



Farmnote

Grain Drying of Malting Barley

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Grain drying of malting barley offers growers in south-west Australia an opportunity to harvest their barley before its quality deteriorates in the paddock. Care and attention must be paid to the drying process and the storage of barley before and after drying to ensure the malting barley achieves and maintains its germination rate and malting quality. If dried grain does not germinate it cannot be used to make into malt.

Why dry malting barley?

The major advantages of grain drying include:

- harvesting grain at moisture levels that are above specifications for receipt. This allows an earlier start to harvest;
- reducing the period that the crop is exposed to rain or hail;
- reducing the potential yield loss from head drop associated with leaving the crop standing for long periods in the paddock;
- reducing cracking and skinning of barley that results from over-threshing grain of a low moisture content;
- increasing harvesting hours by being able to start earlier in the day and continue later into the evening;
- reducing downtime due to bad weather.

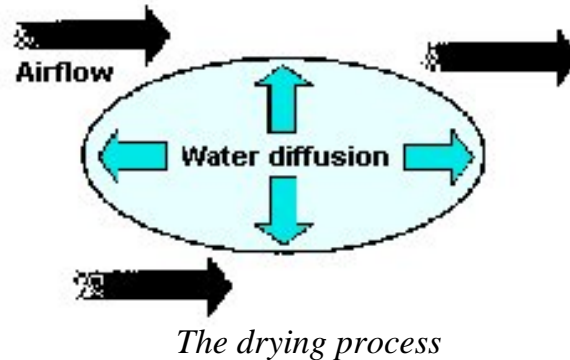
In some situations, a dryer may be a cheaper option than increasing harvester capacity or upgrading equipment.

While there are many advantages in drying malting barley, these must be balanced against the financial cost of capital purchases and the ongoing operating cost or commercial drying cost. For an on-farm system, the labour requirement will mean the direct cost of employing an operator or the indirect cost of prioritising your own labour at harvest time.

Additional handling of grain before and after drying imposes another cost on the operation.

The drying process

Grain drying involves the removal of moisture from the barley kernel. Air of a suitable relative humidity and temperature is passed through the grain mass and moisture from the inner part of the kernel is transferred towards the outer layers of the grain. A difference in relative humidity between the air and the kernel allows for the water in the kernel to evaporate into the drying air that is flowing past the grain.



Maintaining grain quality during drying

When done correctly, grain drying retains the yield and quality of barley produced in the paddock. While the grain drying process itself is quite simple, there is scope for significant problems to develop and for the barley quality to decline if the drying is not done properly.

The rate at which grain can be dried is dependent on:

- air temperature and consequently grain temperature;
- moisture content of the grain;
- rate of air flow (to a lesser extent).

Factors that can damage malting quality and germination percentage during grain drying are:

- excessive heat, which can reduce the ability of barley to germinate and can denature enzymes in the grain that are needed in the malting and brewing process;
- over drying, which makes the grain susceptible to mechanical damage during handling;
- inappropriate storage of moist grain prior to drying.;
- lack of cooling after drying that may promote mould growth.

Avoid over drying, as very dry grain has a lower weight and grain with a low moisture level takes longer and is more expensive to extract.

Grain dryers

Types of dryers

Grain dryers are generally classified as two types, batch and continuous-flow. Both types have features that would make them suitable for different situations.

A batch machine dries a fixed amount of grain over a period of time. Dry grain is emptied from the

bin and a fresh batch of moist grain is added for drying. Batch machines are well suited to drying small quantities of grain.

A continuous-flow machine dries moist grain whilst it flows from the inlet to the outlet. In a continuous-flow system, air temperatures are generally higher, as heating is applied more uniformly, for a shorter period of time and to a thinner layer of grain. Continuous-flow machines are generally more efficient if drying large quantities of the same type of grain and have a lower requirement for labour.

Stationary versus portable

p>Both batch and continuous-flow driers come in stationary or portable varieties. Portability usually means that the machine is more versatile and easier to re-sell. Portable driers are often used in the paddock along side the header and delivery trucks.

Stationary driers are best used as a part of a well-established grain storage and handling system. They need to be associated with a moist-grain holding silo and a conveyor system.

Heating source

Availability, cost and maintenance are the usual factors in selecting a fuel type for heating the drying air. On the south coast of Western Australia, the most common energy sources are LPG and diesel fuel.

LPG has a higher cost of installation because of the need for special pressure tanks and on site safety requirements but gas-burning heaters have a lower maintenance cost over time.

A diesel fired air heater is cheaper to install but has a higher maintenance and fuel cost. The suitability of diesel fired heating of air for malting barley may change in the future in response to feed safety issues.

The cost of electricity appears to be prohibitive for on-farm grain drying on the south coast of Western Australia.

Guidelines for drying malting barley

When to harvest:

Malting barley can be harvested once the grain has reached physiological maturity (grain dough stage) and when the grain moisture content is no more than 20 per cent. Harvesting at a moisture level above this is limited by the ability of most harvesters to successfully thresh grain from the head.

Considering both drying costs and practicalities, the best moisture content at harvest for malting barley is around 16 per cent. If moist grain cannot be effectively handled before drying, harvest at a moisture content of less than 16 per cent.

It is worth noting that dryer efficiency is greatest at a grain moisture content of 14.5 per cent.

Managing moist grain prior to drying

On-farm drying systems generally use a moist-grain silo to provide a constant supply of moist grain to a dryer.

Ideally, moist-grain silos require base slopes of 45 degrees to allow moist grain to flow. The use of general farm silos with a base slope of 30 degrees may necessitate additional cleaning out by hand, as wet grain may not empty completely. As the scale of operations exceeds 100 tonne, a less costly option is the use of a flat bottom silo with a sweep arrangement.

If grain is to be held for a period of time, the moisture content should not exceed 18 per cent. There should be a flow of ambient air with relative humidity below 75 per cent and at a rate of three to four L/sec/tonne.

Drying temperatures

The temperature selected for drying is a compromise between a high temperature that will give the greatest drying capacity for the machinery and a lower temperature that will produce the best quality for the market you are selling into, and hence the best price for the barley.

The ability of barley to germinate during the malting process rapidly drops as grain temperature rises above 43° so the dryer must be run at an air temperature that will heat the grain in the hottest part of the machinery (usually immediately inside the heating inlets) to a temperature that is no more than 43°.

For drying grain that is at the wetter end of the range or when using dryers that do not mix or circulate grain, the drying process should be slower and at a lower temperature.

Cooling down

To remove the remaining excess moisture and to minimise problems with sweating, caking and insect contamination, the grain must be cooled after drying. Cooling to 10° above the ambient temperature using a well-aerated silo with airflow rates of between 5 and 10 L/sec/tonne should be sufficient.

Continuous flow systems often incorporate a cooling section in the machinery. For greater capacity, the cool cycle can be eliminated and a full heating cycle used. Grain can then be batch cooled.

For batch cooling grain from the dryer, it is sensible to have two or more silos or field bins set up to maintain dryer through -put. These silos must be completely emptied before being refilled as the grain first added to the silo will always be the last remaining in the silo, making it prone to mould problems.

Delivery of malting barley dried on-farm or commercially

- Maximum temperature of 38°C for delivery.
- Grain will be randomly tested for germination percentage from the 2000/01 season onwards.
- Growers presenting dried grain as malting grade that has less than 98 per cent germination are liable to face penalties as determined by the Grain Pool of WA.

Further reading

- Andrews A. (1996) *Storage, handling and drying grain, a management guide for farms*. (Ed. T. Jenson) Queensland Department of Primary Industries publication QI96081.
- [Other AGWEST Barley references](#)

Acknowledgments

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