

POULTRY SCIENCE AND TECHNOLOGY

GUIDE

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Light Management for Broiler Breeders

Many changes in the poultry house have occurred over the years; the development of a light management program is only a part of these changes. Light management for the broiler breeder involves interpreting and using existing information about the effects of *light duration, intensity, and wavelength* on bird performance. It also involves developing and using tools that allow us to apply this information. These tools include natural and artificial light sources, light traps, time clocks, curtains, and many other devices.

Visible Light

Part of the energy emitted by the sun is visible light. White light is composed of various colors, which can be observed when light is directed through a prism. Each color has its own wavelength with a different ability to penetrate substances. Long wavelengths have greater abilities to penetrate substances than short ones.

Different artificial light sources have characteristics that depend upon the wavelengths of light they produce. Natural daylight is a broad-spectrum, high-intensity light source. Depending upon the type, artificial light sources can either have a broad spectrum (contain light of a wide range of wavelengths) or a narrow spectral output.

The intensity or amount of energy in each wavelength band varies with the lamp type. Incandescent lamps are broad-spectrum sources, with most of their output in the longer wavelengths (Figure 1). Fluorescent lamps can be manufactured to emit a variety of wavelengths to produce almost any color. The most common commercial fluorescents are warm white, deluxe warm white, cool white, and deluxe cool white (Figures 2, 3, 4, and 5). High-intensity discharge lamps such as mercury or high-pressure sodium vapor lamps produce a narrower spectral output (Figures 6 and 7). The mercury lamp produces light with mostly green wavelengths, whereas the normal high-

pressure sodium lamp produces light with yellow to red wavelengths.

You can manipulate the light environment to stimulate reproductive activity, change behavior, alter metabolic rate, or affect bird activity to optimize reproduction and growth. Birds perceive light through their eyes. The light also penetrates the feathers and skull and is perceived directly by specific areas of the brain in the hypothalamus that are able to receive and translate wavelengths, intensities, and durations of light into chemical and hormonal signals. Depending upon the physiological state of the bird, these chemical and hormonal signals influence the bird's reproductive glands and organs, affecting semen and egg production. Practical light management for broiler breeders can occur in the pullet house and the breeder house.

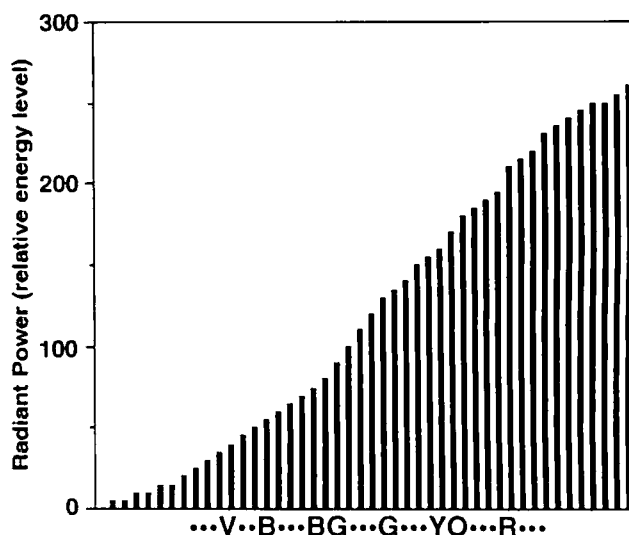


Figure 1. Spectral output of an incandescent lamp.

GRAPH KEY: V=violet; B=blue; BG=blue-green; G=green; YO=yellow-orange; R=red. Key is the same for figures 1-7.

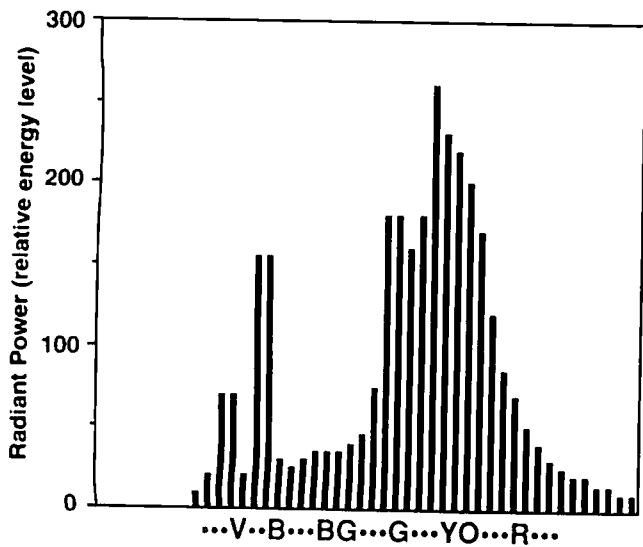


Figure 2. Spectral output of a warm-white fluorescent lamp.

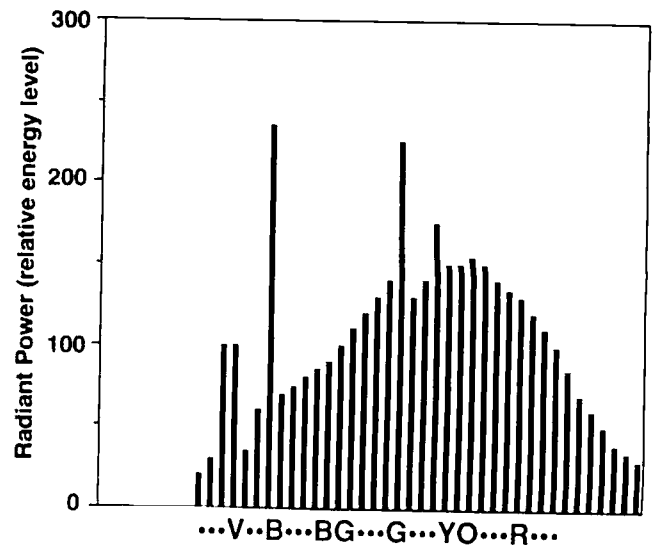


Figure 5. Spectral output of a deluxe cool-white fluorescent lamp.

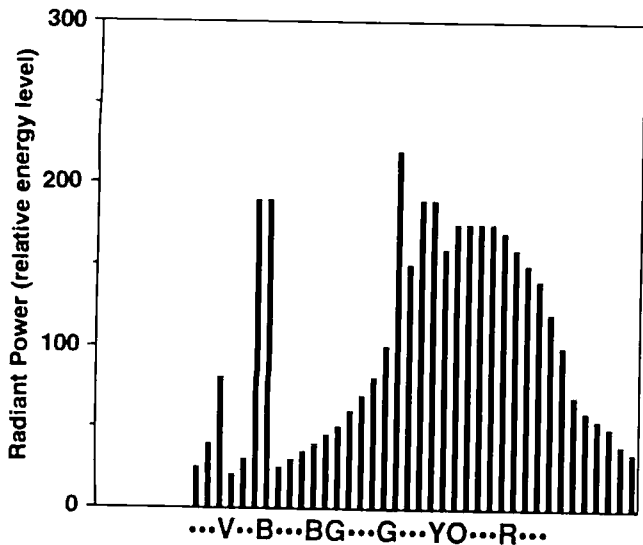


Figure 3. Spectral output of a deluxe warm-white fluorescent lamp.

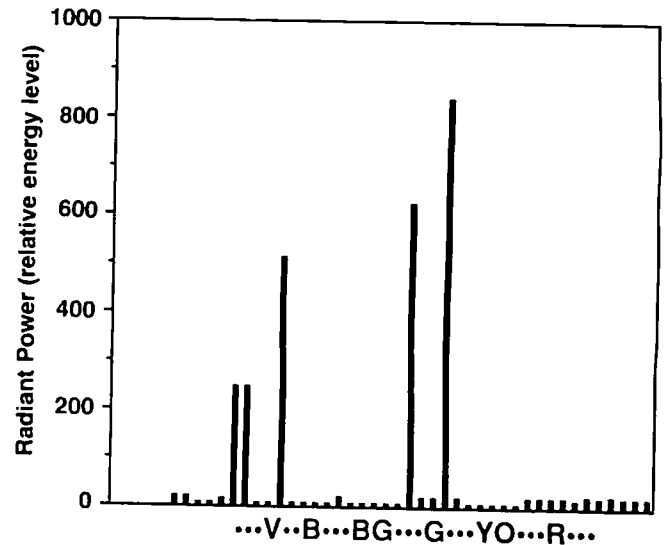


Figure 6. Spectral output of a mercury lamp.

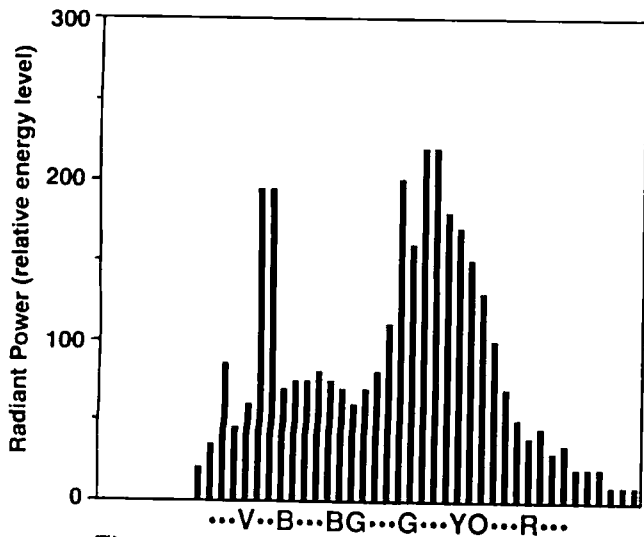


Figure 4. Spectral output of a cool-white fluorescent lamp.

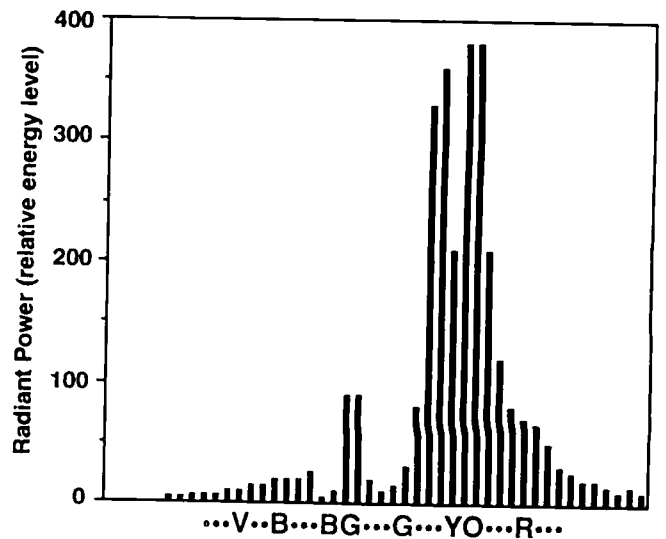


Figure 7. Spectral output of a high-pressure sodium lamp.

Pullet House

Most breeder pullets in the United States are subjected to some form of light restriction (blackout) program during adolescence. The purpose of blackout, or light-controlled housing, is to sensitize the birds to light stimulation when they are moved to the breeder house. The bird must have attained adequate body composition and age for photostimulation in the breeder house to induce egg production. A blackout program is successful when pullets start producing three to four weeks after light stimulation and rapidly attain peak production thereafter. A light-restriction program allows a more accurate prediction of the onset of egg production.

There is no evidence that the breeder pullet requires light with a specific range of wavelengths. Thus, either natural or artificial light is commonly used.

Many typical curtain-sided pullet blackout houses use eight hours of natural daylight. Some breeder managers use artificial light sources for the lighted portion of each day during the blackout program.

Growing pullets must be exposed to short daylengths before they reach sexual maturity. They should normally be exposed to daylengths of eight hours no later than 12 weeks of age and until 20 weeks of age, when they are normally moved to the breeder house. Starting the short daylengths earlier than 12 weeks of age will result in better control of growth rate and additional feed savings.

Growing cockerels do not require short daylengths before reaching sexual maturity to attain optimal reproductive efficiency. However, light duration can modify the time required for the growing cockerel to achieve sexual maturity. In typical light restriction programs, cockerels tend to mature slightly later than pullets. If cockerels are reared separately from the pullets, they can be subjected to stimulatory daylengths earlier than the pullets to assure that they reach maturity at the same time. When pullets and cockerels are raised together, some breeder managers increase daylength to 10 hours when birds are 18 weeks old to stimulate maturity of the cockerels. Daylengths longer than 10 hours will initiate egg production in some pullets.

Information on the effects of light intensity in the pullet house is very limited. In pullet houses with curtain sidewalls or windows where natural daylight has been used, light intensity varies widely depending upon the time of day and the weather.

It is important for the growing bird to be able to differentiate light from darkness. This can be accomplished easily when natural daylight is used. If you use artificial light sources, the minimum light inten-

sity should be 2 to 4 footcandles. This light intensity may require some adjustment upward if the blackout conditions of the house are not complete. There is some limited evidence that artificial light works best with out-of-season birds.

Breeder House

The effects of varying daylengths on the reproductive characteristics of breeder hens are well known. Daylengths must be maintained between 14 and 16½ hours to maintain egg production. The pullet must perceive long daylengths to bring about the onset and maintenance of egg production. If the period of light exposure occurs 12 to 16 hours after dawn (natural or artificial stimuli), then the birds will perceive a long day; otherwise, they perceive a short day.

The effects of various wavelengths on reproductive performance are well known. All available artificial light sources can support egg production. However, breeders apparently respond best to the longer (yellow to red) wavelengths of visible light. Wavelengths outside the visible part of the light spectrum do not seem to elicit a response from birds. Poor performance during the latter part of production has been reported with turkey and broiler breeders when cool white fluorescent lights are used. Cool white fluorescent lights do not produce much visible light in the longer wavelengths (600 to 700 nanometers). Another light source that does not produce much of its visible light in the longer wavelengths is the clear mercury light, the type commonly sold as yard lights.

High-pressure sodium vapor lamps and broad-spectrum fluorescent lights are good sources of light for broiler breeders. Certain wavelengths may have an effect on egg characteristics. Longer wavelengths have resulted in increased egg albumen, whereas shorter wavelengths increased shell quality of eggs from turkey hens.

The intensity of light in the breeder house has been a major concern of breeder managers because of the uncertainty of the hen's requirement coupled with the variability associated with natural daylight. The commercial laying hen is believed to have a minimum threshold level of ½ footcandle. Field observations have indicated that the requirement for broiler breeders may be different. Depressed egg production associated with overcast days is common. Broiler breeder hens in curtain-sided houses are exposed to a variety of light intensities during the day with daylight, dusk, and the supplemental artificial light. Some researchers have demonstrated equivalent egg production with natural light, supplemented with the following artificial light sources:

- incandescent (1.3 footcandles);
- full-spectrum fluorescent (5.3 and 29 footcandles);
- high-pressure sodium (7.5 footcandles).

Artificial light intensities of 2 to 5 footcandles should be maintained at all times during the light periods until additional information becomes available.

Light Meter Use

A light meter will help you manage light intensity in the poultry house. Numerous reports give recommended light intensities, but most fail to mention the method in which the measurements were taken. A standard measurement procedure must be used when comparing light intensities in different houses. Hold the light meter at the height of the bird's head and hold the photoreceptor toward the light source. Take measurements in different areas of the house.

The distance between the light source and the birds is critical in obtaining a reliable light intensity measurement because intensity readings decrease at the rate of the square of the distance from the light source. Legitimate comparisons of light intensities can be made only when they are monitored by a consistent method.

Current knowledge of lighting for the broiler breeder is far from complete. The breeder industry can continue to improve its light management programs as new information is obtained. The light management program is only a part of the total program for broiler breeders; all aspects of the program must be managed properly to ensure desired results.

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