Breeder issues addressed at European nutrition conference

At the 17th European Symposium on Poultry Nutrition that was recently held in Edinburgh, Scotland there were several papers of interest to breeders.

P.M. Hocking from Edinburgh presented a paper entitled 'Controlled Feeding of the Breeder Bird – A Comparative Approach'. Feed restriction is applied to broiler and duck breeders to control body weight gain to specific targets throughout their lives, whereas turkey breeders are fed ad libitum.

Selection for high growth rates in chicken, duck and turkey breeders is associated with high rates of multiple ovulation. When this occurs up to half the eggs may be lost for incubation because of the formation of double yolked, soft shelled and misshapen eggs or by ovulation into the body cavity where they are rapidly absorbed.

Feed restriction of broiler breeders controls ovarian function by decreasing the production of follicles and ovulated ova (see Table 1).

Species	Feeding	Weight (kg)	No. yellow follicles
Broiler breeder	Ad libitum	5.3	13.5
	Restricted	2.9	7.3
Duck breeder	Ad libitum	4.5	9.4
	Restricted	2.7	6.6
Turkey breeder	Ad libitum	11.9	13.2
	Restricted	8.3	9.9

Table 1. Yellow follicle numbers at onset of lay.

The benefits of restricted feeding for breeders are detailed in Table 2.

The ovaries of modern heavy and medium-heavy turkey breeders have too many yellow follicles but an improvement in productivity has not been demonstrated by feed restriction. In addition, feed restriction in turkeys is associated with reduced persistency in comparison with the enhanced persistency associated with feed restriction in broiler breeders.

Optimum ovarian function can be defined as not more and not less than one ovulation per day and in broiler breeders this is achieved by feed restriction that follows the rules detailed in Table 3. Hocking then went on to detail a computer model that could predict egg numbers when parameters, for example body weight at photostimulation, daily weight gain to peak, mortality per week and rate of increase in proportion of birds not in lay, changed (see Fig. 1).

Trait	Ad libitum	Restricted
Body weight (kg)	5.3	3.7
Mortality (%)	46	4
Egg numbers	58	157
Hatch of eggs set (%)	43	86
Feed intake (g per day)		
0-24 weeks	163	63
24-37 weeks	192	157
37-60 weeks	142	151

Table 2. The benefits of restricted feeding of broiler breeders (up to 60 weeks).

M. de Beer from Aviagen considered current approaches to feeding broiler breeders and, in so doing, he highlighted how providing the best possible nutrition for the modern broiler breeder requires an understanding of how the bird has changed with time in terms of growth rate, FCR, yield and reproductive performance.

He stressed that in order to maximise egg production, suppression of some of the commercial broiler traits is needed.

However, maximising chick production should not be the sole goal of a broiler breeder nutritional programme. The balance between energy and amino acids is important if we are to control growth rate and the composition of that growth.

The quality of the chicks produced should also be considered and, to this end, adequate levels of quality vitamins and minerals should be used. Small savings in the cost of vitamins and minerals at breeder level may result in far greater losses at broiler level.

Skip a day feeding programmes produce more stress than every day breeding programmes and such programmes can affect the expression of certain lipogenic genes as well as the endocrine system.

In essence M. de Beer was advocating an integrated approach to feed formulation, feed allocation and feed management in order to maximise the potential of the modern broiler breeder and its offspring.

D. Jamroz and A. Rutkowski from Poland then looked at aspects of the nutrition and breeding of ducks and geese.

Ducks and geese have capacious gastrointestinal tracts and are able to consume large quantities of feed mixtures, green fodders and homemade roughages rich in structural carbohydrates. Ducks and geese are able to retain more fat than chickens and this creates a necessity to limit the energy content of diets during the breeding season.

Maximum energy values for mixes should be 11.0-11.2 MJ per kg for ducks and approximately 11.7 MJ per kg for geese.

The protein content of such mixes should be 16.0 to 18.5-20.0% for breeding ducks and 14.0-18.0% in goose diets.

Y. Noy and Z. Uni from Israel then reviewed early nutritional strategies. Under normal commercial practices chicks will hatch off over a 24-36 hour period (window) and once a chick has pipped it is without food.

Thus, early hatching chicks are at a disadvantage because they have a prolonged fast-

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Table 3. Feed restriction rules for broiler breeders.

- Feed restriction should be applied from 14 weeks of age to photostimulation.
- A minimum body weight of 2.8kg is necessary for the onset of lay.
- The growth trajectory to the target weight at photostimulation is not important.
- The number of yellow follicles at the onset of lay is linearly related to body weight.
- Ovarian follicle numbers after photostimulation are linearly related to body weight.
- Feed allocation post peak should be reduced.

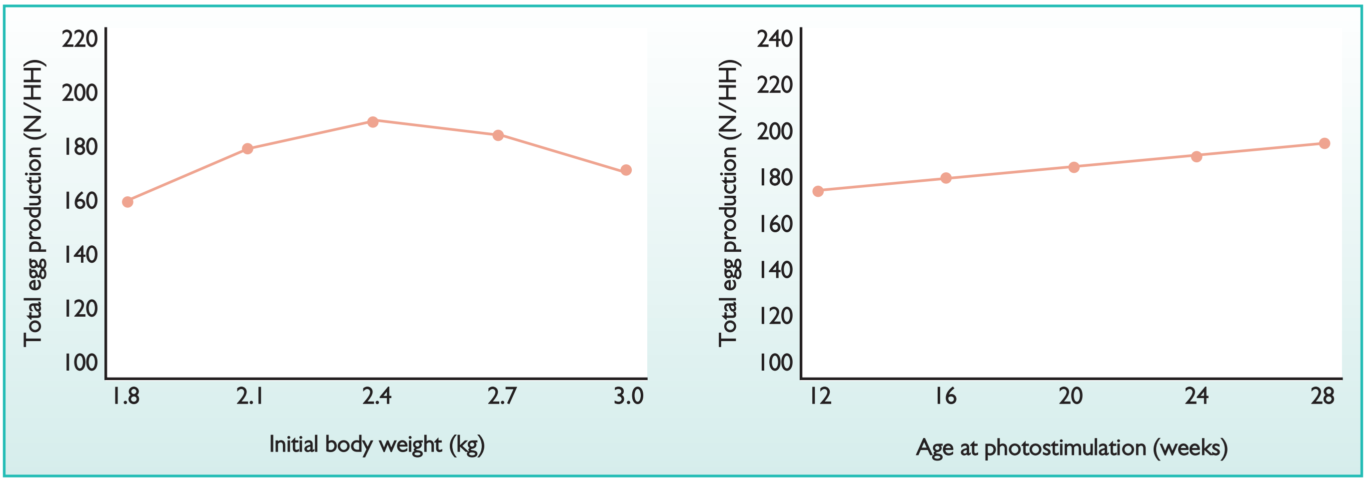

Fig. 1. The effect of initial body weight (left) and age at photostimulation (right) on total egg production (Alvarez and Hocking 2009).

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ing period and are likely to be subjected to dehydration. Logistics within the hatchery and chick transportation to the farm exaggerate this. During the pre-hatch period the amnion's contents are consumed by the chick and this results in accumulation of glycogen reserves in muscle and liver tissues and glycogenesis, the initiation of pulmonary respiration, abdominal internalisation of the remaining yolk, shell pipping and the emergence of the chick.

One of the major physiological needs during this pre-hatch period is the maintenance of glucose homeostasis and glycogen reserves are drawn upon during the hatching process. These glycogen reserves begin to be replenished when the chick has access to feed. There are significant developmental changes in the intestine of the chick during the last few days of incubation. This continues with intestinal morphological development in the gut in the immediate post hatch period. Intestinal growth/development occurs in delayed fed chicks but to a significantly lesser extent than in early fed chicks.

Decreased intestinal development in fasted chicks is reflected in decreased enterocyte numbers, crypt size, number of crypts per villus, crypt proliferation, villus area, rate of enterocyte migration, goblet cell size and mucin dynamics.

So, in essence, the quicker the gastrointestinal tract is functioning the quicker the chick can be utilising dietary nutrients and replenishing its depleted energy status so that it can achieve genetic potential.

Thus, we need to provide a 'nutrient link'. One way to achieve this is by in ovo feeding and this can be achieved by inserting nutrient solutions into the amnion to augment the nutrients that the chick takes in from the imbibing of amniotic fluids.

Studies have shown that by giving 1.0ml of in-ovo feeding solution that includes a source of carbohydrates, sodium, chloride, zinc-methionine and β-hydroxy-β-methylbu-

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tyrate increases total liver glycogen by 75% on the day before hatch and 47% on the day of hatch and markedly enhances enteric development. There is also a significant acceleration of the development of the gut in the two days post hatching.

In ovo fed birds also show increased pancreatic activity for carbohydrate digestion, increased villus size, higher levels of mRNA expression and activity of brush border digestive enzymes and transporters.

It can be concluded that at the time of hatch the intestine of in ovo fed birds is functionally the same as the intestine of a two day old conventionally fed chick.

Various studies have shown increases in hatching weight by 5% and a 6% increase in relative breast mass and these were sustainable increases.

In ovo feeding should also reduce post hatch mortality, result in greater efficiency of feed utilisation at an early age, give an improved immune response to enteric pathogens and reduce the incidence of developmental skeletal disorders.

Another option to consider is immediate post hatch feeding within an hour of hatching. Studies have looked at giving water or water + feed at this time. Just giving water does increase body weight but the advantage is lost by the end of the first two weeks. Broiler chicks given water + feed take the advantage gained through to kill.

One approach is to use early feeding supplements such as Oasis and Earlybird.

Providing early feeding supplements appears to counter the negative effects of delayed feeding. Early access to feed stimulates body growth and maintains this advantage in broilers through to kill. Early nutritional strategies offer the opportunity to sustain progress in production efficiency and bird welfare and better understanding of the transition from embryo to chick will further develop this 'nutrient link'. ■

Site of injection crucial to in-ovo vaccination

How does site of injection affect the immunology of a bird when vaccinated in ovo? This question was addressed at the 2009 Poultry Science Association Meeting where Dr Brett Hopkins, associate director for outcomes research with Pfizer Animal Health, presented data from a large scale commercial hatchery trial comparing the only two commercially available egg injection systems in the USA. When comparing the accuracy of delivery to the correct site of injection, Hopkins found that Pfizer's Embrex Inovoject system exhibited significantly greater correct in ovo site of vaccine delivery (95.3%) as compared with the other in ovo delivery system (52.3%).

In conjunction with Dr Chris Williams, director of poultry technical services Pfizer Poultry Health, Hopkins and Williams designed the trial to evaluate the quality of vaccine delivery as measured by site of injection in ovo, noting that the ability to provide protection against disease after hatch begins with the vaccine being delivered to the correct site of injection in the egg.

"Proper vaccination should be the primary criteria used to evaluate an in ovo injection system because uniform vaccine delivery may provide earlier immunity to diseases when performed correctly," stated Hopkins.

Proper sites of injection were defined as the amnionic sac, subcutaneous injection to the breast, intramuscular injection into the breast or any combination of the previous. Injection and vaccination of the air cell, allantois, yolk sac, a combination of these sites, or no vaccine deposited at all, were classified as improper and therefore provide questionable disease protection.

A 2000 study demonstrates that the efficacy of vaccines delivered in ovo into the amnion or embryo is greater than 90%, regardless of day of injection and breeder flock type, while vaccines delivered in ovo via the allantois or air cell are less than 50% effective in providing disease protection.

Application of the vaccine in other areas of the egg has also been shown to greatly reduce the protective index against disease challenges.

Comparison of delivery

Overall, the Inovoject system performed 871 total injections to eggs with viable embryos while the others system injected 930 eggs with viable embryos. Of those 871 viable eggs injected by the Inovoject system, 830 or 95.3% were performed at the proper site of injection.

The other system delivered only 486 or only 52.3% at the proper site of injection.

Comparing the different injection sites occurring in good eggs, the Inovoject system injected 730 eggs in the amnion and 95 in the embryo, classifying them as proper injections.

In comparison, the other system had only 336 amniotic injections and 135 embryonic injections, followed by 185 combination injections occurring in the allantois and amnion, which is considered an improper injection.

This study uncovers a primary question of concern when injecting in ovo. Why should producers be concerned about where a vaccine is delivered? Vaccine delivery is critical to an embryo's integrity and survival and its proper immunisation for protection against disease challenges.

"Conducting large scale evaluations in a commercial setting such as this, establishes relative value and importance of proper in ovo injection for our customers," Dr Hopkins told International Hatchery Practice.

"The objective of this trial was to reassert the importance of site of injection in ovo and its vital role in providing early, effective and uniform protection against disease." ■

Table 1. In ovo system vaccine delivery categorised by injection site. AC (air cell), AC/comb (air cell plus any other combination of injection sites), ALL (allantois), ALL/AM (allantois/amnion), ALL/comb (allantois plus any other combination of injection sites other than amnion), AM (amnion), AM/comb (amnion plus any other combination of injection sites other than allantois), EMB (embryo), YS (yolk sac).

		AC	AC/ comb	ALL	ALL/ AM	ALL/ comb	AM	AM/ comb	EMB	YS	Total
Inovoject system	Count	6	4	8	21	1	730	5	95	1	871
	%	0.7	0.5	0.9	2.4	0.1	83.8	0.6	10.9	0.1	100
Other system	Count	87	70	62	185	37	336	15	135	3	930
	%	9.4	7.5	6.7	19.9	4.0	36.1	1.6	14.5	0.3	100