How organic selenium improves laying hen performance

Globally, each person consumes on average 165 eggs per year, a continually increasing figure. Eggs are a good source of quality protein and are also relatively rich in fat-soluble compounds (vitamins, fatty acids etc) and can easily be enriched with other key nutrients (for example selenium).

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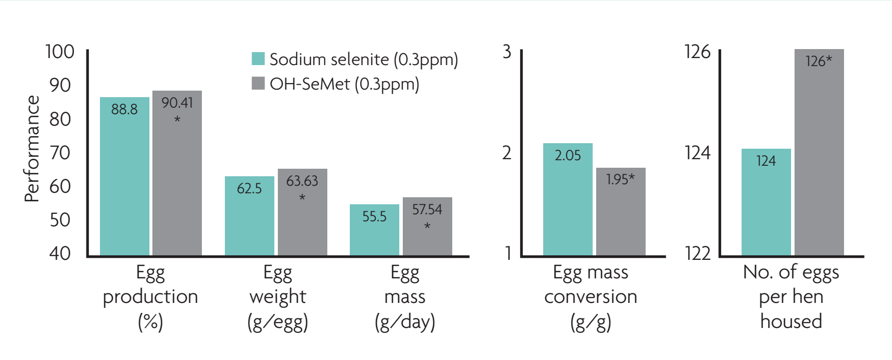

Fig. 1. Performance of layers fed sodium selenite or OH-SeMet (Brazil).

As one of the most affordable sources of animal protein, it is understandable that the number of laying flocks is increasing rapidly in developing countries such as China and India.

So, how can the industry support the growth of egg production and perhaps further improve economics of production?

- Reduce costs of production.
- Advance the genetics of commercial breeds.
- Facilitate longer laying periods.
- Ensure quality of eggs.
- Offer enriched products.
- Increase availability.
- Support performance in challenging environments.

There is a lot to discuss on this topic, but this article will focus on how to support egg production and ensure egg quality – in hens laying eggs for longer.

Increasing laying performance

The length of laying hen cycles is something that geneticists and producers alike have been working to increase. In Europe it is becoming more common to keep layers to 80 weeks of age and beyond. The move to cage-free production complicated this aim somewhat, as producers and packers are nervous about problems occurring late in the cycle; affecting overall productivity.

Demonstration flocks, however, have been kept in production for over 90 weeks with good results – demonstrating that there is further scope for genetic improvement in laying persistency.

However, in order for this strategy to be commercially viable, persistency in lay needs to be maintained along with egg quality. Poor eggshell quality is a major cause of downgraded eggs (seconds), a function of reduced shell thickness and strength. If the number of cracks and breakages becomes too high then profits are severely affected. Supporting these aims is down to genetics, nutrition and management. Birds also need to remain healthy throughout lay from both a production and welfare point of view.

Confounding issues

Oxidative stress increases as animals age, which in turn can decrease laying performance.

Variability in shell quality increases as the flock ages. Therefore, the organs and tissues involved in egg production need nutritional support; in particular protection against oxidative stress.

Hens also require more calcium as they get further into the laying cycle. If not provided by the diet then the bird will take more from bone stores, which can lead to osteoporosis – a significant welfare concern.

Similarly, a hens' selenium body reserves need to be at an optimum level, in order to maintain the selenoproteins synthesis and antioxidant protection ensuring both egg production and quality.

Albumen quality (Haugh units) decreases with age, again due to increased oxidative stress. This affects the cooking and eating quality of eggs as well as some of their functional properties, exploited in food production.

Feeding for persistency

As flocks age eggs get larger and shells tend to get thinner. This is thought to be due to the fact that mineral deposition does not increase along with egg weight. Therefore, the nutritionists' aim should be to minimise any increase in size, whilst supporting egg shell quality. As the hen ages it may not be able to absorb and mobilise minerals as efficiently. This is when source and availability of minerals is particularly important.

Diets for birds producing over 400 eggs may need to be significantly different to those fed to laying hens 20 years ago. The genetic potential of hens can be developed but greater egg production has to be supported by optimal nutrition and management.

Antioxidant protection

Selenium (Se), defined as the chief executive of the antioxidant system, is involved in several levels of antioxidant defence. Its biological functions are associated with selenoproteins, which contain Se in the form of the 21st amino acid, selenocysteine (SeCys).

In avian species, 25-26 different SeCys-containing selenoproteins have been

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identified. Most of them are directly or indirectly involved in antioxidant defences and redox status maintenance.

Of these, glutathione peroxidases (GSH-Px), thioredoxin reductases (TrxR) as well as selenoprotein P play an important role in poultry.

In general, selenoproteins are involved in regulation of many different physiological and biochemical processes, including:

- Glutathione-dependent hydroperoxide removal.
- Reduction of thioredoxins.
- Selenophosphate synthesis.
- Activation and inactivation of thyroid hormones.
- Repair of oxidised methionine residues.
- Endoplasmic reticulum associated protein folding and degradation.

This explains the role of Se in animal health, including roles in antioxidant defence, immune and inflammatory system regulation and other functions.

However, to achieve the best results, the form of Se should be considered.

Organic selenium for egg production

For the last 30 years, a mandatory approach to Se supplementation in commercial feed has been used in worldwide animal production.

To meet Se requirements, the industry has relied completely on supplemental Se delivered within trace-mineral premixes (usually at 0.2-0.3mg/kg diet). Se levels in the feed ingredients and the genetic progress of poultry for example, have not been taken into account.

Moreover, it is generally agreed that Se requirements are substantially increased by stresses that occur during commercial poultry production.

Under certain conditions or at specific points in their lifecycle, livestock can face stress, for example heat stress, viruses, bacterial infections and as they age.

A pure form of organic Se, such as hydroxy-selenomethionine (OH-SeMet) (Selisseo 2%, Adisseo France SAS) have been studied as an alternative to inorganic supplementation (sodium selenite).

Trials in laying hens have shown egg production benefits – particularly in the later stages of lay, when birds were fed OH-SeMet.

The performance of laying hens, supplemented with 0.3ppm of Se in either an organic (OH-SeMet) or inorganic (sodium selenite) form, was compared between 50 and 70 weeks of age in the Federal University of Paraiba in Brazil (Fig. 1).

Birds fed OH-SeMet had significantly higher egg production (+ 1.61 point) and significantly greater number of eggs per hen housed (+2 eggs).

Those fed OH-SeMet also had significantly lower egg mass conversion ratio than hens consuming sodium selenite.

This improvement in efficiency was due both to increases in number of eggs laid, as well as the fact that both egg weight and egg mass were significantly higher from hens fed OH-SeMet.

In a further trial carried out in Colombia, 156,000 laying hens at 62 weeks of age were either fed a diet supplemented with 0.3ppm of Se from sodium selenite or 0.2ppm in the form of OH-SeMet.

The laying performance from the birds was measured three weeks after the start of treatment and at 68 weeks of age (Fig. 2).

Although egg production was similar at 65 weeks of age, only three weeks later the OH-SeMet group had laid 4.2% more eggs. Over the whole period hens consuming OH-SeMet had 2.7% higher egg production and 4.6% lower feed conversion, leading to economic savings.

Support for egg quality

OH-SeMet also positively influences the nutritional properties of eggs, which benefits human health.

Trials comparing Se levels in eggs from hens fed 0.3ppm selenium found that if it was supplied as OH-SeMet (compared to sodium selenite), levels in the yolk were two times higher and three times higher in the albumen, after four weeks of supplementation.

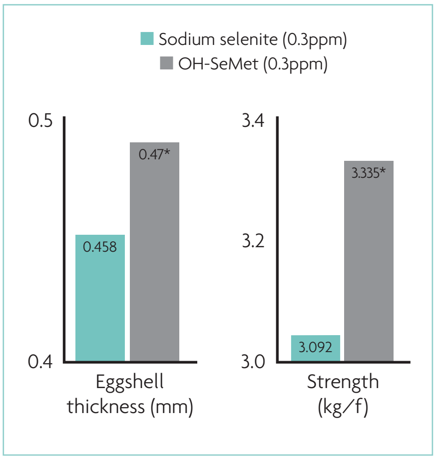


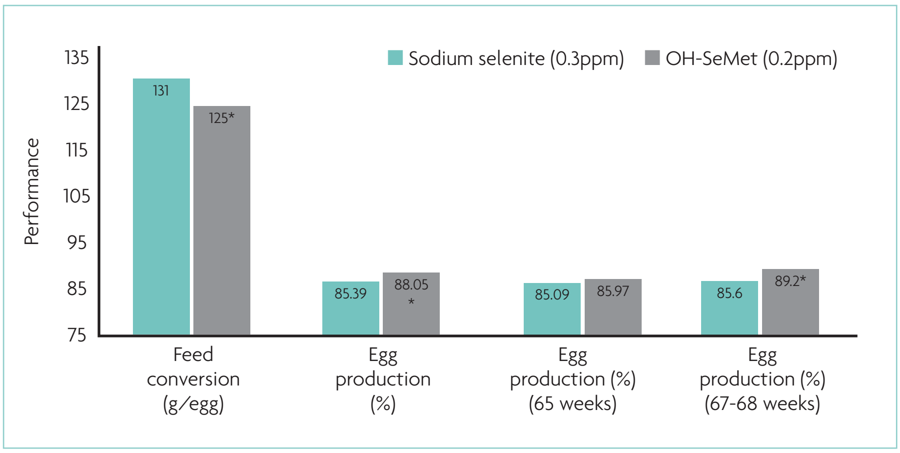
Fig. 3. Egg quality traits (Brazil).

OH-SeMet not only improves Se deposition in eggs, but also enhances the technological properties of eggs (viscosity, foaming properties, gelatinisation properties, eggshell quality, freshness) – all of which contribute to profitability in the egg industry.

In the trial discussed above, where OH-SeMet was shown to significantly improve egg production parameters, egg quality parameters were also measured (Fig. 3).

OH-SeMet significantly improved eggshell thickness (+2.6%) and strength (7.9%) compared to sodium selenite. These improvements in eggshell quality could be linked with the higher Se concentration achievable with OH-SeMet in the shell and shell membrane.

Fig. 2. Performance of layers fed sodium selenite or OH-SeMet (Colombia).



Conclusion

Breeding companies claim that they will have developed the 'long life' layer which will be capable of producing 500 eggs in a production cycle lasting 100 weeks by 2020. A variety of nutrition and management strategies will have to be employed in order to realise this.

OH-SeMet has been proven to be a more efficient Se source than sodium selenite, in improving poultry performance.

By supporting the egg production and quality, later in the laying cycle – the use of OH-SeMet is a promising solution.

Oxidative stress is an important factor of ageing and Se, being an essential mineral involved in several antioxidant and redox processes, can play an important role influencing both laying performance and egg quality.

The supplementation of 0.3ppm Se from OH-SeMet (Selisseo) has the potential to help to prolong the production cycle of laying hens, which in turn could improve the economic and sustainability of egg production globally. ■