Sunflower Harvest, Drying & Storage

Special Supplement To *The Sunflower*

A 'Well-Adjusted' Harvest

Veteran sunflower producers are well-versed in setting and tweaking their combines to produce optimum threshing efficiency. For those newer to the crop, however, the following guidelines should prove helpful. Their source is the section on harvesting in North Dakota State University's Sunflower Production *handbook (EB-25 Revised), published in September 2007. The author is Vern Hofman, recently retired extension ag engineer at NDSU.*

Combine Adjustment Indicators

Source: Kansas State University Extension

Problem —	Possible Cause —
• Partially threshed heads on ground	• Concave spacing too wide
• Excessive tailings	• Air flow too low, overthreshing at cylinder/rotor; or chaffer openings too narrow
• Trash in hopper bin	• Overthreshing; cylinder/rotor speed too high; concave too tight; fan too low; or sieve too wide
• Broken or crushed heads	• High cylinder/rotor speeds; or narrow concave spacing
• Crushed seed with intact hull	• Concave spacing too tight
• Dehulled or broken seeds	• High cylinder/rotor speeds or excessive returns
• Unthreshed heads on ground	• Poor gathering at the header
• Seeds being thrown out back	• Speed/air flow; slow down the machine and air flow rate

— Forward Speed —

A combine's forward speed usually should average between 3.0 to 5.0 miles per hour. The optimum forward speed will vary depending upon moisture content of the sunflower seed and yield of the crop.

Forward speed should be decreased as seed moisture content decreases to reduce the shatter loss as the heads feed into the combine. Faster forward speeds are possible if the moisture of the seed is between 12 and 15%. The higher speeds should not overload the cylinder and the separating area of the combine, except in an extremely heavy crop. Seed having 12 to 15% moisture will thresh from the head very easily as it passes through the cylinder.

— Cylinder Speed —

After the sunflower heads are separated from the plant, they should be threshed at a cylinder speed operating as slow as possible. The normal cylinder speed should be about 300 revolutions per minute (rpm), depending upon the condition of the crop and the combine being used. This cylinder speed is for a combine with a 22″-diameter cylinder to give a cylinder bar travel speed of 1,725 feet per minute.

Combines with smaller cylinders will require a faster speed, and combines with a larger cylinder diameter will require a slower speed. Rotary

combines, as well as conventional machines, should have similar cylinder travel speeds. A rotary combine with a 30″ cylinder will need to be operated at 220 rpm to have a cylinder bar speed of 1,725 feet per minute. A combine with a 17″ cylinder will need to operate at 390 rpm to have a cylinder bar speed of 1,725 feet per minute.

If a combine cylinder operates at speeds of 400 to 500 rpm, giving a cylinder bar speed of more than 2,500 feet per minute, very little seed should be cracked or broken if the moisture content of the seed is above 11%. Cylinder bar speeds of more than 3,000 feet per minute should not be use since they will cause excessive broken seed and increased dockage. Excess dockage and broken seed may overload the sieves and the return elevator.

— Concave Adjustment —

Sunflower threshes relatively easily. When crop moisture is at 10% or less, conventional machines should be set wide open to give a cylinder-to-concave spacing of about 1.0″ at the front of the cylinder and about 0.75″ at the rear. A smaller concave clearance should be used only if some seed is left in the heads. If the moisture of the crop is between 10 and 12%, rather than increase the cylinder speed, the cylinder-to-concave clearance should be

decreased to improve threshing. If seed moisture exceeds 15 to 20%, a higher cylinder speed and a closer concave setting may be necessary, even though foreign material in the seed increases.

Seed breakage and dehulling may be a problem with close concave settings. Make initial adjustments as recommended in the operator's manual. Final adjustments should be made based on crop conditions.

Rotary combines should be set to have a rotor-to-concave spacing of about 0.75 to 1.0″. Making initial settings as recommended in the operator's manual usually is bes, with final adjustments made based on crop conditions.

— Fan Adjustment —

Oil-type and nonoil (confection) sunflower weigh about 28 to 32 lbs/bu and 22 to 26 lbs/bu, respectively. The seed is relatively light compared with other crops, so excessive wind may blow seed over the chaffer and sieve. Seed forced over the sieve and into the tailings auger will be returned to the cylinder and may be dehulled. Only enough wind to keep the trash floating across the sieve should be used. The chaffer and sieve should be adjusted to minimize the amount of material that passes through the tailings elevator.

When the combine is adjusted correctly to thresh sunflower seed, the threshed heads will come through only slightly broken and with only unfilled seed remaining in the head. Cylinder concaves and cleaning sieves usually can be set to obtain less than 5% dockage. Improper settings will crush the seed but leave the hull intact. Proper setting is critical — especially for nonoil sunflower that is used for the human food market. The upper sieve should be open enough to allow an average seed to pass through on end, or be set at a 1/2 to 5/8″ opening. The lower sieve should be adjusted to provide a slightly smaller opening (about 3/8″ wide). The final adjustments will depend upon the amount of material returning through the tailings elevator and an estimation of the amount of dockage in the grain tank. Some operators are able to adjust and operate their machine to allow only 2 to 3% dockage in the seed. ■

Benefits of Earlier Harvest

With the high costs of energy these days, it's tempting to let those sunflower seeds sit in the field and let Mother Nature do all the drying for you. But if you're equipped with either a high-temperature dryer or a natural air/low-temp setup, it can make plenty of sense — and dollars — to harvest your sunflower fields while seed moisture is in the lower to mid-teens, rather than wait for it to dry down to around 10%. Here's why:

• ***Reduced Exposure to Pests & Inclement Weather*** — The sooner mature seeds are harvested, the less you stand to lose to those late-season threats: blackbirds, windstorms, heavy rains and insect- or disease-induced lodging.

• ***Harvest Speed*** — The combine's ground speed can be a little faster when harvesting seeds that are above 10 or 11% moisture. Shatter loss at the head will be lower than when combining at 10% or below.

• ***Less Shattering Overall*** — Along with minimizing seed shatter loss while combining, there will be less shatter loss from plant heads bumping against each other on windy autumn days prior to harvest.

• ***Ease of Drying*** — Drying damp seeds is cheaper and goes faster when ambient temperatures are still warm and the humidity low, as compared to late autumn drying conditions — particularly in the Northern Plains.

• ***Lower Foreign Matter*** — With today's hybrids, sunflower plant heads may still be yellow, not brown, though the seeds are fully mature and dry enough to harvest. Slightly damp heads will not break up during threshing nearly as much as will those whose seed moisture is below 10%.

• ***Reduced Combine Fire Risk*** — Harvesting damper seeds with less foreign material greatly reduces static cling of fines, resulting in less material buildup on the combine and a lower risk of fires.

What's Available in Harvest Attachments & Conversion Kits

Editor's Note: *Numerous sunflower producers utilize row-crop combine heads to harvest this crop. Many others opt for a harvest attachment specifically designed for sunflower. Still others employ special conversion kits fitted to their corn head.*

The following pages contain information on several sunflower attachments and conversion kits available to producers. The information has been provided by the companies themselves and edited for use in The Sunflower.

This compilation is not totally inclusive, as not every company we contacted responded to our request for information. Most did, however. Contact details are included for growers who wish to visit further about a given company's products.

DragoTec USA

Drago sunflower knives have been marketed since 2002. They are manufactured for use with the Drago corn head deck plates, but also can be modified to work with other makes. Drago corn heads range in rows from four to 18; in spacing from 20" up to 36".

The Drago has 50% longer knife rollers that pull the plants into the deck plates and gathering chains at low velocity, thereby reducing shatter and yield loss. The Drago corn head has automatic self-adjusting deck plates, saving butt shelling loss — particularly on the newer fast-drydown hybrids. This head can be adapted to almost any combine by using the proper feeder house adapter plate for the specific combine model.

For More Information: DragoTec USA, 3701 30th Ave., Fenton, IA 50539; phone — (888) 456-8282 or (515) 889-2723; web site — www.dragotec.com

Flexxifinger

The Flexxifinger™ QD™ Sunflower Pan was introduced to farmers in 2007 by Saskatchewan agricultural manufacturer Flexxifinger QD Industries. It is designed for quick installation, removal or transition to other types of harvest attachments. The sunflower system will undergo its final stages of customer trials this season and is expected to be available to the general market in 2009.

The first-release pans will be available in 9" widths. They will offer farmers the option between a straight, conventional, quick-attaching sunflower pan and a pan that features a nose portion that is inclined about 15 degrees. The incline is aimed at salvaging lodged or low-hanging plant heads.

"The Flexxifinger QD Sunflower Pans are installed using our patented QD™ attachment system, which is installed separately on the header using provided guard bolts and a special QD nut, fastened on the top side of the guard," says the firm. "This allows a pan to be removed or installed in seconds and an entire header in minutes."

For More Information: Flexxifinger QD Industries, P.O. Box 1599, Assiniboia, SK S0H 0B0 Canada; phone — in U.S. (800) 544-8512; in Canada (800) 925-1510; web site — www.flexxifinger.com

Gates Manufacturing

Gates Manufacturing has marketed its "Quick Tach" sunflower pans for a number of years. The 48"-long durable plastic pans are available in three- and four-pan assembly units for easy han-

dling. Overall unit widths range from three up to 36 feet. The pans are designed to mount easily (via just two tighteners) on any auger or draper head.

Gates also offers liftrods that can be easily attached to the pans to aid with the harvesting of lodged plants.

For More Information: Gates Manufacturing Inc., 8710 33rd Ave. N.W, Lansford, ND 58750; phone — (701) 784-5434 or 784-5525; web site — www.gatesmfg.net

Golden Plains Ag Tech

Golden Plains, based in Colby, Kan., has been marketing the "SunStar" sunflower harvesting system for the past 15 years, serving customers in North and South America as well as several countries elsewhere.

SunStar corn head attachments are used on John Deere and Case IH corn heads. Golden Plains has recently introduced a new model for the JD 600 Series corn head.

SunStar is designed to take advantage of the unique physical characteristics for the sunflower stalk. For that reason, sunflower is the only crop that can be harvested while the SunStar attachments are installed. However, the attachments are installed and removed quite easily, so the grower can quickly switch from 'flowers to corn, or vice versa, if needed.

"With SunStar conversions installed on the producer's corn head, he can move quickly through his standing 'flowers with a very small loss," says Golden Plains Ag Tech. "He will be able to lift lodged stalks and move the heads into the combine with minimum loss." Sunflower heads enter the cross auger "with the heads unbroken and six to 12 inches of stalk still attached to the head," the company states.

SunStar has no moving parts and requires no physical modification for attachment to the corn head. "There is only one simple adjustment which is usually made only once per season," says Golden Plains. "It is durable, only two inexpensive replaceable parts."

For More Information: Golden Plains Ag Tech, P.O. Box 307, Colby, KS 67701; phone — (800) 255-8280; web site — www.goldenplains.com/sunstar/

Intersteel Industries

The Intersteel sunflower attachment has been marketed for more than 40 years. Pan width options are nine, 12 and 27 inches, and it is available in all rigid header lengths. The pans mount atop guards, with pan supports that attach beneath the combine header. The reel drum mounts with bearings and drive system from the bat reel supplied by the combine manufacturer.

"Pan width, length and rotating drum help feed plant heads into the combine/ header smoothly and evenly," Intersteel states. "Pan width and length ensure maximum collection of shattered seeds in dry crop conditions. The nine-inch pans offer most versatility for any row spacing and also work well for solid seeding." The Intersteel attachment also has been used with corn, the company reports.

Along with the United States and Canada, Intersteel has sold its harvest attachment in Chili and the Sudan.

For More Information: Intersteel Industries, P.O. Box 1451, Morden, MB R6M 1B3, Canada; phone — (204) 822-5055 or (877) 839-9301; web site — www.intersteelindustries.com

Lucke Manufacturing

The original Lucke sunflower harvesting attachment dates back to 1966. Lucke presently offers 9"and 12" pan width options with its non-reel system. Other options include liftrods for lodged plants and roller tips that are particularly useful in solid-seeded fields.

For More Information: Lucke Manufacturing, 305 33rd Ave. S.W., Minot, ND 58701; phone — (800) 735-5848 or (800) 735-5838; web site — www.luckemanufacturing.com

Sheyenne Tool & Mfg.

The "Sunmaster" harvest header has been around since 1995. It was originally produced by Westward Products and later bought by Jim Broten, a North Dakota farmer and the owner of Sheyenne Tool & Mfg. in Cooperstown.

The Sunmaster header is available in eight- and 12-row 30" spacing sizes. Also, 12-, 16- and 18-row 20" sizes are available under an early order program. The units can be used in corn and milo in addition to sunflower. The system will fit on just about any combine, with adapter plates available.

The Sunmaster's star cutting knife is positioned at the back end of the gathering chains. As the stalk is pulled toward the header platform, it is moved to one side so that the plant head is hanging over a vibrating gathering pan. Any seeds that shatter are dropped onto the pan and move to the header platform. As the sunflower plant head is cut off, it drops nearly directly onto the header platform or onto the vibrating pans. A cam on the shaft pushes a rocker arm up and down beneath the pan. The rocker arm, of replaceable

rubber, strikes a thick strap of iron on the underside of the pan, continually moving it up and down. That action moves the seeds back to the platform.

The Sunmaster effectively harvests lodged sunflower plants. Depending on field conditions, it may go with or against the plants' angle — or even crossways. The row dividers slide along at ground level, with each divider moving up and down independently. The ground-level travel, coupled with the star cutters' position at the back of the gathering chain, ensures significant crop savings. There are four large, thick sickle knives per sunflower row.

Some of the other features of the Sunmaster are:

- Replaceable shoes on the underside of the point of each divider.
- Brackets on each end of the header to prevent heads from getting hung up in a back corner.
- An adjustable ridge plate to help direct the stalk into the header.

For More Information: Sheyenne Tool & Mfg., P.O. Box 647, Cooperstown, ND 58425; phone — (800) 797-1883 or (701) 797-2700; web site — www.sheyennemfg.com

SSR Pump Company

SSR Pump Company has been manufacturing a floating-pan attachment since the mid-1970s. Designed to be particularly effective on lodged or down sunflower, the SSR unit fits on any combine, the company says.

SSR's "Quick Tach" pan header is available with 9" or 12" pan widths. A 2x4 support bar and 3/15" mounts for sickle guards are basic features, as are two angles per pan for support. End shields cover the bearings and drive. Lift rods also are available from SSR.

For More Information: SSR Pump Company, P.O. Box 149, Michigan, ND 58259; phone — (701) 259-2331

West Country Products

Jamestown, N.D.-based West Country Products has distributed the "SeedEater" sunflower harvesting attachment since 2006. Midwestern Machine, its manufacturer, acquired the

attachment in 1986. The product underwent an extensive makeover in 1994 to improve upon its fit, function and aesthetics. Along with sunflower, the SeedEater also has been used successfully in milo.

This harvesting attachment has been sold across the United States and in 14 foreign nations. The company is an OEM supplier for John Deere and Case New Holland for their overseas sales.

The SeedEater is available with pan widths or either 9" or 12". Overall attachment widths range from 18 up to 30 feet. "Key features of the SeedEater include a heavy-duty 16-gauge drum with specially designed fingers to move sunflower heads gently but positively to the auger," says West Country Products. "Also, heavy-duty 14-gauge pans with strong design and extra-long dividers for more-positive row alignment.

"The SeedEater is easily mounted on your own combine header and can be left on a dedicated header or removed," West Country adds. "The pans are mounted on a permanent tube frame; therefore the drum can be rolled off the reel arms onto the pans. The chain binders release on the back of the header, and you are ready to back away from the SeedEater."

For More Information: West Country Products, Inc., P.O. Box 2062, Jamestown, ND 58401; phone — (866) 974-2182 or (701) 251-2182; web site — www.westcountryproducts.com ■

A Timely Harvest Circa Early 1900s

The following comments come from the Cyclopedia of American Agriculture, *published in 1907.*

"The sunflower heads should be harvested before the seeds are fully ripe. As soon as the seeds are ripe they begin to shatter, and before the crop is mature it is likely to be damaged by birds which gather in flocks to feast on the rich seeds.

"As ordinarily gathered, the seeds will not be dry enough to shell and store, but the heads should be cured for a week or so before threshing or shelling. If only a small quantity is grown, the heads may be spread out on the barn floor or in a loft or shed.

"At the Kansas Experiment Station has been followed the plan of cutting off the heads with a sickle or corn knife and putting them in shallow windrows in the field for several days, when they are hauled in and threshed or stored in large piles. More or less loss attends the handling of the crop in this way."

Skinny on Shrink

(Moisture Shrink, That Is)

Formulas Provide Clear View of How Deviation from 10% Impacts Growers — Both in the Field and at Market

Sometimes shrinkage is a good thing — like when it happens to your waistline. But when shrink brings the moisture of market-bound sunflower seeds down below 10%, it's not.

Every sunflower producer knows that harvesting the crop at moistures below 10% hurts him in two ways. First, it likely will result in more shattering and seed loss at the header. And second, an 8% or 9% moisture crop will weigh less than a 10% one, thus taking away dollars at the marketplace. That's bad enough when seeds are worth 10 cents a pound; but when they're at 20 or 25 cents, the pocketbook pain is even more pronounced.

And it's another reason not to overdry seeds beyond what's prudent for proper storage.

Some shrinkage occurs at the elevator or other delivery site. Foreign material aside, there inevitably is a certain amount of handling loss — *i.e.*, spillage, dust blowing off the crop, etc. These are items over which the grower has no control, and which will vary from site to site. The elevator typically will factor such shrinkage into its handling charges.

Then there is "moisture shrink." This term refers to the weight loss in grain resulting from the drying of that grain down to a particular moisture content. "It's a straightforward number," points out North Dakota State University extension ag engineer Ken Hellevang. "We have an equation that tells us if we remove [a given quantity of water] from our grain — be it sunflower, wheat or corn — we'll have a certain weight loss associated with it. That weight loss is what we call 'moisture shrink.' "

Table 1 *(right)* shows the percentage reduction in weight — a constant value — based upon the final moisture content of the grain, while Table 2 shows the actual pounds one loses (or gains) at crop moistures below and above 10%. "If working with sunflower, whose market standard is 10% moisture, the shrink is going to be 1.111% for every point of moisture removal," Hellevang says. "If we take off five percentage points of moisture, we know our shrink will be 5.555%."

So drying 100 pounds of sunflower at 15% moisture down to 10% would result in a cumulative moisture shrink loss of 5.56 pounds, for a net weight of 94.44 pounds.

Hellevang advises producers — in advance of harvest — to be clear on what their elevator's shrink and other discount polices are. Understand that "moisture shrink" is different from "invisible shrink" or handling loss. And remember that while moisture discount levels can vary from elevator to elevator (and also from date to date at the same facility), "moisture shrink" is a constant value. ■

Table 1. Moisture Shrink Factors for Drying Grain to Various Moisture Levels

Final Moisture Content *(%)*	**Moisture Shrink Factor** *(% Shrink Per Point of Moisture Removed)*
15.0	1.1765
14.5	1.1696
14.0	1.1628
13.5	1.1561
13.0	1.1494
12.5	1.1429
12.0	1.1364
11.5	1.1299
11.0	1.1236
10.5	1.1173
10.0	***1.1111***
9.5	1.1050
9.0	1.0989
8.5	1.0929
8.0	1.0870
7.5	1.0811
7.0	1.0753
6.0	1.0638
5.0	1.0526

Table 2. Weight of Sunflower At Various Moisture Contents, Compared to Market Standard

Moisture Content *(%)*	**Seed Weight** *(cwt. basis)*
5.5	95.24
6.0	95.74
6.5	96.26
7.0	96.78
7.5	97.30
8.0	97.83
8.5	98.36
9.0	98.90
9.5	99.45
10.0	***100.00***
10.5	100.56
11.0	101.12
11.5	101.69
12.0	102.28
12.5	102.86
13.0	103.46
13.5	104.05
14.0	104.66
14.5	105.26
15.0	105.89

Nothing Fine About 'Fines' in Harvest

Fines are not fine at all when it comes to harvesting sunflower. "Fines" — those multitudes of small fibers or fuzz that rub off sunflower hulls during combining and end up accumulating on machine surfaces — pose a real threat of fires. When seeds are dry and engine compartment surfaces are extremely hot , fines can ignite, smolder and sometimes burst into flames. The result, for more than a few sunflower producers, has been a damaged or even destroyed combine.

Farming in central South Dakota, Chuck Todd knows a thing or two about the risk of combine fires during the sunflower harvest. A hot September afternoon, coupled with seed moistures under 10%, can aggravate the situation in a hurry, he affirms.

That's a primary reason why Todd Ranches likes to harvest at a little higher moisture content. "If we can get in at about 12%, it really minimizes the threat from all those little fines," Todd says. "Even between 12 and 10 isn't so bad. The trouble comes when you wait until it's at 10 — and then the seeds go from 10 down to 7% almost immediately.

"If you're not working on a contract where they have to be at 10% and you can put them in the bin with a little air, combining 12% seeds sure makes a lot of difference [in terms of reducing fire risk]," he continues. "And it's much easier to clean up; you don't have so many of those little pieces in your grain tank."

Todd, who farms near Onida, says the biggest problem he's encountered with fines on his John Deere combines is that they'll accumulate on the intake screen. The engine draws them back, and they sail toward the manifold and muffler. "Then they stick, and you start building up that material. It gets hot, falls off — and starts fires."

The Sully County producer recalls one week during the 2007 harvest when the humidity was below 25%. They had fires every day up until about 5:00 p.m., when temperatures started to drop. "I'd clean off the combine two or three times a day," Todd recounts. "Then we'd slow the machines to keep the exhaust temperature down.

"If you're running a grain cart, the exhaust temperature will get even higher because you're never shutting off [the combine]. Just slowing down and not pushing the engine so hard will help a lot."

For Todd, cleaning the combine means blowing off the fines with an air hose. However, "if a fire does start or there are little 'glows,' we'll usually soak them down first to get the flames off," he explains. "If you just blow them around, you'll start fires everywhere." Once the mass of fines is wet enough to no longer burn, he'll go ahead and blow them off.

The combine always has a fire extinguisher on board. "Sometimes we'll also carry a small garden sprayer," Todd notes.

Some of his neighbors have installed gauges to monitor the combine exhaust temperature. Once that temperature gets to a certain level ,the operator slows down so the engine isn't working as hard. While he hasn't employed an exhaust temperature gauge on his own combines, "last year we painted the exhaust and mufflers with a special silver paint, and that helped," Todd says. "It made the manifold and muffler more slippery, so the dust didn't stick as much." ■

Automatic Fire Extinguisher System for Combines

Roger Holen's misfortune may well be a godsend for other sunflower producers.

Back in 2003, the Upham, N.D., grower was coming to the end of the sunflower field he was harvesting. As he turned his John Deere 9600 around to head back down the field, the engine quit — followed by a loud roar and intense heat. The combine was on fire.

The oil tank blew even before Holen was able to jump from the combine. He made it out safely, other than a sore hip from the leap. But the combine was a total loss.

Holen had just cleaned the combine of chaff a round and a half prior to the incident. He later surmised that a cinder probably went through a hydraulic line, "and with the pressure, it was like a big blow torch."

Coincidentally, Holen's cousin, Shelby Holen of Superior, Wis., had recently partnered with fellow aircraft mechanic Neal Hall to invent an automatic fire extinguishing system for clothes dryers. Hall, a volunteer fireman, was aware of clothes dryer fires that had actually killed people; so he and Shelby set out to devise a system that could protect dryer users.

The result, which received a patent in 2006, consists of a pressurized tank of dry chemical fire extinguishing agent that is attached to the appliance. Copper tubing runs from the extinguisher to the motor area. Soldered at the end of the tubing is a low-temperature cap that melts off in the event of fire, automatically releasing the pressurized extinguisher agent. *(Continued on Next Page)*

Estimating Seed Loss

Do your sunflower seed loss levels during harvest fall within the "acceptable" or "excessive" range? Losing 10 (filled) seeds per square foot represents about 100 pounds per acre, assuming that loss level is consistent across the field.

It's virtually impossible to avoid some seed loss during harvest, of course. Traditionally, 3% has been considered a "permissible" loss level. But harvesting extremely dry seeds can drive up that number; so too can excessive ground speed or a combine that has not been set and/or adjusted properly.

Here's an easy way to estimate sunflower seed loss levels at harvest, as provided by North Dakota State University:

1) Count the number of seeds within a one-square-foot area ahead of the combine at several different sites within the field.

2) Calculate header loss by counting the seeds within a square-foot area behind the head and beneath the combine. Then subtract the "standing crop" loss.

3) The loss in combine separation can be determined by counting the seeds within a one-square-foot area directly behind the rear of the combine. Subtract from that the shatter loss and the header loss.

4) The count from directly behind the combine will be concentrated, so an adjustment must be made to equalize the loss across the entire width of cut. The result should be divided by this ratio:

$$\frac{\textit{Width of Header Cut (feet)}}{\textit{Width of Rear of Combine (feet)}}$$

5) The result — *i.e.*, the adjusted separator loss for the width of cut — must then be divided by 10 to determine the combine separator loss in hundredweight per acre.

6) Total loss (cwt/ac) is arrived at by adding up the seed loss in the standing crop, the header loss, the separator loss — and then dividing that number by 10. The percentage of loss can be determined by dividing the total cwt/ac by the field's final sunflower seed yield. ■

Hall and the Holens merged their experiences by applying the concept to the JD 9650 combine that Roger had purchased following his fire experience. Roger educated Shelby and Neal on the combine sites where fires were likely to start. With the combine running, they measured the temperature of those spots to determine the level of heat sensitivity needed for the end caps of a fire extinguisher system fitted to the combine.

Below: Shelby Holen, Roger Holen and Neal Hall are shown on Roger's John Deere 9650 on which they installed an automatic fire extinguishing system. Its red pressurized chemical agent tank can be seen in the foreground. Roger's JD 9600 that caught fire in 2003 is in the background.

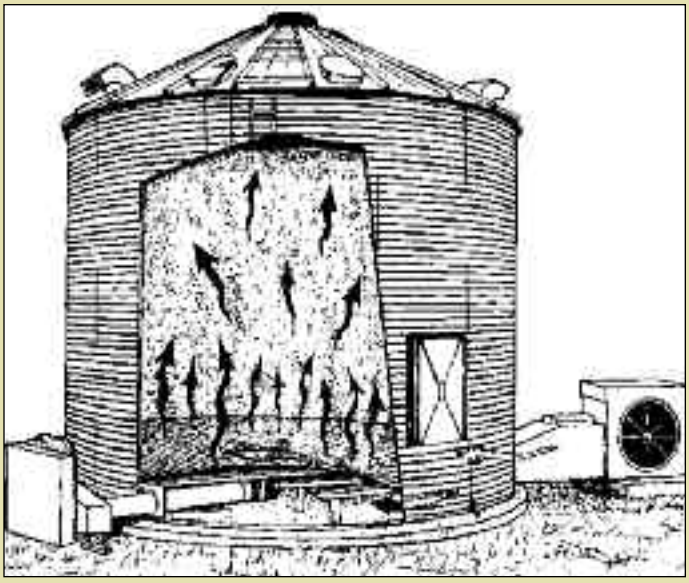
The pressurized 25-lb tank with dry fire extinguishing agent is mounted behind the engine compartment. It's connected to copper tubing that extends to the exhaust, the manifold, in front of the engine next to the fuel tank, and by the driveline that runs through the hopper where chaff can build up.

The good news is that Roger Holen has not had a combine fire since installing the automatic extinguishing system. But while the system has not yet been tested "under fire" on a combine, he and its inventors are confident it would perform as intended. It is suitable for use on any model of combine, they add.

In the meantime, Shelby Holen and Neal Hall are exploring marketing opportunities for their system. UL approval is the next big hurdle, according to Shelby. "This system can be adapted to almost anything," he adds. For example, a homeowner could connect a single pressurized tank, via various lines, to the clothes dryer, the furnace , the hot water heater and any other heat-generating appliances in the utility room area. ■

Dry Is Good
(But Not Too Dry)

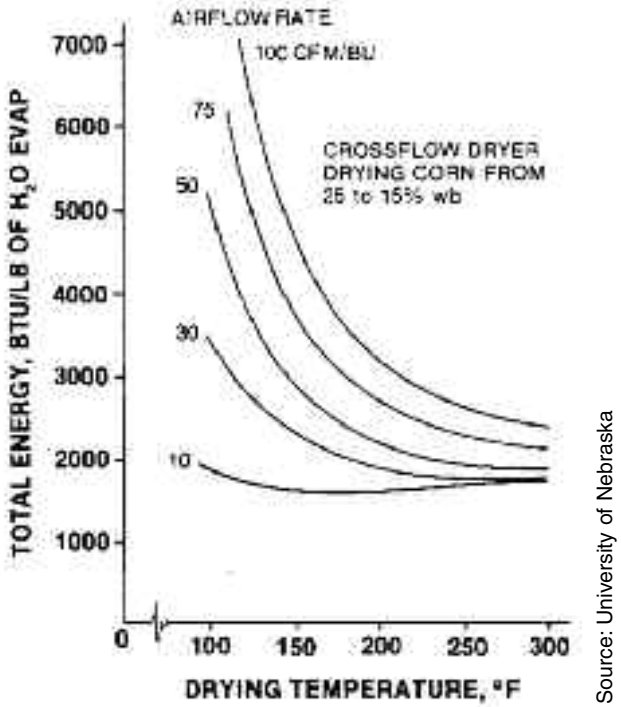
North Dakota Ag Engineer Recaps Advice on Drying Sunflower & Testing Moisture



With North Dakota's corn acreage having doubled since 2002, it's not surprising Ken Hellevang has been getting considerably more phone calls on corn drying and storage — and fewer on sunflower. But a lot of Northern Plains sunflower seed still goes into on-farm storage after harvest, and the North Dakota State University extension ag engineer says it remains a good idea for 'flower producers to regularly review their drying and storage strategies. That's especially true, he adds, given the current levels of energy costs and commodity prices.

Some years ago, Hellevang published a table estimating the energy costs for drying sunflower in a high-temperature dryer. The highest propane price listed in that table was 90 cents per gallon; the highest fan electric rate was 7.71 cents per kilowatt hour; the highest electric heat rate, 3.86 cents per kWh. Today, the average gallon of propane ranges between $1.80-$2.80. "Electric rates probably average around $0.07 per kWh, with a range of 0.06 to 0.09," Hellevang notes. The average electric heat rate in North Dakota (off-peak basis) is around 0.03 per kWh. He equates a $0.03 electric rate to $0.70 propane, while $0.08 would rank with a $2.00 propane price.

Energy Requirements of a Conventional Crossflow Dryer As a Function of Dryer Air Temperature & Airflow Rate



Source: University of Nebraska

Rather than printing more tables to keep up with ever-changing propane costs, Hellevang developed a formula that growers can use to easily calculate the cost of energy required for drying sunflower seeds: Simply multiply the per-gallon cost by 0.037. That will equal the dollars per hundredweight of seed per point of moisture removed. (For corn and wheat drying, he uses a factor of 0.022.)

With the ever-increasing size of farms, the days of the standard free-standing batch dryer are long gone. The capacity of many of today's on-farm drying/storage systems is equitable to that of some commercial elevators of a couple decades ago. "There are a lot of farmers buying [high-temperature] grain dryers that will dry 500 to 1,000 bushels of corn per hour," Hellevang points out. "And for many North Dakota farmers, a 'small' bin today is one 36 feet in diameter; a lot of 42- and 48-ft diameter bins have gone up."

Energy Efficiency & Dryer Cleanliness

Regardless of dryer size, operating the unit for optimum energy efficiency is more important than ever. And that does not imply you'll save money by lowering the drying temperature.

"A lot of people have the idea that if we turn down the heat, it's going to be more energy efficient — for example, going from 200 degrees down to 150," Hellevang says. "Actually, it's the opposite." As shown in the figure at left, the amount of energy required to dry corn in a conventional cross-flow dryer goes down as temperature increases. It's a similar story with sunflower. "So one thing that's going to make the most efficient use of energy is to run the dryer at the maximum recommended temperature," the North Dakota ag engineer advises.

One concern with sunflower is its high oil content.

Growers obviously don't want to dry at a temperature that could impact the seeds' oil quality. NDSU's maximum recommended temperature for sunflower is 200 degrees in a continuous flow dryer. "You'd have to get well above 200 before oil quality is affected," Hellevang says. "But again, if we're running at just 150 or 160 degrees in a continuous flow dryer, we're sacrificing energy efficiency."

Back in the 1980s, many sunflower producers tended to lower drying temperature as a way to reduce the risk of fires. Hellevang examined a number of insurance records for units that had caught on fire while drying sunflower. The records documented how the dryer was operated, where the fire occurred and other relevant items. "I found there was no correlation between drying temperature and fires," he recounts. "But there was a very definite correlation between fires and dryer cleanliness."

That brings the North Dakota engineer to a point he has emphasized for a long time: the critical importance of good housekeeping with a high-temperature dryer — particularly when drying sunflower. As in a combine, the accumulation of 'fines' coming off sunflower hulls and sticking to a dryer poses a real fire threat. "We need to keep that dryer clean," Hellevang stresses. "Pay attention to spots where seeds may get hung up. Make sure you get a complete unload so we're not leaving in seeds that then become overdried."

The downsides of overdrying are well known: First, there's the increased risk of fire; second, shrink loss if the moisture falls below 10%; and third, the extra — and unnecessary — energy costs incurred. "I tell farmers 'you lose two ways' by overdrying," Hellevang remarks. "You spent the money to dry, and then you end up with less to haul to market" than what the market pays for.

Natural Air / Low-Temp Drying

Natural air/low-temperature drying is, of course, utilized successfully by many sunflower producers in lieu of a high-temperature system. It's an especially good fit for High Plains growers with their warmer and typically drier fall conditions. But Northern Plains producers who tend to harvest their sunflower a little earlier also reap the benefits of a natural air system.

It doesn't work well, however, for northern growers who end up harvesting in late October or early November. "I've frequently watched the pattern in North Dakota where the sunflower is drying down and everything is looking great in early October; then we get some rain or snow — and all of a sudden sunflower that was at 12 or 13% moisture is now sitting at 20," Hellevang observes.

"With a natural air system, sunflower at 15% is a 'comfortable' moisture level," he adds. "When you get to 17% or higher, you need a lot of air flow." With oil-type sunflower at 17% moisture, "we really need an air flow rate of 1.0 cfm per bushel," Hellevang advises. "Then you're looking at about 27 days of fan time (under 'typical' North Dakota October conditions) to get it dried down. If you go at 15%, I encourage growers to look at about 0.75 cfm per bushel — and we're still looking at about 30 days."

It takes roughly double the fan horsepower to go from 0.75 cfm up to 1.0 — which is why Hellevang is not very keen on natural air drying for sunflower that's above 15% moisture, especially later in the fall. "What works very well in October doesn't in November," he states. "The earlier we can harvest and get that drying process started, the more efficient we'll be."

Moisture Testers

Still waiting for that "magic bullet" when it comes to eliminating the moisture rebound complication with sunflower seeds? So is everyone else.

"Even the expensive farm meters are still working off an electrical measurement, and that measurement is very much affected by where the moisture is within the seed," Hellevang explains. "It's much more influenced by the moisture near the surface; so the hull can indicate that the sunflower seed is actually dry, whereas the true moisture is higher.

"That's where the rebound is coming from: it tends to measure the hull and not the kernel."

The near-infrared (NIR) testers found at commercial elevators minimize the difference; but the cost of such units means the average farmer is not going to own one. So Hellevang's advice is quite similar to what it was 10 or 15 years ago:

1) Check the seed moisture with your meter, place the sample in a sealed container, and then recheck it at least 12 hours later. By then the moisture will have equalized throughout the seeds, and you'll get an accurate reading.

2) Review your meter operator's manual. "Understand the degree of accuracy, understand the recommended testing procedures — and to get an accurate reading, I still recommend that the sample be at the *same* temperature as the meter." If you have a cold sample and the meter is at room temperature, "there will be some variability." All meters have a minimum temperature at which they're accurate, Hellevang adds. That information should be in the operator's manual.

3) When it comes to discounts, of course, the elevator's moisture reading is the one that really counts. "The easiest way for the farmer to calibrate his own meter is to take a sample, check it, take the same sample to the elevator, check it there — and then compare the readings." ■

Proper Sunflower Storage: The Basics

Editor's Note: *The following comments on proper storage of sunflower are excerpted from the* High Plains Sunflower Production Handbook. *As such, they are reflective of the climactic conditions of eastern Colorado, Kansas, southern Nebraska and adjacent areas. A few items have been edited slightly to also pertain to the Northern Plains production region.*

• **Clean the Storage Facility —** Thoroughly clean the facility, aeration fan, ducts and the handling system by removing trash and old grain, which can harbor insects or fungi. Seal cracks and crevices that can allow insects, fungi or moisture to enter the storage.

• **Consider an Approved Bin Treatment for Insects —** Treat the inside of the facility and beneath the plenum floor with a residual spray for insect control. Be sure the chemical is registered for use with sunflower, and follow label instructions closely.

• **Clean Trashy Sunflower —** Sunflower stored with excessive trash, florets, broken seeds, weed seeds or other foreign material is more susceptible to fungi and insect problems. Such trash normally is at a higher moisture content and will cause heating. Cleaning the seeds also improves airflow through the sunflower.

• **Store at a Safe Moisture Content —** Sunflower should be stored at 10% or less moisture if the plan is to market the crop within six months following harvest. Sunflower seeds held through the spring or summer should be at 8% or less for oil-types and 10% or less for nonoils.

• **Aeration Systems Are Key —** An aeration fan is meant to cool the sunflower seeds; it is not intended to be a method of drying or moisture removal. The target storage temperature is 20 to 40 degrees F., within 20 degrees of the average coldest winter month. Fans should be operated when the outside air temperature is 10 to 20 degrees less than the seed temperature.

Fans may run even during periods of intermittent high humidity. They can be turned off during rainy or damp weather, however. A fan should be covered after it is turned off.

• **Check the Seed —** Sunflower should be sampled weekly until seed temperatures are cooled to the winter storage temperature. Then sample the sunflower every three to four weeks during the winter — and weekly, if the seeds are being held into the warm spring and summer months.

• **Check the Sunflower, Not the Bin —** When sampling, probe the sunflower seed pile and be observant for temperature, moisture, insect, fungi and odor differences from the previous inspection. If the probe is hot, take immediate action.

Feel, smell or walk around the bin and probe the sunflower seeds; don't just peer through a roof opening and assume there is no storage problem. It's also a good idea to write down the results of each inspection for future reference.

• **Act Quickly to Stabilize Problems —** Should a problem be detected, try to stabilize it with aeration. If that fails, move the seeds to market immediately, as the problems

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