Utilising efficient broiler production with optimal lighting

Efficient broiler production requires an optimal environment and therefore an optimal light climate.

An ideal broiler environment consists of correct ventilation and the right humidity and temperature at each phase. Lighting, however, is generally underrated in broiler management, even though lighting controls the biological clock.

Dusk, dawn, day and night are part of a normal biorhythm, which is a necessity for animal welfare and efficient production.

Stimulating an optimal biorhythm is only possible throughout proper lighting management.

by HATO Agricultural Lighting, Sittard, The Netherlands. www.hato.lighting

Due to 40 years of experience HATO BV is an expert in agricultural lighting. All the knowledge compiled in the HATO Light Academy provides lighting solutions for literally everyone. Light is a powerful external stimulus which must be applied efficiently.

Lighting-related issues

Bad lighting can cause various problems in broiler production. Footpad lesions and dermatitis can be indirect results of incorrect lighting as they are caused by bad litter. Bad distribution of broilers in a production house can cause bad litter, in turn broiler distribution is affected by the light spread and resulting light distribution.

A bad light distribution increases the chance of clustering and may decrease uniform growth, see Fig. 1.

Bright spots, shadows and resulting clustered broilers increase the chance of degradation of litter. Light distribution must always be as uniform as possible.

Other unwanted (aggressive) behaviour may be caused by a wrong light climate, specifically a wrong light spectrum. An inadequate light program may unintentionally increase mortality rates.

Optimising the light climate is a necessity to prevent an unwanted decrease in broiler production efficiency.

Broiler vision

To prevent lighting-related issues in broiler production, the provided light climate must meet broiler demands. One of the most important aspects of the broiler's light climate is the light spectrum. The light spectrum must always correspond to the broiler's need. Broilers perceive light in different ways than humans and are affected likewise.

Due to the difference between our eyes, broilers see the world differently than we humans do. Eyes contain cones and rods, these are photoreceptor cells. Cones are responsible for sight in photopic, well-lit, conditions. Cones realise colour vision. Poultry have four different kind of cones, whereas humans have three different kind of cones. The human eye is most sensitive to the colour green. Poultry however are sensitive to green, red, blue and (ultra)violet light. The sensitivity peak of both humans and poultry in the green spectrum can be explained by their primary habitat, the forest. The sensitivity peak in the violet spectrum indicates that poultry can even see UV-A.

Spectral sensitivity

The difference in spectral sensitivity, as shown in Fig. 2, indicates that

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Fig. 1. Ratio between light distribution, clustering and uniform growth.

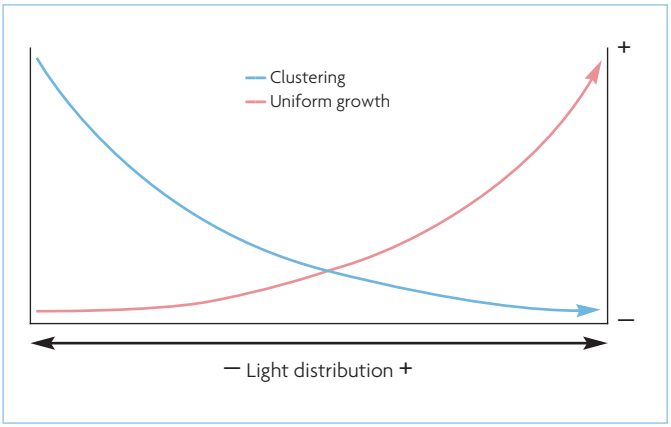
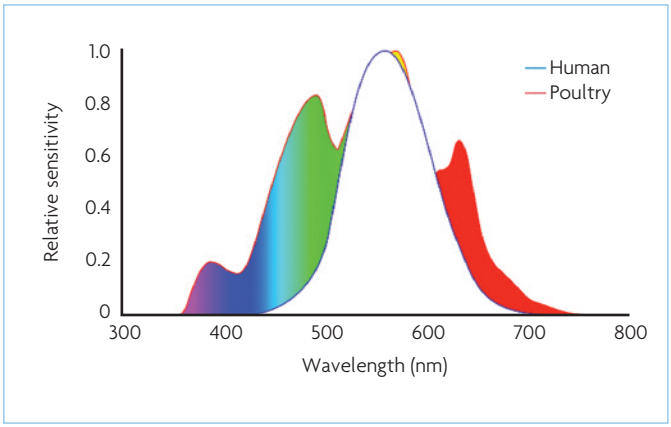


Fig. 2. Relative spectral sensitivity of poultry.



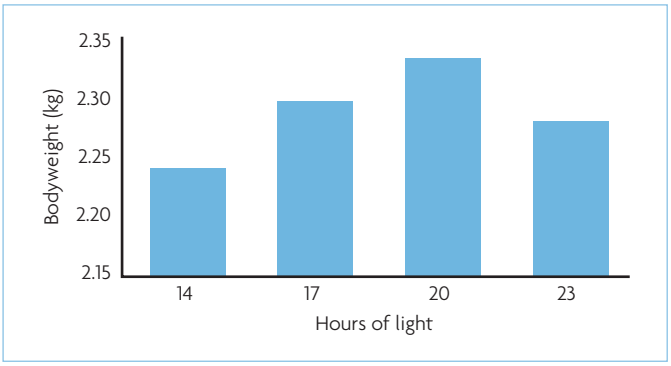


Fig. 3. Impact of daylength on bodyweight.

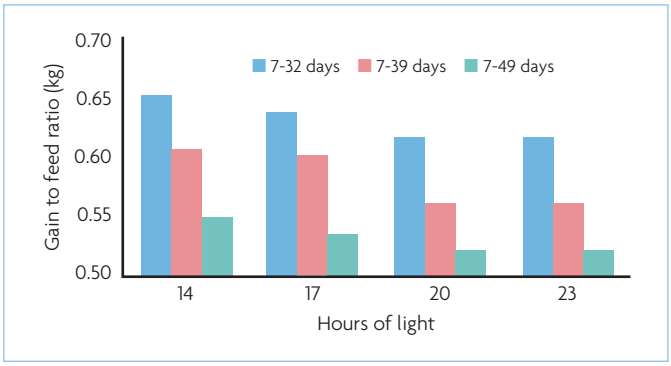


Fig. 4. Impact of daylength on gain to feed ratio corrected for mortality.

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light intensity perceived by poultry is higher than light intensity perceived by humans. Almost every part of the spectrum is perceived higher by poultry than by humans. This is why poultry perceive light differently than humans.

This means different spectrums lead to a different outcome in intensity perception. Keeping this in mind, the unit for light intensity – lux – is not suited for measuring light intensity for poultry.

Two different spectrums may both lead to measurements of 40 lux, however one can be perceived as 40 lux by poultry and the other can be perceived as 50 lux by poultry.

Therefore gallilux is the more appropriate unit for measuring light intensity as poultry perceive it.

Photoreception

Broilers receive light through the eyes and this affects the photoreceptors in the retina. Light which enters the eyes affects behaviour and internal processes. Light passes through the skull as well where it affects photoreceptors in the hypothalamus, the pineal gland, the preoptic area and the lateral septal organ. Light that reaches these 'deep-brain' photoreceptors affects the biological processes within the broiler.

Light regulates the biological clock and the pituitary gland, in turn affects the regulation of growth hormone and the broiler's metabolism through the thyroid glands. Lighting affects both behaviour and internal processes and is therefore an extremely important part of the provided environment.

Adaptation

To prevent lighting-related issues the first step is to realise optimal adaptation to the new environment. Lighting is an external stimulus which aids broilers in adapting to their new environment. A well-lit environment helps broilers in finding feed and water during the first 24 or 48 hours.

Finding water in particular is really important during the first 24 hours due to a lack of access to water during transport.

A well-lit environment consists, apart from a suitable level of light intensity, of a light spectrum which focuses on the needs of the broiler. A light spectrum close to that of natural daylight would be most optimal taking into account broiler vision. A light spectrum complying to the needs of broiler vision consists of all – for chickens – visible wavelengths and the right volume of those wavelengths.

When taking into account the deep-brain photoreceptors and the corresponding lighting needs, either a warmwhite light source or a coldwhite light source can be applied.

Colour temperature

Broilers do not need a high volume of red wavelengths – warmwhite light source – throughout the entire cycle for optimal production, on the contrary to laying hens which need to get sexually stimulated. It is suggested that broilers desire a proper amount of red wavelengths during the brooding period for early growth.

This is generally made up for by applying a high light intensity during the first 24 or 48 hours. A coldwhite light source, which consists of less red wavelengths may therefore be sufficient as well. However, feedback from practice shows broilers grown to heavy weights – more than 3kg – may in some cases thrive better in warmwhite light sources.

A light source capable of fluctuations in colour temperature, much like the sun, would be a very suitable solution to simulate natural daylight.

Light management

To acquire optimal adaptation and optimal production, more is needed than the right light source and a good light spectrum. A good lighting system must be accompanied by good light management. Good light management consists of the right photoperiod and light intensity during the production cycle.

Research has shown that a long photoperiod during the brooding period is beneficial for adaptation to the new environment, providing the chicks with enough time to find feed and water.

After the brooding period the photoperiod should be decreased to 18 hours of light. A longer photoperiod will increase mortality, animal welfare and the electricity bill. A shorter photoperiod will decrease growth.

During the brooding period a light intensity of at least 40 lux should be applied to accompany the long photoperiod in aiding the chicks with finding water and feed.

After the brooding period the light intensity can be decreased to a light intensity of 5-10 lux which is sufficient for optimal growth. There are however other light programs which may be effective as well. Lighting management is always subject to local legislation.

Conclusion

Since light is an extremely powerful external stimulus, providing an optimal light climate to broilers is a necessity. Simulating natural daylight will realise good vision and will foresee in the needed wavelengths for biological processes. Providing an uniform light distribution helps in preventing bad litter and consequently health problems.

Applying the right light management is important. The right light program, including the right light intensity and photoperiod at the right time is needed to optimise overall production and to secure animal welfare. Remember, light proves to be a valuable asset of your climate management. ■

Table 1. Expression of natural behaviour corresponding to the amount of hours of light per day.

	Hours of light			
	14	17	20	23
Inactive resting	+	+	-	-
Walking	+	+	-	-
Standing	+	+	+	-
Feeding	+	+	-	-
Drinking	+	+	+	-
Preening	+	+	-	-
Dustbathing	+	+	+	-