Indian J. Anim. Prod. Mgmt. Vol. 29 (1-2) 50-55 (2013)

EFFECT OF ROCK PHOSPHATE WITHOUT AND WITH ALUMINIUM INSTEAD OF DICALCIUM PHOSPHATE ON PERFORMANCE OF GROWING PULLETS

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Received : 24.08.2013, Accepted : 05.09.2013

ABSTRACT

Dicalcium phosphate (DCP) is used traditionally as phosphorus supplement in poultry diets. However, due to high demand and scarce availability, its cost is steeply increasing. Therefore, to reduce the cost of mineral mixture, it has become imperative to use alternate and economical phosphorus supplement in poultry diet without lowering the production performance of birds and reducing the cost of their production. One of the alternates is rock phosphate (RP) which is available in plenty at much lower cost compared to DCP. The performance of birds on RP varies greatly probably because of large variations in the fluorine (F) content (205 to 5540 mg/kg) of the diets based on RP. Therefore, this study has been planned to see the utilization of rock phosphate instead of dicalcium phosphate on the growth performance of egg type growing chicken. In the experiment, three hundred and twenty four WLH growing pullets (08 weeks age) were randomly distributed to 27 replicates of 12 pullets each and were allotted to 9 dietary treatments. Diet one (T_1) was control. Diets 2, 4, 6 and 8 (T_2, T_4, T_6 and T_8) were same as T_1 except that in these diets DCP was replaced @ 40%, 60%, 80% and 100% with rock phosphate. While, diets 3, 5, 7 and 9 (T_3, T_5, and $T_7$and T_9) were same as T_2, T_4, T_6 and T_8 accept the addition of aluminium at a ratio of 0.8 Al: 1 F, in those diets. Experiment was conducted for 9-20 weeks (Grower phase). The overall performance of growers offered RP diets indicated that increase in the level of RP reduced their performance (weight gain, feed intake, FER and PI), significantly. However, it was significant when level of RP was increased above 40%. 60% replacement of DCP with RP supplemented with aluminium sulphate did not influence the weight gain, feed intake FER and PI and led to better performance in growers. The cost per kg weight gain has certainly increased due to use of higher levels of RP supplemented with aluminium sulphate.Hence it was concluded that 40% RP and 60% RP along with aluminium sulphate was beneficial to replace DCP in the mineral mixture of egg type growers. However, supplementation of aluminium sulphate to RP was not economical.

Key wards : Alternate phosphorus sources, Aluminium sulphate, Dicalcium phosphate, Egg type growers, Mineral mixture, Rock phosphate.

The cost of traditional phosphorus (P) supplement i.e. dicalcium phosphate (DCP) in poultry diet is steeply increasing hence use of alternate economical phosphorus supplement without lowering the production performance of birds has become essential. In India, rock phosphate (RP) is available as an alternate economical phosphorus supplement but its use in the poultry diet is limited. Rock phosphate contains lower amount of P and large amount of fluorine (F) in comparison to DCP. The RP contains F at varied concentration depending on the geographic sources[10].

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Utilization of phosphorus from rock phosphate has been reported to depend on the concentration of fluorine [5,12]. Numerous dietary additives alleviating F toxicosis have been only partially effective and had met only limited use under practical conditions[11]. Initial studies on the use of aluminium sulphate as a fluoride toxicity alleviator in poultry were confined to turkey poults and broilers. Aluminium sulphate over a short time period proved to be an effective alleviator of F toxicity. An Al: F ratio of 0.8: 1.0 was found effective in eliminating the toxic effect of F in turkey poult rations[3]. Similar additions of aluminium sulphate greatly reduced the fluorosis in hens given 1300 mg F Kg^{-1} DM and reduced fluoride concentrations at most sites, particularly eggshell, liver, muscles, bones and kidney[6]. Therefore, the present work was conducted to study the utilization of rock phosphate without and with aluminium, instead of DCP on performance of growing pullets.

MATERIALS AND METHODS

Stock, diet and husbandry

In the experiment, three hundred and twenty four WLH growing pullets (08 weeks age) were randomly distributed to 27 replicates of 12 pullets each and were allotted to 9 dietary treatments. Diet one (T_1) was control diet in which DCP was used as a sole source of P. Diets 2, 4, 6 and 8 (T_2, T_4, T_6 and T_8) were same as T_1 except that in these diets DCP was replaced @ 40%, 60%, 80% and 100% with rock phosphate on P basis. While, diets 3, 5, 7 and 9 (T_3, T_5, and T_7 and T_9) were same as T_2, T_4, T_6 and T_8 accept the addition of aluminium at a ratio of 0.8 Al: 1 F, in those diets. Diets 2, 4, 6 and 8 were planned to know the effect of using rock phosphate (RP) instead of DCP in poultry diet. While, diets 3, 5, 7 and 9 were planned to see the effect of aluminium in combating the fluorine (F) toxicity. Fluorine content in the diets containing 40%, 60%, 80% and 100% RP instead of DCP were 486,729,972 and 1214 ppm., respectively. The growers were vaccinated as per vaccination schedule and final debeaking was done at 16th week. Birds were reared in deep litter system in grower cum layer house, having 45 compartments. The experimental diets were formulated as per specification[7] and are presented in Table 1. Each experimental diets were fed *ad libitum* to 27 replicates of 12 pullets each during experimental period of 9-20 weeks.

Parameters studied

Individual body weights of pullets and replicate- wise feed intake were recorded at weekly interval. Feed efficiency ratio (FER) was calculated as the ratio between the body weights gained and feed consumption. Performance index was calculated as per the formulae PI= Body weight gain (g) x FER , proposed by Bird[2].

Samples of feed were analyzed for proximate composition using standard [1]methods and for estimation of calcium and phosphorous content standard method was adopted[18]. Mortality record was maintained throughout the experiment. Economics of production was calculated as per cost of feed consumed in rupees per kg gain in body weight.

Statistical analysis

The data obtained during experiment were analyzed statistically by using standard methods[16]. Differences among the treatments were tested for significance[4].

Table1: Composition of diets (%), using RP with and without aluminium sulphate, instead of DCP in MM, fed to egg type growers (9-20 weeks).

Diets	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9
Maize (kg)	46	46	46	46	46	46	46	46	46
DORP (kg)	33	33	33	33	33	33	33	33	33
SBM (kg)	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5
DCP (g)	1600	960	960	640	640	320	320	-	-
Rock Phosphate (g)	-	640	640	960	960	1280	1280	1600	1600
Limestone Powder (g)	1500	1500	1500	1500	1500	1500	1500	1500	1500
$Al_2 (S0_4)_3$(g)			480	-	720	-	960	-	1200
Salt (g)	300	300	300	300	300	300	300	300	300
ZnSO4 (g)**	10	10	10	10	10	10	10	10	10
KI (mg)**	150	150	150	150	150	150	150	150	150
Vit. A, B2, D3 K (g)*	30	30	30	30	30	30	30	30	30
Vit. B Complex (g)*	10	10	10	10	10	10	10	10	10
Salinomycin	50	50	50	50	50	50	50	50	50
Total (kg)	100	100	100	100	100	100	100	100	100

Nutrient composition analysed

CP%	16.11	16.14	16.17	16.21	16.15	16.16	16.14	16.15	16.20
Ca %	1.034	1.074	1.074	1.094	1.094	1.116	1.116	1.124	1.124
Total P %	0.970	0.973	0.973	0.959	0.959	0.947	0.947	0.951	0.951

Nutrient composition calculated:

ME(kcal/kg)***	2507	2507	2507	2507	2507	2507	2507	2507	2507
Lysine %	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.723
Methionine %	0.294	0.294	0.294	0.294	0.294	0.294	0.294	0.294	0.294
NPP %	0.437	0.437	0.437	0.437	0.437	0.437	0.437	0.437	0.437

* Vitamin premix provided (each 250 g contains): Vit. A – 10000000 IU; Vit.D3- 2000000 IU; Vit. B1– 800mg; Vit. B2- 5.0g, Vit. B6- 1.60g; Vit. B12-20.50g; Niacin– 12.0g; Calcium D Panthothenate-8.0g; Vit. K3- 1.0g; Vit. E – 8.0 g; folic acid-800mg.

** Trace minerals premix provided (mg/kg diet)- Manganese-50; Iron- 60; Copper-11.24; zinc- 40: Iodine-06.

*** Calculated as per tabulated values of ingredients used.

RESULTS AND DISCUSSION

Effect of using RP instead of DCP on egg type growers:

The performance (feed intake, body weight gain and PI) in growers offered diet containing 40% RP (486 ppm F) instead of DCP was comparable (P<0.05) to those fed diet containing only DCP as source of P supplement (Table 2). However, FER was not influenced up to use of 80% RP instead of DCP. Reduction in weight gain at higher levels of RP was attributed to reduction in feed intake probably related to higher levels of F because with every 20% increase in RP instead of DCP there was an additional increase in 273 ppm F. The results are in agreement with the previous study[13] in which they also observed reduced growth and feed efficiency among egg type growers fed 648 ppm F from RP instead of DCP. They also reported that up to 432 ppm of F (through RP), weight gain as well as FCR of pullets were found statistically similar to control (DCP) groups which is in agreement with our study. Several workers[17]studied the effect of excessive (200 to 600 ppm) amount of dietary fluoride on rats and reported that responses to high F diets were lowered feed intake, altered lipid and carbohydrate metabolism and decline activity of liver enzymes, which were responsible for alteration in either feed intake or its utilization. High level of fluoride has been shown to inhibit lipid metabolism[9] and enzyme systems including fatty acid oxidase[8]. Fluoride fed rats excreted more fecal fat, nitrogen and dry matter than control rats, indicating a reduction in digestibility of ration[15]. Similarly, reduced growth due to high level of fluoride was attributed to depression in feed intake, digestibility and metabolic effects[19].

Effect of RP along with aluminium sulphate instead of DCP on growers:

Perusal of results indicated that use of 40% RP supplemented with aluminium sulphate (486 ppm F) instead of DCP did not influence the performance (weight gain, feed intake, FER and PI) of growing birds but use of higher levels (60%, 80% and 100%) of RP supplemented with aluminium sulphate in place of DCP caused significant improvement in performance (Table 2). However, it was true only up to 60% (729 ppm F) of replacement. This means that aluminium sulphate was effective in eliminating the toxicity of F but to a certain level of F. The aluminium sulphate either reduced the F absorption or increased the faecal and urinary F excretion[14].

The cost of feeding of growers assigned RP without and with aluminium sulphate is presented in Table 2. Feed cost was reduced due to inclusion of RP instead of DCP during 9 - 20 weeks in growers. Among RP diets, minimum and significantly lower cost per kg weight gain was noticed in growers allotted 40% RP (T2) diet. However, it was comparable to those allotted 60% RP diet. Further, use of higher levels (80% and 100%) of RP tends to increase the cost per kg weight gain of growers significantly.

Use of each level of RP along with aluminium sulphate instead of DCP significantly (P<0.05) increased the cost per kg weight gain of growers. Among supplementary diets, it was maximum in growers fed T_9 (100% RP with aluminium sulphate) diet while, minimum cost per kg weight gain was noted in those assigned T_3 (40% RP with aluminium sulphate) diets. Use of aluminium sulphate increased the cost of feeding. Supplementation of aluminium sulphate at each level of RP significantly (P<0.05) increased the cost per kg weight gain of growers. Hence it was concluded that 40% RP and 60% RP along with aluminium sulphate was beneficial to replace DCP in the mineral mixture of egg type growers. However, supplementation of aluminium sulphate to RP was not economical.

Table 2: Performance of growers on mineral mixture containing RP without and with aluminium sulphate (9-20 weeks)

Treatments	F level ppm	Wt. gain g / bird		Feed intake g / bird		FER		PI		Feed cost (Rs / qt.)		Cost / Kg wt. gain (Rs)	
T1	0	701[a]		4688[a]		0.150[a]		104.87[a]		746.93		49.97[g]	
T2 /T 3	486	697[ab]	699[ab]	4684[ab]	4686[ab]	0.148[a]	0.149[a]	103.76[ab]	104.15[a]	736.08	820.08	49.39[h]	55.00[d]
T4 / T5	729	690[b]	697[ab]	4651[c]	4682[ab]	0.148[a]	0.148[a]	102.11[c]	103.56[ab]	730.65	856.65	49.32[h]	57.42[c]
T6 / T7	972	660[c]	666[c]	4606[e]	4620[d]	0.143[ab]	0.144[a]	94.35[e]	95.91[d]	725.23	893.23	50.61[f]	61.95[b]
T8 / T9	1214	621[d]	629[d]	4581[g]	4595[f]	0.136[c]	0.137[bc]	84.46[g]	86.17[f]	719.81	929.81	53.10[e]	67.92[a]
CD		9.372		5.415		0.0610		0.7917				0.5863	
SE		3.154		1.822		0.0205		0.2665				0.1906	

* Values bearing similar superscripts in the same column does not differ significantly (P<0.05)

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