Newsletter

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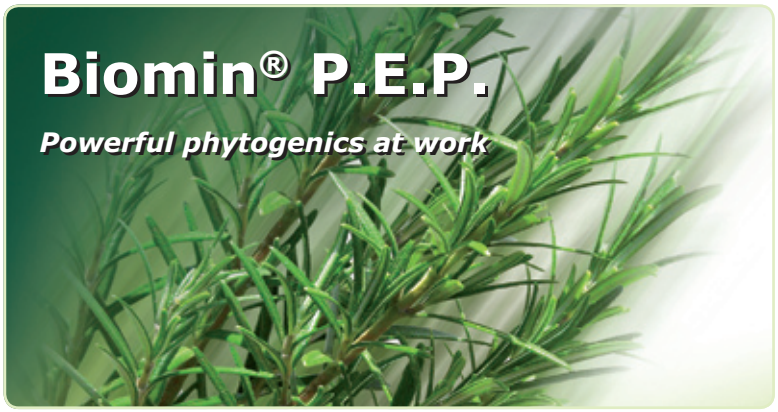
> EDITORIAL

Animal agriculture and its feed industry continue to search for efficacious, safe and cost-efficient health products with a clearly defined mode of action and proven benefits. Plant-derived (i.e. phytogenic) compounds have a considerable potential to fulfill this demand. Whilst the number of studies pertaining to the effects of Phytogenics in swine and broilers is increasing rapidly, relatively little information is available for application and potential benefits of Phytogenics in laying hens.

A review about the efficacy of Phytogenics in laying hens was recently published in the new compendium ***"Phytogenics in Animal Nutrition"*** *(Nottingham University Press, UK). Feeding laying hens diets with Phytogenics affects production parameters involving feed intake, egg production, feed conversion and egg weight. Depending on the type and dosage of the substances used, hens have shown increased egg production with the feed intake unchanged or stabilized, hence ultimately resulting in improved feed conversion.*

"Phytogenics in Animal Nutrition" *covers not only the use herbs, spices and plant extracts in laying hens (as done in this Newsletter), but reviews the most recent knowledge about the application and benefits of Phytogenics in different animal species, including poultry, pigs, ruminants and aquatic animals.*

Tobias Steiner



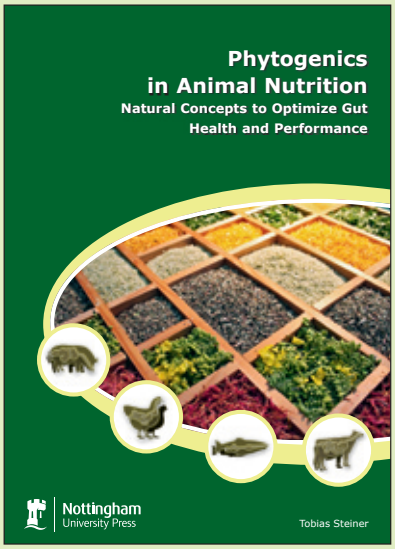
Biomin® P.E.P. product line

The brand new compendium "Phytogenics in Animal Nutrition", published in 2009 by Nottingham University Press, represents a full review of existing knowledge about Phytogenics in poultry, swine, aquatic animals and ruminants. In 181 pages the book addresses the use of herbs, spices and plant extracts in animal nutrition. The potential and application of Phytogenics among animal species is reviewed by internationally recognized experts from renowned universities and research departments. One chapter of this new book, the application of Phytogenics in egg production, is reviewed in this newsletter.

Phytogenics in laying hen nutrition – Insights from a new compendium

Challenges in laying hen nutrition

Within the last decades, production performances of modern commercial laying hens have improved considerably, including an increase in egg production, a reduction in feed conversion and increased livability. Various factors, such as genetics, housing, vaccination, lighting, nutrition, moulting, ambient temperature and processing, may affect the productivity in egg production (Alodan and Mashaly, 1999; Amerah *et al.,* 2007; Franco-Jimenez *et al.,* 2007; Singh *et al.*, 2009). Among these factors, optimal feeding strategies are mandatory to meet the huge metabolic demand of modern laying hens. Undoubtedly,



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the requirement for energy, nutrients, trace minerals and vitamins of these high-performing birds must be met by implementation of adequate feed formulations adapted to the birds' requirement as closely as possible.

Furthermore, a fundamental objective in feeding the modern laying hen is to keep its digestive tract healthy, thereby maintaining functionality on a high and efficient level. Adequate energy intake and utilization is a prerequisite to maintain production on a high level throughout the laying cycle. It is well observed that laying hens regulate feed consumption based primarily upon the feed's energy concentration (Harms *et al.,* 2000; Valkonen *et al.,* 2008). Reduced energy intake and/or utilization may cause drops in egg production and egg size. The time leading towards flock peak production is one of the most stressful periods, which is often associated with insufficient feed consumption. In addition, heat stress has a negative impact on feed intake and conversion (Franco-Jimenez *et al.,* 2007; Grizzle *et al.*, 1992). Hence, most egg producers are looking for strategies to optimize feed efficiency of their flocks. Suitable phytogenic feed additives represent one potential option to help achieving this target (Steiner, 2006).

Effects on performance

Performance parameters were improved by supplementation of diets with aromatic plants, plant extracts, their single active principles or their blended additives in broilers. The *in vivo* mode of action of phytogenic compounds has been investigated in several studies. However, in laying hens, there are a comparatively small number of studies that investigated effects of phytogenic substances on production performance as well as their gastrointestinal effects. Similarly to other species, a direct comparison among these studies is difficult due to the use of phytogenic preparations which differed in terms of their composition, physical form, content of active principles and dosages. Moreover, experimental conditions, as well as genetics and age of the birds may markedly have affected the results observed in the various trials. The preparations used in these experiments included intact herbs, ground plant material, parts of plants and essential oils, with inclusion levels ranging between 0.002 and 1% of finished feed. In several studies feed conversion ratio (FCR) was significantly reduced, indicating an increased efficiency of production. Indeed, egg production, as well as egg weights, was significantly increased in some of the experiments when hens were fed Phytogenics (Bölükbaşı *et al.,* 2007; Radwan *et al.,* 2008).

The efficacy of Phytogenics seems to be dose-related. In studies by Abd El-Motaal *et al.* (2008), Bölükbaşı and Erhan (2007) and Radwan *et al.* (2008), a clear relation between the inclusion level of the substances under test and their effect on feed intake, FCR and egg production was noted. As indicated by Çabuk *et al.* (2006), inclusion of Phytogenics might be useful to maintain laying performance in hot climatic conditions. Increased performance may be due to the various modes of action, including a modified gut microflora (Mitsch *et al.,* 2004), stimulated secretion or activity of digestive enzymes (Jang *et al.,* 2007), altered immune functions (Kroismayr *et al.,* 2008) and histological changes (Jamroz *et al.*, 2006). Therefore, a reduction of potentially pathogenic bacteria and a shift in the composition of the gut microflora towards more beneficial bacteria may reduce the competition for nutrients and dietary energy between the host and its gut microflora.

Effects on egg quality traits

In addition to production performance, there is evidence that phytogenic supplementation affects the oxidative stability of egg yolks. Several active plant compounds possess antioxidant properties. The oxidative stability of eggs is a quality parameter relevant for the nutritional value and sensory qualities. Especially processed eggs are subject to oxidative deterioration, particularly since the demand for eggs with enhanced levels of poly-unsaturated fatty acids has increased (Botsoglou *et al.,* 1997). In addition, beneficial effects of Phytogenics on yolk composition, shell thickness or Haugh Unit rating were discussed in a few studies, indicating potentially an indirect effect of these substances on egg quality traits.

New trial data available

The results of a recent scientific trial, carried out in Serbia, confirms a positive impact of the phytogenic feed additive Biomin® P.E.P. in laying hen nutrition.
This trial was conducted on the experimental farm of the Faculty of Agriculture, University of Novi Sad, Serbia. Hy-Line brown hens, 16 weeks old at the beginning of the trial, were housed in three-floor battery cages. Treatments (6 replicates each) were as follows:

1. Negative control (standard commercial diets based on corn and soybean meal)
2. Standard diet + Biomin® P.E.P. 125 poultry (125 g/t feed)

Overall results are shown in *Table 1*, indicating an advantage of the hens fed Biomin® P.E.P. in terms of body weight development, egg production and feed conversion. Due to the small number of birds there were no major differences in mortality.

Table 1. *Overall results*

	Control	Biomin® P.E.P.	Difference (%)
Body weight week 16 (kg)	1.320	1.324	+0.3
Body weight week 22 (kg)	1.695[b]	1.767[a]	+4.2
Body weight week 28 (kg)	1.838	1.866	+1.5
Egg production, week 23 (%)	84.60	88.91	+5.1
Egg production, week 28 (%)	92.06	92.88	+0.9
Egg production, average (%)	69.4	70.9	+1.5
Second grade eggs (%)	4.02	3.34	-17
Egg mass (kg/hen)	2.588	2.689	+0.101
Average egg weight (g)	59.2[b]	60.2[a]	+1.7
Average daily feed intake (g/hen)	114.8	113.8	-1.0
FCR	2.45	2.34	-4.5

[a,b] Significant difference between groups (P < 0.05)

Egg production

As shown in *Figure 1*, egg production (per hen housed) was higher in hens fed the phytogenic feed additive.

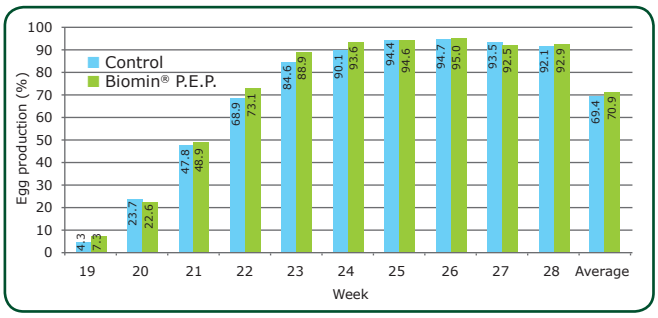

Figure 1. *Egg production*

Feed Efficiency

Feed intake did not differ between the groups. However, feed conversion ratio (FCR) was improved by supplementation of the diet with Biomin® P.E.P. *(Figure 2)*. Improved FCR was also obtained in a previous trial carried out in Thailand (Steiner and Nichol, 2008).

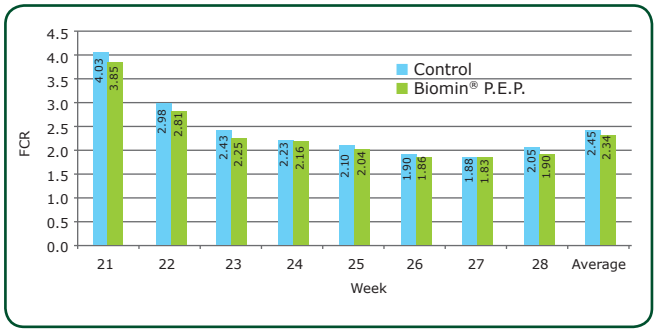

Figure 2. *Feed conversion ratio (FCR)*

Egg quality

Egg quality parameters were slightly different in both treatments *(Table 2)*. Especially shell thickness and Haugh Unit rating revealed higher values the Phytogenics group as the hens grew older.
Moreover, eggs were slightly and significantly heavier in the Biomin® P.E.P. group, as indicated by a higher number (29.5 *vs.* 23.1%) of heavier (L) eggs, particularly towards the end of the trial.

Table 2. *Egg quality parameters (28 weeks of age)*

	Shell cleanness	Shell breaking force	Shell thickness	Shell weight	Shell weight	Albumen height	Yolk color	Haugh Units
		(kg)	(0.01 mm)	(g)	(%)	(mm)		
Control	4.9	2.7	35.4	6.9	10.8	9.85	11.60	93.5
Biomin® P.E.P.	4.9	2.8	36.3	7.2	11.1	9.58	11.78	98.8

[1] Shell cleanness was evaluated by scoring system on a scale from 1 (very dirty shell) to 5 (completely clean).
[2] Egg breaking force (kg) was measured by equipment by Rauch.
[3] Egg yolk color was determined according to Roche yolk color fan.

Table 3. *Economic calculation, based on trial data from University of Novi Sad (Serbia)[1]*

	Control group	Biomin® P.E.P. group	Difference
No. of birds initial	50,000	50,000	
No. of birds end	49,500	49,500	
Laying rate (%)	69.4	70.9	+1.5
Egg weight (g)	59.2	60.2	+1.0
Number of eggs/hen	43.72	44.67	+0.95
Egg mass (kg/hen)	2.588	2.689	+0.101
Egg mass produced (kg)	129,417	134,448	+5,031
Egg price /100 eggs[2] (€)	6.5	6.5	
Egg price /kg eggs[2] (€)	1.098	1.080	-0.018
Egg mass revenue (€)	142,097.-	145,168.-	+3,071
Feed consumption (kg/hen)	7.23	7.17	-0.06
Total feed consumed (kg)	358,097	354,885	-3,212
Feed price (€/t)	235.-	235.-	
Total feed cost (€)	84,153.-	83,398.-	-755.-
Cost of additive (€)	---	1,078.-	1,078.-
Contribution margin (Revenue - feed)	57,944.-	60,692.-	+2,748.-
Total benefit of additive (€)[3]		3,826.-	
ROI[4]			3.6

[1] Prices may vary in different countries.
[2] A smaller number of downgraded eggs and an increased number of heavier eggs would provide an extra benefit in the Biomin® P.E.P. group, but are not taken into account for this calculation.
[3] Add. egg mass revenue + saving on feed cost
[4] Return on investment.

Economic Calculation

The economic evaluation *(Table 3)* is based on the performance data from 20-29 weeks of age obtained in this trial and the calculations were carried out for flocks of 50.000 hens and assuming mortality of 1%.

Conclusion

The hens in the trial presented herein were housed under excellent environmental conditions. Supplementation of the layer feed with the phytogenic feed additive Biomin® P.E.P., however, resulted in improved performances and egg traits, hence may positively affect egg production, especially in the early stages of the laying cycle.

> LITERATURE

Steiner, T. (2009) Phytogenics in Animal Nutrition – Natural concepts to optimize gut health and performance. Nottingham University Press, Nottingham, UK (ISBN-13: 978-1-904761-71-6).

> EVENTS

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We are looking forward to meeting you there!

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