



canola
council
OF CANADA

Canola Storage

**Management tips for
conditioning and drying**



Canola Storage

All canola should be put on aeration immediately after harvest to cool it. This conditioning process is important for safe long-term storage of canola. Freshly harvested canola, even dry canola, can maintain a high respiration rate for up to six weeks, producing heat and moisture that can feed molds and create hot spots.

Don't stop aeration until the cooling front moves completely through the grain mass. Position of the front is difficult to detect unless you have temperature cables or a temperature probe to continually check grain near the top of the bin. As a rough guide, check the air moving capacity of your fan. A fan that blows 0.1 cubic feet of air per minute (cfm) per bushel (roughly one litre per second per cubic metre) of grain takes 150 to 200 hours to cool a bin. At 0.2 cfm per bushel, it takes half that time.

Monitor bins closely during the first six weeks and then continue to check stored canola regularly until delivery. Make sure stored canola cools to 15°C or lower throughout the bin. If stored canola temperatures plateau or start to rise while outside air cools through the winter, it can signal the start of spoilage. It only takes one small hot spot to start a chain reaction that can spoil a whole bin.

Factors that increase spoilage risk

Heat. The higher the temperature, the higher the storage risk. Enzymatic and biological activity tends to increase with higher temperatures. This activity creates the hot spots that lead to spoilage. Canola binned hot without aeration can retain its heat for months. As outside temperatures decrease relative to the grain temperature inside, a bin of warm canola will see air flow increase, creating new high moisture zones for mold development and spoilage.

Moisture. Moisture also raises enzymatic and biological activity that leads to mold growth. Canola with moisture above 8% is more likely to spoil within the first five months of storage, especially if heat is also above 20°C.

Dockage. Chaff, weed seeds and insect parts often have moisture levels three to four percentage points higher than canola seed. When dockage concentrates in certain areas of the bin, it becomes a start point for mold growth that can lead to heating and spoilage of canola. Higher dockage increases this risk.

High oil content. Canola seed containing more oil may need lower moisture levels for safe long term storage. Research is looking into the effect of higher oil content on stored canola under western Canadian conditions. However, research from Australia shows that for every 1.0 percentage point increase in oil content, canola should have 0.1 percentage points lower moisture for safe long-term storage! For example, if canola with 40% oil is safe at 8.5% moisture, then canola with 45% oil should be stored at 8% moisture.

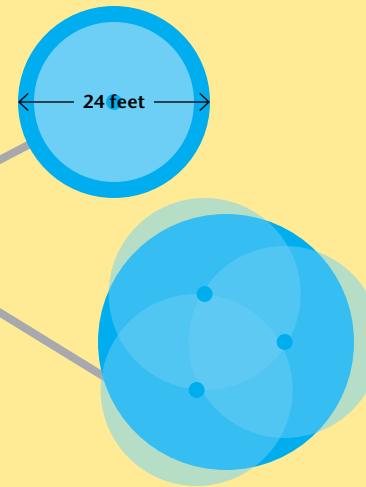
High green. Elevated chlorophyll levels in canola seed will increase the storage risk – even if the canola is dry and cool. Canola with high green seed content should be thoroughly conditioned, closely monitored and delivered as soon as possible after harvest to prevent additional price discounts from spoilage.

Bin size. Bigger bins mean increased compaction of stored canola, particularly when bins are tall and relatively narrow. More compaction reduces air flow.



Bin monitoring cables provide temperature readings through the grain mass so growers can check bins quickly from ground level. Cables are now available to monitor moisture as well as temperature.

Bin monitoring cables cover an area 20 to 24 feet across. If the bin is wider than that, then three or more cables will be needed to monitor the whole volume of canola.

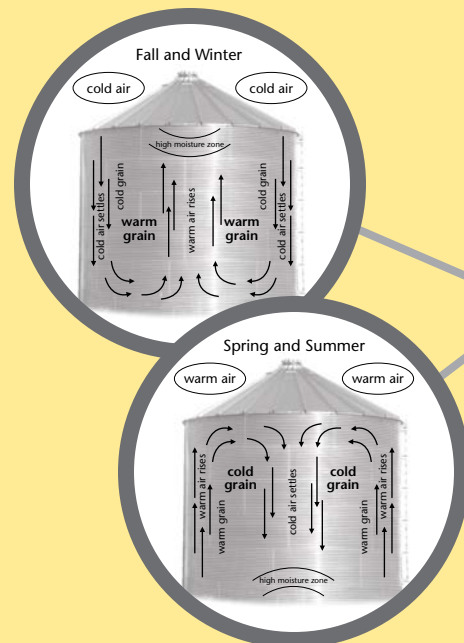


This is a solid column of heated canola in the middle of a 5,000-bushel bin. It was harvested dry and fairly cool in late October, which might seem safe, but it had green counts above 10%.

Canola has smaller seeds, which means smaller air pockets around the seed. Therefore the fan horsepower needed to condition canola is higher than the horsepower needed to push air through the same size bin of wheat.



Air movement within a bin changes with the seasons. In winter, when outside air is colder than air inside the bin, air currents in the grain tend to concentrate moisture at the top of the central core. In spring when outside air is warmer than air inside the bin, air currents in the grain tend to concentrate moisture at the bottom of the central core. This is why canola that seemed safe in the winter can start to spoil in the spring.



The aeration system and fan horsepower have to be adequate for the volume and configuration of canola storage. Also remember that the small size and round shape of canola seed leaves fewer air pockets relative to wheat and other larger grains, which adds to the aeration capacity requirement. For example, a 2,000-bushel hopper bottom bin may require only a 3 hp fan for wheat but will need a 5 hp fan to effectively condition canola.

How to monitor stored canola

Move grain. Taking canola out of the bin is the best way to check temperature and odor for signs of heating. This can also allow some cooling and disrupt moisture migration. If using this method, move a minimum one third of the bin. Bins tend to empty the central core first, where typical moisture cycles often lead to heating. But if green count or dockage is high, heating can start anywhere. If you have a sense that the bin is at risk, transfer the whole bin. If spoilage has started, look for immediate delivery opportunities.

Use properly anchored bin monitoring cables. These add to the cost of storage but make monitoring easier. One cable has a coverage diameter of 20 to 24 feet. Bins with a diameter greater than 24 feet will need at least three cables to adequately monitor grain temperature (see diagram on left). More cables provide extra assurance because grain never conditions or dries consistently throughout the mass. Temperature fluctuations are normal based on erratic air flow patterns.

Probes. Probing through doors or roof hatches may uncover hot spots near the bottom and top of the bin, but cannot show canola condition through the central core and all sides. Be careful and consider your own safety when climbing bins to probe grain. Reduce your risk of falling by using appropriate safety equipment such as a harness.

Moisture removal tips

While canola may be graded "dry" at 10% moisture, 8% moisture or less is preferred for long-term storage. Dry canola as soon as possible. If you can't dry tough or damp canola immediately, aerate continuously and move canola between bins to prevent spoilage.

Natural air drying using aeration alone can remove one or two percentage points of moisture, but only if outside air has "capacity to dry." Air's capacity to dry depends on its temperature and relative humidity (RH). For example, if air temperature is 15°C, then RH has to be 60% or lower to bring canola down to 8% moisture. If air temperature is 5°C, then RH has to be 50% or less. See Table 1 on next page. Air with a higher RH may be capable of cooling the grain but don't expect much drying capacity. In winter, as temperatures drop, the capacity to dry canola using aeration alone is minimal unless RH is very low.

Natural air drying also requires much more fan capacity than simple conditioning. Cooling grain can be achieved with air movement as low as 0.1 cubic feet per minute (cfm) per bushel. Natural air drying requires 1 to 2 cfm per bushel. The manual for aeration fans will show the expected air flow rate for a given bin size. Check with the manufacturer or retailer if you're unsure.



Temp °C	Relative Humidity (%)										
	35	40	45	50	55	60	65	70	75	80	85
-2	6.7	7.5	8.2	8.9	9.7	10.5	11.3	12.2	13.2	14.3	15.7
2	6.4	7.0	7.7	8.4	9.1	9.9	10.7	11.6	12.5	13.6	14.9
5	6.1	6.8	7.4	8.1	8.8	9.5	10.3	11.1	12.0	13.1	14.3
8	5.9	6.5	7.1	7.8	8.5	9.2	9.9	10.7	11.6	12.6	13.8
10	5.7	6.3	7.0	7.6	8.3	8.9	9.7	10.5	11.3	12.3	13.5
13	5.5	6.1	6.7	7.3	8.0	8.6	9.4	10.1	11.0	11.9	13.1
15	5.4	6.0	6.6	7.2	7.8	8.5	9.2	9.9	10.7	11.7	12.8
18	5.2	5.8	6.4	7.0	7.6	8.2	8.9	9.6	10.4	11.3	12.4
22	5.0	5.6	6.1	6.7	7.3	7.9	8.5	9.3	10.0	10.9	12.0
26	4.8	5.4	5.9	6.5	7.0	7.6	8.2	8.9	9.7	10.5	11.6
28	4.8	5.3	5.8	6.3	6.9	7.5	8.1	8.8	9.5	10.4	11.4

Table 1: Effect of relative humidity and temperature on equilibrium moisture content of canola. These numbers are valid for canola only. Source: PAMI, adapted from the Henderson equation.

Adding air heaters to an aeration system.

Air heaters will remove moisture from air and increase air temperature, greatly increasing the air's "capacity to dry." The general recommendation is to increase air temperature by no more than 10°C. With aeration systems, the retention time of the air within the grain mass is much higher than with true grain dryers, so the grain is exposed to the high temperatures for a longer period. Using too much heat in this system may cook the canola. As a guide, if outside temperature is 5°C, then air should be heated to no more than 15°C. This system can work when temperatures are below zero as long as RH of the air going into the bin is lower than RH of air inside the bin, but required drying time will be longer.

Tip: Can your fan move enough air? The higher the grain moisture, the more power required to push air through the grain mass. Insufficient air flow can result in a high moisture zone near the top of the bin that can initiate spoilage. If the fan can't move enough air, take out some grain to reduce the depth of the grain mass. Removing some grain will also flatten the cone, making the depth of grain more consistent throughout the bin. Remember to open the bin vents.

Dryers. Continuous flow or re-circulating batch drying systems are preferable to heated air aeration or natural

air drying. True dryers tend to reduce the potential for seed damage from heating and allow for slightly higher drying temperatures. The key word is "slightly." Check the maximum safe drying temperature for your system. Reduce that by 11°C when working with damp canola as opposed to tough. Canola with higher moisture is more likely to cook in a heated air drying system. For very damp canola, growers may prefer to run the grain through twice at a lower temperature to prevent seed damage and reduce the risk of fires. If the dryer has screens, make sure the screen size is small enough to hold canola.

A little overdrying is OK. Moisture content tends to rebound slightly as grain cools coming out of the dryer. A general rule is to over dry by 0.1 percentage points for every point the grain is dried. For example, if canola is at 13% moisture and your target is 8%, over dry by 0.5 percentage points to 7.5%. It should rebound to around 8% when cooled.

Canola in bags

Research projects looking at storage of canola in bags in Western Canadian conditions are underway but not complete. Until we better understand the parameters for safe long-term storage of canola in grain bags, we recommend that growers who choose to store canola in bags manage them as short-term storage. Canola should be as cool and dry as possible when bagged. Bags should be positioned where they can be regularly monitored and easily emptied at the first delivery opportunity or if monitoring reveals the start of spoilage. For example, a bag on high ground but surrounded by soft ground and pools of spring runoff could prevent timely removal. Bags in remote locations could also be more susceptible to wildlife damage, which can let water into the bag and promote spoilage.



¹"Isotherms for Australian canola varieties," Cassells et al, published in Stored Grain in Australia 2003.