

Handbook for the preparation and holding of a training workshop using a flip chart

Instructions for Metal Silo Management

Table of Contents

- 1. Introduction**
 - 2. Training Objectives**
 - 3. Preparing the Training Workshop**
 - 4. Steps for Carrying out the Workshop**
 - 5. Proper Use of the Flip Chart**
 - 6. Contents of Flip Chart Sheets**
- Why buy a silo?
 - Maize sales during the harvest
 - Safe storage
 - What factors shall we take into account when buying a metal silo?
 - The traditional storage cycle
 - Silo storage cycle
 - Artisan explaining silo use and management
 - Proper silo transportation
 - Advice regarding metal silo management
 - Improper silo management
 - Drying grains
 - Silo preparation
 - Filling the silo
 - Losses due to humidity in grains
 - Use of fumigation tablets
 - Fumigation dose
 - Sealing the silo
 - Checking for gas leaks
 - Duration of fumigation
 - Correct emptying of silo
 - Incorrect emptying of silo
 - Food security and the metal silo

Instructions for Metal Silo Management

1. Introduction

This handbook is intended as a guide for the use of the flip chart titled “Instructions for Metal Silo Management”. Its aim is to help you in your work as a trainer involved in transferring Postcosecha metal silo technology.

2. Training Objectives

The Training Workshops on Metal Silo Management and Use are geared at farmers, their family members or students. The purpose is to have participants learn and / or experience the following:

- Benefits of a well-managed metal silo
- Management recommendations before purchasing a metal silo
- Metal silo management through training talks
- Grain preparation before storage in a metal silo
- Correct metal silo usage through training talks
- How to seal the silo correctly through practice at the workshop.
- Exchange experiences related to grain storage through a dialogue among technicians, artisans, farmers and other participants.

3. Preparing the Training Workshop

To ensure the success of training workshops we suggest the following preparatory activities:

- Plan and organize the workshop together with the producers and the artisan. Agree upon the place, date and time the workshop is to take place. Invite people five (5) days in advance.
- Invite the nearest *Postcosecha* artisan to the training workshop.
- Ensure that conditions are adequate for holding the event. There must be benches, tables, chairs and so on.
- Ensure that the tools to be used at the workshop for purposes of communication and training be available. These include a flip chart, strip cartoons, a rubber strip, Phostoxin, a silo or model structure, posters and pasteboard.
- Study the technical contents to be presented at the workshop, in particular those related to management of grains stored in the silos.

- Study the flip chart, sheet by sheet. Be familiar with its contents.
- Study the *Postcosecha* booklets and strip cartoons on the subject.
- Ensure that the demonstration metal silo to be used at the workshop has the poster attached to it, is placed upon a platform under a roof and that the surroundings are clean.

4. Steps for Carrying out the Workshop

- Enroll the participants.
- Begin the workshop on time.
- Hold the workshop in a participatory manner.
- Make the purposes of the workshop known. Explain how these are related to the problems described by the participants.
- Begin a dialogue with participants on the subject of the workshop.
- Begin your talk using the flip chart. Encourage participation.
- The flip chart has 26 sheets and contains enough information for a discussion lasting anywhere from 2 to 5 hours. Use only the sheets that deal with the main objective of the workshop. Several workshops can be held using the same flip chart.
- Upon concluding the talk, promote a dialogue so as to discuss the main topic of the workshop in greater depth.
- Practice fumigating and sealing the silo.
- Draw up a list of conclusions from the workshop.
- Distribute the strip cartoons regarding the metal silo.
- Evaluate the workshop together with the participants.

5. Proper Use of the Flip Chart

- Place the flip chart in a spot from which it can be seen clearly by all and at a height at which the pages can be turned comfortably.
- Have the audience seated in such a manner that **everyone** can see the flip chart from a distance not to exceed 8 meters.
- The person giving the talk should position himself / herself so that he / she does not interfere with the view of the flip chart by participants.
- The level of language to be employed should match the educational level of participants.
- The flip chart's sheets should remain exposed for as long as it takes for participants to study the images in detail and understand the message.
- The talk should follow the drawings being seen by participants. It is recommended not to advance ideas that will be shown in subsequent sheets.
- For repetitions or clarifications it is always possible to return to sheets shown earlier.

6. Contents of the Sheets in the Flip Chart

For many years the technical assistance and training provided to farmers in Central America, specifically in the area of basic grains, have been geared at the increase of production, without taking into account that although an increase in production may indeed be achieved, there are always problems with the conservation of the harvest. The farmer works for many hours, investing his / her energy to bring in the harvest and try to solve the problems related to pests in the field. This leads us to a question: why produce more if problems related to losses in storage have not been solved?

The proper answer to solve this serious problem is that the farmer can have access to a type of improved storage structure that is easy to use, inexpensive, acceptable, effective and made of materials that are readily available in the area. This improved structure is the *FLAT METAL SILO*, designed by the *POSTCOSECHA PROJECT*. It is the outcome of a four year process of research and evaluation.

Some will say that a silo is nothing new. A number of producers have used them for 30 or 40 years in different regions and communities throughout Central America. Nevertheless, the *POSTCOSECHA PROJECT* has found many conic metal silos abandoned on farms, or being put to uses rather different from storage. Good experiences are those of producers who without having received specific instructions have properly managed both the silo and the grains.

The design of the *POSTCOSECHA* Flat Silo is not simply the creation of something old with a new name. Rather, it is a structure that attempts to satisfy the needs that have emerged as a result of adverse circumstances in the productive process and the way in which other metal structures were designed. One of the problems inherent to a conic silo is that the producer cannot provide adequate maintenance on the inside because the intake throat is too small. Further, should oxidation occur, it cannot be fought, regardless of what caused it. Oftentimes the conic silos cannot be easily sealed and the manufacturer does not know the correct handling of the structures.

Because of the obvious limitations of the conic metal structure, a flat silo has been designed, with the aim of consolidating the necessary steps for the efficient management of both grains and structure.

In what follows we shall explain and demonstrate how important it is to raise the awareness of producers regarding the value of their silo and how to use it correctly, without repeating the mistakes made in past.

Why buy a silo?

The traditional way in which farmers store their grains is in an open-air storage. In the case of maize on the cob, it will frequently be found stored in an improvised structure within or outside the farmer's home, as maize is one of the staple foods in the diet of the Central American people. Some farmers undertake certain practices to keep the maize healthy for a longer period of time, others only gather it together and make a pile up. Year after year farmers have suffered great losses in their traditional storage arrangements, as a result of exposure to insects, birds, rodents and theft.

These losses may be partial, involving several bags, but sometimes after 6 to 9 months they may be total, thus limiting the family food intake months before the next harvest comes in. This in turn forces the farmer to buy grains at the local store, paying high prices for food that is often of inferior quality. Efforts made by farmers to produce their own food are in vain when the grains are lost while in storage. If we are to attach a monetary value to this, adding in the money spent to purchase additional grains, it is easy to determine the extent of the problem resulting from the lack of safe storage facilities (see the booklet titled "Postharvest Basic Grains Situation and Recommendations for Storage").

Maize sales during the harvest

In many cases, upon having a good harvest, the farmer does not have adequate storage facilities with sufficient space. He / she therefore finds it necessary to sell the crops immediately and at very low prices, that sometimes do not even cover the cost invested in the production of one bag. The main beneficiary of this situation is the intermediary, who is even willing to go and buy the grains in the field where they are being harvested, offering to pay whatever he wishes and not what the farmer is asking.

When there is a good harvest nationwide the prices offered by intermediaries is so low that farmers often prefer not to sell at all, but rather heap up their product almost anywhere, hoping that it is not entirely ruined and that at least a few bags are left over for home consumption (see the booklet titled "Economic and Financial Aspects".)

Safe Storage

Compared to traditional storage methods, a Metal Silo occupies less space and can safely store a larger quantity of grains for a longer period of time, until the next harvest comes around. The most common enemies of grains stored in an open-air storage structure, such as weevils, rodents and birds and fowl, can do nothing to harm the grains kept inside the silo. Further, upon storing the grain in a Metal Silo a good profit can be made later on in the year. However, to make sure that the grains are well-protected in silo, it is necessary to follow certain

recommendations regarding grain storage management. These are explained below.

BENEFITS OF A WELL-MANAGED METAL SILO

Grain losses are minimized

Quality maintenance = increase in grain value

**Possible Marketing
Benefits**

**Less money spent
on grain purchases**

**MORE MONEY
FOR THE FARMER**

GREATER GRAIN SECURITY

No more attacks from weevils and rats

Protection from theft

BETTER HYGIENE -- BETTER HEALTH

HOWEVER

To obtain the aforementioned BENEFITS it is necessary to pay off the silo within one year at the most.

Through proper silo management the farmer can significantly increase his / her income, obtaining the following results:

- a) Diminishing grain losses from an average of 10 – 15% to 0%.
- b) The quality of the grain being stored is maintained during the storage period. Thus the family has food to eat, healthy seeds are used for planting and the farmer can market quality grains, which will increase its nutritional and financial value.
- c) Grains can be preserved during a shortage and it will not be necessary to buy them at the local store or from an intermediary charging a high price. Had the grains remained in the open-air storage structure, it would become necessary to sell it at a low price after 2 to 4 months of storage.

- d) The farmer can benefit directly from marketing if prices are high due to a shortage. However, this is simply a possibility, not a certainty. Sometimes the price of grains remain low even during a shortage.

The four (4) points presented above illustrate how a farmer can directly increase earnings by using a metal silo.

Besides having more income available, the farmer will obtain additional benefits from silo use, such as:

- Greater security for the grains because pests such as weevils, mice, etc. will not be able to attack it.
- The grain will be protected against theft, since usually the silo will be located inside the farmer's home.
- The grain will have been stored in a hygienic fashion, thus ensuring better health for the family and avoiding possible medical costs.

NEVERTHELESS, TO OBTAIN THESE BENEFITS IT IS NECESSARY TO PAY OFF THE SILO IN A PERIOD NOT TO EXCEED ONE YEAR. These recommendations are the result of calculations made by economists and are based on experience. The idea is to avoid that the payments on the credit granted eliminate the financial benefits.

What factors must we take into account when purchasing a metal silo?

Traditional storage cycle

Regardless of the outcome of the harvest, the farmer does not feel it is necessary to program each year in writing the same crop management activities. Usually the storehouse for the maize will be the traditional open-air structure.

Depending upon whether or not there is a single harvesting cycle the farmer will bend the maize stalks, leaving it in the field for several months. This is a tradition in Central America. Once the grains have dried on the stalk it is harvested or heaped up and left to dry in the sun for a few more days. Then it is transported to somewhere near the house. The large cobs with good grain coverage are separated from the rest and placed in a nearby open-air structure, with or without an insecticide or other recommendable product. No effort is made in terms of repairing or changing materials, cleanliness or hygiene of the structure.

The maize stored is quickly damaged, depending on the degree to which the area is infested by weevils from the field, or the efficacy of the insecticide, if indeed any was applied.

According to tradition, each day or week the women and children take out the corncobs the family is to consume and remove the grains. Family members participate in all activities, which are carried out for as long as there is maize in the open-air structure

Thus it can be seen that over the years farmers have adopted a particular work pace based on the harvest and the traditional open-air structure. The issue here is whether or not it might be easy for farmers to give up their traditional storage methods or adapt to a different type of crop management and if habits could be changed to free up time for carrying out other household or agricultural tasks.

Silo storage cycle

The purchase of a metal silo implies a shift from the traditional grain management to which farmers are accustomed.

The silo storage process must be carried out within one (1) month. This includes harvesting, transportation, and the removal of husks and grain. The maize must be dried to less than 14% humidity.

Subsequently the grain is deposited in the silo, where it is fumigated.

In the traditional open-air structure this process takes from two (2) to four (4) months and there is more family participation.

Handling Advice
1,360kg capacity

Handling Advice
800kg capacity

Handling Advice
180kg capacity

COST PER BAG STORED

The present price of a silo in the area should be marked on the flip chart with tape, as should the cost per bag stored. The larger the silo the less expensive the storage. The cost per bag stored decreases if the silo is large. For example:

Prices/ capacity	Silo 1,360kg	Silo 800kg	Silo 540kg	Silo 360kg	Silo 180kg
Total Price	US\$ 58	US\$ 41	US\$ 34	US\$ 25	US\$ 20
Price per 100kg	US\$ 4.26	US\$ 5.13	US\$ 6.30	US\$ 6.94	US\$ 11.11

The extensionist should explain this situation to interested farmers, as should the silo manufacturer in the case of potential silo buyers. Thus it is possible to avoid a situation in which a small producer plans to purchase two (2) 540kg capacity silos (US\$68) instead of a single 1,360 kg silo (US\$58), thus incurring in an unnecessary expenditure of US\$10 (see also the “Calculation Table for Metal Silo Costs” which every *POSTCOSECHA* artisan and technician involved in technology transfer carries with him).

It is also common that the buyer think only of the need to store the grain at a given moment in time. However, it is known that the demand for food always is on the increase. It may be that the following year it becomes necessary to store 1,360 kg instead of 800kg. If at that time another silo were purchased so as to overcome the problem, a similar mistake would be made as in the circumstance described above. Further, it is necessary to keep in mind that heads of family always try to keep their children and grandchildren close to home even though they may be married.

It is the obligation of the silo manufacturer and of the technician to tell the interested party what the dimensions of the silo he / she wishes to purchase are (height and diameter), since often the width of the door or the height of the place in which the silo is to be located are not in keeping with the silo’s size.

Capacity	Height		Diameter	
	Inches	Centimeters	Inches	Centimeters
180kg	36	90	24	60
360kg	36	90	30.5	76
540kg	48	120	35.5	89
800kg	72	180	35.5	89
1,360kg	72	180	46.5	117

In a situation such as the one described above the farmer may incur extra or unnecessary costs upon building or improvising a in which to locate the silo. If the farmer wishes to have the silo indoors or in some nearby structure, and the door is narrower than the diameter (width) of the silo he / she wants to buy, this is no problem, since the manufacturer can build the silo inside of the proposed location (see the strip cartoon titled “Benefits of having a Silo”).

Artisan explaining silo use and management

The manufacturer should demonstrate the use and management of metal silos to each buyer upon delivery. The silo should be delivered to the farmer with the poster titled METAL SILO – USE AND MANAGEMENT attached to it. The strip cartoon titled SILO BENEFITS and other didactic material that may be helpful should also be made available for orientation purposes.

Once the farmer has his / her silo it is the obligation both of the extensionist and the artisan (silo manufacturer) to visit him / her periodically so as to verify directly that the silo is being properly managed and to provide guidance if mistakes are being made (read and review the poster titled “Metal Silo – Use and Management”, the strip cartoon titled “Silo Benefits” and the booklet “Review of Silo Quality”).

Proper silo transportation

The manufacturer must build the silo at the buyer’s home, so as to avoid having to carry it along often bad roads and long distances on pick-up trucks, as this may cause dents or bumps as a result of improper placement on the truck bed or the pressure of the ropes with which it is tied down. Often people *think* they can easily transport the silo and only realize their mistake once the damage is done.

If distance is not too great the silo may be transported in the following manner: two (2) persons carry it in a horizontal position and well tied down to two (2) strong beams or poles. This procedure avoids that the structure and surface be subjected to bumping or denting, and should be carried out as illustrated on the corresponding sheet in the flip chart.

It must be remembered that the care afforded the silo will be reflected in the length of time during which it will last and provide an effective service as an improved storage structure (see the booklet titled “Metal Silo”).

Advice on Metal Silo Management

Once the farmer has the silo on the premises it should be placed upon a wooden platform to avoid oxidation (rusting) caused by contact with the ground.

The platform surface must be placed in an exactly horizontal position. This can be done using beams or boards, so long as the latter are not very far apart. If the boards are placed too far apart or on an uneven keel (high and low parts), the silo may become deformed due to the weight of the grain upon its bottom part. This will diminish the silo’s useful life.

The dimensions of the platform should be such that the entire diameter of the silo bottom rest upon wood. The size of the platform will thus depend upon the size of the silo.

The approximate measurements for each side of the platform are that of the silo's diameter. The platform should be **5 or 6 inches (12 to 15 cm.)** off the ground. The support for the boards on the surface are provided by two or three **6cm x 12cm studs (2.5" x 5")**, whose length will be equivalent to the width of the platform. The surface itself is made of boards or planed down beams **1" (2.50cm)** thick. The spaces between the boards should not exceed **1 inch**.

The important thing is to place the silo on the platform in such a manner that the seed outlet is free and the grain can be removed without difficulty.

The silo must be placed under a roof so as to protect it from the rays of the sun and the rain throughout the day. Otherwise the sheets of which it is made will become rusty not only on the outside, but also on the internally as a result of the condensation of water inside the silo.

If a silo full of grains is exposed to the sun during the day, the grains will sweat, water accumulates at the top lid or on the interior walls. When it rains during the night, or with the arrival of dew at daybreak, drops of water are formed within the silo that fall onto the grain, leading to attacks by fungi and the formation of lumps and fermentation. This occurs even over a very short time. The decomposed material will then stick to the silo walls and cause oxidation (rust).

The silo should not be in contact with any surrounding wall. The minimum distance should be at least 10 cm, so as to avoid oxidation caused by humidity, especially during the rainy season and if the walls are made of adobe.

Poor silo management

The location and placement of the silo as seen in the following illustration is entirely incorrect. Note that the silo has been set directly on the ground, which as we know will cause the bottom lid to rust as a result of the humidity in the soil. Nor should bags of fertilizer be placed close by the silo, given that their residue also leads to rusting.

Further, heavy objects such as saddles or farming tools must not be put on top of the silo as over time they may damage it.

Drying the grain

Drying the grains well is extremely important if the silo is to be functional and of great benefit. This will depend upon a correct drying process to be carried out by the farmer.

To store the grain in a silo it must be both dry and clean, with a humidity content not to exceed 14%. If the grains are deposited in the silo with more than 14% humidity, the result will not be what one would wish for, since the grains will begin to be attacked by fungi, take on a foul smell, ferment and lump together.

To ascertain that the grain has less than 14% humidity the farmer should do the following:

Manage and dry the product as is usually done. Then test the grains for dryness based on traditional methods (touch, hardness upon being bitten, springiness upon being dropped, etc.). Then continue to dry the grains in the sun for three (3) more days in the usual place. Count on 7 to 8 hours of sunlight per day, but if there is cloud cover, a few more days in the sun may become necessary. This recommendation is valid for all regions in the country.

If you normally dry grains in your yard, be sure to place the product upon a canvas or tarpaulin that will protect it from the humidity in the soil. Do not dry grains directly on the ground, as the earth contains humidity.

This drying operation (less than 14% humidity, 3 extra days of drying after the grains are considered dry based on experience) must always be carried out with any amount of grain that is to be deposited in the silo (see the booklet titled “Drying and Drying Hut”).

Silo Preparation

The farmer must always clean the inside and the outside of the silo before and after use.

The diameter of the intake throat allows for one person to enter the silo (800 and 1,360 kg silos only).

Whenever necessary clean the inside and the outside of the silo with a damp cloth. Then repeat the cleaning with a dry cloth.

It is necessary to check if the silo has any holes as a result of faulty handling or a defective soldering job. If you detect a hole the first time you intend to use the silo, it is the obligation of the manufacturer to repair it (by soldering). If there are rusty spots, scrape with sandpaper and eliminate all the oxide, then clean with a cloth and paint over.

When cleaning the silo care should be taken to place it in a horizontal position upon a flat and clean surface (see booklet titled “Metal Silo”).

Filling the silo

Fill the silo with clean, dry grain (moisture content inferior to 14%).

Do not lean the ladder against the silo when filling as this may lead to denting.

One or two persons can fill the silo in an easy and simple manner. A bench or chair is used to climb up into the appropriate position and thus deposit the grain inside the silo with a bag or bucket.

Try to have the grain to be placed in the silo readily at hand. If only half the silo is filled up and you opt to buy the other half of the grain, make certain it too well dried. If it is not, dry the purchased grain to less than 14% moisture and dry it for 3 days more in an appropriate place. Use your own judgment. Do not simply take the seller's or your friend's word for it if they tell you the grain is quite dry.

Losses caused by humidity of the grain

If the silo is filled up with humid grain serious problems will occur, such as the lumping of the grain. This could cause it to become a total loss. It means the effort made and the money invested are lost. To make matters worse, the grain will have to be bought again at a higher price for family consumption.

In some cases this mistake on the farmer's part can have even more deleterious consequences, such as largely ruining the storage structure. Thus, additional money will have to be spent to repair it (see the booklet titled "Microorganisms").

Use of the fumigation tablet

Some farmers who acquire a metal silo are of the opinion that it is not necessary to fumigate the grains and that it is enough to select it and store it well. In reality this is not the case. The silo should always be fumigated. If some farmers have not done so and have had good results nonetheless, this is because the grain came from the field without weevils and they indeed made a good selection. But these cases are rare and more than anything a matter of luck.

The product that is used to fumigate the grain contained in a silo goes by commercial names such as Phostoxin, Gastion or Detia, but they are essentially the same thing. They come in the form of pills or tablets and once in contact with the humidity contained in the grain and in the air produce a gas known as phosphine or hydrogen phosphide. This product should be used under hermetic conditions, in structures into which and from which no air can pass. Thus the gas will remain at the desired concentration for the amount of time necessary to control the insects. In rural areas this product is simply known as "fumigation pills". Farmers usually do not use them properly, both in open-air structures in

bags, for if the structure is not airtight the gas will escape and may poison persons and animals, while increasing resistance among insects.

When going to purchase these tablets it is recommended that a bottle with a lid be brought along. The tablets may be placed inside and thus be kept at home in a safe, airtight place from which the gas cannot escape. This will avoid problems with intoxication. The receptacle used should be opened only when the tablets are to be used. Usually the tablets are sold wrapped in a piece of paper. Farmers often put the package in their pockets, but sweating will cause the gas to escape, which may lead to nausea and dizziness (see the booklet titled “Phosphine” and the strip cartoon “On every cloud a silver lining”).

Fumigation dose

Once the desired amount of grain has been deposited in the silo it should be fumigated immediately.

To fumigate properly takes one (1) tablet of Phostoxin, Gastion or Detia for every 225 kg of silo capacity. The amount of tablets is related to silo capacity per volume, not to the amount of grain deposited. Always place the same number of tablets in the silo, regardless of how much grain has been stored.

For example, a silo with a 1,360kg capacity will always be fumigated using six (6) tablets, whether it contains one (1) pound, 135kg or is filled to the brim with grain. For a silo with an 800kg capacity some may argue that three-and-a-half tablets are needed, and mathematically they are right – except that tablets should never be split. In the case just described, use four (4) tablets.

On the poster containing management advice and that should be attached to the silo, there is a space in the lower right hand corner in which to write down the name of the manufacturer, silo capacity and the amount of tablets to be placed inside, so that the farmer always remembers correctly.

The tablets are placed in a corn husk or a piece of paper atop the grain in the silo. This makes it easy to gather the dust that will be left over after all the gas has been produced, and will avoid its getting mixed up with the grain. As the gas is heavier than the air and is spread about faster and forcefully, the tablets may be placed anywhere in the silo, but for the aforementioned reasons they should be placed on top of the grain, regardless of whether the silo is half full or has been filled to the very top.

Sealing the silo

The aim is to keep the gas enclosed inside the silo, unable to escape and in contact with the grain. To that end the intake throat and seed outlet of the silo

must be hermetically sealed so that air is not allowed to enter or to escape (much as with the inner tube of a tire).

The seal may be fashioned from a rubber strip (bicycle inner tube). It should be 1.5 **inches** (3.8cm) wide and long enough to be stretched around the intake throat and seed outlet three (3) times. The extremities of each strip should be cut into the shape of an arrow. Then the strip is placed directly upon the neck of the intake throat and seed outlet and wrapped around it three (3) times, stretching the rubber. After tying the ends of the strip into a knot, spread grease, soap, tallow or wax along both sides of the strip. Enough grease, soap, tallow or wax should be used to achieve complete sealing, so that the silo becomes totally airtight.

If no rubber strip is available, the intake throat and seed outlet can be sealed directly with grease, soap, wax or tallow. Smear the external part of the neck or the interior part of the lid. Once it is in place, finish by sealing around and on the neck of both the intake throat and seed outlet.

Checking for gas leaks

After fumigating and sealing leave the silo to itself and wash your hands with soap and water. After **2 to 5 hours** check if any gas is escaping from the silo as a result of defective soldering, sealing or holes in the sheets. To do so it is necessary to know the smell that emanates from the tablets: it is similar to that of garlic or onion. If such a smell is present, locate the hole in the sheet or the defective portion of the soldering from which it is escaping. Then cover it with grease or any other appropriate material. If it is the first time the silo is being used the manufacturer is obliged to repair it as soon as the silo is empty.

If the escape is caused by improper sealing of the intake throat and seed outlet, correct the ties and seal well (see booklet titled“Phosphine”).

Time of Fumigation

The silo must remain sealed and airtight for ten (10) days. This is the time it takes to achieve a concentration of the gas high enough to eliminate the weevils at all stages of development. If the silo is opened before 10 days have gone by it is likely that the adults and the larvae will have been controlled, but not the eggs and the pupae. These will soon develop into adult weevils and an attack will soon take place. The same may occur if the farmer uses an amount of tablets inferior to that which is recommended.

On the eleventh day the residue or dust left over from the tablets is removed. Now the grain is ready for use. It can be taken from the silo and sold or used for family consumption. There is no danger of poisoning (important: see the booklets titled “Phosphine” and “Fumigation Management”).

The silo must remain closed at all times, but it is necessary to check the grain every two weeks to verify if there are any live insects about and if the quality of the grain is being maintained.

As it is the housewife who usually removes the grain from the silo, the correct procedure should be explained to her. If the grain is removed on a daily basis, it is enough to watch out for live weevils. However, if the grain in the silo is not for immediate use, but rather is to be consumed in 2, 3 or 4 months, it becomes necessary to take samples and check for living insects every two weeks.

A sieve is used for purposes of sampling. Its openings must be small enough to allow only the weevils to pass through. A basket or pan can be used as a receptacle.

To take a sample, place the basket or pan with the sieve over it underneath the seed outlet of the silo. Remove the lid, take part of the emerging grain (perhaps 4 ounces) and place it on the sieve. Introduce your hand into the silo and remove about 4 ounces more from the middle of the silo. Place that grain also upon the sieve covering the receptacle. Take 2 more similar amounts from the left and right hand side of the silo, and repeat the procedure until a sample weighing approximately one (1) pound has been extracted.

Shake and sieve the sample. If only dead weevils fall into the basket or pan, along with pieces of grain and other miscellaneous material, the grain in the silo is considered healthy. However, if a single live weevil is found it is necessary to repeat the entire fumigation procedure.

If the first sample is taken 10 – 15 days after fumigating and many live weevils are found, it must be concluded that the fumigation is a failure and sealing was not carried out properly.

If no sieve is available, place the sample in the sun, since should there be live weevils they will emerge to escape from the sun's heat.

Whenever grain is removed, the silo must be closed immediately thereafter. Weevils can fly, and if care is not taken may invade the grain even if the fumigation itself has proved successful.

The sample serves to detect if the grain has the adequate humidity. If there is too much humidity or the grain smells bad it must be removed and the entire process is then repeated.

If there are live weevils repeat the fumigation procedure.

Correct grain removal

To remove the last few hundredweights of grain the best method is to use a T-shaped wooden hoe or to place a child inside the silo. In the latter case, he / she can also clean the silo.

Incorrect grain removal

If in an effort to remove the remaining grain the silo is leaned over, damage will be caused to the folded joints of the bottom lid and to the silo body. The weight then placed upon a single point may be of **400 or 500 pounds**. To avoid this outcome, make and use a T-shaped wooden hoe if one is not already available.

Food security and the metal silo

There can be no doubt that if the silo is used efficiently, following management instructions as recommended, many benefits will be obtained. From the first harvest cycle onwards many of the usual field and storage losses can be avoided. Thus the farmer and his / her family will have enough grain for consumption and can avoid purchasing it at high prices. Further, there may be a surplus that can be sold, resulting in an economic benefit that can be used to cover other costs (food, clothing, medicine and school equipment for the children). Review the existing *POSTCOSECHA* literature regarding problems faced by farmers.