to meet different **field sizes** and **fertilization requirements**.
- **Vibrating or screw feeding system** ensures **uniform distribution, high coverage accuracy**, and **fast operation efficiency**.

Applications

- Widely used for **base fertilization** and **topdressing** in farmland, offering both **precision and practicality.**

Mechanization in Fertilization Management

3. Multiple solid and liquid fertilizer application equipment

Core Function

- Enables **combined application** of **organic solid and liquid fertilizers**.

Key technologies integrated

- Efficient solid-liquid separation.
- Controlled fertilizer transport and uniform spreading.
- Subsurface liquid fertilizer application.

Equipment and processing

- Utilizes specialized fertilizer tanks and separation devices to process mixed solid-liquid fertilizers.

Application Process

- Through **precise control**, **solid fertilizers** are **evenly spread**.
- **Liquid fertilizers** are **deeply applied** and **covered with soil**.

Mechanization in Fertilization Management

3. Multiple solid and liquid fertilizer application equipment

Environmental Benefits

- **Reduces nutrient loss** and **environmental pollution**.
- Improves **fertilizer return** efficiency.
- Promotes the **resource utilization** of agricultural waste.

Liquid Fertilizer Application

- **Precise control of flow rate and atomization** to evenly spray liquid fertilizers onto crop leaves or root zones.
- Enables **efficient topdressing** and **rapid nutrient absorption**.

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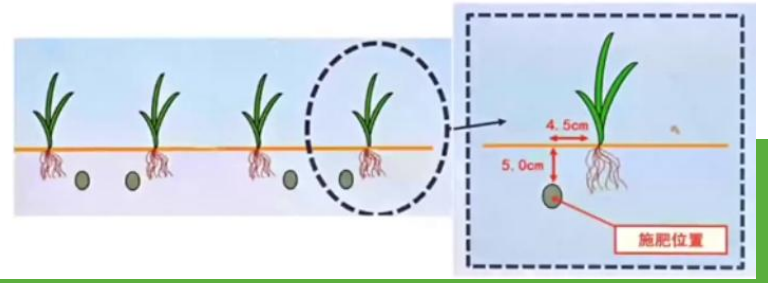
4. Deep side-placement fertilization technology for rice

- **Core Function**：Enables **efficient application of chemical fertilizers**, reduces nutrition loss and environmental impact in **hot/humid environments**.



- **Technical measures**
  - **Optimizes the fertilizer delivery** to avoid blockages.
  - Precisely places **fertilizer in the root zone** using an **anti-drift design**.
  - During transplanting, **granular fertilizers** are **precisely applied** into **deeper soil** near the root zone.

- **Technical effects**
  - **Shorter distance between fertilizer and roots** enhances nutrient uptake.
  - Improves fertilizer use **efficiency**.
  - **Reduces nutrient loss**.
  - Supports both **increased yields** and **environmental protection**.

Mechanization in Fertilization Management

5. The slow-release fertilizer encapsulation technology

- **Uses organic/inorganic binders**.
- **Coats fertilizer granules.**

Intelligent Nutrient Release System

- **Regulates nutrient release** to meet crop needs.
- Aligns nutrients with growth cycles.

Precision Release Technology

- Improves **fertilizer utilization rate.**
- **Reduces environmental risks.**

Eco-efficiency Features

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6. Fertigation technology

Technical Principle

- **Combines irrigation and fertilization** by **delivering nutrients and water directly to the crop root zone** through pipelines.

Technical Features

- Synchronized and on-demand delivery of nutrients and water.

Technical Advantages

- Improves absorption efficiency of nutrients and water.
- Reduces resource waste.
- Promotes efficient crop growth.

Mechanization in Weeding Management

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Chemical weeding

- **Method:** Relies heavily on the spraying of herbicides.
- **Issues:** Environmental pollution, phytotoxicity, increased herbicide resistance, and residue in agricultural products.

Manual weeding

- **Issues:** labor-intensive, inefficient, and costly.

Mechanized weeding

- **Advantages:** Intelligence-based operation, high efficiency, and environmental friendliness.
- **Status:** A much-needed green solution for agriculture.
- **Role:** Replaces traditional methods and promotes sustainable agricultural development.

Mechanization in Weeding Management

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■ Mechanized inter-row weeding

- **Principle:** Power-driven blades or tines penetrate the soil to cut weed roots and stir the topsoil.
- **Advantages:** Efficient soil loosening and weed removal, suppresses weed regrowth, enhances crop competitiveness, and reduces labor costs.
- **Status:** A key technology in modern field management.

■ Spring-tooth inter-row weeding and fertilizing machine

- **Functions:** Loosens soil and removes weeds using flexible tine rods with integrated fertilization.
- **Characteristics:** Simultaneous weeding and topdressing, reduces labor input, and increases operational efficiency.
- **Applicable scenarios:** Conservation tillage.
- **Benefits:** Offers dual advantages of soil preservation and improved yields.