Technical Update

Hy-Line®

OPTIMIZING EGG SIZE:

TIPS FOR ACHIEVING DESIRED CASE WEIGHT

THE VALUE OF ACHIEVING EARLY CASE WEIGHTS

Maximizing profitability for all commercial egg producers requires the ability to produce larger eggs faster. While egg prices fluctuate, most shell egg producers strive to reach a 48 lb case weight as early as possible and stay close to this case weight throughout lay. Figures 1–3 illustrate the value of achieving a larger case weight as early as possible and the opportunity cost of prolonging the time spent producing medium eggs. The case weight in these examples is the actual median case weight of all US W-80 flocks in the Hy-Line commercial database, reaching 48 lb case weight at 35 weeks, compared to flocks reaching 48 lb at 40, 45, and 50 weeks of age. Figure 2 demonstrates that the flocks reaching 48 lb case weight more rapidly produced more higher-value (extra large and large) eggs and fewer lower-value (medium and small) eggs. Figure 3 confirms that reaching 48 lb case weight faster gives the highest total value of the eggs produced to 60 weeks of age. Figure 4 shows the difference in market value of large and medium eggs widening, making achieving early case weight more important today.

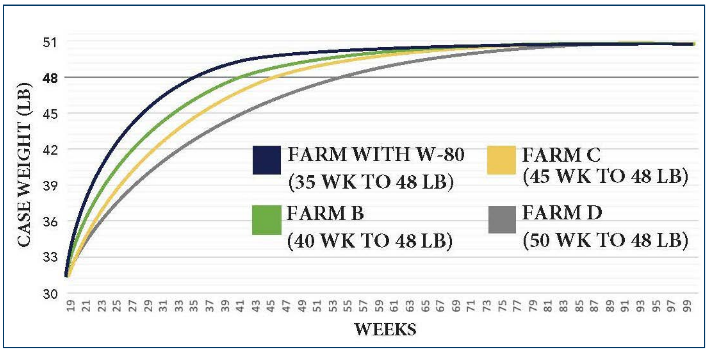

Figure 1. Four flocks reaching a 48 lb case weight at different ages.

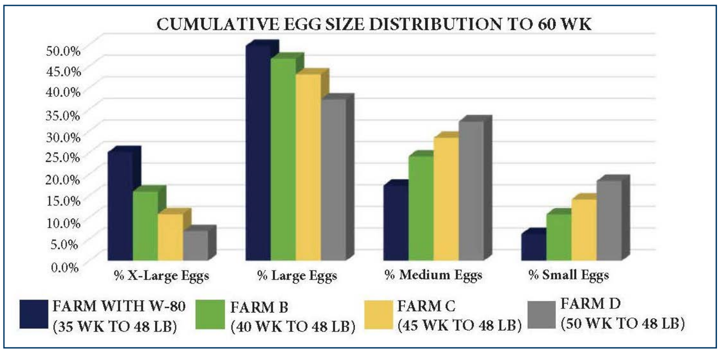

Figure 2. Percentage of eggs in different USDA egg size categories to 60 weeks.

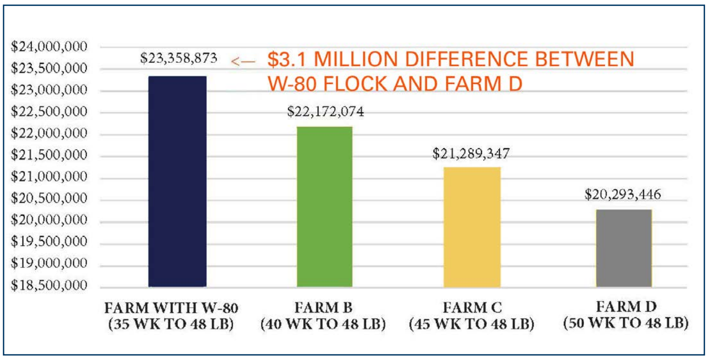

Figure 3. Total market value of the eggs produced by the four farms (1 million hens at 60 weeks of age with 255 eggs).*

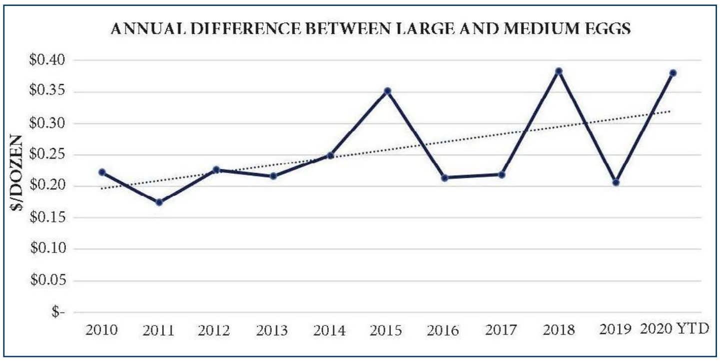

*Figure 4. Historical difference** between the market value of large and medium eggs.*

Urner Barry Midwest 3-year average (May 1, 2017 to April 30, 2020) market value applied to the egg size mix for 1 million layers with 255 eggs per hen house at 60 weeks. The difference in market value from 35 to 40 weeks, 35 to 45 weeks, and 35 to 50 weeks is $1.1mm, $2.1mm and $3.1mm, respectively. The per-dozen market prices used to calculate total market value were J - $1.3428, XL - $1.2353, L - $1.1683, M - $0.8908, S - $0.6516, Peewee - $0.524 (breaking stock).

**Urner Barry Egg Price Current, Midwest large and medium, white shell egg.*

INTRODUCTION

Genetics, body weight management, lighting programs, and nutrition are the four pillars of egg size and are useful tools for the egg producer to change egg weight profiles to best supply the optimum egg size to a market. Each commercial variety has a genetically determined range of egg size, and within this range, environment plays an important role in the expression of egg size.

THE FOUR PILLARS OF EGG SIZE

1. Genetics: Hy-Line geneticists select commercial lines having different egg size profiles to serve the different egg markets in the world. Egg weight is a heritable trait that responds well to genetic selection. The heritability estimate is that 40% of the egg size variation is due to genetics. The remaining 60% of egg size variation is due to non-genetic factors (nutrition, management, etc.). These non-genetic factors can be manipulated by egg producers to achieve the desired egg size profile. The Hy-Line Research Department has been collecting egg weight data and selecting based on egg weights for decades. Currently, Hy-Line weighs the first three eggs produced by the hen, eggs laid mid-cycle, and eggs laid late in the cycle. This egg weight data is used to select for a more desirable shape to the egg weight curve. Specifically, the goal is to select for increased early and mid-cycle egg weights and maintain late cycle egg weights (Figure 5).

Between the W-36 and W-80, Hy-Line can now offer a genetic selection of hens with different strengths and egg weight profiles.

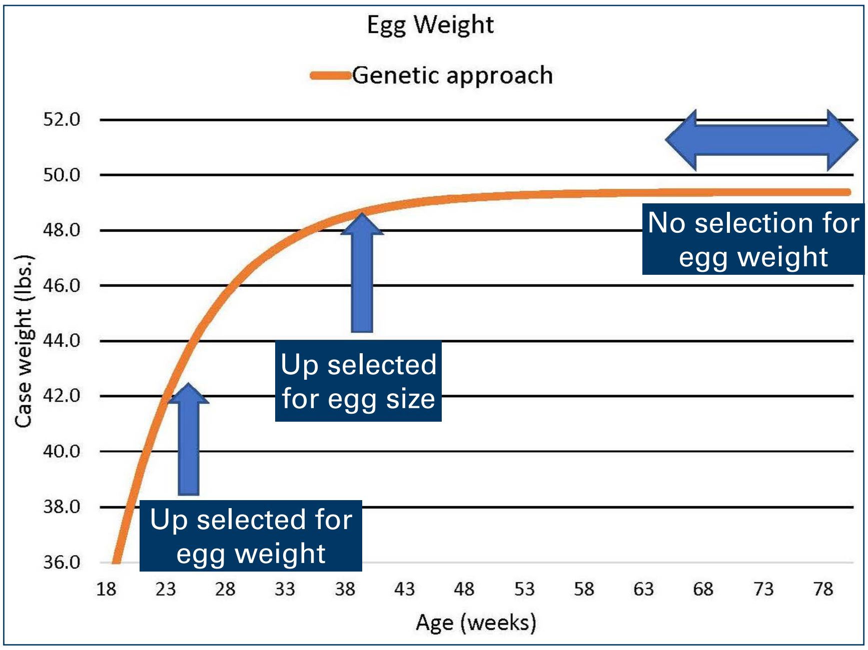

Figure 5. Genetic selection to create the ideal egg weight curve.

2. Body Weight and Flock Uniformity. Heavier pullets tend to lay more eggs throughout the production period and will have greater flexibility in adapting different egg size profiles. Pullet body weight and uniformity are affected by many factors, including beak trimming, vaccination program, transfer, disease challenges, pullet lighting program, space allotment, and nutrition.

It is important to carefully monitor the progression of pullet body weights. A body weight monitoring program should begin when the flock is one week old. Take individual bird body weights from at least 100 birds per flock weekly to track uniformity. Continue to weigh weekly until mature body weight is reached around 32 weeks of age. Thereafter, weigh at least every five weeks during the remainder of the production period. Birds should also be weighed prior to a scheduled change in feed formulation, such as from starter to grower feed. Scheduled changes in feed formulations should always be based on achieving breed standards for body weights and not the age of the flock.

Good uniformity of body weights within a flock is as important as achieving the target average body weight. The goal for uniformity during the rearing period is 85%, which means 85% of the individual bird weights are within +/- 10% of the average bird weight. Poor body weight uniformity is a major contributor to low peaks and substandard egg production. Too many underweight birds in the flock will lower peak egg production and result in lighter case weights.

For more information on target body weights and specific recommendations for each Hy-Line variety, see the management guides at https://hylinena.com/varieties/.

Table 1: Target Body Weights

	W-36	W-80
6 weeks of age: Development of immune and digestive systems	0.91–0.94 lb	0.95–1.04 lb
12 weeks of age: Development of skeleton and muscle	2.09–2.15 lb	2.07–2.27 lb
17 weeks of age: Development of the reproductive tract	2.72–2.80 lb	2.63–2.88 lb
40 weeks of age: Evaluates adequacy of layer nutrition	3.32–3.45 lb	3.51–3.77 lb

3. Lighting Programs. Chickens are responsive to changes in day length, and this has a significant effect on egg production and egg size. Age of light stimulation and body weight are interacting factors that help determine the onset of egg production, as well as egg size (see Table 2). Light stimulation should be done based on the flock's body weight and uniformity. Generally, early light stimulation at lighter body weights will accelerate maturity and decrease egg size; later light stimulation at heavier body weights will delay maturity and increase egg size.

4. Nutrition. Nutrition during the rearing and laying period has a critically important role in determining egg weight. Proper rearing nutrition allows the hen to achieve optimal body weights (ideally closer to the upper range). Changing the rearing diets based on attaining body weight standards (and not bird age) will best match the diet to the actual nutritional needs of the pullet. For more information, see the "[Growing Management of Commercial Pullets]" technical update.

During the laying period, the specification of diets can be used to manage egg size. Energy, methionine/cystine, other digestible amino acids, linoleic acid, and total fat can be specified in layer diets to partially influence egg weight upwards or downwards within the range of the bird's genetic potential.

Table 2: Recommended Lighting Programs

	W-36	W-80
Weeks to step down lights during rearing	12 weeks	7 weeks
Hours of constant light during rearing	12 hours	11 hours
Body weight at first light stimulation for egg numbers	2.70 lb	2.70 lb
Body weight at first light stimulation for balance	2.80 lb	2.80 lb
Body weight at first light stimulation for egg weight	2.90 lb	2.90 lb
Age to reach full light in lay	16 hours at 28 weeks	16 hours at 28 weeks

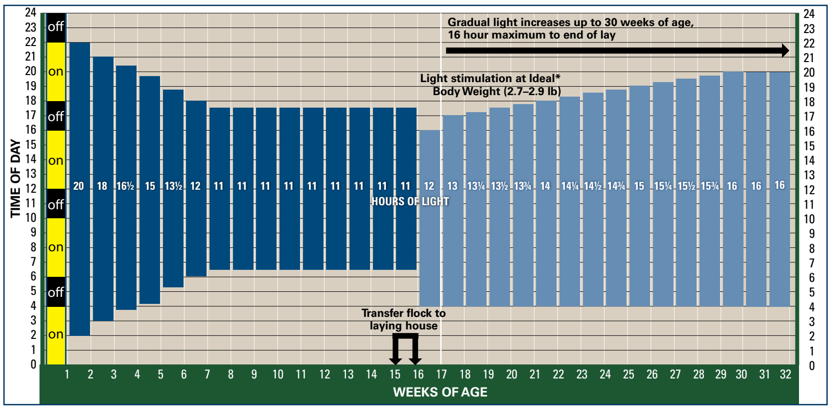

Figure 6. Lighting program for Hy-Line W-80.

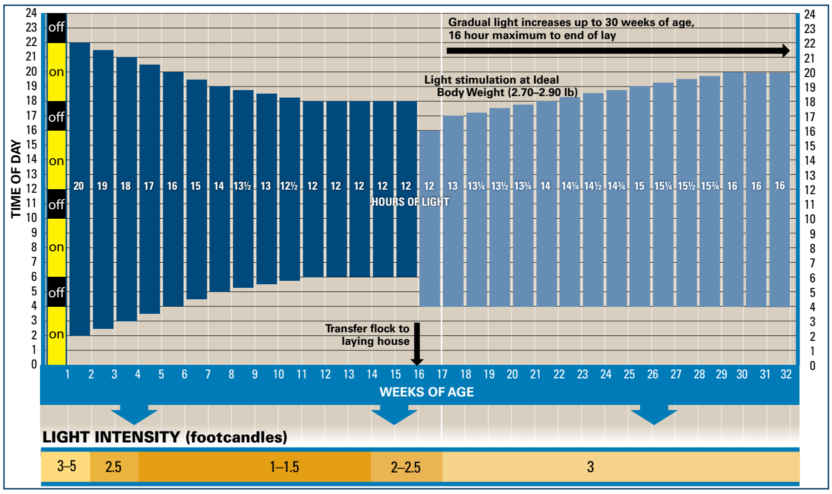

Figure 7. Lighting program for Hy-Line W-36.

The protein content of the diet should be balanced to ensure that amino acids are utilized efficiently by the bird. Unbalanced protein can result in poor utilization of amino acids and suboptimal egg size. Research has shown that laying hens have an "ideal amino acid profile;" the ratio of methionine + cystine to lysine should be a minimum of 91% during the pre-peak period to support maximum egg mass. All other amino acids should be balanced relative to lysine to ensure egg weight is optimized. Ideal amino acid ratios can be calculated based on the nutrition table, Production Period Nutritional Recommendations, found in the W-36 and W-80 management guides. Generally, management of egg size through nutrition is by changing the intake of amino acids when the case weight is within 1.0 lb of the target.

Adequate mineral intake, starting in the rearing period, is important to maintain shell quality and persistency for longer single-cycle laying flocks. From 6–12 weeks of age is the time for growth and development of the skeleton.

Pre-lay or higher calcium developer (if not using pre-lay) rations will increase the amount of medullary bone prior to the start of egg production. If a pre-lay diet cannot be provided, the developer diet should have an increased calcium level, up to 1.4%. Once egg production starts, matching mineral intake to daily requirements, particularly during the peaking period, will help with the longevity of good shell quality.

In addition to nutritional levels, the other aspects of nutrition management affects egg size. Feed particle size, water intake, water temperature, and feeding schedule can affect daily feed intake and nutrient intake.

Nutrition Recommendations

1. To more rapidly achieve a 48 lb case weight, utilize a pre-peak diet. This is a peaking feed formulation that provides 10–15% higher digestible amino acid intake (mg of digestible amino acid per bird per day) than recommended in the Hy-Line management guides. This can also be achieved by feeding the peaking diet calculated based on the actual bird intake.
2. Linoleic acid has a positive impact on egg size. For increased egg size, use a minimum of 2% linoleic acid in the diet. Supplemental oils which are high in linoleic acid include soybean and corn oil.
3. Increase total and supplementary fat content in the diet. Studies have shown that at the same linoleic acid levels, birds consuming a higher amount of total fat will produce larger eggs.
4. Keep an optimal energy intake. In situations of deficient energy intake, laying hens will utilize protein and amino acids as an energy source, resulting in fewer amino acids available for optimal egg size. Many situations of low egg weight are due to low energy intake. Overfeeding energy above recommended amounts tends to depress egg weights as a consequence of lower feed intake.
5. To maintain optimum egg weight during a long laying cycle, use a phase feeding program that makes small, gradual reductions in energy and amino acids. Do not reduce methionine only, as this will create an amino acid imbalance and reduce feed efficiency and feather cover.
6. During times of heat stress, the feed intake of the flock usually drops and will result in a reduced intake of critical nutrients such as protein (amino acids) and energy. Adjust the formulation of the diet to match the actual feed intake of the flock to help reduce the negative effect of heat stress on egg size.

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