Designing successful lighting programs for layers

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The genetic makeup of a layer variety determines its range of possible performance results. Within this genetically defined range, we can alter the production characteristics through our management systems to optimise those traits that are most profitable for our egg market. For example, in some markets, egg size is a very valuable trait, which needs to be maximised at almost any cost. In other cases, egg size is not particularly important and maximum egg numbers are desired. Depending on this preference, we can design the flock management to obtain the desired results.

Management tool

Lighting is one management tool that can be manipulated to maximise either egg numbers or egg size. Chickens are naturally responsive to changes in day length.

In the wild, they survived through evolution by laying their eggs for reproduction in the spring when the weather was good for raising young, and the day length was increasing. Physiologically, increasing day length stimulates hormone release in the brain, which starts the process of egg production.

Conversely, in the autumn, with decreasing day length, the hormone levels decline and the bird is signaled to stop egg production. Although today's layer varieties are bred for maximum egg output, this light responsiveness trait is still present and needs to be managed for optimum results.

Since our egg production needs are not seasonal, as the hens' production would naturally be, we have to use artificial lighting to counter the natural changes in day length and essentially make the hens think it is summer all year.

The basic rules of lighting are to keep lights constant or decreasing during pullet growing to prevent the flock from starting production too soon. Then, when maturity is desired, light stimulation is begun by increasing day length and light intensity. As adults, layers should never be exposed to decreasing day length.

In open housing it is necessary to plan the lighting program around the natural seasonal day length changes. For this purpose, it is useful to have a graph showing the sunrise and sunset times for the specific location over about 1.5 years. This provides the opportunity to plot any hatch date and plan the lighting program for the flock's entire life.

A closely related factor to be considered is the body weight at maturity, or first egg. The heavier the pullet is at maturity, the larger her egg size will be, not only initially, but for her entire productive life.

Likewise, underweight pullets at maturity will produce a relatively small egg size for their entire life. If we can hold a flock out of production with decreasing lighting, it will attain a larger body size before it starts production. So, by using lighting to influence age at maturity, we are really also influencing the body weight at maturity, and therefore egg size.

Standard lighting programs generally grow pullets to 18 weeks of age on a constant 10-12 hour day length, or, in open housing, the longest natural day length the flock will experience during that period.

Longer day lengths during the growing period usually result in more feed intake and heavier body weights. Assuming body weight is at or above target, light stimulation can begin at 17-18 weeks with weekly increases in day length of 30 minutes initially, and 15 minutes later, until about 16 hours of total day length is reached. That type of 'normal' program should achieve standard egg size and egg numbers for the layer variety.

Maximise egg size

If management objectives are to maximise egg size, even at the expense of some loss of egg numbers, we can use a delay-type lighting program to accomplish that.

Any declining day length after about 10 weeks of age in the pullet house will tend to delay the maturity of the flock. A program useful in breeders steps the lights down by 15 minutes a week starting at about nine or 10 weeks and ending at 15-16 weeks of age.

Bright lights for the first three days increases chick activity and allows chicks to quickly find feed and water.

Then we wait to start light stimulation in the breeder house until 19 or 20 weeks of age. A study done in the German random sample test demonstrated that this type of delay program did increase average egg size by 1.7g in white varieties and 1.5g in brown varieties. However, this was at the expense of a loss of 7-8 eggs per hen day. Total egg mass produced by either lighting program was essentially identical. This demonstrates the birds apparently have a certain capability to produce egg mass. It is our decision how to obtain that egg mass; either more eggs of a smaller size, or less eggs of a larger size. This must be an economic decision based on differences in egg size prices.

Maximum egg numbers

If the management objective is to obtain maximum egg numbers, and egg size is relatively unimportant, then we can use the reverse philosophy and provide early light stimulation to bring the flock into production at a lighter body weight.

Here we would want to avoid any step-down lighting after 10 weeks of age, and start light stimulation as early as 15-16 weeks of age. The age at maturity is not always proportional to age of stimulation, as the birds still have to attain a certain body weight before they will respond to lights, but by stimulating 2-3 weeks early, we should get egg production 7-10 days earlier than normal.

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Understanding the previously described lighting principles is the first step, however it can still be difficult to determine the exact time clock settings for a particular flock.

Lighting programs depend on many variables including the variety of layer, geographic location, time of year, degree of outside light control in the house, and other management preferences.

Hy-Line's information technology and technical service departments have developed a web-based computer program that will generate customised lighting programs based on the user's input for these variables. It can be accessed on Hy-Line's home web page, www.hyline.com, at the link, 'Lighting Program'. An e-mail address is needed to enter the system and this also serves as an identification for the program to store previously made light programs.

There are four major inputs needed from the user to generate an accurate program. First is the location, which is needed to determine sunrise/sunset times throughout the year. There are drop-down menus for the region of the world, country, and city. Many locations are already in the database, but if another location is needed, there is a link to e-mail that request. The location does not need to be exact; within 75 miles or 120km of a listed city should be sufficiently close.

The second input to select is the housing style of both the growing and laying facilities. Another drop-down menu shows the four choices. 'Dark' means the house is essentially lightproof, and we are assuming there is no physiologic influence of outside sunlight on the flock. Anything other than essentially lightproof should be considered 'open'.

The selections made here will determine whether the lighting program is built around the natural day length, or is determined without regard to natural light. The third input is the hatch date of the flock for which the lighting program will be made. That can be entered manually or by clicking on the appropriate date in the calendar.

The final input is the type of flock (genetic variety and breeder or commercial generation). A drop-down menu allows selection of the three primary Hy-Line varieties and two generations (breeder or commercial).

This determines the values of the four points below:

- Length of the initial step-down period in grow.
- Hours of constant light in grow after the step-down.
- Age to start light stimulation at maturity.
- Hours of constant light in lay after the step-up.

The program will default to the values recommended by Hy-Line for each variety and generation, but will allow the user to override these and insert their own values if they wish.

Once these inputs have all been made, the program has what it needs to calculate the appropriate lighting program for that specific flock. After clicking on 'Create Lighting Spreadsheet' and waiting a few seconds, the bottom left corner will show a Microsoft Excel file name with part of the e-mail address used and the day's date it was created. The file can be opened by clicking on it. The first view is a chart that shows the natural sunrise and sunset time for each week, total natural day length, recommended time clock on and off times, and total day length the flock will be exposed to.

The second tab on the bottom of the chart brings up a graphical display of the day length supplied to the flock each week and the natural day length in open houses. The third tab shows day length changes in a line graph form. Manual changes to the time clock settings can be entered in the chart if desired.

The chart and graph can be printed when finished. The website will save and display the last five files created by the user.

It should be noted that all time designations are in standard time. Many locations change clocks one hour for 'daylight saving time' in the summer, but this will not be reflected in the program. It is recommended to never disrupt flock lighting programs with these seasonal clock changes, but rather to leave them on standard time all year.

Use of this technology to generate accurate lighting programs will allow producers to manage their flocks to optimise egg size for their most profitable egg production. ■