Lighting and Gamebird Production

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Lighting for Upland Game Birds as well as all avian species is extremely important for growth and reproductive development. Today producers are faced with a wide variety of various fixtures from different light sources, different light wattage, and heat production / efficiency of wattage used per lumen. It is important to understand the reasons to use lighting, characteristics of light, advantages of different lighting sources, and management requirements for different species of upland game birds.

Why do we control the light environment for birds? Light is obviously used to facilitate sight to enable intake of feed and water, socialization with other birds, and selection of nesting/roosting areas for most birds. Sight is quite important for behavior (eating and drinking, aggression, sexual display, etc.) during the growth and maturation of the birds. Light also stimulates internal day / night cycles due to daylight changes and initiates hormone release. Upland game birds are long day breeders, that is, there is a direct correlation between day length during the rearing period and the age at onset of sexual maturity; moreover of more importance is a steadily increasing day length during this period (Lewis and Morris, 2006). The lighting (day length) can stimulate release of sex hormones and result in development of sexual characteristics in mature or developing birds. Conversely, egg production can decline, cease, and/or cause a molting situation if the day length decreases once the birds are in production. Occasionally, breeders have found that an equipment malfunction will cause the time clocks to shut off and the result is often a decrease in egg production. If the light continues to malfunction for some time, birds will cease lay and initiate a feather molt. Producers have noted that even dark or overcast days can contribute to an overall slight decrease in a flocks performance for the week. Therefore, light is very important in growing and breeders to successfully manage their development and productivity.

What is light? Light is comprised of three different attributes: wavelength, intensity, and day length or duration. Wavelength is traditionally visualized by dividing a ray of white light through a prism to form the rainbow of colors. Many of us memorized the divisions of color within the visual spectrum by the saying: ROY G BIV that stands for Red, Orange, Yellow, Green, Blue, Indigo and Violet. The wavelength differences in spectrum colors can be measured in nanometers for Infrared > 700nm, Red 625 – 740 nm, Orange 585- 620 nm, Yellow 570 – 580 nm, Green 520 – 570 nm, Blue 440 – 490 nm, Indigo 420 – 450 nm, and Violet 380 – 420 nm.

The other end of the spectrum is ultra-violet which has a wavelength < 380 nm. Birds are sexually stimulated by the longer wave lengths of the visible light spectrum, e.g. yellow, orange, and red and therefore the lights for breeding birds use light sources that have predominately orange and red wavelengths. Incandescent, daylight or warm fluorescent lamps supply proper wavelengths. Also, newer cold cathode fluorescent and LED's can also provide proper wavelengths. Growth is thought to be benefited by lighting sources with wavelengths in the Green and Blue spectrums. Another term that you will hear with reference to lighting sources is warmth or coolness of light. This refers to color temperature expressed in degrees Kelvin. A general rule is that > 4000 K is equal to Cool light (more in the Blue light spectrum); Balanced or neutral wavelengths is 3500 to 3600 K and is in the Green spectrum; and the Red spectrum is more in the Warm spectrum measured at < 3000 K. High pressure sodium (HPS), incandescent (I), and compact fluorescent (CF) lights have a color temperature in the area of 2100 - 2700 K which would be warm, and metal halide lights is 3700 to 4000 K would be more neutral. Fluorescent lights depend on the phosphor coating used and can be cool for daylight fluorescent (6300 K), warm white fluorescent (2700 – 3200 K), or cool white fluorescent with a rating of 4100 K (Darre and Rock, 1995). Two of the more important metrics used to compare light sources are rated life (operating life in hrs) and efficiency (rated lumens or intensity per watt). In the following Table, comparisons of rated life and efficiency are given for the different light sources. As you can see, great economy and effective use of light sources can be gained by choosing a good match to meet the growing or breeding demands of your birds. Equivalent performance with energy savings has been shown in the broiler industry by using more efficient lighting (Simpson et.al., 2009).

Table 1. Light Sources and their features

	I	**CF**	**HPS**	**CCFL**	**LED**
Initial Cost	Low	Moderate	High	High	High
Operating Cost	High	Moderate	Low	Very Low	Very Low
Efficiency*	8-24	50-69	51-132	150+	150+
Rated Life (hrs)	500-2000	10,000+	24,000+	25,000+	100,000+

Color Temp (K)	2500K	2700K	2100K	Variable	Variable

I = Incandescent; CF = Compact Fluorescent; HPS = High Pressure Sodium Vapor; CCFL = Cold Cathode Fluorescent; and LED = Low Emission Diode.

***** Efficiency is measured as the rated lumens per watt.

Light intensity is usually measured in units of foot candles or lux. One foot candle is equal to 10.76 lux. Most people can measure light intensity by purchasing a light meter from a local camera shop. Care should be made to measure the light intensity at bird eye/head level and not at your waist or just underneath the light source. If you have natural daylight coming into the area that you want to measure, then a night time measurement can be made to determine the proper intensity for your birds. Light intensity for growing birds traditionally is quite low – less than half a foot candle. This allows for the birds to be calm and reduces aggressive behavior toward one another. While light the first day is necessary for the birds to find feed and water, the lights are reduced to a minimum level during the time they are brooded inside. No optimum light intensity for laying upland game breeders has been established nor has the minimum intensity to cause light stimulation. However, good production has been reported for breeder pheasants and partridges given 5 – 10 foot candles, measured at bird level. Some producers have expressed that a higher light intensity (5 – 10 foot candles) is needed to induce adequate lay for the first cycle of egg production but a lower light intensity (2 – 3 foot candle) after the hens have experienced at least one cycle of lay.

Continuous light of 13 to 16 hours per day is generally adequate for optimal stimulation of upland game bird breeders. Amounts in excess of 16 hours are a waste of energy. Some operators will stimulate birds early with 13 – 14 hours of light and then increase the day length 15 minutes a week until they reach 16 hours of light per day. Little information is available on the use of intermittent lighting programs for egg production in game birds. Intermittent lighting is a system of varying periods of light and dark in a cyclic manner over 24 hours in contrast to continuous lighting. One example commonly used in broilers is 1 hr on: and 3 hours off. It has been found with most birds that 15 minutes of light per hour will stimulate the bird in thinking that the light has been on the whole hour. A bird will usually key on the longest time period that the light is off to determine its' reproductive cycles – release of eggs. The intermittent lighting has been successfully used in growing of birds to stimulate meal feeding and shown in broilers chickens to improve feed efficiency while maintaining growth rate. It has been used for some laying birds but the schedule must be flexible enough for egg collection, breeding and other activities that occur on a laying facility to be successful. To use an intermittent lighting system, a producer needs to have light tight buildings, adequate feeder

and drinker space, and good management to carryout routine management during the times when the lights are on.

The law of lighting for birds is two fold:

1. **Never Increase** the duration or intensity of light during the growing period; and
2. **Never Decrease** the duration or intensity of light during the egg production period.

This means that during the growing period, normally light is either decreased during the first week or is started at a low level to allow birds to find feed and water, but not to excite or cause aggressive behavior and to keep them calm. Often producers will decrease the day length from a 23 or 24 day length to a level that they will maintain through the growing period that will matches the outside day length when the birds are put outside. Likewise with birds that are stimulated to lay. Normally, breeder candidates will be grown on day lengths of around 8 hours of light per day for 6 to 8 weeks prior to light stimulation and then boosted incrementally during a two week period to 13 or 14 hours of light per day. Care is taken to make sure that the light the breeder candidate is exposed to never decreases in duration or intensity from that time until the end of egg production.

Pheasants, chukars and Bobwhite quail respond best when they are at least 30 wks of age provided they have been preconditioned under short day photoperiod of 8 hours per day for a period of 6 to 8 weeks. Males respond more slowly than females and must be given stimulatory light two weeks in advance of the hens in order that both reach sexual maturity at the same time. The onset of lay for chukars and pheasants requires 18 – 21 days after given stimulatory light. About ten days later the flock will attain a 50% rate of lay. Coturnix quail females begin to lay at 35 days of age and therefore need a lighting schedule modified to meet their production and hormonal needs.

Pheasant, partridge and turkey hens will become refractory (non-responsive) to long day lengths or increases in day length (>13 hrs) after several weeks of laying eggs. In order to recycle these birds for another season, it is necessary to decrease day length, which will cause egg production to stop, and expose them gradually to a light : dark cycle of around 8 hrs Light: 16 hrs Dark per day for a minimum of 8 to 12 weeks before stimulation. This period allows the bird to go through a molt and build up nutritional reserves and health to allow the hen strength to prepare physically and hormonally to go through another laying season.

Lighting is an important part of the management of upland game birds. Understanding lighting and its effects on your growing and breeder birds can help you to be more productive and

efficient in producing a quality product. Other helpful advise can also be gleaned from the "Bob white Quail Production and Management Guide " (Dozier, Bramwell, and Hatkin, 2009).

References:

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