# The Storage Building for Agricultural Product

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**Abstract**—The Agricultural product is necessary special treatment in order to long life availibility. The building as the storage for agricultural product should design unique which we call as SILO and it means that the quality of the product should better and longlife.
In agriculture, postharvest handling is the stage of crop production immediately following harvest, including cooling, cleaning, sorting and packing. The instant a crop is removed from the ground, or separated from its parent plant, it begins to deteriorate. Postharvest treatment largely determines final quality, whether a crop is sold for fresh consumption, or used as an ingredient in a processed food product. Keywords—building, postharvest, availibility, crop, quality.

## I. Introduction

A silo (from the Greek σιρός – *siros*, "pit for holding grain") is a structure for storing bulk materials. Silos are used in agriculture to store grain (see grain elevators) or fermented feed known as silage. Silos are more commonly used for bulk storage of grain, coal, cement, carbon black, woodchips, food products and sawdust. Three types of silos are in widespread use today: tower silos, bunker silos, and bag silos. The most important goals of post-harvest handling are keeping the product cool, to avoid moisture loss and slow down undesirable chemical changes, and avoiding physical damage such as bruising, to delay spoilage. Sanitation is also an important factor, to reduce the possibility of pathogens that could be carried by fresh produce, for example, as residue from contaminated washing water.

After the field, post-harvest processing is usually continued in a packing house. This can be a simple shed, providing shade and running water, or a large-scale, sophisticated, mechanised facility, with conveyor belts, automated sorting and packing stations, walk-in coolers and the like. In mechanised harvesting, processing may also begin as part of the actual harvest process, with initial cleaning and sorting performed by the harvesting machinery.

Initial post-harvest storage conditions are critical to maintaining quality. Each crop has an optimum range of storage temperature and humidity. Also, certain crops cannot be effectively stored together, as unwanted chemical interactions can result. Various methods of high-speed cooling, and sophisticated refrigerated and atmosphere-controlled environments, are employed to prolong freshness, particularly in large-scale operations. Regardless of the scale of harvest, from domestic garden to industrialised farm, the basic principles of post-harvest handling for most crops are the same: handle with care to avoid damage (cutting, crushing, bruising), cool immediately and maintain in cool conditions, and cull (remove damaged items).

### *1.1 Postharvest shelf life*

Once harvested, vegetables and fruits are subject to the active process of senescence. Numerous biochemical processes continuously change the original composition of the crop until it becomes unmarketable. The period during which consumption is considered acceptable is defined as the time of "postharvest shelf life". Postharvest shelf life is typically determined by objective methods that determine the overall appearance, taste, flavour, and texture of the commodity. These methods usually include a combination of sensorial, biochemical, mechanical, and colorimetric (optical) measurements. A recent study attempted (and failed) to discover a biochemical marker and fingerprint methods as indices for freshness.

### *1.2 Importance of Post Harvest Technology*

a) It has to develop in relation with needs of each society to stimulate agriculture production, prevent post harvest losses, Improve nutritional and add value of production.

b) To this process , It must be able to generate employment reduce poverty & stimulate growth of other selected economic sector.

c) The Process of developing of post harvest technology and its purposeful use need on inter disciplinary and most multidimensional approach which must include scientific creativity , technology innovation and institutional capable of interdisciplinary research.

d) The fruit & vegetable processing industry in India is highly decliners having wide capability the deserve Agro-climateric zone make it possible to grow almost all varieties of fresh fruit & green vegetables in India.

**2. The Classic Silo**

The classic Silo in egypt showed in figure 1. The grain silos were built in walled enclosures, carefully plaster-coated on the inside and whitewashed outside. In order to store the grain, the workers had to climb stairs to a small window near the top of the cone, carrying baskets. Through a little door at the bottom corn could be taken out. The mudbrick walls of the silos were quite sturdy, yet not impenetrable. Rats and mice found their way into the stores, spoiling significant amounts of grain and against corn eating insects the Egyptians were
Powerless.

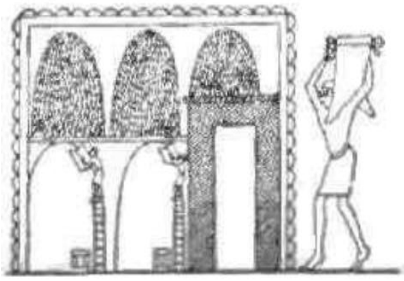

**Figure 1.** The Classic Silo in Egypt

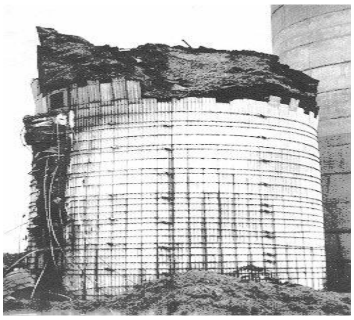

**Figure 2.** Fire Damaged Stave Silo in North America

**Figure 3.** Traditional SILO in Mexico

Every year in North America there are fires and feed damage caused by spontaneous combustion and heating. Millions of dollars are lost each year in structures, feed, and cattle from hay and silo fires (figure 2). Also **lives** have been lost!

This process of forage heating up and then burning is typically called spontaneous combustion. Spontaneous combustion for hay usually occurs within the first two months of storage. In silos, forage can dry down if air enters the silo through leaks in walls or doors; this results in the potential for fires throughout the whole year.

Fire Danger Zone?

1. If mow or silo warms up.
2. You see wisps of water vapour (steam).
3. If you smell a slight caramel odour.
4. Emergency if you have a pungent, scorched stench like burning baler twine. **Call fire department.**
5. Emergency if you see **smoke or flames. Call fire department.**

Most silo fires occur because the silage is too dry. Silage should be between 45-65% moisture content. Silage below 40% moisture content, coupled with extra air from poor packing or leakage of air into the silo creates a risk of heat damage or fire. The classic SILO is safe as indicate in Mexico in figure 3. The Agricultural product keep in this SILO with no rat or other disturbane. But the capacity of Silo is very limited.

## 3. The Modern Silo

The first modern silo, a wooden and upright one filled with grain, was invented and built in 1873 by Fred Hatch of McHenry County, Illinois, USA. Low-oxygen silos are designed to keep the contents in a low-oxygen atmosphere at all times, to keep the fermented contents in a high quality state, and to prevent mold and decay, as may occur in the top layers of a stave silo or bunker. Low-oxygen silos are only opened directly to the atmosphere during the initial forage loading, and even the unloader chute is sealed against air infiltration.

It would be expensive to design such a large structure that is immune to atmospheric pressure changes over time. Instead, the silo structure is open to the atmosphere but outside air is separated from internal air by large impermeable bags sealed to the silo breather openings. In the warmth of the day when the silo is heated by the sun, the gas trapped inside the silo expands and the bags "breathe out" and collapse. At night the silo cools, the air inside contracts and the bags "breathe in" and expand again.

**Figure 4.** Steel Grain Storage Silo

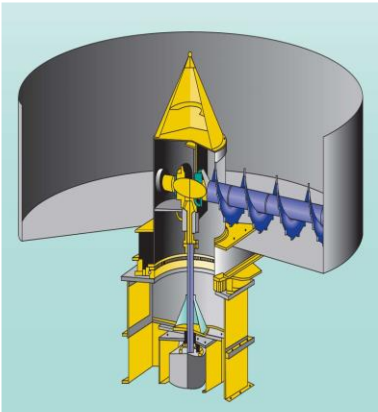

**Figure 5**. Bottom of Silos with diameter up to 25m

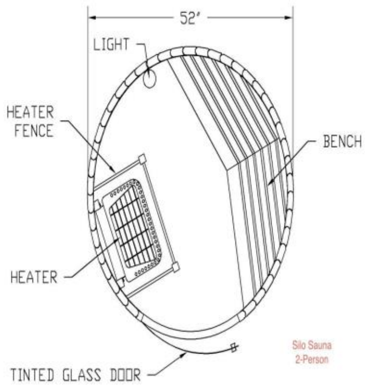


**Figure 6.** The structure of Silo Cedar Sauna

The most identifiable structure in many grain-handling complexes is what most people call the elevator in fig 3.. Tall in stature, the cylindrical silos are landmarks along the railroad tracks. On top, the head house contains the conveyor leg and piping to each silo. The Head House w/Silos kit includes eight silos, a top head house structure, a truck dock with loading doors and rooftop vent details. It's a great addition to any grain complex and is ideal for use with the Conveyor Leg kit (933-2936, sold separately) for loading covered hoppers and trucks as well as other grain series structures and accessories. The main operating component of the silo unloader is suspended in the silo from a steel cable on a pulley that is mounted in the top-center of the roof of the silo. The vertical positioning of the unloader is controlled by an electric winch on the exterior of the silo.

For the summer filling of a tower silo, the unloader is winched as high as possible to the top of the silo and put into a parking position. The silo is filled with a silo blower, which is literally a very large fan that blows a large volume of pressurized air up a 10-inch tube on the side of the silo. A small amount of water is introduced into the air stream during filling to help lubricate the filling tube. A small adjustable nozzle at the top, controlled by a handle at the base of the silo directs the silage to fall into the silo on the near, middle, or far side, to facilitate evenly layered loading. Once completely filled, the top of the exposed silage pile is covered with a large heavy sheet of silo plastic which seals out oxygen and permits the entire pile to begin to ferment in the autumn. In the winter when animals must be kept indoors, the silo plastic is removed, the unloader is lowered down onto the top of the silage pile, and a hinged door is opened on the side of the silo to permit the silage to be blown out. There is an array of these access doors arranged vertically up the side of the silo, with an unloading tube next to the doors that has a series of removable covers down the side of the tube. The unloader tube and access doors are normally covered with a large U-shaped shield mounted on the silo, to protect the farmer from wind, snow, and rain while working on the silo. The silo unloader mechanism consists of a pair of counter-rotating toothed augers which rip up the surface of the silage and pull it towards the center of the unloader as in Fig 4 below. The toothed augers rotate in a circle around the center hub, evenly chewing the silage off the surface of the pile. In the center, a large blower assembly picks up the silage and blows it out the silo door, where the silage falls by gravity down the unloader tube to the bottom of the silo, typically into an automated conveyor system. Silos are hazardous, and people are killed or injured every year in the process of filling and maintaining them. The machinery used is dangerous and with tower silos workers can fall from the silo's ladder or work platform. Several fires by heater in fig 5. or methane gas generated in SILO have occurred over the years. Most silo fires occur because the silage is too dry. Silage should be between 45-65% moisture content. Silage below 40% moisture content, coupled with extra air from poor packing or leakage of air into the silo creates a risk of heat damage or fire.

For silage, temperature readings above 82° C (180° F) indicate that the material will eventually char, smoulder, or burn. Probing silage is mainly used to find the location of the fire, since in most cases a fire is burning before anyone notices the signs of heating. Typically, the fire will be in the top 3 metres (10 feet) or around poorly sealed silo doors. Infrared scanning can also be used to indicate the hot spot location. Access to this equipment may be obtained through your farm safety officer, the Ontario Fire Marshall's Office in Toronto, or local insulation companies. The two main problems which will necessitate silo cleaning in dry-matter silos and bins are *bridging* and *rat-holing*. Bridging occurs when the material interlaces over the unloading mechanism at the base of the silo and blocks the flow of stored material by gravity into the unloading system. Rat-holing occurs when the material starts to adhere to the side of the silo. This will reduce the operating capacity of a silo as well as leading to cross-contamination of newer material with older material. There are a number of ways to clean a silo and many of these carry their own risks. However, since the early 1990s acoustic cleaners have become available. These are non-invasive, have minimum risk, and can offer a very cost-effective way to keep a small particle silo clean.

**45° Hopper Bottom Steel Silo**

| Model | | TC036 | TC046 | TC055 | TC064 | TC073 | TC082 | TC091 |
|---|---|---|---|---|---|---|---|---|
| Diameter(m) | | 3.667 | 4.584 | 5.5 | 6.417 | 7.334 | 8.25 | 9.167 |
| Roof Height(m) | | 0.89 | 1.065 | 1.28 | 1.495 | 1.71 | 1.925 | 2.135 |
| Ring Beam | | 2.75 | 3.21 | 3.72 | 4.17 | 4.61 | 5.2 | 5.48 |
| **Layer** | **Eave Height(m)** | **Volume (m³)** | | | | | | |
| 2 | 2.31 | 33 | | | | | | |
| 3 | 3.43 | 45 | 73 | | | | | |
| 4 | 4.55 | 57 | 92 | 139 | | | | |
| 5 | 5.67 | 68 | 111 | 160 | 231 | 314 | | |
| 6 | 6.79 | 80 | 129 | 181 | 265 | 361 | 468 | |
| 7 | 7.91 | 92 | 148 | 202 | 299 | 408 | 528 | 666 |
| 8 | 9.03 | | 166 | 223 | 333 | 455 | 588 | 740 |
| 9 | 10.15 | | 185 | 244 | 367 | 503 | 648 | 813 |
| 10 | 11.27 | | | 265 | 401 | 550 | 708 | 886 |
| 11 | 12.39 | | | | 435 | 597 | 768 | 960 |
| 12 | 13.51 | | | | | 644 | 828 | 1034 |
| 13 | 14.63 | | | | | 692 | 888 | 1108 |
| 14 | 15.75 | | | | | | 948 | 1182 |
| 15 | 16.87 | | | | | | | |

**4. Silo Volume Calculator**

*4.1 Instructions for Use of Silo Volume Calculator*

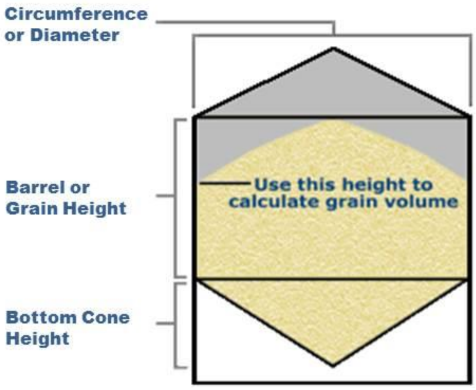


**Figure 7.** Volume of Silo

For reasonable accuracy, make all measurements to the nearest centimetre (0.01 of a metre) then enter them into the calculator in metres (e.g. if you measure 1052 cm then enter 10.52 m). Adhesive tape is useful for holding the end of the tape measure in the right spot when making measurements.

a) Measure around the barrel (circumference) of the silo and enter this into the first space. If you already know your silo's diameter from the manufacturer's specifications, click on Silo diameter and enter this measurement instead.
b) Measure the barrel height to calculate the volume of the whole silo or, if it isn't full, the height of the contents against the silo wall to calculate the volume and weight of the contents. If the silo is being emptied (i.e. the top of the material is coned down) then tick the box.
c) Finally, measure the height of the bottom cone of the silo. Just leave this blank if the silo is an on-ground model. Then click the "Calculate" button to show the results. You can change any of the measurements and hit the calculate button again to recalculate.

Please note: The results from this calculator use standard material weights and are intended as a guide only. Actual material weights depend on many factors such as moisture content, grain size etc.

*4.2 For Example : Silo Volume Calculator*

Circumference or Diameter (1 m)
Barrel or Grain Height (1m)
Bottom Cone Height (1m)
Calculated Volume
Volume1cubic metres
Wheat 1 tonnes
Barley1tonnes
Triticale 1 tonnes
Oats 1 tonnes
Lupins 1tonnes
Canola 1tonnes
Corn1 tonnes
Sorghum1tonnes
Polypropylene 1ton

**5. Conclussion**

1. Silo is usefull for keeping agricultural product but Silos are hazardous, and people are killed or injured every year in the process of filling and maintaining them. The machinery used is dangerous and with tower silos workers can fall from the silo's ladder or work platform. Several fires have occurred over the years.

2. Silage and hay fires can be safely extinguished by fire departments. If a fire occurs on your farm, call the fire department. They have the equipment and the training to deal with it.

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