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# Performance evaluation and economics of production of rabbits fed graded levels of *glyricidia* leaf protein concentrate as replacement for groundnut cake protein.

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**Abstract**

The study was conducted to determine optimum dietary inclusion level of Glyricidia leaf protein concentrate (GLPC), for growing rabbits. Thirty five weaned rabbits of mixed sexes were weighed and randomly allocated to five dietary treatments which contained 0, 5, 10, 15 and 20% GLPC for diets 1 to 5, respectively in a completely randomized design. Diet 1 served as the control diet.Each treatment was replicated seven times with a rabbit to a replicate. Feeds and water were provided ad-libitum throughout the experimental period of 63 days. The results showed that the different test diets did not show any significant difference (P>0.05) in the average weight, feed conversion ratio and feed digestibility by the experimental rabbits. However, feed consumed decreased significantly (P<0.05) above 10%-bassed GLPC diets and lowest (62.91±1.02g/rabbit/day) at 20%-based GLPC diet. Results on economic analysis showed significant reduction in cost of feed/kg weight gain and this was most encouraging at 10%-based GLPC diet (N314.18). Cost differential and relative cost benefit also showed improved savings at 10%-based GLPC diet. The implication therefore is that rabbit production could be better enhanced when GLPC is substituted for GNC at 10% level of inclusion on equi-protein basis.
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## 1. Introduction

Feed cost accounts for over 50% of intensively reared rabbit in the tropics. The high cost of feed is mostly from concentrate feeds such as soybean meal, fish meal and groundnut cake which are conventional feeds, supplying protein in rabbit feed. The up shoot in the prices of these orthodox protein feed sources is attributed to the stiff competition between man, industrial use and, or livestock industry. This is to say that both man and animals compete for these feed sources either for direct consumption or industrial use. Apart from the high cost of these feed resources, their seasonal availability also limit their use in livestock feed formulation. Groundnut cake obtained from groundnut also contains aflatoxin; a toxic substance, especially the mould or germinated ones, which limit their utilization by animals. Fajimi et al. (1993); Onifade (1993) and Agbede et al. (2008 and 2009) indicated that the evaluation of unconventional feed resources alongside other strategies would reduce pressure on conventional feed resources, and accelerate the attainment of feed security for livestock in the tropics.

Several research reports have shown that rabbits can neither be raised on forage alone nor on forage free diets (Iyeghe-Erakpotobor et al., 2006; Olorunsaya et al., 2007 and Omole et al., 2005). Olorunsaya et al. (2007) and Omole et al. (2005) reported that above 45% inclusion level of forage in rabbit diet bring remarkable reduction in growth performance, while Oluremi and Nwosu (2002), reported the incidence of diarrhoea in rabbits managed under forage free diets. Because of the high conventional feed resources and the ever increasing competition for these conventional feed resources between man and the livestock industry, nutritionists have in recent times delve more into using differently available local protein resources that have no nutritional and economic value to man. For instance, the use of maggot meal (Atteh and Ologbenla, 1993; Akpodiete and Inoni, 2000), cassava leaf protein concentrate (Fasuyi, 2000), cassava leaf meal (Okonkwo et al., 2010), cassava peel (Tewe, 1985), winged bean seeds (Igene, 1999) and *Leucaena* leaf protein concentrates (Agbede, 2000) at various times to replace the conventional protein feed ingredients in livestock feed formulation had recorded remarkable success. An ingredient with high nutrient density deserving evaluation is the leaf protein concentrate from *Glyricidia sepium*. Recent reports by Agbede and Aletor (2004); Agbede et al. (2007) and Agbede et al. (2008) showed that *Leucaena leucocephala* and *Telferia occidentalis* contained 38.2-55% protein, 21.3-23.3 $MJkg^{-1}$ with good amino profile acid, except methionine conforming to the FAO/WHO (1985) recommendations.

This study was designed to evaluate leaf protein concentrate from *Glyricidia* with respect to the growth performance and economics of production of rabbits in the developing countries, particularly Nigeria. It was further intended to determine the least cost at which rabbit can be raised without compromising the performance, so that protein consumption by an average citizen be affordable.

## 2. Materials and methods

### 2.1. Leaf Protein Concentrate Production

Green *Glyricidia* leaves were harvested from the established legume pasture field of the College farm. The leaves were weighed and washed before pulping (Fellows, 1987). The basic step for the production of leaf protein concentrate involves:

1. Harvest fresh *Glyricidia* leaves
2. Weigh and wash the leaves
3. Pulp the leaves to rupture the plant cell walls
4. Press the pulped leaves to extract the juice which contains the proteins
5. Separate the juice from the leaf residue
6. Heat the separated leaf juice in batches to 80-90$^0$C for 10 minutes and filter thereafter by using a rubber hose to siphon the hot whey from the protein coagulum
7. Separate the coagulated proteins from the whey by filtering through a muslin cloth.
8. Press again with a screw press to remove the remaining whey.
9. Wash the leaf protein with water, re-press and sun-dried.

Thereafter, the GLPC was used together with other ingredients purchased from the Sunshine feed mill, along Ondo-Ore ring road, Ondo, Ondo State, Nigeria to formulate the rabbit diets.

### 2.2. Experimental Diets:

Five iso-nitrogenous and iso-caloric diets were formulated. The composition of the experimental diets, as well as their proximate composition and that of the test ingredient (GLPC) are shown in Tables 1 and 2, respectively. Diet 1 was the control with 25% groundnut cake (GNC), and diets 2, 3, 4, and 5 were substituted at 5, 10, 15 and 20% representing 1.31, 2.62, 3.93 and 5.24gkg$^{-1}$, respectively with GLPC in the gross feed composition.

### 2.3. Experimental Rabbits:

The rabbits used for the study were purchased at 5-6 weeks old from the Village Pioneer Project along Ondo-Ore ring road. They were given Maxiyield and Embazin forte in drinking water on the day of arrival as anti-stress and to fortify them with energy.

### 2.4. Management of Rabbit and Experimental layout:

The study was carried out at the College Rabbitary Unit. Each rabbit cage measured 58 x 43 x 40cm to conveniently accommodate the rabbit. The stands were immersed in insecticidal solution to prevent crawling insects from getting to the rabbits. The rabbit house and cages were thoroughly washed and disinfected before the start of the experiment. The feeding and drinking troughs were washed, disinfected and fixed on the cages to avoid been tipped off by the rabbits.

Thirty-five rabbits of mixed sexes (15 males and 20 females) used for the experiment were made to undergo a week pre-experimental period, during which they were put in individual cages with commercial feed (guinea feed) with 18% crude protein and water supplied ad-libitum. The reason for this acclimation period is to make the rabbits familiarize and adapt to the cage facilities and conditions. Completely randomized design (CRD) was adopted for the trial with a total of 35 experimental units.

At the end of the acclimation period, the rabbits were weighed and 3 males and 4 females were randomly assigned to each of the five dietary treatments. Each treatment was replicated seven times and a rabbit was regarded as a replicate. The mean weights of rabbit treatments were 472.00, 512.50, 497.70, 470.60, and 500.20g for diets 1, 2, 3, 5, and 5, respectively. The rabbits were fed their respective diets ad-libitum for a period of 63 days, during which daily feed intake and weekly weight changes were taken.

Table 1. Gross composition of experimental diets (g/100g) for growing rabbits

| Ingredients | Levels of *Glyricidia* Leaf Protein Concentrate (%) | | | | |
|---|---|---|---|---|---|
| | 0 | 5 | 10 | 15 | 20 |
| | Diets | | | | |
| | 1 | 2 | 3 | 4 | 5 |
| Maize | 54.85 | 54.20 | 53.55 | 52.90 | 52.25 |
| GNC | 25.00 | 23.75 | 22.50 | 21.25 | 20.00 |
| GLPC | _ | 1.31 | 2.62 | 3.93 | 5.24 |
| Wheat offal | 5.00 | 5.04 | 5.08 | 5.12 | 5.16 |
| Rice bran | 10.00 | 10.55 | 11.10 | 11.65 | 12.20 |
| Bone meal | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 |
| Blood meal | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| Salt | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| Premix | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Lysine | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| Methionine | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| Total | 100 | 100 | 100 | 100 | 100 |
| Calculated composition(%) | | | | | |
| Crude protein | 18.23 | 18.24 | 18.24 | 18.25 | 18.26 |
| Crude fibre | 9.52 | 10.08 | 10.49 | 10.65 | 10.82 |
| Energy/kcal/ME/kg | 2312.32 | 2354.71 | 2358.65 | 2367.43 | 2375.49 |

Table2. Proximate composition (g/100g) and energy content (GE/kcal/g) of experimental diets and test ingredient

| Diets | % * | DM | CP | Ash | Fat | CF | NFE | GE |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 91.08 | 18.59 | 4.33 | 5.06 | 10.13 | 61.89 | 2.66 |
| 2 | 5 | 90.58 | 18.61 | 4.18 | 4.64 | 10.39 | 62.18 | 2.70 |
| 3 | 10 | 90.19 | 18.69 | 3.96 | 4.81 | 10.85 | 61.69 | 2.61 |
| 4 | 15 | 89.93 | 18.54 | 4.11 | 4.51 | 11.58 | 61.26 | 2.68 |
| 5 | 20 | 90.10 | 18.81 | 4.30 | 4.71 | 12.33 | 59.85 | 2.63 |
| GLPC | | 90.50 | 42.03 | 7.50 | 14.3 | 8.30 | 27.85 | 22.3 |

*% GNC replaced with GLPC

### 2.5. Cost Items:

The cost of processing the 13.1kg leaf protein concentrate used for the diets formulation was ₦851.50 as at the time of the study (November 13, 2010 – January 15, 2011). Therefore a kilogram of GLPC was procured at ₦65.00 while that of groundnut cake was ₦85.00. The cost of other ingredients as at the time of study were pulled together to calculate the cost of each dietary treatment. The cost/kilogram of feed compounded for each replacement level was calculated from the prevailing market price of ingredients as at the time of the experiment

### 2.6. Chemical Analysis:

The proximate composition of the experimental diets as well as the test ingredient was determined by the method of AOAC (1990).

### 2.7. Data Collection:

Data were collected on the various production performances such as average feed intake, average weight gain and feed conversion ratio. Data were also collected on the prevailing market price of the feed ingredients used in formulating the diets as well as the cost of processing GLPC.

### 2.8. Statistical Analysis:

Data collected on performance were subjected to one way analysis of variance using SPSS package version 10. When significant differences exist, the means were separated using Duncan Multiple Range Test (DMRT) (Duncan 1955) of the same statistical package. On cost analysis, cost per kilogram weight gain was calculated by multiplying the cost of feed intake by the feed consumed and divide by the weight gain (kg). It is mathematically expressed as:

Cost of feed/kg weight gain = Cost of feed intake ₦/kg x Ave. feed consumed
Ave. weight gain

The cost differential was calculated as follows:

Cost differential = Cost/kg weight gain of control diet less cost/kg weight gain of test diet.

Relative cost benefit (%) was calculated as: Cost differential x 100
Cost/kg weight gain of control diet 1

Where relative cost benefit describes the percentage gain realized by feeding GLPC meal at the desired level in relation to groundnut cake.

## 3. Results and Discussion

Table 1 showed the composition of the experimental diets to reveal the percentage composition of GLPC in place of groundnut cake at 1.31, 2.62, 3.93 and 5.24%, GLPC-based diet for diets 2, 3, 4 and 5, respectively. The chemical composition of the experimental diets with respect to crude protein content, crude fibre and energy values fell within those recommended for rabbits in the tropics (NRC 1994). The crude protein content of GLPC ($420kg^{-1}$) found in this study is similar with the value obtained by Agbede (2006) and approaches the conventional soybean meal and groundnut cake used in feed formulation. Throughout the period of the experiment, all the rabbits were alert and showed normal excitement. No mortality was recorded, although rabbits on diet 5 (20%-based GLPC) showed reduced feed intake at the first two weeks of the experiment, this could be due to the change of feed (Beynen, 1988) and levels of anti-nutrients (Agbede, 2003 and 2003a). The higher the level of GLPC in the diet, the higher will be the level of the residual anti-nutrient, particularly phytin (Agbede, 2000).The performance of the rabbits (Table 3) showed that average feed intake significantly decreased ($P<0.05$) at 15%-based *Glyricidia* leaf protein concentrate diet and lowest ($62.91\pm1.02g100g^{-1}$) at 20%-based GLPC diet. The reason for this might be due to the high crude fibre content and possible level of anti-nutrient components (Agbede, 2003) as the level of GLPC inclusion rises. Agbede et al. (2007 and 2008) observed that feed intake decreased as GLPC increases on rats fed up to 25%-GLPC-based diet and at levels up to 50%-based GLPC in place of fish meal in broiler starter (Agbede, 2003b). The average daily weight gain were not significantly affected ($P>0.05$) by the diets as evidenced by the similar weight gain which range between 10.27±0.34 on rabbits placed 20%-based GLPC diet to $12.50\pm0.34gkg^{-1}$ on rabbits fed 5%-based GLPC diet. The implication is that the test diets supported similar growth rate of the rabbits. The non-significant difference in this study is at variance with the report by Agbede (2003a) that weight gain progressively declined in broiler starter fed up to 50%-GLPC diet and rat (Fasuyi, 2005). However, Adeparusi et al. (2007) reported that *Oreochromis niloticus* fed Glyricidia leaf protein concentrate in partial replacement of soybean meal had superior growth rate, nutrient utilization and digestibility than those fed with control diet. The similar feed conversion ratio by the rabbits fed the control diet and those fed the different test diets could be attributed to similar dietary protein contents in the diets.It is evident that neither the control diet nor the GLPC-based diets had any deleterious effect on the health status of the rabbits, as no sign of disease infection or mortality was recorded throughout the period of the experiment. The economic indices showed significant reductions in cost of feed in ₦/kg and in cost of feed/kg weight gain. The economic analysis showed that the cost of feed ₦kg$^{-1}$ decreased progressively as the levels of GLPC increases. The cost differential per kilogram gain and relative cost benefit per kilogram gain showed improved savings as the levels of substitution of GNC for GLPC increases. The savings was most encouraging at 10%-based GLPC. The improved savings was as a result of the cost of GLPC relative to the weight gain recorded at 10% GLPC inclusion. The least cost of feed/kg weight gain (₦314.18) recorded at 10%-based GLPC diet showed that rabbit production is best raised at 10%-based GLPC diet compared to the control and other test diets. The implication therefore is for a profitable rabbit production in the tropics, rabbit feed should be formulated with the inclusion of 2.62% GLPC in place of GNC so as to reduce the operating cost of rabbit production in the tropics, particularly Nigeria. This findings agree with Viroje and Milan (1998), Atteh and Ologbenla (1993), Akpodiete and Inoni (2000), Agbede and Aletor (1997), Fasuyi (2000), and Agbede et al. (2009) that reducing feed cost will no doubt reduce cost of livestock production in the third world countries.

Table 3. Performance of rabbits (g100g$^{-1}$) fed graded levels of g*lyricidia* leaf protein concentrate as replacement for groundnut cake.

| Parameters | Levels of substitution (%) | | | | |
|---|---|---|---|---|---|
| | 0 | 5 | 10 | 15 | 20 |
| | Diets | | | | |
| | 1 | 2 | 3 | 4 | 5 |
| Initial weight (g) | 472.00 ± 10.08 | 512.50 ± 12.17 | 479.70 ± 15.83 | 470.60 ± 13.17 | 500.20±11.40 |
| Final live weight (g) | 1084.50 ± 16.39 | 1212.50 ± 9.15 | 1167.20±14.78 | 1108.10±10.10 | 1075.20±13.64 |
| Liveshrunk weight(g) | 1049.50 ± 14.12 | 1162.50 ± 11.15 | 1112.20 ± 10.30 | 1053.70±10.90 | 1021.80±10.50 |
| Average feed intake (day/rabbit) (g) | 66.97 ± 0.90$^{b}$ | 66.25 ± 0.66$^{b}$ | 65.99 ± 0.78$^{b}$ | 63.19 ± 0.54$^{a}$ | 62.91 ± 1.02$^{a}$ |
| Total feed consumed (g) | 3750.45±50.37$^{b}$ | 3710.00±36.94$^{b}$ | 3694.55±43.74$^{b}$ | 3594.53±30.37$^{a}$ | 3522 ± 56.90$^{a}$ |
| Total weight gain (g) | 612.50 ± 25.00 | 700.00 ± 1921 | 687.50 ± 25.00 | 637.50 ± 23.39 | 575.00±19.02 |
| Average weight gain (day/rabbit) (g) | 10.94 ± 0.45 | 12.50 ± 0.34 | 12.28 ± 0.45 | 11.38 ± 042 | 10.27 ± 0.34 |
| Feed conversion ratio | 6.13 ± 0.31 | 5.41 ± 0.97 | 5.39 ± 0.40 | 5.70 ± 0.68 | 6.30 ± 0.41 |
| Feed digestibility (%) | 86.45 ± 2.28 | 88.45 ± 2.85 | 85.60 ± 3.29 | 87.28 ± 1.83 | 86.90 ± 1.85 |
| Mortality (%) | 0 | 0 | 0 | 0 | 0 |

$^{abc}$ Means within the same row with different superscripts are significantly different (P>0.05)

Table 4. Economic analysis of production of rabbits fed diets containing graded levels of GLPC as replacement for groundnut cake

| Parameters | Levels of substitution (%) | | | | |
|---|---|---|---|---|---|
| | 0 | 5 | 10 | 15 | 20 |
| | Diets | | | | |
| | 1 | 2 | 3 | 4 | 5 |
| Ave. feed consumed (kg) | 3.75 | 3.71 | 3.69 | 3.59 | 3.52 |
| Ave. weight gain (kg) | 0.61 | 0.70 | 0.69 | 0.64 | 0.58 |
| Cost of feed ₦/kg | 61.55 | 60.07 | 58.75 | 57.28 | 55.91 |
| Cost differential | - | 60.01 | 64.19 | 59.06 | 39.05 |
| Cost of feed ₦/kg weight gain | 378.38 | 318.37 | 314.18 | 321.31 | 339.32 |
| Relative cost benefit/kg gain (%) | - | 15.86 | 16.96 | 15.08 | 10.32 |

$1.00 = ₦152.00 as at the time of the study

## 4. Conclusion

*Glyricidia* leaf protein concentrate holds a better alternative to groundnut cake in supplying protein for good rabbit performance. The use of GLPC at 10% equi-protein replacement representing 2.62% is most encouraging, as this level proved most economical without compromising the performance of the rabbits.

## 5. Recommendation

It could therefore be recommended that rabbit farmers in the tropics, particularly Nigeria be substituting GLPC for groundnut cake at 2.62% for better rabbit performance and reduced production cost

**References**

1. Adeparusi, E.O., Agbede, J.O and Adeniran, M.O. (2007). Growth and Apparent Digestibility Coefficient of *Oreochromis niloticus* fed Bambara Groundnut (*Vigna subterranean* (L) *Verde*) diets supplemented with leaf concentrate. Nigerian Journal of Forestry 35: 199-200

2. Agbede, J.O and Agbede, A.B. (2009). Leaf Protein Concentrates: Panacea for relieving protein under-nutrition in Nigeria. Proceeding of Humboldt Kellog/5th SAAT Annual Conference Federal University of Technology, Akure, Nigeria. Pp95-105.

3. Agbede, J.O., Adegbenro, M., Onibi, G.E., Oboh, C and Aletor, V.A. (2008). Nutritive Evaluation of *Telfairia occidnetali*s leaf protein concentrate in infant foods. African Journal of Biotechnology 7(15): 2721-2727.

4. Agbede, J.O., Adegbenro, M., Aletor, O and Mohammed, A. (2007). Evaluation of the nutritional value of *Veronnia amygdalina* leaf protein concentrates for Infant weaning Foods. ACTA ALIMENTARIA, 36(3): 387-393

5. Agbede, J.O. (2006). Characterization of the leaf meals, protein concentrates and residues from some tropical leguminous plants. Journal of the Science of Food and Agriculture 86:1292-1297.

6. Agbede, J.O and Aletor, V.A. (2004). Chemical characterization and protein quality evaluation of leaf protein concentrates from *Glyricidia sepium* and *Leucaena leucocephala* International Journal Food Science Technology 39:253-261

7. Agbede, J.O. (2003). Egui-protein replacement of fishmeal with *Leucaena* leaf protein concentrate: An assessment of performance characteristics and muscle development in the chicken. International Journal of Poultry Science 2(6): 421-429

8. Agbede, J.O and Aletor, V.A. (2003a). Comparative evaluation of weaning food from *Glyricidia* and *Leucaena* leaf protein concentrates and some commercial brands in Nigeria. *Journal Science Food Agriculture* 84: 21-23

9. Agbede, J.O and Aletor, V.A. (2003b). Evaluation of fish meal replaced with leaf protein concentrate from *Glyricidia* in diets of broiler-chicks: Effects on performance, muscle growth, haematology and serum metabolites. International Journal of Poultry Science 2(4): 242-250

10. Agbede, J.O. (2000). Biochemical composition and nutritive quality of the seeds and leaf protein concentrates from under-utilized herbaceous legumes Ph.D Thesis, Federal University of Technology Akure, Ondo State, Nigeira.

11. Agbede, J.O and Aletor, V.A. (1997). The performance, nutrient utilization and cost Implication of feeding broiler finisher conventional or under-utilized feed resources. Applied Tropical Agriculture Journal 2(2): 57-62

12. Akpodiete, O.J and Inoni, O.E. (2000). Economics of production of broiler chickens fed maggot meal as replacement for fish meal. Nigerian Journal of Animal Production 27: 59-62

13. Amata, I.A and Brattte, L. (2008). The effect of partial replacement of soybean meal with *Glyricidia* leaf meal on the performance and organ weight of weaner rabbits in the Tropics. Asian Journal of Animal and Veterinary Advances 3(3) 169-173

14. AOAC. (1990). Association of Official Analytical Chemist. Official Methods of Analysis. 15th ed. Washington D. C.

15. Atteh, J.O and Ologbenla, F.D. (1993). Replacement of fish meal with maggots in broiler diets: Effects on performance and nutrient retention. Nigerian Journal of Animal Production. 20: 44-49

16. Beynen, C.A. (1988). Dietary fat level and growth performance in rabbits. Journal of Applied Rabbits Research 11: 21-24

17. Duncan, D.B. (1955). Multiple Range and Multiple F-tests. Biometrics 11: 1-42

18. Fajimi, A.O., Babatunde, G.M., Ogunlana, F.F and Oyejide, A. (1993). Comparative Utilization of Rubber Seed Oil and Palm Oil by Broilers in a Humid Tropical Environment. Animal Feed Science Technology 43: 177-188

19. FAO/WHO/UNU. (1985). Energy and protein requirements. Report of a joint FAO/WHO/UNU Expert consultation, Geneva, Switzerland, WHO Technical Report Series No. 724.

20.Fasuyi, A.O. (2005). Nutritional evaluation of cassava (*Manihot esculenta, Crantz*) leaf protein concentrates (CLPC) as alternative protein sources in rat assay. Pakistan Journal of Nutrition 4(1): 50-56

21. Fasuyi, A.O. (2000). Biochemical, nutritional and socio-economic aspect of cassava (*Manihot esculenta Crantz*) leaf utilization. Ph.D Thesis, Federal University of Technology, Akure, Nigeria

22. Fellows, P. (1987). Village-scale leaf fractionation in Ghana. Tropical Science, 27:77-84

23. Igene, F.U. (1999). Biochemical, nutritional and physico-chemical characteristics of differently processed winged bean seeds (*Phsophocarpus tetragonalobus*). Ph.D Thesis, Edo State University, Ekpoma, Nigeria.

24. Iyeghe-Erakpotobor, G.T., Aliyu, R and Uguru, J. (2006). Evaluation of concentrate, grass and legume combinations on performance and nutrient digestibility of grower rabbits under tropical conditions. African. Journal of Biotechnology, 4: 2004-2008

25. NRC. (1994). Nutrient Requirement of Rabbit. In the nutrient requirements of farm animal. (National Academy of Science) 9th revised ed.

26. Okonkwo J.C., Okonkwo, I.F and Umerie, S.C. (2010). Replacement of feed concentrate with graded levels of cassava leaf meal in the diet of growing rabbits: Effect on feed and growth parameters. Pakistan Journal of Nutrition 9(2): 116-119

27. Olorunsanya, B., Ayoola, M.A., Fayeye, T.R., Olagunju, T.A and Olorunsaya, E.O. (2007). Effect of Replacing Maize with Sun-dried Cassava Waste Meal on Growth Performance and Carcass Characteristics of Meat type Rabbit. Livestock Research for Rural Development, 19 article #55 http://www.lrrd.org/lrrd19/4/olor19055.htm

28. Oluremi, O.I.A and Nwosa, A. (2002). The Effect of Soaked Cassava Peels on weaning Rabbits. The Journal Food Technology African., 7:12-15

29. Omole, A.J., Omuetti, O and Ogunleke, O.J. (2005). Performance Characteristics of weaned Rabbits fed graded levels of Dried Cassava Peel fortified with Soycorn residue basal diet. Journal of Agriculture Environment., 3:36-38

30. Onifade, A.A. (1993). Comparative utilization of three dietary fibre sources by broiler chickens. Ph.D Thesis, Department of Animal Science, University of Ibadan.

31. Tewe, O.O. (1985). Protein Metabolism in Growing Pigs Fed corn or cassava peel based diets containing graded protein levels. Research in Veterinary Science 29: 259-263.

32. Viroje, W and Milan, S. (1998). Effects of fly larva meal grown on pig manure as a source of protein in early weaned pig diets. Thurakit-Ahansat (Thailand) 6: 25-31