Why Humidity Matters

Maintaining proper humidity in one's bin or shed is a critical component of tuber storage. The first step towards achieving that goal is understanding the somewhat complicated science of air moisture.

The total amount of moisture in air is termed air's absolute humidity. Equally important in potato storage is relative humidity (RH): the amount of moisture held in air at a specific temperature, expressed as a per cent of the maximum amount the air could hold at that temperature.

Because warm air can hold more moisture, relative humidity decreases as air temperature rises. Conversely, cold air can hold less moisture. As air cools, it will eventually reach its moisture saturation (dew) point, or 100 per cent relative humidity. When air is at its saturation point, its dew point temperature equals both its dry bulb (air) temperature and its wet bulb (air temperature at 100 per cent moisture saturation) temperature.

Saturated air cannot absorb any more water. Should the air temperature increase from the saturation point, the air's relative humidity will decrease, allowing the air to absorb more moisture. However, if the air cools below the dew point, it will be unable to hold all of the moisture and condensation will begin.

Moist air becomes a problem during storage when it cools past its dew point and water droplets form on the interior surfaces of the storage bin or, if the tuber surface is colder than the dew point temperature, on the tubers themselves.

The total amount of moisture emitted by the tubers' lenticels accounts for just 2.4 per cent of the tubers' total moisture loss over the storage period. The vast majority of the moisture loss – a full 97.6 per cent (so long as the relative humidity in the surrounding air is less than 97.8 per cent) occurs due to evaporation through the tubers' skin.

The rate that moisture is lost through the tubers' skin is based on the water vapor pressure deficit (WVPD): the difference between the water vapor pressure within the tubers' skin cells and the water vapor pressure in the surrounding air. The cooler and drier the air, the greater the pressure differential between the tubers and the surrounding air, resulting in greater moisture loss.

In our climate, humidification is imperative to maintain tuber quality and reduce shrink, since it is impossible to maintain adequate storage humidity without humidification. Consider, for example, if 5°C, 95 per cent RH return air is mixed with an equal amount of 3°C, 70 per cent RH outside air in order to produce a supply temperature and humidity of 4°C and 82.5 per cent RH: equidistant between the two original airstreams. At 4°C and 82.5 per cent humidity, the air has total moisture (absolute humidity) of 5.25g/m3 and a dew point temperature of 1.29°C. In comparison, 100 per cent RH (saturated) air at 4°C has 6.38 g/m3 absolute humidity and a 4°C dew point temperature. As such, the non-humidified supply air has the capacity to absorb 1.12 g/m^3 of moisture.

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