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# Poultry Housing Tips

## *Lighting Poultry Houses with Incandescent Bulbs*

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Though fluorescent lights are much more energy efficient and last longer than incandescent lights, they have one major weakness: they tend to be difficult as well as expensive to dim to the levels most producers desire. To gain maximum control over light intensity throughout the life of a flock, many producers who were using compact fluorescent lights in the past are finding themselves switching to incandescent light bulbs. With incandescent bulbs, a producer can start a flock with a high lighting level (1 to 2 ft-candles) to help get the chicks off to a good start and then later in the growout the bulbs can be easily dimmed to a much lower level (0.2 to 0.05 ft-candles) through the use of an electronic dimmer to help reduce bird activity and thereby improve feed conversions.

When it comes to lighting a poultry house with incandescent light bulbs, it is important to keep in mind that it is the lumens a bulb produces that will determine the light intensity at floor level, not the wattage of the bulb. A lumen is a measure of the light output of a light bulb while wattage is simply the amount of power used to produce that light. Though higher wattage light bulbs tend to produce more light than lower wattage bulbs, this is not always the case. Due to construction differences there can be significant variation in light output among bulbs of the same wattage (Table 1). For example, in Table 1 it can be seen that a 60-watt incandescent light bulb can produce anywhere between 500 and 890 lumens of light, a variation of nearly 70% . As a result, some 60-watt light bulbs will produce about the same amount of light as some 40-watt light bulbs, while others will produce more light than some 75-watt light bulbs.

| Incandescent Wattage | Average Lumens Produced | Lumen Range |
|---|---|---|
| 40 | 408 | 320 - 495 |
| 60 | 695 | 500 - 890 |
| 75 | 1910 | 700 - 1210 |
| 100 | 1412 | 1075 - 1750 |

Light intensity in poultry houses is typically measured in ft-candles. A ft-candle is defined as lumens per square foot. Simply the greater the number of lumens a light bulb produces the more foot-candles you will have at floor level, i.e,

20% more lumens=20% more foot-candles. Now keep in mind that the light emanating from a bulb is not just going toward the floor but toward the walls and ceilings as well. The reflectivity of the walls and ceilings in a house will have a significant effect on the amount of lumens you will have directed at the floor where it is needed. A clean white ceiling acts like a reflector redirecting the lumens that are emanating from the top of the light bulb down to floor level. But if a ceiling is very dirty, little of the light emanating from the top portion of the bulb will be redirected down to the floor, resulting in a significantly darker house. This is one of the reasons why two dropped ceiling houses with light bulbs of the same lumen output may have a 20% or more difference in floor light intensity. Other causes of variations in light intensity between houses with the same lumen light bulbs could be differences in age of light bulbs, cleanliness, and voltage due to improper wire sizing to name a few.

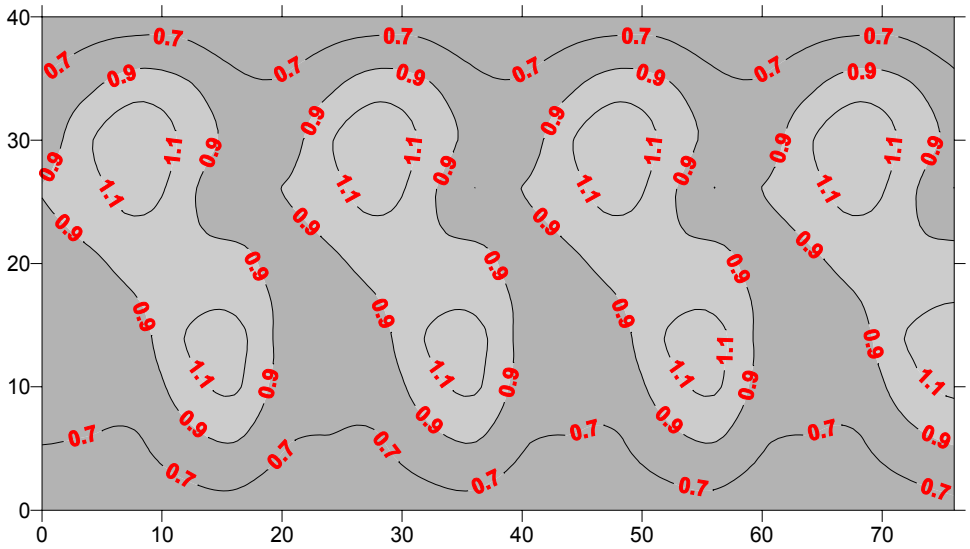

Figure 1. Light intensity at floor level (475-lumen bulbs)

Figure 1 illustrates the light intensity at floor level in a 75' section of a 40'-wide dropped ceiling broiler house with two rows of new 475-lumen (40-watt) light bulbs 20 foot on center. Figure 2 is the same house with 350-lumen (40-watt light bulbs). As you might expect since the 350-lumen light bulbs produce 25% fewer lumens than the 475 lumen bulbs the light intensity at floor level was 25% lower. It is interesting to note that there was as much light at the floor near the side wall with the higher lumen bulbs than at the floor directly underneath the lower lumen bulbs.

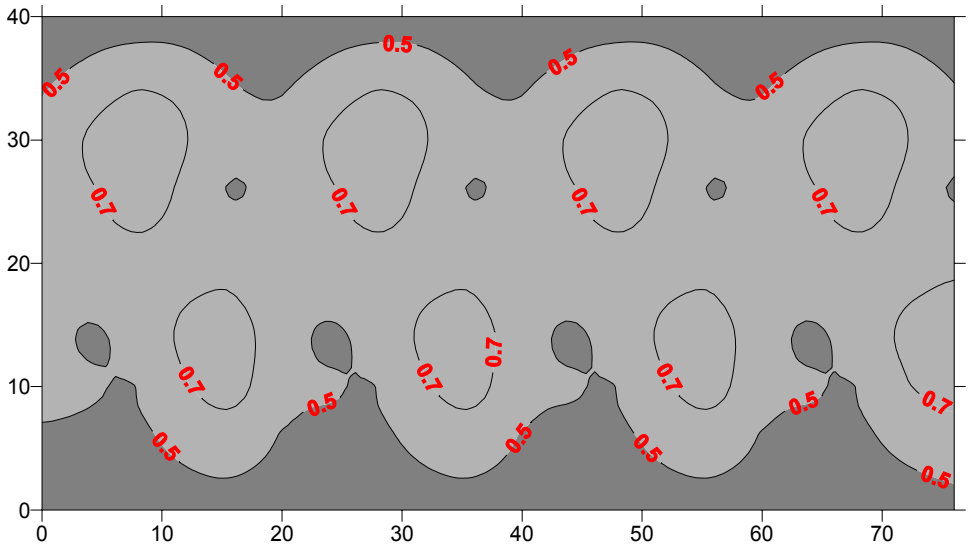

Figure 2. Light intensity at floor level (350-lumen bulbs)

Differences between lumen output of lights can often explain differences in bird performance between houses with the "same" light bulbs. During brooding, chicks in a house with low lumen bulbs would probably be less active than those in a house with high lumen bulbs. With older birds, the level of bird activity a house with high lumen 40-watt bulbs with a dimmer setting of two out of ten would be very different than those in a house with low lumen 40-watt bulbs with the same dimmer setting. Add to this the fact that one house may have a dirtier ceiling than another, reflecting less light to the floor, and two houses with the "same" lighting system can have dramatically different light intensities at floor level.

From Figures 1 and 2 it can be seen that it would be difficult to get the one to two ft-candles of light that many poultry producers are looking for during brooding with two rows of 40-watt incandescent bulbs. Figure 3 illustrates the same house with two rows of 1550-lumen (100-watt) light bulbs. As you might expect since the 1550-lumen light bulbs produce approximately three times the light as the 475-lumen, 40-watt bulbs, the light intensity at floor level is approximately three times greater. Though this level of lighting would be great for young chicks it would be too much for older birds, hence the need for electronic light dimmers.

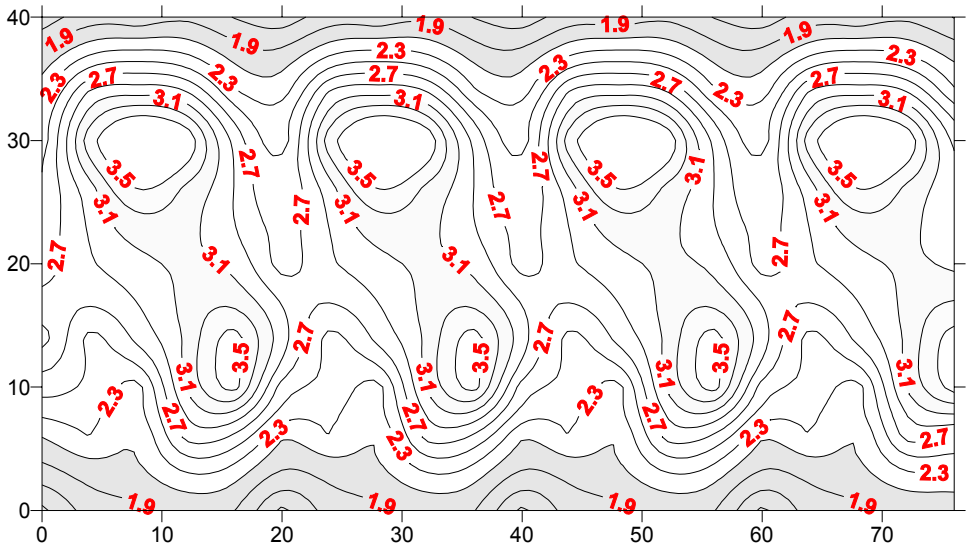

Figure 3. Light intensity at floor level (1550-lumen bulbs)

Since light intensity at floor level is directly proportional to lumen output of the light bulbs in a house, it is not hard to determine what size light bulbs you need to obtain your desired light intensity. For instance, if you are presently using 475-lumen light bulbs and you are getting 0.7 ft candles near the side wall and you want a minimum of 1.5 ft candles near the side wall you need to install light bulbs that produce at least 950 lumens. If you want to increase your light intensity near the side wall 30% to approximately 1 ft candles, you would need light bulbs that produced 30% more (620) lumens.

Is it possible to use just a single row of lights in a 40-foot wide house? Though it is possible, the problem is that light intensity at floor level will not be very uniform. The closer you are to a light bulb the greater the number of lumens per square foot you will receive. As you move away from a light bulb, light intensity will decrease rapidly as the same number of lumens are now being spread over a wider and wider area. In fact, the lumen density (ft-candles) varies in an inverse proportion to the square of the distance between the light source and the point of measurement. For instance, let's say that you measured the light intensity 10 and 20 feet from a bulb. The light intensity measured 20 feet from the bulb would not be half that measured 10 feet from the bulb, but rather one fourth (twice the distance, a quarter the light intensity). If you move 30 feet from the same light bulb the light intensity will only be one ninth than that measured at 10' (three times the distance, one ninth the light intensity).

For instance, Figure 4 illustrates the light intensity at floor level in a house with a single row of 1550-lumen light bulbs 20 foot on center. The light intensity directly under the light bulbs was approximately 2.7 ft candles while on the side wall it was approximately 0.8 ft-candles (twice the distance....one quarter the light intensity). No matter the wattage of the lights, the birds on the side wall will only receive 25% of the light as those in the center of the house. With two rows of lights, the variation in light intensity is cut roughly in half.

How does variation in light intensity from the side wall to the center of a house affect the birds? It is hard to say. During brooding it is likely once you reach a certain threshold of light, having additional light is not likely to have an adverse effect. For example, having a couple ft candles on the side wall and five in the center is not likely to be a problem whereas having two ft candles in the center of the house and only one half ft-candle on the side wall probably would problematic. With older birds, large variations in light intensity, i.e., those experienced with a single row of lights, could result in different levels of bird activity that could work against the benefits of a lighting program. But again, there could also be a threshold effect on the low end of light intensity for older birds (i.e., the birds react to 0.1 ft candle the same way as 0.01). Though there is still a lot to learn about lighting and performance it would stand to reason that the more uniform the light intensity the better off the birds will likely be.

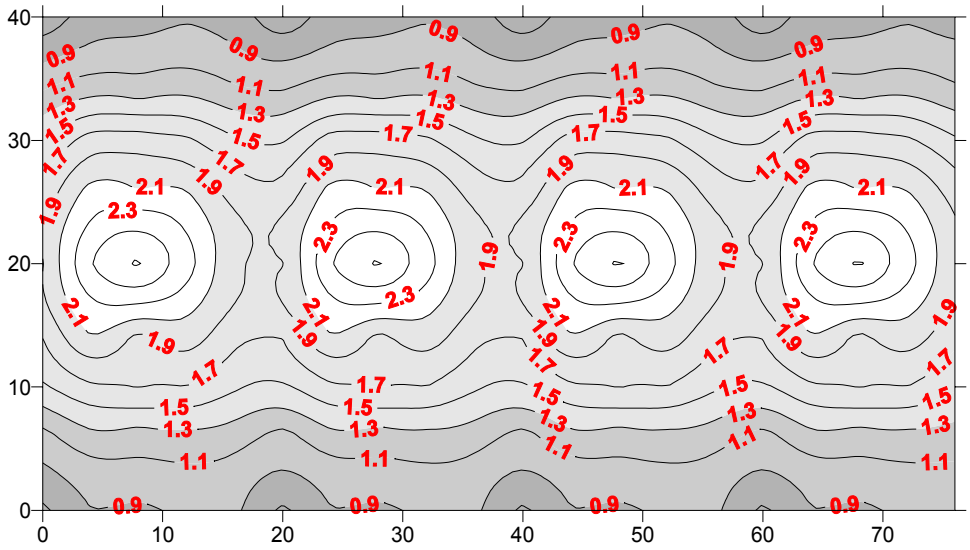

Figure 4. Light intensity at floor level (single row of 1550-lumen bulbs).

Does adding a third row of lights down the center of a house make floor light intensities more uniform? Not really. As you might expect, three rows of lights produces more light intensity at floor level than two rows of bulbs with the same lumen output (Figure 5). But since the third row of lights are in the center of the house directly above where the highest floor light intensity already exists, the greatest change is in the center of the house. So we end up with a scenario that though the house is significantly brighter, there is actually more variation in light intensity than there is in a house with two rows of lights or even in a house with a single row of lights (standard deviation of 0.62, 0.2, 0.52 respectively - note the lower the standard deviation the better the uniformity).

The variation in light intensity between the side walls and the center of the house increases as the variation between lumen output of the center row of lights and those towards the sides of the house increases. For instance, when the outer two rows of lights are 475-lumen bulbs and the center row has 1550-lumen bulbs, the standard deviation in light intensity increases to nearly 0.70, compared to 0.62 with three rows of 1550-lumen bulbs (Figure 6). The fact of the matter is that if you want to get a little more light to the side wall by installing a center row of lights you will end up adding a lot of light to the center of the house.

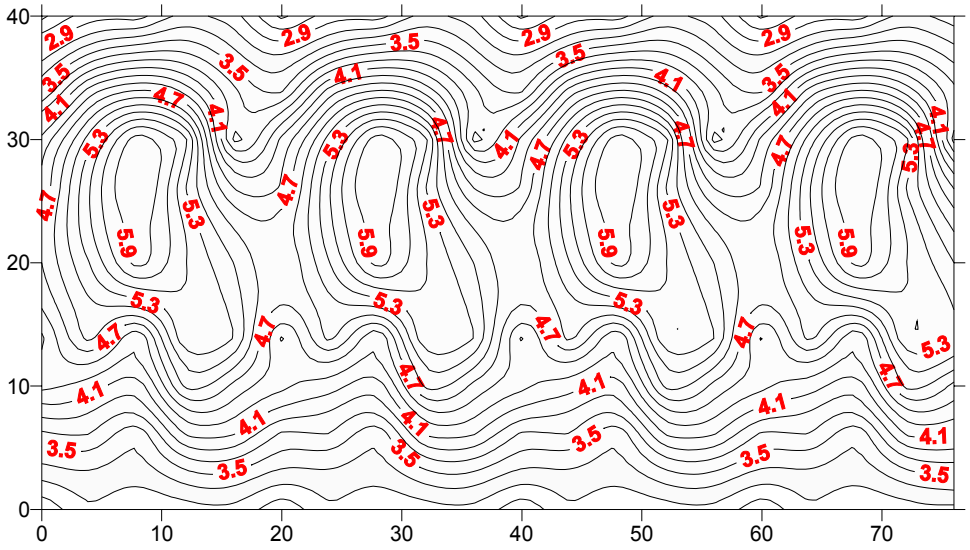

Figure 5. Three rows of 1550-lumen light bulbs.

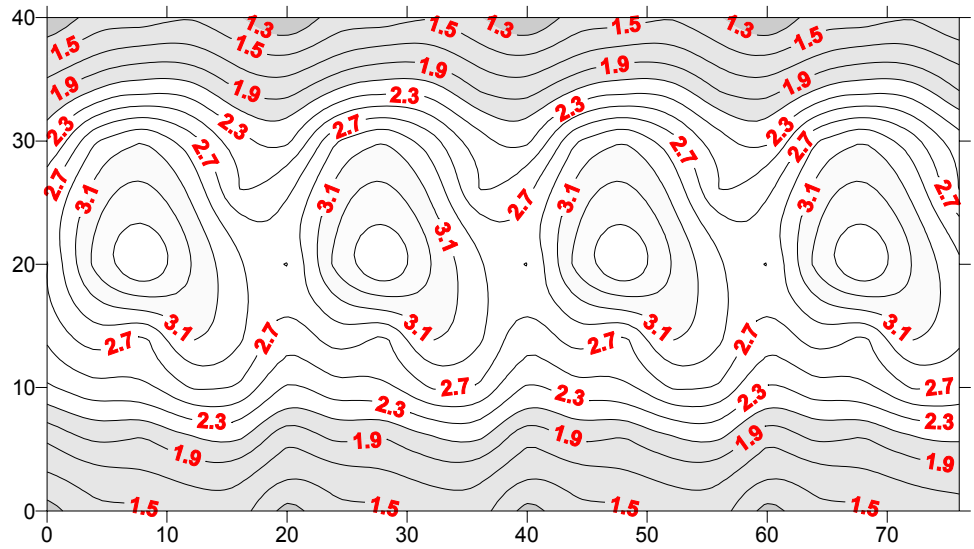

Figure 6. Two rows of 475-lumen lights, and single row of 1550-lumen lights.

Probably the best way of increasing light intensity as well as uniformity is instead of adding a third row of lights down the center of the house is to have two rows of lights over each of the feed lines. The two rows of lights would each be 20' to 24' on center but shifted 10' or 12' so a house would end up with two rows of lights 10' to 12' on center. One row of lights over each feed line could be equipped with 1500-lumen fluorescent bulbs (using approximately 20% of the power as the same lumen output incandescent and roughly ten times the life) while the other row would be equipped with a 475-lumen (40-watt) incandescent bulb. Both rows of lights over each feed line would be used during brooding, with the incandescent lights used during the remainder of the growout. One advantage of using the 40-watt bulbs and using 100-watt bulbs is that though using an electronic dimmer reduces the power usage of a light bulb as it is dimmed, it is more energy efficient to dim a 40-watt bulb down to the level where it produces the same amount of light as a 25-watt bulb as dimming a 100 watt bulb to the same intensity. For instance, dimming a house of 40-watt, 475-lumen light bulbs down to typically growout light intensities (less than 0.2 ft-candles) would use about half the electricity as dimming a 100-watt, 1550-lumen light bulb to the same level.

Things to keep in mind when it comes to poultry house lighting:

1) When purchasing light bulbs look for the lumen rating of the bulb on the package not just wattage.

2) Be careful when purchasing long life bulbs. The lumen output of many long life bulbs is rated at 130 volts, not 120 volts. Since light bulbs in poultry houses are operated at 120 volts the lumen output will be lower than what is listed on the package.

3) Light intensity of an incandescent light will reduce 10 to 20% toward the end of its life.

4) Light bulbs should ideally be cleaned between flocks. Dirt and fly specs can dramatically reduce the lumen output of a light bulb.

5) To maximize light uniformity light bulbs should be installed no further than 20' apart.

6) To increase light intensity at floor level you may want to consider installing light reflectors on each fixture.

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