

LIGHTING PROGRAMS AND COBB 500 BROILER PERFORMANCE

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Surveys of broiler lighting programs around the world reveal a plethora of entrepreneurial lighting regimes. To discern which broiler lighting program should be implemented, there are several critical factors a producer should consider. This paper attempts to answer the following questions: What are the specific benefits of such programs? Are breed differences seen in their responses to broiler lighting programs? How should the program be adjusted for open-sided curtain houses vs. solid sidewall housing? Should a lighting program be adjusted based on average daily gains? What are the animal welfare benefits of broiler lighting programs?

Canada and Europe have led much of the research effort in developing specific lighting programs, particularly in solid sidewall housing. This work done in solid sidewall housing has generally been applied to poultry operations in more northern latitudes. Meanwhile integrators in the United States have, during remodelling or expansion efforts, also migrated towards dark curtain or solid sidewall housing. Clear curtain sidewall housing however, still remains in prevalent use throughout the US industry and much of the rest of the world. Broiler producers with clear curtain or open sidewall housing are restricted in lighting alternatives and are forced to design programs around the limitations of natural daylight/length. To address the unique differences of these two scenarios, this paper provides examples of lighting programs for both open sidewall and solid sidewall housing.

The benefits of broiler lighting programs on improved performance as measured by improved livability, average daily gain (ADG) and calorie conversion or feed conversion rate (FCR) are well documented.

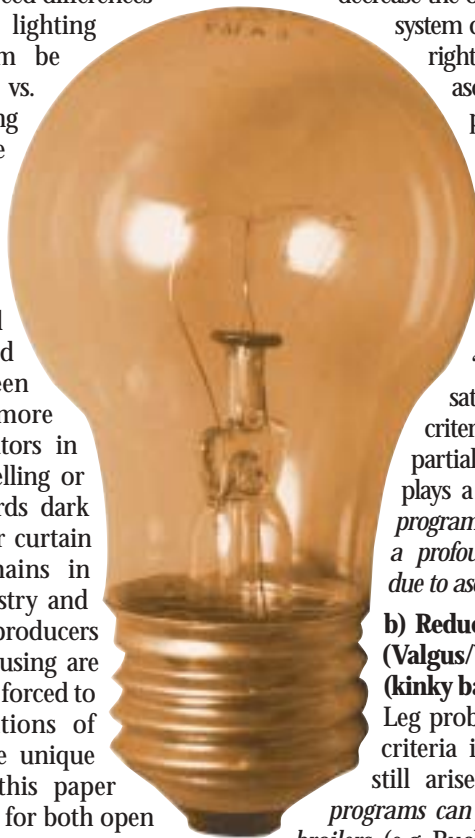
Lighting programs improve livability by decreasing mortality as spelled out in the following partial list of causes:

a) Reduction in mortality due to ascites (water-belly) and sudden death (flip overs)

Ascites has a complex etiology with contributing factors such as genetics, temperature, altitude and ventilation. Any condition that may increase the oxygen demand at the tissue level or inversely decrease the oxygen carrying capacity of the circulatory system can result in pulmonary hypertension and right heart failure with the clinical sign of ascites. (Julian, R.J. 1993) To counter this, primary broiler breeders have aggressively selected against ascites for over a decade. Ascites resistance has successfully been selected for, while geneticists continue to improve average daily gain (ADG). Tools used at Cobb-Vantress in the selection process against ascites include full broilerization and routine use of the "pulse oximeter" to measure blood oxygen saturation with results applied as a selection criterion. While genetic resistance has been partially successful, broiler management still plays a role in avoiding ascites. *Light restriction programs for broilers are established as having a profound effect in ameliorating late mortality due to ascites.*

b) Reduction in mortality due to leg problems (Valgus/Varus deformities, Spondylolisthesis (kinky back), rotated tibia)

Leg problems have been an important ongoing criteria in genetic selection but problems can still arise. *It is well documented that lighting programs can reduce the incidence of leg disorders in broilers.* (e.g. Buckland et al., 1973, 1974; Buckland, 1975; Classen and Riddell, 1989; Simons, 1982, 1986; Wilson et al., 1984; Simons and Haye, 1985; Ketelaars et al., 1986; Renden et al., 1991, 1996). Research by Sorenson et al. (1999) seemed to refute earlier research on the benefits of moderated photoperiods for broilers during the first three weeks. **However**, broiler companies and other researchers extol the virtues of lighting programs and the benefits for prevention



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of leg problems due to Valgus/Varus deformities (VVD) in particular (Classon and Riddell, 1992). A Denmark study (Sanotra et al., 2002) demonstrated a significant reduction in the prevalence of impaired walking ability (corresponding to (Bristol) gait score >2). In this study, broilers reared with a light-dark program were compared to broilers under constant light. These researchers concluded that the light-dark program in this study not only reduced leg problems but also reduced chronic fear in the birds. Selection for ADG with concomitant selection for musculoskeletal integrity has been the practice of Cobb geneticists for many years. Selection for increasing ADG does not necessarily lead to development of musculoskeletal problems. Genetic selection against musculoskeletal problems and management interventions such as broiler lighting programs and/or feed restriction programs offer a manageable solution to welfare concerns in this important area.

c) Reduction in spiking mortality

Lighting programs have been shown to minimize the effects of spiking mortality syndrome. Controlled amounts of light/darkness can ameliorate much of the hypoglycemia, mortality and runting-stunting associated with spiking mortality syndrome of chickens. (Davis et al., 1996)

d) Improved immunocompetence

The light/dark period or diurnal rhythm of the typical broiler lighting program increases melatonin production. Melatonin influences development of immunocompetency. (Moore and Siopes, 2000). Enhanced immunocompetency is a recognized benefit in broiler production. Cobb geneticists, Cobb veterinarians and consultants comprise the Cobb immuno-genetics committee whose focus is the immunocompetence traits of Cobb breeding stock. In addition to immuno-genetic factors, *the added benefit of a light/dark period on development of the immune system should not be underestimated.* The practice of offering additional light stimulation in an effort to make up for a lack of genetic potential in ADG may actually impair immunocompetence and negatively impact calorie conversion or FCR. A decision must be made as to the appropriate lighting program considering all objectives.

Benefits of Lighting Programs

Improvements in ADG and FCR with broiler lighting programs are well documented by research institutions and the poultry industry. Increasing livability accounts for a portion of improved FCR. Any decrease in late mortality ameliorates the loss of feed calories by those birds that succumb. Likewise, we can improve FCR and ADG by repartitioning the number of calories expended for bird activity to calories available for gain (Beker, A. et al., 2003). The caloric sparing effect of the resting response as influenced by a lighting program is evident in current research from Oklahoma State University with the Cobb broiler. (Teeter, R. unpublished data). Moderate bird movement or exercise is desirable for the benefit of leg strength. However, too much bird activity wastes calories and may result in bird injury or downgrades evident at processing. This excess of activity can be controlled through lighting.

A Word of Caution

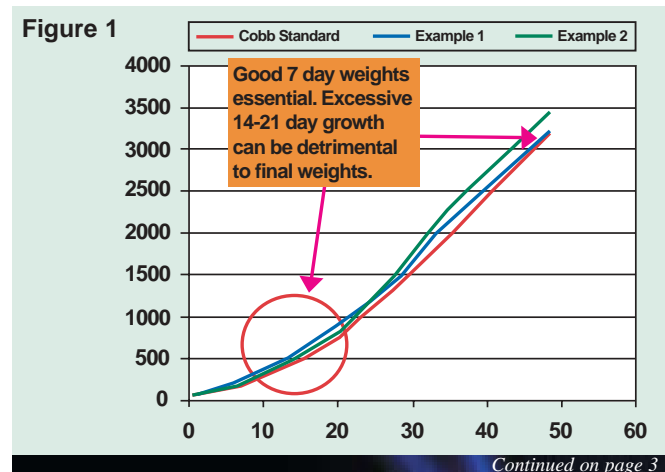
Average Daily Gain (ADG) may be impaired with restrictive lighting programs under certain conditions. Growers experiencing difficulty with average daily gains may not fare well with the longer dark periods. Careful observation of the factors involved in performance are critical and upon study may require customization of lighting programs to achieve desired benefits.

In addition to genetics, the variables of feed nutrient density and management factors have a significant impact on the results of any lighting regime. For any given feed nutrient density, feed intake is a critical factor influencing ADG and FCR. While lighting programs influence feed intake it must be noted that as lighting adjustments are made, feed availability (feeder height adjustments, feed form, feeder management, etc.) becomes more critical. In some parts of the world, growers practice purposeful feed restriction to improve FCR and livability with good effect. However, accidental feed restriction is more common than many growers would admit and may result in frustrating impairments of performance or skin quality upon flock settlement.

The Basics

Lighting programs are typically designed with changes occurring at predetermined ages and tend to vary according to final market weight of the broilers. A more refined program utilizing weekly average weight gain data is worthy of consideration. It is recommended that growers have scales in place and consistently record weight data or average daily gain (ADG) information. However, most growers do not have accurate ADG information. The merit of gathering broiler weight data, at least weekly is to allow educated adjustments of lighting programs and determine the factors that compromise ADG. At first this seems a daunting task but there are efficient and practical means of weight data collection. Bucket (group) weighing may be used at young ages as a tool to make decisions on initial light restriction.

Figure 1. is shown to accent the need to control growth during the 14-21 day period. Excessive growth during this period may be detrimental to performance or mortality. Lighting programs are one tool to control growth during this period.



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When considering lighting programs as a management tool, both the amount of light and light intensity are factors that need to be considered when designing a successful program. Field data indicates that a minimum light intensity of 20 lux (2 FC) helps to stimulate bird activity during the first 5-7 days. Proper stimulation of activity during these first few days of life is needed to ensure that the chicks become properly acclimated to their environment and is essential for optimal feed consumption. Recent evidence suggests that 60 lux (6 FC) offers additional enhancement of early weight gains. At the onset of light restriction, light intensity can be decreased to between 5 and 10 lux (0.5-1.0 FC) for the balance of the grow out period incorporating a light intensity increase just prior to processing (10 to 20 lux or 1 to 2 FC). A general suggestion is to start light restriction at about 160 grams of weight. As a rule chick weights typically quadruple by 7 days of age. (Example: 40 gram chick x 4 = 160 grams.) If weights are less than expected, a one or two day delay in the onset of light restriction may help to enhance performance. Conversely, light restriction should commence at an earlier day of age if chicks reach this 160 gram weight prior to 7 days.

We recommend one block of darkness and that this darkness be given at night even in solid sidewall houses. Keep the "off time" the same for the entirety of the grow-out period. Feeding and drinking behaviour becomes established and moving the "off time" earlier will cause a significant decrease in feed and water consumption. It is the "on time" that should change as the amount of light hours change.

Examples below are for straight run (as hatched) weights and age and include examples for curtain-sided and solid sidewall or dark curtain conditions. Genetics, feed density, feed intake and management programs significantly impact results and must be considered when customizing the program. The challenge is to customize broiler lighting programs using strategic broiler weights to refine adjustments. The charts or examples show minimal lux recommendations and are based on the current average daily gains, not the desired ADG.

Lighting Programs for Open Sided Broiler Housing

- 1 Lighting programs involving natural light will be variable in their restriction of light depending on the time of the year and the latitude of the farm.
- 2 Light intensity recommendations are with artificial light only at the outside feed line.

55+ Grams (0.12 lbs) Average Daily Gain

Age (days)*	Wt. (gm)	Light (hrs)	Dark (hrs)	Light Intensity (lux)
0	40	24	0	20-60
1	48	23	1	20-60
6-7	160	Natural + 2		5-10
Days Prior to Slaughter:**				
20-15		Natural + 4		5-10
15-12		Natural + 6		5-10
10-6		23	1	5-10
Till Market		23	1	5-10 ---> increase***

50+/- Grams (0.11 lbs) Average Daily Gain

Age (days)*	Wt. (gm)	Light (hrs)	Dark (hrs)	Light Intensity (lux)
0	40	24	0	20-60
1	48	23	1	20-60
7-8	160	Natural + 4		5-10
Days Prior to Slaughter:**				
20-15		Natural + 6		5-10
15-12		Natural + 8^		5-10
10-6		23	1	5-10
Till Market		23	1	5-10 ---> increase***

45+ Grams (0.10 lbs) Average Daily Gain

Age (days)*	Wt. (gm)	Light (hrs)	Dark (hrs)	Light Intensity (lux)
0	40	24	0	20-60
1	48	23	1	20-60
8	160	Natural + 6		5-10
Days Prior to Slaughter:				
15-12		Natural + 8^		5-10
10-6		23		5-10
Till Market		23	1	5-10 ---> increase***

* Age at which to make light change.

** If thinning a flock, follow the program for the whole flock. After the flock is thinned, revert back to Natural Day Length plus 6 hours for the remaining birds. 6-7 days prior to kill of the remaining flock, increase light to 23 hours light:1 hour darkness.

*** 24-48 hours prior to catch, increase light intensity an additional 5 to 10 lux (0.5 to 1FC) to acclimate birds for catch.

^ Depending on the time of the year and the latitude of the farm, this additional 8 hours of light may equal 24 hours of continuous light; however adjust added light amount so that there is a minimum of 1 hour of darkness.

Lighting Programs For Solid Side Wall or Dark Curtain Broiler Housing

55+ Grams (0.12 lbs) Average Daily Gain

Age (days)*	Wt. (gm)	Light (hrs)	Dark (hrs)	Light Intensity (lux)
0	40	24	0	20-60
1	48	23	1	20-60
6-7	160	18	6	---> 5-10**
10-11	300	15	9	5-10
13-15	450	12	12	5-10
Days Prior to Slaughter:***				
15		15	9	5-10
12		18	6	5-10
9		21	3	5-10
6		23	1	5-10
Till Market		23	1	5-10 ---> increase****

50+/- Grams (0.11 lbs) Average Daily Gain

Age (days)*	Wt. (gm)	Light (hrs)	Dark (hrs)	Light Intensity (lux)
0	40	24	0	20-60
1	48	23	1	20-60
7-8	160	18	6	---> 5-10**
11-12	300	15	9	5-10
Days Prior to Slaughter:***				
15-12		18	6	5-10
12		20	4	5-10
9		21	3	5-10
6		23	1	5-10
Till Market		23	1	5-10 ---> increase****

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45+ Grams (0.10 lbs) Average Daily Gain

Age (days)*	Wt. (gm)	Light (hrs)	Dark (hrs)	Light Intensity (lux)
0	40	24	0	20-60
1	48	23	1	20-60
8	160	18	6	---> 5-10**
Days Prior to Slaughter:				
12-9		20	4	5-10
9		21	3	5-10
6		23	1	5-10
Till Market		23	1	5-10 ---> increase****

- * Age at which to make light change.
- ** Gradual dimming of light to 5 to 10 lux (0.5 to 1FC). If birds are brooded in partial house, wait until birds are in full house to begin dimming light.
- *** If thinning a flock, follow the program for the whole flock. After the flock is thinned, revert back to 18 hours light: 6 hours dark for the remaining birds. 6-7 days prior to kill of the remaining flock, increase light to 23 hours light: 1 hour darkness.
- **** 24-48 hours prior to catch, increase light intensity an additional 5 to 10 lux (0.5 to 1FC) to acclimate birds for catch.

Lighting programs employed around the world are not standardized and likely will never be. However, when one considers all of the variables involved in the rearing of broilers and the individualistic objectives of poultry companies, this is no surprise. Weight, feed intake and mortality data are needed to customize the lighting programs of the future.

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Research and the popular use of broiler lighting programs provide data and an endorsement of efficacy. Broiler lighting programs in concert with the proper genetics, environment, nutrition and management create the best in welfare for the animal and performance for the integrator.

The Cobb commitment to genetic improvement of the Cobb 500 continues to increase the performance potential in all areas of broiler and broiler breeder production. However, to attain both genetic potential and consistent flock production, it is important that the flock manager has a good management program in place. The success of the Cobb 500 broiler worldwide has provided considerable experience of the breed in a wide range of situations: hot and cold climates, controlled environment and open housing. This Cobb 500 Broiler Lighting Guide is designed to assist you in building your management program.

Management must not only meet the basic needs of the stock but must also be finely tuned to benefit fully from the breed's potential. Some of the guidelines may need to be adapted locally according to your own experience, and our technical teams will assist with this.

The Cobb Breeder Management guides highlight critical factors that are most likely to influence flock performance. Our recommendations are based on current scientific knowledge and practical experience around the world. You should be aware of local legislation, which may influence the management practice that you choose to adopt.

The Cobb 500 Broiler Lighting Guide is intended as a reference and supplement to your own flock management skills so that you can apply your knowledge and judgment to obtain consistently good results with the Cobb 500.



From Ireland, Matthew Wilson professional foundation was built from a comprehensive background in poultry production. Originating from production management, Matthew has progressed from a technical advisory position into technical services. Currently Matthew holds the position of World Technical Support Broiler Specialist for Cobb Vantress, Inc. With unflagging dedication, Matthew assists customers worldwide, helping producers to achieve the genetic potential of Cobb products.



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