CPRC Update – Optimizing Lighting for a Precision Broiler Breeder Feeding System

Uniformity of body weight within a breeder flock remains a key challenge faced by the hatching egg industry. Broiler breeders are genetically selected for increased growth rates, which is associated with an increased appetite. Reproduction in broilers breeders is impeded unless their growth is constrained, which has resulted in the implementation of feed restriction strategies that may not allow for coordination of nutrient requirement and nutrient supply in non-uniform flocks. Dominant birds tend to eat more and become overweight while subordinate birds remain below target weight and poor flock weight uniformity may result in low reproductive success.

A Precision Broiler Breeder Feeding System (PBBFS) has been developed by Dr. Martin Zuidhof from the University of Alberta. The PBBFS is a feed restriction system that allocates feed to individual birds based on their body weight in real time. Validation studies show that implementation of the PBBFS is capable of meeting birds target body weight profiles and obtaining increased flock uniformity, producing flocks that will respond uniformly to photostimulation (CPM December 2015), a management strategy used to initiate reproduction.

Light detection in poultry is facilitated by photoreceptors which are specialised neurons capable of converting light to electrical signals. Photoreceptors are present on the retina within the eye and the pineal gland and hypothalamus which are located within the brain. Detection of light through retinal photoreceptors regulates behavioural patterns, whereas hypothalamic photoreceptors control the reproductive axis. It is possible to adjust lighting programs to specifically manipulate behavioural patterns and/or the reproductive axis. Dr. Gregoy Bedecarrats, from the University of Guelph, has developed a lighting spectrum LED light bulb (with 60% red spectral output), used for specific applications within the poultry industry. Validation studies show that this LED light bulb triggers rapid sexual maturation and promotes high peak production in layer hens (CPM November 2015). Drs. Zuidhof and Bedecarrats are cooperating on research combining precision feeding and lighting to optimize broiler breeder performance.

The Approach

To facilitate the application of the PBBFS within a commercial flock, the amount of time birds have access to the PBBFF would need to be increased. This could be achieved by providing a non-photostimlatory auxiliary light during the dark phase.

Thus the objective of the research is to provide sufficient light for broiler breeder pullets to maximize access to the PBBFS (24 hours a day) without activating the reproductive axis of the birds prior to them reaching target weight/age nor delaying sexual maturation as a consequence of being exposed to long photoperiod during the juvenile stage. Additionally, determination of the optimal combination of main barn and auxiliary light spectrum, intensity and photoperiod will be studied to increase reproductive success in broiler breeders. This research combines both precision feeding and spectrum lighting to enhance broiler breeder industry reproductive success.

The Experiments

Three overlying experiments were planned to accomplish the objectives of this research. The initial experiment will determine the effects of adding varying spectrum and intensity auxiliary LED lighting to tube feeders, in addition to using varying LED spectrum light bulbs in the main barn lighting system. The second experiment is to determine the effects of differing spectrum lighting as the main barn-lighting system throughout the production cycle in combination with switching the lighting spectrum prior to photostimulation. The final experiment will determine the effect of increasing the photoperiod during pullet rearing in addition to varying body growth profiles throughout the production cycle. Experiment three will determine if increased photoperiods will increase time allocation per bird to the PBBFS without impacting sexual maturation and egg fertility and hatchability. It will also determine if reproductive success can be maintained while reducing feed restriction during the rearing and laying phases.

Interim Results

Body growth profiles and egg production were measured in the initial experiment. Results show that main barn lighting spectrum had no effect on body growth profiles; whereas red LED light bulb spectrum made a significant increase to egg production during the early lay stage. Constant auxiliary red spectrum lighting induced a significant increase in body growth profiles and significantly delayed the onset of egg laying. These results suggest that constant exposure to red spectrum auxiliary lighting desensitized the reproductive axis, as there was a delayed response to photostimulation. Further hormonal analysis revealed that neither the main barn lighting spectrums, nor the auxiliary lighting spectrums had effects on plasma estradiol levels.

The Next Steps

The second and third experiments have been initiated and are ongoing. Outcomes based on preliminary findings show increasing success in implementation of the application of the PBBFS and fundamental findings of light spectrum influences within a commercial flock of broiler breeders throughout a production cycle.

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