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***Critical Information for Improved Bird Performance Through Better House
and Ventilation System Design, Operation and Management***

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Update: LEDs for Broiler House Lighting

National Poultry Technology Center – Auburn University College of Agriculture

By: Gene Simpson, Dennis Brothers, Jess Campbell, and Jim Donald

We at the NPTC have been closely monitoring broiler house lighting developments over the past several years. The broiler industry relied almost totally on incandescent lights for both growout and brooding until around 2006-2007, when considerably more energy efficient cold cathode (CCFL) and compact fluorescent (CFL) lights began appearing. Many growers began replacing brood lights with non-dimmable spiral CFLs and growout lights with either CCFL or dimmable CFL. The typical end result was an annual power bill reduction of \$1,000 or more for a typical 40 ft X 500 ft broiler house with 50-54 feed line growout lights and 12-14 center line brood lights. However, both the CCFL and dimmable CFL growout lights began showing a number of problems, such as light level reductions, and in some cases caused slight performance reductions over time.

In 2008-2011, several new light emitting diode (LED) lights became available. Unfortunately most of these LEDs were very expensive, and in some cases did not hold up or perform well in the harsh environment of a poultry house. As a result, and in the absence of rebate or cost-share programs, most growers made a business decision not to install LEDs until their quality, longevity, cost, and warranty improved. Those improvements, for the most part, began occurring in 2010-2011 and have continued at a rapid rate. We now have very reliable, fairly inexpensive LEDs available with longer warranties. More than two years ago, the NPTC began installing and closely monitoring several brands and models of LEDs in multiple houses on a large number of farms across the Broiler Belt. Based on the data we have collected, we are able to report that most of the LEDs currently available do a great job of helping to raise the best broiler possible, and do that at the lowest possible cost. We must offer a caution, however: commercial grade LEDs, available from most poultry supply firms, should be used rather than residential-grade LEDs from building and home supply outlets.



Current models of commercial grade LEDs have overcome early problems with the technology, and now can be an excellent choice in converting from incandescent to higher-efficiency lighting. In a 52-socket broiler house, power bill savings from this conversion can range from about \$1,000 to \$1,500 per year, with break-even payback ranging from two or three flocks to around two years, depending on circumstances.

LEDs shown here are finned A19 types, which are dimmable and have proven to provide good lighting uniformity in dropped-ceiling houses. Fins dissipate heat, helping extend bulb life and maintain light intensity; however, cleaning between flocks is especially important for finned types.

Things you need to know in considering a house lighting upgrade

Be Realistic in Calculating Costs/Savings – A watt is a watt is a watt. Significant power bill savings occur when incandescent bulbs are replaced with LEDs, not in replacing one low wattage bulb with a different bulb of close to the same wattage. For example, replacing 52 10-watt bulbs with 52 9-watt bulbs will reduce a grower's annual power bill by only about \$20.00. However, replacing 52 75-watt incandescent bulbs with 52 10-watt LEDs will yield a saving of about \$1,200 to \$1,400. The LED purchase cost could range from less than \$800 to more than \$2,000, with basically the same lighting level and performance results. In comparing costs of usage for different models or brands, advertised "power factor," a measure of electrical efficiency, can usually be disregarded. All LEDs have similarly high power factor ratings, and Alabama Power Company engineers have estimated that the annual value of even a 10% LED power factor improvement for a poultry house with 52 LED bulbs is no more than about \$20-\$25. Remember, a smart business decision will also include comparing warranties (which range from 3 to 5 years) and possible rebate and incentive program savings (which might save as much as 70%).

Get the Light Intensity You Need – All light intensity (brightness) is measured in lumens of output. In measuring light intensity, we are interested in lumen levels achieved at bird level. In the US, this is measured in footcandles (fc) which is lumens per square foot, and in metric countries it is measured in lux (lumens per square meter). 1 fc = 10.76 lux (approximately 10 lux per fc). With the directional output of LEDs, a bulb producing 500 lumens will typically provide comparable fc/lux readings to a non-directional bulb with 1,500 or more lumens. Footcandles and lux are standard units of measurements, and the fc/lux measurement at bird level is the appropriate comparison to make when evaluating different LED brands and styles. Overall lamp efficiency is measured in lumens per watt (lm/w). Most LEDs are in the range of 55-65 lm/w; however several recently introduced models are 80-85 or more lm/w. Most of these new higher output, higher efficiency LEDs have been designed to better dissipate the added heat they generate. Note that all lights lose light intensity over time. However, lumen depreciation for LEDs is typically less than 10% per year, but typically 15-25% per year for CCFLs and CFLs.

Broiler House Lighting Layouts

In general, we have found that using LED dimmable grow lights (~500 lumens) with spiral CFL brood lights of sufficient lumen output needed to achieve the company's specific minimum footcandle (fc) requirement, typically as measured along feeder lines, is the most cost-effective approach for broiler lighting in dropped ceiling houses. Most companies recommend or require a minimum average of 3-5 fc along the feeders during brood, with progressive dimming to 0.25 fc or lower at the end of flock, depending on the flock's target weight (bigger birds typically finish at very dim levels (< 0.05 fc).

Here are a few example lighting layouts that have been successful for growers:

A. ~40' wide, dropped ceiling, 2 grow lines 20' OC over feeders with center brood line in brood chamber. These houses typically will use 6-8 watt dimmable A19 shaped LED grow lights and 55 watt spiral CFL brood lights. This layout will provide 3+ fc along feeders; however, much higher fc readings will be found in the middle of the house.

B. ~40' wide, dropped ceiling, 2 grow lines 20' OC with alternating brood lines over feeders in brood chamber, also 20' OC. These houses typically will use 6-8 watt dimmable A19 shaped LED grow lights and 23-26 watt or 40-42 watt spiral CFL brood lights. This layout concentrates lighting over the feeders in brood better than B. above.

C. ~40' wide, dropped ceiling, 2 grow lines 20' OC over feeders with socket splitter and no center brood line in brood chamber. These houses typically will use 6-8 watt dimmable A19 shaped LED grow lights and 23-26 watt or 40-42 watt spiral CFL brood lights per splitter in the brood area, and 6-8 watt LED only in the off-brood area. This layout concentrates lighting over the feeders in brood nearly as well as B. above.

D. 50-54' wide, dropped ceiling, 3-4 grow lines 16-20' OC with alternating brood lines over feeders in brood chamber. These houses typically will use 6-8 watt A19 shaped dimmable LED grow lights and 23-26 watt or 40-42 watt spiral CFL brood lights.

E. 60-66' wide, dropped ceiling, 3-4 grow lines 16' OC with alternating brood lines over feeders in brood chamber. These houses typically will use 6-8 watt A19 shaped dimmable LED grow lights and 23-26 watt or 40-42 watt spiral CFL brood lights.

Open Truss Houses – Similar to dropped ceiling houses, but with higher output LED grow lights (700-900 lumen, either A19, PAR, or hybrid shape) and spiral CFL brood bulbs to account for decreased floor fc levels due to increased mounting heights of several feet. A reflector device on spiral CFL brood bulbs helps direct all brood light toward the floor.

LED Types – All LEDs have directional light output, so they are capable of providing higher bird level light with far less power consumption, since all emitted light is directed toward the floor. The greater the beam angle of the bulb, the broader the light spread.



A19 LEDs are tear-drop shaped like incandescents. They are dimmable and have controlled directional light output. A19s work well as grow lights in dropped-ceiling broiler houses.



PAR XX LEDs are floodlight shaped with a curved lens for better light spread. The XX is the number of eighths of an inch the lens is wide. PAR bulbs are most useful in higher wattages as grow lights in open truss ceiling broiler houses. Bulbs pictured above are PAR 30; bulbs at left are PAR 38.



Hybrid LEDs are not in a designated lighting industry category, but are engineered for light spread and heat-shedding capability. Like PAR bulbs, they are often used in open truss ceiling houses.

Look for Certification – All LEDs purchased should be UL certified, at a minimum. Other important certifications which are typically seen are Energy Star and Lighting Design Labs-LM79. Energy Star is unable to certify any LED with a color over 4000°K. Lighting Design Labs will certify LEDs over 4000°K. Depending on LED color, either certification is acceptable, and ensures that the LED has been independently tested and has passed all certification requirements. Avoid any LEDs not having either of these two certifications.

Consider Dimmability – Most LEDs dim very smoothly to extremely low light output levels with the most common commercial poultry house dimmers. However, some LED brands exhibit dimming problems at very low dimmer settings, and may actually require the use of one or more incandescent bulbs to achieve acceptable, consistent, and smooth low-end dimming. Several new LED-specific dimmers are now available which can be optimized for most any LED brand.

Get Uniform Light Spread – Some brands and shapes of LEDs produce very uniform side-to-side, end-to-end lighting and some simply do not. Some LED models concentrate their light output in a small area while others spread the light more evenly over a larger area. In general, we have observed most brands of A19 shaped LEDs to have better uniformity than PAR and hybrid shaped LEDs in dropped ceiling houses where mounting heights are relatively low (9-10'), while PAR and hybrid shaped LEDs tend to provide better uniformity in open truss houses where mounting height is higher (>10'). Open truss houses also need higher lumen output LEDs to allow for the higher mounting height, and may benefit from the use of reflectors.

Beat the Heat – Excessive heat will shorten bulb life and reduce its light output over time. Some LED models have external metal or plastic heat sinks to promote cooling, and some of these fins are quite large. Unfortunately, in poultry houses, these fins can quickly become clogged with dirt and debris leading to increased heat buildup, decreased light output over time, and shorter bulb life. Some LED manufacturers have succeeded in developing bulbs with no external fins, yet do not overheat. It is a good idea to clean all lights, LED or CFL, between every flock. You can use a hand-held pressure sprayer with the nozzle turned to jet stream and spray off each bulb for a few seconds. We have found that a 10% solution of household ammonia or window cleaner works well. Simply power off the lights, spray them, and allow them to drip dry.

Match Brood Light and Grow Light Colors (at least approximately) – Light color is the visible spectrum wavelength expressed in degrees Kelvin (°K). Most LEDs range from 3000 to 5000°K. 3000°K lights (warm white) have a yellow-white appearance; 5000°K lights (cool white or daylight) have a blue-white appearance. For comparison, most incandescent lights are 2800°K and most non-dim CFLs and CCFLs are 2700-2850°K, although cooler white incandescent bulbs, CFLs and CCFLs are readily available. Light color selection should be based on the integrator's preference. In choosing LEDs, be wary of claims of better bird performance strictly due to light color. Within the 3000 to 5000°K range, such claims have been shown to be highly questionable.

Protect your investment: use nickel-plated, not aluminum lighting sockets. Aluminum screw-sockets are cheaper but subject to rapid corrosion, early failure and possible dimmer interference.

Don't Count on Performance Gains – Improvements in mortality, feed conversion, weight, ADG, etc. with LEDs have not been consistently demonstrated or replicated in unbiased comparison tests, as long as the lighting levels being compared were the same.

The Bottom Line

We at the NPTC suggest you shop for LEDs wisely. Before you commit to one brand of LED, think about what you are trying to accomplish, namely raising the best broiler possible while at the same time minimizing your ownership cost and utility bills. Don't be swayed by various marketing and sales claims. Consider what you are trying to accomplish, what you need, and then spend time looking. Ask questions and compare as much as possible. Talk to other growers and live production people who have experience with multiple LED brands. Require honesty, and if you don't sense that you get it, walk away and keep looking. Carefully consider the purchase or ownership cost, operational cost, and warranty, and explore rebate and incentive programs that might be available in your area. Look for cost savings, but don't expect performance improvements – they are, of course, tied to many more factors than just lighting. Explore and weigh all your options and then make a smart business decision.

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Jess Campbell, Poultry Housing Specialist,
National Poultry Technology Center


Dennis Brothers, Poultry Housing Specialist,
National Poultry Technology Center


Jim Donald, Professor and
Extension Engineer


Gene Simpson, Professor and
Extension Economist

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