Commercial Poultry Production and Management

Michael Youn
Editor

Encyclopaedia of Broiler Breeder Production: Production, Feeding and Management Techniques: Series

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Preface

The amount of time required for broilers to reach a given target weight has been considerably reduced due to improvements in genetics, nutrition and management. At the same time, processing bodyweight requirements have become more precise in response to market demand. Although these two factors would seem to promote a simpler route to an improved final product, producing a target weight broiler in a reduced amount of time can present a challenge to the grower. For example, flock weight differences of 115g (0.25lb) and 230g (0.50lb) are commonly seen at target weights of 1815g (4.00lb) and 3405g (7.50lb), respectively. These deviations in flock weight occur even though the same genetics and feed source are being used within a production complex, significantly affecting economic output. So why do these differences in target weight occur? Variation in the in-house environment, which is largely influenced by ventilation, significantly affects broiler performance. The grower is responsible for managing ventilation.

Nutritional decisions for breeders need to take account of the overall economics of the whole production cycle. Table shows the changes in hatchery and broiler performance that are required to equalise the effect of a 1% increase in breeder feed cost on the profitability of the whole production cycle. Only one of these changes is required to have the necessary economic effect; in practice all are likely to move positively making the measurements of any one change difficult. The calculations are done under typical UK 2003 conditions and they show quite clearly that small improvements in bird performance are required to 'pay' for more expensive breeder feed. Conversely, apparent savings in breeder feed cost can readily lead to an overall loss if small changes in broiler performances are ignored. Similar economic analyses have been conducted by Mississippi State University which, based on US integration 2002 costs, demonstrates that a measurable improvement in progeny liveability as a result of hen diet change can be profitable. The key point is that trying to cut the cost of a breeder feed may easily reduce the profitability of the overall enterprise.

Underfeeding the hen can have an impact on chick quality and this is particularly noticeable in the early production period. Modern hybrid parent flocks commence production at a faster rate than in the past and consequently egg output increases over a shorter time span during the early laying period. Feed allocations during this period have not necessarily increased in line with this egg production trend. Low feed allocation intake by young commercial breeder flocks has been shown to compromise nutrient transfer to the egg, resulting in increased late embryonic death, poorer chick viability and uniformity.

Hence the book would be of great help to those who are already concentrating on this subject and students of universities. This book has been designed so as to make the students, scholars and teachers informed of the principles of this subject.

—Editor

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Circadian Control of Egg-laying

Circadian system in Japanese quail, and presumably in many other (perhaps all?) species of birds, is a two-oscillator system. It is as if the brain contains two separate circadian clocks, each with its own properties. These two clocks also interact with each other. One of the clocks is easily and directly entrained by the environmental light-dark cycles. It governs the overt daily rhythms of such things as body temperature, feeding activity, heart rate, blood pressure and release of hormones such as melatonin. The other clock appears not to be directly sensitive to light. It seems that it gets its information about the environmental lighting conditions from its interaction with the first clock. This second clock (or second component of the circadian system) also drives rhythms such as activity and body temperature, but more importantly, it drives the circadian rhythms of ovulation and oviposition. In this species, once an egg is laid, the next follicle ovulates about 45 minutes later. It takes anywhere between 24 and 30 hours for an ovulated egg to be laid. Thus, one egg is laid each day.

The two circadian clocks interact in ways that are possible to describe using models borrowed from the physics of oscillations (remember the pendulum from high school?). One of the predictions from the model is that some biological events can happen only when the two oscillators are in a particular phase-relationship with each other. This phase, in regards to ovulation in birds, is sometimes called "the permissive zone". Only if the ovary is ready to ovulate during this zone, ovulation will occur. Otherwise, it will wait until the next day.

In short daylengths, e.g., during the winter, the permissive zone is so narrow (or even non-existent), so that no ovulation happens at all. The bar on top of the graph indicates the duration of the day -

white and night - black. The first line is first day, the line below it is the second day, etc. X-axis is 24 hours long. Bluish area shows the times when the first clock drives body temperature to be above the daily mean and drives the animal to be behaviourally active; the white area shows the times when the first clock determines when the quail is asleep and the melatonin levels are high.

As the photoperiod increases in spring, the permissive zone appears (between two dotted lines) and is broad enough that ovulation can happen. In relatively short photoperiods, the two clocks are quite tightly coupled. They are almost entrained to each other - they exhibit what is called relative coordination, which means that the two clocks can entrain ("lock") to each other for a few cycles but cannot remain phase-locked indefinitely:

The first egg gets laid at the beginning of the permissive phase. Each day, the second clock tries to escape from the pull of the first clock and to time the egg-laying a little bit later. Finally, the ovulation reaches the end of the permissive phase and the clutch stops. If everything is OK, prolactin will kick in to prevent the hen from laying any more eggs and she can sit down on her eggs and incubate them. If a predator, like a snake, eats the eggs (or a researcher removes the eggs from the cage) there is no rise in prolactin and the quail starts a new clutch all over again, following the same pattern, after one or two days of pause.

A couple of months later, after the bird has successfully raised a brood of hatchlings, the quail may decide to renest. This is now early summer and the daylength is much longer. The permissive phase is much broader and intrudes even into the night. On the other hand, the coupling between the two clocks is now very weak and the second clock freeruns with its own inherent period which can be anywhere between 26 and 30 hours.

One thing that you will notice is that the clutch consisted of more eggs in shorter photoperiod (spring), than in the long photoperiod (summer). This is something that has been observed in a number of species of birds in the wild. Every 10-minute period that is black denotes the time when body temperature is above the daily mean. The light bars on top show when the lighs were on (white) and off (black). Circles show times when eggs were laid. On the top is a quail in LD 14:10. In the middle is a quail in LD 18:6. On the bottom are two examples of oviposition patterns during a transition from LD 14:10 to LD 18:6 (all from).

Not so obvious, but the time-difference between two successive eggs in spring is just a little bit longer than 24 hours. In summer, this difference is 26-30 hours. This means that in summer, each follicle has more time to get filled by filtering of blood and each egg has more time to spend in the oviduct and the shell-gland. One should expect that summer eggs will be, on average, larger, heavier and with thicker shell than eggs laid in early spring. Evolutionary theory predicts the existence of a trade-off between egg-number (i.e., clutch-size) and egg-size. It is almost like a switch between r-strategy and K-strategy. In spring, premium is put on quantity and in summer on quality of progeny. The quail literature suggests that the circadian clock is the physiological mechanism underlying this switch in evolutionary strategies.

Apart from Japanese quail, few other species have been studied. The sister species, European Migratory Quail (*Coturnix coturnix*), which is not domesticated, has virtually identical egg-laying patterns. In domestic chickens, it looks very similar, except that the first egg is laid at dawn (as opposed to noon) and the last egg is laid around noon (as opposed to evening). A couple of studies in turkeys also suggest the same mechanism. Can we generalise this finding to all Gallinaceous birds at least? Sounds reasonable, but I do not know. Is the same mechanism operating in birds from other Orders? Hummingbirds? Owls? Ostriches?

There is an interaction between estrous cycle and circadian cycle in rodents. Sex steroid hormones that are released during ovulation have effects on circadian clocks in several species of birds and mammals (presumably also humans). Does this information make it seem more likely that the quail data are generalisable to all birds? Every time I ask a friend who studies wild birds at what times the eggs are laid, the answer is "I don't know - we usually find the eggs in the morning". This means that the egg could have been laid at any time between 5pm and 9am - a very broad region. No temporal patterns appear to be known in wild birds. So, if you study wild birds, please let me know at what time of day the eggs are laid.

Hatching and Rearing

It is best to start raising chickens in the spring. This is the time in nature when the most eggs would be laid, and gives enough time for the chick to reach a level of maturity where it might stand a good chance of surviving the coming winter. It takes 21 days to hatch a chicken egg under the correct conditions of temperature. At a minimum of three times a day the egg must be gently turned hand or 'rotated' to prevent the developing embryo from sticking to the inside of the egg. The hen does this same job *in nature* very well, but chickens have lost a lot of their child rearing skills through dependence upon man, so you must take over this responsibility.

Why Chickens can'Thatch their Own Eggs

Chickens have been bred domestically for centuries to produce eggs. But a chicken from the wild who sits upon their nest will stop laying to try to hatch their eggs. so the more a chicken has to do with man, the more they will lay and the less they will sit on the nest.

When a chicken becomes broody, it sits on the nest constantly. This behaviour can be triggered anytime. What we do is let the chicken do it for 1 to 2 weeks, then lock her out of the coop and force her out of it till she stops acting all fluffy. They won't snap out of it on their own for a while because "the chicks" never hatch. They don't lay eggs when they are broody because new eggs would not be timed to hatch with 'the others' (they all have to hatch at once) less than compassionate chicken breeders would kill these because they are not good layers that is why, after generations, chickens today do not sit on the nest. (This is not to say that there are no free-breeding flocks of chickens in the world.)

Restricting access to the nest is the only way to cure broodyness. unless you want the chicken to breed, and in that case, stimulating instinctual behaviour is what you want in some sense the chicken is demonstrating its suitability as a mother but because its instincts are impulsive and bread out, most likely it will peck at chicks after hatching and may just give up and walk away any old time.

Normally to get a modern chicken to hatch eggs it must be imprisoned on the nest with a cage, that keeps the bird in place (it should be able to stand but not leave the nest.)

If you are lucky enough to have a chicken that hatches and raises her own chicks, make sure that the baby is safe from predators and from other chickens hens can be very jealous, and might kill the chick.

The first efforts to free itself are crucial to the chicken's life cycle and it will die if you interfere in this mysterious process. Once the chick is free of the egg, and begins to walk, you should move it to a cardboard box containing a 40 or 50 Watt light bulb suspended from above, a small tray of finely ground scratch feed, and a dish of water. The first day the temperature should be maintained at 94 degrees Fahrenheit at the level of the litter of chicks. This means hanging the light close! Do not fear that the constant light will hurt the chicks. They don't seem to mind. After the ninth day the temperature should be kept at 88 degrees. By day 18, it is fine to be at about 80 degrees. After six weeks the lights can be turned off and the chicken acclimated to day and night cycle.

As young chickens you should get them a bigger box. Raising them indoors for a short while acclimates them to you, and allows them time to grow their 'outdoor feathers'. Doing this builds a strong bond between the keeper and the chicken. Once the new feathers have grown on its back and the chick looses its 'angelic look', you may introduce them to the outside world.

Don't rush this because the chick needs these new feathers to withstand cold and protect its lungs from infection. Chickens in this stage of development are gifted with flight, so make sure there is a top or screen on the box. It is in this flighted stage that chickens are most fun to play with, as they will easily adopt your finger as perch, and they will fly around your room if you let them.

Once you decide that its time to bring them outside, you must still be mindful of their flying ability. They can easily hop a six-foot fence. Integration into a pre-existing flock can also be tricky. Some keepers recommend against introducing new birds to an old flock, but we find that supervision and open forage conditions do allow for a gradual acclimation of the established birds to newcomers but make no mistake, introducing young birds to an older flock is hazardous.

Molting

Chickens loose their feathers naturally, like a snake that sheds its skin its called 'molting' and they do it about once a year when the light levels go down. Chickens do not necessarily all molt together it depends on ther age and breed its perfectly natural so seeing chickens without feathers is not necessarily an indication that they are a victim of aggressive behaviour. The best way to tell if your chickens are aggressive is to spend time observing them chickens missing some feathers could just be molting.

People Chickens

One of the most wonderful discoveries we've made about chickens is their emotional compatibility with humans. For us, it is as if the chicken's conscious rhythms are somehow at the same level or frequency in chickens as humans. The emotional content of chicken speech is observable and intelligible to us as well as them. They enjoy times of work and times of rest similar to our own (they enjoy a good breakfast and an afternoon siesta). They seem to be keyed into the same threshold of perception as humans, in their response to danger and in their reaction to our approach.

Chickens have interactive emotional states similar to humans. They feel jealously, greed, pleasure, affection and camaraderie. They are subject to life trauma like dogs and cats, and enjoy physical contact with the trusted keeper. They like to 'snuggle' and like to press their little heads up against your neck affectionately and with obvious relish. They like to hide in your armpit when you hold them and if you gently scratch the back of their neck they will assist you by preening the front of their neck. Chickens gesture to you by pretending to peck at the ground as a way of getting attention or feigning disinterest (while secretly wanting to be held). They particularly enjoy walking all over you if you sit on the ground and will seek out your warm embrace.

Of all the pets I've ever had, chickens seem the most well adjusted and balanced in their relationship to man, but they can be 'little monsters' as well. Jealousy is part of their emotional pallet. You can tell when a chicken is upset at you because it crouches and pretends to peck the ground while glaring at you, at the same time ruffling the feather of the wing furthest from you. It's really quite astounding to be chastised by the alpha chicken when you demonstrate affection to a chicken of lower rank.

If a chicken wants attention it might peck you or jump on your head. You never know! They also like to dig in the garden and will tear up your plants if they get into it. And of course they can start laying eggs in bushes (their natural choice) and will escape from time to time.

The time to begin gaining your chickens trust so that it will reveal this wonderful side to you is when they are small. Handle your chickens frequently. Feed them by hand and encourage trick and individual behaviour. Depending upon the breed and temperament, you will be richly rewarded.

Moulting: How, When and Why Chickens Moult

During autumn, many household poultry keepers, particularly people keeping poultry for the first time, are puzzled because egg production markedly declines or ceases despite their laying birds appearing healthy. This seasonal decline in egg production occurs when birds go into a condition known as the 'moult'.

Moulting is the process of shedding and renewing feathers. During the moult, the reproductive physiology of the bird has a complete rest from laying and the bird builds up its body reserves of nutrients.

The provision of new feathers or a coat (a feature inherent in most animals) is a natural process, designed by nature to maintain a bird's ability to escape enemies by flight and better protect against cold winter conditions.

Under usual conditions, adult birds moult once a year. Some may moult twice in one year and, rarely, once in two years.

The Pullet

The chick goes through one complete and three partial moults during its growth to point of lay. Generally, complete moulting occurs from 1-6 weeks of ag, and partial moulting at 7-9 weeks, 12-16 weeks and 20-22 weeks. During this final moult, the stiff tail feathers grow.

The Laying Hen

Mature birds normally undergo one complete moult a year, usually in autumn. However, this can depend on the time of the year that the bird started laying. Natural moulting usually begins sometime during March or April and should be completed by July when egg production recommences. The three main factors that bring about moulting are:

- physical exhaustion and fatigue
- completion of the laying cycle (as birds lay eggs for a certain period of time)
- reduction of the day length, resulting in reduced feeding time and consequent loss of body weight.

Eleven months of continuous production is expected from pullets hatched in season. So if a flock of pullets commences laying in March at six months of age, they should continue laying until the following February, although an occasional bird may moult after laying for a few weeks. However, these few birds should begin laying again after June 22 (the shortest day of the year) and continue in production until the following autumn. Pullets coming into lay in June should lay until the following April, giving 11 months of continuous egg production without the aid of artificial light. Pullets coming into lay in spring (August) should lay well into April (nine months); however, unless artificial lighting is provided, most of them will moult during May and June.

Moulting and Nutrition

If a bird stops laying and moulting, this means its physical condition is deteriorating and, therefore, cannot support egg production, continued nourishment of their feathers or body maintenance. Feathers contain protein and are more easily grown when laying ceases because of the difficulty in assimilating sufficient protein for both egg and feather production. During the moult, the fowl still needs a considerable amount of good quality food to replace feathers and build up condition.

Good Layers and Moulting

The time at which a laying hen ceases production and goes into moult is a reliable guide as to whether or not the hen is a good egg producer. Poor producing hens moult early (November-December), and take a long time to complete the process and resume laying i.e. they 'hang' in the moult and are out of production for six to seven months. Poor producers seldom cast more than a few feathers at a time and rarely show bare patches.

High-producing hens moult late and for a short period (no more than 12 weeks), and come back into production very quickly. Rapid moulting is seen not only in the wing feathers of good producers, but also in the loss of body feathers generally. Because of this, it is common to see a late and rapid moulting hen practically devoid of feathers and showing many bare patches over its body.

The Moulting Process

Moulting takes place in a particular order. Feathers are confined to definite tracts or areas of the body surface, with bare patches of skin between. The first plumage is lost from the head and neck, then from the saddle, breast and abdomen (body), then from the wings and finally from the tail.

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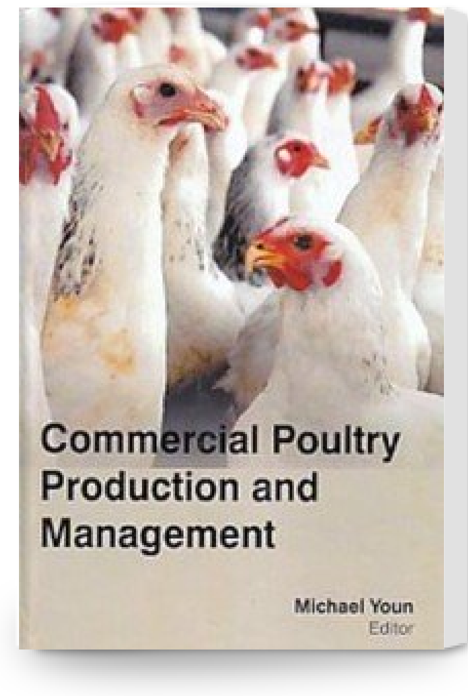

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