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NEWS RELEASE

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Grain aeration still important in dry year

HUMBOLDT, SK – Harvest is over is most parts of the prairies, and from all indications, yields are above average. And that means that grain storage is on a lot of producers' minds this fall.

"Each bin of grain represents thousands of dollars of investment and must be managed properly," stated Dr. Joy Agnew of the Prairie Agricultural Machinery Institute (PAMI), who often speaks to farmers about how to store their grain to avoid spoilage.

The risk of grain spoilage in the bin is highest when the grain is hot or wet, so both temperature and moisture must be managed to prevent it.

While most producers got their crops off the field dry this fall, grain aeration is still something important they need to consider. Even dry grain is susceptible to spoilage as natural convection will cause temperature variations in the bin, which then result in moisture variations within the grain. Blowing air through the grain helps to limit those variations and minimize the risk of spoilage

As opposed to drying grain using natural air or with hot air dryers, grain aeration is about conditioning grain; that is, evening out the temperature in the bin.

"Aeration is still useful in a dry year like this," said Agnew.

Aeration is actually critical for canola and pulse crops like peas and lentils, which remain "alive" for up to six weeks after harvest. These crops respire in that period of time, giving off water vapour and carbon dioxide. This "sweating," as it is commonly referred to, can spoil grain. Grain aeration can help keep that from happening.

Sweating may actually be a bigger problem for farmers straight-cutting these crops, Agnew noted, as the plants are not getting that time in the field to respire as they do when swathing occurs before harvesting the grain.

Producers are advised to turn aeration fans on as soon as the ducts are covered with grain and to leave them on continuously until the average temperature of the grain is at a safe to store temperature. Fans may be turned off during periods of high humidity, but there is very little moisture movement between grain and air at low airflow rates (0.1-0.2 cfm/bu) associated with aeration.

Farmers that need to actually dry their grain, and want to use natural air drying (NAD) systems need a higher air-flow rate than those simply aerating their bins. They also need to run their fans when the air has the capacity to dry, noted Agnew, which is typically during the day. Though the debate still rages about when it is best to naturally dry grain, Agnew sticks by her determination that it is during the day.

“If grain has water in it, and the air is dryer than the grain, it will draw the moisture out of it. And the warmer the air circulating, the more water it can hold. The air has a greater capacity to dry during daylight hours, especially at this time of year,” Agnew stated.

Farmers can “freeze dry” tough grain to minimize the risk of spoilage over the winter, but it will result in issues in the spring.

“Once grain is cold, it is extremely difficult to remove the moisture using natural air,” Agnew advised.

She advised farmers with “freeze-dried” grain to sell it frozen, or use hot air drying, as NAD will not work well to dry cold grain.

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Attached: The Facts About Grain Aeration factsheet published by PAMI earlier this year.

The Facts About Grain Aeration

Each bin of grain represents thousands of dollars of investment and must be managed properly. The following information can be used to help make better management decisions.

- The risk of grain spoilage is highest when grain is ***hot or wet,*** so both temperature and moisture must be managed to prevent grain spoilage. Hot air drying systems are common for drying grain, but natural air drying (NAD) systems are lower cost and increase the capacity for managing tough grain.
- Even dry grain is susceptible to spoilage because natural convection will cause temperature variations which then result in moisture variations within the grain. Blowing air through the grain helps to limit these variations and minimize the risk of spoilage. Depending on the airflow rate of the fan, blowing air through the grain will result in grain conditioning or cooling or it may result in grain drying.
- The airflow rate from the fan depends on fan specifications and the static pressure (resistance to airflow) of the bin. Static pressure depends on grain type, depth of grain, and type of ducting.

It's all about the airflow rate

Aeration = grain conditioning/cooling ➡ low airflow rate (0.1-0.2 cfm/bu)

Natural air drying = removing moisture from grain ➡ high airflow rate (1-2 cfm/bu)

Understanding the Equilibrium Moisture Content (EMC)

For aeration, if the outside air is cooler than the grain, the grain will cool. For natural air drying, if the air has "capacity to dry", the grain will dry. The air's capacity to dry is dictated by the Equilibrium Moisture Content (EMC) of grain. The EMC dpends on air temperature, air relative humidity (RH), and grain type.

For every temperature/relative humidity combination, air has a specific EMC or a point where the moisture in the air and grain have reached a steady state or equilibrium. At this point, the air will not take moisture or give moisture to the grain. The EMC of air for wheat is shown in the following table.

EMC for wheat

Temp	Relative Humidity (%)										
°C	35	40	45	50	55	60	65	70	75	80	85
-2	11.5	12.2	13.0	13.7	14.5	15.3	16.0	16.9	17.7	18.7	19.8
2	11.1	11.9	12.6	13.4	14.1	14.9	15.6	16.4	17.3	18.2	19.3
5	10.9	11.7	12.4	13.1	13.8	14.6	15.3	16.1	17.0	17.9	19.0
8	10.7	11.5	12.2	12.9	13.6	14.3	15.1	15.8	16.7	17.6	18.7
10	10.6	11.3	12.0	12.7	13.4	14.2	14.9	15.7	16.5	17.4	18.5
13	10.4	11.1	11.8	12.5	13.2	13.9	14.6	15.4	16.2	17.1	18.2
15	10.3	11.0	11.7	12.4	13.1	13.8	14.5	15.2	16.1	17.0	18.0
18	10.1	10.8	11.5	12.2	12.9	13.6	14.3	15.0	15.8	16.7	17.7
22	9.9	10.6	11.3	11.9	12.6	13.3	14.0	14.7	15.5	16.4	17.4
26	9.7	10.4	11.1	11.7	12.4	13.0	13.7	14.4	15.2	16.1	17.1
28	9.6	10.3	11.0	11.6	12.3	12.9	13.6	14.3	15.1	15.9	16.9

- For example, if air has an RH of 50% and a temperature of 5°C, its EMC for wheat is 13.1%. That means that, if you blow air that has an RH of 50% and a temp of 5°C through wheat, that wheat will eventually equilibrate to 13.1%. Whether the wheat started at 8% or 14%, it doesn't matter.
- Remember that EMC also depends on grain type, so the EMC chart for barley and canola will be slightly different. For example, the EMC of 50% and 5°C air is 10.8% for barley and 8.1% for canola.

- This information on EMC can be used to "optimize" when natural air drying fans are operating. The ambient temperature and RH fluctuates during the day, so there are times during the day when the EMC of the air is higher than the grain so running the fans will not result in drying. This information can also be used to help even out the moisture content profile in a bin. With most air distribution systems, the air flows from the bottom up. So to dry the grain at the top of the bin, the grain at the bottom becomes over-dried. Air can be used to re-wet the over-dried grain and result in an even moisture content profile.

Using the EMC of air to optimize natural air drying — sounds simple, right?

One problem with using the EMC is that air conditions fluctuate from hour to hour. Another problem is that the air conditions change as soon as the air hits the grain. The grain temperature and moisture content will affect the air temp and RH as it moves through the grain. So simply monitoring the outside temp and RH won't allow you to completely predict the air's capacity to dry.

How do grain conditions affect the air's capacity to dry?

Warm air + warm grain = drying

Warm air + cool grain = wetting

Cool air + warm grain = quick (short term) drying (approx. 1-2%)

Cool air + cool grain = no change

When is the best time to run natural air drying fans?

The best time to run fans depends on grain moisture content, grain temperature, air temperature, air RH and grain type. The best fan strategy also depends on your ultimate goal. See table below

Goal	**"Best" NAD fan strategy**
Safe storage for all grain types in a variety of ambient conditions	Run fans continuously
Minimal fan hours (grain is only 1-2% above dry)	Run fans at night only
Minimal fan hours (grain is more than 1-2% above dry)	Run fans during day only
Uniform moisture content profile (no overdrying)	Run fans during day only until average MC is 1-2% above dry, then run fans at night until grain is cool (tough grain will try and over-dry grain will re-wet)

What about "freeze drying" grain?

Freezing tough grain will minimize the risk of spoilage over winter, but once grain is cold, it is very difficult to remove moisture without a hot air dryer system.

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When is the best time to run aeration fans?

Turn aeration (conditioning) fans on as soon as the ducts are covered with grain and leave them on continuously until the average temperature of the grain is at a safe to store temperature. You can turn aeration fans off during rainstorms, but there is very little moisture movement between grain and air at low (0.1-0.2 cfm/bu) airflow rates.