PAT Dec, 2017; 13 (2): 73-80 ISSN: 0794-5213
Online copy available at *www.patnsukjournal.net/currentissue*
Publication of Nasarawa State University, Keffi

Performance Evaluation and Organ Weight Characteristics of Grower Rabbit Fed Graded Levels of Fungal Treated Maize Stover

Akinfemi, A[1] and Adebayo .B. J[1]
[1]*Yaba College of Technology, Department of Agric. Technology, Epe Campus, Lagos*
Corresponding author e-mail address: akinfemiabayomi@gmail.com

Abstract
Maize (Zea mays) stover abounds in Nigeria with potential for inclusion in the diet of rabbits if treated with suitable fungi. In view of this, this study was conducted to evaluate the response of grower rabbits to varying levels of fungal treated maize Stover. Fifty, 5-8 weeks old weaner rabbits of mixed breeds and sex with a range of between 687 and 692g were randomly assigned to five dietary treatment groups of ten rabbits per group in a complete randomized experimental design such that T1 (0% fungal treated maize Stover) (FTMS), T2 (25% FTMS), T3 (50% FTMS), T4 (75% FTMS) and T5 (100% FTMS). Feed intakes and live weights were recorded daily and weekly respectively throughout the experiment which lasted for 59 days. Results obtained showed that Total weight gain due to treatment differed significantly (P <0.05) with values ranging from 625g (T1) to 1075g (T3). The weight of the head ranged from 8.55g (T4) to 10.05g (T5), forelimb 11.74g (T3) to 13.13g (T5) and Rack 11.67g (T3) to 13.40g (T5). Digestibility of fibre was highest in T3 (92.62%) while T5 recorded the best digestibility of crude protein (84.30%). Generally, the treated samples performed better than the control especially T5 with 100% replacement of wheat offal. From the results obtained in this study, FTMS can conveniently replace wheat offal in the diet of grower without any deleterious effect.
Keywords*: Maize Stover, fungi, rabbits, performance, apparent digestibility*

Introduction

The demand for animal protein and the attempt to meet this demand has prompted many researchers to embark on researches that will meet the need. In effort to achieve this, the world development is toward the consumption of more of white than red meat because white meat yields less cholesterol than red meat (Holness 2005). The potential of rabbits in terms of fast growth and short gestation period is an attribute that can be harnessed for the benefit of growing nation like Nigeria. Apart from this, rabbit (*Oryctolagus cuniculus*) appear to be the most sustainable source of high quality protein for the expanding population of the developing countries like Nigeria (Nkwocha *et al*, 2014).

Rabbits do not compete for wholesome grains used for human consumption, since they can grow on low grain and high forage diet (Ahaotu *et al*, 2008). This is especially so because of the availability of forages and the ability of rabbit to convert the forages to meat for humans.
The shortage of feed is a major challenge of livestock farmers in the developing countries, hence, the need to search for alternative feed resources. This study attempt to evaluate the potential of replacing wheat offal, a conventional feedstuff with fungal treated maize Stover, a non conventional feed stuff on the performance and nutrient digestibility of grower rabbits

Materials and Methods

The experiment was carried out at the Rabbitry Unit of the Teaching and Research Farm of Yaba College of Technology, Epe, Lagos, Nigeria. The area is located in the rain forest zone of Nigeria.

Animal housing and their management

Fifty, 5-8 weeks old weaner rabbits of mixed breeds and sex with a range of between 687 and 692g were randomly assigned to five dietary treatment groups of ten rabbits per group in a complete randomized experimental design. The rabbits were housed individually in all-wire metabolic cages with provision of feeding and drinking troughs. The rabbits were fed twice daily at 8.30h and 15.30h while water was provided *ad-libitum*. Feed intakes and live weights were recorded daily and weekly respectively throughout the experiment which lasted for 59 days. The rabbits were treated with ectoparasite and fed with the experimental diets before the commencement of the experiment.

Fungal treatments of maize stover in large scale (on-farm condition)

The experiment was carried out at the small ruminant unit of Research Farm Yaba College of Technology, Epe Campus, Lagos between the period of August and December.

A heap of 100kg of milled maize stover was moistened with water on a concrete floor, covered with cellophane sheet and allowed to ferment for two weeks. The fermenting heap of milled maize cob was turned every third interval to allow even distribution of heat. After the completion of the composting process, the fermented substrate was then transferred to 2-tier inoculation trays (2ft x 6ft) and allowed to cool before inoculating with active fungal culture (spawn). The mixture of active fungal culture prepared in bags was used at 10% w/w, mixed well into the cool fermented maize stover and allowed to ferment for 21 days.

At the end of the fermentation period, the treated maize husk was sun dried until the substrate attained less than 10% moisture content. It was then bagged and stored until required for feeding trials with weaner rabbits.

Preparation of active fungal culture for on-farm inoculation of maize husk

The active fungal culture of *Pleurotus tuber-reguim* obtained from the culture bank of Department of Botany and Microbiology, University of Ibadan was reproduced in bags for on-farm inoculation. Each 5kg bag of sterilized guinea corn grains was inoculated at 5% w/w, and immediately the bag was sealed and kept in a dark room for two weeks to allow total ramification of the guinea corn grains by the active fungal culture. The treated substrates were subsequently used for inoculation on large scale.

Growth study

The control and formulated diets containing varying levels of fungal treated maize stover were offered in separate earthen concrete feeders at 5% of body weight of the experimental rabbit in the morning (8:00hrs). Feed left over and/or wastage was weighed daily before feeding. Water was given *ad libitum*. The rabbits were routinely treated against ecto – and endo parasite using 10mg/ml ivomectine and coccidiostat. All rabbits were weighed at the start of the study before randomly allocated to the treatments and at weekly intervals during the study. The growth study lasted for six weeks. Parameters determined were feed intake, weight gain and feed conversion ratio.

Digestibility study

Digestibility study was conducted using five rabbits per treatment (n=25) in the fourth and sixth weeks of the growth study and four days in each case. Faecal samples were collected daily and stored at -20^0c in a deep freezer immediately after collection. At the end of each collection period, the samples were bulked for each animal for proximate composition using standard methods (AOAC, 1980).

Carcass analysis

Five rabbits per treatment were selected for carcass analysis. The rabbits were fasted for 24 h, stunned using electroshock method Zotte, 2002, and bled by neck slit using sharp knife. The rabbits were eviscerated and the internal organs (liver, pancreas, heart and kidneys) carefully excised, clean of blood and weighed using electronic weighing scale. Weights of the skin and other organs were expressed as the percentage of the live weight of the animals. The carcass was cut into primal cuts as described by Blasco and Ouhayoum, (1993) weighed and expressed as the percentage of the live weight of the animals.

Statistical analysis

The data collected was subjected to one way analysis of variance using SAS (1998) and significant means separated by Duncan multiple range text (Duncan 1955).

Table 1: Gross composition of the test diet fed to grower rabbits

Ingredient	T1	T2	T3	T4	T5
Maize	30	30	30	30	30
PKC	10	10	10	10	10
GNC	10	10	10	10	10
Wheat offal	40	30	20	10	-
FTMS	-	10	20	30	40
Common salt	1	1	1	1	1
DCP	3.5	3.5	3.5	3.5	3.5
Soya bean meal	3.5	3.5	3.5	3.5	3.5
Vitamin/min premix	1.5	1.5	1.5	1.5	1.5
Methionine (g)	250	250	250	250	250
Lysine (g)	250	250	250	250	250
Total	100	100	100	100	100

T1=0% FTMS, T2= 25% FTMS, T3= 50% FTMS, T4= 75% FTMS, T5= 100% FTMS, DCP = dicalcium phosphate

Table 2: Proximate composition of experimental diet

NFE =nitrogen free extract, GE = gross energy

Parameter	T1	T2	T3	T4	T5
Dry matter	89.88	89.66	89.83	89.76	89.21
Crude protein	16.50	16.76	16.38	15.96	16.14
Crude fiber	22.14	17.89	19.21	20.69	21.76
Ether extract	3.87	3.64	3.61	3.76	3.58
Ash	8.21	10.28	11.26	9.28	10.81
NFE	49.22	51.00	49.54	50.39	48.21
GE Kcal/Kg	3985	3978	3876	3787	3724

Results

The gross composition of the experimental diet and the proximate composition of the diet are presented in Tables 1 and 2. The crude protein (CP) content of the diet was approximately 16% CP. The crude fiber (CF) levels of the test diet discovered with increasing levels of fungal treated maize Stover (FTMS), (17.89-22.76%).

The percentage inclusion of FTMS were graded such that the control was 0%, T1 25%), T2 (50%), T3(75%) and T5(100%)

The performance of grower rabbit feed graded levels of fungal treated maize Stover is shown in Table 3. There were significant ($P<0.05$) differences in the final weight, feed intake (Daily and Weekly) and feed conversion ratio. Presented in Table 4 is Effect of graded levels of fungal treated maize Stover on organ weight characteristics of grower rabbit. Ash, ether extract, crude protein and crude fiber digestibility were significantly different ($P < 0.05$) among treatments.

Carcass characteristics as affected by treatment were significant ($P > 0.05$). Hot carcass weight (g) range from 1200 – 2150. The live weight, hot carcass weight, slaughter weight and empty carcass weight were significantly higher for rabbits on Treatment 2, followed by rabbits on control diets. The retail cuts were significantly affected by the diets with highest value obtained in Treatment 5. The values obtained for GIT, Kidney, liver, lung and heart was lowest in Treatment 3, followed by the rabbits in the control diets.

In Table 5 is the result of the apparent coefficient or digestibility of grower rabbit fed graded level of fungal treated maize Stover. Rabbits on diet 5 showed a more consistent higher nutrient digestibility value ($P < 0.05$) than others in diets 1, 2, 3 and 4. However, crude fiber digestibility is higher in diet 3. Treatment 1, however, recorded higher digestibility of ash compared to Treatment 4.

Discussion

The crude protein level of the test diet were not within the level of 18% recommended for growing rabbit (Omole, 1982).Whereas the crude fiber(%) levels of the diet (17.89-22.14) were above the 14% recommended by Ikurior and Akem (1998) for growing rabbit. However, the fat content (%)(either extracts)(3.58-3.87) were within the recommended 3% necessary to provide essential fatty acids and maintain glossy sleek hair Cheeke *et al*., 1986). Furthermore, the gross energy (GE) values of the test diets are above the recommended range (2390-2500) Kcal digestible energy for optimum growth and performance in rabbit (Aduku and Olukosi, 1990).

The highest total feed intake was recorded in T2 (25% replacement) with the least recorded in the control T1 (0% replacement). The increased feed intake resulted in a corresponding weight gain with the highest Total weight gain and daily weight gain recorded in T2. This may be the result of lower fiber content contained in T2. The reduction in intake of rabbit or the control diet could be attributed to the high crude fiber content (Asuquo, 1997). Asuquo (1997) attributed differences in lousy weight and rate of gain of rabbits to differences in the nutrient composition of the diet offered. It could also be observed that the daily feed intake and weight gain of growing rabbits recorded in this study were lower than the feed intake (96-130g) and daily weight gain (34.50-39.00g) reported in literature (Eiben *et al*.,2008; Volek and Marounek, 2008) probably as a result of breed differences, diet composition and the environment.

Table 3: Performance of grower rabbit fed graded levels of fungal treated maize Stover

Treatment	T1	T2	T3	T4	T5	SEM
Initial weight (g)	690	690	691	692	687	
Final weight (g)	1740^{c}	2015^{a}	1766^{b}	1295^{d}	1262^{e}	11.01
Total weight gain	625^{d}	1325^{a}	1075^{b}	890^{b}	1050^{b}	10.68
Weekly weight gain	78.13^{d}	165.62^{a}	134.38^{b}	111.25^{c}	131.25^{b}	8.12
Daily weight gain	10.98^{d}	23.66^{a}	17.97^{b}	15.90^{c}	18.75^{b}	8.34
Total feed intake	2200^{d}	4200^{a}	3600^{b}	3000^{c}	3400^{b}	16.42
Weekly feed intake	265^{d}	525^{a}	450.00^{b}	375^{c}	425.00^{b}	6.08
Daily feed intake	37.86^{c}	75.0^{a}	64.29^{ab}	52.57b^{c}	44.72^{c}	3.44
Feed conversion ratio	3.47^{a}	3.17^{b}	3.59^{a}	3.39^{a}	3.24^{b}	0.02

T1=0% FTMS, T2= 25% FTMS, T3= 50% FTMS, T4= 75% FTMS, T5= 100% FTMS, SEM= standard error of mean

Table 4: Effect of graded levels of fungal treated maize Stover on organ weight characteristics of grower rabbit.

Parameters	T1	T2	T3	T4	T5	SEM
Head	9.06^{b}	9.08^{b}	8.64^{b}	8.55^{b}	10.05^{a}	0.14
Troater	6.87^{c}	7.35^{b}	7.33^{b}	7.87^{a}	8.81^{a}	0.08
Hind limb	14.11^{b}	13.61^{b}	13.75^{b}	14.07^{b}	14.76^{a}	0.10
Fore limb	12.38^{b}	11.76^{b}	11.74^{b}	11.75^{b}	13.13^{a}	0.12
Loin	17.65^{b}	16.83^{c}	16.93^{bc}	17.32^{bc}	18.42^{a}	0.14
Rack	12.35^{b}	11.72^{b}	11.67^{b}	11.82^{b}	13.40^{a}	0.13
GIT	6.98^{ab}	6.74b^{c}	6.46^{c}	6.77^{bc}	7.28^{a}	0.07
Kidney	0.66^{d}	0.61^{d}	0.76^{c}	0.84^{b}	1.17^{a}	0.01
Liver	2.45^{d}	2.15^{e}	2.73^{c}	3.21^{b}	4.39^{a}	0.02
Lungs	0.50^{c}	0.52^{c}	0.52^{c}	0.55^{b}	0.64^{a}	0.001
Heart	0.24^{d}	0.20^{e}	0.29^{c}	0.34^{b}	0.43^{a}	0.001

GIT = gastro intestinal tract, T1=0% FTMS, T2= 25% FTMS, T3= 50% FTMS, T4= 75% FTMS, T5= 100% FTMS, SEM = standard error of mean

Table 5: Apparent coefficient of digestibility of grower rabbit

Treatment	T1	T2	T3	T4	T5	SEM
Ash	83.9^{c}	84.0^{b}	82.3^{a}	83.2^{d}	86.50^{a}	0.003
Ether extract	75.80^{e}	98.3^{b}	0.979^{c}	97.60^{d}	99.3^{a}	0.003
Crude protein	59.0^{e}	68.6^{b}	60.5^{c}	59.0^{d}	84.3^{a}	0.003
Crude fiber	87.20^{e}	85.37^{c}	92.62^{a}	91.23^{b}	89.91^{d}	0.003

T1=0% FTMS, T2= 25% FTMS, T3= 50% FTMS, T4= 75% FTMS, T5= 100% FTMS, SEM = standard error of mean

Poor performance of rabbits on the control diet, however is attributed to limited post-gastric fiber digestion by rabbits, which was not sufficient to provide adequate nutrients necessary for maximizing growth performance (Onibi and Owa, 1999, lyeghe- EraKpotobor *et al.*, 2010). Others (Adegbola *et al*., 1985) attributed poor performance to high ambient temperature in tropical regions.

Digestibility of nutrients seems to favor diets containing fungal treated maize husks, an indication of better utilization of feed. Crude protein digestibility was best in T5 (100% replacement of wheat offal) is comparable with result obtained elsewhere (Alade *et al*., 1999). Apparently nutrient digestibility showed that rabbits on diets 2-5 had better nutrient digestibility than those on the control diets (T1). This may be the optimum range for efficient nutrient utilization (Osakwe, 2008). In the present study, the best digestibility of Ash, ether extract, crude protein and crude fiber were obtain in Treatment 5 where wheat offal is completely replaced with fungal treated maize Stover. Treatment effect was much in favor of fiber digestibility. This observation suggests that microbial population secret enzyme capable of hydrolyzing the main component of dietary fiber (Maronnek *et al*, 1995). Apparent digestibility values obtained in this study for CF, EE, Ash and CF were higher than those reported by Peirell *et al* 2007) with mixed feed of increasing levels of false flax seeds using male and female rabbits, although the breed of hybrid is unstated and also higher than those obtained by Zewell *et al*, (2008) with New Zealand, however, it is comparable with digestibility of coefficients reported by lyeghe-Erakpotobor and Esieuo (2010) for growing rabbits fed soya bean cheese waste meal diet and lab hay. High digestibility of nutrient in the present study indicates that rabbits were able to utilize nutrients in the formulated diet for growth.

The empty carcass weight, hot carcass weight and slaughter weight which were best in Treatment 2 (50% replacement of wheat offal) is consistent with the findings of INRA 1989 and Lebas, 1991 that variation in the nutritional requirements of growing rabbits may modify the anatomical equilibrium of the carcass tissue and the chemical component of the muscles others (Quhayoun, 1978) suggested that meat and carcass characteristics depend on age of the animal and its weight at a given age, which further depends in how quickly they reach their weight. The rack limb (fore and hind) and loin were better developed in T5, the reason being that T5 had the best apparently digestibility. The consequence of this is that nutrient digestibility enhanced efficiency of tissue deposition and carcass yield. Report (Deltoro and lepoz, 1985) observed that the body part located in the leg of rabbits have high growth rate according to their characteristics pattern of locomotion. The result obtained in the present study will be beneficial because loin and leg are the most economical important portion of the carcass and also provide the greatest portion of edible meat in rabbits (Fanimo *et al*, 2003). Although the weight of liver increased in T5, however, there is nothing to suggest any toxification as a result of this enlargement, since fungal treated maize Stover contains no toxic material. The enlargement of the liver therefore is due to reason outside the diets applied.

References

Adegbola J.A, Tibi Ell and Adegora DC (1985). Feed intake and digestibility in rabbits in all forage plan concentrate and all concentrate diet. J.Anim. Prod. Res. 5:5 – 16

Aduku A and Olukosi JO (1990) Rabbit Management in the tropics: Production, Processing, Utilization, Marketing, Economics, Series, GU Publications, Abuja.

Ahoatu, EO, Onwuka CF and Ayo-Enweren CM 2008. Commercial Rabbit Production. Jeolas Enterprises Nig. 33p

Alade NK, Teru DT, Abbator FI, Abu DA and Adamu SB (1999). Growth performance and digestibility of nutrients in growing rabbits fed guided levels of oven-dried poultry waste in: Enhancing livestock production in Nigeria (Eds. JK Joseph, B. Awosanya DF Apata, MA Belewu, JO Atteh and KL Ayomide). Proceedings of the 26th Ann conf. of the Nig. Soc. For Anm. Prod. 21-25 March, Ilorin, Nigeria 134-135.

AOAC (1990). Official methods of Analysis. Association of official analytical chemist (15th Ed), Washington DC, USA 83pp.

Asuquo, B.O (1997) Nutritional potential of Ipomea, centrosema, pueraria, Emilia and tridax forages in mixed feeds for weaner rabbits. Nigeria J. of Anim. Prod. 28(1) : 46-50.

Blasco, A. and J. Ouhayoun, 1993. Harmonization of criteria and terminology in rabbit meat research. Revised proposal. World Rabbit Sci., 4: 93-99.

Checke PR, Grobner MA and Palton NM 1986. Fiber digestion and utilization in rabbits J. Appl. Rabbit Res. 9(1): 25-30.

Deltoro J and Lopez AM (1985). Allimetric changes during growth in rabbits, J of Agric. Sc. 15: 27.

Duncan DG 1955 Multiple range and multiple F-Test Biometrics 11: 1-42

Eiben Ct, Gippert K, Godor Surmann, Podmaniczky B and Kurtos K (2008). Influence of dietary protein reduction and enzyme and or amino acid supplementation on fattening performance of rabbits in: Proc. 9th World Rabbit congress, June 10 – 13, 2008, Verona, Italy, pp 631 - 642

Fanimo AO, Odungiwa OO, Alade AA, Ogunaike TO and Adesehinwa AK (2003). Growth performance, nutrient digestibility and carcass characteristics of growing rabbits fed cashew apple waste. Livestock Research for Rural Development 15: (8) 1 – 7.

Ikunir SA and Akem JO 1998. Replacing maize with cassava root meal or its mixture with brewer's yeast slurry in rabbit diets. Nig J. of Anim. Prod. 25(1) : 31 – 35.

INRA 1989 Alimentation des Animaux Monodastrique Lapin, Volailes 2nd Edn. INRA, Paris 282p

Iyeghe – Erakpotoloor, GT and Esievo Lo (2010). Performance of growing rabbits fed soya bean cheese waste meal diets and lablab hay Nig. J. Anim. Prod. 37: 173 – 183.

Leban F (1991) Alimentation pratique deslapins en engraissment. Cuniculture 18:273

Maronnelle M, Vork SJ and SKrrnova V (1995). Distribution of activity of hydrolytic enzymes in the digestive tract of rabbits Bri. J. of Nutr. 83: 463-469

Omole TA (1982). The effect of level of dietary protein on growth and reproductive performance of rabbits. J. App. Rabbit Res. 5: 83 – 88.

Osakwe IK and Nwose RN (2008). Feed intake and nutrient digestibility of weaned rabbits fed cassava peel as replacement for maize. Animal Research international 5(1): 770-773.

Quhayoun J (1997) Etude comparative de races de lapins different parle poids adulte incidence du format paternal surles composantes de la crossance des palreeaux issus de crisement terminal. These de deoctoral, Universite de Mintpellier.

Quibi, G. E and Owa (1999). Influence of period of provision of commercial pellets and forage (*Aspillia Africana*) on the growth performance and economics of production of rabbits in: Enhancing livestock production in Nigeria. Eds JK Joseph, B Awosanya, DF Apata, MA Belaru, JO Atteh KL Ayomide proc. 26th Ann. Conf. Nig. Soc. Anim. Prod. (NSAP), Kwara Hotels, Ilorin, Nigeria 21-25 March 1999 PP 151-153.

Volek Z and Marounete M (2008) White lupin (CV Amiga) seeds as a protein source in diet for growing rabbits. Effect in growth performance digestibility of nutrients and carcass trait in: Proc. 9th World Rabbit Congress, June 10 – 13, 2008 erona, Italy pp: 831 - 836

Zewell HS, Ahmed MH, EL-Adawy MM and Zaku B (2008) Evaluation of substituting Nigeria seed meal as a source of protein for soya bean meal in diets of New Zealand White rabbits. In: Proc gk World Rabbit congress, June 10-13, 2008, Verona Italy.

Zotte, A.D., 2002. Perception of rabbit meat and major factors influencing the rabbit carcass and meat quality. Livest. Prod. Sci., 75: 11-32.