INCORPORATING POULTRY LITTER IN RABBIT FEED: A SOLID WASTE MANAGEMENT STRATEGY

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SUMMARY

An investigation was carried out for recycling of poultry litter by incorporating it in animal feed to reduce the risk of polluting the environment and reduce the cost of feed. Twenty-four 2 – 3 months old growing rabbits (Chinchilla breed) were used to evaluate the nutritive quality of poultry litter (PL). Soy Bean Meal (SBM) in the diets was replaced with poultry litter at 0,5,10 and 15% (21.70, 48.4, and 65.2%) levels, respectively in a study that lasted twelve weeks. The rabbits were divided into four groups and each group was assigned to one of the four dietary treatments in a Completely Randomized Block Design (CRBD). Results obtained showed that the inclusion of poultry litter had significant (P<0.05) effects on mean weight gain, feed intake and feed efficiency. These indices were better on 0% (control) and 5% when compared to 10% and 15% levels of inclusion. The economics of production indicated a better performance on those fed poultry litter over the control group in all the indices vis-à-vis cost/kg feed (₦), cost/kg weight gain (₦) and relative cost (%) measured suggesting that poultry litter has an economic advantage over soy bean meal as protein supplement in diet formulation. From the results obtained, poultry litter could replace up to 5% (21.70) of soy bean meal in growing rabbits diet without detrimental effects on growth performance. This study justifies the practical possibility of using poultry litter as dietary protein source using rabbits as a model and also provides an environmentally friendly way of disposing this pollutant.

Keywords: Environment, growth performance, growing rabbits, pollutant, poultry litter

INTRODUCTION

The increasing difficulties with the high cost of feed ingredients in particular have brought about the need to evaluate other alternatives to the conventional feed resources. Studies have intensified in the past two decades on the utilization of agro-industrial by-products and agricultural wastes as feed ingredients (Mustapha and Tunde 1990; Alawa and Umunna, 1993 and Abudulmalik *et al*., 1994).

Feed represents 70 – 85% of the total cost of production of meat and table eggs and as such is the most expensive input in animal production. It has thus become

necessary to explore other feed materials that are locally available and relatively cheaper. The limited supply of raw materials for the feed industry has resulted in a continuous increase in the cost of production, causing a phenomenal rise in the unit cost of products. Thus, these products have become too expensive for the majority of the population (Hahn, 1988). The increase in the cost of protein sources in Nigeria has been related to their scarcity as a result of the competing demand for these ingredients. However, the use of these ingredients in feed production when human needs have not been met introduces questions of economic and moral justification. Several studies have revealed the composition and potential nutritive values of majority of industrial by-products and agricultural wastes. There is also increasing knowledge of the problems created in the environment by disposing these by-products and agricultural wastes. The use of these by-products in diets for animal production can reduce the high price of feedstuffs as well as environmental problems.

As a result of environmental concern and high feed prices, this study becomes necessary to suggest ways of disposing poultry litter in an environmentally sound and economically efficient manner.

MATERIALS AND METHODS

Poultry litter used in this study was collected from a deep litter layers pen in the Teaching and Research Farm of Rivers State University of Science and Technology, Port Harcourt. It was stock pilled and covered with thick black cellophane and placed under a roof for twenty-one (21) days. Samples were subjected to proximate analysis (AOAC, 1990).

Table 1. Percentage ingredient and calculated chemical composition of the trial feeds

Ingredients	A (0% control)	B (5%)	C (10%)	D (15%)
Maize	50	50	50	50
Soy bean meal (44%)	23	18	13	8
Poultry litter	0	5	10	15
Palm kernel cake	8	8	8	8
Rice bran	15	15	15	15
Bone meal	2.5	2.5	2.5	2.5
Vit/mineral premix	0.50	0.50	0.50	0.50
Salt	0.50	0.50	0.50	0.50
DL-lysine	0.25	0.25	0.25	0.25
DL-Methionine	0.25	0.25	0.25	0.25
	100.00	100.00	100.00	100.00
Calculated crude Protein	17.57	16.40	15.17	14.00
Calculated fat	3.91	3.84	3.78	3.71
Calculated Crude fibre	11.50	13.72	15.92	18.11
Calculated Energy (DE Kcal/kg)	3381.00	3271.34	3161.34	3052.00

* Vitamin/Mineral Premix Composition: Vit, A – 10,000, 000 IU; D 3-2, 000,000 IU; B1-0.75g; B_2-5g Nicotinic Acid – 25g calcium pantothenate – 12.5g; B_{12}-0.15g K_3 - 2.5g; / - 25g; Biotin – 0.05g; Folic Acid – 1g; choline chloride – 25g; cobalt – 0.400g; copper – 8g; Iron – 32g; iodine – 0 – 8g; manganese – 64g; zinc – 40g; Flavomycin – 100g; spiramycin – 5g; 3; DL methionine – 50g; selenium 0.16g; BBT – 5g 1kg / ton of feed

A total of twenty-four 2 – 3 months old Chinchilla rabbits were used for this trial. They were allocated to four treatments with 3 replicates per treatment in a completely Randomized Block Design (CRBD). Each replicate consisted of 2 rabbits. All routine management procedures were adhered to. Poultry litter was incorporated into the diets at 0%, 5%, 10% and 15% levels which represents 21.7, 48.4 and 65.2% of soy bean meal respectively. The composition and calculated analysis of the experimental diets are shown in Table (1). Feed and water were given *ad-libitum* throughout the experiment that lasted 12 weeks (84 days). Feed consumption was recorded daily while the rabbits were weighed weekly. Data obtained were subjected to Analysis of Variance (Steel and Torrie 1980) and Duncan multiple range test was applied to partition means, where necessary (Duncan 1955). The cost per unit weight gained as a result of using any of the diets was obtained by using: cost/kg weight gain (₦) = unit (kg) cost of feed multiplied by weight of feed required for 1kg body weight gain (feed conversion efficiency).

RESULTS AND DISCUSSION

The growth performance of the rabbits fed graded levels of poultry litter is shown in Table 2

Table 2. Effects of dietary graded levels of poultry litter (PL) on the feed intake and growth performance of growing rabbits (Mean ± SEM)

Treatment	Initial Weight (kg)	Final weight (kg)	Weight gain (kg)	Daily weight gain (g)	Total feed intake (kg)	Daily Feed Intake (g)	Feed conversion Efficiency (Feed/ Gain ratio)	Mortality %
A	0.68	1.80 [b]	1.11 [a]	13.20 [a]	5.41 [b]	64.40 [b]	4.90 [a]	0
(0%-Control)	± 0.33	± 0.45	± 0.06	± 0.30	± 0.18	±0.30	±0.12	
B	0.76	1.87 [a]	1.11 [a]	13.20 [a]	5.58 [b]	66.42 [b]	5.02 [a]	0
(5% PL)	± 0.28	± 0.38	± 0.04	± 0.18	± 0.41	± 0.18	± 0.19	
C	0.78	1.82 [a]	1.04 [b] ±	12.36 [b]	5.60 [b]	66.66 [b]	5.40 [b]	0
(10% PL)	± 0.35	± 0.40	0.09	± 0.05	± 0.20	± 0.20	± 0.15	
D	0.76	1.80 [b]	1.04 [b] ±	12.36 [b]	5.69 [a]	66.73 [a]	5.50 [b]	0
(15% PL)	± 0.33	± 0.43	0.05	± 0.08	± 0.16	± 0.08	± 0.09	

Within columns, Means ± SEM with different superscript differs significantly at P<0.05.

There were significant (P<0.05) differences on mean weight gain, feed intake and feed conversion efficiency. In absolute terms, daily feed intake was highest for rabbits fed the 15% poultry litter although comparable values were recorded on the 0%, 5% and 10% PL diets. The significant increase in daily feed intake and differences in daily weight gain observed in this work agree with the results of earlier researchers (Alawa and Umunna, 1993; Alawa and Oyarole, 2004) who reported that the inclusion of most agro-industrial wastes in livestock diets has often resulted in increased feed intake as a compensation for the reduced energy concentration of such diets.

Generally, the poultry litter diets showed a trend of increasing crude fibre (CF) content as the levels of incorporation increased. The importance of crude fibre (CF) in the diet is its effect on intestinal function (Champe and Maurice, 1983; Alawa and Oyarole, 2004). It is however, necessary that dietary CF for rabbits be held within range of 12-16% and should not exceed 14% for growing rabbits aged 4 – 12 weeks (Alawa and Oyarole, 2004). In this present study, the poultry litter level of 0% and 5% gave the best results in terms of feed conversion, which were subsequently reflected in corresponding live weight gains. The depressive effects of poultry litter incorporation as it increased to 10% and 15% on weight gains and feed conversion might be due to dietary fibre contents of diets. The study showed crude protein levels of 14 – 17.5% and energy levels of 3052 – 3381 DE kcal/kg. The apparent inability of these nutrients to maintain rabbits in good condition with respect to weight gains and feed conversion is not clear but it could be ascribed to the probable loss of nutrients resulting from the high passage rate of the ingesta in high crude fibre diets. The higher the fibre levels, the lower the weight gains. It is also possible that the amount of crude fibre could not be easily digested by the rabbits (Omole and Onwudike, 1981. Comparing these results with those recorded by Parr et al. (1990), who recommended 5% poultry litter in rabbits diet, there is an agreement that using poultry litter up to 5% had no significant effect on both weight gain and feed conversion efficiency ratio. Table (3) shows the effect of poultry litter on the economics of production.

Table 3. Effects of dietary graded levels of poultry litter on economics of production

Parameters	A (control)	B (5% PL)	C (10% PL)	D (15% PL)
Weight gain *(kg)*	1.11 ± 0.06	1.11 ± 0.04	1.04 ± 0.09	1.04 ± 0.05
Feed efficiency (Feed/Gain ratio)	4.90 ± 0.12	5.02 ± 0.19	5.40 ± 0.5	5.50 ± 0.09
Cost/kg feed *(₦)**	47.62	43.62	39.62	35.62
Relative cost *(%)*	100.00	91.60	83.20	74.80
Cost/kg weight gain *(₦)**	233.34	219.00	214.00	195.91

*Exchange rate: 1U.S.D ($) = ₦120.00

The cost (₦) per kg feed for treatments A, B, C and D are 47.62, 43.62, 39.62 and 35.62, respectively. The diet containing 0% PL (treatment A) had the highest cost per kg feed while the diet containing 15% PL (treatment D) had the lowest cost per kg feed. On relative basis, the cost per unit (kg) of treatment B (5% PL) was 91.60 of cost per unit (kg) of control diet (0.%). Treatment C (10% PL) and treatment D (15% PL) were 83.20% and 74.80% respectively of control diet.

It is worthy to mention that treatment B (5% PL) which had similar ($P<0.05$) weight gain, feed intake and feed conversion efficiency to the control group performed better than the control (0% PL) in terms of economics of production. The 5% level of inclusion (Treatment B) further had better weight gain and feed efficiency than rabbits on treatments C and D (10% and 15% PL), respectively.

Generally, 5% level of PL compared favourably with the control and better than treatments C and D (10% and 15%) levels of inclusion in terms of growth performance indices. It is therefore recommended that to exploit the full potentials of poultry litter and minimize its environmental hazards, 5% level of incorporation is

ideal for growing rabbits and it could be used as feed ingredient in animal feed especially in ruminants.

REFERENCES

Abdulmalik, M.E, O.A. Aduku, T.F. Balogun, S.O. Ogundipe and I.A. Adeyinka, 1994. Evalution of brewers' sorghum residue as feed ingredients in rabbit diets. *A paper presented at the 19th Annual Conference of Nigerian Society of Animal Production,* University of Benin, Benin City 20th – 24th March.

Alawa, J.P. and F.T. Oyarole, 2004. The effect of varying the roughage to concentrate ratio on the performance of growing rabbits. *Bulletin of Animal Health and Production in Africa*, 52: 263-265.

Alawa, J.P. and N.N. Umunna, 1993. Alternative feed formulation in the developing countries: prospects for utilization of agro-industrial by- products. *Journal of Animal Production Research.* 13 (2): 63 – 98.

Association of Official Analytical Chemists, 1990. *Official methods of Analysis.* 12th ed. (ed. W. Horwitz) Association of Official Analytical Chemists, Washington. pp 129-146

Champe, K.A. and A.V. Maurice, 1983. Research review on response of early weaned Rabbits to source and level of dietary fibre. *Journal of Applied Rabbit Research,* 6 (2): 64 – 67.

Duncan D.B., 1955. Multiple range and multiple F-tests. *Biometric* 11:1 – 42.

Hahn, N.D., 1988. *Proceedings of Inter-regional Experts' Group Meeting on Exchange of Technologies for Cassava processing Equipment and Food Products.* IITA pp. 23.

Mustapha, G.G and O. Tunde, 1990. Var Siberiana Seeds. *Nigerian Journal of Animal Production,* (5), 17 – 20.

Omole, T.A and O.C. Onwudike, 1981. Investigations of the treatment of Sawdust for rabbit feeding. I. Effect of sodium hydroxide treatment. *Animal Feed Science and Technology*, 6: 43 – 50.

Parr, W.H; B.S. Capper, D.R.S Cox, K. Jewers, A.D. Marter, W. Nichols, D.R. Silvey and J.F. Wood, J.F., 1990. The small – scale manufacture of compound animal feed. *Overseas Development Natural Resources Institute*. *Bulletin* No. 9, pp 60.

Steel R.G.D. and J.H. Torrie, 1980. *Principles And Procedures of Statistics.* 2nd Ed. MacGraw-Hill. Singapore.

إستخدام مُخلفات الدواجن فى تغذية الأرانب: إسترتيجية إدارة المُخلفات الصلبة

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تمت الدراسة بهدف إعادة تدوير زرق الدواجن بإستخدامه فى تغذية الحيوان كوسيلة لخفض نسبة التلوث البيئى وخفض تكاليف تغذية الحيوان. تم إستخدام 24 أرنب نامى (2- 3 أشهر) لتقييم القيمة الغذائية لزرق الدواجن. تم إستبدال فول الصويا فى علائق الأرانب بنسب صفر، 5، 10، 15% على التوالى فى تجربة إمتدت لمدة 12 أسبوع. تم تقسيم أربع مجموعات، غُذيت كل مجموعة على أحدى العلائق الخاصة بالتجربة.

أوضحت النتائج أن إضافة زرق الدواجن إلى عليقة الأرانب كان لها تأثير ($P<0.05$) على متوسط الوزن، كمية الغذاء المأكول، كفاءة التحويل الغذائى. وكانت هذه الصفات للمجموعات التى أخذت صفر أو 5% من زرق الدواجن مُقارنة بالمجموعتين الأخريتين.

إقتصاديات الإنتاج أوضحت إرتفاع فى المجاميع المُغذاة على زرق الدواجن مُقارنة بمجموعة