The University of Georgia

College of Agricultural and Environmental Sciences
Cooperative Extension

Poultry Housing Tips

Do Sprinkler Systems Increase Broiler Water Consumption?

Volume 29 Number 3 **2017**

Broilers can be very responsive to changes in the environment around them. Increase air speed on a hot summer day, and warm birds will become more comfortable and tend to sit down. Reduce air speed and the birds get warmer and often stand up and make a visit to the drinkers. Increase minimum ventilation rates during cold weather and lethargic birds will tend to get up and move around. But, if you increase minimum ventilation rates too much and house temperature falls, the birds will sit down and huddle.

A broiler will respond not just to changes in environmental factors such as temperature, humidity, and air movement but also to changes in light, sound, feeder/drinker equipment height as well as just the presence of a producer. For instance, if a producer walks into a house and turns the lights up, the birds will get up and go to the drinkers and feeders. Make adjustments to a feed or water line height and the movement of the feeder or drinker lines will again tend to cause the birds to go the feeders and drinkers. Just the sound of a feed line auger motor starting up will increase the level of bird drinking/feeding activity throughout a house.

Since broilers often respond to changes to their environment with a visit to the feeders/drinkers, it is not unreasonable to conclude that stimulating the birds to become more active could result in an increase in water/feed consumption and therefore an increase in bird performance. A good example of this theory being put to the test is the use of low-pressure sprinkler systems. Low-pressure sprinkler systems were originally installed as an alternative to fogging and pad systems to provide bird cooling during hot weather. But recently many producers have not only been looking at sprinklers as an evaporative cooling system, but as a tool to help to stimulate bird activity throughout the year. From a couple of weeks of age sprinklers are set to operate a few seconds each hour. The coarse water droplets falling on the birds tends to cause the birds to stand and drinking/feeding activity is increased.

A study was conducted on a commercial broiler farm to explore the relationship between sprinkler usage and bird activity, specifically water usage. Though feed consumption was not monitored directly, it was theorized that since feed consumption is highly correlated to water consumption (roughly one pound of feed for every quart of water consumed) that an increase in water consumption would indicate that there was an increase in feed consumption.

Commercially available sprinkler systems were installed in two adjacent 42' X 500' broiler houses. The house was center brooded and as a result the drinker system was originally plumbed into three equal zones so a water meter was installed in each of the drinker areas (nonbrooding cool cell area, brooding area, nonbrooding tunnel-fan area.) Water meters were also installed on each of the two sprinkler zones (front, rear). Water usage, outside temperature and relative humidity as well as inside temperature and relative humidity were recorded every minute for the entire 63-day summertime flock.

The sprinkler system was operated for the most part according to manufacturer recommendations. The sprinkler system would operate in stimulation mode (10 seconds per hour) from 8 am to 8 pm starting at 14 days of age (adjustments to the hours of operation were occasionally made as the birds got older.) If house temperatures became excessive, 12ºF above target temperature, the sprinkling system would start to operate in cooling mode, sprinkling the birds for 20 seconds every 30 minutes. The higher the house temperature became the more often the sprinkler system would operate (+15ºF, once every 15 minutes. +19ºF, once every 5 minutes.) The house's evaporative cooling pads were set to operate 22ºF above the house set temperature. Ideally, the pad system would have only operated if the house temperature exceeded the high eighties, but due to limitations of the houses' environmental controller systems, during roughly the last 10 days of the flock, the pad system operated when house temperatures were in the low to mid eighties.

Commonly when conducting a field study there is a test house and a control house. The problem with this method of testing is it assumes that not only are the two houses perfectly identical, but the birds are identical as well. Every producer knows that though all their houses appear identical and have the "same" birds, rarely is bird activity/performance identical. To account for the "house effect", the sprinkler system in each of the two houses operated on an alternating three-day basis. Specifically, the sprinkler system was operated in one house for three days and turned off in the second house. At the end of the three-day period, the operation of the sprinkler systems in the two houses would be swapped. Comparisons in bird water usage could then be compared not only between the houses but also within the same house between sprinkler and nonsprinkler days.

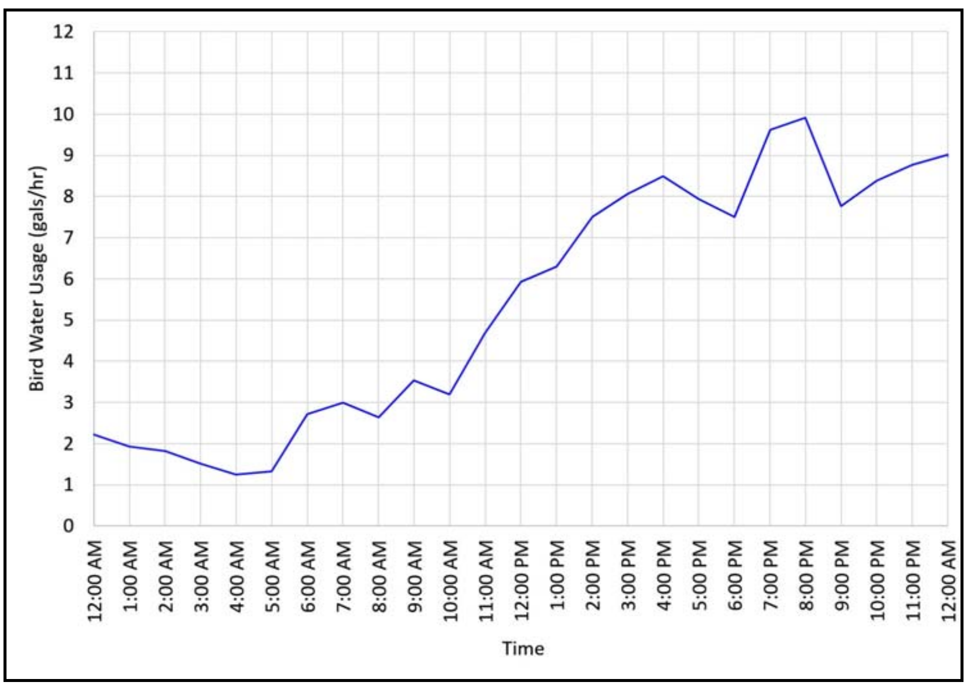

Figure 1. Hourly bird water usage (Day 4).

Though conventional water meters could have been used in the study to document differences in daily bird water usage, "high resolution" water meters were used so that bird drinking activity could be more closely examined. The water high resolution meters enabled the recording of water usage in 1/20ths of a gallon increments which facilitated the creation of more precise water usage graphs than is possible when using traditional water meters that can only record water usage in single gallon increments. So instead of just being able to examine water on a daily or hourly basis, the high resolution water meters allowed water usage to be examined on a minute-to-minute basis which made it possible to examine the birds immediate reaction to being sprinkled. For example, Figure 1 illustrates the hourly water usage for a 40' x 500' broiler house (separate study) with approximately 26,000, four-day-old chicks. We can see that over the course of the day water usage is generally increasing, but not much more. But, in this particular house, ultra-high resolution water meters were installed which were capable of measuring water usage in 1/25,000 gallon increments. In Figures 2 and 3, created using one-minute data, a hidden chick drinking behavior becomes visible...chicks tended to drink in waves. In other words, they essentially drank and presumably ate as a flock. The chicks would all tend to drink then would all rest in roughly a 30-minute-long cycle. It is important to note that due to the length of the cycle, if a producer were in the house for a few minutes this pattern would be impossible to observe. Furthermore, just the presence of the producer in the house would likely affect the behavior of the birds and therefore the flock cyclic drinking pattern could be temporarily altered.

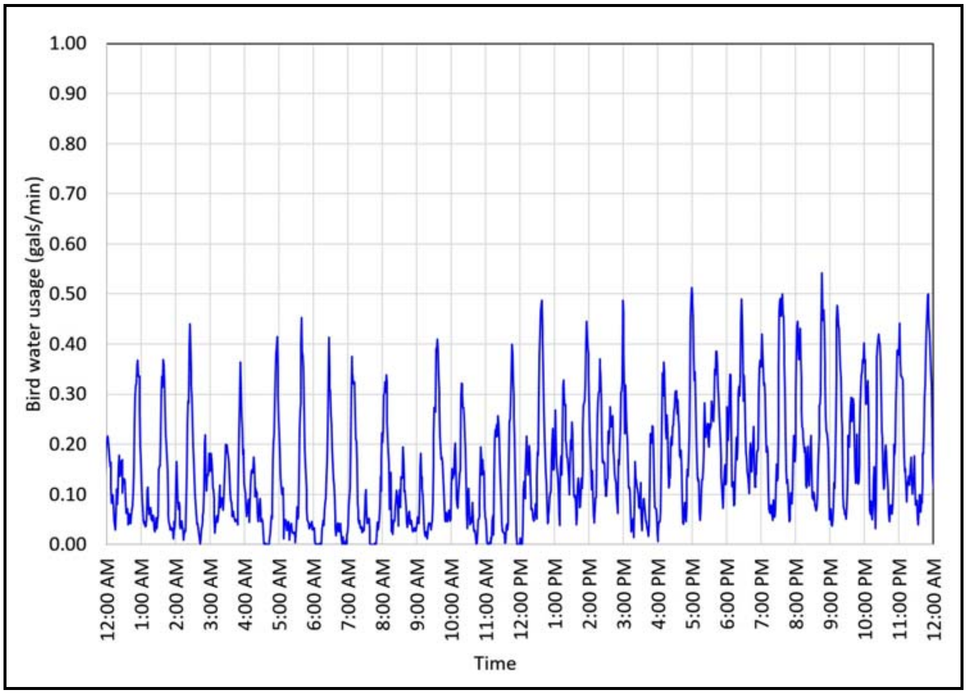

Figure 2. One-minute bird water usage (Day 4 - 26,000 birds, 24 hours).

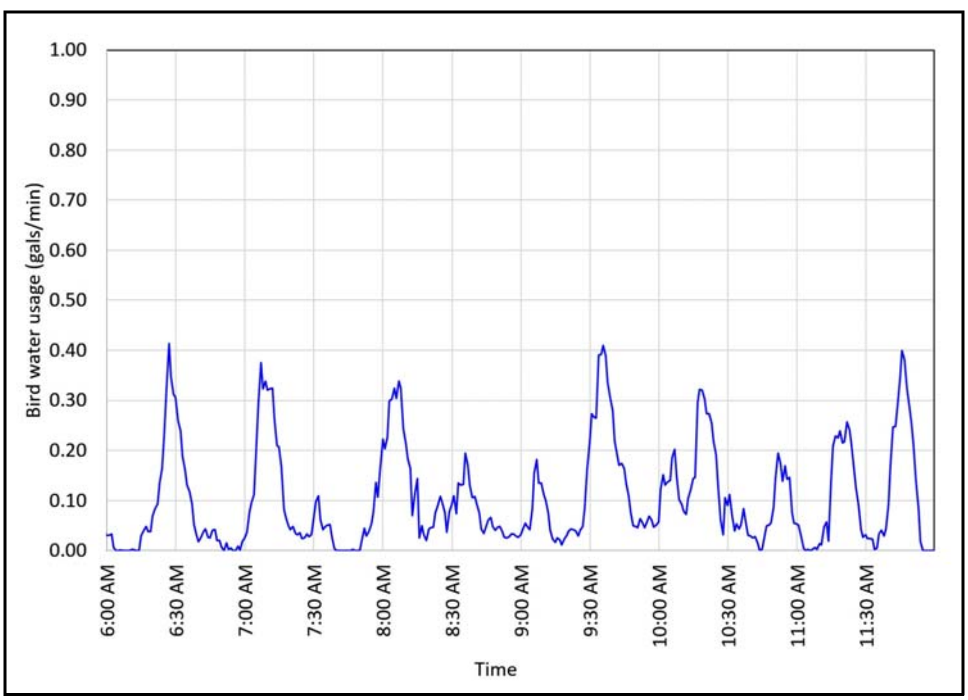

Figure 3. One-minute bird water usage (Day 4 - 26,000 birds, 6 hours).

As the birds get older the cyclic drinking pattern tends to become less defined. For instance, at 10 days of age the flock cyclic drinking behavior is still occurring but is less defined (Figure 4). Towards the end of the flock the cyclic drinking pattern becomes difficult to discern (Figure 5). The peaks and valleys are dramatically reduced and the frequency of the cyclic pattern becomes more varied. The cyclic pattern in older birds could be lost due in part to the increased competition for relatively limited drinker and feeder space. When the birds are small it is not uncommon to find two to four chicks drinking from the same nipple at the same time. Furthermore, since the volume of water a chick requires is relatively small it doesn't take long for a chick to be satiated, freeing up a nipple for others. This means that it is relatively easy for a very high percentage of the chicks in a house to drink/eat at nearly the same time which in turn facilitates them all resting at the same time. Conversely, with older birds not only is it more difficult for multiple birds to share a single nipple, but a bird has to spend more time at a nipple to consume the water it requires. Furthermore, the larger the birds become the lower the percentage of birds that can actually physically get to the drinkers/feeders at the same time. The combination of these factors results in the birds essentially having to take turns over the course of the day drinking and eating. There can still be a cyclic pattern to their drinking, but it will be muted by the fact that it is essentially impossible for a high percentage of the birds to drink and/or eat at the same time.

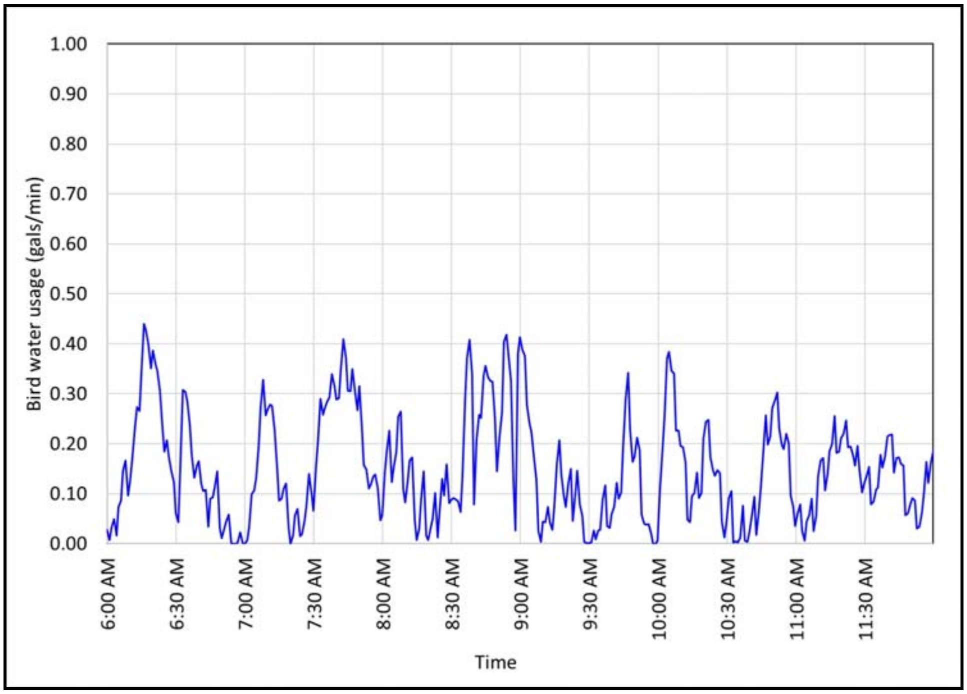

Figure 4. One-minute bird water usage (Day 10 - 26,000 birds, 6 hours).

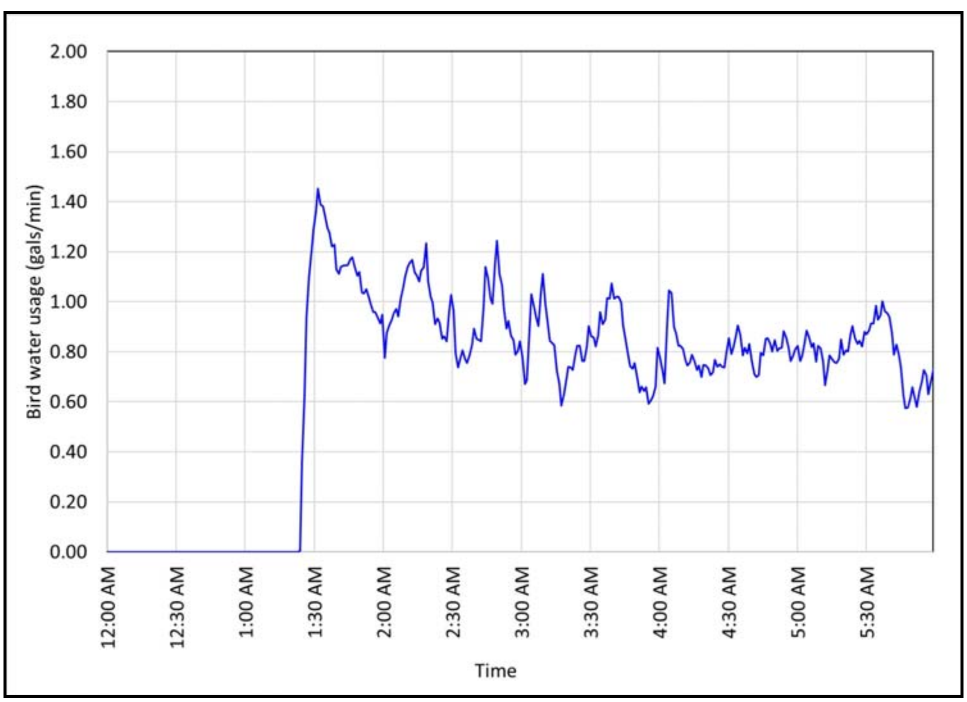

Figure 5. One-minute bird water usage (Day 34 - 26,000 birds, 6 hours).

A sprinkler system operating in stimulation mode appears to impose a more defined water-usage cycle length. In Figure 6 the lights in the house are on from 4 am to 8 pm for the five-week-old birds. The sprinklers are set to operate 10 seconds every hour from 10 am to 6 pm. When the sprinklers come on there is a short spike in flock water usage followed by a lull. It is important to note that though nearly all the birds may get up during a sprinkling event, not all the birds will go to the drinkers and/or feeders. For example, in Figures 6 and 7 water usage only increased approximately 30% after a sprinkling event.

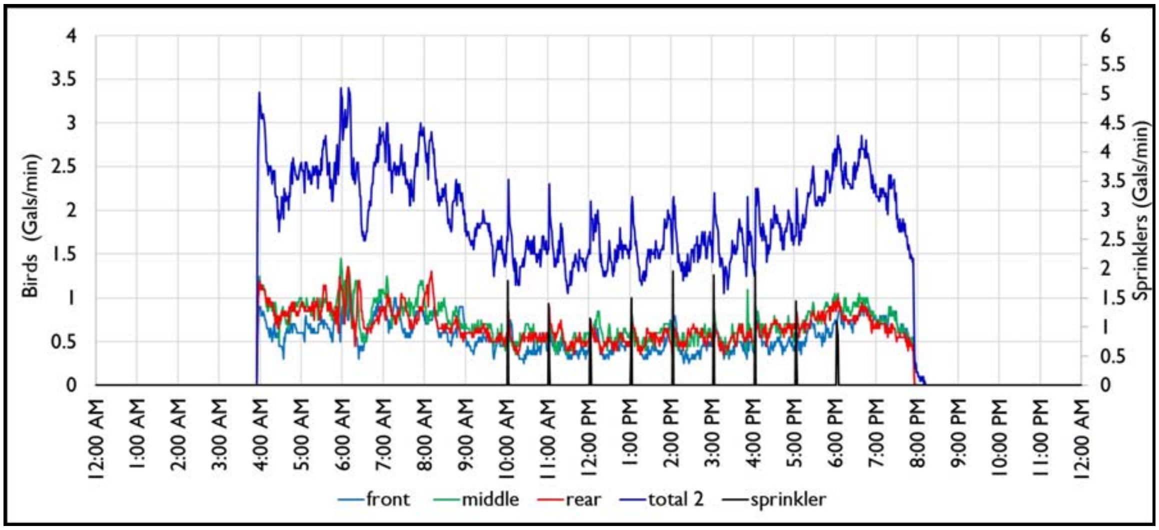

Figure 6. Bird and sprinkler system water usage (five-week-old birds, 24 hours).

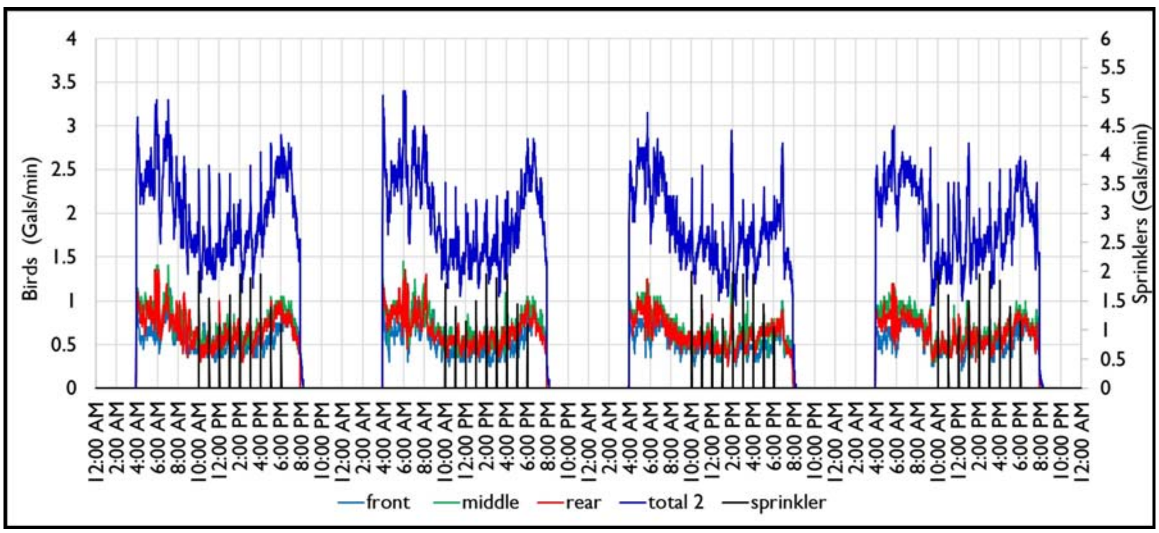

Figure 7. Bird and sprinkler system water usage (five-week-old birds, four days).

Figures 8, 9 and 10 illustrate water usage profile for seven-week-old birds in a house when the sprinkler system was operational. At this point in the flock the sprinkler system was set to operate from 7 am to 10 pm. In the morning when house temperatures were relatively low, the sprinkler was operating in stimulation mode, turning on for 10 seconds each hour. In the afternoon, as house temperatures increased, the sprinkler system operated in cooling mode where the birds were sprinkled 20 seconds every 15 minutes. Figures 11, 12, and 13 illustrate water usage in the adjacent house where the sprinkler system was not being used.

As seen earlier in the flock, every time the sprinkler system operated there was a short spike in flock water usage followed by a lull. The approximate 25% increase in flock water usage only lasted a couple of minutes then water usage dropped within a minute or two by approximately 50% (Figure 10). Water usage would gradually rise over the following 15 minutes then spike once again when the sprinklers came on. It is important to notice that throughout the day every peak in water usage caused by the sprinklers was followed by a valley of roughly equal magnitude (Figure 10). Though the sprinkler system did cause a momentary increase in water usage, it also caused a momentary decrease in water usage, with an average water usage rate of roughly 1.25 gallons per minute which was roughly the same rate seen in the house in which the birds were not being sprinkled (Figures 10 and 13).

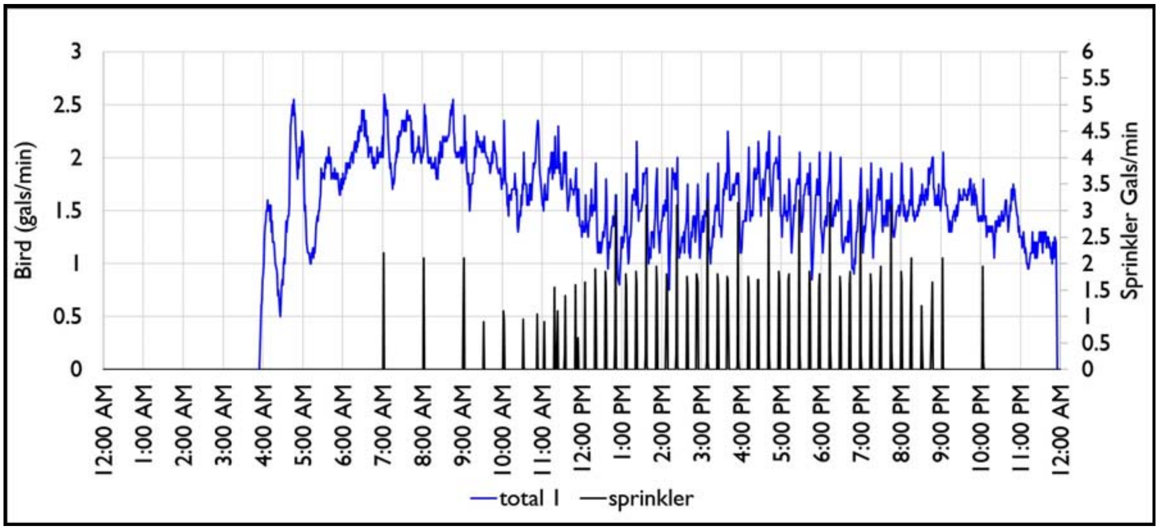

Figure 8. Bird and sprinkler system water usage (seven-week-old birds, 24 hours).

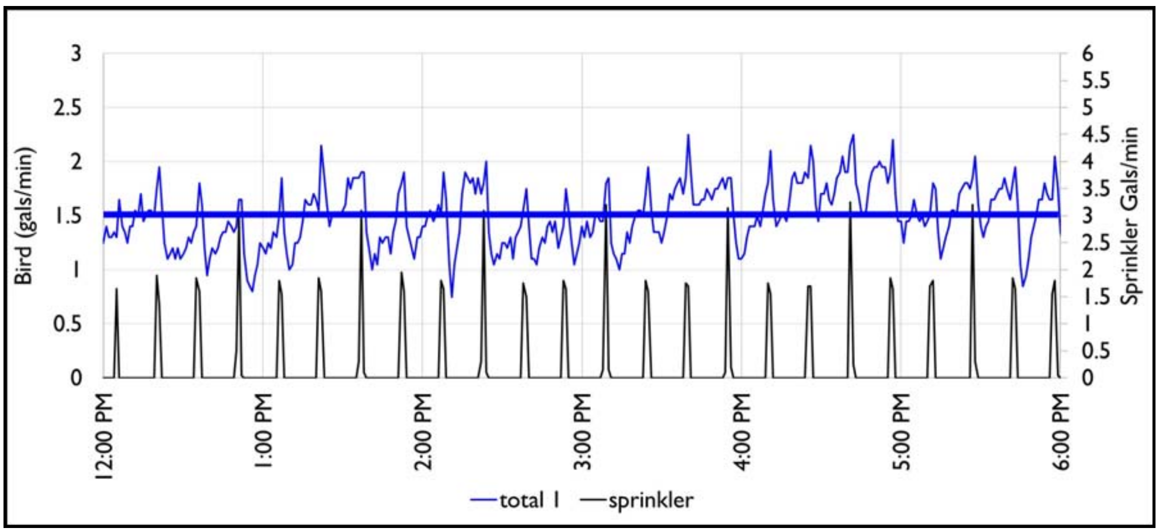

Figure 9. Bird and sprinkler system water usage (seven-week-old birds, 6 hours).

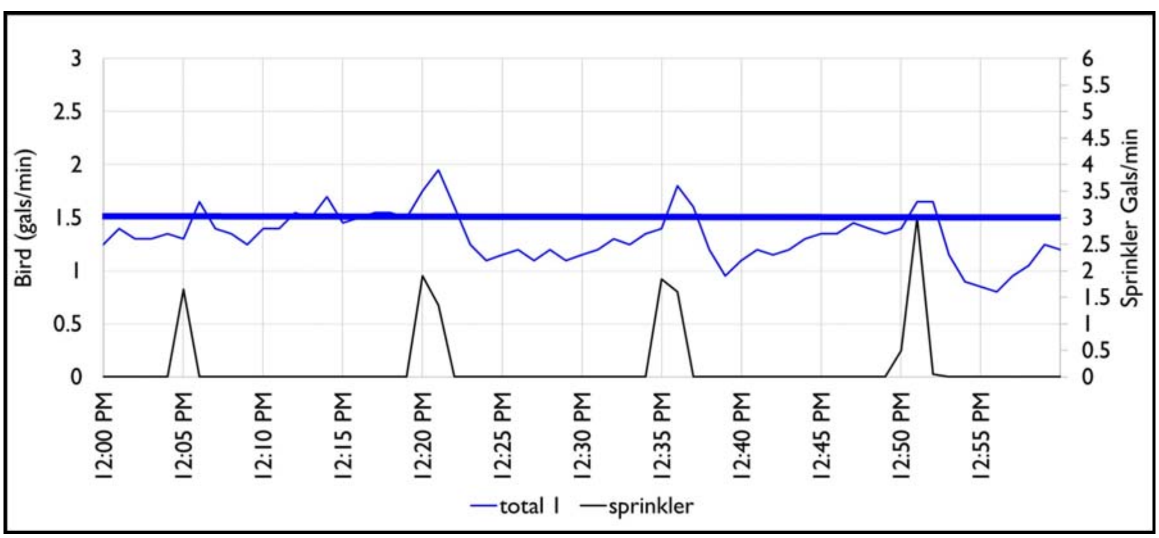

Figure 10. Birds and sprinkler system water usage (seven-week-old birds, 6 hours).

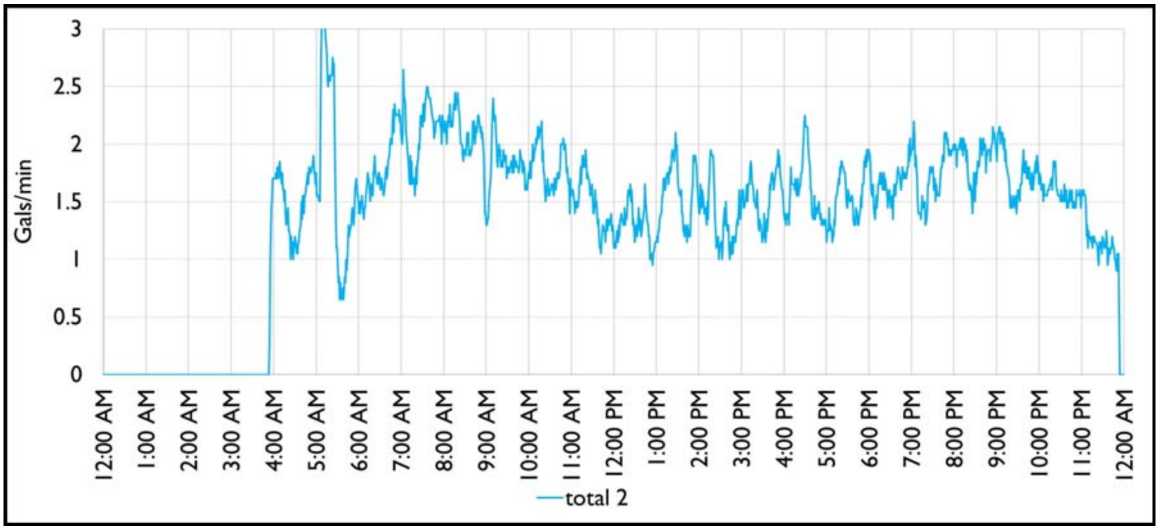

Figure 11. Bird water usage in house without sprinklers operating (seven-week-old birds, 24 hours).

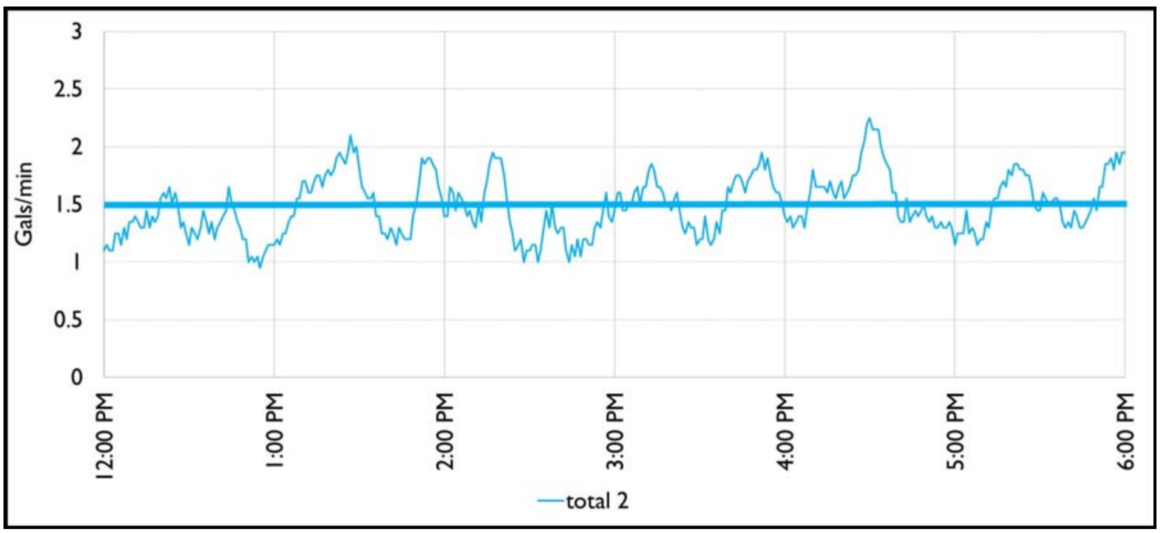

Figure 12. Birds water usage in house without sprinkler system operating (seven-week-old birds, 6 hours).

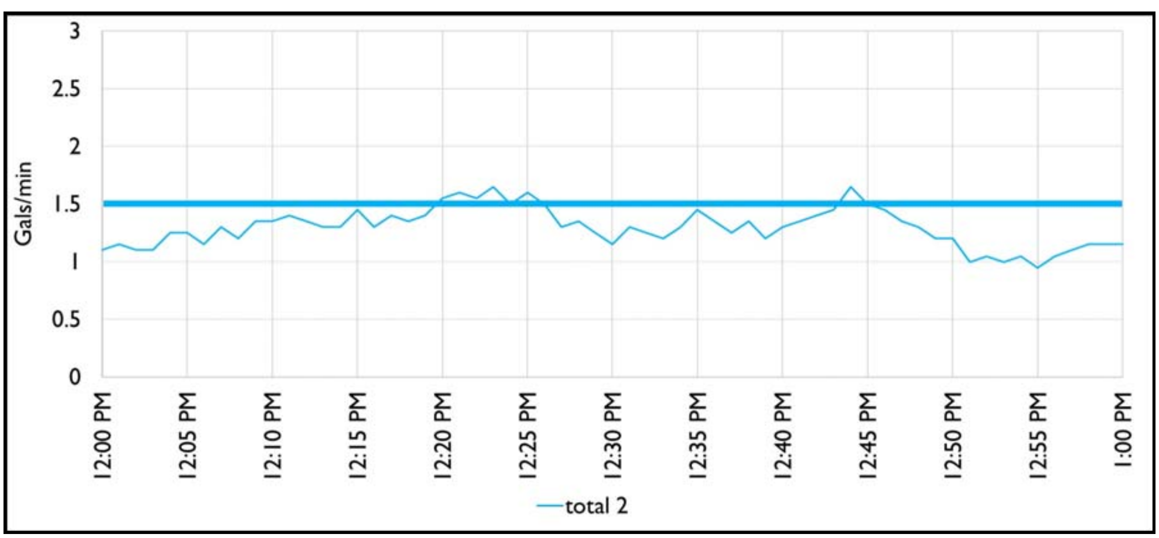

Figure 13. Bird water usage in house without sprinkler system operating (seven-week-old birds, 1 hour).

Interestingly enough there was a cyclic nature to flock water usage in the house where the sprinkler system was not being operated on the same days. Instead of a very uniform 15 minute water usage cycle, in the house without an operating sprinkler system the cycle length was between 30 minutes and an hour (Figures 9 and 12). Furthermore, the amplitude of the water usage cycle was very similar in both houses, ranging for the most part between 1 and 2 gals/min. Birds in both houses drank/ate in a cyclic pattern, the primary differences being is the sprinkler house the cycle length was determined by the sprinkler system whereas in the house without the sprinklers the birds were determining their own cycle length (Figure 14).

It is understandable that the cyclic nature of flock water usage goes unnoticed due to the relatively long cycle length. Water usage increases slowly over a period of 30 minutes or so then decreases equally as slowly. The sudden spike in bird activity/water usage caused by a sprinkler system tends to amplify the naturally occurring behavior making it more apparent.

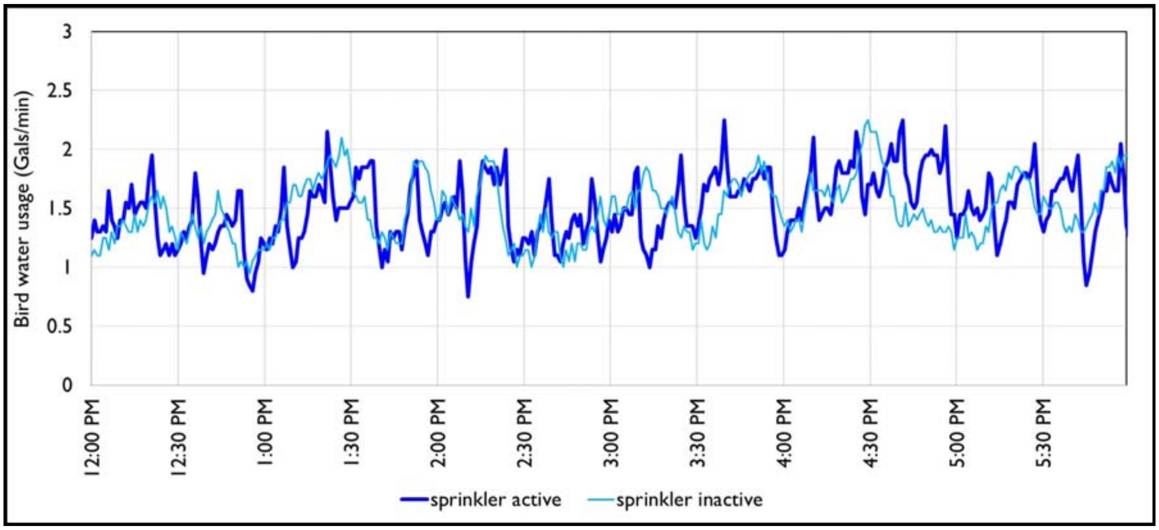

Figure 14. Bird water usage in houses with active and inactive sprinkler systems (seven-week-old birds, 6 hours).

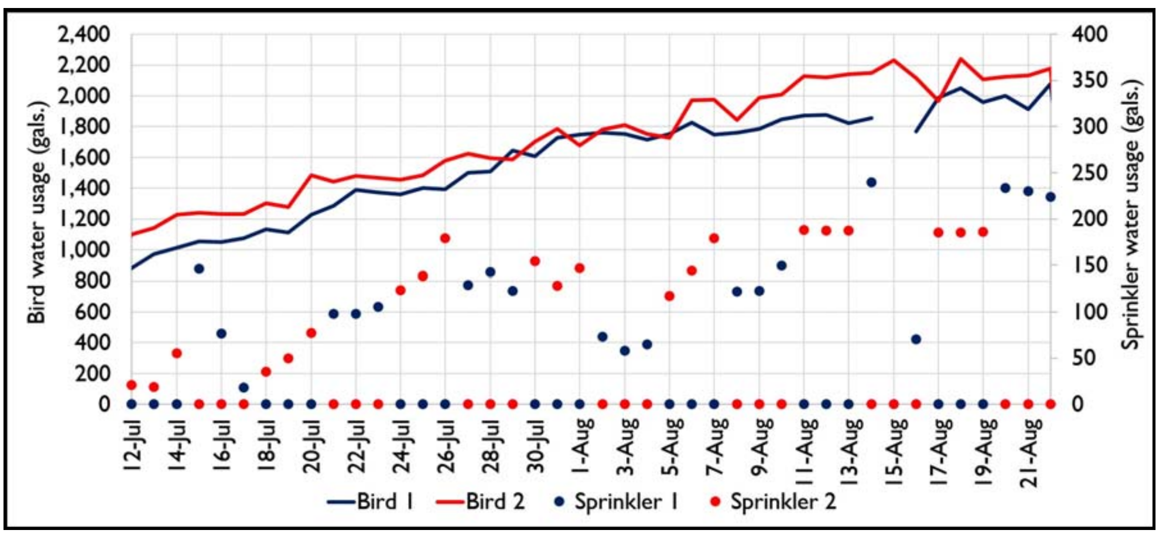

Figure 15. Daily bird and sprinkler system water usage.

Figure 15 illustrates daily bird and sprinkler system water usage in the two houses where the study was conducted. As expected, daily bird water usage increased over the course of the flock but the use of the sprinklers didn't noticeably increase bird water usage over that seen in the house where the sprinklers were not being operated. Nor does there appear to be a increase in water usage between adjacent days in the same house when the sprinkler system was not operating or operating other than the expected increase due to birds simply getting older and drinking more water.

So does a sprinkler system actually increase daily bird water consumption? It doesn't appear to. Yes, a sprinkler system tends to stimulate the birds to get up and bird water usage momentary increases, but it decreases a roughly equal amount moments later. The net result is no change in daily flock water usage. This is not to say that there may not be some advantage to the use of a sprinkler system, for example decreased evaporative cooling water usage and drier litter, but stimulating birds to drink more water doesn't appear to be one of the advantages.

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