Influence of level of groundnut haulms and feeding system on performance of growing rabbits

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Abstract

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Forty crossbred weaner rabbits were used in a factorial experiment involving three levels (15, 30 and 45%) of groundnut haulms (GHM) and two feeding systems (separate and mixed). Ratios of concentrate to groundnut haulms or groundnut haulms meal were: 1) 85% concentrate plus 15% GHM, 2) 70% concentrate plus 30% GHM and 3) 55% concentrate plus 45% GHM. For separate feeding system, concentrate and groundnut haulms were offered in separate feeders while for mixed feeding system, groundnut haulms meal was incorporated into the concentrate as complete diets. The control rabbits were placed on concentrate alone. Total feed offered was 100g/rabbit/day. Final weight, feed intake and total weight gain increased quadratically with increase in level of groundnut forage. Weight gain and feed conversion ratio were not affected by level of groundnut forage. Feed cost and cost/kg gain decreased with increase in groundnut haulms level. Savings/kg gain increased with increase in level of groundnut haulms from ₦7.9 to ₦107.6. Feeding groundnut haulms separately or mixed increased daily feed intake of rabbits than sole concentrate. ADG was higher for separate feeding than mixed and sole concentrate. Feed cost was significantly higher for sole concentrate than separate and mixed feeding. Savings/kg gain was ₦450 - ₦300 for separate and mixed feeding compared with sole concentrate. Feed intake was higher for separate at 15 and 45% GHM, while for 30% GHM, mixed feeding had higher intake than separate system. ADG was higher for separate than mixed feeding for all levels of groundnut forage. Feed conversion ratio was similar for separate and mixed feeding system irrespective of groundnut haulms level. Feed cost was lower for separate feeding system at all GHM levels except for 30% GHM level where it was higher for mixed than separate feeding. Feed cost/kg gain was higher for mixed feeding at 15 and 45% GHM and lowest for separate at 45% GHM. It is concluded that rabbits can be offered up to 45% GHM while, separate feeding was better than mixed feeding.

Key words: Feeding system, groundnut forage, rabbits, performance.

Introduction

Rabbits produce healthy meat that is suitable for producing healthy people because of its low salt and fat content, being a white meat like poultry. The recent understanding of the usefulness of the meat for diabetics, hypertensive and middle aged people has further raised awareness on the production of rabbits. Thus increasing demand for rabbit meat. In recent times, the cost of commercial feeds for feeding livestock has increased because of high cost of feed ingredients. The feeding of low quality forages and hay to rabbits is a

common practice, especially in areas with long dry season, where availability of forages is only for short periods in the year during the rainy season. Thus, these fibre, low protein feedstuffs often require supplementation to optimize their utilization (Linga and Lukefahr, 2000).

Supplementary feeding is therefore necessary when the recommended nutrient requirement is not provided by forage. Adequate balance and or quality of feed for effective maintenance and production of rabbits are traditionally raised on forage or roughage diets with concentrate

or energy supplements such as molasses (Linga and Lukefahr, 2000; Iyeghe-Erakpotobor *et al.*, 2002). Groundnut haulms, cowpea and lablab forage are common crop residues in the tropics and subtropics.

These legume forages have shown great promise as sources of protein for feeding rabbits (Iyeghe-Erakpotobor *et al.*, 2002, Iyeghe-Erakpotobor *et al.*, 2006, Iyeghe-Erakpotobor, 2007, Bawa *et al.*, 2008). Bamikole and Ezenwa (1999) reported a replacement of 50% concentrate with verano stylo forage produced similar performance with the all concentrate diet. Separate free-choice offering of concentrate and forage might be employed by producers desiring to minimize labour input with acceptable performance (Goetsch *et al.*, 2003). Mixed or complete feeding reduces space requirement for feeding while meeting crude fibre requirement of rabbits and also makes possible commercial production of balanced feeds for rabbit production.

Increasing the level of forage meals in rabbit diets makes for amenable commercial rabbit production. In Nigeria currently, there are very few commercial rabbit production farms, and these farms produce their own feed. The bulk of rabbit production farms are mainly small holder/backyard farms, who feed their rabbits mainly kitchen waste and forages, while some few farmers, feed commercial poultry feeds such as grower mash and in a few cases chick mash, because of the high cost. Commercial rabbit meal or pellets are not produced; however, some feed millers produce feed for individuals on request. It should be possible to produce commercial rabbit diets that would meet their nutrient and crude fibre requirements. This study was undertaken to evaluate the influence of level of groundnut haulms and feeding

system on performance of weaner rabbits.

Materials and Methods

Study area

The study was carried out in the Rabbitry Unit of the Department of Animal Science Research Farm, Bayero University, Kano, Nigeria. Kano lies between longitude 9°30' and 12°30' north and latitude 9°30' and 8°42' east in the Sudan savannah zone of Nigeria. The climate of Kano city consist of two seasons; the rainy season which comprises the months of May – October and dry season which is from early November to April. The annual rainfall ranges from 787 – 960mm and temperature ranges between 21°C - 39°C. (KNARDA, 2001).

Experimental animals

A total of forty, four to five weeks old crossbred rabbits of mixed breeds (progenies of mating between New Zealand White, California and Dutch) and sexes, obtained from Kano State University of Technology, Wudil, Kano State, Nigeria were used for the study. The rabbits of average initial weight of 500g were individually housed and maintained in battery cages in an open sided house.

Forage meal preparation

Groundnut haulms were obtained from markets in kano. Groundnut haulms are obtained from the tops, stems and some roots after the harvest of groundnut pods. The haulms are then dried on the farm before bagging for market. At the experimental site, the haulms were placed in bags and pulverized with sticks into smaller sizes before being ground into forage meal using a laboratory forage miller.

Experimental procedures

Groundnut haulms and concentrate meal were used for feeding the rabbits. A factorial experiment involving three levels

Table 1: Composition of concentrate diet fed to growing rabbits

Ingredient	(%)
Maize	45.11
GNC	36.39
Maize offal	15.00
Bone meal	3.00
Salt	0.25
Vitamin/mineral premix*	0.25
Total	100.00
Calculated composition	
Protein (%)	18
Energy (Kcal ME/Kg)	2400

*Content/kg ration: Vit. A 1251 IU, Vit. D3 2750 IU, Vit. E 151 IU, Vit. K 0.002g, Vit. B₁ 0.006g, Nicotinic acid 0.035, Calcium D-Pantothenate 0.01mg, Vit. B₆ 0.0035g, Vit. B₁₂ 0.02g, Folic acid 0.001g, Biotin 0.0005g, Vit. C 0.025g, Cholin chloride 0.39g, Zinc bacitracine 0.02g, Methionine 0.2g, Avatec (Lasolacid) 0.09g, Manganese 0.1g, Iron 0.05g, Zinc 0.04g, Copper 0.002g, Iodine 0.00153g, Cobalt 0.000225g, Selenium 0.0001g.

(15, 30 and 45%) of groundnut haulms (GHM) and two feeding systems (separate and mixed) in a completely randomised design was used. The treatments consisted of ratios of concentrate to groundnut haulms or groundnut haulms meal of: (1) 85% concentrate plus 15% GHM, (2) 70% concentrate plus 30% GHM and (3) 55% concentrate plus 45% GHM. The concentrate meal was formulated to contain 18% CP and 2400 kcal ME/kg. Table 1 shows the composition of the concentrate diet while Table 2 shows the proximate composition of the concentrate and groundnut haulms offered. The separate feeding system involved feeding the concentrate and groundnut haulms in

separate feeders while the mixed feeding system involved grinding the groundnut haulms into meal and incorporating the meal into the concentrate at the inclusion levels and offered as complete diets. The control rabbits were placed on concentrate alone.

The rabbits were randomly assigned to treatments (n= 6 rabbits per treatment). A two weeks adjustment period was observed before the commencement of the feeding trial. Prophylactic treatment with Terramycin® was carried out to reduce stress and also take care of likely infections. The rabbits were also treated against ecto- and endo-parasites using 10mg/ml ivermectine (Pantex, Holland). The rabbit

Table 2: Proximate composition(%) of concentrate and groundnut haulms fed to growing rabbits

	Dry matter	Ash	Ether extract	Crude fibre	Crude protein
Concentrate meal	91.75	8.23	8.11	5.56	18.53
Groundnut haulms	92.00	10.77	7.05	28.84	12.23

were weighed at the start of the study and subsequently at weekly intervals. Feeding was done in the morning at 08.00 hours in earthen flat bottom pots. The concentrate and groundnut haulms were offered to give a total of 100g feed/rabbit/day. Feed wastage and/or leftover were measured daily before the morning feeding so as to determine the total feed intake. Water was provided *ad libitum* in plastic drinkers. Feed consumption was recorded daily while body weight was recorded weekly for eight weeks. Weight gain, feed conversion ratio, feeding costs and feed cost/kg gain were computed.

Statistical analysis

Feed intake was computed as feed offered minus feed left over and wastage. Cost of concentrate was computed at N8.80/kg and N20/kg of groundnut haulms (1 dollar (\$) = 150 Naira (N)). Data collected were subjected to the analysis of variance test (SAS, 1987) for factorial experiment using the general linear model procedure in a completely randomized design. Comparisons between levels of groundnut haulms and feeding system were carried out with sole concentrate fed rabbits (control). Pair-wise difference method was used to separate significant means. Trend analysis was conducted to determine the trend of parameters with the level of feeding groundnut forage.

Results

Performance of weaner rabbits fed different levels of groundnut haulms (GHM) is shown in Table 3. Final weight of rabbits was not affected by level of groundnut forage. Final weight and feed intake had a quadratic increase with increase in level of groundnut forage. Daily weight gain and feed conversion ratio were not affected by level of groundnut forage. Feed cost however decreased significantly with increase in level of groundnut forage. Cost/kg gain also decreased with level of groundnut haulms though not significantly ($p>0.05$) while savings/kg gain increased with increase in level of groundnut haulms (N7.90 to N107.60). Comparison of levels of feeding groundnut haulms and those not fed groundnut haulms (0% GHM) shows increased total feed intake (Fig. 1a) and weight gain (Fig. 1b) with increase in level of groundnut forage. Rabbits fed 0% GHM and 30% GHM had lower feed intake and weight gain than 15% and 45% GHM groups. Feed cost/kg gain (Fig. 1c) reduced with level of groundnut forage.

Table 4 shows the comparison of the feeding systems and feeding of sole concentrate to growing rabbits. Offering groundnut haulms separately or mixed increased total feed intake of weaner rabbits than when sole concentrate was offered. Average daily weight gain was higher for

Table 3: Effect of level of groundnut haulms on performance of growing rabbits

Parameter	Groundnut haulms level (%)				Trend		
	15	30	45	SE	Linear	Quadratic	Cubic
Final weight (g)	1020	1025	1065	54.16		*	
Feed intake (g/d)	80.84	81.35	82.43	0.70		*	
ADG (g)	9.91	8.70	9.45	0.71			
FGR (intake/gain)	8.51	9.79	10.01	0.88			
Feed cost (N/d)	6.33 ^a	5.47 ^b	4.56 ^c	0.04	*	*	*
Cost/g gain (N)	0.67	0.66	0.56	0.05	*	*	
Cost/kg gain (N)	665.60	657.70	558.00	54.53	*	*	
Saving/kg gain (N)	-	7.90	107.6	-			

^{abc}Means with different superscripts along rows are significantly different ($P<0.05$). N – Naira.

Table 4: Effect of feeding system on performance of growing rabbits fed groundnut haulms

Parameter	Concentrate	Separate	Mixed	SE
Final weight (g)	790 ^b	1103 ^a	970 ^a	47.73
Feed intake (g/d)	78.10 ^a	81.95 ^b	81.13 ^b	0.62
ADG (g)	7.97 ^b	10.38 ^a	8.33 ^b	0.62
FGR (intake/gain)	11.46	8.29	10.58	0.87
Feed cost (₦/d)	6.83 ^a	5.42 ^b	5.48 ^b	0.18
Cost/kg gain (₦)	1000 ^a	550 ^b	700 ^b	65
Saving/kg gain (₦)	-	450	300	-

^{ab}Means with different superscript along rows are significantly different ($P < 0.05$). ₦ – Naira.

separate feeding than mixed and sole concentrate. Feed cost and cost/kg gain were significantly ($p < 0.05$) higher for sole concentrate than separate and mixed feeding systems. Feed conversion ratio was similar for all the groups though slightly better for separate feeding system. Feed cost/kg gain was higher for sole concentrate than separate or mixed systems. Savings/kg gain was ₦450 - ₦300 for separate and mixed compared with the sole concentrate fed rabbits.

Final weight was higher for separate than mixed feeding systems for all levels of groundnut haulms (Table 5). Feed intake was however higher for 15 and 45% groundnut haulms levels offered concentrate and groundnut haulms separately, while for 30% level, mixed feeding system had higher intake than separate system. Feed intake was highest for separate system at 45% groundnut haulms level and lowest on separate system at 30% groundnut haulms level. Total feed

intake was highest for separate system at 45% groundnut haulms level (Fig. 2a) and lowest on separate system at 30% groundnut haulms level. Average daily weight gain was higher for separate than mixed feeding system for all the levels of groundnut forage. Total weight gain (Fig. 2b) was however lower for separate at 45% GHM, separate and mixed at 30% GHM, while it was higher for separate at 15% and 45% groundnut haulms levels. Feed conversion ratio was similar but slightly better for separate than mixed irrespective of the groundnut haulms level. Feed cost was also similar but lower for separate for all groundnut haulms levels except for 30% GHM level where it was higher for mixed than separate system of feeding. Feed cost/kg gain was higher for mixed feeding system at 15 and 45% GHM and lowest for separate at 45% GHM.

Table 5: Effect of groundnut haulms level and feeding system on performance of growing rabbits

Forage level (%)	15		30		45		SE
Feeding system	Separate	Mixed	Separate	Mixed	Separate	Mixed	
Final weight (g)	1090	950	1090	960	1130	1000	7.59
Feed intake (g/d)	81.76	79.93	80.86	81.84	83.24	81.62	1.00
ADG (g)	10.53	9.30	9.03	8.36	11.57	7.32	1.00
FGR (intake/gain)	7.79	9.23	9.62	9.97	7.47	12.54	1.24
Feed cost (₦/d)	6.42	6.23	5.37	5.57	4.47	4.65	0.06
Feed cost/kg gain (₦)	610 ^a	720 ^a	640 ^a	690 ^a	400 ^b	710 ^a	80.0

^{ab}Means with different superscript along rows are significantly different ($P < 0.05$). ₦ – Naira.

Figure 1a: Influence of level of groundnut forage on total feed intake of rabbits

Figure 1b: Influence of level of groundnut forage on total weight gain of rabbits

Figure 1c: Influence of level of groundnut forage on feed cost/kg gain of rabbits

Fig. 2a: Influence of level of groundnut forage and feeding system on total feed intake of rabbits

Fig. 2b: Influence of level of groundnut forage and feeding system on total weight gain of rabbits

Discussion

Feed intakes obtained in this study were similar with a trend of slight increase with increase in groundnut haulms from 15 to 45%. This is at variance with the significant increase in feed intake with increase in level of groundnut haulms (Bawa *et al.*, 2008) and verano stylo (Iyeghe-Erakpotobor *et al.*, 2006) reported. Jokthan *et al.* (2006) however, reported high fibre diets increased feed intake of animals. Feed intake of 80.84g in this study is similar with 81.04g obtained with 20% groundnut haulms meal by Adeyegun (2009).

Similar intakes observed for rabbits on 15 to 45% groundnut haulms could indicate a threshold of intake might have been approached as the forage level increased. This could probably also indicate, an inability of the rabbits to further increase their gastrointestinal tract capacity, to accommodate any further increase in feed intake as groundnut haulms level increased

from 15 to 45% level. Feeding system did not affect feed intake of rabbits. Similar intake by rabbits on separate and mixed feeding system indicates the ability of rabbits to correctly adjust their feed intake given the same level of forage offered whether it is offered separately or as complete diets.

Weight gains of 8.7-9.9g/day obtained in this study are similar with gains of 5.8-10.7g/d obtained for rabbits on groundnut haulms and sweet potato forage (Iyeghe-Erakpotobor *et al.*, 2006, Iyeghe-Erakpotobor, 2007), mucuna, lablab and groundnut haulms (Iyeghe-Erakpotobor *et al.*, 2002) and verano stylo, groundnut haulms (Iyeghe-Erakpotobor, 2006, Iyeghe-Erakpotobor, 2009) supplemented with 50g concentrate. Dried forages such as Stylosanthes, lablab, cowpea and groundnut haulms (Iyeghe-Erakpotobor, 2006, Iyeghe-Erakpotobor, 2009, Bawa *et al.*, 2008, Iyeghe-Erakpotobor and Yakubu,

2009, Iyeghe-Erakpotobor and Esievo, 2010) have been incorporated in rabbit diets to give daily weight gains ranging from 5-25g.

Lower weight gains of rabbits on forages in current studies compared to earlier studies could be as a result of the depressing effect of increasing inbreeding depression observed in rabbits bred over the years. Fibre level and composition of forages used could also be a factor in the level of weight gain obtained. Fibre level of 15-20% in the diet of rabbits is required for normal growth, while any level in excess of 20% may produce ceacal impaction and limit energy intake, crude fibre level of between 10-17% was found to support weight gain (Cheeke *et al*, 1983).

Lower feed cost/kg gain and higher savings/kg gain obtained with increasing level of groundnut haulms indicates the potential of reducing cost of producing rabbits by increasing level of forage in the diet. Higher savings/kg gain obtained for separate feeding system over mixed system would indicate that rabbits likely prefer separate than mixed (complete) feeding and would therefore perform better on separate feeding system. Comparing separate, mixed and sole concentrate feeding indicates higher savings/kg gain with separate and mixed than sole concentrate, further indicating rabbits preference to be in the order of separate followed by mixed and lastly sole concentrate feeding.

Higher performance of rabbits on separate and mixed feeding systems could therefore be affected by the fibre intake of rabbits on the diets fed. It is an established fact that rabbits are never fed sole concentrate in order to meet their crude fibre requirement (Cheeke *et al*, 1983; Bamikole and Ezenwa, 1999). Where forage meals are incorporated into concentrate to form complete diets, it should be possible to feed

concentrate to rabbits and obtain good performance as was the case with the mixed feeding system.

It is concluded from the study that rabbits can utilise up to 45% groundnut haulms as shown by similar performance of rabbits on all levels of groundnut forage, lower feed cost and high saving/kg gain obtained. For feeding system, separate feeding where the rabbits are offered concentrate and forage separately was better than mixed feeding (complete diet) and sole concentrate feeding without forage supplementation.

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