The University of Georgia

College of Agricultural and Environmental Sciences
Cooperative Extension

Poultry Housing Tips

Is Light From Your Tunnel Fans Determining Your Birds' Day Length?

Volume 28 Number 2 **2016**

Broiler producers, especially those growing large birds (>6 lbs.), often prefer to raise their birds under fairly low light. Low light levels, often less than 0.2 ft*candles, are typically sought in an effort to reduce bird activity which in turn will help to improve feed conversions, as well as reduce scratches and condemnations. Though growing broilers under minimal light has proven beneficial in many instances, there is a potential downside, namely a reduction in day-length control, particularly during hot weather.

Often during cold weather only few side wall 36" fans and a portion of the side wall inlets opened a couple of inches are all that is required to maintain the proper house temperature and air quality. The amount of sunlight that enters a house through the fans and side wall inlets is often barely noticeable and as a result lighting levels are primarily determined by the house's lighting system and not by what is happening outside. But, during hot weather when a house can be operating in tunnel ventilation mode for weeks on end, controlling lighting levels can become difficult due to the amount of sunlight that can enter through tunnel door/curtain openings and tunnel fans. Though the amount of light entering through the tunnel inlet can be dramatically reduced through the use of evaporative cooling pads, there is often little blocking sunlight from entering through a house's numerous operating tunnel fans.

The amount of sunlight flooding the tunnel fan area of a house has increased steadily over the years. With the movement toward growing larger broilers, air speeds have increased from 400 to 500 to 600 ft/min and now in some cases 800 ft/min. To be able to generate these higher air speeds the number and size of the tunnel fans have increased dramatically, thus creating more openings for sunlight to enter a house. The increased popularity of fans with butterfly shutter (Figure 1), which allow more light into a house compared to traditional tunnel fans with interior shutters (Figure 2), has also contributed to the problem. Last but not least is the trend in today's wider houses where a portion of the tunnel fans are installed in the end wall. When a tunnel fan is located in an end wall sunlight can be projected far along the length of a house. The net result of all these changes is that light intensity in the tunnel fan area of a house can easily exceed 75 ft*candles, which is 300 times brighter than what is typically desired.

Figure 1. Light entering though tunnel fan with butterfly shutter.

Figure 2. Light entering through tunnel fan with traditional interior shutter.

Figure 3. Tunnel fans in end wall

Figure 4. Light from tunnel fans increasing house light levels.

Though it can be extremely bright near the tunnel fans, house light levels typically decrease rapidly with distance from the tunnel fan end wall. In fact, in most instances light levels are well below one ft*candle within 100 feet of the tunnel fans. The rate at which the light levels decrease is primarily determined by the location of the tunnel fans. When tunnel fans are located in the side walls, sunlight entering through the fans tends to be projected across the width of the house, thereby limiting the number of birds exposed to potentially high light levels. But, when the tunnel fans are in the end wall, sunlight is projected along the length of the house, potentially affecting floor light intensities up to 200 feet from the tunnel fans (Figures 3 and 4).

Another important factor which can determine the number of birds potentially impacted by sunlight entering the tunnel fans is the lighting level the producer is trying to maintain. Specifically, the darker the house, the greater the number of birds that will potentially be affected by sunlight entering through operating tunnel fans. For instance, Figures 5 and 6 illustrate the light intensity at floor level in a house where the only light in the house is that coming from the tunnel fans located in the end wall of the house. If the producer desires a very bright house, i.e, over 1 ft*candle, the number of birds being potentially exposed to higher than desired light level would be limited to those within approximately 90' of the tunnel fans, or 20% of the birds. But, if the producer were trying to maintain a very low light intensity of for example 0.1 ft*candles then the sunlight from the tunnel fans would be providing more than the desired light intensity for all the birds within 200' of the tunnel fans or nearly

50% of the birds in the house. Quite simply, the lower the desired light intensity the greater the number of birds affected by sunlight entering through the operating tunnel fans. Though the increased lighting levels would obviously affect the level of bird activity in the house, recent studies have shown that the light entering through a house's tunnel fans can also actually determine the birds' day length.

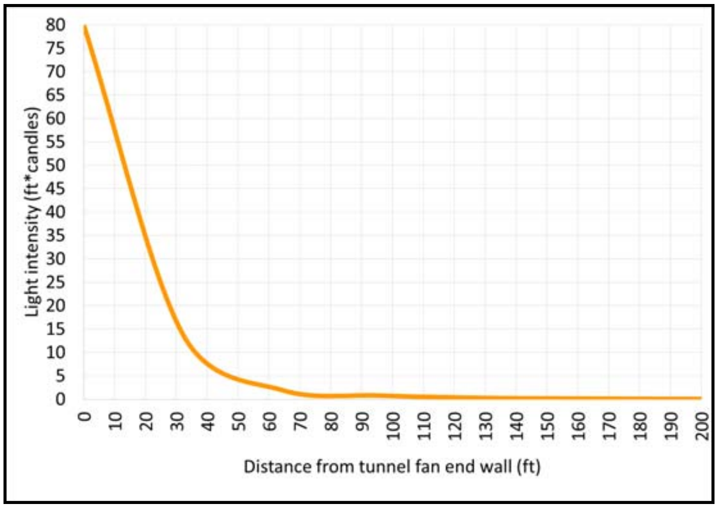

Figure 5. Light intensity vs. distance from tunnel fan end wall (tunnel fans in end wall).

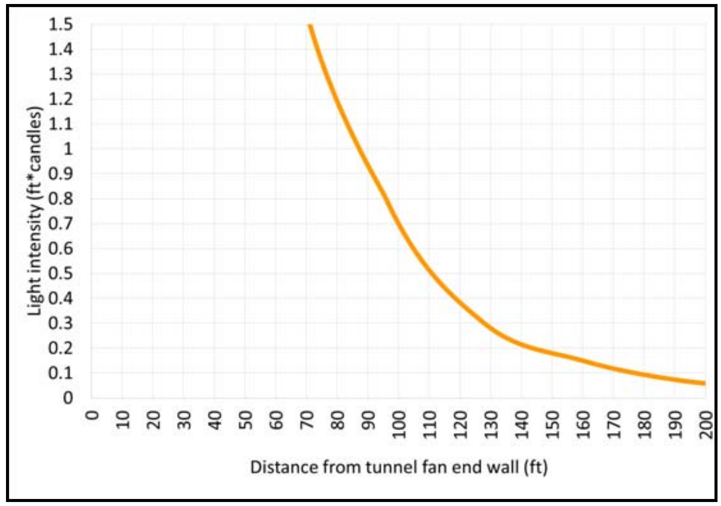

Figure 6. Light intensity vs. distance from tunnel fan end wall (tunnel fans in end wall).

Figure 7 illustrates the water consumption pattern for birds on the evaporative cooling pad end of a tunnel-ventilated house during hot weather. The house was 50' X 560' and had 11, 52" tunnel fans with "butterfly" shutters, nine of which were installed in the side walls and two in the end wall. The birds in the house were approximately seven weeks old and most of the tunnel fans were operating 24 hours a day. The lights were set to operate from 3 am to 9 pm providing a six-hour dark period. The spikes in water consumption that occurred at approximately 9 am are the result of the producer turning the lights up from their normal level of 0.2 ft*candles to 2 ft*candles to pick up daily mortality as well as to check feeders and drinkers.

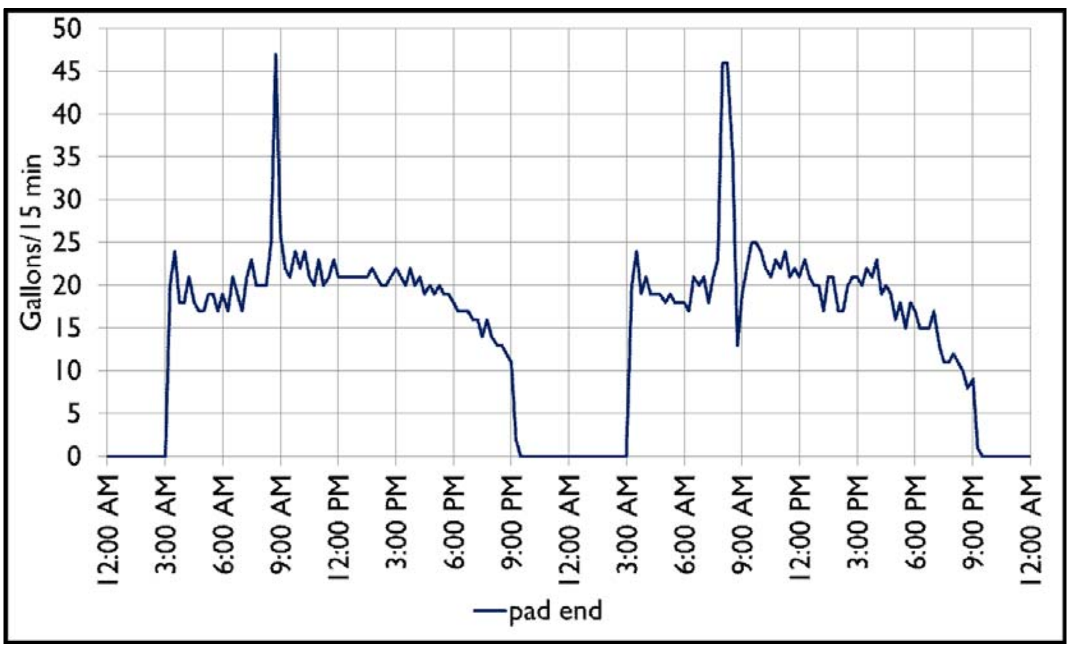

Figure 7 15-minute water consumption profile over a two-day period for ½ the birds in a house (pad end of house).

Monitoring water consumption is important for a number of reasons, the most important of which is the close relationship between water consumption and feed consumption. For every gallon of water the birds drink they will eat approximately 15 lbs. of feed. This relationship holds fairly consistent from the beginning to the end of a flock. As a result, a water consumption graph provides an inexpensive way of knowing how feed consumption changes over the course of the day. The spike in water consumption that occurred each day at 9 am in Figure 7 when the grower turned up the house lights would have also resulted in a spike in feed consumption. The slow decrease in water consumption at the end of the day would indicate that there was a slow decrease in feed consumption toward the end of the day.

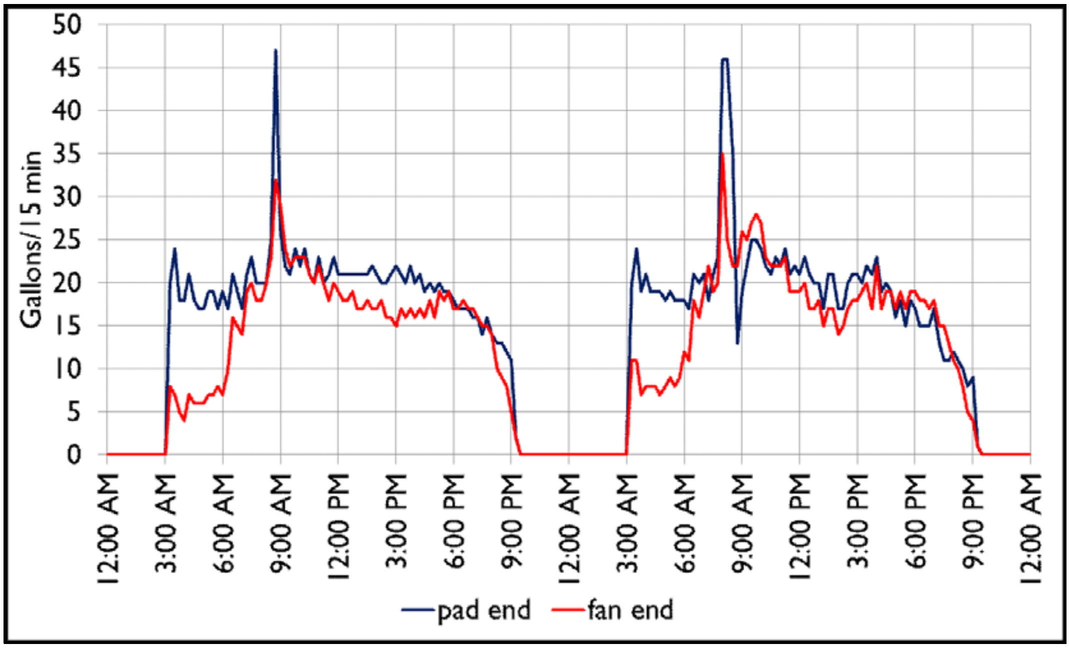

Figure 8. 15-minute water consumption for birds on pad and fan ends of a house.

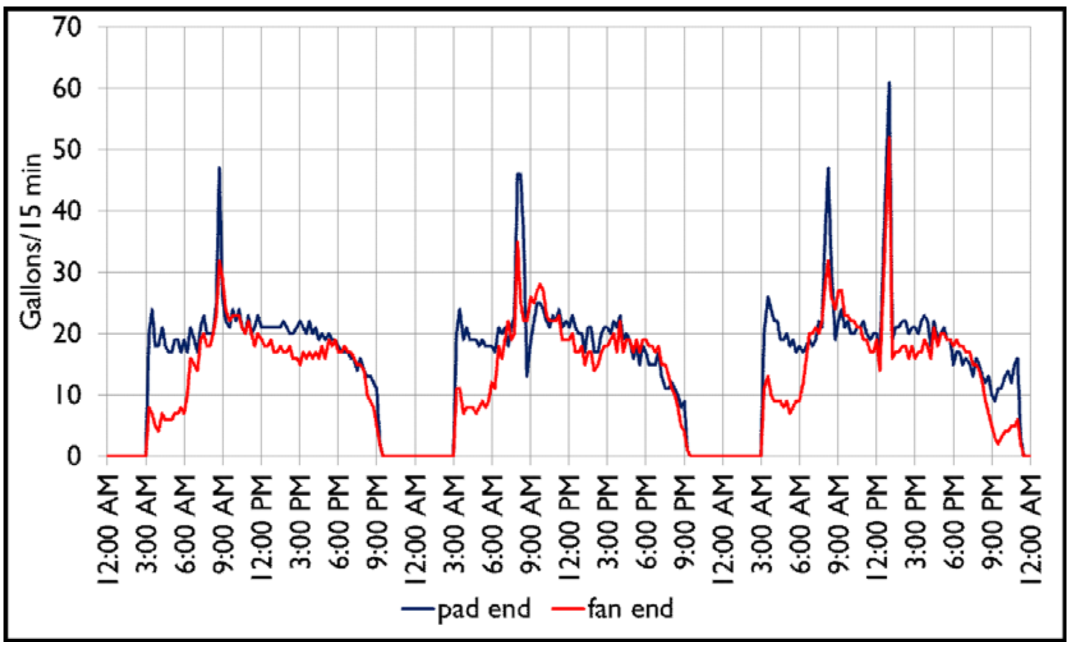

Figure 9. 15-minute water consumption with change in day length.

Figure 8 illustrates the water consumption pattern for both the pad and tunnel fan ends of the same house shown in Figure 7 over the same time period. Whereas on the evaporative cooling pad end of the house the water consumption rate rises to 20 gals/15 minutes when the lights came on at 3 am, water consumption rate on the tunnel fan end of the house only increased to 10 gals/15 minutes. It is not until 6 am that the water consumption rate on the tunnel fan end of the house was equal to that of the pad end of the house. After a visit to the farm it was determined that roughly half the birds on the tunnel fan end of the house were getting up and drinking like they did on the pad end of the house when the lights came on at 3 am, the other half of the birds, those closest the tunnel fans, waited for the sun to come up at 6 am to start their day. Even though the lights on the tunnel fan end of the house were on at 3 am, the birds didn't perceive the 0.2 ft*candles of light produced by the house's lighting system as day when compared to the high light intensities produced by the sunlight entering the operating tunnel fans. The net result is that 25% of the birds in the house were essentially living a 15-hour day instead of the intended 18-hour day.

Further evidence that the birds near the tunnel fans day length was being determined by the sunlight entering the tunnel fan occurred when onset of the dark period was changed from 9 pm to 11:30 pm (Figure 9 - third day). On the evaporative cooling pad end of the house the birds continued to drink until 11:30 pm, taking advantage of the 2 ½ hour extra day length. But, a majority of the birds on the tunnel fan end of the house stopped drinking at 9 pm even though the house lights remained on. Again, it appears that the birds were using the sunlight entering the tunnel fans, not the house lights determine their day length.

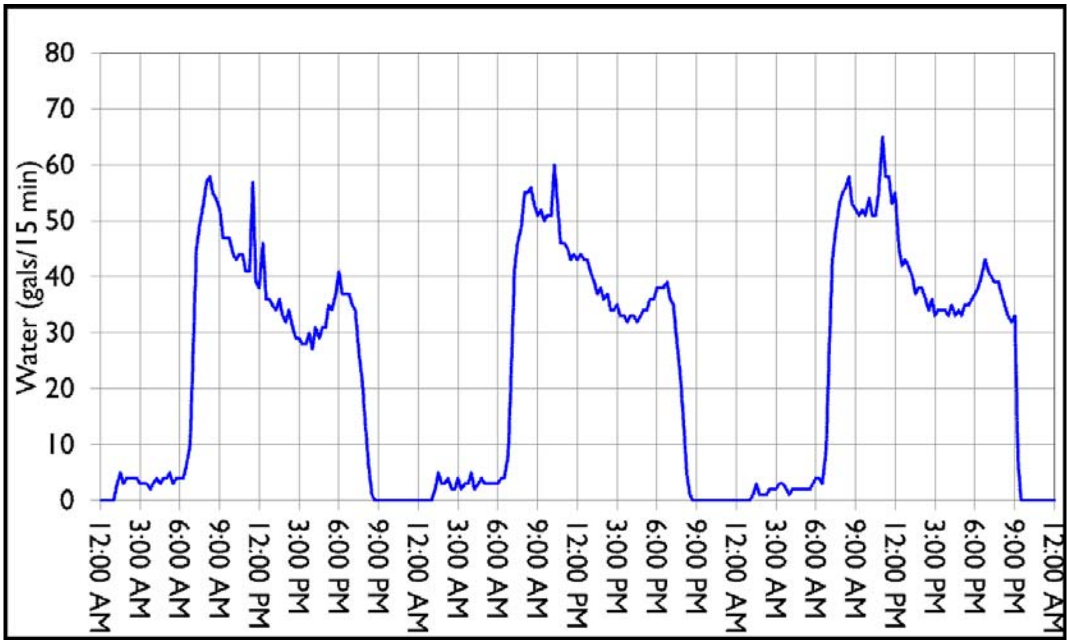

Figure 10. Water consumption profile in dark house with tunnel fans in the end wall.

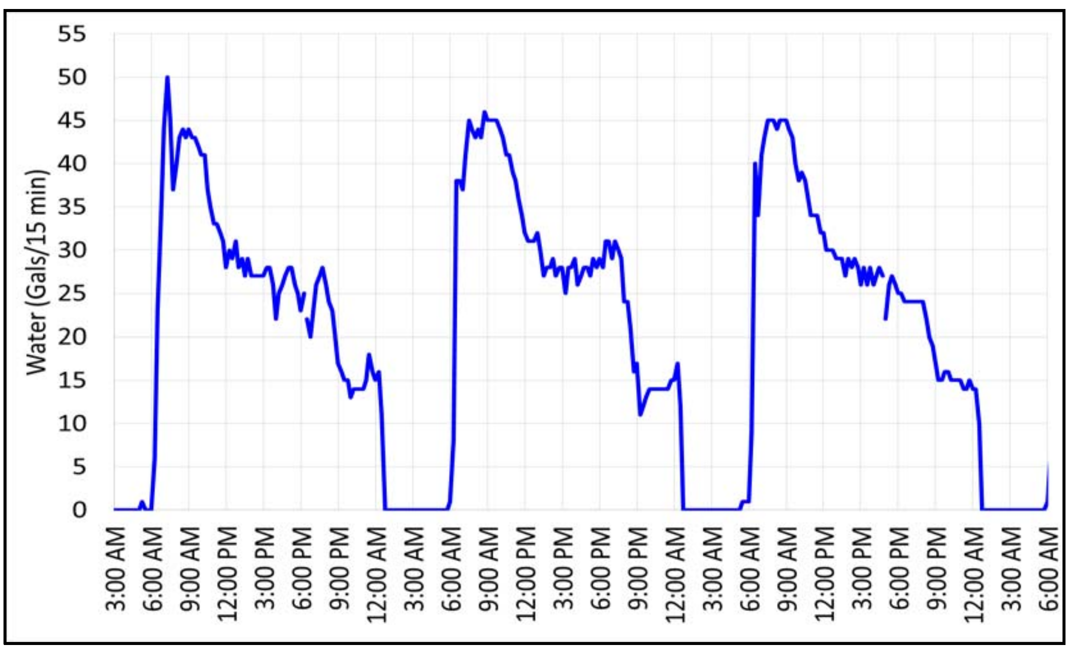

Figure 11. Water consumption profile of dark house with tunnel fans in the side walls.

Figure 10 is a very good illustration of how substantial of an effect sunlight entering through tunnel fans can have on the birds throughout a house. The 40' X 500' house was equipped with six, 48" slant wall fans (installed in the side walls) and seven, 52" butterfly shutter fans, six of which were installed in the end wall of the house. The intended light intensity for the near-market-age birds was less than 0.1 ft*candles and the lights were off between the hours of 8 pm and 1 am. The combination of the very low light intensities and the fact that the house had six large 52" end wall tunnel fans projecting sunlight far into the house resulted in the majority of the birds in the house essentially ignoring the house lights. When the lights turned on at 1 am water consumption was less than five gallons per 15 minutes. It wasn't until sunrise at 7 am, six hours later, that water usage quickly rose to 60 gals per 15 minutes...a nearly 95% increase. This essentially meant that 95% of the birds were living a 12 hour day length instead of intended the 19 hour day length

It is important to note that during the day light coming from the tunnel fans did not add significantly to the light provided by the house's lighting system once the distance from the tunnel fans exceeded 200' (Figures 5 and 6). Since there was essentially no measurable light from the tunnel fans on the pad end of the house one would assume that the birds on the pad end of the house would be drinking water and eating feed 19 hours per day (five-hour dark period). But since water consumption increased so minimally when the lights came on it tends to indicate that most of the birds on the pad end of the house were, like those near the fans, were living a 12-hour day determined by the sunlight entering the operating tunnel fans. The reaction of the birds on the pad end of the house would tend to indicate that in very dark houses the birds just need to be able to see the sunlight coming in the tunnel fans to use it as their method of determining day length.

Figure 11 shows the water consumption profile over a three day-period in another 40' X 500' house during hot weather with near-market-age birds. In this house the tunnel fans were in the side walls and the light intensity in the house was approximately 0.1 ft*candles before the sun rose. Though the lights shut off at midnight water consumption was roughly cut in half when the sun went down around 9 pm, indicating that roughly half the birds stopped drinking. This indicated a perceived nighttime duration of approximately 9 hours instead of the desired 6 hours. Though the light intensity in the house was similar to that of the house shown in Figure 10, the fact that the fans were in the side walls apparently helped to reduce the overall effect that sunlight entering the tunnel fans had on the flock. Whereas in the house with the fans in the end wall approximately 90% of the birds were determining their day length by light entering the tunnel fans, in this case less than 50% the birds were doing so.

The water consumption graph illustrated in Figure 12 provides a good example of how the effect of sunlight entering through the tunnel fans can be minimized by simply growing birds under moderate lighting levels and positioning tunnel fans in the side wall of a house. The 40' X 500' had ten tunnel fans with interior shutters installed in the side walls next to the end wall of the house. The house light intensity was approximately 0.20 ft*candles. Water consumption momentarily spikes each day when the lights first turn on at 2 am, then there is a gradual increase in water usage until it comes to a peak between 8 and 9 am. The gradual increase in water consumption after the initial spike was likely the result of the birds in the immediate vicinity of the tunnel fans waiting until the sun came up to start their day. The peak when the sun came up was not that dramatic because it appears that the vast majority of the birds got up when the house lights came on at 2 am. Typically when the lights come on around the time the sun comes up the water consumption profile looks more like that illustrated in Figure 11. The combined strong stimulus of the house lights and sunlight entering the tunnel fans at roughly the same time results in the vast majority of the birds getting up to drink and eat.

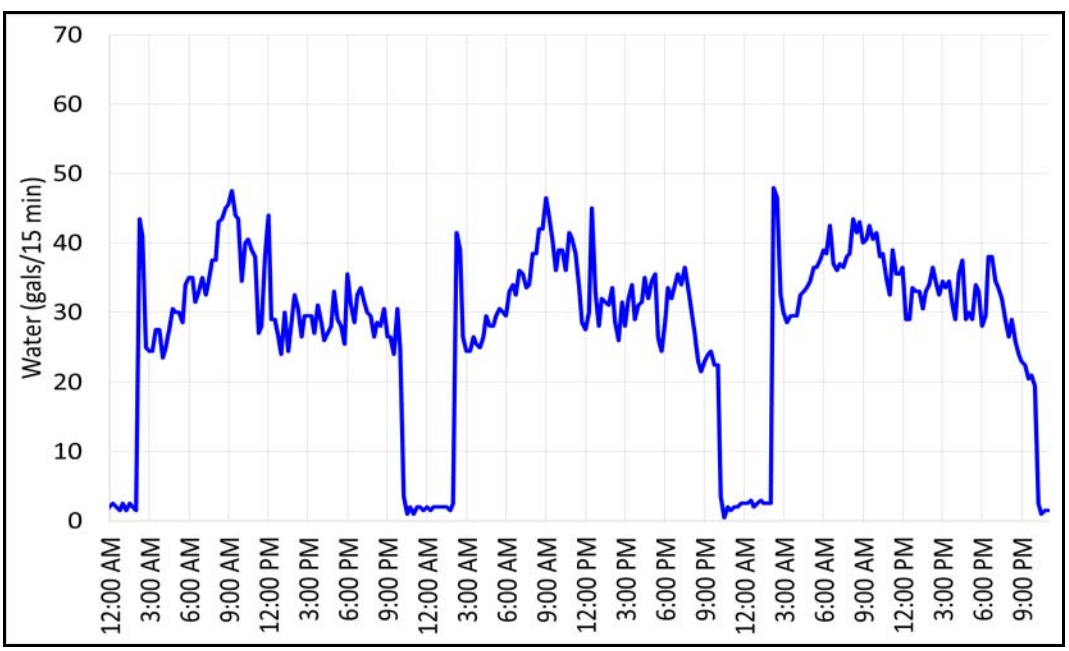

Figure 12. Water consumption profile for house with moderate light level and tunnel fans located in the side walls.

Short of installing light traps on the tunnel fans, it is virtually impossible to eliminate the possibility of at least a few birds being affected to some degree by sunlight entering through a house's tunnel fans. This doesn't necessarily mean that the effect can't be minimized to manageable levels by taking a few simple precautions:

1) Avoid installing tunnel fans in the end wall of a house.

Figure 13. Shades installed on tunnel fans to reduce the amount of light entering the house through operating tunnel fans.

2) If tunnel fans are in the end wall of house it may prove beneficial to install shade wall behind the house, especially if the fans are on the west end of the house (Figure 13). A properly designed shade wall would also have the benefit of reducing bird migration. When the tunnel fans are in the end wall and a producer is trying to maintain a fairly dark house there will tend to be a large difference in bird activity between the pad end of the house and the fan end of the house (Figures 14 and 15). The higher activity level tends to increase bird mobility, while the darkness at the pad end of the house makes birds less active. The birds over time tend to migrate more toward the pad end of the house and then remain there. When tunnel fans are located in the side walls fewer birds tend to be active, thereby resulting in a lowered potential for migration.

Figure 14. Tunnel fan area - low bird density.

Figure 15. Tunnel pad area - high bird density.

3) Maximum control over day length can typically be achieved by maintaining lighting levels of 0.2 ft*candles or greater.

4) The best way to determine if sunlight entering through the tunnel fans is affecting your birds' day length is to simply install a water meter with a pulse output and connect it to a data logger than can record water usage on a 15-minute basis. Some of the latest controllers have the ability to graph water usage on a 15-minute or hourly basis over the course of the day. If there is a stair-step change in water usage at the beginning or end of the day like those illustrated in Figures 9, 10 or 11, the day length of a portion of the birds in the house is being affected by sunlight entering through the tunnel fans.

5) Installing light traps on the tunnel fans to in most instances would not be practical. Not only would light traps costs thousands of dollars, they would require a substantial amount of maintenance, increase power usage, and most importantly result in a significant reduction in air speed.

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