

How to Improve Bulk Grain Dryer Performance

Introduction

Drying grain in bulk using large volumes of air with little or no added heat is a cost effective and energy efficient method of drying. The dryer efficiency can be compromised if it is not serviced and properly maintained. In poor condition the dryer will not only cost more to operate but also it will not deliver the goods; it could spoil your crop.

Bulk grain dryers rely mainly on the availability of suitable ambient air to drive moisture from the grain. This air is only available during certain hours of the day and is less available as the drying season progresses and winter approaches.

Correct management of the store - the grain, fans, heater ducts and controls, is therefore essential if you are to 'win the race' against the weather and dry your grain successfully.

These following pointers may help in the challenge:

Before Harvest

Store preparation is the first key to success.

- *Clean the store* - contaminated grain may be unmarketable.
- *Unblock ducts and floors* - essential to achieve design airflow. Floors are often so blocked that they only deliver 50% of intended airflow.
- *Number laterals inside and out* - to help in locating accurately batches of grain and deciding which laterals need opening or shutting.

- *Check fan and heater controls are working* - controllers should be calibrated every year and replaced if obsolete. Heaters may need to be refurbished if they have not been used for a few years.

Loading

Loading affects airflow and therefore efficiency of drying.

- *Keep grain level and avoid heaps* - coned grain produces uneven airflow and drying so change the position of the discharge point regularly to spread the load evenly along each lateral. Level the store at least once a day.
- *Stick to the maximum grain depth* - the deeper the grain the higher the resistance to air flow and the lower the output of the fan. Recommended depth varies with grain type but for wheat and barley, 2.5 to 3m is the maximum, even in round bin drying systems.

Airflow

Achieving the correct airflow during drying is probably the most important single factor in achieving successful drying.

- *Is the fan up to the job?* - many fans were installed when harvests were smaller and grain depth was lower. Recommended airflow is 0.05m³/s for each tonne of grain being dried at the same time.



- *Air speed through the crop* - should be about 0.1m/s (20 ft/min) for a 2.5m depth of grain - check this with an airflow meter.

Pressure

The greater the air pressure in the main duct, the lower the airflow from the fan.

- *Check this* - by using a manometer.
- *Reduce fan pressure* - by cleaning the floors, reducing the grain depth or opening more lateral doors.

Humidity

Wet air won't dry grain.

- *Use a controller to switch the fan off if humidity is too high* - set the controller to the equilibrium RH corresponding to grain 30 cm (1 ft) below the surface of the heap.
- *Use controlled heat or dehumidification to reduce RH* - this will accelerate drying and keep costs down.
- *Monitor humidity* - using a low cost wet and dry bulb hygrometer.

Heating

Many get away without heating in drier years, but have problems when the drying time is wet. Even in good weather some heating can be effectively used. Any form of heating will accelerate drying.

- *Control heaters* - to achieve the RH corresponding with the final target moisture content.
- *Electric heating* - used during cheap night rate tariff periods can be as cheap as using the fan only during the day.

Dehumidification

This lowers humidity by directly removing water from the air using electrical equipment based on refrigeration technology. It offers the following benefits:

- cheap to run compared with heaters
- consistent drying times and drying costs each year
- fast drying
- works well with 'under-fanned' installation

- no fear of 'capping' when drying wet grain
- electrical rating considerably lower than the equivalent heater bank.

Store Log

Good records are a useful aid during drying.

- *Record* - crop type, tonnage, position in store, moisture, controller setting, drying progress, laterals opened.

Finishing Drying

For long term storage moisture and temperature must be down to acceptable levels.

- *Restart fan* - 2 to 3 days after drying and check for any smell of deterioration.
- *Check* - the stack temperature for local overheating.
- *Cool* - grain by ventilating for short periods overnight to below 12°C.
- *Use low volume ventilation* - to cool periodically during winter and reduce temperature to around 5°C.

Is your dryer in good condition?

Here are 10 check points to achieve fitness. Well before harvesting and the beginning of drying, check and remedy any faults as follows:

1. Store should be clean and dry. Vacuum up all loose grain, dust, chaff and straw from the floor, ducts, from under the laterals and from the fan and heater bank. If the floor has been driven over make especially sure that the air outlets are clear of pressed in grain.
2. Disinfect where necessary.
3. Check for entry of any wetness, moisture or damp air, seal up any holes in floor, walls and roof.
4. Check for rodent entry and seal up any holes.
5. Have the fan, heater bank, controls and other electrical equipment serviced by a competent electrician. Some regional electricity companies offer this service as a packaged deal.



6. Check the air ducts for leaks and seal any found. Air will escape through these in preference to passing through the grain and thus lower the drying performance.
7. Mark and number the positions of all laterals both inside and outside the main duct and walls. Check that the shutters are working well and make effective seals when closed.
8. Use a whirling hygrometer to check the calibration of the drying controller.

Instrumentation

9. Have ready a moisture meter, a grain sampling spear, and a grain thermometer. Also useful will be an airflow meter, a whirling hygrometer, and a manometer. Where these instruments are battery powered such as the moisture meter and electronic thermometer, check that new batteries are fitted.

Store records

10. Produce store log sheets to help you plan and record the drying progress. This will help :
 - record the moisture content of each load
 - record the distribution of different loads within the store
 - record daily the sample of moisture content readings from three different depths so as to monitor progress towards target dryness, and provide you with the information to decide your best drying strategy.

Grain Moisture Equilibrium Chart

| CROP MOISTURE CONTENT % | WHEAT | BARLEY | RAPE | BEANS PEAS | RYEGRASS |
|----------------------------------|-------|--------|------|---------------|----------|
| 6 | | | 45 | | |
| 7 | | | 55 | | |
| 8 | | | 64 | | |
| 9 | | | 71 | | |
| 10 | | | 76 | | 50 |
| 11 | | | 80 | | 55 |
| 12 | | | 84 | 55 | 60 |
| 13 | | | 86 | 60 | 65 |
| 14 | | | 88 | 65 | 70 |
| 15 | | | 89 | 68 | 75 |
| 16 | | | 90 | 70 | 77 |
| 17 | | | 91 | 73 | 79 |
| 18 | | | 92 | 75 | 81 |
| 19 | | | | | |
| 20 | | | | | |
| 21 | | | | 80 | 85 |
| 22 | | | | | |
| 23 | | | | | |
| 24 | | | | | 90 |
| 25 | | | | | |
| 26 | | | | | |

WHAT TO DO EACH DAY

- Sample grain 12" below bed surface and measure moisture content
- Set controller to RH value from this chart

Blow cold air continuously
 Fan controlled by humidistat, no heat
 Fan and heat controlled by humidistat

35
42
48
55
61
67
72
77
81
83
84
88
92
94
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