

Producing selenium enriched eggs by different Se-sources in the feed.

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Abstract

In this experiment three Se-sources (sodium selenite, sodium selenate and Sel-Plex (Alltech Inc., USA) dosed at levels of 0.45 mg/kg feed were compared for their effect on egg production, Se-content in eggs and Se-utilisation by laying hens during 8 weeks. The eggs were analysed on Se-content after two weeks and after eight weeks of feeding the extra selenium. Throughout the experiment the performance of the laying hens was almost the same per Se-source. Only Sel-Plex improved the FCR compared to Se from sodium selenate with 2% (p=0.02). After eight weeks of feeding extra Se, Sel-Plex increased the Se-content of eggs much more than the other two sources: 0.52 versus 0.33 mg/kg egg (p<0.01). With Sel-Plex it is possible to produce eggs of higher Se content (0.50 mg Se per kg egg content or around 30 µg per egg). Such an egg a day can fulfil half of the daily requirement of selenium for adult men and women.

Introduction

Selenium (Se) is a trace mineral that is essential for a good health, but required only in small amounts (Thomson, 2004). Se is incorporated into proteins to make selenoproteins, which are important antioxidant enzymes. Some of these enzymes as glutathione peroxidase (GSH-Px) are involved in membrane integrity and play a major role in the antioxidant defence in the cell to prevent cellular damage from free radicals. These free radicals can contribute to the development of chronic diseases as cancer in humans. Other selenoproteins help to regulate thyroid function and play a role in the immune system (McKenzie et al, 1998). In poultry Se-deficiency is associated with impaired immunocompetence, reduced egg production and increased embryonic mortality (Combs and Combs, 1984). Enrichment of animal-derived food with selenium via special supplements to animal diets can be an effective way of increasing human selenium status (Surai, 2000).

Objective

The objective of this experiment was to assess the effect of three different Se-sources (sodium selenite, sodium selenate and Sel-Plex) in poultry feed on performance, Se-content in eggs and Se-utilisation.

Materials and Methods

- Housing:
 - 1900 Hy-line brown laying hens in the age of 40 – 50 weeks and divided into 12 floor pens (approximately 160 hens per pen).
 - Each pen contained two bell drinkers and a separate chain feeder.
 - Trial was conducted for 8 weeks
- Feed:
 - Feed was mash and supplied daily at a restricted level of about 125 g per hen per day throughout this trial

- Before the trial a feed was given with only 0.05 ppm Se in the layer feed.
- During the experiment extra Se was added to the feed as either sodiumselenite, sodiumselenate or Sel-Plex at a level of 0.45 mg per kg feed (0.5 ppm in total)
- Measurements:
 - Eggs were collected and weighed daily for the determination of laying-%, egg weight, egg mass and feed conversion rate (FCR).
 - Eggs were collected after two and eight weeks for Se-analysis by breaking and mixing three eggs per pen and analysing the egg content.

Results and Discussion

All pens showed a good performance. Feeding Se from Sel-Plex improved the FCR compared to selenate, while the hens with selenite in the feed performed intermediate (Table 1).

The Se-content and the Se-utilisation with Sel-Plex as Se-source in the feed are much higher than with selenite or selenate as Se-source (Table 2). Also a significant effect of the collection date on the Se-content in eggs occurred ($p < 0.01$). Especially for the feed with Sel-Plex the increase in Se-content in eggs between two and eight weeks after the start of the experiment was quite high (interaction feed x time: $p < 0.01$).

Table 1. Effect of selenium source on performance

	Selenite	Selenate	Sel-Plex	LSD*)
Feed intake (g/day)	125.6	125.4	124.8	1.6
Eggs/hen (%)	89.5	88.0	89.4	2.2
Egg weight (g/egg)	63.2	63.2	63.3	0.4
Egg mass (g/hen)	56.6	55.7	56.6	1.2
FCR (g/g)	2.222 ^{ab}	2.253 ^b	2.205 ^a	0.038

*) Least significant difference at a P-value of 0.05

Table 2. Effect of selenium source on Se-utilisation and Se-level in eggs

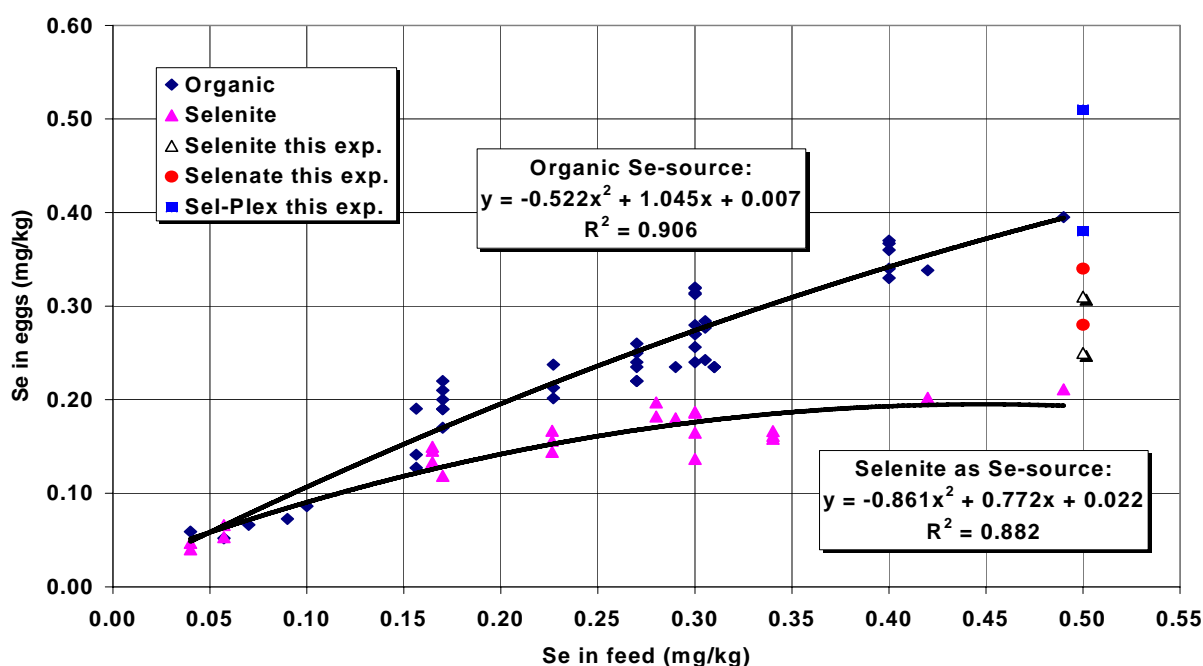
	Selenite	Selenate	Sel-Plex	LSD
Se in feed calculated (mg/kg)	0.50	0.50	0.50	
Se in feed analysed (mg/kg)	0.58	0.42	0.38	0.33
Se in eggs week 2 (mg/kg)	0.25 ^a	0.28 ^b	0.38 ^c	0.02
Se-utilisation week 2 (%)	21.8 ^a	24.4 ^b	34.3 ^c	1.6
Se in eggs week 8 (mg/kg)	0.31 ^a	0.34 ^a	0.52 ^b	0.03
Se-utilisation week 8 (%)	28.0 ^a	30.3 ^a	49.1 ^b	2.8

Comparison of the results of this experiment with other results as described by Paton et al. (2000) shows that the Se-levels in eggs achieved in this experiment with sodiumselenite or -selenate are some higher than calculated with the quadratic polynomials, mentioned in the article of Paton. After feeding eight weeks 0.5 ppm sodiumselenite or -selenate the level in eggs was over 0.3 ppm, while with the polynomial equation a level of 0.2 ppm with 0.5 ppm in the feed is estimated. One explanation for this difference might be that there have not been done many experiments with high inorganic Se-levels above 0.35 ppm in the feed, and that extrapolation gives too low estimates of the Se-level in eggs at high Se-levels in feed. Another explanation might be that in many trials the period of feeding extra selenium was too short for reaching the maximum level. With Sel-Plex however the Se-levels in eggs analysed in this trial correspond very well with the value predicted by the equation of Paton (Fig. 1).

Conclusions

- The Se-source hardly affected the performance. Only the FCR was improved slightly by feeding Se from Sel-Plex compared to Se from sodium selenate with 2%.
- Feeding sodium selenate instead of sodium selenite increased the Se-level in eggs slightly, while feeding Sel-Plex raised the Se-level in eggs significantly compared to selenite and selenate.
- It takes more than two weeks feeding extra Se to reach a maximum Se-level in eggs.
- After eight weeks of feeding extra Se the utilisation of Se from Sel-Plex was 20% higher than with the other two Se sources.
- The quadratic polynomial equation, calculated by Paton et al. (2000) gives for sodiumselenite and -selenate a too low estimation of the Se-content in eggs at high Se-levels of 0.5 ppm in the feed.
- With Sel-Plex it is possible to produce Se-enriched eggs with 0.50 mg Se per kg egg content, or around 30 µg per egg.

Figure 1. Relation between the Se-content in feed and eggs (Paton et al, 2000; this experiment).



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