TECH NOTES

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Feeding the Modern Broiler Breeder

A Holistic Approach

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Summary

Managing the modern broiler breeder is an exciting challenge. The reproductive potential of these birds is high, with 145-150 chicks per hen housed being an attainable goal, all the while maintaining the growth potential of a modern broiler. An important part of allowing broiler breeders to achieve their full reproductive potential is to ensure that they receive the correct nutrition, with particular attention being paid to feeding pre and post-peak. At these times, the broiler breeder manager must take into account the status of the flock, with respect to level of egg production, body-weight gain, fat reserves, and feather cover, to ensure that the birds are not being over or under fed.

Energy is the first limiting "nutrient" for breeders. Therefore, it is essential that they receive the correct amount of energy during both rear and lay to fulfill maintenance requirements, support growth, and meet the needs of egg mass, daily egg production, and egg size. Energy is utilized for two main purposes, maintenance and reproduction. Maintenance requirements are mainly affected by body weight and may be modified by changes in ambient temperature. If environmental temperature is not appropriate or is variable, the bird may have to use part of its supplied energy to maintain core body temperature. This energy is then no longer available for growth and egg production.

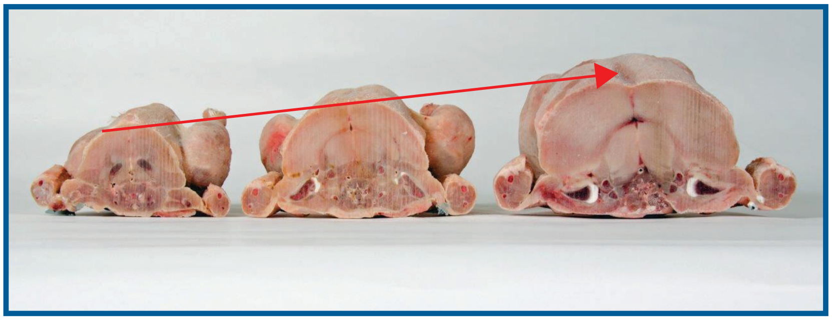
Proper control of daily protein intake in broiler breeders is also needed during rear, when it affects body composition and during lay, when it will have an impact on weight gain and egg size. Correct amino acid requirements are determined by accounting for changes in body tissues and egg content. Apart from specific situations, such as heat stress, the protein and amino acid levels in the diet are related to dietary energy content. This, along with the energy requirement of the bird at each stage of life, is what determines feed, and subsequently, nutrient intake. In short, feeding the modern broiler breeder requires a holistic strategy for nutritional parameters and feeding programs to be correctly established.

ROSS
An Aviagen Brand

Broiler Genetic Improvement and Breeder Nutrition

One of the objectives of a breeder farm is to produce as many fertile eggs as possible with sufficient quality to maximize hatchability and produce healthy chicks that are able to tolerate field challenges and achieve performance targets. As a primary breeder company, Aviagen® made significant progress in producing an efficient broiler with increased yield, while at the same time, emphasizing the production of hatching eggs in the broiler breeder. **Figure 1** illustrates recent internal evaluations comparing modern broiler lines to an unselected broiler line from the early 1970's. This shows the progress that has been made in developing broilers that provide favorable yield.

Figure 1: Example of the progress in 49 day live body weight between 1972 and 2012.



The consequence of this progress is that the modern broiler breeder, just like its progeny, has a phenomenal ability to efficiently utilize feed, and gain body weight on progressively lower amounts of total feed intake. These birds have the potential to produce hatching eggs at rates comparable to their predecessors; however, it is imperative that proper management be maintained during rear and lay. The performance of the flock in rear (i.e. growth rate, flock uniformity and carcass composition) will influence future reproductive performance. Once the birds reach sexual maturity, all feeding decisions must take into account body weight, required body-weight gain, fat reserves, feathering, egg production, egg weight, and hatchability in order to maximize high quality chick output. Therefore, a holistic strategy should be considered during the development of nutritional parameters and feeding programs.

The Rearing Period: What Comes First, Nutrition or Management?

The uniformity of a flock has always been crucial to a successful breeding operation. Currently, maintaining good flock uniformity is even more important because broiler breeders are able to rapidly consume their allocated feed and deposit protein with limited body fat deposition. Farm managers may observe that birds are consuming less feed in less time while growing at the same rate. This is due to genetic improvement. However, when feeding a flock of pullets, it is not the individual that is being fed but the entire flock. If uniformity is low (high CV%), the birds will come into production unevenly and may produce 3 weight groups within the flock - heavy, normal, and light.

In this situation, it is good management practice to implement grading for body weight. This allows each graded population to be fed according to its weight, and the flock to achieve adequate uniformity. This is crucial for achieving high standards of production later in life. After grading, the breeder manager must provide a specific amount of feed to each population so that the weight difference between each population is reduced week by week, and flock uniformity is maximized by point of lay. Adequate feeding must occur during the rearing period in order to synchronize sexual maturity, achieve consistent and uniform growth, and promote future reproductive performance.

Starter Period

The period of time from hatch to 4-5 weeks of age is important in determining the future performance of the birds. Nutrition at this stage must focus on the proper development of skeletal, intestinal, cardiovascular, and immune systems with the uniformity of that development within the flock being high. Feeding a starter diet, per Ross® nutritional recommendations, is sufficient to support appropriate body-weight gains so that females are on target weight at 4 weeks of age (see current Ross Performance Objectives for more details).

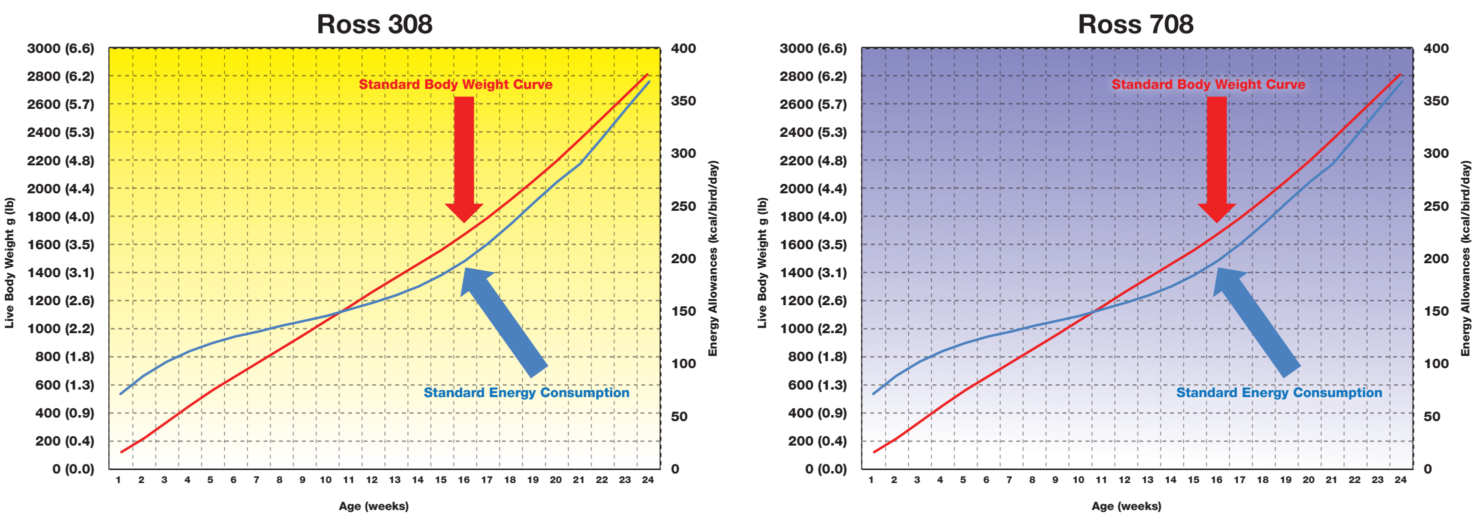
Grower Period

While Ross provides recommendations for the dietary specifications of a grower feed which are based on a given energy level, it is possible to meet the energy needs of the bird at this time with a differing dietary energy content, provided nutrients are appropriately factored to dietary energy density and feed intake is adjusted to achieve the correct daily energy intake. In practice, grower diets are usually formulated with an energy level in the range of 2,600 to 2,950 kcal ME/kg (1,180 to 1,138 kcal ME/lb). However, it is usually more difficult to achieve good flock uniformity with higher dietary energy density because a smaller amount of feed is needed to meet the energy requirement of the bird and feed clean-up times are shorter. On the other hand, low dietary energy density requires the inclusion of fibrous raw materials, which should have strict quality control in terms of composition and mycotoxin contamination.

Many producers reduce dietary energy density in order to extend feed clean-up time. When lower density diets are used, it is important to increase the feed allocation to achieve the daily energy needs of the bird. The protein:energy ratio must be maintained in order to avoid excess protein intake and, subsequently, changes in weight gain composition (fat and protein), which could result in over-fleshed birds with insufficient fat reserves at photostimulation. Regardless of the dietary energy level, it is essential to provide the correct feeder space and uniform feed distribution.

When provided with properly designed diets, it is up to the breeder manager to implement the correct feeding program from 0 to 20 weeks. The Ross 308® recommended feeding program results in a cumulative consumption of energy and protein at 20 weeks of age of about 22,260 kcal ME and 1,230 g, respectively. For the Ross 708®, the numbers are 19,817 kcal ME and 1098 grams. However, apart from ensuring the cumulative total nutrient intake during this period is achieved, it is also important to consider how energy and protein is distributed over time. Incremental changes to weekly feed allocation must be compatible with the standard daily energy requirements profile, in order to allow birds to achieve the correct body-weight gain at target age. To help with this, Ross provides daily energy allowances for the rearing period (**Figure 2**). These values are based on an environmental temperature of 20-21°C (68-70°F), so they must be adjusted according to average daily temperature. Consideration should also be given to the lighting program, altitude, and level of activity, which will change the actual energy needs of the bird.

Figure 2: Ross 308 and Ross 708 daily energy intake and body-weight profiles during rearing period.



The Pre-breeder Phase

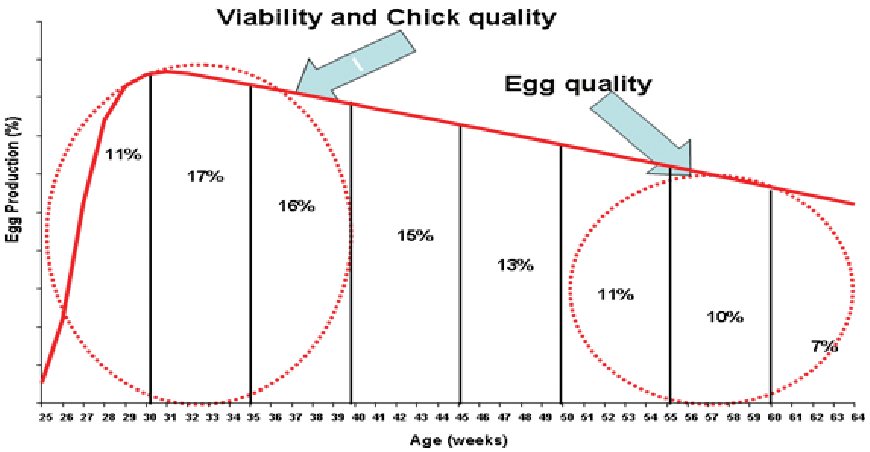
The pre-breeder phase is a crucial stage in the preparation of the broiler breeder female for sexual maturation and egg production. At this time, the bird must receive the right feed increments in order to successfully complete the growth phase. Studies about the use of pre-breeder diets have generated controversial conclusions (Cave, 1984; Brake et al 1985; Bowmaker and Gous, 1991), mainly due to the particular characteristics of the bird development and proposed objectives.

The classical concept of using a pre-breeder diet containing 1.2-1.5% calcium is to prepare the female for the laying phase by increasing calcium deposition in medullary bone. Currently, the use of pre-breeder diets can have a different connotation according to the dietary energy concentration used in the developing period. If the grower diet has low content of ME (as low as 2600-2650 kcal/kg), a pre-breeder diet with higher ME content (other than simply extra calcium) will allow a smoother energy transition into the production phase - promoting small weekly increases in feed amounts, proper weight gain, breast conformation, and fat reserve deposition. If dietary energy content in the rear and lay diets are the same, the use of pre-breeder might be unnecessary.

The Production Phase (25-35 weeks of age)

During this phase, the objective of a breeder manager is to achieve the maximum number of fertile hatching eggs with emphasis on chick quality during the first weeks of production and hatchability during late production. **Figure 3** shows the importance of each 5-week period during production on total egg output. The first phase of production (25-40 weeks) is responsible for almost 45% of total egg output and the late phase of production (>50 weeks) for more than 25% of total egg production.

Figure 3: Important aspects during egg production (%) of broiler breeder hens.



Exposure to increased light (photo-stimulation) initiates a cascade of physiological and hormonal development that ultimately results in egg production. The priority during this period is to ensure the female receives enough nutrients for body-weight maintenance, growth, and egg production, simultaneously. The nutritional requirements of the female must be met by providing an adequate daily energy allowance while maintaining the correct relationships between energy, protein, essential amino acids, vitamins, and minerals.

Small deviations in feed allocation may adversely affect the production of eggs and chicks (Robinson et al., 1993; Robinson and Renema, 1998). Assuming that birds are continually producing yolk precursors within a follicular hierarchy, the feed allocation from onset of lay to peak production is a key point for maintaining weight gain, achieving standard egg size, and avoiding metabolic disorders.

As described in the Ross Parent Stock Management Handbook (2013), peak feed should be given when birds achieve ~60% of hen-day egg production. A small and constant increase in feed amount should be given from 5% of hen-day egg production onwards (**Table 1**). However, some breeder managers have the perception that this feeding schedule is too aggressive and will try to delay the peak feed to 70-75% of hen-day egg production. The breeder manager must be aware that when flocks have low fat reserves, peak feed should not be delayed beyond 70% of hen-day egg production. If peak feed is delayed in these conditions, the existent fat reserves may be completely utilized during peak egg production. In order to replenish that, feed reduction post-peak might be compromised. This may impact the control of body weight and egg weight, possibly impacting persistency of egg production.

When breeder hens have an early onset of production (photostimulated before 22 weeks), correct feeding during the pre-peak period is even more critical. Furthermore, birds that are underfed and have lower daily gain in this period will produce a greater number of small eggs, compromising the initial performance of chicks produced from these eggs.

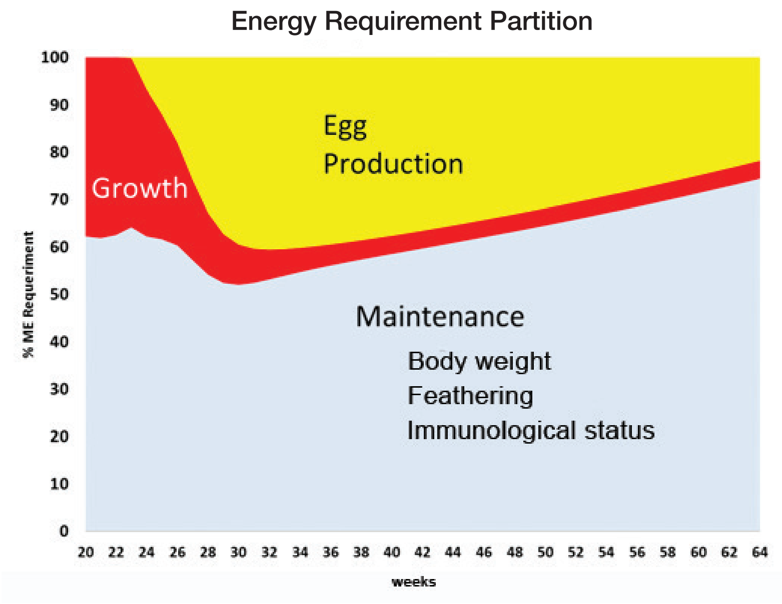
Table 1: Example female feeding program to peak egg production (for further details refer to the Ross Parent Stock Performance Objectives). Feeding program for a 24 week old flock on 368 kcal ME/bird/day (131.5 g/bird/day or 28.9 lb/100 birds/day), based on a feed energy level of 2800 kcal ME/kg (11.7 MJ/kg) or 1270 kcal ME/lb. Average daily temperature is assumed to be 20-21°C (68-70°F) and the flock is assumed to be on target body weight with good uniformity.

	ROSS 308			ROSS 708		
Hen-day %	**Daily Energy Intake (kcal/bird/day)**	**Feed Amount* g/bird/day (lb/100 birds/day)**	**Feed Increase g/bird/day (lb/100 birds/day)**	**Daily Energy Intake (kcal/bird/day)**	**Feed Amount* g/bird/day (lb/100 birds/day)**	**Feed Increase g/bird/day (lb/100 birds/day)**
5	386	138 (30.4)	7 (1.4)	354	127 (27.9)	11 (2.2)
10	395	141 (31.1)	3 (0.7)	362	130 (28.6)	3 (0.7)
15	403	144 (31.8)	3 (0.7)	371	133 (29.2)	3 (0.6)
20	410	147 (32.3)	3 (0.5)	379	136 (29.9)	3 (0.7)
25	418	150 (33.0)	3 (0.7)	388	139 (30.5)	3 (0.6)
30	427	153 (33.6)	3 (0.6)	396	142 (31.2)	3 (0.7)
35	434	155 (34.2)	2 (0.6)	404	145 (31.9)	3 (0.7)
40	441	158 (34.7)	3 (0.5)	413	148 (32.5)	3 (0.6)
45	448	160 (35.3)	2 (0.6)	421	151 (33.2)	3 (0.7)
50	455	163 (35.8)	3 (0.5)	430	154 (33.8)	3 (0.6)
55	462	165 (36.4)	2 (0.6)	438	157 (34.5)	3 (0.7)
60	469	168 (36.9)	3 (0.5)	446	160 (35.2)	3 (0.7)
65	469	168 (37.0)		446	160 (35.3)	
70	469	168 (37.0)		446	160 (35.3)	
Peak	469	168 (37.0)		446	160 (35.3)	

**Figures in this table are rounded. Table Notes: (a) Flocks can consume 115-135 g (25-30 lb / 100 birds/ day) of feed per bird per day prior to 5% hen-day production; feeding programs should be adjusted according to given start point. (b) Uniform flocks will come into production rapidly and feed amounts should be adjusted (increased) accordingly. (c) Even though the table shows feed increases every 5% production, it may be necessary to adjust feed levels daily, taking into account the rate of daily production. (d) If feed energy levels different to 2800 kcal (11.7 MJ) ME/kg feed are used then feed intake will need to be adjusted accordingly. (e) Peak production is assumed to occur around 6 weeks after 5% production is achieved. (f) Adjustments will need to be made if environmental temperature is warmer (reduce feed intake) or cooler (increase feed intake) than that assumed here.*

Energy is said to be the first limiting "nutrient" for broiler breeders. In reality however, energy is not a nutrient at all. Energy is released from dietary carbohydrates, fat, and protein/amino acids into the body during digestion and metabolism. It is then distributed in the body and used for growth, maintainance of tissues, and egg production (**Figure 4**).

Figure 4: Components of the total energy requirements of broiler breeder females from 20-64 weeks of age.



The energy required for maintenance is affected, to a large degree, by body weight and temperature. Birds that are outside of their thermoneutral zone (the temperature zone in which they are most comfortable/efficient) may require more or less energy to keep them cool or warm, as well as to maintain their normal physiological needs. Feather cover can also affect the amount of energy required, even at thermoneutrality.

The energy needs of broiler breeders are well established. The nutritionist must establish the correct dietary energy level in order to allow the breeder manager to design a feeding program that will fulfill requirements and result in a feed allocation strategy which can be evenly distributed by the feeding equipment. Once the dietary energy level has been selected, the other nutrients are formulated so that their daily allowances will meet the birds' needs as well.

Environmental temperature is a major factor influencing energy requirements. As operating temperature differs from 20°C (68°F), energy intakes should be adjusted. Operating temperature can be calculated according to the following formulas:

- Open Sided Houses: T°C min +1/3 * [T°C max-T°C min].
- Closed Houses: T°C min + 2/3*[T°C max-T°C min].

It should be noted that the use of temperature loggers is necessary to help better understand local conditions and to provide accuracy in the energy allowance adjustments. In regions where the variation of temperature occurs abruptly, there is a tendency to underestimate the operating temperature and the effects of the cooler period.

The current daily energy recommendation at peak, for broiler breeder hens kept in their thermoneutral zone, is approximately 460-470 kcal. According to Ross guidelines, it is recommended to increase energy by 0.126 MJ (30 kcal) per bird per day if temperature is decreased by 5°C (9°F) from 20° to 15°C (68°to 59°F). That corresponds to 6 kcal for every each 1°C (2°F) below thermoneutral temperature. Birds kept in operating temperatures between 20° to 25°C (68° to 77°F) may have a reduction in terms of net energy requirement by 0.105 MJ (25 kcal) per bird per day. As temperatures increase to the point where the bird begins to pant, the energy requirement increases again and feed composition, feed amount, and environmental management should be controlled to reduce heat stress. Providing correct nutrient levels and using feed ingredients with higher digestibility will help to minimize the effect of heat stress. Increasing the proportion of the feed energy that comes from fats rather than carbohydrates, and minimizing total dietary protein while meeting essential amino acid requirements may also be beneficial.

Broiler breeder managers commonly increase the amount of feed in order to provide more energy and reduce the effects of cold. However, it is important to remember that when the amount of feed is increased, more protein will also be provided, which can affect body-weight control and egg size. Therefore, in cold conditions, the use of a diet containing a higher energy:protein ratio can be useful.

Modern broiler breeders, as a result of their genetic background, are likely to have reduced energy stores available as fat reserves when their feed intakes are below their needs. This leads to their being in an energy deficit situation, and will affect their immunological system, feathering status, and egg production and persistency. Proper nutritional balance will help minimize the risk of metabolic problems, maximize egg shell quality, properly control egg size, and promote optimal transfer of nutrients to progeny.

Protein Allowances

Summers (2008) recommended a daily protein intake of 22 g /bird/day for egg production. Rabello et al. (2002) established a prediction model to estimate the protein requirement as following:

$$CP = 2{,}282 * W0.75 + 0.356 * G + 0.262 * EM$$

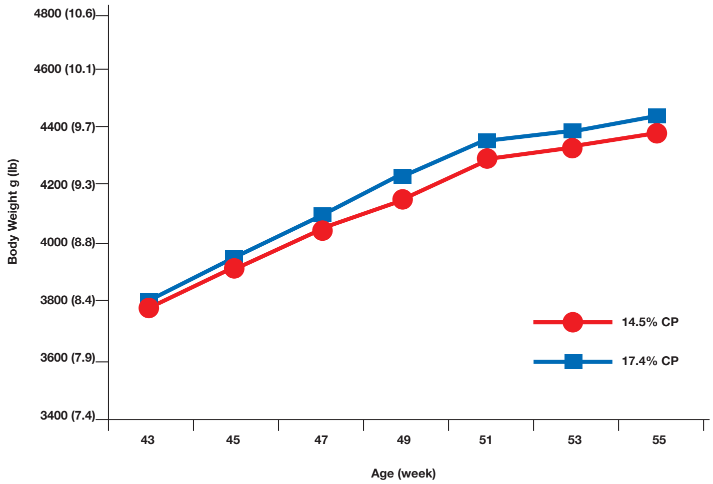
Where CP is crude protein requirement (g/bird/day), W is body weight (kg), G is weight gain (g/day) and EM is egg mass (g/day). Even in regular productive flocks this model results in a protein requirement of only 20 g (0.71 oz)/bird/day at peak of egg production. Such a low level of protein allowance is likely an underestimation of the protein requirement for optimal egg size.

Lopez and Leeson (1995) fed diets with 16, 14, 12, and 10% of crude protein during lay corresponding to a protein intake of 26, 23, 19, and 16 g/bird/day at peak feed, respectively. Feeding the lowest level of protein intake did not affect egg production and increased fertility. However, birds receiving the lowest protein intake had significantly lower body weight than those given higher levels of protein. Furthermore, there was a reduction in egg size when birds were fed diets with 10% and 12% crude protein, causing a reduction in the weight of 1 day old chicks.

A general principle, which also seems to be applicable to broiler breeders (Spratt and Leeson, 1987), is that the composition of the egg will be kept constant regardless of the environmental conditions so that the size and number of eggs are affected by dietary protein and amino acids (Fisher, 1998). A small increase in protein intake above the optimal level might have resulted in responses proportionally equal to the rate of lay and egg weight (Bowmaker and Gous, 1991). Therefore, Joseph et al. (2000) reported an increase in the egg size when protein intake changed from 23.4 to 26.6 g /bird/day. This relationship between protein intake and egg weight is particularly important in the early stages of egg production. Ulmer-Franco et al. (2010) reported that heavier eggs generated heavier 1 day old chicks resulting in heavier broiler chickens at 41 days of age.

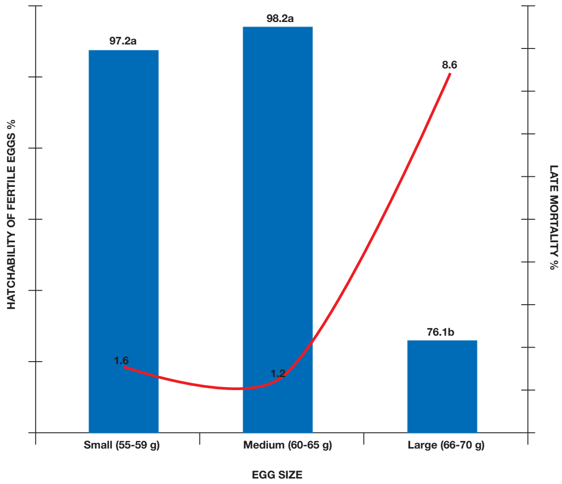
Broiler breeder hens between 43 and 55 weeks of age showed an increase in daily body-weight gain of 12% when the dietary crude protein was increased from 14.5 to 17.4% (**Figure 5**) but there was no significant effect of protein increase on egg size (Mohiti-Asli et al., 2012).

Figure 5: Effect of dietary protein on body weight of broiler breeder hens from 43 to 55 weeks of age.



The use of diets with higher protein for extended periods may make body-weight control difficult, and often results in overweight birds and increased egg size (> 65 g/ 27.5 oz per dozen) just after 40 weeks of age. It has been shown that the hatchability of eggs heavier than 65 g (27.5 oz per dozen) is reduced (Shafey, 2002 – **Figure 6**). The difficulty for broiler breeder managers, therefore, is to maximize chick quality at the beginning of production while achieving good egg size and hatchability after 50 week of age.

Figure 6: Effect of egg size on hatchability and late mortality (adapted from Shafey, 2002).



Considering the energy requirement of 460-470 kcal/bird/day at peak and an expected consumption of 24-25 g of protein/bird/day, a Breeder 1 Layer diet formulated with 2800 kcal/kg (1270 kcal/lb) and 15% crude protein will result in excellent egg production peaks and good egg size at the beginning of production.

Broiler breeder diets continue to be formulated with minimum levels of crude protein which achieve not only good egg production, but also proper egg size, chick quality, and feather structure throughout production. However, it is important to know the daily recommendations of digestible amino acids and to formulate breeder diets to fulfill requirements without leading to excesses.

Amino Acids

Ross estimates the amino acid needs of the hen using various models developed by researchers such as Hurwitz and Bornstein (1973), and Leveille and Fisher (1958, 1959, and 1960a,b). These models take into account the amino acid requirements for growth and maintenance. Trial and field experiences have confirmed the accuracy of these amino acid recommendations allowing nutritionists to confidently formulate diets.

Once the energy level of the diet is calculated, the level of dietary amino acids is based on the daily requirements as determined by the models described above. For example, if the birds need 580 mg/bird/day (0.128 lb/100 hens/day) of methionine and a feed containing 2920 kcal ME/kg (1325 kcal ME/lb) is being fed, to achieve the required 460 kcal/bird/day, the feed intake will be 157.5 g/bird/day (34.7 lb/100 hens/day) at peak production. To achieve the required methionine intake, the diet will therefore have to be formulated to contain a minimum of 0.368% methionine. This process is repeated for each individual amino acid until all are expressed in dietary density. If the flock is overweight, extra energy and amino acids will need to be provided to maintain that extra weight as well as weekly weight gain and egg mass production.

Vitamins and Minerals

Proper vitamin and mineral supplementation in the laying phase is important for promoting good chick quality. Adequate levels of vitamins and minerals in breeder layer diets are important to support normal embryo development, avoiding possible deficiencies (**Table 2**) that might cause:

- Death.
- Malformation.
- Other abnormalities – e.g. shortened legs and beak , clubbed down, perosis, edema, abnormal feathering.
- Accelerated oxidative metabolism during late incubation.

Table 2: Embryonic mortality associated with vitamin and mineral deficiencies.

Vitamin/Mineral	Stage of Incubation			
	Early	Mid-term	Mid to Late	Late
A	x			
D				x
E	x			x
K				x
Thiamin (B_1)	x			x
Riboflavin (B_2)		x	x	x
Niacin	x		x	
Pantothenic acid	x		x	x
Pyridoxine (B_6)			x	
Biotin	x			x
Folic acid				x
B_{12}		x	x	x
Ca				x
P		x		x
Mg				x
Cu	x			
I				x
Mn				x
Se	x			
Zn		x		x

Feeding Post-Peak

Fat accumulation can occur in the uterus vaginal junction of obese birds which may restrict the area for storage of spermatozoa, resulting in reduced fertility (Yu et al., 1992; Robinson et al., 1993). What tends to be seen in the modern broiler breeder is overweight birds (10-12% above standard) that are very large, over-fleshed, and have insufficient fat reserves. To avoid this situation, and the associated drop in production and hatchability that occurs, adopting specific feeding strategies after peak egg production is necessary.

Peak production is generally reached in weeks 30-31, unless the flock has been intentionally brought into production earlier or later. Farm managers need to observe the relationship between body weight and egg production (egg mass), maintaining peak feed for more than 2 or 3 weeks after the peak egg mass before reducing feed. Reducing feed post-peak is not a simple task, and the time and amount of feed to be reduced depends on several factors:

1. Body-weight curve and body-weight gains from start of production.
2. Daily egg production and trends.
3. Energy stores as fat reserves.
4. Egg weight trend.
5. Health status of the flock.
6. Ambient temperature.
7. Feathering status.
8. Flock history.

Several methods have been proposed to help farm managers determine the appropriate post-peak feed reduction schedule.

It is useful to evaluate egg mass, body weight, and feed clean-up time as criteria for post-peak feed reduction. However, Lewis (1996) stated that putting too much emphasis on egg mass results in excessive feed being given, causing an unnecessary increase in body weight, subsequently increasing the energy requirement for maintenance.

To better use clean-up time effectively as a tool to reduce feed after peak of production, it is necessary to keep accurate records. Major changes in feed clean-up time often precede a change(s) in body weight and/or egg production a few days later. At peak egg production, feed clean-up time is normally in the range of 2 to a maximum of 4 hours at 19-21°C (66-70°F), dependent on the feed physical form, as seen in **Table 3**, below.

Table 3: A guide to feed clean-up times at peak of production.

Clean-up at peak egg production (hr)	Feed texture
3-4	Mash
2-3	Crumble
1-2	Pellet

Recording hatching egg weights is a good tool for evaluating proper feed allocation. Changes in the trend of egg weight should reflect changes in body weight, regardless of egg production. According to the energy requirement model proposed by Connor (1980), another helpful method is to look at the egg production difference compared to the standard (%), multiplied by 1.8 to determine how much energy to reduce (or leave) from a flock. Most companies reduce a total of approximately 45 kcal/bird, or about 10% of feed from peak until the end of production when the environmental temperature is 19-21°C (66-70°F).

On a practical level, the use of a single diet during the laying phase can lead to rapid feed reduction post-peak in an attempt to control body weight and egg size. However, in this case, a decrease in egg production, flock and egg size uniformity, feathering cover, and hatchability may occur. The use of a second diet after 35 weeks (Breeder 2 diet) helps to maintain performance parameters. This second diet must have lower crude protein, balanced amino acids, and higher calcium levels than the first breeder diet, but should maintain the same energy level. Even though the use of a Breeder 2 diet is recommended, frequent feed reduction is still practiced until the end of production. The feed reduction strategy must not only consider egg production and body weight, but also egg size, feathering status, and fat storage. Post-peak feed reduction is not simply a matter of calculation. Each flock is unique and will have different requirements, and appropriate post-peak feed reduction requires close observation and understanding from breeder managers.

Feed Physical Form

Studies on the effect of pellet form on broiler breeder production have been contradictory (Hocking and Bernard, 2000; Cier et al., 1992) with some suggesting that, as in broiler chickens, pellet processing might increase ME availability. However, breeders are controlled-fed, so the assumption that pelleting the feed increases "availability" of ME is questionable.

It is strongly recommended not to assign energy to the feed form for breeders as they are not fed ad libitum like broilers. Controlled-fed breeders, in most feeding systems, simply eat until all of the feed is consumed. In this situation, there is no chance to see a difference due to decreased feeding behaviors. If the nutritionist assigns an energy value to feed form, it reduces feed cost, but the birds may potentially not be fed the appropriate amount of energy per day, creating a negative energy balance.

Nutrition of Males

During the rearing period, males can be fed the same diets as the females. However, separate control of male feeding level during the reproductive period using sex-separate feeding systems is essential. The use of a separate feed system for males will improve male body-weight control and uniformity.

The use of a single feed for both sexes is a widespread practice during the laying period. However, the use of a specific male diet during this time has been shown to be beneficial to the maintenance of male physiological condition and fertility (Moyle et al., 2011). If a separate male diet is used, it should be introduced at move to the laying house or photostimulation. A separate male diet, with lower protein and amino acid levels than the female diet, can help prevent excessive breast muscle development and ensure proper feed allocation according to male requirements. Nutritionists should explore the use of ingredients which may be beneficial for sperm quality (e.g. organic selenium, omega 3 fatty acids, L-carnitine, ascorbic acid, creatine).

At peak fertility (around 30 to 38 weeks, and male body weights between 4.1 to 4.4 kg [9.0-9.7 lb]), it is recommended that males receive at least 380 kcal ME/bird/day and 16-18 g of crude protein. Feed must be increased continually to ensure a small but continuous body-weight gain until the end of production, in order to achieve 420 kcal/bird/day and 18-20 g protein at 65 weeks. Male body weight and fleshing status must be monitored on a regular basis to achieve and maintain optimum fertility levels.

Male diets are formulated within a range of 2600 to 2850 kcal ME/kg (1180 to 1293 kcal ME/lb). The use of lower dietary energy density allows longer clean-up time and helps to improve body-weight uniformity. However, in lower density diets, the feed intake must be adjusted in order to ensure recommended caloric intake. On the other hand, dietary protein level must be adjusted carefully to prevent excessive body-weight gain. Holding feed intake at constant levels for prolonged periods of time can result in negative consequences for feathering status, breast muscle condition, and fertility.

Conclusions

Following the Ross recommended nutrition advice for broiler breeders will help to achieve target body weights and reproductive performance. Special attention must be paid to protein and energy allowances in the production phase and feed allocation must ensure that the nutritional needs of the birds are adequately met.

Enough energy must be supplied for maintenance, growth, and egg production. Environmental temperature must be monitored to determine required feed allocation changes since the maintenance energy requirement is influenced by environmental temperature. All other nutrient levels should be determined in relation to the dietary energy level to ensure that nutrient intakes remain correct. The challenge for the broiler breeder manager is to improve early chick quality and maintain late hatchability. In order to achieve this, feeding strategies pre- and post-peak must be carefully monitored, taking into account egg production, body weight, egg size, fat reserves, and feather cover. Any changes to feed intake must also consider the effect on nutrient intake if birds are to avoid being over- or under-fed.

Nutritional resources available in the market should be included in the formulation with an objective to maximize egg production and chick quality. The breeder manager and nutritionist must work together to exploit the genetic potential of the modern broiler breeder and to ensure good bird welfare. If this is done, the critical points for the care and feeding of the flock during rearing and production will be managed effectively.

Key Points

- Feeding broiler breeders requires a holistic approach.
- During the rearing period, the feeding program should be designed to achieve uniform bird growth and synchronization of sexual maturity.
- During the reproductive period, the feeding program should be designed to achieve the maximum number of fertile hatching eggs ensuring adequate chick quality and persistent hatchability.
- Energy is the first limiting nutrient and all other nutrient levels are calculated in relation to dietary energy content.
- Dietary nutrient density and corresponding feed allocations must fulfill the birds' nutritional requirements at all ages for optimal production.
- Ross nutritional advice uses specific dietary energy levels as a base. If using differing dietary energy levels, feed amounts must be properly adjusted to ensure the same caloric intake.
- Feed allocation must be adjusted for changes in environmental temperature. Ross nutritional advice for energy requirements is based on an average daily temperature of 20-21°C (68-70°F).
- Peak feed should be given at around 60% hen-day production with small consistent feed increases in feed being given from 5% production to peak.
- Post-peak feed reduction requires careful monitoring of the flock (i.e. body weight, egg weight, egg production, egg mass, and temperature variation) to properly determine the rate and total amount of reduction.
- The use of a second breeder diet after 35 weeks with a lower crude protein and balanced amino acids can help maintain good egg production while effectively controlling body-weight gains.

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