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Study on farm grain storage in China

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Abstract

In China, farm grain storage cover about 60 percent of grain yield. While, the grain loss of farm storage was serious resulting from bad grain storage condition there. The grain loss of farm storage was about 5 %. This paper particularly introduced a series of work for reduction of loss of stored grains, which was carried out by some science and technology research institutes organized by State Grain Administration, just like Chengdu Grain Storage Research Institute from 2004, and also introduced the fruits obtained already including 10 sorts of new storage facilities exploited for farm storage of different cereal varieties such as paddy, wheat and corn in different areas of China. Meanwhile, the paper introduced the technique reconstruction measures for present grain bin in countryside, pesticide fit to prevent from insects contaminant in countryside grain storage and construction of technology demonstration district in 11 provinces, also stated the main model and status of farm storage in China.

Key words: study, farm storage, grain loss.

Situation of farm storage of grain

Chinese government have invested great fund to establish some state grain depot with international

advanced level since 1998. Some technology on grain monitoring, circumfluence ventilation, cereal cooling and machine ventilation have been extended and applied widely. Meanwhile, low temperature grain storage and CO₂ controlled atmosphere grain storage also make great progress. Now green storage techniques with Chinese unique characters are developing, and grain loss had been controlled less than 0.2 %. On the other hand, there are 0.24 billion farmer families in Chinese countryside, and farm storage of grain cover 60 percent of total grain yield in whole country. Since storage of grain in countryside is dispersive and poor in storage condition, grain loss, mainly damaged by rodent, is relatively serious with 8 % grain loss rate. Rodent damage in North of China is heavier than South, while insect in South areas is heavier than North areas.

In China, grains are mainly produced in 3 plains such as northeast plain, plain in north of China and plain in middle & lower reaches of Yangtse river. North-east plain mainly produce corn, and corn storage is priority of farm storage. Plain in north of China mainly produce wheat, wheat storage is priority of farm storage. The plain in middle & lower reaches of Yangtse river mainly produce paddy, and take paddy storage as priority of farm storage.

According to the ecological condition of grain storage, China can be divided into 7 grain storage ecology areas showed in Figure 1.

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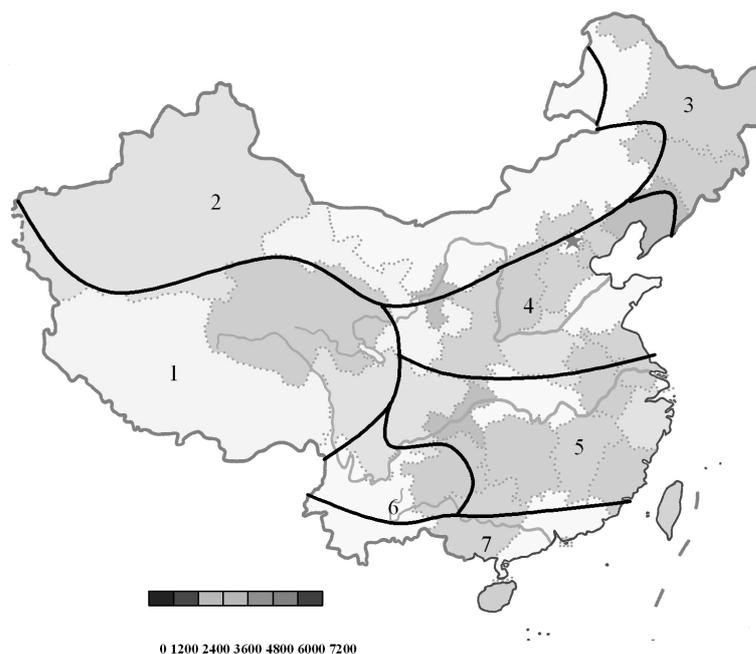


Figure 1. The map of China grain storage areas.

Notes:

- 1 Qinghai-Tibet frigid and dry grainstorage ecology areas 2. Mongolia-Xinjiang dry and cold grainstorage ecology areas 3. North-east cold and wet grainstorage ecology areas 4. North of China dry and hot grainstorage ecology areas 5. East of China hot and wet grainstorage ecology areas 6. South-west mesotherm and low humidity grainstorage ecology areas 7. South of China highly hot and highly wet grainstorage areas.

Achievements of farm storage of grain in China

Since 1995, some granaries for farm storage have been built in China under support of FAO, which have active effect on reduction of grain loss in farm storage. State Grain Administration have organized 5 science and technology units including Chengdu Grain Storage Research Institute(CSR) and Henan University of Technology to make overall study on safe farm grain storage, and have got significant achievements.

Have developed a series of new equipments and facilities for farm storage

Equipments and facilities are major factors affecting safe grain storage. And then, in terms of storage properties of paddy, wheat and corn combined with weather characters of different areas

and storage tradition, experts have developed a series of new equipments and facilities for farm storage and already distributed widely. These facilities included:

(a) Metal silo(showed in Figure 2)

This silo has some advantages. It take up small area, easily installing, have beautiful appearance and is able to prevent from the damage of rodents, insects and molds efficiently.

Metal silo is made from galvanization armor plate or color steel plate with 0.5mm thickness. The diameter and height of layer can be added or reduced according to the different demand. The metal silo can be rotated by 180 angle and its upper, middle and lower layers can be folded to 0.6m height when it is not in use(showed as Figure 2). Meanwhile, the folded silo can store other goods, not only save space to maximum degree but also increase the usage efficiency of facilities.



Figure 2. Metal silo.

(b) Airtight bin with double PVC surface (showed in Figure 3)

Airtight bin with double PVC surface (AB-DPVC) is able to be folded, convenient to use, well moistureproof and air-proof, it has properties to prevent from insect pest. ABD-PVC has been



Figure 3. Airtight bin with double PVC surface.

outfitted special openings to take in and take out grains, meanwhile ensuring air-tightness. In addition, the empty bin is easy to kept.

This kind bin has 1,000 ~ 1,500 kg capacity, is especially fit to store wheat, but is relatively poor to prevent from rodents.

(c) Under-ground bin

Under-ground bin include inside bin and outside bin. Storage of grain with under-ground bin is a sort of ideal method, is able to keep grain quality stable and also prevent from insects and rodents. What's more, it is low cost consumption, never cover space, so is easy to be accepted by farmers. In under-ground bin for farm storage with little capacity, packing storage is proper because of convenience of grain convey. Under-ground bin outside need to add moistureproof layer around bin, increase height of openings and use plastic film liner to insure dryness of bin and good drain around. There is region restrict to build under-ground bin, it is fit to be built in areas with low water level. The plain of north of China posses condition to build under-ground bin.

(d) Concrete bin(showed in Figure 4)

This kind of bin has been designed referencing



Figure 4. Concrete bin.

the requirements of state depot building, can be built near to 3 walls, also 2 walls or only 1 wall. The length, width and height can be confirmed according to specific conditions and demand. The door of bin has been designed double layers, and the doorframe and door outside has been wrapped with sheet aluminum to prevent rodents. Bottom of bin has 10-20 cm distance from ground, combined with concrete plate(1.0m length, 0.5m width and 0.05 m thickness) above bricks, and treated with dampproof felt, finally laid with concrete. For the side near to wall, pitch should be used to cast a layer there, besides, felt can be used to proof water before building with bricks.

New concrete bin is firm and bearable, corresponding with house as well as prevent from rats, insects, proof moisture. It has 9-13 m³ volume and 3,000-6,000 kg capacity.

(e) Bin under stair (showed in Figure 5)

Bin under stair(BS) is a kind of simple grain silo by making use of space under stair, uses steps as bin roof to form a right-angled container. The BS has capacity range from 2,000 kg to 4,000 kg. BS make good use of space of house, correspond with house, is a economics and efficient style for farm storage with good effect on preventing from rodents

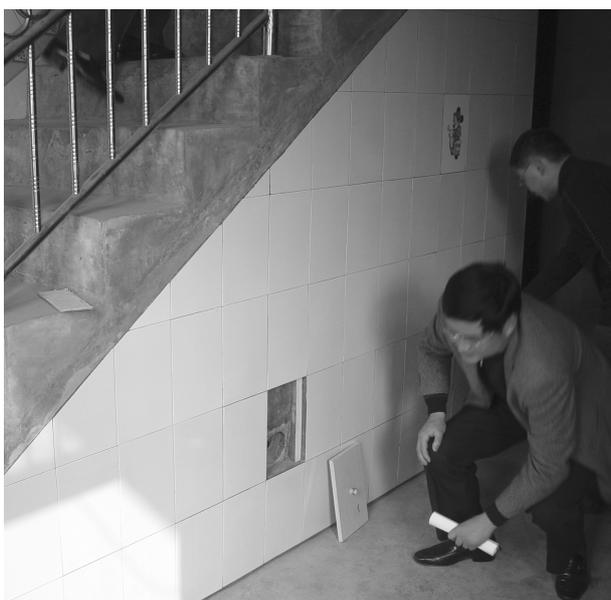


Figure 5. Bin under stair.

and moisture. This kind of bin is suggested to be design when building house.

(f) Steel net bin(showed in Figure 6)

Steel net bin posses function of natural aeration drying, is especially fit to corn storage, meet to two functions of fringe storage and whole kernel storage. In position that corn is susceptible to molds, there are vertical and circle horizontal ventilation pipes installed for natural ventilation as well as machine ventilation in high temperature reason. The equipment is surrounded by metal net with 6 x 6 mm aperture, and the top and bottom of bin are enclosed by metal net with 3 x 3 mm aperture, then the problem of rodent damage has been resolved.

(g) Ventilation drying silo made from prefabricated straw board

This kind of silo is of 2 m height, 2 m diameter, 5 t capacity for corn (Figure 7). The silo body is jointed with 6 piece of prefabricated straw board by size of 1 x 2 m. There are galvanization sheet iron as cover above and air-ducting on ground outfitting 1 kW fan in bottom of silo. The characters of this silo are good temperature preservation and tightness. This kind of silo is suitable to storage and drying of paddy and corn with low moisture content, and meet to functions of storage as well as drying.



Figure 6. Steel net bin.



Figure 7. Ventilation drying silo made from prefabricated straw board.

Have developed special pesticides for farm grain storage

Insects is another major factor lead to grain loss of storage. Since the bin of farm storage are generally in house, prevention of insects are more difficult than that of state depot. In China, state depots commonly use Aluminium Phosphate fumigation to prevent from insects, while this method is not fit to farmers due to they are living in house. At the base of Microencapsulation Technology, Chengdu Grain Storage Research Institute has developed Bao Liang Lin (a kind of special pesticide for farm storage, its components are Fenitrothior and Deltomathrin). This kind of pesticide made the period of validity last to 2 years by adopting controlled release microencapsulation technology. It has wide and significant function for killing insects, is safe and convenient to use, needn't airproof or other special safeguard. It need to be mixed with raw cereals not cereal product by the ratio 1:2,500 to come to 4 ppm concentration.

Have developed INTERNET edition professional farm grain storage consultation system , provide consultation service for farmers

In order to establish convenient path for knowledge dissemination of farm grain storage, the internet edition *professional farm grain storage consultation system*(PFGSCS) has been developed, which reached the goal to run the consultation system in www.grainstorage.net and to search information by free. PFGSCS include 8 parts such as consultation of storage equipments, sense inspection of grain quality, consultation of grain storage approach, consultation of feed storage approach, consultation of insects identification, consultation of insects control, consultation of rodent identification, consultation of rodent control, involving identification and control of main insect, moth, mite and rodent in farm grain storage. Since PFGSCS started to run in June 2005, there have been 65,000 persons browse in website by now. PFGSCS is expected to play a more and more important role in dissemination of knowledge of scientific grain storage.

Have held variety of technology distribution activities

Since 2005, there have been a series of books, TV, DVD etc. disseminating materials. Some books, 'paddy safe storage technology', 'wheat safe storage technology' and 'corn safe storage technology' are all good examples. In order to extend the technology of farm grain storage as soon as possible, the demonstration areas had been set in 11 provinces of 3 large plains, 3,644 demonstration families had been set, 1.2 million set of materials had also been sent to farmers by free, 0.4 million bag of preservative had been sent to farmers, and 166 thousand of farmers had been trained about grain storage technique. In May 2006, State Grain Administration held '2006 activities week of grain science and technology', held 13 set of propaganda activities on science and technology of farm grain storage in 11 mainly grain-producing provinces of China, trained 26 thousand of farmer families. These series of work has greatly promoted the

dissemination and spread of farm grain storage technology.

Development trend of farm grain storage in China

Application of farm grain storage technology must adjust measures to local conditions. It's needed to considerate the design of grain bin when building house, to blend the grain silo construction into the whole design of house layout, or to promote application of storage equipment flexibly outfitted.

While, farm grain storage should only aim at storage of grains for own family consumption because of facilities limit of condition and storage technology etc.. The residue grains of family's should been sent to special grain storage enterprises to store, which can reduce the cost of storage greatly.

It's perhaps the direction accord with the development of future farm storage in China to establish some grain accepting storehouse for farm grain storage and to adopt the 'grain bank' model. At present, there have been some special grain storage enterprises especially storing residue grains for farmers.