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## “Grain Spoilage Risk Increases as Ambient Warms Up and We Move into Summer”

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You may have dried and cooled your grain for safe winter storage; however, the spoilage risk for stored grain increases as we move in to summer and warmer weather. If the stored grain was exposed to extreme initial storage conditions such as high moisture and/or temperature for a significant period before drying, or if the grain contains a high percentage of fines, broken and immature kernels, the spoilage risk is even greater. During the winter months, cool and dry grain is relatively safer. However, in warm climate zones during summer months the grain temperature may rise significantly due to solar heating. This effect of solar heating may cause significant condensation near side walls if the grain was stored below freezing and can result in mold growth. High fluctuations in daily temperatures (hot days followed by cooler nights) may also cause headspace condensation on the inside of the bin roof, that can accumulate and drop on the grain surface. Mold growth further accelerates grain heating and moisture accumulation leading to sprouting, crusting, germination loss, mycotoxin development, and significant grain spoilage. Due to one or more of these reasons, grain crusting, sprouting, and mold are often visible on the top grain surface and near side walls. The following steps should be considered in managing grain in summer months and minimizing spoilage risk.

### **Seal off Fans**

Warm air enters the bin through fan inlet and moves upward through the grain and hits the cool/frozen grain resulting in condensation which would be absorbed by grain. Additionally, this convective current of warm air will heat the cool grain increasing the grain spoilage risk. The fan inlet should be sealed as soon as grain conditioning (drying followed by aeration) is completed. OPI recommends sealing of the fans in winter months as well when the fan is not operational. Be sure to lock out the fan if the inlet is sealed to prevent the fan from running while the inlet is sealed.

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## **High Moisture Grain**

High moisture grain is not recommended for summer storage. As ambient warms up, the grain temperature will also increase due to solar heating. In summer months, the ambient air will not have any cooling potential so grain temperature will remain high. High moisture grain at high temperature has very short safe storage period so the grain will spoil quickly. High moisture grain should be handled immediately and quickly dried. If the grain storage bin is equipped with fan(s) that delivers sufficient airflow rate (1.0-1.5 cfm/bu), in-bin drying with IntergisPro (©OPIsystems Inc.) automated fan control can be used for timely and effective drying. Supplemental heat is usually not needed as the air is dry enough at this time of year for in-bin drying. Care should be taken not to overheat the grain while drying by limiting the maximum plenum temperature to about 70-75°F. The overheating risk is higher with manual fan control and only few hot days are enough to overheat the full grain bin and insufficient cool temperatures would be available to cool the grain down again. Drying in summer using in-bin drying should not be attempted in grain bins with less than 1 cfm/bu airflow rate. Try to unload a portion of grain and transfer into another bin (if available) to reduce the grain depth and improve airflow rate, then dry the grain quickly. Otherwise, dry the grain using high temperature dryer as quickly as possible. Often high moisture grain is frozen for winter holding which prevents the mold growth in winter months. However, holding such grain in summer months without spoilage is nearly impossible due to condensation as explained in next section. The best way to deal with frozen high moisture grain is to quickly drying it in high temperature dryers.

## **Frozen Grain**

Handling frozen grain in summer months, whether dry or high moisture, is quite challenging. Ideally the grain should have been gradually warmed to 50°F in spring as recommended by OPI. However, if it was not done early enough then we have lost that opportunity and condensation problem may be unavoidable. As ambient warms up, headspace and bin side walls get hot due to solar heating. Due to this heating inter-granular air near top surface and side walls warms up and moves towards frozen grain (towards the core) and cools, resulting in condensation. As a result,



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mold growth, hotspot development, and spoilage may occur. Running the aeration fan in frozen bins will start warming the grain and condensation will form throughout the bin as warm front moves up and hits the cooler grain (in upward airflow). This situation is likely to become out of control in hot summer. You should consult OPI grain management team to evaluate different options available in such scenario. If you notice a hotspot, try to run the fan using coolest period (during nights) to remove the condensed moisture and avoid heating over 60°F.

### **Headspace Condensation**

Headspace condensation is the major cause of mold growth, hotspot development, and grain spoilage near the top surface of grain, particularly in spring and early summer when daily temperature fluctuations are high. In sunny and warm days headspace temperature may rise to 30-40°F above ambient temperature. In night, as ambient cools the bin roof also cools down but headspace remains hot and as warm air hits the cool bin roof, condensation occurs on the inner side of the roof and drops on the top grain surface. This condensed water is then absorbed by grain, increasing its moisture and combined with its warmth spoils rapidly, leading to mold growth, hotspot development, mycotoxins, and grain spoilage.

The best way to deal with headspace condensation is by using power exhaust vents with IntegrisPro automated control. The exhaust fans will run independently (without main fan) when dew point (condensation) condition develops and removes all the moist air before it has the opportunity to condense. The headspace air can be removed without running the aeration fan, avoiding the potential of warming the grain. Additionally, power vents have low power consumption.

Alternatively, unload the affected portion of grain and handle it separately. Running the aeration fan is not recommended if ambient is above 70°F to avoid heating of the grain. Look at the daily night time temperatures and if there is cooling potential with night time temperature dropping below 70°F then attempt cooling and avoid heating over 60°F.



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### **Regular Monitoring Bin**

Continue to monitor the grain frequently during the summer months, and if you notice a hot spot developing in the bin, it may be removed by unloading a portion of the grain. If it is not possible to remove the hotspot in this manner, operate the fans in the coolest conditions available while continuing to monitor the situation. Running the fan during coolest period of day/night cycle can aid in your ability to manage hotspots, provided that your airflow is sufficient. Unclean grain with higher percentage of immature, damaged and broken kernels and fines is not recommended for long term safe storage. The maximum recommended moisture for summer storage for corn and wheat is 13.5%; barley and rice is 13%; soybean is 11%; and canola is 8%. Grains stored during summer months are also at a high risk of insect infestation. OPI Insectors can be installed in silos to monitor insect activity through the IntegrisPro system. If you have any questions or concerns about your stored grain, or are not sure about how to deal with the hotspot or spoilage issues you might be facing, please feel free to call us at our toll free number (800-661-1055). Our advanced grain management experts will be happy to assist and provide you with the appropriate recommendations.