POULTRY SCIENCE AND TECHNOLOGY GUIDE

from North Carolina State University at Raleigh / Extension Poultry Science

Lighting System For Layers

Light is the most important factor in regulating the onset of egg production; therefore, it will have a great impact on egg size, production levels, and mortality from blow-outs.

Light affects the reproductive system of poultry by a mechanism that involves the brain, the pituitary gland, and the gonads. Birds, unlike all mammals, do not require the presence of eyes to have a physiological response to light. They have the ability to perceive light directly by the brain by, as yet, unknown mechanisms.

Blinded chickens can respond to light and can perceive when the lights go on and off. This means that light passes through the feathers, skin, and bone to reach the brain. However, all this surface tissue serves to filter out much of the light and only the longer wavelengths (orange-red) penetrate to the brain. This is why the reproductive system of birds only responds to orange-red light.

It is also important to understand that the response of birds to light does not depend on the length of the day or night. Rather, it is the time the light is given during the day. Research has shown that there is a period of sensitivity to light occurring once each day (24-hour period). It occurs 12 hours after the lights-on signal and lasts for about 4 to 6 hours. This is called the photosensitive phase (PSP) of the day. If, and only if, light falls within this light sensitive period will the reproductive system be photostimulated.

Natural daylight gradually increases during the spring from 12 hours on March 21 to a maximum of approximately 15 hours on June 21. During this time natural light falls within the photosensitive period of the bird and reproductive activity is stimulated. However, the daylength decreases after June 21, dropping back to 12 hours of daylight in September and approximately 9 hours in December. During these winter months the daylength is not sufficiently long to reach the photosensitive phase and thus reproductive activity is not stimulated.

Growing Period

Normal or Open Brooder and Grow-Out Houses

In North Carolina, replacement layers hatched between April 1 and mid-August give satisfactory results when exposed only to natural daylength from hatch to 20 weeks of age.

For layer replacements hatched from mid-August to April 1, a constant daylength (12 to 15 hours) from hatch to 20 weeks of age is superior to natural daylength. This prevents excessive small eggs and early maturity and gives a rate of lay superior to that of birds exposed to naturally increasing daylength during this period and a rate of lay about equal to the step-down, step-up systems.

Another variation of controlled lighting (windowless houses not needed) follows a program similar to the natural lighting of June or July hatched pullets. Under this system, when the chicks arrive determine the date when the pullets will be 20 weeks old. Using a table of daylight hours, determine the number of hours of natural daylight at the time the birds will be 20 weeks old. To this figure add 5½ hours. This latter figure is the hours of light given the chicks in the first week of brooding. Reduce the light period each week thereafter by 15 minutes until the 20th week of age; then increase the light hours by 15 minutes each week until 17 hours of light is reached. The amount of daily light is then held constant.

Windowless Brooder Houses

Twenty hours of light and four hours of dark for the first week, reduced gradually to 8 hours by 20 weeks of age, has been proved to give excellent results. This is simple to maintain, either by adjusting manual timeswitch to provide 15 minutes less light each week or by the more expensive astronomical timeswitch set to reduce light 2 minutes each day.

A constant 9 hours from one week of age to 20 weeks gives results in the laying house about equal to the reducing light program, except possibly in egg size. Constant short days during the brooding and growing periods have, for the most part, resulted in smaller egg size than other systems. Therefore, if slightly smaller eggs are no problem, then the constant 9-hour day is best. It is simpler and cheaper.

Light Control in Laying House

Open Houses

If pullets are grown in open houses under a step-down, step-up lighting program, at 20 weeks of age their light day will be equal to the natural daylength. You then increase the daylength abruptly to 12 hours (if natural daylength is less than 12 hours), then increase lights 15 to 20 minutes weekly until the maximum light day of 17 hours is reached.

If pullets were grown in open houses under a constant daylength of 12 to 15 hours (depending upon hatch date), then you would increase the daylength starting at 20 weeks of age by 15 minutes per week until the maximum daylength of 17 hours is reached.

An alternate method is to expose the 20-week old pullets immediately to a light day of 15 to 17 hours. One caution, however, is that in some pullet flocks, non-layers may develop if subjected to sharp light increases prior to about 18 weeks of age.

Windowless Laying Houses

If pullets have been grown on a decreasing light program to 8 hours at 20 weeks of age, increase light to 12 hours at 20 weeks, then increase light by about 15 to 20 minutes weekly until the desired light day of 17 hours is reached.

Increasing light to the maximum desired at 20 weeks is satisfactory if such is desired due to other management practices.

In recent tests, it has been shown that light stimulation should begin at 20 weeks or earlier, rather than at 22 weeks, for best results. Consult breeder manual for specific breeder recommendations.

Under constant light growing systems, satisfactory results can be obtained by jumping the light to 12 to 13 hours at 20 weeks and then increasing light by 30 minutes weekly until 15 to 17 hours is reached.

Ten Tips to Reduce Lighting Costs

An ideal lighting system is one that maximizes the desired productive trait with the minimum use of electricity and maintenance.

1. Keep lamps and reflectors clean for maximum efficiency. A clean 40-watt bulb gives as much light as a dirty 60-watt bulb. This amounts to $300 per year savings in a 40 x 250 foot-laying house when electricity costs at 5¢ per kwh.
2. Use reflectors with all bulbs. A clean 25-watt bulb with a reflector is equal to a clean 40-watt bulb without a reflector or a dirty 60-watt bulb without a reflector.
3. Turn lights off when not needed.
4. Replace dim and discolored bulbs.
5. Provide proper light intensity:

	Recommended Intensity (Foot-Candles)
Chickens—pullets 0-1 week	1-2 floor 2-3 cages
pullets 2-20 weeks	.5-1
layers 20 weeks	1
semen production	1
Broilers	.5-1
Turkeys—breeder hens	3-4
breeder toms	3-4

6. Use fluorescent tubes in all areas possible.
7. Outside lights should be mercury vapor, metal halide, or high pressure sodium.
8. Use *only* solid state dimmer switches. *Rheostat dimmers do not conserve electricity.*
9. Use correct size bulb.
10. Use energy-efficient bulbs.

Summary

It is not advisable to grow pullets under conditions of increasing lights or to maintain laying hens under conditions of decreasing light. No drastic light change should be made on pullets between 12 and 18 weeks of age. This appears to be the most critical period of the bird's life span, as far as light stimulation is concerned.

Basic Lighting Information

Foot-candle is a measure of brightness on a surface. It is the amount of light falling on a surface one foot away from a standard candle.

Lux is the metric equivalent of a foot-candle. It is the amount of light falling on a surface one meter away from a standard candle. One foot candle = 10.76 lux; 1 lux = .0929 foot-candle.

Light efficiency refers to the number of lumens of light produced per watt of bulb. Larger bulbs are more efficient than smaller bulbs.

Lumen is a measure of the brightness of a light bulb. One lumen/ft.^{2} = 1 foot-candle.

Available lumens is the amount of light that is available to the bird. About 50 percent of the lumens of a light bulb without a reflector never reach the bird due to absorption by the surroundings and condition of the bulb (dust and deterioration). Therefore, in practical situations 2 lumens per ft.^{2} at bulb is equal to 1 foot-candle at bird level.

Fluorescent tubes are manufactured with different fluorescing materials coating the inside of the tubes. The "daylight" or "cool" type produces rays predominantly in the blue-violet range while the "warm" tubes, "soft white" or "pink" provide rays similar to incandescent illumination. A 15-watt fluorescent tube gives as much light as a 60-watt incandescent. Either light type will cause birds to become productive.

TABLE 1. LUMEN OUTPUT OF VARIOUS SIZE LAMPS

	Approximate Lumens Per Lamp	
Watts	Fluorescent	Incandescent
15	550	125
20	800-900	
25		225
40	2,300	430
60	3,300	810
75	4,500	1,150
100	5,500	1,600

$$\text{Lamp Size} = \frac{\text{Lumens needed}}{\text{Lamps needed}} =$$

$$\frac{\text{Sq. ft. floor x 2 (ft.-candles desired)}}{\frac{\text{(Length of house in feet)}}{\text{(Lamp spacing in feet)}} \text{ x rows of lights}}$$

Example: House 400 x 40; 3 rows of lights; 1 foot-candle at floor level desired =

$$\frac{16{,}000 \text{ sq. ft. x } 2(1)}{\frac{400}{12} \text{ x } 3} = \frac{32{,}000}{100}$$

Lamp Size = 320 lumens per lamp

Prepared by

W. C. Mills, Jr., In Charge, Extension Poultry Science
Thomas D. Siopes, Department of Poultry Science
Thomas A. Carter, Extension Poultry Specialist

Published by
THE NORTH CAROLINA AGRICULTURAL EXTENSION SERVICE

North Carolina State University at Raleigh, North Carolina Agricultural and Technical State University at Greensboro, and the U. S. Department of Agriculture, Cooperating. State University Station, Raleigh, N. C., T. C. Blalock, Director. Distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. The North Carolina Agricultural Extension Service offers its programs to all eligible persons regardless of race, color, or national origin, and is an equal opportunity employer.

PS&T 16 (Revised) 3/81/2.5 M