



Cooperative Extension Service

Drying and Storing Sunflowers

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Introduction

Harvesting sunflowers with high moisture content normally results in higher yields, less bird damage and less head dropping and shattering. Under certain fall conditions, drying may become mandatory so harvesting can be completed. Many producers who dry sunflowers will experience a fire until they learn proper drying procedures. However, generally the conditions are favorable in Kansas for field drying of sunflowers without artificially drying.

One out of four storage facilities filled with sunflowers go out of condition. Generally, the seeds go into storage at moisture contents above nine percent. Research shows that the resistance to storage fungi by sunflowers at about 10 percent moisture is equal to wheat at 15 percent moisture content. Probably the most critical aspect of storing sunflowers is to place dry-cleaned seeds into storage.

Drying Sunflowers

Sunflowers dry easily. Bin, batch and continuous-flow dryers have been used successfully. The large seed allows air to pass easily. Because of their low test weight, relatively small quantities of moisture are removed. Operators accustomed to drying corn or small grains may tend to over-dry sunflowers. For example, drying corn from 25 percent to 15 percent moisture will remove 6.6 pounds of moisture per bushel. Drying sunflowers from 20 percent to 10 percent moisture removes only about 3.0 pounds of moisture per bushel. Thus, the flow rate through the dryer has to be increased or drying air temperature decreased.

Drying temperatures of 160 up to 220 degrees F do not have an adverse effect on oil yield or fatty acid composition. With the non-oil varieties, high drying temperatures may cause the nutmeats to be steamed, wrinkled or even scorched. Continuous-flow dryers and recirculating-batch dryers should be operated at plenum temperatures of 160 degrees F. Batch and bin dryers should be operated at 110 to 140 degrees F, respectively. **UNDER NO CONDITIONS SHOULD SUNFLOWERS TO BE USED FOR SEED BE DRIED AT PLENUM TEMPERATURES OVER 110 DEGREES F.**

Fire hazards exist in dryers being used for sunflowers because very fine hairs or fibers from the seed are rubbed loose during handling and commonly float in the air around the dryers. These hairs or fibers ignite when drawn through the drying fan and open burner. A fire hazard is present unless these ignited particles burn themselves out before contacting the sunflowers.

The fire hazard is DECREASED when the fan can draw clean air that does not contain fine hair or fibers. This may be accomplished with a portable dryer by turning the fan into the wind. Another alternative is to build an intake duct over the air inlet to reduce the amount of hairs and fibers drawn into a stationary dryer. Long snorkel tubes are available for attachment to the drying fan.

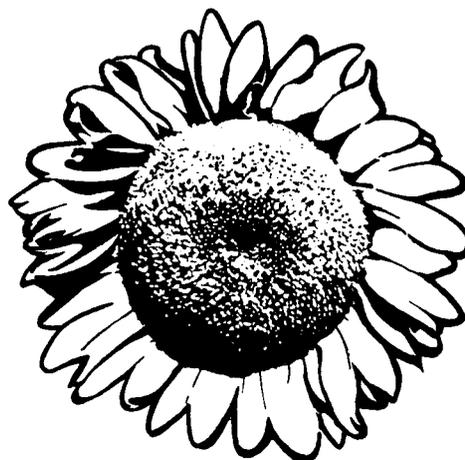
Guidelines for drying sunflowers are:

1. Use good housekeeping practices. Clean up around the dryer and in the plenum chamber daily.
2. Do not over dry.
3. Ensure continuous flow for all sections of recirculating batch and continuous-flow dryers. Uneven flow will cause over-dried spots and increase fire hazards.
4. Do not leave drying equipment unattended.

Cleaning Sunflowers

The difficulties with obtaining uniform air through the seeds is related to fines. Fines will accumulate below the down spouts and hinder proper aeration. Thus, clean seeds should be placed into storages. Stalks and trash are a higher moisture content and cause sunflowers to heat even though the seeds are below nine percent.

Seed should be cleaned before storage. A concentration of fines can seal off a bin and cause heating because air cannot be moved through the fines. Large pieces of head and stalk should be removed as this is the highest moisture fraction of the seed. Early harvested seed contains 1-2 percent of the small flower (florete) that is fastened to each seed in the head. The florets



disappear after a hard frost or later as the head dries out. The fraction of dockage containing florets is high in moisture and tends to heat in storage.

The sunflower harvesting season does not lend itself to seed cleaning operations. Cleaning may be accomplished after fall field work has halted. A concentration of foreign material in the center of your bin can be removed after harvest if you have a center unloading system and access to a seed cleaner. Since the center is heaviest in trash and most likely where storage problems occur, growers who normally would not envision cleaning their sunflower may clean only the seeds in the center core.

Another strategy followed by some growers with center unloading systems is to peak a bin completely to the top when filling it at harvest. Following harvest, they'll pull out the center of the bin market it right away.

Storing Sunflowers

Sunflowers are light weight. Oil seed types weigh about 27 to 32 pounds per bushel and non-oil types weigh 22 to 28 pounds per bushel. This bulkiness requires more storage volume than for heavier crops, but most farm storage structures for small grains are adequate for sunflowers.

Aeration controls grain temperatures. Aeration is the process of using ambient air to uniformly change the temperature of sunflowers in storage.

Aeration is NOT for:

- drying sunflowers;
- cooling hot sunflowers as they come from a dryer;
- re-wetting over-dried sunflowers.

These processes require airflow rates greater than those used for aeration.

Aeration controls grain temperatures to create an unfavorable environment for fungi and insects and to prevent moisture migration. Aeration is used to maintain a uniform temperature throughout the seeds and within 10-15 degrees F of the average outside temperature while outside temperatures are in the range of 30-60 degrees F. Stored sunflowers should be cooled to 35-45 degrees F for over winter storage.

Aeration fans are operated in the fall when the average outside air temperature is about 10-15 degrees F less than the sunflowers' temperature. The fans are operated until the temperature of the stored seeds are uniform and near the outside temperature. Repeat this cycle each time the average outside temperature is 10-15 degrees F lower than the seed temperature until the grain temperature reaches about 35-45 degrees F.

A cooling cycle typically takes five to seven days of continuous operation, but varies with the airflow rate. Aerating for one week should be adequate and makes remembering when the fan should be shut off easier.

If you want to warm the seed in the spring, the same procedure should be followed, except in reverse. Aerate when the average outside temperature is about 10-15 degrees F higher than the seed temperature. Continue aerating in stages until the grain temperature is between 50-60 degrees F.

The fans and unloading tubes should be covered when not aerating to prevent natural air movement from excessively cooling the seeds near the ducts or floor. A canvas cover or plastic bag held in place with an inexpensive elastic cord around the fan housing or unloading tube works well. Several times during the winter, when outside temperatures are about the same as the grain temperature, remove the fan cover and operate the fan for about one day; then re-cover the fan. This operation will tend to even the grain temperatures if any changes have taken place.

Aeration can be used to prevent the continuation of a storage problem. If insects or hot spots are discovered, aeration with cool air can remove the heat necessary for fungi and insect activity. If a crust is present, it should be broken or the seeds turned prior to aerating sunflowers.

Aeration can be accomplished by moving the air up or down through the seeds. The aeration fan moves the same amount of air either way. However, there are advantages and disadvantages to each way.

Moving air up through the grain (positive pressure system) results in the seeds at the top of the bin being the last to cool. The temperature of the seeds at the top of the bin can be measured to know when to stop aeration. Warm flowers can be added to the bin and cooled without having to move the warm air through the grain that has already been cooled. Air distribution may be slightly better for a positive pressure system. One disadvantage of moving air up through the sunflower is that moisture in the warm air may condense on the roof and drip into the grain.

The main advantage of moving the air down and exhausting it out through the fan (negative pressure system) is that condensation on the roof is eliminated when aerating warm seeds during cold weather. Odors can also be sensed with suction systems to aid in determining if spoilage is present. The main disadvantage of moving air down through the grain is that it is difficult to know when aeration is completed. The grain at the bottom of the bin is the last to cool and the most difficult to check.

Sunflowers can be stored safely if farmers will operate their aeration fans and cool the seeds immediately. The aeration fan is used to cool sunflowers, not dry sunflowers. There is a tendency not to run the fans because of high energy cost or damp wet weather. Proper management of the aeration system is critical and it should be operated regardless of energy cost. The average relative humidity of the air should be below 70 percent. However, if heating is occurring, operate the fan irrespective of weather conditions. The aeration fan should operate continuously if the humidity is high for only a few hours. The humidity may increase for several hours during the night but no significant amount of rewetting will occur by nighttime operation of the fan.

Other Problems

Spontaneous combustion is a real danger. If there is moisture condensation on the roof or crust on the pile, the seed has probably started to heat. Immediately action is needed to cool the pile before it's too late.

Growers should check bins at least once a week for moisture condensation on the roof or crusting.

Do not attempt to store seed that is immature; such as seed caught in an early frost. Also, lots containing a high percentage of seed without hulls tends to go out of condition and become rancid.

If the sunflowers become infested with insects, consult Sunflower Insect Management, publication number MF-814 by Kansas Cooperative Extension Service. This is available through your local county extension office. The publication has information on protectants and fumigants for sunflowers.

Getting Optimum Accuracy From Moisture Meters

An obvious but important aspect of sunflower production is the moisture level of the seed. It determines when to harvest, when to dry and when it's safe to store your sunflower crop. Moisture level is also important in determining whether seeds will be subject to a price discount when sold on the market.

A meter should be calibrated according to the specifications outlined in the manufacturer's guide. Without following those guidelines, one cannot expect to obtain a reasonably accurate reading. Frequent calibration is necessary since bumps to the machine, a drop in battery levels, even moving the machine from one location to the next can affect its accuracy.

Testing the moisture meter is not the only means of insuring the accuracy of a moisture reading. Other factors are constantly involved in changing the moisture level of seeds. For example, a change in temperature can significantly alter a moisture reading.

Oil content of sunflowers can also alter moisture readings. The standard oil content by which seeds are measured for moisture is 40 percent, but a higher oil content will mean higher moisture. To compensate, high-oil sunflowers should be dried and stored at a moisture level one or two points lower than usual.

Guidelines to improve the accuracy of your moisture readings are:

1. Take numerous samples. The more samples tested, the more you can be sure you have an accurate picture of the moisture level of your seeds. Remember, a more representative sample can be obtained by taking samples from different locations throughout your bin and testing each one separately, rather than combining the samples and taking just one moisture test.

2. Remember the importance of controlling samples so that tests are conducted on the same seed under the same circumstances. **THIS IS THE KEY TO ACCURACY IN MOISTURE TESTING!**

Inspecting Sunflowers

It is important to weekly inspect the sunflowers in storage. During an inspection, the temperatures should be monitored very closely. This will be the first indication that sunflowers are going out of condition. Sunflowers will heat once the molds begin to grow. In round circular storage structures with a pull aeration systems, research in North Dakota found most storage problems occur in the bottom two-thirds of the bin. The

top of the bin looks fine, however, probing is necessary to determine seed condition below the top layer. In flat structures, North Dakota research found the problems frequently occur in the top layer and spread downward. One possible reason for this occurring, is the non-uniformity of airflow through the grain mass. It is recommended to use a push aeration system with full perforated floor. A push aeration system distributes the air through the bin or flat structure more uniformly. The time of harvest also influences the frequency of inspections. Sunflowers harvested late in the year tend to go out of condition quicker than those harvested earlier. Often late harvest indicates a wet fall and molds invade the seeds quicker or higher moisture seeds are placed in storage. Late harvest problems are often detected during the first six weeks of storage while other difficulties may not be detected until early summer (June). These are caused by moisture migration during the spring which causes additional moisture to be added to the seeds.

Nine Steps to Successful Storage

1. **CLEAN THE STORAGE.** Thoroughly clean the storage facility by removing trash and old grain which may be harboring insects. Clean the aeration fan and air distribution system as well and repair any cracks or holes.

2. **FUMIGATE FOR INSECTS.** Treat the inside of the storage facility and aeration system with a residual spray for insect control. Use only approved chemicals and follow label instructions. Make sure product is labeled for sunflowers.

3. **SCREEN THE SUNFLOWERS.** Stored crops containing a large amount of foreign material or damaged seed are more susceptible to attack by molds and insects.

4. **MAKE SURE SUNFLOWERS ARE AT THE RECOMMENDED MOISTURE LEVEL.** The maximum recommended moisture content for the storage of sunflower is 9.5 percent through the winter and eight percent if the storage period is longer than about six months. Average moisture content is of no importance since any seed that is too wet is a potential problem. It is very important to remember that all of the material in storage must be dry.

5. **DON'T PEAK THE SUNFLOWERS.** Peaking results in non-uniform airflow through the sunflowers, and the grain peak may not be adequately cooled.

6. **AERATE WHEN THE AVERAGE DAILY OUTSIDE TEMPERATURE IS 10 DEGREES (F) LOWER THAN THE SEEDS.** Controlling grain temperature with aeration in this manner reduces insect and fungi development and activity and also prevents moisture migration.

7. **CHECK STORED GRAIN WEEKLY.** One of the most important parts of management is not to forget about it. Make a habit of always checking on the same day of the week.

8. **CHECK THE SUNFLOWERS, NOT THE BIN.** Check by getting into the storage each time and walk, feel, smell and probe the grain. (Remember! Walking around in grain-filled bins can be dangerous, so take extra precautions) Probe with temperature measuring equipment recording the locations and temperatures. Compare them to the previous week's readings. Any increase may be an indication of the beginning of a problem and warrants closer attention.

9. **ACT QUICKLY TO STABILIZE PROBLEMS.** If a problem is detected, try to stabilize it with aeration. If this fails, move the grain to market.

Summary

Although some cooperators experience problems when storing sunflowers, most cooperators are able to store sunflowers successfully with good management. Those farmers who dried their sunflowers to 8-9 percent, wisely use aeration and periodically inspect their product do not have any problems. With proper management, sunflowers can be dried and stored safely.

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