International conference focuses on selenium story

At Alltech's recent 20th International Feed Industry Symposium Robert Renema from the University of Alberta in Canada presented a very focused paper on the importance of selenium in broiler breeders. In this short article we will summarise the salient points he addressed.

In essence, in modern broiler breeder nutrition we have significant levels of feed restriction while the breeders have increased competition for a reduced feed allocation and, therefore, the consequences of getting it wrong are potentially greater.

Diet	Shell weight (g)	Egg specific gravity
Control	5.43	1.0740
Sel-Plex	5.68	1.0762
Inorganic selenium	5.53	1.0745

Table 1. The effect of selenium source on shell weight and egg specific gravity after nine weeks of supplementation.

Ovarian function is the cornerstone to a good breeder flock and it has a complicated interaction with nutritional status, age and strain of bird.

Productive ovarian function

The process of initiating a productive ovarian function involves the conversion of genetic, environmental and nutritional cues into a cascade of signals from the neuroendocrine system which must, in turn, be integrated into and responded to by the organs and tissues that are primarily involved in reproduction.

The end result of all of this is egg production.

Thereafter, the ability of the embryo to survive the incubation process is dependent on a balance between hatchery management and breeder management.

Specific feed ingredients, bird age and flock management can directly affect semen quality, the environment in the oviduct and the environment the egg finds itself in after having been laid and all of these influence the potential of the egg to be fertile and to ultimately produce a viable chick.

Diet	No. of perivitelline holes			Changes in perivitelline sperm hole numbers between 2-4 and 5-7 days	
	2-4 days	5-7 days	Total (2-7 days)	Absolute change	Change (%)
Control	19.9	4.7	12.3	17.1	73.4
Sel-Plex	55.8	10.3	32.5	44.4	75.1
Inorganic selenium	40.7	9.5	25.1	31.1	68.5

Table 2. The effect of selenium supplementation and source on perivitelline membrane sperm holes.

Diet	No. of perivitelline holes		
	2 days	3 days	5 days
Control	83	46	14
Sel-Plex	119	61	60
Inorganic selenium	150	58	31

Table 3. The effects of selenium supplementation and source on perivitelline sperm holes of eggs from broiler breeders.

The mineral selenium can be given to the hen via her ration in inorganic and organic forms and the latter of these include Sel-Plex, which is a selenium yeast.

Eggs with a higher selenium content have higher antioxidative properties during storage and for hatching eggs this means potentially higher hatchabilities and better quality chicks.

Previous research work has shown that eggs from Sel-Plex fed breeders had significantly higher levels of selenium than did eggs from sodium selenite fed birds.

Other work has shown that feeding supplemental organic selenium to breeders increases the levels of other antioxidants in the egg such as vitamins A and E and carotenoids.

Protective effects

The protective effects of organic selenium are especially evident during the highly oxidative state of late incubation and in the first few days after hatching.

Selenium is an integral part of the antioxidant enzyme glutathione peroxidase which aids the removal of oxidative compounds from the cell.

This is important because the build up of these substances can impair cell membrane structure and function and this has an adverse effect on reproductive efficiency.

Organically derived selenoamino acids have a higher bioavailability than traditional inorganic sources and they are better absorbed across the intestine making availability to the bird easier.

In addition, selenomethionine and selenocysteine can be incorporated non-specifically into structural proteins, especially muscle tissue, during protein synthesis, thereby contributing more to selenium reserves in the bird.

Continued on page 17

Table 4. The effect of selenium supplementation and source on commercial egg traits of broiler breeders.

Diet	Hen housed egg production (%)				Total egg production	Settable egg production	Unsettable egg production (%)
	24-28 weeks	29-38 weeks	39-48 weeks	49-58 weeks			
Control	48.9	88.9	75.6	60.2	174.5	168.5	3.49
Sel-Plex	46.4	87.7	75.5	67.7	177.7	174.6	1.90
Inorganic selenium	49.7	88.1	73.1	60.1	172.7	168.6	2.37

Diet	Embryo mortality and culls						
	Infertile (%)	Day 1-14 (%)	Day 15-hatch (%)	Fertility (%)	Hatchability (%)	Hatch of fertile (%)	Chick Nos.
Control	13.06	5.33	3.66	86.9	77.9	88.6	131.3
Sel-Plex	9.87	3.52	3.14	90.1	83.5	92.5	145.3
Inorganic selenium	9.91	3.72	3.85	90.1	82.5	91.5	138.1

Table 5. The effect of selenium supplementation and source on hatchery figures.

Continued from page 15

This process also enables the enhanced transfer of selenium from the hen to the embryo and, hence, the day old with obvious benefits.

Defences against oxidation

Defences against oxidative damage are also important in the male where antioxidant enzymes play a key role in maintaining sperm cells which contain large amounts of polyunsaturated fatty acids.

This allows them to retain flexibility which is important for sperm motility.

This can have a positive impact on fertilising ability.

Some research has shown that the inclusion of selenium in breeder diets enhances sperm numbers.

It has also been shown that the use of organic selenium (Sel-Plex) reduces the production of defective sperm, thereby having a positive effect on the fertilising potential of the male.

The paper then went on to consider two recent studies. In the first of these the effects of selenium supplementation on female reproductive performance and egg traits was considered.

The effect of selenium source on shell weight and specific gravity are shown in Table 1.

In addition, perivitelline sperm hole assays were undertaken (see Table 2).

These results suggest that the greater availability of selenium from Sel-Plex compared to from the inorganic selenium may be advantageous for the fertility of the hen because of changes to the oviduct's environment.

Selenium appears to play an important role in maintaining the fertility of older hens.

This is most likely because of selenium dependent gluthathione peroxidase improving the environment of the sperm storage tubules.

Effects on fertility studied

In a second experiment the effects of selenium on fertility and hatchability of broiler breeders was studied.

Three groups of breeders were in this trial – one group received no supplementation and was the control, one received inorganic selenium and the third received Sel-Plex.

The results of this trial are summarised in Tables 3, 4 and 5. ■