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## Keep Stored Grain Cool and Dry during Summer

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Grain should not be warmed to average outdoor air temperatures during the summer. It should be kept cool. The goal is as close to 40 degrees as possible in northern regions of the country and as close to 50 degrees as possible in southern regions. Grain at the top of the bin and along the walls will be warmer than the goal, but the goal should be to keep the bulk of the grain cool.

Insect infestations and mold growth are more likely at warmer grain temperatures. Optimum grain temperature for insect activity is approximately 70 to 90 degrees. Insect reproduction and activity is reduced as grain temperatures are reduced below 70 degrees. Also, warming the grain using aeration may slightly increase the moisture content of the grain. Typically the increase will be less than 0.50 percentage point.

There is a belief that condensation will occur particularly near the bin wall if the grain is not warmed to near average outdoor air temperatures. Condensation forms on cool or cold surfaces when warm moist air comes in contact with the cool surface. An example of this is condensation forming on a glass or container of cold liquid. However, the bin wall is heated by the warm outdoor temperatures during spring and summer, so conditions for condensation on the interior of the bin wall will not exist. The grain wall is warmer than the grain and the air in the stored grain.

There has also been concern that moisture will move from the warm grain near the bin wall into the cooler grain away from the bin wall. However, when 16 bins of grain were monitored through a summer, no statistically valid change in grain moisture content occurred within 4 feet of the bin wall.

Cold or cool grain has been safely stored through the summer for many years.

Many grain storage problems that have been blamed on leaving grain cold during the spring and summer actually are the result of condensation that occurred during the fall and winter. Condensation will form on the interior of the grain bin wall when warm grain is placed into a bin with a bin wall that is being kept cool by cold outdoor temperatures. Reports of grain sticking to the bin wall and possibly deteriorating likely are due to condensation in the fall causing the grain to increase in moisture content and then deteriorating during the spring and summer due to mold growth occurring when warmer temperatures exist.

Aeration fans should be covered to prevent wind and a natural chimney effect from warming the grain. Wind blowing into uncovered fans or ducts will move air through the grain similar to operating an aeration fan.

A galvanized bin roof absorbs large amounts of solar energy during the summer, heating the air above the grain. Convection currents in the grain flow up along the bin wall and down into the

grain near the top middle of the bin during the summer, drawing this heated air into the grain. Ventilating the space between the grain and the bin roof can reduce the amount that the grain near the top of the bin is warmed.

Natural ventilation to cool this space can occur if the bin has openings near the eave and peak in a manner similar to ventilating an attic of a building. The heated air rises and exits near the peak, drawing in cooler air near the eave. This natural ventilation will not occur unless the bin has adequate openings at both the eave and peak. Roof exhaust fans also can be used to draw the heated air out of the bin if it has openings to allow air into the area above the grain.

Grain near the top of the bin should be cooled about every three weeks to reduce the potential for insect infestations during the summer by operating the aeration fan for a few hours during a cool and dry morning or couple of mornings. Using positive pressure aeration to push air up through the grain enables the cool grain in the bottom of the bin to cool the air, which then cools the grain near the top of the bin. Only run the fan long enough to cool the grain near the top surface, which may require running the fan for a few hours during the coldest time of the day for a couple days. Running the fan more than is necessary will warm more grain at the bottom of the bin, increasing the potential for storage problems. If the air dew point is warmer than the grain temperature or if the air relative humidity is high, some moisture will condense onto the grain during fan operation. Condensing moisture will release heat that will slightly warm the air reducing the effectiveness of the aeration and increasing the amount of warming occurring in the grain at the bottom of the bin. Therefore it is important to select mornings when the air is cool and dry if possible. The amount of grain moisture content increase is limited by operating the fans only enough to cool the top grain.

Cover the aeration fan when it is not running.

Check the grain moisture content to assure the grain is dry enough for storage at summer temperatures. Measure the stored grain temperature at several locations near the top surface, along the walls and several feet into the grain.

The recommended long-term grain storage moisture contents are about 13.5 percent for wheat, 12 percent for barley, 13.5 percent for corn, 11 percent for soybeans, 13 percent for grain sorghum, 8 percent for oil sunflowers and 10 percent for confectionary sunflowers.

Temperature sensors are an excellent tool, but remember that they only measure the temperature of the grain next to the sensor. Since grain is an excellent insulator, the grain temperature may be much different just a few feet from the sensor. Record the measured temperatures. Increasing grain temperature may be an indicator of an insect infestation or mold growth.

Mold growth and insect infestations occur rapidly at summer temperatures, so stored grain should be checked every two weeks. An insect infestation can go from only a few insects to a major infestation in less than a month. Using insect traps or placing samples on white material aids in looking for insects.