Broiler breeder nutrition gives a return in the meat generation

International Hatchery Practice recently attended the 9th Asia Pacific Poultry Conference (APPC 2011) held in Taipei, Taiwan, where Dr Aziz Sacranie, Alltech's technical director, poultry for Asia, gave a comprehensive review on how to maximise the performance of broiler breeders and broilers.

He outlined how genetic progress over the last three decades has been rapid at 1% per year and, as a consequence of this, today's broiler breeders and broilers are very different in terms of production, reproduction and health compared to their predecessors of 30-40 years ago.

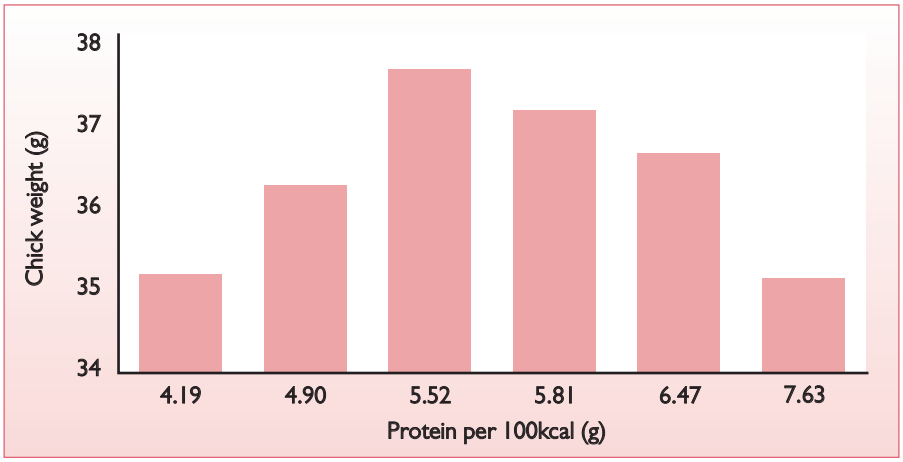

Fig. 1. The relationship between protein content of breeder feed and chick weight.

Essential prerequisite

As an essential prerequisite for successful broiler production in 2011, the chicks must get off to a good start and this requires good body weight, excellent nutrient reserves in their yolks and good health with a fully functioning immune system.

This is then capitalised on by providing the correct environment and nutrition so that the broilers can maximise their growth.

This starts with effective nutrient supply to the breeder which, in turn, requires correct and adequate nutrients being present in the diet and all birds consuming an adequate amount of the breeder feed. Balancing these two issues should ensure that our broiler breeders get the correct daily nutrient supply.

To this end it must be remembered that the developing embryo and the newly hatched chick are 100% dependent on the nutrients deposited in the egg for their growth and development – the physiological status of the chick at hatching is greatly influenced by the nutrition of the breeder hen!

While feed restriction programs are necessary to control growth of broiler breeders, a better understanding of the effects of the various programs is required. Programs that include days without any feed (such as skip-a-day or 4-3) result in more stress than every day feeding programs.

These programs can also affect expression of certain lipogenic genes as well as the endocrine system. Therefore, an integrated approach to feed formulation, feed allocation and feed management is needed to maximise the potential of the modern broiler breeder and its offspring.

The aim should be the best possible nutrition. Maximising chick production should not be the only objective of a broiler breeder nutritional program, the quality of the chicks should also be considered.

High quality vitamins and trace minerals should be supplemented in sufficient quantity and small savings on vitamin and trace mineral costs at the breeder level may well be a false economy as these often result in far greater negative consequences at the broiler level.

Table 1. Effect of organic trace minerals on egg quality.

Parameter (60 weeks)	Control	Bioplex
Shell thickness (mm)	0.336	0.341
Egg density	78.4	79.0
Shell variability*	32.9	30.4
Eggshell**	36,507	38,092

*Ultrasound of variability of shell structure **Degree of mineralisation

The cost of feeding the breeder to ensure good nutritional status of the chick is low and compared with the total feed cost of raising a broiler to slaughter weight.

Calini in 2006 calculated the cost of breeder feed to produce the broiler chick is 7% of the total feed cost for a broiler grown to 2.5kg.

Improved performance

Reflecting on the broiler breeder, Dr Sacranie highlighted that improved breeder performance through improved genetics had resulted in 15 chicks more per hen housed, which equated to 10% more chicks.

Yet, feed quantity and nutrients remained unchanged and adverse conditions were often observed in broiler chicks, particularly from young breeders (25-35 weeks of age).

These chicks needed higher brooding temperature and lacked appetite and this was manifested as poor growth and uniformity.

According to Leeson, "The amount of nutrients supplied to the broiler breeder is of consequence to chick quality and production performance…" and it has been shown many times that the levels of protein fed to breeders in production can affect chick bodyweight and final broiler performance. This is shown in Fig. 1.

When it comes to protein, optimum crude protein is a content of 15% for a diet of

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2,750 kcal per kg and excess protein can be as detrimental as insufficient protein!

Protein quality must be ensured by having a balance of amino acids that is supplied from good quality protein sources.

A reduction in fertility with increasing levels of lysine and isoleucine have been found, although the specific mechanisms for these reductions in fertility are not clear.

When it comes to energy there is a trend in feeding lower energy and crude protein levels to broiler breeder pullets (grower/developer diets), but the exact reason for this is not clear.

A possible reason could be that as appetites continue to increase, feeding a lower density diet has benefits in terms of feed volume and clean-up times.

	With Bioplex		Without Bioplex	Difference (%)
	House A	House B	House C	
Starting program	06/26/2002	06/26/2002	06/26/2002	
Breed	Cobb	Cobb	Cobb	
Livability	87.01	85.89	86.29	0.19
Peak production	82.96	83.43	82.81	
Weeks of production	44.00	44.00	44.00	
Total eggs per hen	197.59	197.34	194.53	1.51
Fertility	94.70	94.11	93.85	0.59
Settable eggs per hen	187.13	185.79	182.57	2.13
Estimated hatch	84.00	84.00	84.00	
Chicks per hen	157.19	156.06	153.39	2.13
Chicks difference	–	3.27	–	

Table 2. The benefits of organic trace minerals.

Lower density diets help to promote uniformity. Part of this could also be related to cost as ingredient prices have soared over the last two years.

Lower crude protein levels also make it easier to control the fleshing of the pullet.

An energy intake of 440-480 kcals per bird per day is optimal for chick quality. This equates to 160-175g of feed per bird per day at an energy level of 2,750 kcal per kg feed.

Attention to fat composition is important, particularly linoleic acid (unsaturated fatty acids), as this essential fatty acid is required for cell membrane integrity, immune competence and embryonic development and, therefore, directly affects chick quality.

It is prudent to keep fat levels low in breeder diets and to preferably use unsaturated fats rather than saturated ones.

Mineral nutrition

The presentation then touched on the topic of mineral nutrition. The major minerals (calcium, phosphorus, sodium, potassium, magnesium and chloride) are needed for good shell formation.

As a rule, better shell quality results in better egg and chick quality and variations in maternal phosphorus supply have been shown to influence bone ash of young progeny chicks. So, adequate phosphorus is important in breeder diets ensuring best possible bone integrity in the early stages of broiler chick growth.

There is also very good evidence that maternal levels of trace minerals, especially zinc, manganese, copper and selenium, impact on the levels of these minerals in the egg and this, in turn, influences the progeny chicks.

As long ago as the late 1950s breeder hen feeds deficient in zinc were shown to cause slow growth of chicks and cause weak chicks, poor feathering and high mortality.

In the 1990s it was shown that supplementing deficient feeds with inorganic and/or organic zinc increased zinc levels in the bones and increased bone weight.

Zinc's role in DNA and various enzymes, is particularly important in the young bird for the synthesis of two key proteins – collagen and keratin. Keratin is a structural protein in skin and feathers and collagen is the major structural protein of various internal tissues such as cartilage and bone.

When you consider that the cost of ensuring a sufficient and available zinc source in breeder and early broiler feeds is minimal and the impact of poor skeletal development and compromised immunity on the profitability of broiler production, there should be no financial excuse for inadequate zinc in the diet.

Embryonic development

Manganese, copper and selenium levels can be affected in the egg by maternal supplementation. Manganese is vital in embryonic and post natal bone development, while copper is essential for reproduction and development.

Selenium as an overall antioxidant provider effects all physiological systems and its role is therefore very important for breeder and broiler performance.

Most current interest is centered on the use of organic minerals and particularly in the use of proteinates such as Alltech's Bioplex.

This product increases deposits in the egg and transfer to the tissues of the hen and the embryo. Recent work looks at the antioxidant status of breeders, embryos, offspring and the role of selenium proteins in this. Bioplex also appears to impact on chick uniformity (see Table 2).

Selenium proteins, such as Sel-Plex, have been shown to improve both the vitamin E and antioxidative status of eggs, embryos and chicks up to 10 days of age.

Now we are into the 'age of nutrigenomics' and in this context Sel-Plex altered the expression of over 1100 genes (200 more than selenomethionine) and more beneficial genes are positively regulated with Sel-Plex, while the expression of stress associated genes is depressed.

When it comes to minerals Dr Sacranie emphasised that he had to agree with Dr Leeson who has stated that, "NRC recommendations for mineral inclusion levels in diets are out of date as NRC recommendations are based on inorganic trace minerals (less bioavailable) and these old figures were based on feeding minerals to prevent deficiency symptoms rather than to optimise performance and health".

The role of vitamins

Finally and for completeness, vitamins were briefly reviewed. Vitamins play an integral part in embryonic development and are involved in most metabolic pathways. Suboptimal vitamin levels in the breeder diet will have a negative effect on parents and offspring.

Breeder age	Control diet	Supplemented diet
60	17.3	12.2
64	26.9	17.9

Table 3. Vitamin E and percentage clears.

Vitamin E has the largest impact on progeny and higher levels of vitamin E are needed when inorganic rather than organic selenium is used in the breeder diet.

Dr Sacranie stressed the merits of feeding enough vitamin to breeders so that egg vitamin E contents are maximised. This is not to prevent deficiencies but rather to ensure that the progeny broilers perform to their full potential.

When vitamins E, K and B were supplemented at 20% above recommendation in breeder diets, progeny broiler body weights were only 20g heavier at 35 days, but mortality was 2.2% lower than the control birds with a yield advantage of 0.2% at 2kg body weight.

In other studies egg yolk vitamin E levels were found to be 50% higher in α-tocopherol supplemented diets and its addition impacted candling clears at 60 and 64 weeks of age (see Table 3). ■