THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212

Popular Article

November 2024 Vol.4(11), 5223-5227

Effect of different lighting programmes on poultry production

I.U.Sheikh, S. S. Nissa and B. Zaffer
Division of Livestock Production and Management
Faculty of Veterinary Sciences and Animal Husbandry
Sher e Kashmir University of Agricultural Sciences and Technology of Kashmir, Shuhama,
Jammu and Kashmir, Srinagar-190006, India

Introduction

The effect of lighting on poultry is a topic that has been studied for decades. Lighting is a powerful exogenous factor in the control of many physiological and behavioral processes. Light allows the bird to establish rhythmicity and synchronize many essential functions, including body temperature and various metabolic steps that facilitate feeding and digestion. It is integral to sight, including visual activity and color discrimination (Manser, 1996). Of equal importance, light stimulates secretory patterns of several hormones that control, in large part, growth, maturation and reproduction (Olanrewaju *et al.,* 2006). Light is considered as an important environmental factor for bird vision and modulation of physiological condition, growth performance, behavior and immune response (Rozenboim *et al.*, 2004; Xie *et al.*, 2008). Environmental factors are one of the critical factors associated with poultry production. Light is one of the major microclimate factors in poultry production that greatly influences the growth and development, behaviour, physiological functioning, immune response, and growth rate of the birds (Zheng *et al.*, 2013; Yang *et al.*, 2016). Light is composed of a broad spectrum of electromagnet (EM) waves. The visible portion of the EM spectrum is relatively small and is composed of wavelengths from roughly 350 to 800 nm. The importance of light for poultry can be understood from the fact that combined weight of both their eyes is same as their brain (Appleby *et al.*, 2004). Good poultry lighting is adapted to suit the poultry type and how it is housed. As a result, it improves performances and reduces costs.

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com

Published 30/11/2024

Since light bulbs were invented, the primary source of lighting for avian of all types has been incandescent lighting. Over the last three decades and increasing dramatically in recent years, different types of lighting have been introduced into houses and poultry barns as well.

Perception of light in poultry

The perception of light is quite different in poultry. The poultry can perceive light in different, non-pictorial ways. There are three key photosensitive areas: (1) Retina – In the retina, photons are absorbed by photo-pigments rhodopsin (rods), iodopsin (cones) and melanopsin. (2) Pineal Gland - Photon absorption is achieved by functional photoreceptors located in the pineal gland on the top of the brain. (3) Hypothalamus - photon absorption by deep encephalic photoreceptors. The photoreceptors located in several parts of the brain can receive light energy transmitted through skull and tissues, which are involved in transduction of photo stimulation. The pathways through which these phenomena exert their effects through the hormones serotonin and melatonin, which go on to affect other endocrine functions and diurnal patterns are well known and include locomotor activity, deep body temperature, migration and seasonal breeding.

Light perception for reproductive processes does not depend on eye photoreceptors. It was demonstrated that photoreceptors in the hypothalamus are biological transformers that convert photon energy into neural impulses. These impulses affect the endocrine system that controls ovarian activity in females, and therefore, their reproductive and behavioral functions and secondary sexual characteristics (Morris, 1973; Etches, 1994). The visual ability of birds is far superior to human as their colour vision extends to the UV region (Honkavaara *et al.*, 2002) and can view up to 330° (Prescott and Wathes, 1999). Color vision comes from cone cells in the retina that interpret and send signals to the brain. Aves typically have five types of cone cells including a double cone which allows them to see in the ultraviolet spectrum.

Importance of light in poultry production

Over the years, poultry production and management has become highly specialized to optimize bird performance and maximizes the profit. Artificial lighting has been an important component of poultry production extensively studied over the past fifty years as producers have sought to increase muscle gain, egg production while maintaining an efficient feed conversion ratio, bird health and wellbeing. Growth and well-being of the bird is influenced to a great extent by the three components of light which plays an important part in bird development and performance. These components are:

1) Intensity of illumination (lux)
2) Photoperiod, or the timing of the dark and light periods within a repeatable cycle; and
3) The wavelength or color of the light emitted.

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 30/11/2024

Light manipulation has been an effective measure to improve the production performance in poultry. On the one hand, poultry have highly specialized visual systems and the majority of their behavior is mediated by vision. Second, light is in control of many physiological and behavioral processes of poultry. Circadian regulation of energy homeostasis is controlled by an endogenous biological clock, located in the superchiasmatic nuclei (SCN) of the hypothalamus that is synchronized by photic information that travels directly from light-sensitive ganglion cells in the retina to the SCN, thereby entraining individuals' physiology and behavior to the ambient light. Importantly, light is a powerful exogenous factor entraining signal for circadian clock, although other factors such as food consumption influence clock signaling. Layers use circadian rhythms to perceive the duration of the day and they are most sensitive to light between 11 and 15 hours after the light is turned on. During this photosensitive phase, a neural-hormonal mechanism controls the reproductive functions (Boni and Paes, 1999). Therefore, light plays a vital role in affecting the growth and the development of poultry.

Light requirements

Light requirements vary according to the type of birds to be reared and the stages of rearing period. e.g. in case of chicks (0-8 weeks of age), 23 hours of light is required and one-hour darkness provided, lights required for chicks to visualize feed, water and free movements of birds. One hour of darkness is provided to adopt the birds in case of power failure. During grower phase the light is slowly reduced to 8 or 9 hours to prevent the birds from early maturity which is called step down lighting programme. If the day length is sufficAgain during pre-laying phase just before shifting the birds to layer houses the light is slowly increased and provided 16 hours of light for optimum egg production. This increasing light schedule is called step up lighting programme.

Effect of light on performance: the performance of birds is greatly influenced by the intensity of light, duration, color, sources etc. which are provided during rearing period. They also influence the behaviour and wellbeing of the birds. If there is bright light in the poultry houses then some vices may develop among the birds. During winter the day length decreases, then artificial light should be provided to meet the exact light requirements of the bird to reach the optimum performance.

High poultry performances

By fulfilling the needs of the type of poultry, good poultry lighting improves performances in many ways. For example:

- Increased egg production
- Better feed conversion rate
- Improved growth

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 30/11/2024

Low poultry-related costs

Optimal lighting makes poultry feel and perform better. This reduces various poultry-related costs:

- Fewer floor eggs
- Decreased mortality
- Lower antibiotic costs

Light levels (intensity or illuminance) and the duration of light (photo period) are important factors in poultry production. Intensity has an effect on cannibalism and aggression, along with feed and water intake, while photo period influences reproductive and egg production cycles, total feed intake, and growth rate. Light intensity at the working plane (bird level, egg collection table, work-bench level, etc.,) is measured in lux or foot-candles (10 lux equals about one foot-candle).

Typical light levels found in broiler and layer operations are about 10 to 20 lux (1 to 2 foot-candles), while a bright sunny day in mid-summer is about 80,000 lux (8,000 foot-candles). Variation of the photo period is used to stimulate egg production in pullet flocks for both breeding and commercial layers. In broilers (chickens and turkeys), several different lighting programs are being studied to help improve skeletal development through feed intake. All lighting programs that use more hours of darkness than the hours of darkness during natural day length require light traps on fans and air inlets. Light intensity is affected by many variables: lamp type (i.e., incandescent versus fluorescent, versus high pressure sodium, versus metal halide, versus low pressure sodium, etc.); reflectance of the floor, walls, ceiling; height of the lamp fixture above the working plane; dirty conditions, and maintenance schedule. Incandescent or fluorescent fixtures are the most common in poultry facilities.

Conclusion

Light is one of the most important factors after genetics and nutrition in poultry production**.** Welfare and behavior of broiler is strongly affected by light intensity. Light being one of the major microclimatic factors for poultry production is largely an unexplored production input that will enable producers to increase production at a reduced cost with less stress on the environment. By taking advantage of the unique spectral requirements of poultry, farmers can reduce stress and mortality, regulate circadian rhythm, and substantially increase the production of eggs and meat, while dramatically reducing energy use and other input costs. Darkness is as important to growth and health of broilers as that of light. Therefore, appropriate selections lights will help to maximize the production of birds at minimum cost as well as welfare issues of the birds.

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 30/11/2024

References

Appleby, M. C., Mench, J. A. and Hughes, B. O. (2004). Poultry behavior and welfare. *CAB International: Wallingford UK.*

Boni, I.J. and Paes, A.O.S. (1999). Light program for matrices: males and females. Proceedings of the Technical Symposium on Broiler Dairy Matrices; Florianópolis, Santa Catarina. Brazil.pp.17-39.

Etches, R. J. (1994). Luminous stimulus in reproduction In: Pinheiro, M.R. Physiology of breeding birds. Campinas: FACTA. p.59-75.

Honkavaara, J., Koivula, M., Korpimaki, E., Siitari, H. and Viitala, J. (2002). Ultravoilet vision and foraging in terrestrial vertebrates. *Oikos* **98:**505-511.

Manser, C.E. (1996). Effects of lighting on the welfare of domestic poultry: A review. *Animal Welfare* **5**:341-360.

Morris, T. R. (1973). The effects of ahemeral light and dark cycles on egg production in the fowl. *Poultry Science* **52**(1):423-445.

Olanrewaju, H. A., Thaxton, J. P., Dozier, W. A., Purswell, J. L., Roush, W.B. and Branton, S. L. (2006). A review of lighting programs for broiler production.

Prescott, N. B. and Wathes, C. M. (1999). Spectral sensitivity of the domestic fowl (*Gallus g.domesticus*). *British Poultry Science* **40**: 332-339.

Rozenboim, I., Biran, I., Chaiseha, Y., Yahav, S., Rosenstrauch, A., Sklan, D. and Halevy, O. (2004). The effect of green and blue monochromatic light combination on broiler growth and development. *Poultry Science* **83**: 842-845

Xie, D., Wang, Z. X., Dong, Y. L., Cao, J., Wang, J. F., Chen, J. L. and Chen, Y. X. (2008). Effects of monochromatic light on immune response of broilers. *Poultry Science* **87**:1535–1539.

Yang, Y., Yu, Y., Pan, J., Ying, Y. and Zhou, H. (2016). A new method to manipulate broiler chicken growth and metabolism: Response to mixed LED light system. *Nature Science Report* **6**:25972.

Zheng, L, Ma, Y.E., Gu, L.Y., Yuan, D., Shi, M.I., Guo X.Y and Zhan, X.A. (2013). Growth performance, antioxidant status, and nonspecific immunity in broilers under different lighting regimens. *Journal of Applied Poultry Research*.**22**:798-807.

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 30/11/2024