Drying and Storage

(Kenneth Hellevang)

Harvesting sunflower at higher moisture contents normally results in higher yields and less field loss. Early harvest also reduces exposure to late-season wet and cold weather. Frequently, mechanical drying is required so harvesting can be completed.

Natural-air, low-temperature and high-temperature bin, batch (Figure 124) and continuous-flow dryers can be used to dry sunflower.

Natural-air and low-temperature bin drying is energy efficient if designed properly and permits rapid harvest since bins can be filled at the harvest rate. Drying will take three to six weeks, depending on the initial moisture content, airflow rate and outdoor temperature. Required airflow rates and drying time for drying oil sunflower at various moisture contents using air at 47 degrees Fahrenheit and 65 percent relative humidity (average North Dakota conditions for October) are shown in Table 16. Drying times will be twice as long at 27 degrees due to the reduced moisture-holding capacity at colder temperatures. Heating the air more than about 5 degrees normally causes overdrying.

Figure 124. A high temperature column dryer used for drying sunflower. (K. Hellevang)

Table 16. Recommended airflow rates and drying times for natural-air drying oilseed sunflower in October. (47 F and 65 percent relative humidity).

Moisture Content	Airflow (cfm/bu)	Fan Time	
		hours	days
17%	1.00	648	27
15%	1.00	480	20
	0.75	720	30
	0.50	960	40
13%	1.00	336	14
	0.75	504	21
	0.50	672	28

Add enough heat when needed to dry the sunflower to the safe storage moisture content. Generally, enough heat to warm the air about 5 degrees is the maximum amount required. As a rule of thumb, about 2 kilowatts (kW) of heater will be required per fan motor horsepower. The equation for calculating the heat requirement in Btu is: Btu/hr = cfm x 1.1 x temperature increase. Convert Btu to kW by dividing by 3,413 Btu/kW. Refer to NDSU Extension Service publication EB-35, “Natural Air and Low Temperature Crop Drying,” and publication AE-701, “Grain Drying,” for more information on drying sunflower.

A perforated floor is recommended. Since air does the drying, making sure air reaches all the sunflower is imperative. The uniform airflow distribution required for drying is more difficult to achieve with ducts than

with perforated floors. However, drying can be done successfully if ducts are spaced no more than one-half the grain depth apart and the distance from the duct to bin wall does not exceed one-fourth the grain depth. Provide 1 square foot of duct or floor perforated surface area for each 25 cubic feet per minute (cfm) of airflow. One square foot of bin exhaust opening should be provided for each 1,000 cfm of airflow.

Drying temperatures up to 220 F do not appear to have an adverse effect on oil percentage or fatty acid composition. High drying temperatures for the nonoil varieties may cause the kernels to be steamed, wrinkled or even scorched.

Column batch and bin batch dryers should be operated at 180 and 120 F, respectively. Continuous-flow and recirculating batch dryers may be operated at temperatures up to about 200 F. Temperatures in excess of 110 F should not be used to dry sunflower seed for seeding purposes.

Fire hazards exist in dryers used for sunflower. Very fine hairs or fibers from the seed are rubbed loose during handling and commonly are found floating in the air around the dryer. These hairs or fibers or other plant materials may be ignited when drawn through the drying fan and open burner. A fire hazard is present unless these ignited particles burn themselves out before contacting the sunflower seed.

The fire hazard is decreased if the fans of a portable dryer are turned into the wind to draw clean air that does not contain fine hair or fibers and by pointing stationary dryers into the prevailing wind. A moveable air intake duct may be placed on the burner intake to draw clean air away from the dryer. However, the duct must be large enough to not restrict the airflow because drying speed will be reduced if the airflow is reduced.

Clean the dryer, air ducts and area around the dryer at least daily. Frequently remove the collection of sunflower lint on the dryer column and in the plenum chamber, as this material becomes extremely dry and can be ignited during dryer operation. A major concern is that some sunflower seeds will hang up in the dryer or be stopped by an accumulation of fines and become overdried. Make sure the dryer is completely cleaned out after each batch, and check a continuous-flow dryer regularly (at least hourly) to see that the sunflower seed is moving.

High-speed dryers are like a forge when a fire gets going. However, fires can be controlled if they are noticed immediately, which makes constant monitoring necessary. Many fires can be extinguished by just shutting off the fan to cut off the oxygen. A little water applied directly to the fire at the early stages may extinguish it if shutting off the fan fails to do so. A fire extinguisher for oil-type fires should be used for oil sunflower fires. Many dryers are designed so that sunflower can be unloaded rapidly in case of a fire, before the dryer is damaged. In some dryers, just the part of the dryer affected by the fire needs to be unloaded.

Measuring Moisture Content

Measuring the moisture content of sunflower immediately after removal from the dryer results in only an estimation. As moisture is removed from the sunflower seed, the hull dries first and the kernels dry last. Moisture testers used by local grain elevators and farm operators generally result in a reading that is lower than the actual moisture percentage when moisture is measured while the moisture variation exists. The initial moisture content of the sunflower and the temperature of the drying air influence the amount of error. A number of operators have reported that sunflower removed from the dryer at 9 percent to 10 percent moisture (according to the moisture tester) would be up to 12 percent moisture later. The moisture rebound can be estimated by placing a sample from the dryer in a covered jar and then rechecking the moisture after 12 hours.

Guidelines for drying sunflower are:

- The area around the dryer and the plenum chamber should be cleaned thoroughly.
- The fan must be fed clean air without seed hairs.
- A continuous flow in all sections of recirculating batch and continuous-flow dryers should be maintained. Uneven flow will cause overdried spots and increase fire hazard.
- Drying equipment must not be left unattended day or night.
- The dried sunflower should be cooled to air temperature before storing.

Storage

Farm structures that are structurally adequate to store other grains are adequate for storing sunflower due to sunflower's light test weight, Figure 125.

Seed should be cleaned for storage. Fines tend to concentrate in the center of the bin if a distributor is not used. Since this material tends to be wetter, this area is more prone to storage problems. Also, airflow will be restricted by the fines, limiting cooling by aeration in the center of the bin. Large pieces of head, stalk and corolla tubes, which frequently adhere to the seed, should be removed because they are higher in moisture than the seed.

Oil sunflower should not be stored above 10 percent moisture during the winter and 8 percent during the summer. Nonoilseed sunflower should not be stored above 11 percent moisture during the winter and 10 percent during the summer. Sunflower can be stored for short periods in the fall at 12 percent with adequate airflow to keep the seeds cool. Resistance of oilseed sunflower to fungal infection during storage at 10 percent moisture is equal to wheat resistance at 15 percent stored moisture.

Aeration to control seed temperature is essential. Aeration fans normally are sized to provide 0.05 to 0.2 cfm/bu. (0.15 to 0.6 cfm per cwt) of sunflower (Figure 126). Sunflower should be rotated between bins during the storage period when aeration is not available.

Cooling sunflower reduces the potential for sunflower deterioration from insects and mold. Sunflower should be cooled to 40 degrees or below before or soon after it is put in the bin and to about 25 degrees for winter storage. Insects become dormant and will not cause damage or multiply if seed temperature is below about 40 F.

Moisture and heat accumulate in the peak due to moisture migration, which results in crusting, spoilage and increased possibility of insect infestations (Figure 127). This can be prevented by cooling the sunflower using aeration.

Bins should be checked initially every two weeks for moisture condensation on the roof, crusting and changes in temperatures within the pile. Any of these conditions could indicate the presence of mold or insects. If the sunflower has started to heat, it should be cooled immediately. The sunflower should be checked at least monthly after the seeds have been cooled to about 25 F for winter storage and a history of temperature and moisture content has been developed.

Figure 125. Structures adequate to store other grains are adequate for sunflower. (K. Hellevang)

Figure 126. Aeration is critical for proper storage. (K. Hellevang)

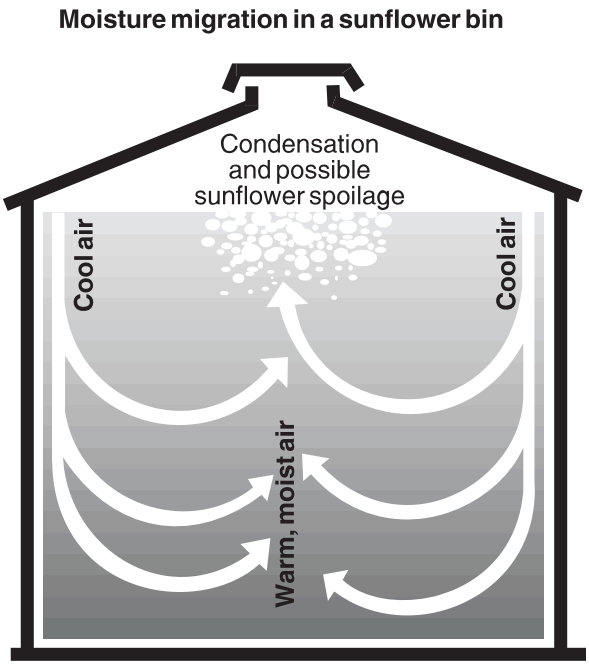

Figure 127. Moisture migration leads to increased moisture in top center of stored sunflower.
(K. Hellevang)

Seed lots containing a high percentage of hulled seed or immature seed, such as seed resulting from an early frost, tend to deteriorate in storage, affecting oil quality.

Refer to NDSU Extension Service publication AE-791, "Crop Storage Management," for more information on aeration and storage management.