The impact of breeder nutrition on chick performance

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The modern broiler and breeder are performing at levels never seen before. In order to multiply by 15x (or more) their bodyweight in just four weeks, they do not have the time to correct the effects of nutritional deficiencies.

In a recently published paper coming from the University of Alberta, the effect of genetic selection was studied using unselected strains from 1957, 1978 and a 2005 commercial Ross 308 strain and fed contemporary modern diets.

Some of the results included an increase in broiler growth by 400% and a feed conversion ratio reduction of 50% when comparing 1957 to 2005.

On top of this, breast meat yield increased by 79% in males and 85% in females. The genetic of the chick has changed so dramatically, it can be compared to a high performance athlete.

The correct amount of nutrients should be present in their blood from the very beginning and of course everything starts from the egg.

The day old chick depends 100% on the egg nutrient composition to develop all their organs and functions, activate all their necessary genes and systems and become fully ready to start growing right from the very beginning. Therefore, it is important to review the aspects of breeder nutrition that will provide the chick with the best start. It is the objective of this article to review some of the main factors of breeder nutrition affecting chick performance.

Non-nutritional factors

Several factors related to incubation and pre-incubation can be related directly to the quality of the chick.

Storage time of eggs under seven days has little influence on hatchability; however longer storage times have been related to a greater occurrence of poor quality chicks, especially for older aged breeders.

However, Sahan at al. demonstrated that 52 week old breeders yielded heavier chicks (47.8 vs. 40.4), with a higher yolk-free BW (43 vs. 36.7) when compared to 36 week old breeders.

On the other hand, Sarabia (2010) found that chicks coming from older breeders tend to have a lower glycaemic value at birth; 143 versus 225mg/ml for the progeny of birds of 53 and 27 weeks old respectively. The lower glycaemic value could be coming from a less stressful hatching process thanks to a thinner shell in the older birds.

During incubation, it is very important to review the hatch window. It has been shown that chicks taking up to 493 hours to hatch will grow slower than chicks hatched after 480 hours or less, part of the explanation was a lower thyroid (T3) hormone level in these late hatches. In the same paper, different hatching systems were analysed with no particular influence on weight gain and livability.

Egg shell temperature and carbon dioxide levels are also important factors to control during incubation, as determinants of the quality of the chick.

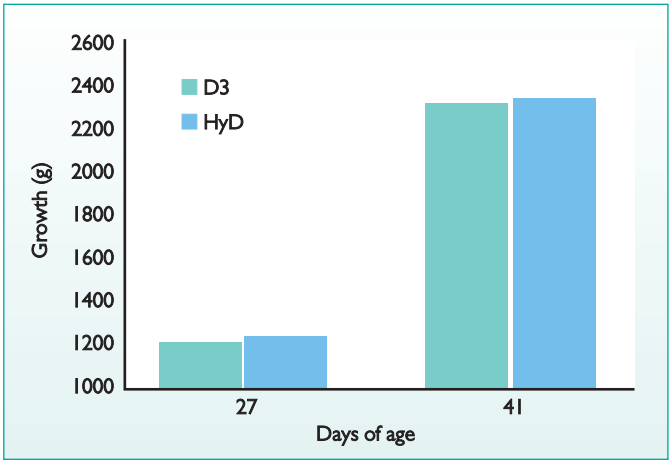

Fig. 1. Effect of HyD in the breeder diet on the growth of the progeny.

Level of protein

The University of Guelph carried out an experiment reviewing four different levels (16, 14, 12 or 10%) of protein (CP) with constant SAA (Cys+Met) and lysine levels on Hubbard broiler breeders and the effect on the performance of the offspring (Table 1).

There was a clear difference on bodyweight day 0, where the progeny of breeders receiving the lowest protein level, showed a lighter weight at hatching.

Most producers regard light weight chicks as an inferior trait. However, in this experiment chicks were followed up to 42 days of age and no differences on BW, carcase or breast weight were detected. However, the lighter chickens showed a better feed conversion than heavier chicks coming from breeders receiving the high protein diet.

Another study demonstrated that the effect of different levels of lysine and CP in the breeders' diet on the performance of the progeny is quite dependent on the age of the breeder.

In hens 48 weeks and older increasing dietary levels of lysine did not affect the performance of the progeny, however chicks coming from hens at 38 weeks of age, experienced a reduction on productive parameters (ADF, FCR) when the dietary Lys intake per day went from 702 to 1032.

Feed allowance has been also studied. Renema and Robinson reviewed the subject and concluded that (even from the welfare standpoint) the modern broiler breeder is unfit to eat ad libitum and their performance in terms of productivity, fertility and hatchability will be compromised by such a feeding regime (obesity related problems).

Therefore, they have to be in some kind of feed allowance.

Taherkhani et al., in 2010, published a paper where it is shown that breeder hens fed twice a day in a restricted regime performed better than hens fed ad libitum or restricted to one meal a day, however there was no observations on the quality of the offspring.

On this subject, Triyuwanta, et al. (1992) performed an experiment where different groups of broiler breeders were assigned to three dif-

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Table 1. Effect of dietary protein level of broiler breeders on performance d0 chick weight (g) at two different ages (Adapted from Lopez and Leeson, 1995). Means within a column with no common superscript differ significantly (P<0.01).

% CP	30 weeks old		52 weeks old	
	Females	Males	Females	Males
16	38.9^{A}	40.2^{A}	47.9^{A}	48.1^{A}
14	38^{A}	39.2^{AB}	47.2^{A}	47.2^{AB}
12	37.7^{AB}	37.7^{BC}	45.8^{B}	46.0^{B}
10	36.2^{B}	37^{C}	43.8^{C}	44.4^{C}
SD	1.2	1.2	0.8	0.7

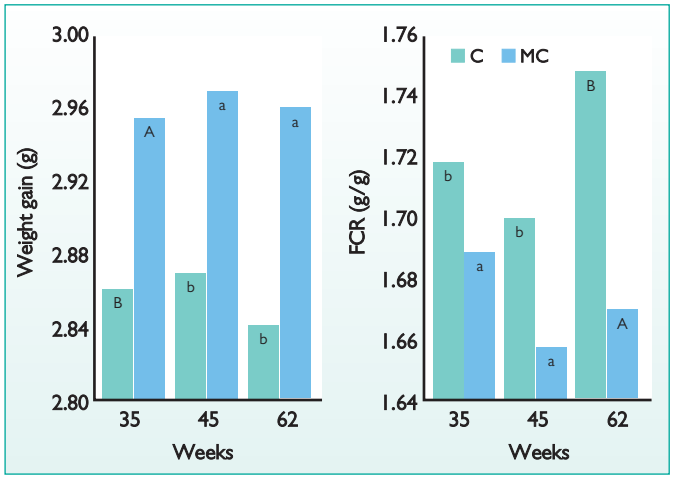

Fig. 2. Performance of the progeny at different ages of the breeder flock (Araujo and Araujo, 2014).

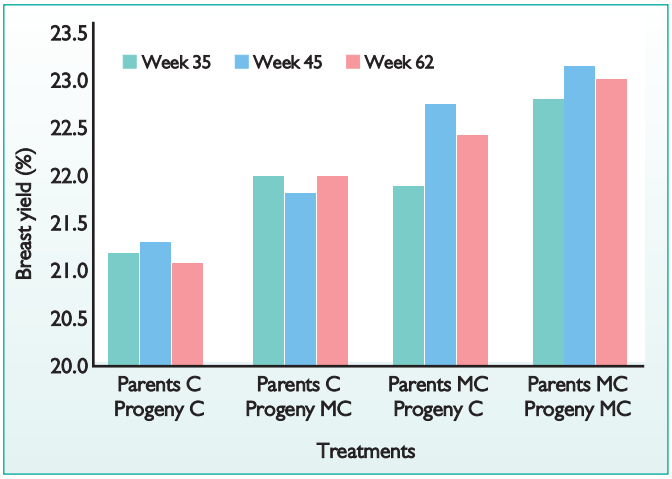

Fig. 3. Breast yield % for broilers from parents supplemented with MaxiChick and then fed with or without MaxiChick.

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ferent dietary allowance, namely liberal, intermediate or severe feed restriction.

Egg production was higher with the liberal allowance, however fertility and hatchability were better with the restricted levels of feed.

On the progeny performance; a liberal regime produced heavier day-old chicks and this difference was kept up to 40 days of age where a difference of about 40g in final weight was observed between the progeny of the liberal and the severely restricted breeders (from week 45-61 of production they were fed 120, 110 and 100g of feed/day respectively).

Broiler ossification was also affected in similar fashion. However, maternal size was more important than feed intake (importance of pullet rearing).

Another point related to feed is the maternal energetic efficiency. In 2009 Romero et al. published a paper describing that hens with the highest individual maintenance requirements produced faster growing chicks and with higher breast yield after 38 days of age.

Minerals

Minerals like zinc, manganese and selenium have been included in the diet of breeders in order to enhance the quality of the progeny.

Hudson, et al., examined the effects of zinc source and dietary concentration in caged broiler breeder hens on progeny performance (Table 2).

They concluded that providing zinc to breeders (regardless of the source) will provide no additional advantage to the performance of the progeny in terms of growth or feed efficiency.

However, the supplementation of organic zinc in the diet of the chick resulted in improved performance. Similar responses were found in a second study by the same laboratory, however in this study, humoral immunity in the chick was better when the hen was fed with ZnSO4 instead of organic zinc.

In another study, Virden et al studied the effect of different sources of zinc and manganese in the diet of the breeder hen on the performance of the chick. They found that using organic zinc and organic manganese instead or inorganic sources, does not affect BW gain or FCR of the progeny. However the livability went up from 97.9 to 100% with organic sources.

Pappas et al studied the effect of different sources of selenium in the diet of the mother, and the effect on the performance of the progeny.

They found the supplementation of selenium as organic-Se compounds was ineffective in improving the performance of the chick regarding body mass, weight gain, feed conversion rate or mortality at day seven or 14 of age in the progeny. However, the Se concentration in the liver and brain of the progeny was significantly higher.

Table 2. Live performance responses of male broilers fed two different zinc sources from placement until 17 days of age originating from hens fed two different supplemental zinc sources (adapted from Hudson, et al., 2005).

Contrast	BW gain (kg)	Feed/ gain	Leg abnormalities (%)
Hen Zn	NS	NS	NS
Basal	0.53	1.34	6.15
ZnSO4 160ppm	0.53	1.34	4.76
ZnAA 160ppm	0.53	1.35	3.57
ZnSO4+ZnAA 80+80ppm	0.53	1.34	1.19
SEM	0.01	0.01	2.12
Progeny Zn	P<0.05	P<0.01	NS
ZnSO4 140ppm	0.52	1.36	2.38
ZnSO4+ZnAA 00+40ppm	0.54	1.32	5.46
SEM	0.01	0.01	1.50

Vitamins

Broiler breeders receiving graded levels of vitamin E in the feed (25, 50, 75 or 100) at 32 or 52 weeks old showed no performance differences among treatments, even as the α tocopherol increased linearly in the yolk.

An interesting experiment evaluated the use of a high level or low level of vitamin supplementation of the breeder and the combined effect of a high or low level of vitamin supplementation in the chick on the performance of regular or immunologically challenged progeny.

The vitamin supplementation level had no effect on ADG or FCR of the regular animals.

However, progeny of hens with high vitamin status and receiving a high level of vitamins, were better able to cope with the challenge of intestinal homogenate of MAS affected chicks.

They were actually able to keep their ADG at around 90% of the normal, while the low vitamin status chicks were depressed by 20%. So, it seems that in an ideal environment, a high vitamin level in the dam will have no major impact on the performance of the progeny. But, when there is a challenge the differences will be evident.

In another experiment, Parkinson and Cransberg from the University of Queensland reported that the use of 25OHD3 in the diet of the breeder hen, resulted in a 12% improvement in body weight at 14 days of age.

Recently, Saunders-Blades and Korver at the University of Alberta, found that the use of 25OHD3 as a source of vitamin D in the breeders' diet, resulted in a higher body weight at 41 days of age when compared with the progeny of hens fed regular Vitamin D3 (Fig. 1).

MaxiChick

The patented combination of HyD and Carophyll red has proven very successful in increasing the performance of the progeny. Araujo and Araujo found that the progeny of Cobb 500 coming from mothers receiving MaxiChick, presented a significantly higher body weight and FCR at 42 days of age (Fig. 2).

Moreover, they found an increased breast yield in the progeny of MaxiChick fed breeders. On top of these, several studies have shown the advantage of using MaxiChick on the performance of the breeders with over three more chicks per hen.

Conclusion

Good nutrition of the breeder will significantly influence the performance of the progeny and not only the reproductive parameters of the breeder flock. ■