The ***Alabama Poultry Engineering and Economics***

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Feature article

Controlling Light in Broiler Production

Many broiler companies now use lighting programs as part of their production program. Lighting programs are not new, and there are many variations. Growers often ask how important lighting programs are and what their benefits really are. This newsletter addresses the basics of lighting programs – outlining how and why they are being used today, along with giving information on techniques for darking out the broiler house and management of lights.

The Basics

Genetic selection for growth rate in modern broilers has given us birds that gain weight very rapidly, so we can grow birds to a given weight in much less time. One difficulty that is often seen, however, is that early in the growout, the modern-day broiler is likely to lay down muscle at the expense of skeletal development, heart and circulatory operations, immune response and livability. That is, we may produce heavy birds very quickly, but the flock is not as profitable as it should be because birds are developing leg problems and ascites (water belly), and do not have good livability, which means that feed efficiency can be seriously hurt. This presents a challenge in flock management. The industry must find a way to take advantage of this explosive growth capability, while still maintaining maximum performance at the end of the growout.

Keeping birds from growing too fast early in a growout pays off at catch time

One way that has been found to meet this challenge is by controlling the rate of early growth in the young chicken. This offers the opportunity for organs such as the heart, lungs, and skeletal system to develop before the rapid and dramatic formation of muscle tissue occurs. A well-managed program of early growth restriction generally improves feed conversion and livability, while decreasing ascites and leg problems. The methods used in the industry to accomplish this include a threefold combination of: (1) lighting programs, (2) low density feed, and (3) mild feed restriction.

Lighting programs are being widely adopted because they offer a means of controlling growth rate

Lighting programs in broiler production have evolved over the years, with success in improving live performance. The relatively recent and rapid improvement in broiler growth rate, however, has renewed interest in lighting programs as an aid in restricting early growth. Since withholding light is a mild form of feed restriction, lighting programs can be applied during critical periods in the broiler growout to limit or modify early growth and then capture compensatory gain in the latter part of the growout. The most effective lighting programs are applied in combination with early feed restriction, and provide more flexibility than feed/nutrient restriction via the diet used alone. Their use in the industry is now significant and increasing.

Lighting programs work best in combination with early feed restriction, and must be adapted to house type and management

Types of Lighting Programs

Significant efforts in research and field trials have led to three general types of lighting programs that take into consideration house design and management objectives:

1. 16 hours light: 8 hours dark;
2. Increasing light; and
3. Intermittent lighting.

The first two approaches have probably found the widest acceptance in the U. S. broiler Industry. In contrast, intermittent programs may disrupt labor management due to the short periods of light/dark cycles. Open-sided houses may limit flexibility in the light/dark cycle depending on the season and house characteristics. The intermittent lighting programs may also be more difficult to implement in a typical open-sided house with clear curtains.

It is imperative that the grower/producer work with the integrator when designing and implementing any lighting program. The program must be compatible with the characteristics of the housing, the feeding/nutrient program, target weight and general management regime. Data on light source and intensity also are best acquired from the integrator.

Some Typical Programs

Most lighting programs are started on day three. For the first three days, flocks are usually exposed to 23 hours of light and one hour of darkness to allow for adjustment to their surroundings and for finding feed and water. The hour of darkness acclimates the flock to darkness and prevents later piling in case of electrical failure. Light duration is then controlled from day four to five or six weeks, depending on target weight and duration of the growout. Recent research data suggests that in order to program the broiler for maximal performance later in the growout, the lighting program may need to be delayed to six or seven days in the started chick, instead of starting on day three. Most complexes require a long light period one to two weeks prior to processing.

Most lighting programs are started on day three or later, to allow chicks time to get adjusted to their surroundings

Typical programs used by major integrators in the Southeastern United States are presented on page 3. A wide variety of other programs exhibit minor variations, but the intended results are similar. Obviously, provided the expected results are obtained, the simpler the program and the lighting and control equipment, the better.

Fairly simple 16-hour light vs 8-hour dark programs have been successful, and can be used in conventional houses

One of the simple, initial lighting programs was similar to that used in replacement pullets and was designed around a 16-hour light and 8-hour dark cycle during some portion of the growout. Experience and research have led to variety of programs with subtle differences, many of which have been successful. Programs designed around conventional, open-sided houses may utilize natural light that ranges from 12 to 16 hours in Alabama, depending upon the season. Such programs are easy and economical in application, but lack flexibility during certain times of the year.

Some operations include one or more short periods of light during the dark period. This promotes flock activity and some feed and water consumption during the rest period. Also, adding small periods of light during the dark period limits the severity and duration of feed restriction, reducing the potential for breast blisters, and crowding or piling at the feeders which may occur when lights come on following longer periods of darkness.

Step-up programs, with severe early restriction, have been very successful in controlled-environment houses

Step-up lighting programs, characterized by severe early feed restriction, then increasing periods of light later in the growout, have proven to be quite successful. Such programs are most effective and manageable in environmentally controlled types of housing. The rather severe restriction during the dark period, followed by increasing periods of light, seems to trigger compensatory gain and a flush of hormonal activity that encourages growth, particularly in the male broiler.

Intermittent lighting programs with short phases of light/dark/light/dark periods have capitalized on feed savings, but require rather tedious management, may encourage litter consumption and would not be easily implemented in conventional, open-sided housing. Such programs may also impact feed and water consumption adversely because of effectively limited feeder space.

Housing Trends

Many companies now specify dark-curtain tunnel houses that can provide darkout during daytime

Because of the benefit of lighting or dark out programs many major broiler companies are now specifying a broiler house capable of low intensity light levels during the day. These “Class A dark-curtain tunnel houses” are built and equipped in such a manner to allow partial darkout during daylight hours. Light levels during dark periods can be as low as 0.5 foot candles. This is accomplished in part by the following modifications:

1. Lights in the house suitable for dimming
2. Dark out curtains installed on the house
3. Turning of ceiling dark side down to minimize light reflection
4. Use of ceiling type ventilation inlets vs sidewall inlets or installing hoods over side wall inlets.
5. Locating tunnel fans on sidewalls at end of house to minimize “light glow” when in tunnel mode.
6. Use of pad type cooling to block light from entering the tunnel air inlet.

Some Typical Lighting Programs Used in the Industry

The programs shown below are typical of programs being used by some integrators in the Southeast U.S. It should be noted that lighting programs are designed in combination with nutritional/feeding regimes, management practices, and housing and equipment specifications. Therefore, growers should adhere to lighting programs/recommendations as prescribed by their integrators, because they are interrelated with most other management and nutritional practices. The programs below are presented for illustration purposes only, not as recommendations.

Broiler Lighting Program #1

Days	Light (hrs)	Dark (hrs)	Intensity (lux)
0	23	1	20
1-2	20	4	20
3-4	18	6	20
5-14	6	18*	5
15-21	10	14*	5
22-28	14	10*	5
29-35	18	6	5
36-42	24	0	5

*Denotes addition of 1 hr light in middle of dark period.
(Program adapted from Classen and Goldkist, Inc.)

Broiler Lighting Program #2

Days	Light (hrs)	Dark (hrs)*	Intensity (lux)
0-3	24	0	5
4-7	18	6	5
8-14	14	10	5
15-22	16	8	5
23-28	18	6	5
29-processing	22	2	5

* Always start at same time of day
(From Light Control Housing - major integrator-USA)

Cornish/Roasters Lighting Program

Days	Light (hrs)	Dark (hrs)	Intensity (lux)
0	23	1	20
1-2	20	4	20
3-4	18	6	20
5-14	6	18*	5
15-21	10	14*	5
22-28	14	10	5
29-35	16	8	5
36-42	18	6	5
43-49	20	4	5
50-56	22	2	5
57-63	24	0	5

*Denotes the addition of 1 hr light in the middle of dark period.
(Program adapted from Classen and Goldkist, Inc.)

Note: 1 foot-candle = 10 lux approx.

Management of House Lighting

There is no doubt that there are economic benefits to lighting programs. For sure we are still refining the technique of light control for broilers. Based on current knowledge, growers need to be aware that there is value to them in the controlling of light and that the abandonment or any major modification of the lighting program specified by their integrator could have negative economic implications to them. A few of the most major misunderstandings in light program application would be items such as:

Lighting programs are tied to feed, nutrition, and other management practices, and must not be changed or implemented alone

1. Opening Class A darkout houses for natural ventilation during mild weather. Not only does this destroy the lighting program, but research has proven over and over that for best temperature control and performance the power ventilation mode of operation is the best.

2. Turning the lights up to very high levels for long periods of time frequently during the growout. While light is necessary for us to work our birds, make equipment adjustments, and do routine tasks in the house, we need to remember that for maximum benefits possible we need to disrupt the lighting program as little as possible.

The Bottom Line

Future research and field exploration should provide the broiler industry with more detailed data on the impact of various lighting programs on the health and immune status of the broiler and the impact on breast yield. While many integrators have not chosen to implement lighting programs, the increasing adoption of such programs in the broiler industry verifies that they can be of economic value. The table below compares performance data from continuous versus light/dark controlled growouts including millions of birds. Note that the light/dark program resulted in significantly better numbers in all performance categories. A further bottom-line benefit to the grower would be savings in electric costs for lighting.

Comparative Broiler Performance

Performance	Continuous Program	Light/Dark Program
Number sold	3,787,609	3,772,976
Livability(%)	95.93	96.38
Avg. weight (lbs)	5.03	5.09
F/C ratio	2.000:1	1.983:1
Adj. caloric conv.	2,769	2,730
% condemnations	1.05	0.87

From J. F. Davis et al, data presented at Alabama Poultry & Egg Association Alabama Broiler Industry Seminar, Auburn University, Sep-Oct 1997

For up-to-date information on poultry housing and ventilation topics, including publications, newsletters, pictorials and other items, check out the newly expanded Auburn University web page at *www.poultryhouse.com*

ALABAMA COOPERATIVE Extension SYSTEM

The Alabama Poultry Engineering and Economics Newsletter provides up-to-date information on topics of interest to poultry production personnel, focusing on most effective and efficient uses of modern technology and equipment, with a special emphasis on economic implications. The Newsletter is published six times a year, or as needed to address emerging or special issues. Contact: Jim Donald, Extension Biosystems Engineering, 228 Corley Bldg., Auburn University, AL 36849-5626, (334) 844-4181, fax (334)-844-3548, jdonald@acesag.auburn.edu. Published by:

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