Department of Animal Science

COOL CELL CLEANING AND MAINTENANCE

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Tom Tabler, Department of Animal Science
Shawn Hawkins, Department of Biosystems Engineering and Soil Science
Yang Zhao, Department of Animal Science
Pramir Maharjan, Tennessee State University Department of Agricultural and Environmental Sciences

It may still be winter according to the calendar, but for poultry growers, summer is almost here. Now is the time to inspect and prepare your evaporative cooling system for the hot weather ahead. This work must be done well ahead of that first really hot day if you expect to not be caught off guard. Have the cool cell pads and filters been cleaned? Very little water can pass through a clogged filter (Fig 1) or clogged cool cell pad (Fig 2). Don't just look **at the pads**, but **through the flutes** and make sure the holes are clear. Keep in mind that dirt, algae and mineral deposits can clog the flutes in the pads and reduce efficiency. Are the distribution lines all intact? Make sure nothing froze over the winter. Are all the holes in the header pipe unclogged? If this is not the case, it's time to get started because you have work to do before that first hot day arrives.

Prevent heat stress

Heat stress for poultry results in lower performance and higher mortality rates. These combine to take dollars out of poultry growers' pockets. While many growers stay on top of routine maintenance, many others fail to see the importance of fans and evaporative cooling systems operating at peak performance. Fans can't do their job properly if cool cell pads and filters are clogged or header pipes are not putting out sufficient water. A well-designed and properly working evaporative cooling system can bring inside air temperature down 10 F or more below outside temperature, depending on outside humidity. Water evaporates as it passes through the cool cell pads, cooling the surrounding air. How this works is a bit complicated and requires an understanding of the relationship between temperature and humidity.

Figure 1. A clogged filter. Photo: Tom Tabler

To evaporate water, heat is required. The heat comes from whatever object the water is in contact with as it evaporates; in a chicken house situation, that object is hot

outside air as it passes through the wet pads. As heat is removed from the air, temperature decreases, but the heat remains, although it's now in another form. We can't destroy the heat, but we can change its form. Consider the following fact: **for every gallon of water that is evaporated, 8,700 Btu's** of sensible heat is taken out of the air (temperature drop) and converted to latent heat (higher humidity). The decrease in air temperature of the hotter, drier air entering the wet pads must be accompanied by an increase in humidity of the now cooler, but moister, air exiting the wet pads. We did not destroy 8,700 Btu's of heat; we simply changed its form (hotter, dryer air to cooler, moister air). Should you be wondering if the temperature of water going through the pad makes any difference in the cooling potential, the answer is not enough to matter. A gallon of water at 50 F has a cooling potential of 8,900 Btu's. A gallon of water at 90 F has a cooling potential of 8,700 Btu's. The cooling potential is essentially the same. Water temperature doesn't really matter.

Figure 2. A clogged cool cell pad. Photo: Tom Tabler

The 80-80 rule

Something that does matter is outside weather conditions. Outside temperature and relative humidity are inversely related; the higher the temperature, the lower the humidity. And the lower the humidity, the better evaporative cooling works. There is a "tipping point" that can help determine whether to run cool cells. That tipping point, in most cases, is an **air temperature of 80 F**. If the air temperature is above 80 F, running cool cells will likely be beneficial. If air temperature is 80 F or below, the cooling effect of running the pads is minimal. The reason for this is the humidity in the air associated with a particular air temperature.

In most cases during summer, if air temperature is 80 F, relative humidity in the air is roughly 80 percent. As air temperature gradually increases above 80 F (late morning, afternoon), relative humidity gradually decreases. As air temperature gradually decreases to below 80 F (late evening, overnight, early morning), relative humidity gradually increases. Once relative humidity has increased to 80 percent, let's say, between 9:00 p.m. and 9:00 a.m., running cool cells offers little benefit. Why? Because it is difficult to evaporate water into air and get much cooling effect when the air already is 80 percent full of moisture. However, there are always those few exceptions each summer when extreme heat keeps the temperature above 80 F until after midnight. When these conditions occur, running cool cells after 9:00 p.m. would likely be advantageous. In general, however, the 9:00 p.m. to 9:00 a.m. scenario is a good rule of thumb.

Pads must dry out

Cool cell systems should not be operated 24 hours a day. **Pads must be allowed to dry out at least once per day**. They are called "evaporative" cool cell pads for a reason … water must evaporate, and the pads must dry out from time to time. Failure to do so will increase the risk of algae growth and reduce life expectancy of the pads by keeping them wet for extended periods of

time. Pump life will also be shortened by needlessly using it overnight when little cooling benefit exists. Also, high in-house humidity levels created by running pads overnight will make it difficult to keep litter dry. Wet litter increases footpad damage. More on that later.

A common question is "**At what temperature should the pads start running?**" Often, growers tend to run pads too soon (at too low of a temperature) to do what they think is best for their birds. If the house has adequate air speed (minimum of 500 ft/min in a 500-foot house; 600-700 ft/min is better), there is little benefit to running pads before **about 82 F to 85 F** with larger birds. Certainly, running pads at 80 F or less will be counterproductive in terms of house humidity levels and litter conditions.

Wind-chill is critical

Keep in mind that cool cell pads are only part of the overall cooling system. Tunnel fans are the other part — the more important part. Understand that cool cells work to enhance tunnel ventilation. The **first requirement for successful cooling is adequate air flow**. Sufficient air velocity to provide a good wind-chill effect is more important than any other item in a hot weather broiler house. Pad cooling is complementary to tunnel ventilation and relies on the large volume of air flow created by the tunnel fans to improve sensible heat loss from the birds. Chickens do not sweat. However, they do have two methods to cool themselves: 1) air movement, and 2) moisture evaporation from the respiratory tract. Respiratory evaporation may be enhanced by an increase in the volume of air breathed per unit time, which is usually achieved by rapid shallow breathing, which we recognize as panting. The amount of heat a bird loses through evaporation of moisture off its respiratory system depends on the relative humidity of the air it breathes. The lower the relative humidity, the more moisture and heat are removed from the body. On the other hand, the bird can't evaporate much water off its respiratory system if the air it breathes in is already 85 to 90 percent saturated (often the case with cool cells), thus, heat stress increases.

It is extremely important that the fans and cool cell pads work together to keep the birds alive. The fans can't be as effective if the evaporative cooling system has clogged or dirty filters, sumps, header pipes and/or cool cell pads. There are numerous combinations between fans and pads depending on the controller set up, but to achieve maximum bird cooling for older birds, **all tunnel fans should be on before evaporative cool cell pads receive water**. This provides maximum air speed down the house and produces the greatest wind-chill effect. It is critical that none of the fans shut off when water is added to the pads and house temperature begins to drop. Make sure that set points between fans and cool cells are far enough apart that some of the fans do not shut off when the cool cells run and house temperature drops. If some of the fans shut off, air speed down the house slows at the same time house humidity rises, leaving the birds more dependent on panting instead of air movement for cooling, thus increasing heat stress. It may take some work with the set points, but make sure you have a wide enough range in settings between fans and cool cells that fans are not shutting off when the pads cycle.

Once on, none of the fans should shut off until house temperature has dropped low enough that heat stress is no longer an issue. With older birds in hot weather, this may not happen until late at night, or perhaps in the early morning hours before sunrise. In some cases, depending on nighttime temperatures, it may not happen at all when additional nighttime cooling may be

necessary for older birds. Some or all the fans may run 24 hours per day but the additional nighttime cooling may help older birds better withstand heat stress the following day.

Can evaporative cooling and dry floors co-exist?

In all honesty, maybe not, but that must be our goal. There are things we can do to help maintain relatively dry floors, even when cool cells are used:

- Litter preparation
  - Remove cake between flocks.
  - Maintain an adequate litter depth.
  - Ventilate between flocks to dry the litter.
- Drinker maintenance
  - Clean lines between flocks (flush, charge with approved line cleaner, activate nipples, flush, inspect system).
  - Check dark period water use on the controller (should be little or no water use activity on the lines during the dark period when the lights are off).
- Ventilate during brooding
  - Stay ahead of moisture buildup in the litter with ventilation.
  - Maintain a humidity level of 50-70 percent as long as possible.
  - Use stir fans in the ceiling (moisture evaporating from the litter creates very high humidity in the thin layer of air next to the litter surface; stir fans help break up this high humidity layer and improve litter drying).
- Manage bird migration
  - Use migration fences and have them installed at the proper times (birds must be uniform throughout the house to properly manage litter conditions).
  - Use front and back half water meters to know when birds are evenly distributed.
- Proper cool cell operation
  - Do not run cool cells at night.
  - Follow the 80:80 rule. Do not run cool cells at 80 F or less.
  - Use fans and wind-chill as much as possible before running cool cells.
  - Don’t hold back additional fans if cool cells are running and birds are panting (if birds are panting, they need additional airflow if you have it).

High humidity for long periods of time leads to wet litter. Wet litter leads to more ammonia, higher bacterial loads and higher litter pH. All of these are detrimental to foot health and paw quality. Wet litter can soften and ulcerate footpads, making the footpad more sensitive to damage and footpad dermatitis. Paw quality is an important part of animal welfare audits these days and is a reflection on grower management practices. Good paw quality often translates to better mobility, improved animal welfare, better flock performance and increased profits when the flock is harvested. Sprinkler use, in combination with cool cells, is becoming more common in houses today to reduce cooling water use by more than half and maintain lower house humidity and, therefore, drier litter conditions. A properly operated sprinkler house runs hotter, but the inside humidity is lower and flock performance is as good or better than in cool cell only houses.

Cool cell cleaning and maintenance are critical to provide conditions that flocks will need to withstand the upcoming summer temperatures. Take steps now to have the evaporative cooling system in top condition and ready to go before the first really hot day arrives. You cannot afford

to be taken by surprise. Efforts now to have an evaporative cooling system that is inspected, primed and ready to go long before it is needed will pay dividends this summer.

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