Logistics management experience: moving from bag handling to bulk handling in rice supply chains

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Outline

I. Evolution of grain reserve system in China
II. The construction and development of bulk grain warehouse
III. Advance in Chinese bulk grain storage technology

Introduction to research institute

- College of Food Science and Engineering (NUFE)
- Collaborative Innovation Center for Modern Grain Circulation and Safety (Jiangsu province)
- National Engineering Laboratory for Grain Storage and Transportation (Paddy platform)

I. Evolution of grain reserve system in China

Period: prior to 1949
Transportation, turnover and storage based on bag grain

Reserve purpose: stabilize prices, provide for famine, compassionate the poor, support the army and agricultural production
Storage facility: army provisions warehouse, public granary, reserve warehouse, etc.
Reserve type: government position reserve, farmer reserve
Reserve management: grain reserve management by government and farmers

Period: 1949-1990
Transportation and turnover based on bag grain, and storage based on bulk grain

Reserve purpose: ensure national food security, stabilize the market, be prepared against war and natural disasters

Reserve type: reserve storage, turnover reserve
Storage facility: the state reserve grain depot
Reserve management: grain reserve management at three levels of the state, provincial and county

Period: 1990 to now
Transportation, turnover and storage based on bulk grain

Reserve purpose: ensure national food security, be prepared against war and natural disasters, protect the interests of farmers, stabilize the market
Reserve type: strategic reserve, reserve storage, turnover reserve
Storage facility: the reserve grain depot in country, province, city and county,
Reserve management: the vertical management system consisting of State Administration of Grain, China Grain Reserves Corporation and the contracted enterprises

II. The construction and development of bulk grain warehouse in China

Since 1991, a quantity of new grain depots constructed
- Grain reserve warehouse, turnover warehouse and simple grain depot.
- Bulk packaging, bulk unloading, bulk transportation and bulk storage.

Starting in 1993, warehouse construction entered into a new stage
- Four grain distribution corridors of the northeast China, the Yangtze River, the southwest China, the Beijing-Tianjin belt with a total storage capacity of 4.37 million tons

Entering after 2006, grain warehouse in the stage of improvement, consolidation and strengthening
- Focused on solving the weakness and improving the layout of the grain depots
- By the end of 2010, China warehousing enterprises has 18,000 households with storage capacity of 390 million tons
**Advantage of bulk grain handling**
- Save the cost of distribution
- Suitable for various links of the mechanical operation
- High efficiency in operating with low cost
- High utilization coefficient of warehouse space
- A complete set of bulk grain storage and management technology to guarantee grain quality.

**Disadvantage of bulk grain handling**
- Impact of environmental sanitation and dust explosion hazard
- The capacity utilization rate is not as good as packaged grain
- Certain requirements for transportation
- Bulk bin does not adapt to the grain grading, classification, and small batch storage

**Rice production in China**
(data of 2012)
- China, India and Indonesia accounted for 60% of the total consumption of rice in the world.
- Rice yield accounting for about 27.5% of the world’s total rice production, accounting for 1/3 of the total domestic grain yield.

**Stored-rice in China**
I. Social warehouse storage to meet the business and consumer needs
   - private enterprises, farmers, state-owned grain enterprises
II. Storage reserves to be used to adjust the annual grain supply and demand balance
   - the state special reserve, temporary acquisition storage and local reserves.
Challenges of stored-grain in China

- China's annual loss of grain among storage, transportation and processing caused by waste as high as 35 million tons.
- One-sixth of the grain stored in old warehouse or simple facilities.

III. Advance in bulk grain storage technology

Ecological stored-grain region
1. Cold and dry area; 2. Low temperature and dry area; 3. Low temperature and high humidity area; 4. Medium temperature and dry area;

Economic and safety evaluation system for different ecological geographical storage technology
- The reasonable choices of warehouse types
- Grain machinery and equipment configuration
- Storage technologies and optimal operation modes

Large warehouse  Squat silo
3. Advanced technology for bulk grain storage
- Low temperature technology for grain storage
  (1) Intelligent control technology of mechanical ventilation for grain storage;
  (2) Low temperature technology by solar to reduce space temperature in bulk grain and grain bin;

Controlled atmosphere technology for bulk grain storage
Improve pollution-free grain storage technology in China
(I) CO₂ atmosphere technology and control of grain pests;
(II) Nitrogen rich storage technique for grain storage.
**Other technologies for bulk grain storage**

- The development of grain granary management and pest-control expert decision system
- Physical control technology for grain pests, including the freezing temperature, heat treatment, radiation, and inert powder
- New technology for monitoring stored-grain quality by odor and color of grain

**The integrated innovation technology of "four in one" in bulk grain reserves**

Won the first prize of China Science and Technology Progress Award in 2011

- Mechanical ventilation technology
- Phosphine recirculation fumigation system
- High effective technology for grain cooling
- Intelligent grain inspection analysis system

Applied in more than 1100 the state reserve grain depots with total storage capacity of 52.5 million tons

**Mechanical ventilation technology**

- Effective prevention of large granary temperature increase, humidity stratification, condensation and mildew

**Phosphine recirculation fumigation system**

- Low dose, less residue, explosion prevention
- Complete solution to pest resistance problem in the world
High effective technology for bulk grain cooling

The independent patented energy-saving technology for controlling temperature and humidity in bulk bin

Intelligent bulk grain inspection analysis system

- Prevention of fumigation corrosion and strong electromagnetic interference
- Lightning protection
- Intelligent analysis of mass data

Achievement of "four in one" technologies

- The grain loss is reduced from 4% to less than 1%, the use of chemical agents to reduce the amount of grain 80%.
- Low energy consumption and storage costs with a total of 290 billion yuan in economic returns

Thank you