Broiler Breeder Management Is No Easy Task

Broiler breeder genetics are constantly changing as the poultry industry continues to shift more to processed items to meet increasing consumer demands for these products. Strains with the potential for high breast-meat yield in a feed-efficient manner now have the majority of the U.S. market. Genetic improvement over the past 50 years has been nothing short of remarkable. In fact, the six-fold improvement in carcass yield of 2001 broilers fed a 2001 diet compared to 1957 broilers fed a 1957 diet was **85 to 90 percent due to genetics**, and only 10 to 15 percent due to nutritional changes (Havenstein et al., 2003) .

However, this efficient growth and high meat yield in the broiler means that a lot is demanded of broiler breeders. Unfortunately, efficient growth in the broiler and reproductive fitness in the breeder are negatively related production traits (Siegel and Dunnington, 1985). As a result, effective **management of a commercial broiler breeder flock is a compromise**. The continued genetic advancements in feed efficiency, rapid growth, and high breast-meat yield in the broiler requires constant modifications to the management and feeding of broiler breeders to prevent overweight birds and the associated negative impacts on egg numbers, fertility, and reproductive performance.

Body weight gain must be limited throughout the life of breeder birds by controlling feed intake to minimize reproductive problems in the adult bird (Richards et al., 2010). This presents breeder managers and broiler breeder growers with what is commonly known as the **"broiler breeder paradox"** (Decuypere et al., 2006); that is, the difficult task of managing a breeder bird so that it retains all the important broiler production traits by strictly controlling its feed intake and body weight gain to prevent decreased egg production and poor reproductive efficiency.

The Goal Is Fertilized Eggs

The main goal of broiler breeder management is producing eggs. Eggs ultimately determine the number of broiler chicks per hen housed. But **the only good broiler breeder egg is a fertilized egg** (McDaniel, 2011). A non-fertile broiler breeder egg is basically a table egg that holds little value for the breeder manager. If egg production numbers or mating activity is low, it is likely that the number of chicks per hen housed will be less than desirable. While it is true that integrators are in the business of selling broiler meat and not eggs, you have to have a fertilized egg before you can have a broiler chick, and eventually broiler meat to sell.

Achieving a fertilized hatching egg is more difficult than you might think. The external factors that can affect egg production are numerous. Bird age, flock management practices, and specific feed ingredients, formulations, and allocations can affect the oviduct, the egg itself, and semen quality. In turn, these affect egg production numbers and reproductive efficiency. Understanding ovarian function of the chicken and its interaction with nutritional status, age, and genetic strain is critical to the production of fertile eggs with a high hatching probability (Renema et al., 2008).

The interaction between nutritional and reproductive traits is complex and constantly shifting as genetic advancements continue to be made (Renema et al., 2007). Managing modern broiler breeder strains is made more difficult because these birds cannot adequately self-regulate feed intake during the growth and development stage. This increases the difficulty associated with achieving an optimal body weight and composition needed to support efficient egg and chick production by the hen (Richards et al., 2010).

To assist integrators with managing the changing genetic landscape, **primary breeders provide guidelines that target feeding levels, diet compositions, and body weights** that best suit individual genetic strains. The key to maximizing egg production is to provide just enough feed at the right times. Too much or too little feed intake will result in decreased egg production. In general, the best performing breeder flocks closely follow primary breeder recommendations for body weights, photostimulation, diet composition, and feed allocation.

Feed Intake

Female broiler breeders require a minimum cumulative nutrient intake before photostimulation to sustain subsequent egg production and fertility during the production cycle (Walsh and Brake, 1997). The same may be true for male broiler breeders to sustain subsequent reproductive performance (de Reviers and Seigneurin, 1990). Although numerous factors affect egg production and mating activity, nutrient intake is certainly high on the list. Also important is the underlying relationship between energy status and the physiological processes that require energy, such as maintenance, growth, and reproduction (Richards, 2010). Included in broiler breeder management is the **strict control of feed allowance** during both rearing and breeding phases to limit body weight gains and reduce the incidence of overweight birds.

Correct feed allocation and proper body weight management are essential to maximizing the potential of any breeder flock, regardless of genetic strain. Although birds in controlled feeding programs take longer to reach sexual maturity (Leeson and Summers, 1982), the added value associated with increased egg production, increased fertility, improved hatchability, improved egg quality, and reduced mortality far outweigh the delayed sexual maturity and starting of lay (Bruggeman et al., 1999). However, even with controlled feeding programs **it is still very easy to overfeed broiler breeders**. Therefore, regularly monitoring and recording body weight and uniformity are critical management tools, especially during the period between 15 weeks of age and photostimulation.

In addition, care must be taken not to stimulate a flock with too much feed at the wrong time. Feed management benefits reproductive efficiency in broiler breeder females by controlling follicle development (Robinson, 2002). **Pullets that enter the breeder house overweight tend to have excessive follicular development** that can lead to oviductal prolapse, increased number of double-yolk eggs, egg yolk peritonitis (presence of egg yolk in the abdominal cavity), erratic oviposition (laying outside the normal laying time), and laying more than one egg per day (often with poor quality shells) (Stanley, 2003). **Overweight hens may have poor fertility** due to sperm transport problems in the oviduct. They also may become too large to mate successfully.

Feed management after peak of lay is also critical. Mistakes can have negative consequences for the remainder of the lay cycle. A number of factors may affect timing and amount of feed reduction post-peak (Aviagen, 2013):

- Body weight and body weight change from the start of production
- Daily egg production
- Daily egg weight and egg weight trend
- Egg mass trend
- Health status of the flock and feathering condition
- Ambient temperature
- Feed energy and protein levels
- Feed texture
- Feed quantity consumed at peak (energy intake)
- Flock history (rearing and pre-peak performance)
- Changes in feed clean-up time
- Feather cover

Too much nutrient intake after peak can result in overweight birds and a faster drop in production and fertility as the birds age (Meijerhof, 2011). Proper feed management in the breeder flock during and after peak helps prevent excessively heavy birds that may lay poorly or show very low fertility as the flock ages. **Breeder managers often struggle with when to start cutting feed back after peak**, especially if the birds are still laying eggs at a high level. However, waiting too long increases the risk that birds may become overweight as egg production gradually declines in the weeks after peak.

Photostimulation

Photostimulation, or daylength perception, is just as important to breeder managers and growers as nutrient intake. The actual age to increase daylength from short (8 hours) to long (≥ 11 hours) depends on the average flock body weight and flock uniformity. However, in most cases, **primary breeders recommend that photostimulation not occur before 20 to 21 weeks**. Flocks that are below target weight or non-uniform (CV greater than 10 percent) may need to delay photostimulation by a week or more. Photostimulating a flock too soon will make the feeding program even more difficult to manage and result in a sexually uneven flock. All birds will be receiving the same feed allotment, but sexually mature birds will have to split their feed nutrients three ways (some for maintenance, some for growth, and some for egg production). The non-layers will only have to split their feed nutrients two ways (some for maintenance and the rest for growth), allowing them to divert additional nutrients to unwanted weight gain and body fat. Maintaining high egg numbers and fertility throughout the production cycle depends on **reaching the desired target weight and flock uniformity at photostimulation**.

Photostimulation sets up a series of events that ultimately results in eggs. As daylength increases, the brain responds by producing hormones that, in turn, travel to the ovary where they cause follicles to develop. When the mix and amount of hormones is right, the follicle ovulates an ovum (yolk) that can then be fertilized before traveling down the oviduct where albumen and shell are formed around the yolk (Robinson, 2002; McDaniel, 2011).

For hens, the complete **process of egg formation, after ovulation of the egg yolk, takes a little longer than 24 hours**. You may have noticed that hens usually lay for several days in a row and then pause for a day or two. This happens because of the relationship between the time of day hormones are released and the length of time it takes for an egg to form. The number of eggs a hen lays on consecutive days before pausing is called her sequence. The rate of follicle maturation and egg formation determines the sequence length; hens with slow follicle maturation and egg formation rates lay in short sequences (two to three days), while hens with faster rates lay in long sequences. Sequence length changes throughout the production cycle, with the longest sequences occurring at peak production somewhere around 30 to 35 weeks of age. Hens that have their feed intake strictly controlled produce more eggs because they lay longer sequences, persist in lay longer, lay fewer abnormal eggs, and have fewer multiple ovulations in a single day (Gibson et al., 2008).

Summary

Managing modern broiler breeder genetic strains becomes more specialized each year. Improvements in broiler growth rate, feed efficiency, and breast-meat yield put increasing pressure on breeder managers and growers because these improvements can negatively affect egg production, fertility, and reproductive fitness on the breeder side. Regularly monitoring body weight and uniformity during the rearing and production phases is necessary to keep flocks on target with recommendations of primary breeders for different genetic strains. Following recommended targets from primary breeder companies is important if the breeder flock is to meet expectations.

References

Aviagen. 2013. Ross PS Management Handbook. Available at: http://en.aviagen.com/assets/Uploads/RossPSHandbook2013i.pdf. Accessed: April 30, 2013.

Bruggeman, V., O. Onagbesan, E. D'Hondt, N. Buys, M. Safi, D. Vanmontfort, L. Berghman, F. Vandesande, and E. Decuypere. 1999. Effects of timing and duration of feed restriction during rearing on reproductive characteristics in broiler breeder females. Poult Sci. 78:1424-1434.

Decuypere, E., P. M. Hocking, K. Tona, O. Onagbesan, V. Bruggeman, E. K. M. Jones, S. Cassy, N. Rideau, S. Metayer, Y. Jego, J. Putterflam, S. Tesseraud, A. Collin, M Duclos, J. J. Trevidy, and J. Williams. 2006. Broiler breeder paradox: A project report. World's Poult. Sci. J. 62:443-453.

de Reviers, M., and F. Seigneurin. 1990. Interactions between light regimes and feed restrictions on semen output in two meat-type strains of cockerels. Pages 220-231 in: Control of Fertility in Domestic Birds. Les Colloques de L'INRA. Vol. 54. J. P. Brillard, ed. INRA,

Paris, France.

Gibson, L. C., J. L. Wilson, and A. J. Davis. 2008. Impact of feeding program after light stimulation through early lay on the reproductive performance of broiler breeder hens. Poult. Sci. 87:2098-2106.

Gordon, R. W. 2002. Feeding females. Pages 43-44 in Proc. N.C. Broiler Breeder and Hatchery Management Conf., Statesville, NC. North Carolina State Univ., Raleigh.

Havenstein, G. B., P. R. Ferket, and M. A. Qureshi. 2003. Carcass composition and yield of 1957 versus 2001 broilers when fed representative 1957 and 2001 broiler diets. Poult. Sci. 82:1509-1518.

Leeson, S., and J. D. Summers. 1983. Consequence of increased feed allowance for growing broiler breeder pullets as a means of stimulating early maturity. Poult. Sci. 62:6-11.

McDaniel, C. 2011. The only good broiler breeder egg is a fertilized egg. Info. Sheet 1610. Mississippi State University Extension Service. Mississippi State, MS.

Meijerhof, R. 2011. Broiler breeders: Managing the paradox between production and growth. Available at: http://www.worldpoultry.net/Breeders/General/2011/10/Broiler-breeders-Managing-the-paradox-between-reproduction-and-growth-WP009434W/. Accessed: April 30, 2013.

Renema, R. A., F. E. Robinson, and M. J. Zuidhof. 2004. Manipulating reproductive potential: Growth profile and photostimulation age effects in broiler breeders. N.C. Broiler Breeder and Hatchery Management Conf., Statesville, NC. North Carolina State Univ., Raleigh.

Renema, R. A., M. E. Rustad, and F. E. Robinson. 2007. Implications of changes to commercial broiler and broiler breeder body weight targets over the past 30 years. World's Poult. Sci. J. 63:457-472.

Renema, R. A., F. E. Robinson, M. J. Zuidhof, and L. F. Romero. 2008. Identifying broiler breeder management-nutrition interactions to optimize chick production. Available at: http://www.zootecnicainternational.com/article-archive/management/282-identifying-broiler-breeder-management-nutrition-interactions-to-optimize-chick-production-.html. Accessed: April 30, 2013.

Richards, M. P., R. W. Rosebrough, C. N. Coon, and J. P. McMurty. 2010. Feed intake regulation for the female broiler breeder: In theory and in practice. J. Appl. Poult. Res. 19:182-193.

Robinson, F. E. 2002. Management for control of ovarian development in broiler breeders. The Poultry Informed Professional. Issue 59. Department of Avian Medicine, University of Georgia, Athens.

Siegel, P. B., and E. A. Dunnington. 1985. Reproductive complications associated with selection for broiler growth. Pages 59-72 in Poultry Genetics and Breeding. W. G. Hill, J. M. Manson, and D. Hewitt, ed. British Poultry Science Ltd., Harlow, UK.

Stanley, B. 2003. Reproductive management of the broiler breeder female. Pages 93-94 in Proc. N.C. Broiler Breeder and Hatchery Management Conf., Statesville, NC. North Carolina State Univ., Raleigh.

Walsh, T. J., and J. Brake. 1997. The effect of nutrient intake during rearing of broiler breeder females on subsequent fertility. Poult. Sci: 76:297-305.

Publication 2783 (POD-05-19)

By **Tom Tabler**, PhD, Extension Professor, Poultry Science, **Chris McDaniel**, PhD, Professor, Poultry Science, **Jessica Wells**, Extension Instructor, Poultry Science, and **Haitham M. Yakout**, PhD, Visiting Research Professor, Poultry Science.