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ENERGY AND PROTEIN SPARING EFFECT OF KEMZYME MAP DRY – A COMMERCIAL LAYER STUDY

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Abstract

Use of enzymes in commercial layer diets helps to increase the use of high fiber alternative ingredients into the feed formulation to achieve lower feed costs without depressing laying hen performance. The aim of the present study was to evaluate the effect of KEMZYME MAP Dry, a multi-enzyme formulation containing NSP hydrolyzing enzymes, multi-amylases and multi-proteases, on the production performance of commercial layer birds. Treatments used for the trial were (1) Positive control diet (corn-soybean), (2) Negative control diet (ME reduced by 60 kcal/kg and crude protein reduced by 0.5%) (3) Negative control diet + KEMZYME MAP Dry (250 g/t) and (4) Negative control diet + KEMZYME MAP Dry (500 g/t). The trial was conducted from 17 to 31 week of age. Each treatment had 6 replicates with 20 layers per replicate. Results showed that KEMZYME MAP supplementation significantly improving egg production ($P<0.05$) starting from 24th week onwards. At 250 g/t dosage, improvement in egg production was found to range from 0.9 % HD to 3.3% HD ($P<0.05$) over negative control diet. Egg production showed an improvement ranging from 2.3 %HD to 3.7% HD from 24th week to 31st week with KEMZYME MAP supplementation at 500 g/t ($P<0.05$) over negative control diet. No significant changes observed in egg quality and body weight measurements for different treatments. The result of the present study suggests that KEMZYME MAP has energy and crude protein sparing effect in commercial layer diets, thus serves as significant tool to manage the feed cost without compromising performance.

Key words: KEMZYME MAP, multi-enzyme, commercial layer, energy, protein sparing, egg production

Introduction

Layer producers are looking for lower feed costs with the inclusion of alternative feed ingredients. Although this high-fiber feed ingredients are potential cost-effective alternatives for corn and soybean, their use in layer feed can be limited by the variable digestibility of nutrients.

Laying hens and the eggs they produce are largely composed of protein. The simple act of laying an egg depletes the chicken of necessary protein that must be replaced through the diet. However, a laying hen typically utilizes only 40% of consumed dietary protein, which is both costly to the integrator and wasteful in terms of nitrogen utilization The concept of low protein diets for layers is thus attractive because of the lower feed costs and reduced nitrogen excretion.. While the use of low-protein diets for laying hens is recommended to reduce nitrogen excretion, the reduction of protein may negatively impact egg production. One strategy to maintain layer performance while using low protein diets is the use of exogenous enzymes which could maximize nutrient digestibility.

The use of a multi-protease system designed to sustain protease activity under fluctuating pH conditions inside the GIT will enhance the digestibility of protein sources resulting in lowering of nitrogen excretion and feed costs. Kemin Animal Nutrition and Health, Asia Pacific has developed a unique combination of different proteases (acid protease, alkaline protease and neutral proteases) which showed superior in vitro and in vivo efficiency in improving protein digestibility compared to a single neutral protease. A combination of NSP hydrolyzing enzymes, amylases and proteases working together to digest the poorly digestible segments of feed ingredients could increase the energy and amino acids available for growth. Previous studies have demonstrated the potential of KEMZYME MAP in improving nutrient digestibility and growth performance in broilers and swine. This paper summarizes the effect of KEMZYME MAP in improving the production performance of layers in low energy and protein diet.

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Materials and Methods

The trial was conducted at a commercial farm at Thailand. The birds were housed in a closed monitor layer house provided with wire laying cages in air-step arrangement and fed with mash feed. Treatments used for the trial are shown in Table 1. A total of 480 Hisex Brown pullets, 16 weeks of age was used in the study. The birds were randomly allocated to 4 treatment diets (Table 1). Each treatment had 6 replicates with 20 layers per replicate. Composition of experimental diets is given in Table 2. The study lasted a total of 15 weeks, starting from 17 weeks until 31 weeks of age. The birds were weighed at 17 and 31 weeks of age. Feed intake and hen-day egg production was measured at weekly basis. At 21 and 24 weeks of age, 50% of total eggs per replicate were randomly selected for egg qualities analysis (shell thickness, shell weight, Haugh units (HU), yolk color score).

Table 1. Treatments used for the growth trial.

Treatments	Diet	Details	Enzyme &Dosage (g/t)
T1	Positive control		Nil
T2	Negative control	60 kcal/kg lower ME, 0.5% lower crude protein	Nil
T3	Negative control	-	KEMZYME MAP (250 g/t)
T4	Negative control	-	KEMZYME MAP (500 g/t)

Table 2. Composition of diets

Ingredients	Composition (kg/t)	
	Positive control	Negative control
Corn	620	506
Rice bran oil	10	4
SBM 44%	230	200
Cassava	-	50
Rice bran (full fat)	-	50
DDGS	-	50
Meat and bone meal	50	50
Calcium carbonate	82	82
DL-Met	2	2
Premix	3	3
Salt	3	3
Total	1000	1000
Nutrients		
ME (Kcal/kg)	2800	2740
Crude Protein (%)	17.5	17.0
Crude Fat (%)	3.85	4.00
Crude Fiber (%)	3.16	3.9
Ca (%)	3.71	3.72
Av. P (%)	0.36	0.39
Lysine (%)	0.89	0.86
Met+Cys (%)	0.70	0.70
Met (%)	0.48	0.48
Thr (%)	0.66	0.65
Trp (%)	0.22	0.21
Linoleic acid (%)	1.72	1.40

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Results and discussion

Effect of KEMZYME MAP on egg production: Results indicate that the lowering of metabolizable energy and crude protein content of layer diets negatively impacted egg production from 21st week onwards. The difference in egg production (%) between the negative control treatment and positive control treatment increased with age. Significant drop in performance of negative control treatment was observed from 26th week onwards (Table 3&4). This reduction in egg production for the negative control group may be due to the reduction in metabolizable energy and crude protein levels in the diets. Supplementation of KEMZYME MAP resulted in increased egg production over negative control. The positive effect of KEMZYME MAP on productive performance of layers could be attributed to the enhancement in digestive enzymes and nutrient digestibility.

Table 3. Effect of KEMZYME MAP supplementation on egg production (%HD)

Treatment	Age (weeks)											
	20	21	22	23	24	25	26	27	28	29	30	31
T1	28.2^{a}	66.8^{a}	79.4^{a}	82.1^{ab}	86.9^{ab}	89.0^{ab}	92.4^{b}	92.4^{ab}	92.9^{b}	92.3^{b}	92.0^{b}	92.4^{b}
T2	28.8^{a}	62.1^{a}	78.9^{a}	80.7^{a}	85.8^{a}	88.1^{a}	90.7^{a}	91.3^{a}	88.8^{a}	89.5^{a}	89.4^{a}	88.7^{a}
T3	26.4^{a}	67.6^{a}	82.1^{a}	81.8^{ab}	86.7^{a}	90.3^{bc}	92.1^{b}	93.1^{b}	92.6^{b}	92.6^{b}	92.7^{b}	92.1^{b}
T4	30.4^{a}	70.4^{a}	79.2^{a}	83.2^{b}	88.1^{b}	90. 7^{c}	92.4^{b}	93.0^{ab}	92.6^{b}	92.6^{b}	92.4^{b}	92.4^{b}

^{a,b,c} Means with different superscripts are significantly different ($P < 0.05$)

Table 4. Effect of KEMZYME MAP on productive performance of layers at different intervals of time

Parameters	Treatments			
	Positive Control (T1)	Negative Control (T2)	Negative Control + KEMZYME MAP (250 g/t) (T3)	Negative Control + KEMZYME MAP (500 g/t) (T4)
	20-23 weeks			
Egg production (%HD)	64.13^{a}	62.63^{a}	64.48^{a}	65.80^{a}
Feed intake (g/bird/day)	110.00^{a}	109.75^{a}	110.25^{ab}	110.50^{c}
Feed conversion (kg feed/dz egg)	2.058^{a}	2.103^{a}	2.052^{a}	2.015^{a}
Egg production (%HD)	90.18^{b}	88.98^{a}	90.55^{b}	91.17^{b}
Feed intake (g/bird/day)	112.00^{b}	111.00^{a}	112.50^{b}	112.25^{b}
Feed conversion (kg feed/dz egg)	1.490^{a}	1.497^{a}	1.491^{a}	1.478^{a}
Egg production (%HD)	92.40^{b}	89.10^{a}	92.50^{b}	92.50^{b}
Feed intake (g/bird/day)	111.5^{a}	111.5^{a}	111.75^{a}	111.75^{a}
Feed conversion (kg feed/dz egg)	1.448^{a}	1.502^{b}	1.450^{a}	1.450^{a}

$^{a, b,c}$ Means with different superscripts are significantly different ($P < 0.05$)

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Effect of KEMZYME MAP on feed intake and body weight: Protein is the major nutrient which contributes to the feed cost and is used for optimum egg production. Several studies have examined the effects of low-protein diets in laying hen nutrition. Several studies reported that the layer performance can remain be satisfactory on reduced-crude protein diets for short periods, but long-term feeding of reduced-crude protein diets may not be advisable due to low production and body weight loss. Current study results indicate that response in egg production was more sensitive to the reduced-nutrient diets. Feed intake (Table 5) and body weight (Table 6) showed no significant difference between the treatment groups ($P < 0.05$). This is similar to the observation by Chauynarong *et al*. who reported that the body weight of layers was not affected by protein level and enzyme supplementation.

Table 5. Effect of KEMZYME MAP supplementation on feed intake of layers.

Weeks	Average Feed intake (g/bird/day)			
	T1	T2	T3	T4
17	102	101	101	101
18	103	105	105	104
19	108	110	111	109
20	109	109	109	110
21	109	109	109	109
22	110	110	110	110
23	112	111	113	113
24	112	111	113	112
25	112	111	112	112
26	112	111	112	113
27	112	111	113	112
28	112	111	112	112
29	111	112	112	112
30	111	111	111	111
31	112	112	112	112

Table 6. Effect of KEMZYME MAP supplementation on body weight of layers.

Treatment	Average body weight (kg/bird)	
	17^{th} week	31^{st} week
T1	1.43	1.80
T2	1.43	1.81
T3	1.43	1.79
T4	1.43	1.79

Effect of Enzyme supplementation on egg quality: Egg weight did not differ significantly with the change in diet at any age (Table 7). At 21 weeks the average egg weight was between 47.9 - 49.3 g and 50.1 - 51.6 g at 24 weeks. Inclusion of cassava in the negative control diet tends to decrease yolk color score due to lack of pigments in cassava and the effect was significant for all the treatments using negative control diets ($P < 0.01$). Shell weight at 21 and 24 weeks ranged between 5.0 and 5.2 g and 5.2 and 5.4g, respectively. However, there was no significant difference between the treatments. At 20 weeks, shell thickness significantly improved ($P < 0.01$) for all KEMZYME MAP supplemented diets. There were no apparent effects of treatment diets on albumen and yolk weight. At 24 weeks, albumen weight ranged between 33.4 g and 34.2 g. A similar trend was evident in the Haugh unit score as well.

Since no deleterious effects of feeding a negative control diet were found for any of the measured egg quality parameters except yolk color during the 21st week, the only conclusion that could be drawn was that the KEMZYME MAP had no negative effect on any of the parameters measured.

Table 7. Effect of KEMZYME MAP supplementation on egg quality.

Treatment	Egg weight (g)	Albumin height (mm)	Yolk color score	Yolk Weight (g)	Shell weight (g)	Shell thickness (mm)	Albumin weight (g)	HU
			21 weeks					
T1	47.9	6.3	8.0 [b]	11.5	5.0	0.280 [a]	31.3 [a]	82.3
T2	49.3	6.3	7.7 [a]	11.6	5.2	0.283 [a]	32.5 [b]	82.3
T3	49.2	6.5	7.6 [a]	11.3	5.2	0.348 [b]	32.7 [b]	83.4
T4	48.6	6.3	7.5 [a]	11.3	5.0	0.348 [b]	32.3 [ab]	82.3
			24 weeks					
T1	50.1	7.3	8.5	11.9	5.2	0.402 [ab]	33.4	87.8
T2	51.3	7.2	8.4	12.0	5.2	0.397 [a]	34.1	87.1
T3	51.6	7.1	8.3	12.2	5.4	0.418 [b]	33.9	86.6
T4	51.0	7.2	8.3	11.8	5.3	0.415 [ab]	33.8	87.6

[a,b] Means with different superscripts are significantly different ($P < 0.05$)

Return on investment (ROI) for KEMZYME MAP: As evident from the results, the inclusion of alternate feed raw materials produced a negative impact on layer performance which affected the ROI. The addition of KEMZYME MAP to negative control diets produced numerical improvement in egg production from 21st week onwards and the effect emerged significant from 25th week onwards. This resulted in higher ROI for KEMZYME MAP supplemented diets at two different level of dosages. (Table 8).

Table 8. Return on investment for KEMZYME MAP

Parameters	Positive Control	Negative Control	Negative Control + KEMZYME MAP (250 g/t)	Negative Control + KEMZYME MAP (500 g/t)
Total number of birds	10000	10000	10000	10000
Trial period (days)	70	70	70	70
Feed intake (g/b/day)	111.70	110.75	111.50	111.50
Average Egg Production (%)	82.23	80.23	82.51	82.43
Number of eggs produced (per day)	8223.00	8023.00	8251.00	8243.00
Feed intake (g) per egg	135.8	138.0	135.1	135.3
Feed cost per ton (USD)	400.70	388.66	390.16	391.66

Feed cost per egg (USD)	0.054	0.054	0.053	0.053
Feed cost per 1000 eggs (USD)	54.4	53.7	52.7	53.0
Selling price of one egg (USD)	0.10	0.10	0.10	0.10
Income from selling eggs (USD)	23024	22464	23103	23080
Return on investment				
Number of eggs produced /kg of feed	7.36	7.24	7.40	7.39
Number of eggs produced /ton of feed	7,362	7,244	7,400	7,393
Revenue generated through selling eggs	736	724	740	739
Extra revenue generated (Less feed cost)	335	336	350	348
Net return (USD) for the trial period		0.30	14	12
Treatment cost (USD) of Enzyme (per ton feed)			1.50	3.00
ROI Ratio			**9.58**	**4.05**

Conclusion

The aim of the present study was to evaluate the effect of KEMZYME MAP, a multi-enzyme product containing NSP hydrolyzing enzymes, multi-amylases and multi-proteases, on the production performance of low energy & crude protein diet of commercial layer birds. Significant drop in performance of negative control diet was observed due to reduction in metabolizable energy and crude protein levels in the diets. Supplementation of KEMZYME MAP resulted in increased egg production over negative control. The positive effect of KEMZYME MAP on productive performance of layers could be attributed to the enhancement in digestive enzymes and nutrient digestibility. The result of the present study suggests that KEMZYME MAP has energy and crude protein sparing effect in commercial layer diets, thus serves as significant tool to manage the feed cost without compromising performance.

References

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