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THE FACTS ABOUT GRAIN AERATION

PRODUCT APPLICATION

- 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,” then the grain will dry.
- The air’s capactiy to dry is dictated by the Equilibrium Moisture Content (EMC) of grain.
- The EMC depends 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 of 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.
- For example, if air has an RH of 50% and a temperature of 5 degrees Celsius, 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 degrees Celsius 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 degrees Celsius 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.

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

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?

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 (no over drying)	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 dry 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.

When is the best time to run aeration fans?

- Turn aeration (conditioning) fans on as soon as the ducts are covered with grain
- 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.