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Bulletin #2227, Maine Poultry Facts: Lighting For Small-Scale Flocks

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It is well known that light intensity and the length of the daily light period will influence the growth rate and reproduction (capacity to lay eggs) in poultry flocks. The first person credited with using a systematic lighting pattern for laying hens was E. C. Waldorf, a medical doctor from Buffalo, New York. The year was 1889, and Dr. Waldorf's claim that his birds averaged ten eggs per week under artificial lights probably did much to create an interest in this new management technique. However, despite subsequent favorable reports from several agricultural experiment stations, it was nearly twenty years before the practice of lighting became commonplace.

About Bulbs and Fixtures

For years, incandescent bulbs were used in lighting for poultry. Then, the use of fluorescent bulbs was implemented. When using fluorescent fixtures, one should choose "warm" wavelength bulbs, which emit more rays at the red-orange wavelength. The "cool" bulbs commonly used in homes and offices are less stimulating. Now, poultry keepers are looking to LEDs or light-emitting diodes to provide low-cost lighting for their birds.

If you are depending on just one bulb, be sure to check it daily and replace it immediately if it should burn out. Keep in mind that the shadows cast by equipment, cages, and dropping boards will cut down on light efficiency. In addition, dusty bulbs can cause a real decrease in intensity.



Incandescent, CFL, and LED light bulbs.

Incandescent light bulbs

One 60-watt incandescent bulb with reflector downward, 7 feet off the floor in the center of a 12- x 12-foot pen, provides 2- to 3-foot candles (fc) of light, in the absence of any natural daylight. A 25-watt bulb in the same location should provide 0.5 fc of light. The conventional industry level for lighting is about 0.5 fc or less, similar to a moonlit night. However, most small-scale producers would prefer a somewhat higher level of light— from the equivalent of a 60- to a 75-watt bulb.

Compact fluorescent light bulbs

Energy-efficient compact fluorescent light bulbs (CFLs) are a good choice for fixtures that are used at least 15 minutes at a time or several hours a day, according to Energy Star, a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy. ENERGY STAR qualified lighting provides bright, warm light but uses about 75 percent less energy than standard lighting and lasts up to 10 times longer. Be aware that CFLs also produce about 75 percent less heat than standard incandescent bulbs.

Light-emitting diode light bulbs

Light-emitting diodes light bulbs (LEDs) are currently the most efficient source of light since they use 90 percent less energy than standard lighting and last up to 25 times longer. LEDs light up quickly. They don't contain any toxic materials and they can operate in cold temperatures without flickering. They come in warm and cool colored light. LEDs are more expensive but have a much longer work life.

Which bulb?

To choose the right CFL, compare the lumens, or amount of light output, with that of the incandescent bulb you are replacing.

Light Output Equivalency

Incandescent bulb (watts)	Minimum light output (lumens)	CFL (watts)	LED (watts)
40	450	9 to 13	6
60	800	13 to 15	9
75	1,100	18 to 25	13
100	1,600	23 to 30	15
150	2,600	30 to 52	20

Source: [Energy Star](#), ("Lighting") (U.S.Environmental Protection Agency and U.S. Department of Energy).

Before installing any light fixtures, be sure that the electrical wiring is adequate and meets all safety and local codes. Incandescent bulbs can get hot, so keep fire prevention in mind when wiring the house. Automatic timer switches are really a necessity to ensure that the birds receive a uniform number of hours each day. An automatic dimmer is a good addition when evening lights are used. Fluorescent bulbs are now available that can be used with a dimmer switch. Keep the light bulbs clean and check the timer weekly to be sure it is in good working order.

For a more complete discussion of types of light bulbs, wavelength, and intensity, refer to Michael Darre's "*Light and Lighting for Poultry*" (see references below).

Specific Lighting Recommendations

Lighting for baby chicks

Baby chicks need 24 hours of light for the first 48 to 72 hours of life to ensure that they find food and water. Use a 60-watt incandescent bulb, a 14-watt compact fluorescent bulb, or a 9-watt LED bulb for every 200 square feet of floor space. Remember to choose the warm-white type if you use fluorescent bulbs. Using shallow-dome reflectors such as aluminum pie plates, or bulbs with built-in reflectors will improve the distribution of light within the house.

Some growers suggest 23 hours of light and at least one hour of darkness in the first few days in order to accustom the chicks to a dark period. This hour of darkness will be hard to achieve if you are using heat lamps, which also give off light.

If supplemental light is still needed after two to three weeks for any of the reasons described in the sections below, use a 40-watt incandescent, an 11-watt compact fluorescent bulb or a 6-watt LED bulb to help avoid overly high light levels.

Lighting for broilers and roasters

Producers don't always agree on the amount of light needed for growing meat birds. Keeping broilers at low light levels tends to reduce fighting and feather picking, and may result in better weight gains. However, low light levels can cause an increase in leg problems since the birds spend more of their time resting.

Commercial operators generally rear broilers in windowless houses or houses with side curtains that will cut down on natural light, allowing for complete control of the amount of light in any season. Although most backyard flock owners use windowed houses, you can still augment the amount of light if you need to. Controlling the amount of light is more of a challenge with birds on the range.

Meat birds should have at least 12 hours of light in a 24-hour period, but they also need a period of dark to rest and properly digest their food. Dark periods are especially useful in the first three weeks of life for Cornish Rock crosses, to allow them to grow a solid frame and thus reduce future leg disorders. Some growers will provide up to 16 hours of light to extend the recommended minimum of 12 and still allow for an adequate dark period. In a windowed house, this can be easily accomplished by adding artificial light to the natural day length.

Raising broilers under long periods of light, such as a continuous 24-hour light period, is a bad idea; it can cause rapid growth, which can lead to leg problems. Also, birds grown under a 24-hour light regimen may panic during the sudden darkness of a power failure and pile on one another, smothering birds on the bottom of the pile. Broilers given a dark period of up to eight hours will be more active during the light period than those on 23 or 24 hours of light. This activity will contribute to improved leg strength.

During hot weather when birds tend to be more lethargic, some growers will provide lights in the morning and the evening, when temperatures are lower, in order to increase feeding time. Using an automatic timer will save you the trouble of remembering to flip the switch.

Roosts are usually not recommended for broiler birds or for roasters. Sitting on a perch can cause such a rapidly growing bird to develop a crooked keel (breast bone), which will detract from the appearance of the dressed bird. Leg injuries can also occur when these heavy birds jump down from roosts. All of this means that the quality of the litter is of prime importance. Birds resting for long periods of dark on caked, damp litter can develop breast blisters or skin burns that will be painful to them and result in unsightly carcasses when dressed.

Most backyard producers in northern New England rear birds from May through August using only natural daylight. And many of these birds are grown on pasture after 3 to 4 weeks of brooding. This ensures the minimum light period naturally plus a long dark period. Generally, for a small flock grown during the late spring and summer months in a windowed house or on range, there is no need for artificial light — other than during the first three days. Growers finishing birds in late July and into August may want to consider morning or evening lights in order to increase feed consumption during warm weather.



Clean, high-quality litter is important for meat birds. Photo by Stephen Ausmus, ARS.

Rule of Thumb: Raise broilers on at least twelve hours of light daily.

Lighting for Growing Pullets

The role of light in reproduction

The first important aspect of light is that it allows birds to be active and to find their food and water. But light has another very important effect in the pullet, or young female, in that it causes the production of follicle-stimulating hormone (FSH), which is necessary for the growth of the ovarian follicles, and the eventual production of an ovum (yolk).

Light is perceived by the bird primarily through the eye, but can also pass through the skull. This light stimulus reaches the hypothalamus of the brain via the optic nerve. A message is then sent from the hypothalamus to the anterior lobe of the pituitary gland. The pituitary gland releases follicle-stimulating hormone (FSH), which travels via the bloodstream to the ovary. Under the influence of FSH, the ovarian follicles initiate growth and, in turn, produce the hormone estrogen.

Estrogen secretions from the developing follicles are responsible for the development and enlargement of the oviduct to allow for the passage of the yolk and the eventual formation of the egg. Estrogens also cause the spread of the pubic bones (through which the egg passes when laid) and enlargement of the vent necessary for oviposition, or expulsion (laying), of the egg.

The ovary also produces small amounts of the male sex hormone, androgen, which causes the reddening and waxiness of the comb and wattles in the female. Poultry keepers use three indicators to distinguish “layers” from “loafers”: vent size, pubic bone spread, and comb condition/color.

Pullets grown as layers, if hatched between April and July in Maine, require no additional artificial light during the growing period as long as they are on range or in windowed houses. The birds are maturing sexually as the days are growing shorter. This decreasing day length is actually beneficial, from a physiological standpoint, as it slows ovarian development and allows the female to complete her skeletal growth before the rigors of egg production. Other than the light required during the initial part of the brooding period (see suggestions for broilers/roasters above), natural light is sufficient for these birds.

Off-season pullets

Pullets hatched from August through March in Maine will be maturing when the day length is increasing. These pullets should be put on a declining light schedule or a constant short-day schedule to control their date of the first egg.

There is an advantage to growing pullets during what some might think of as off-season. Birds that have laid through the winter months have passed their peak in production. Peak production generally occurs after about two months in lay, after which egg numbers move slowly downward. A new batch of birds coming into lay during late winter and early spring will help offset the downward trend occurring in the older flock. For the backyard keeper with up to a dozen females, growing a winter flock is probably not practical. But for someone depending on retail sales, this system may help provide a constant egg supply.

If chicks are brooded during the winter months, you may find it necessary to keep brooder lights (heat lamps) on for longer than the usual four-week period. Some might worry about the effect of this extended light on subsequent sexual maturity. As long as the light is cut back before the chicks reach eight weeks of age, there should be no adverse effect.

Growing pullets in windowless houses: the eight-hour lighting system

Commercial producers generally rear pullets in windowless houses and so can easily control both the level and the duration of artificial light at any season of the year. One simple system of light control that was used for several years in a windowless house at the University of Maine was to raise pullets on an eight-hour day. From zero to eight weeks the birds were given 12 hours of light, and from eight to 20 weeks they received eight hours of light. Then starting at week 20, one-half hour of light was added to the day length each week until the birds were up to a total of 16 hours. Given that most commercial crosses are maturing earlier, light stimulation could begin as early as 18 weeks with this system.

Off-season pullets in windowed houses: the decreasing-day-length system

For those who have only a windowed house available, as is the case with many small-scale producers, there is a system that can be used for growing off-season pullets—those hatched between August and March.

Let's assume that you hatched chicks on October 1, 2021. Consult an almanac, or the [Time and Date website](https://timeanddate.com) (timeanddate.com) to determine how much natural daylight there will be 22 weeks from the date of the hatch — in this case, on March 4, 2022. The day length in Bangor, Maine is approximately 11 hours and 20 minutes for March 4, when the birds will be 22 weeks old. Add 5½ hours to that figure,* for a total of 16 hours and 50 minutes in this case, and provide this amount of light daily for the chicks' first week starting October 1, 2021. Then reduce the total light period by 15 minutes each week through the growing period until March 4, 2022. The artificial light period must overlap both ends of the natural light period so the bird does not realize that the days are actually increasing during the latter part of the growing period.

By the time the pullets reach 22 weeks of age, you will have gradually decreased the period of artificial light to 11 hours and 20 minutes, which will now equal natural day length. The pullets will be finished with the artificial light and on a natural day length that is a week until 16 hours of daily light is reached. Hold this light constant for as long as you keep the birds.

Rule of Thumb: Raise pullets on a constant eight- to ten-hour day, or on a decreasing-day-length system.

*To simulate decreasing day length, you will need to be able to reduce the amount of light by 15 minutes a week for 22 weeks: $15 \times 22 = 330$ minutes or 5.5 hours.

Three Reasons to Prevent Early Sexual Maturity

Early Sexual Maturity can lead to:

- Prolapsing of the reproductive tract
- Smaller egg size
- Lifetime egg output may be diminished

Allowing young pullets to begin laying before they reach 17 or 18 weeks of age is unwise and may produce a condition known as prolapse (also known by the unlovely term “blow-out”). In young birds, this can happen when the bird produces an egg (often a double yolk) that is too large to pass easily through the cloaca, and by straining to expel it she everts the uterus through the vent. If you feel so inclined, try gently cleaning the extruded organ with K-Y Jelly or normal saline (no disinfectants), using a cotton swab. Then with your index finger, carefully push it back through the cloaca. This may correct the condition if the other birds have not seriously injured her. Remove the affected bird from the flock. If you keep her in the pen showing a bloody rear, she may become a victim of cannibalism, and may also cause general picking by the entire flock.

Keep her away from her pen mates until she has laid a couple of eggs. With any luck, she may not expel the uterus a second time. If she does then she will have to be eliminated from the flock. Prolapse can occur in older females if they are overweight: don't feed whole corn to layers.

A second negative effect associated with early sexual maturity is a small egg size. Birds that lay early may never reach their genetic potential in terms of egg weight. And finally, if pullets are stimulated to lay before 17 or 18 weeks, their lifetime egg output may suffer.

Lighting for Laying Hens

In northern New England, as in most areas of the country, chicks are hatched in the spring, grow through the summer on natural day length, and start producing eggs in the fall. But then come the short, dark days of November and December, and those eager young females begin to lag in their production of follicle stimulating hormone, resulting in a drop in egg output. Although a light-day of 11 to 12 hours will initiate egg production, this amount of light is not sufficient for sustained, high production. Poultry keepers who had great expectations regarding fresh eggs for the table become disillusioned. When natural day length falls below 15 hours per day, this is the time for the lights to come on!

Use increasing light after 20 weeks

Regardless of which lighting system was used during the growing period, pullets should be on a schedule of increasing light by the time they are 20 weeks of age. For the heritage breeds, it may be preferable to wait until 22 weeks of age. **When you provide artificial light, do it in an orderly manner.** Don't confuse your birds by changing their day length from 10 hours of light to 13 hours of light all in one day. Birds can be given an increase of 15 minutes each week (some authorities recommend 30 minutes per week) until they reach 14 to 16 hours a day. Some breeders suggest a total of 16 to 17 hours daily. Create a written schedule from which to follow for the change in light duration. Please note that light periods longer than 17 to 18 hours may actually depress production.

You can set your timer so that birds receive light in the early morning until sunrise, and then again in the afternoon at sunset. This will save a bit in electricity costs. On the other hand, an advantage of adding all artificial light during morning hours is that it allows the birds to naturally go to roost with the setting of the sun.

Hold day length for laying birds

Laying birds must never see a drop in day length. If you are flicking the switch by hand and forget to turn on lights for just one day you may see a drop in production. If the power is out for two days or more the birds may go into a molt, which can affect production for up to six weeks.

If birds seem nervous and flighty, try reducing the level of light by using a smaller bulb size. Nervous birds may resort to cannibalism and egg eating. Tossing them a handful of scratch grains or birdseed in the late afternoon helps to keep down boredom and helps to keep the litter stirred.

Hanging a head of cabbage for the birds to peck at their leisure can accomplish the same result. You might consider, developing an arrangement with your local market to obtain their discarded vegetables and add a few chopped greens such as chard, lettuce or spinach. These items not only reduce boredom but they make for nice dark yellow yolks.

Light levels - summary

For small laying flocks, one 60-watt ceiling light (14-watt fluorescent or 9-watt LED) for each 200 square feet of floor space is adequate. For ceilings over ten feet, a 75-watt bulb (22-watt fluorescent or 13-watt LED) can be used. Remember to use a “warm” wavelength bulb, as “cool” bulbs are less stimulating to the hens. Be sure to check bulbs daily. The light level for females in production should be 1 fc at the level of the feed trough. It is well to remember that the shadows cast by equipment, cages, and dropping boards will cut down on light efficiency. Light lost from dusty bulbs can cause a real decrease in intensity. Wipe the bulbs of dust or grime every month. Be sure that there are no dark areas under nest boxes and roosting areas. These darkened areas are an invitation for females to lay on the floor rather than in the nest box. Try to darken the nest box and then place a few wooden or ceramic eggs in the nests as an invitation to visit. Darkening each nest box entryway with a dark washcloth as a curtain may work nicely. Do this before the birds come into lay. Give them the idea of depositing eggs in the nest boxes before they think of laying on the floor.

Using light to affect laying times

You can also use light to change the time of day that the bulk of the eggs are laid. The earlier the lights come on in the morning, the more eggs will be laid before noon. As mentioned above, providing all artificial light in the morning hours allows birds to find their roost during naturally declining light. But having lights on at 5 a.m. means that someone must tromp out in the cold January morn to deliver fresh water. Hens should not be without a drink for more than an hour after the lights are turned on. A good drink just before roosting time is also important. Early lights also mean that an egg collection should take place mid to late morning to prevent frozen eggs and cracked shells. Do not consume eggs that have cracked shells and ruptured egg membranes. Ruptured membranes may allow contamination of egg contents with fecal matter.



Photo by Patricia Maher, UMaine Cooperative Extension.

Rule of Thumb: Water is a necessity for sustained egg production—and snow doesn't count.

The effect of heat lamps

Many small flock owners in cold climates like ours use heat lamps, which are often hung over the waterer to prevent freeze-ups. Keep in mind that if you keep the heat lamp on for 24 hours daily, the birds see this as a continuous light period. Then in the spring when the temperatures rise and the heat lamp is turned off, the birds sees this as a shortening of the day and may respond by a drop in production. Red heat lamps are preferable to white heat lamps in this regard as they have less of a stimulating effect on egg production. Always use a safety chain to hang heat lamps. A safety chain is a cheap insurance as many barns (and livestock) have been lost to fire due to heat lamps.

There are less risky methods of keeping water available to birds buy using heat tapes, heated water buckets, or radiant heaters. A student project (Grier, 2018) developed a solution for small-scale poultry keepers to solve chicken watering issues.

Rule of Thumb: Keep laying hens on a constant 14 to 16 hour day.

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