

A nutritional approach for improving hatchability and profitability

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There is absolutely no doubt today in the minds of scientists and producers that nutrition greatly affects reproductive performance and profitability in each and every broiler breeder farm. The figure most looked upon as an indicator of performance and profitability is of course laying rate, but we should also not overlook what actually 'hatches' the eggs, and this is the number of chicks hatched per hen placed, or hatchability. Yes, there is considerable room for improvement in the area of hatchability as not every egg placed in the incubator hatches successfully and of those eggs that are indeed fertile, not all produce a viable broiler chick. With hatchability rate of total eggs placed running about 80%, and that of fertile eggs barely above 90%, it is apparent that even small improvements at minimal cost will lead to significant improvements in overall profitability.

The reasons for reduced hatchability are many and multi-factored, but nutrition indeed plays a significant part. Although modern breeders are rarely underfed in terms of dietary nutrient concentration or amount of

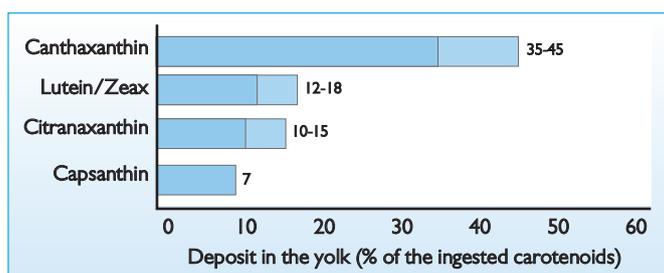


Fig. 2. Canthaxanthin is one of the best deposited carotenoids in the egg yolk (Bauernfeind, 1981).

feed, more emphasis has been placed on energy and protein (amino acids) and less on vitamins and other 'functional' nutrients.

Indeed, the most recent review of vitamin requirements for breeders dates from 1994 (National Research Council), and even this report is based on data that span several decades back.

In contrast, modern genetics with emphasis on cost efficient production have reduced feed intake and increased productivity, questioning thus the validity of such out-dated and outmoded data as those used in the 1994 review by the NRC.

Indeed, most recent data, mostly from field research and practical experiences, indicate that diets for modern breeders need to be updated with the latest nutritional knowledge in the sector of vitamins and other functional nutrients, such as antioxidants.

As recently published by some leading breeding companies, one of

the goals will be to extend the laying cycle several weeks.

This would make laying persistence and egg quality factors of utmost importance where an optimal breeder nutrition concept would certainly play a key role.

Vitamin D metabolites

The role of vitamin D in skeletal development is well known. What is substantially less known is the fact that new research on vitamin D metabolites has demonstrated beneficial effects in terms of better immunity, disease resistance, and overall productivity.

Nevertheless, feeding extra vitamin D3 does not result in increased productivity or better health as the liver acts as a barrier in the conversion of vitamin D to its first biologically active metabolite, which is 25-hydroxy-vitamin D3. This metabolite of vitamin D is being

commercialised by DSM Nutritional Products under the trade name of HyD. Research findings have repeatedly indicated that feeding HyD to poultry breeders, broilers and layers increased performance, health, growth, reproduction and immunity.

Fig. 1 shows results from a recent trial in Europe with close to 1% laying rate improvement when feeding HyD to Ross broiler breeders.

It was then the next logical step to explore the effects of this new functional 'nutrient' on hatchability, among other traits in broiler breeders.

Antioxidant properties

Similarly to vitamin D, canthaxanthin (marketed by DSM as Carophyll Red 10%) requires little introduction.

It has been used safely for over 40 years now as the major in-feed pigment for poultry eggs and skin, as it is the most efficient carotenoid in terms of deposition efficiency in egg yolk and body tissues. Indeed, over 40% of ingested canthaxanthin is deposited in biological tissues making it a primary target for investigation of possible functional properties in eggs (Fig. 2). Here, it is important to recall that in nature, the major role of carotenoids is to act as natural antioxidants. As a matter of fact, eggs from wild birds contain as much as 10 times higher levels of carotenoids than eggs from farmed

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Fig. 1. HyD (25-OH-D3) has been shown to enhance laying rate in Ross broiler breeders (Santos, 2005).

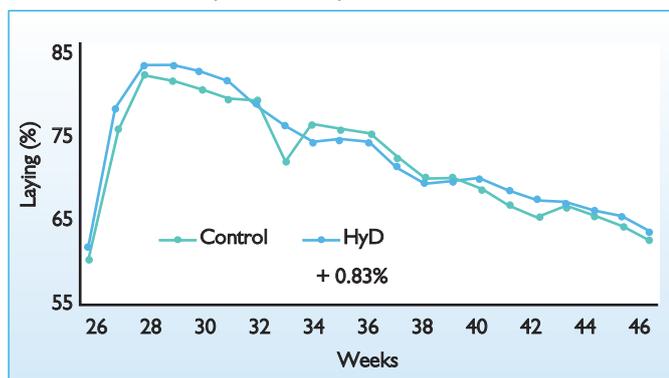
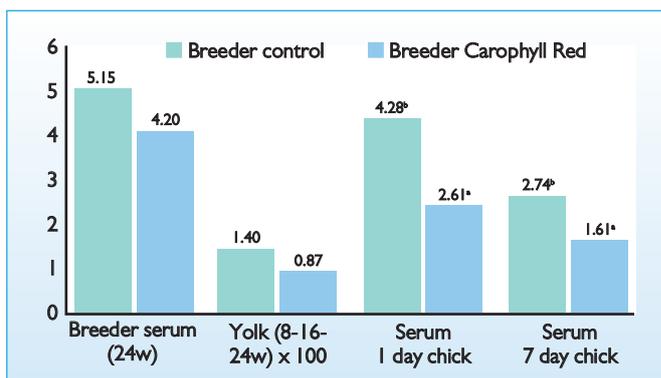


Fig. 3. Effect of feeding canthaxanthin to breeders (Carophyll Red) in the antioxidant status of different poultry tissues (Zhang et al, 2010).



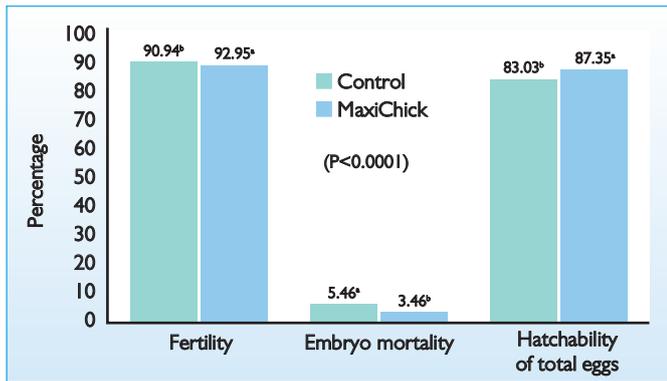


Fig. 4. Brazilian study demonstrates the effects of Rovimix MaxiChick in Cobb broiler breeders (Rosa et al, 2010).

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birds. For example, pelican eggs contain 150mcg/g carotenoids, whereas farmed chicken eggs contain only 10-15mcg/g. Clearly, this is an area that merits further investigation since, in nature, high carotenoid levels in egg yolk seems to be of benefit for the developing embryo, particularly during the first part of incubation. Carotenoids like canthaxanthin scavenge free radicals, protect lipid oxidation thus supporting cellular membrane integrity, and spare more rare antioxidants, such as vitamins E and C, and selenium. With yolk being rich in lipids, it is only natural for canthaxanthin to accumulate there to protect the developing embryo and the one day old chick from the damaging effects of embryonic lipid oxidation (Fig. 3).

Ten years of R&D

In the past 10 years, the combined effects of HyD and Carophyll Red as functional nutrients in broiler breeder nutrition have been investigated by DSM and a number of leading worldwide research partners.

Work was undertaken on studying the effects of these two functional nutrients on female and male reproductive performance, egg hatchability and chick quality, and broiler quality and performance. Suffice to say, results were so impressive that a patent has been filed and a new product was finally launched in 2010

(Rovimix MaxiChick), which has been successfully tested by most major poultry breeder houses worldwide.

Here, we discuss only the findings on hatchability by focusing on a couple university studies conducted under research conditions to ensure the least interference from commercial production problems, so common in field studies.

Broiler breeders in Brazil

Rosa and his colleagues at the Federal University of Santa Maria and DSM researchers studied the effects of feeding MaxiChick to 360 females and 36 males from the Cobb 500 genetic line.

Birds were 45 weeks of age at the beginning of the trial, which lasted for 20 weeks. There were two treatments (negative control, and MaxiChick), with six replicates per treatment. The birds were housed in an open facility on wood shavings, feed was controlled, and eggs were collected six times per day. The diet was a typical maize-soy fortified formula. The negative control and treatment diets both contained typical levels of vitamin D3. The diet had 2850 kcal/kg metabolisable energy and 16% protein, with 3% calcium, and 0.4% available phosphorus.

In a few words, diets were not deficient in any nutrient and birds were fed and managed in conditions similar to those found under com-

mercial settings. As expected, the laying rate dropped from about 70% to below 50% as the birds aged, and there was no effect of dietary treatment. Hatchability of total eggs placed increased by four percentage units (from 83% to above 87%) by feeding MaxiChick. This was partly due to enhanced egg fertility which increased from 91 to 93%, but also because of reduced embryonic mortality that was reduced by two percentage units (Fig. 4).

Thus, it appears that feeding MaxiChick had the desirable effect of improving hatchability of total eggs by a considerable amount and this was due to the combined effects of enhanced egg fertility (effect on breeders) and reduced embryonic mortality (effect on egg). It can be assumed that the functional nutrients of MaxiChick enhanced reproductive performance by supporting a better immune status in breeders as well as a good embryo survival by the use of 25-OH-D3 (as it is the main vitamin D metabolite that the embryos can use), while improved egg quality by providing enhanced antioxidant capacity.

Turkey breeders in France

A study with 1,100 BUT turkey breeders and 270 toms presented at the International Poultry Scientific Forum in Atlanta (January 2011) revealed that MaxiChick improved the number of first grade poult from 79.5% to 81.4%. This was related to improved egg production, hatchability and fertility (Figs. 5, 6).

Sperm volume and sperm concentration were 6.8% greater for the MaxiChick birds at 33 weeks.

Candling at 10-14 days indicated increased fertility for the MaxiChick group (93.81 vs. 92.95%) after six weeks in the trial, and also a subjective evaluation indicated more first quality poult for the MaxiChick group. The antioxidant status of the day-old poult, as indicated by the TBARs assay, was better for the treated birds. Liver TBARs of poult coming from 44 week old breeders fed MaxiChick were significantly lower than for control birds.

Hatchability, in terms of first grade poult, was increased by 2.9%, in very close accordance with data obtained in broiler breeders. As a result, it was estimated that the use of MaxiChick gave at least 2.3 extra poult per hen housed, which can provide an additional net income of over €190,000 for a 100,000 breeder operation!

Financial considerations

Coming back to broiler breeders, in commercial terms an improvement of 4% in hatchability is of not insignificant economic value.

To get a better idea, let us assume a breeder farm with 100,000 layers, with an average 50% laying rate. This farm produces 50,000 eggs per day to be hatched. An improvement of 4% in hatchability will yield an extra 2000 day old chicks (here, we do not even account for the other benefits of MaxiChick on overall breeder reproductive performance).

These extra 2,000 chicks will bring an additional income of at least €500 per day (assuming a price of 25 euro cent per day-old-chick), or over €182,000 per year.

Considering the cost of feeding MaxiChick we reach the net benefit of €170,000 annually. This translates to a return on investment ratio of around 15, a very respectable number. As part of the product development process, more data have been accumulated, and they all point to the same general direction of increased hatchability. In a similar study by Souza and colleagues in 2008, hatchability was improved by 3.5, caused by 1.5% improvement in fertility, and 2% reduction in embryonic mortality. Such strong data give credence to the functional properties of canthaxanthin and 25-OH-D3 and their combined effects as part of MaxiChick.

It is to be expected that actual improvements will vary according to conditions and problems causing lower hatchability rates in each farm, but functional nutrients such as those in MaxiChick should be an integral part in addressing this problem! ■

Fig. 5. Fertility improvement in BUT turkey breeders and toms fed Rovimix MaxiChick (Soto et al, 2011).

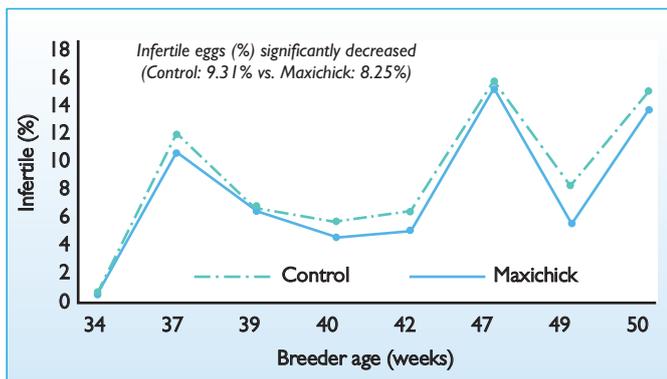


Fig. 6. Hatchability improvement in BUT turkey breeders and toms fed Rovimix MaxiChick (Soto et al, 2011).

