Evaluating breeder efficiency

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Consumer demand for lean poultry products necessitates that broiler leanness and uniformity be improved. As a result, technologies are directed at greater muscle production, not overall bird mass. Shifting focus to the profit centre of broiler muscle tissue necessitates that broiler genetics and management focus on muscle growth as well.

Though this direction may change the way we grow broiler breeders, research directed at energy and amino acid requirements may help offset this dilemma. Nonetheless, technological developments must occur within the bounds of increasing environmental restrictions, which are becoming more intense.

Today's commercial broiler is the fastest growing and most efficient bird ever produced. It represents the combined efforts of genetics and management. However, this tremendous improvement in broiler performance produces a need to change the way broiler breeders are managed and fed.

Much like the broiler, the broiler breeder is also changing rapidly and although geneticists are also selecting for increased egg production, the emphasis is still placed on broiler traits. This does not create broiler breeders that are more difficult to manage but, as the bird changes, innovative nutritional and management approaches must be developed to match these needs.

Variable	Energy required
3.6kg hen	+288kcal/day
15 hour of light	-6.2kcal/day
Gaining 4g body weight	+14kcal/day
Producing a 60g egg	+126.6kcal/day
Total	**422.4kcal/day**

Table 1. Daily hen energy requirements when producing an egg.

There is a great wealth of information available on nutrition and management of broiler breeders but, the industry often lacks basic knowledge of pullet and breeder hen metabolism and the amino acid requirements for optimal productivity. Though many companies offer feed and body weight guidelines for rearing breeders it seems that much of the industry practices and management guidelines are based more on circumstantial opinions and trial by error than on scientific evidence and documented solutions. Therefore, the intent of this article is to describe some of the trends that are taking place in broiler breeder energy and amino acid requirements.

The Cobb 500.

Energy requirements

The broiler breeder energy requirements are dependent on numerous factors but can be summarised as energy needed for maintenance, tissue gain, egg production and management. The maintenance component contains the greatest variability and encompasses factors such as effective temperature, immune status and light period. All components are interactive and can be quantified to allow managerial decisions to enhance efficiency of production. Tissue gain and egg production are written after maintenance to reflect that maintenance components must be satisfied first. Any increase in bird maintenance need will divert energy away from growth and egg production, unless an increase in feed energy takes place.

Relative to the production state managerial decisions can have a positive or negative influence on breeder hen energy requirements.

Managerial decisions related to house design, ventilation, stocking density and lighting are among the many variables influencing maintenance. Various stress categories have the potential to adversely reduce performance. Variables include ambient temperature and relative humidity extremes, immunological response, atmospheric contaminants (ammonia, dust, brooder gases) and stress.

The following example illustrates the energy required for a 3.6kg broiler breeder hen. The data is from research conducted by Robert Teeter at Oklahoma State University. Under thermoneutral conditions the hen's maintenance requirement is equal to 80kcal/kg body weight per day. The maintenance energy required is increased during heat or cold stress conditions. The maintenance energy requirement for a 3.6kg hen is 288kcal/day (3.6kg x 80kcal/kg) under 16 hours of light. If less or more light is given, an adjustment factor of ±6.3kcal/hour must be used.

Variable	Energy required
3.6kg hen	+288kcal/day
15 hour of light	-6.2kcal/day
Gaining 4g body weight	+14kcal/day
Producing no eggs	+0kcal/day
Total	**295.8kcal/day**

Table 2. Hen energy requirement with no egg production.

The energy needed for a 1g of body weight gain/day is 3.5kcal/day. A broiler breeder gaining 10g/day (70g/week) requires 35kcal/day for body weight gain. The energy required to produce a 55g egg is only 11.1kcal but the energy of the egg must also be included. The energy content of a 55g egg is 105kcal; therefore, a hen will need 116.1kcal (11.1kcal+ 105kcal) per day to lay a 55g egg. This calculates to 2.11kcal of energy needed for every gram of egg produced.

Using the preceding example, a flock at 80% daily egg production will require an average daily energy intake of 397kcal/

Continued on page 17

Amino acid	Maintenance	Egg mass	Egg mass + body weight	Maintenance + egg mass	Maintenance + egg mass + body weight
			(mg/bird/day)		
Crude protein	5852	–	13502	–	19354
Arginine	314	753	708	1067	1022
Histidine	74	–	–	–	–
Isoleucine	159	689	669	848	828
Leucine	205	–	–	–	–
Lysine	168	710	721	878	889
Methionine	91	340	345	431	436
Cysteine	31	395	437	426	468
Phenylalanine	224	–	475	–	699
Tyrosine	66	–	–	–	–
Threonine	243	399	370	642	613
Tryptophan	21	191	222	212	243
Valine	199	575	587	774	786
Non-essential AA	4057	–	7690	–	11747
Essential:non-essential AA ratio	31:69	–	43:57	39:61	–

Table 3. Digestible amino acid requirements for maintenance and production in the Cobb 500 broiler breeder (Dr Craig Coon, University of Arkansas, unpublished).

Continued from page 15
hen/day. This is where the art or experience of poultry production comes into play. If a manager feeds this flock 397kcal/day, 80% of the hens will not have enough energy to lay an egg, maintain body weight or grow. Previous research indicates that a hen will obtain the energy from body reserves for a period of time but egg production persistency will be negatively affected after some time.

A manager's only choice is to make certain that the hens laying eggs are receiving the proper amount of energy. This dilemma is exacerbated with poor producing flocks. The less eggs a flock produces the greater number of hens will be overfed leading to overweight flocks.

Amino acid requirements

To feed a broiler breeder hen efficiently, amino acids must be balanced for maintenance, tissue accretion and egg production. The amino acid needs must be expressed on a factorial basis so that data can be extrapolated for differences in strain, age, body weight, body composition, egg size, egg composition and egg number.

Research, sponsored by Cobb-Vantress and conducted by Dr Craig Coon at the University of Arkansas, determined the digestible amino acid for maintenance, tissue accretion and egg production for the Cobb 500 broiler breeder (see Table 3).

There is limited data on specific amino acid requirements for fertility. Work conducted by Craig Coon has revealed that increasing levels of lysine and isoleucine in the hen diet is detrimental to fertility.

Craig's hypothesis is that there may be a pH change in sperm host tubules affecting the sperm quality after a period of storage.

Conclusion

Rearing broiler breeders for optimum chick production and quality can be a complex enterprise. As broiler breeder nutrition and feeding guidelines are established they must be constantly updated as the genetic packages and management styles change.

Feeding broiler breeder hens according to their requirement decreases production costs by decreasing feed costs and improving chick production. Allowing the hens to receive the proper balance of energy and amino acids, maintains the breeder flock in optimal condition.

Research will help with managerial decisions but will not replace the art of poultry production. ■