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Addition of Supplemental Heat

Is adding supplemental heat right for my farm?
In the field of natural air drying, the question often comes up as to whether or not adding supplemental heat to a natural air drying system will be beneficial. To answer this question, you must first assess your environmental conditions, as well as, your natural air drying equipment. If you are dealing with low ambient air temperatures and/or high relative humidity (RH), then yes, adding supplemental heat to your natural air drying system will be of benefit. If you have aeration fans and equipment in place to provide 0.75 to 1 cfm per bushel, then adding supplemental heat will also be beneficial.

Supplemental heaters are commonly available as either electric or gas fired. Depending on the individual producer's needs, either method can produce satisfactory results. Electric heaters are recommended on smaller bins when just minimal or intermittent heat is required. Gas-fired heaters are useful when larger BTU outputs are required for larger airflow rates. Whatever the case, it is important to closely match fan, heater and bin sizes to produce the optimum airflow and temperature values, for each particular type of grain being dried.

A general rule of thumb when naturally air drying is, the ambient air needs to be a minimum of 10°Celsius to allow for the drying process to occur. With the help of a low temperature supplemental heater, you will have the ability to raise ambient air temperature 8-12°C with a 60,000 or 100,000 BTU heater and 15 to 35°C with a 200,000 BTU heater. What this means to the average producer is, that with the smaller BTU output heater you will be able to continue to dry grain until the ambient temperature drops to approx. 0°C and with the 200,000 BTU heater you will be able to dry until the ambient temperature drops to approximately -10°C.

Benefits of adding a low temperature supplemental heater go beyond just temperature rise. Increasing the temperature by 10°C also lowers relative humidity (RH) by 50%. Relative humidity plays a vital role in grain drying. By lowering the RH and increasing the temperature inside the bin, the ability of the air to remove moisture from grain is increased. This greatly benefits producers trying to dry grain in high humidity situations, as a result of adding heat, drying times will be reduced contributing to lower operating costs for the producer.

When drying grain, it is important to pay attention to relative humidity, as well as, the equilibrium moisture content (EMC) of specific crops. The EMC of grain is the minimum moisture content grain will dry to at a given temperature and RH when exposed to those conditions over a period of time. Producers may become frustrated when natural air drying seems to stall out after a period of success. Quite often, this stalled drying process is a result of grain reaching its equilibrium moisture content. In these situations, only with the introduction of supplemental heat

(to reduce RH and increase temperature) will the drying process be able to continue. In the following chart, you will be able to see the relationship of relative humidity to a temperature in various grains and where the moisture content reaches an equilibrium. You can also see, that by increasing the temperature you will decrease the humidity and allow for more moisture to be removed from the grain.

Relative Humidity of Air %	Wheat Equilibrium Moisture Content %		Canola Equilibrium Moisture Content %		Corn Equilibrium Moisture Content %	
	at 25°C (77°F)	at 10°C (50°F)	at 25°C (77°F)	at 10°C (50°F)	at 25°C (77°F)	at 10°C (50°F)
58	12	13	7.5	8.6	12.2	13.5
64	13	14	8.2	9.4	13.0	14.4
70	14	15	9.0	10.3	14.0	15.4
75	15	16	9.8	11.1	15.0	16.4
79	16	17	10.8	12.0	15.8	17.1
83	17	18	12.0	13.2	16.9	18.2
86	18	19	13.4	14.5	17.8	19.0

To be successful naturally air drying grain, you must monitor weather conditions and conditions within your bin. If you add too much heat to your bin you can over dry grain in the bottom of the bin before the grain at the top of the bin reaches its' safe storage condition. Through the use of temperature and moisture cables, a producer is able to track the drying front as it moves through the bin.

When adding supplemental heat to your system to keep temperatures above 10°C and the humidity low, you can expect to see the removal of up to ¾ of a percent of moisture every 24 hours. When taking into consideration all the factors mentioned above such as airflow, air temperature, RH, and EMC, it is possible with supplemental heat to turn poor drying days in the fall into optimum drying conditions. Successfully applying natural air drying systems on your farm will enable you to start harvest earlier, helping you finish earlier in the season and give you peace of mind that your crop is safely stored.