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Poultry House Light Dimming Issues

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With the rising cost of electricity and incandescent bulbs disappearing, the NPTC staff has been working on refining poultry house lighting for several years. Two of our previous newsletters ("Energy Efficient Lighting" #59-May 2009, and "Broiler House Lighting Developments" #64-February 2010) covered the fundamentals and can be referenced for clarification. This newsletter addresses dimming problems commonly encountered by growers making the transition to dimmable Compact Fluorescent (CFL) and Cold Cathode (CC) bulbs.

Reports from growers and our own field observations indicate growers are experiencing two different kinds of dimming problems: 1) Failure to get the proper light intensity; and 2) CC & CFL bulb failures or very short life. Most complaints are that the dimmers aren't working right or the light bulbs are bad. We have found that in nearly all cases, neither the dimmers nor the bulbs are at fault.

In the summer of 2010, NPTC staff conducted an extensive study, looking at six different dimmer models, old and new but all widely used in the Broiler Belt and made by four leading manufacturers. We tested in poultry houses under identical conditions using various CC and CFL bulbs. All of the dimmers showed excellent materials and workmanship and all worked well with both CC and CFL bulbs. We found lighting level problems typically to result from reliance on dimmer dial or display percentage settings instead of actual light intensity to set desired light levels. We found bulb failures commonly being caused by dimming too low (below 8-10% of full intensity, as measured with a light meter); improper grounding and/or power surges; and corroded keyless sockets.

Photos of the same house but with lighting controlled by different dimmer models illustrates how the same dimmer percentage setting – here 30% or 0.3 – is likely to produce very different actual light intensity levels.

THERE IS NOTHING WRONG WITH THE DIMMERS.

They simply need to be set at whatever points on their dial or display that will produce the needed light level – as measured in foot-candles, not percentages.

Setting Proper Light Levels

Many company-specified dimming programs using dimmable grow lights (CC or CFL) instruct growers to dim to a specific light intensity level for a particular growout period. Sometimes the wording of the instructions may specify the intended light level as being a certain percentage of the dimmer dial or display reading, say 25%. However, the problem is that different dimmer models typically produce different actual metered or measured light footcandle levels at the same dial or display settings, and growers will not have the same dimmer model or even exactly the same lighting installation that the dimming instructions are based on.

The chart on page 3 shows the different light intensity levels produced by four of the dimmer models tested by NPTC under identical conditions. The dimmer settings run along the bottom, and the light intensity produced by the four example dimmers at any given setting is shown by the curves, reading across to the light intensity in footcandles (fc) on the vertical axis. For example, at the 25% dim setting, Model #1 produces 0.30 fc, Model #2 produces 0.12 fc, Model #3 produces 0.77 fc, and Model #4 produces 0.33 fc.

Notice that Model 1 and Model 4 are very close at the 25% dial/dimmer setting, but far apart at other settings: Model 3 and Model 4 are close to the same at a 50% dimmer/dial setting, but far apart at other settings.

Thus, a setting of 25% on a dimmer dial/display is specific to a particular brand and model of dimmer. Again, there is nothing wrong with any of the four dimmers tested. And unless a particular dimmer is shown to actually be defective, a grower with light level problems should not be looking to purchase new dimmers. In almost all cases, the grower simply needs to "calibrate" his dimmers. That is, the grower needs to know for every stage of the growout what actual light intensity (in footcandles) is needed, then use a light meter (at bird level) to determine whatever dial or display reading on the grower's dimmer produces that number of footcandles. Consequently, company dimming programs should specify the desired footcandle readings during growout, and not just % dim settings.

NOTE: A grower may have light levels set wrong and not even be aware of it. This is mainly because the human eye is not very good at differentiating light levels. The fact is that variations in light intensity not detectable by the human eye can have a significant effect on flock performance. In other words, it's probably a good idea to go through the dimmer calibration steps outlined below even if you are not aware of having a problem.

Steps for Proper Use of a Light Meter to Understand and "Calibrate" Your Dimmer:

1. Use a light meter capable of measuring to 0.01 footcandles (fc). These are not too expensive, usually around $150 or less.
2. Take all light meter readings at bird level, along feed lines and halfway between bulbs.
3. Measure footcandles with brood lights off and dim lights at full (100%) intensity. This will provide a baseline footcandle level for your dimmer at full intensity.
4. Measure footcandles at bird level between bulbs along feed line until your desired fc reading is achieved. For example, if 0.25 fc is desired, keep turning the dimmer down in small steps until the 0.25 level appears on the light meter display.
5. Observe the dimmer's dial or display setting at the desired fc level, and mark the dimmer accordingly or record the correct setting nearby the dimmer.
6. If you have trouble getting a footcandle reading low enough, it may indicate that the bulbs you are using are providing too much light to be dimmed to the desired level, and you may want to consider replacing them with lower wattage bulbs.
7. While you are taking light intensity measurements, it is a good idea to determine what setting on the dimmer dial or display corresponds to 10% of full light intensity. This is because setting dimmers too low, typically below around 8-10% of full intensity, can cause premature bulb failure (as explained below).

Preventing Premature Bulb Failures

Avoid setting dimmers too low. Most energy efficient CC and CFL bulbs cannot be dimmed below 8-10% of full intensity without severely shortening bulb life. That does not mean that setting a dimmer on or above a 10% dial or display setting will prevent damage. It means that bulbs should never be dimmed below 8-10% of full intensity as measured with a light meter in footcandles. We go with the conservative 10% level. For example, if full (100%) intensity is 1.0 fc as measured on your light meter, then do not set your dimmer

Light Intensity Produced by Four Example Dimmer Models

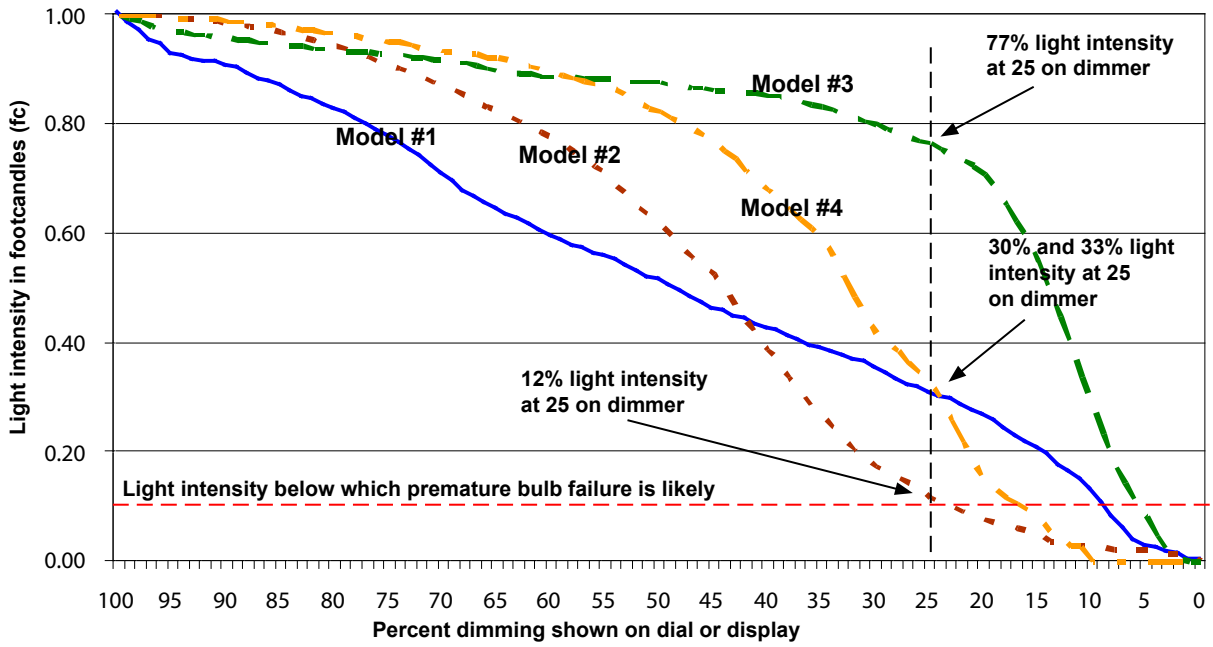

Chart above shows the different light intensity levels produced by four dimmer models, as tested by NPTC. The dimmer settings run along the bottom, and the light intensity produced by the four example dimmers at any given setting is shown by the curves, reading across to the light intensity in footcandles (fc) on the vertical axis. The curves show clearly marked differences in light output of the four dimmer models at the same dimmer dial/display settings. Notice for example that while Model 1 and Model 4 are very close at the 25% dial/dimmer setting, they are far apart at other settings.

Model-to-model differences do not mean there is anything wrong with any of these dimmers. A grower simply needs to know what light intensity in footcandles is needed, then test to find out what settings on his dimmers produce that light intensity.

Dimmer Settings at Which Premature Bulb Failure Is Likely

Dim % Setting	---------- Footcandle Reading (Percent of Full Intensity) ----------			
	Model #1	Model #2	Model #3	Model #4
100	1.00 (100%)	1.00 (100%)	1.00 (100%)	1.00 (100%)
75	0.77 (77%)	0.91 (91%)	0.93 (93%)	0.95 (95%)
50	0.51 (51%)	0.62 (62%)	0.88 (88%)	0.82 (82%)
40	0.42 (42%)	0.39 (39%)	0.85 (85%)	0.68 (68%)
30	0.35 (35%)	0.17 (17%)	0.80 (80%)	0.42 (42%)
25	0.30 (30%)	0.12 (12%)	0.77 (77%)	0.33 (33%)
20	0.27 (27%)	0.08 (8%)*	0.71 (71%)	0.15 (15%)
15	0.20 (20%)	0.05 (5%)*	0.55 (55%)	0.08 (8%)*
10	0.13 (13%)	0.03 (3%)*	0.29 (29%)	0.00 (0%)*
8	0.08 (8%)*	0.02 (2%)*	0.18 (18%)	0.00 (0%)*
5	0.03 (3%)*	0.02 (2%)*	0.08 (8%)*	0.00 (0%)*

*Shaded areas show dimmer settings at which premature bulb failure is likely to occur

Table shows the measured data from which the above chart was produced. Shaded areas show the low dimmer settings that are likely to cause premature bulb failure (dashed line at bottom of chart also points out the danger levels for each dimmer model. Experience and testing shows that premature bulb failure is likely if dimming is set to produce 8-10% or less of full intensity. This varies from one dimmer model to another. For example, Model 1 produces light intensity at 8% of full at a dimmer setting of around 8%, while Model 2 produces 8% of its full footcandle output at a dial/display setting of 20%. Again, model-to-model differences do not mean there is anything wrong with any of these dimmers. A grower simply needs to know what light intensity in footcandles is produced at a given dial/display setting.

below 0.10 fc. Since all dimmers have different curves, you must find the appropriate setting on your dimmer dial or display that will keep lighting in the "bulb-safe" area, above 10% full light intensity. The table on page 3 shows how much difference there can be from one dimmer model to another and where the dial or display should be set for safety for these particular dimmers. Should you ever observe bulbs flickering or strobing, those are telltale signs that the dimmer setting is too low and bulb damage may soon follow.

Provide proper grounding and power surge protection. Improper grounding can cause erratic dimmer and bulb performance and in some cases may void warranties. We continue to emphasize that a good ground is critical in achieving good dimmer and bulb performance. Additionally, having a good ground may help prevent lightning or power surge damage to other sensitive electronic equipment (controllers, alarm systems, etc.), as well. When undertaking a lighting change project, it is always a good idea to have a qualified electrician ensure that your electrical system is in good repair.

Use nickel-plated sockets. Corrosion in keyless sockets results in added resistance to the circuit and can quickly cause premature bulb failures with energy efficient CC and CFL bulbs. We continue to recommend replacing keyless sockets with nickel plated brass models before changing to CC or CFL bulbs. These sockets retail for little more than $1.00 each, so it is a small price to pay for avoiding problems and helping to get the advertised CC or CFL bulb life. Use of Noalox or other anti-oxidant electrical joint compound or Vaseline is not recommended in screw shells.

Note on Warranty Issues. Dimmable CC and CFL bulbs usually come with a 1 to 2 year manufacturer's warranty. However, these warranties may be voided if older corroded sockets are in use, if there is evidence of improper grounding, or if other electrical system problems are apparent.

The Bottom Line

Dimming problems with CC and CFL bulbs can be avoided by paying close attention to the factors mentioned above. Understanding your dimmer's capabilities and limitations, recognizing that dimmer settings and actual light levels are not a straight line relationship, not dimming too low, ensuring a good electrical ground, and using good quality keyless sockets will help avoid warranty problems and pay dividends by reliably providing the correct lighting for best bird growth and avoiding premature bulb failure.

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