Temperature and Airflow: Two Aspects of Potato Storage Management

Nathan Oberg[1], Nora Olsen[2], and Gale Kleinkopf[1]

A potato storage needs some attention and fine-tuning in preparation for this season's incoming crop. In order to maximize tuber quality and limit shrinkage, it is important to make sure that each component of the storage facility is in operational condition prior to harvest. Two key components include: 1) temperature sensor calibration and 2) ventilation system performance.

Temperature sensors play several crucial roles in storage operation and management. For example, an outside air (OSA) sensor will dictate when to admit fresh air or when to activate a refrigeration system. Plenum and return temperature sensors dictate how the control system mixes fresh and return-air in order to maintain set-point temperature. Temperature sensors also provide information about pile temperature differential (ΔT from bottom to top of pile) and can cutoff fans in case of low or high temperature deviations. This protects the crop from temperature extremes. In short, these sensors function as the eyes and ears of the control system. Therefore, these sensors need to be as accurate as possible.

Inaccurate sensors not only prevent the control system from functioning properly, but reduce product quality by inadvertently holding tubers at a temperature other than desired. Maintaining the correct temperature is especially important as it relates to processing quality and sugar accumulation. Thus, sensor calibration or replacement is a part of proper storage management;

as well as an economic issue. A wide variety of temperature sensors are commonly found in potato storages. These include resistance temperature detectors (RTD's), thermistors, as well as glass and bimetallic thermometers. All sensors (OSA, pile, plenum, and return) should be routinely checked and calibrated or replaced. Some types, such as RTD's, are difficult to calibrate and are best calibrated or replaced by a ventilation system service provider. The others listed can be corrected on site.

Temperature Sensor Calibration

A fairly simple method of calibration is to compare the sensor reading to that of a reference thermometer under standardized ice-bath conditions. A reference thermometer should be one that is known to be accurate and well calibrated. These thermometers can be obtained from industrial and laboratory suppliers as well as from ventilation system service providers. To standardize the conditions, form an ice-water slurry in an insulated container (e.g. thermos). Place both the reference thermometer and the sensor of question in the slurry and agitate. The reference thermometer should read close to 32 ºF. The exact temperature will vary with impurities in the water and elevation relative to sea level, so take that into account as well. Once the readings have stabilized record the temperature from each sensor. The difference in temperature readings between the reference and sensor is the 'offset' value. Use this offset value to add or subtract from the sensor reading to obtain the correct reading. Each sensor will likely vary in the offset value, so all sensors need to be calibrated. The offset value for each sensor should be recorded in a storage logbook and checked periodically by repeating the above calibration procedure. Pulp temperature thermometers can also be calibrated in this manner.

Ventilation System Performance

Now that the control system is providing air of the correct temperature, it is the job of the ventilation system to uniformly deliver it through the pile. The ability of the ventilation system to supply air can be significantly limited by the condition of various system components. For example, airflow and static pressure measurements were recently taken in a commercial storage. The system was found to be delivering less airflow than design specifications. A detailed examination revealed that the refrigeration coils and evaporative cooling media were fouled or plugged to the point that the system static pressure was elevated from the design specifications. This produced a significant resistance to airflow. Airflow was reduced by 7%, so less than 17 CFM/ton was delivered instead of the desired 18 CFM/ton. Seven percent may not seem like much, but when coupled with the overall reduction of system efficiency and performance, it would cost more money to deliver this smaller volume of air than it would to deliver the design airflow. Plus, the product quality benefits associated with proper airflow are reduced.

Both temperature sensor accuracy and ventilation system performance are closely linked with stored product quality and profitability. Time spent checking sensors as well as maintaining ventilation system components will greatly enhance your ability to maintain product quality in storage.

[1] Graduate Research Assistant and Research Professor, respectively, University of Idaho, Kimberly Research & Extension Center, 3739 N 3600 E Kimberly, ID, 83341

[2] Extension Potato Specialist, University of Idaho, Twin Falls Research & Extension Center, Twin Falls, ID, 83303-1827