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Monitoring Egg Weights to Help Manage Post-Peak Feed Allocation in Broiler Breeder Hens

In terms of egg production and fertility, successful broiler-breeder flocks have high peak production and persistency from peak to depletion. However, many flocks fail to produce their potential post-peak because hens are overfed and become too heavy to sustain a high rate of egg production or underfed and have insufficient nutrients for maintenance and growth, suspending egg production. Both errors can be caused by failures to respond quickly with appropriate feed allocation changes to address the root cause of greater than expected egg production drops.

Introduction

Traditionally, during post-peak production, managers follow an established guideline (e.g. Cobb Technical Supplement) for reducing feed allocations daily or weekly with further fine-tuning using actual flock observations. The flock observations include egg production rate, body weight gain (BWG) and feed "cleanup time". Monitoring and managing daily egg weight change (DEWC) is an additional metric that can be used to fine-tune feed allocation during post-peak production. Moreover, monitoring DEWC can help maintain good eggshell quality by controlling egg size in older flocks (post 45-weeks of age).

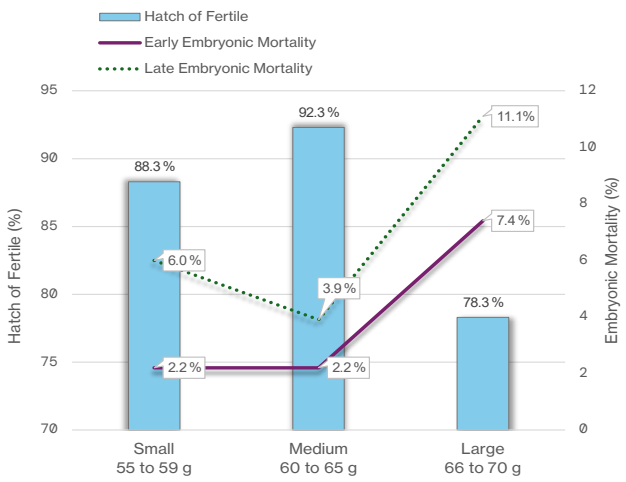
Managing DEWC is founded on the principal that to promote maximum egg production, hens should never lose weight to ensure that excess nutrients are available after meeting the daily body maintenance requirement to drive egg production. The optimum growth body weight (BW) profiles required throughout the life of flock for Cobb products are provided in our technical supplements (www.cobbgenetics.com). In broiler-breeder hens, egg weight and BW increase concurrently and by using this direct relationship, a smooth DEWC profile was developed from 31 to 65 weeks of age. Including an egg weight monitoring step into a flock tracking program is an easy, inexpensive and effective management tool to improve hatching eggs per hen. In many parts of the world, labor shortages prevent frequent body weight measurements after flocks reach peak egg production. Incorporating a robust DEWC monitoring program would reduce the dependency on hen BW measurement to some extent and yet efficiently optimize post-peak feed allocation to support a persistent high rate of egg production.

Excess body weight gain after 40 weeks of age leads to poor egg production rates and persistency

Paying attention to details post-peak production is important to maximize hatching eggs and chicks per hen. Nearly 82% (or more) of hatching eggs are produced after peak egg production (>32 WOA). After 45-weeks of age, some challenges production managers face include an excessive drop in egg production and fertility or large eggs with poor eggshell quality. Once these issues begin, mitigation often has limited success. For the most part, these issues originate from hens that were over the Cobb standard BW targets either before or after peak egg production. The challenge during post-peak is to promote "just enough" daily and weekly growth so that persistency of egg production occurs while preventing excess BWG.

Hens excessively heavier than standard will divert the bulk of feed calories into body maintenance, reducing available energy to drive egg production, and ultimately an abrupt decline in egg production. Additionally, eggs will be larger (2 to 3 g heavier than standard) with thin eggshells. Regardless of the hen age, as egg weights near and exceed 70 g (Figure 1), they tend to hatch poorly because of low fertility and have higher early and late embryonic mortality than eggs 65 g or less.

Figure 1. As egg weights near 70 g, hatch and fertility decrease and late embryonic mortality increases.



Data adapted from (Shafey, T.M., 2002)

Post-peak optimum daily body weight gain is important to maintain egg production persistency

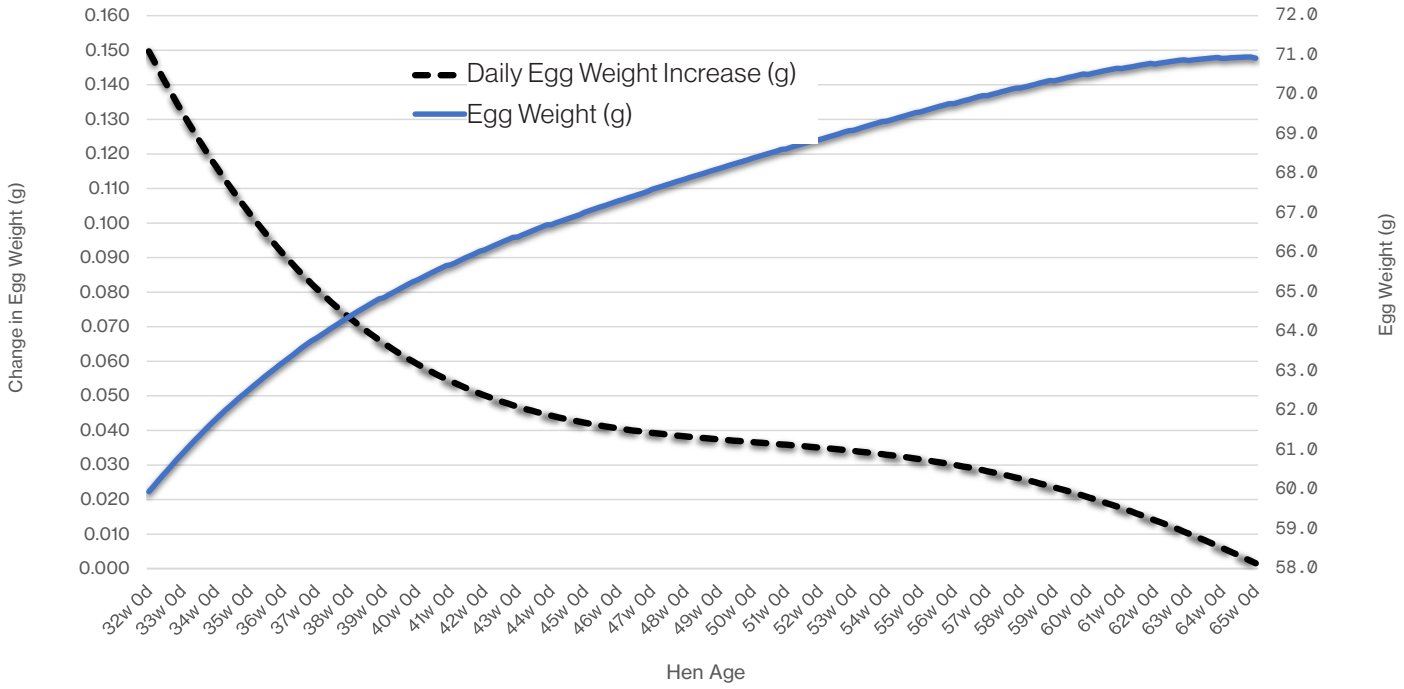
A broiler-breeder hen allocates nutrients for egg production only after its daily maintenance and growth requirements are met. The magnitude of growth requirement slows down after peak egg production, but a steady but small body weight gain is necessary for persistent egg production. Therefore, Cobb recommends a slight increase in daily BW from post-peak to flock depletion. If feed allocation is excessive or insufficient sub-optimal performance may occur.

While it is obvious why overfed hens become excessively heavy hens, insufficient feed amounts also causes excessively heavier hens. Insufficient feed allocation leads to inadequate or arrested BW gain which is perceived as a negative nutrient balance, and, in turn, causes an egg production drop. The quick and unexpected egg production drop sends the proportion of protein and lipid intended for the egg to muscle growth and fat deposition causing BW gain. If the egg production rate is not restored, the producer will be left with a poorly performing flock.

Monitor egg weight to support optimal body weight gain and hatching egg production persistency

Weighing hens routinely to ensure steady BWG is still the gold standard. However, including daily egg weight measurements during post-peak flock management can help improve the timeliness and accuracy of feed allocation decisions to drive egg production persistency while preventing excessive body weight gain. The advantage of using a DEWC profile is that it can be used to manage hens regardless of egg weight profile and hen BW differences among breeds. Note that the DEWC is not linear (equivalent at all ages (Figure 2). Post-peak, egg weight should increase relatively rapidly and plataeu around 40 WOA.

Figure 2. Egg weight will increase over the life of the flock, while the change in egg weights should decrease.



Deviation from the expected DEWC is an early indicator of errors in post-peak feed allocation

As noted, the rate of egg production is driven by "excess /left over" nutrients available after hens meet their maintenance and growth requirements. In most field situations the limiting component is the energy (fuel or calories), however, nutrients like proteins (amino acids) and minerals could become limited in rare situations. The egg size is mainly driven by hen size and to a small but very sensitive degree by the adequacy of overall nutrient intake. Changes in egg weight are an early, visible, and manageable indicator of hen's nutrient sufficiency to drive egg production.

A slight inadequacy in nutrient balance can decrease or stop daily egg weight increase. If the nutrient inadequacy persists, egg production will stop. In broiler breeder hens, as soon as the egg production stops, a proportion of nutrients designated to that day's egg are diverted to tissue growth, causing the hen to get heavier and ultimately increases the nutrient and fuel (calories) demand for body maintenance.

A case study demonstrating the concept of using DEWC

Early detection and troubleshooting the root cause of egg production drops by monitoring DEWC is demonstrated in Figures 4 and 5.

Figure 4. An unexpected drop in total egg production (%TEP) occurs between 35 and 36 WOA. The problem was corrected, and persistency of egg production returned to normal by 40 WOA.

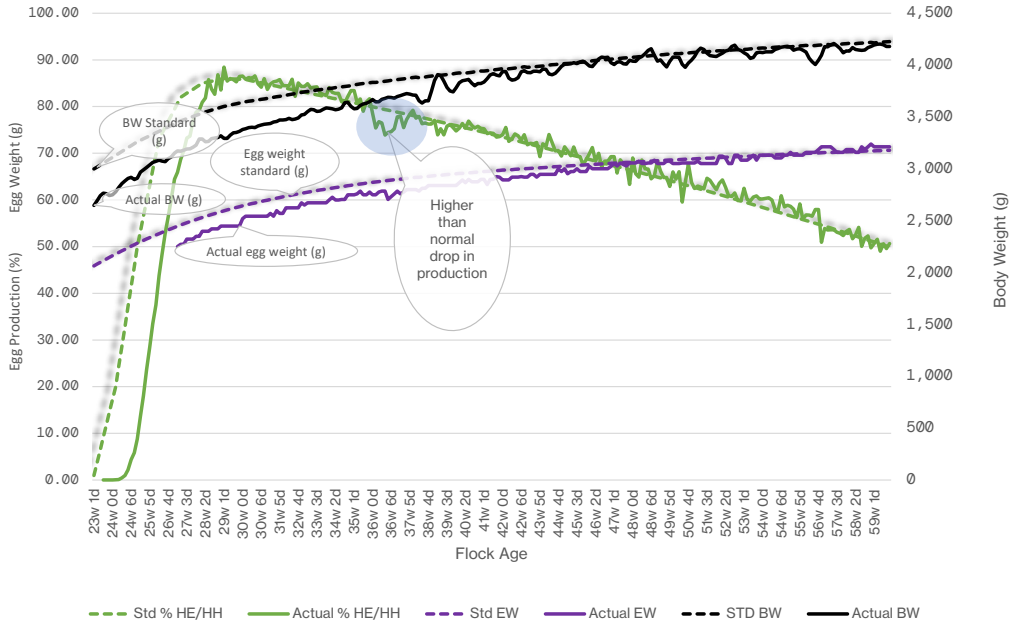
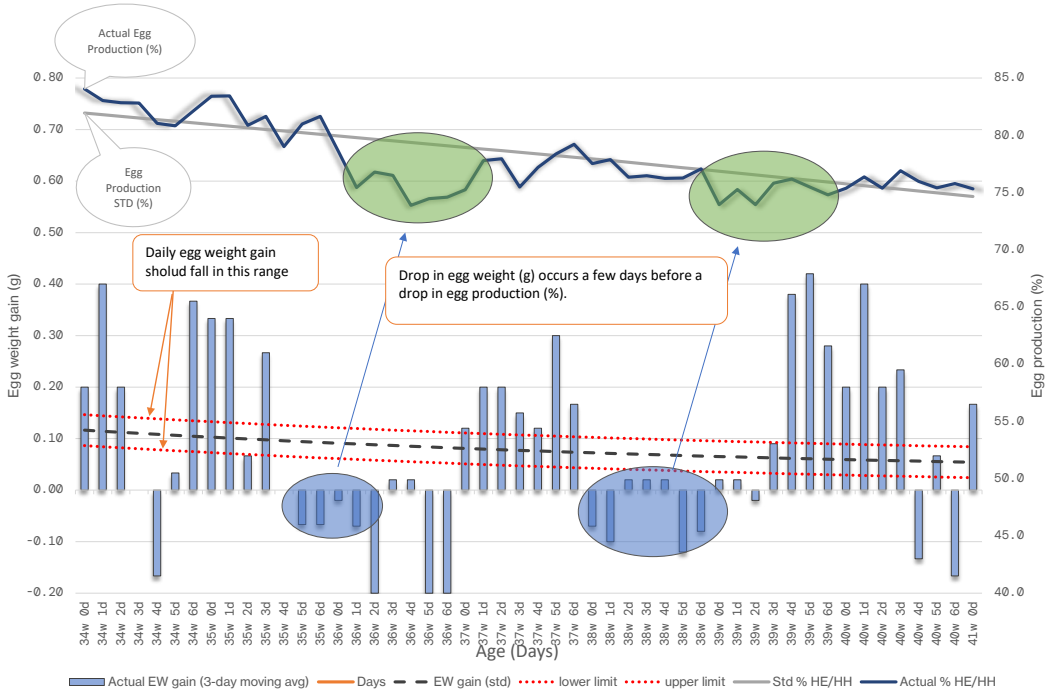


Figure 5. The DEWC gain was plotted using a 3-day moving average to reduce the day-to-day fluctuations in EW measurement due to sampling error. From 238 to 247 DOA, the gain was mostly positive. On day 248, the DEWC was zero and then stayed mostly negative for a week. Within two days after the first 3-day moving DEWC fell below requirement, the rate of egg production dropped by a higher degree than expected.

At 259 days of age, the DEWC became and remained positive for the next 7 days. From 259 to 264 DOA, the rate of egg production began recovering and returned to the expected level. Then again, from 265 to 275 days of age, an insufficient or negative DEWC occurred, corresponding with a drop in egg production. In this flock, the producer was able to fix the problem by adjusting the feed allocation appropriately using the data from daily egg weight gain and body weight.



Procedure for weighing and tracking egg weights

Equipment

- A digital scale capable of weighing up to 20 kg (40 to 50 lb) with a weighing accuracy of +/- 10 g (0.02 lb).
- A calculator.
- Access to a set of calibration or test weights – (1 kg and 20 kg). If certified calibration weights are not available, then the exact weight of a solid object closer to 1 kg and 10 kg should be measured and their weights written on them; to be used for calibration). Scales need to be calibrated preferably every day, but at least once a week to make sure the scale accuracy is maintained.
- Plotting graphs or tabular charts to track daily, and 3-day moving average.

Procedure

The objective is to randomly sample about 10 % of the daily production and weigh them in bulk. Bulk weigh between 36 and 180 eggs at a time, but be consistent with the egg numbers. For example, if weighing 180 eggs at a time is convenient, then weigh that number of eggs each time.

Develop a highly randomized sampling system to represent eggs from morning, noon and afternoon. If sampling is not adequate and random, then interpretation of the data will be difficult. Reducing variation in sampling and weighing will give more confidence using the daily egg weight change data to make decisions on adjusting feed allocation.

Daily Steps

1. To make sure that previous day's eggs are not sampled, do not use eggs from the first collection in the morning (or if continuous belt collection, the first one hour of collection).
2. Remove the double yolks, cracks, abnormal eggs, shell less etc. selecting eggs that would go to the hatchery.
3. Sample 10 % of the daily production and bulk weigh in even portions. For example, if the estimated daily production is 6,000 eggs in a house, then sample about 600 eggs. If 180 eggs are weighed in a bulk, then record 3 to 4 bulk weights daily. Similarly, if a tray containing 36 eggs is used bulk weighed, then record 15 to 16 bulk weights. Sample eggs throughout the day and not just eggs collected in the morning.
4. The platform scales should be placed on a sturdy level table.
5. Make sure the scale is calibrated, to weigh accurately.
6. Zero the scales and weigh an empty egg tray or carton to determine the tare (empty) weight.
7. Weigh the trays filled with eggs and record the number of eggs weighed and total weight.
8. Calculate the average egg weight = (total weight – empty tray weight) ÷ number of eggs weighed.
9. Once all the daily recordings of bulk weighs are done, calculate the average egg weight for the day. This information can be directly plotted on the egg weight chart or used to calculate 2- or 3-day moving averages to be plotted.

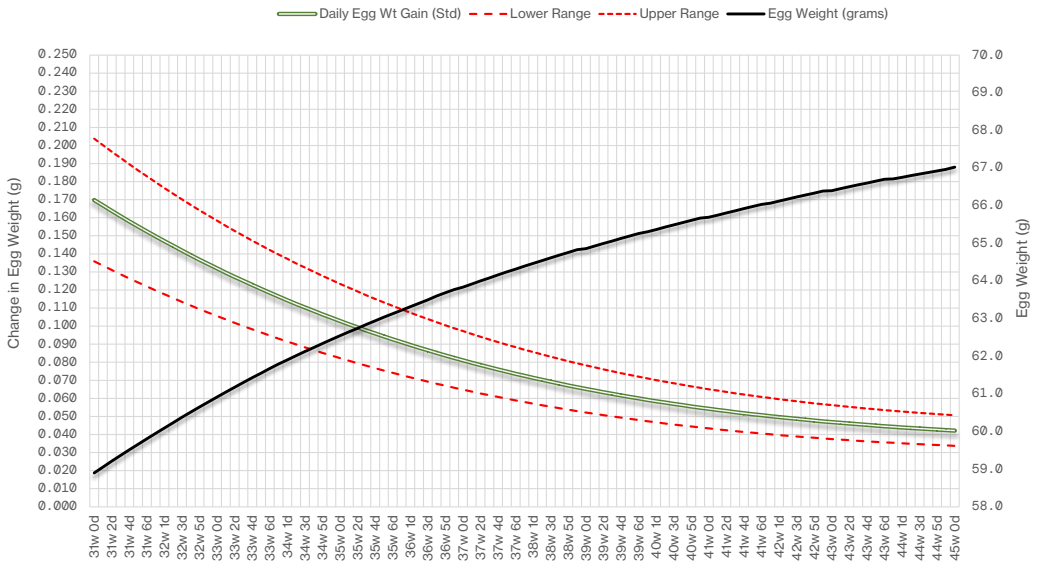
Data collection options

In reality, the daily egg weights for a flock will oscillate around the Cobb standard. Depending on the quality of the sample, even for a highly productive and uniform flock, the daily egg weight measurements fluctuate to some degree. Therefore, rather than using daily data, it is better to track 2- or 3-day moving averages of EW or EWG. Daily fluctuations can be reduced by improving the sampling quality and minimizing errors in weighing. The general recommendation is to initially track 3-day moving average and work towards using 2-day and eventually daily average as the quality of the egg tracking program improves.

Option 1. Tracking Daily Egg Weight Change (DEWC).

To begin, it is best to track a 3-day moving average of DEWC in a spreadsheet or on a large plotting chart (Figure 6). Regardless of the tracking format (plotting graph or the table), if the daily egg weights are positive and fall within the expected range and rate of egg production, then there is no need to change the feed allocation plan. If the 3-day average daily egg weight gains are negative or below the required range for two or three consecutive data points then consider immediate corrective actions.

Figure 6. An example of daily egg weight (EW) standard and daily egg weight change (DEWC).



To verify hens are not losing BW, it may be necessary to weigh hens as soon as possible (not to wait for the scheduled weighing which may be a week to 10 days away). If several negative or insufficient daily egg weights occur, the rate of egg production will begin to drop severely. If two or three daily gains are far above the range, then investigate and take necessary corrective actions to preserve egg production persistency and control accelerated increase in egg weight.

The advantage of tracking the DEWC is that this plotting chart can be used regardless of the hen size and the overall egg weight because this approach focuses only daily increments in egg weight and not on absolute egg weight. Also, a DEWC chart is more sensitive than DEW chart because of the higher resolution (expanded scale).

Option 2. Tracking Daily Egg Weight.

Track 3-day moving average of egg weight either in a spreadsheet or on a chart. Depending on the hen size, the exact egg weight at 32 weeks of age (after peak production) could be above or below the standard, but the objective is to keep the egg weight increasing parallel to the standard. At least, on a visual basis, actual egg weight tracking seems less recognizable as compared to the tracking of DEWC to use as an indicator of the impending egg production drop. The concept of managing egg weight is similar to the DEWC in Option 1. If egg weight is not increasing parallel to the standard for 2 or 3 three days, feed allocation must be evaluated and optimized without delay to prevent excessive production drops.

Option 3. Use a Simplified/Abbreviated Reference Table of Daily Egg Weight Gain.

After determining the 3-day moving average weight for every day, compare the actual EWG to the corresponding age group. If the daily EWG (based on a 3 - day moving average) falls below standard for 2 or 3 days consecutively, then corrective action in feed allocation is necessary as described in Option 1.

Table 1. Expected increase in daily egg weights based on hen age.

Age		Expected Increase in Daily Egg Weight (g)
Weeks	Days	
32 to 33	218 to 231	0.14
34 to 35	232 to 245	0.12
36 to 37	246 to 259	0.10
38 to 39	260 to 273	0.08
40 to 41	274 to 287	0.06
42 to 55	288 to 384	0.04
56 +	385+	0.03 to 0.02

Limitations and final considerations

- Managing feed allocation based on the DEWC ***prior to peak egg production is not recommended*** because feed allocation decisions depend mainly on rapid body weight gain requirements, onset of egg production and rate of increase in egg production prior to the peak. Detailed guidelines on feed allocation prior the onset of egg production and "production, feeding" are outlined in Cobb Technical Supplements (cobbgenetics.com/resources).
- Feed allocation decisions based on DEWC should still consider the rate of egg production, "feed cleanup" time and if necessary, a body weight measurement to validate the DEWC observation.
- Feed allocation decisions based on DEWC help to maintain standard egg production persistency if acted upon quickly and before the egg production drops occur. Once the egg production begins to deteriorate due to insufficient body weight gain, corrective actions in feed allocation may take 7 to 12 days before improvements in egg production can be observed.
- Egg production drops that occur even though the DEWC is within range may be due to environmental factors (extreme house temperatures; too hot or cold), poor feed quality (mycotoxins), or other causes that should be investigated and corrected immediately.