INFLUENCE OF SOME TROPICAL FORAGES AND AGRO INDUSTRIAL BY-PRODUCTS ON THE PERFORMANCE OF NEWZEALAND WHITE RABBITS.

[1]C.F.I. ONWUKA AND H.E. NELSON[2]

[1]Department of Animal Nutrition, University of Agriculture, P.M.B. 2240, Abeokuta, Ogun State, Nigeria. 110001. *E-mail:* chysonka@yahoo.com

[2]Department of Animal Science, University of Uyo, P.M.B. 1017, Uyo, Akwa Ibom State, Nigeria

[1]***Author for correspondence***

ABSTRACT

Fifty intact 8-week old New Zealand White rabbits, averagely 710g liveweight were used to evaluate the effects of selected forage plants' leaves (*Tridax procumbens, Gliricidia sepium, Imperata cylindrica)* and agro-industrial by-products (Grower's mash, fermented sorghum grain waste and yam peels) on some performance characteristics of weanling rabbits. Results obtained indicated significant ($P<0.05$) daily weight gains up to 18.3g d^{-1} at 10 weeks of age. Dry Matter intake ranged between 61.94g d^{-1} and 113.84g d^{-1} while water intake values were between 66.00ml day^{-1} and 126ml day^{-1}. The ratios of retained nitrogen (RN) to nitrogen intake (NI) ranged from 54.93 to 69.3%. All the rabbits were in positive nitrogen balance during the trial. Agro-industrial by products could be useful in feeding rabbits especially in rural areas.

KEY WORDS: Tridax, Gliricidia, Imperata, Rabbit feeding, water utilization, sorghum waste.

INTRODUCTION

The lag in productivity of the Nigerian Livestock industry occasioned by shortfall in feed availibity has resulted in the average Nigerian getting only one-quarter of his daily minimum animal protein supply. This has been compounded by the ever growing human population (put at 140millions, NPC, 2007). Just as Cheeke and Patton (1979) indicated, rabbit is an emerging livestock specie and it compares favourably with other classes of livestock. Rabbits represent an economical method of securing animal protein in the tropics (Huss, 1982): They have a high growth rate which is as rapid as that of calf in the first three months of life and they reach sexual maturity in 6 - 7 months (Somade, 1982).

Rostogi (1985) has indicated that rural dwellers could usefully and profitably intergrate small-scale rabbits production with their system of farming by utiliizing crop residues, forages, by-products and concentrates. For herbivores, alternative feed sources of great potential to grains are forage and agro-industrial by-products which are at present underitilized, especially in rural areas. Herbivores are known to cope with the anti-nutritional compounds found in forage and grains (Mcleod, 1974; Onwuka, 1992). Although rabbits synthesize some nutrients, amino acids, minerals, vitamins, etc. are either not produced at all, or are produced in insufficient quantities and these must therefore be supplemented in their diets (Schlolaut, 1985). Ajayi *et al* (2007); Akinfala *et al* (2003) obtained weight gains of 11.13 - 12.08 g/d and feed: gain of 5.3 -6.03.

Considering the vast untapped/underutilized browse leaves and agro-industrial by-products available in Nigeria, and in the tropics generally, for animal feeding, this study was carried out to monitor the performance of rabbits raised on some of such feeding stuffs.

MATERIALS AND METHODS

50 intact 8-week old New Zealand White rabbits, averagely 710g liveweight, were used for the experiment. They were separated into five treatments in a completely randomized design with 10 rabbits per treatment. The rabbits were 20 weeks old at the end of the experiment. The rabbits were housed individually in two-tier metabolism cages at the University of Uyo Teaching and Research Farm. They were treated regularly

for endo- and ecto- parasites before the commencement of the experiment and declared healthy throughout the experimental period.

Diets and Management of the rabbits:

The rabbits were given forages from *Gliricidia sepium, Imperata cylindrica* and *Tridax procumbens.* Agro-Industrial by-products fed included Yam peels (YMP), dried fermented sorghum residue (DFSR) and commercial poultry grower's mash (GRM). Sorghum residue was collected after fermentation of sorghum grain in the production process of *Burukutu*, a local wine.

Feeding was done twice daily at 08.00hrs and 16.00hrs while the orts were collected and weighed at 07.00hrs daily. The rabbits had continuous access to feed and fresh clean water daily. Weights were taken weekly for a period of 3 months. Ambient temperatures during the experimental period ranged from 19.0°C to 35.5°C (Av. 27.8±4.65°C)

Collection of faeces and Urine:

Faeces and urine excreted by the experimental animals were collected separately in metabolism cages. Total faeces and urine voided daily were respectively weighed and measured. Faecal samples were dried at 60°C for 24 hours and 10% aliquot bulked daily. Urine samples were stored at -5°C and both faeces and urine were stored until needed for chemical analyses.

Analyses of Samples:

Proximate composition of the feed and other samples was determined according to AOAC (1995) methods of analysis.

Statistical analyses:

The variances obtained were analysed using the competely randomized design. Differences in means were compared and separated with the Duncan's Multiple Range Test according to Steel and Torrie (1980) using the parameter of interest.

RESULTS

The chemical contents of the herbages and agro-industrial by-products fed to the rabbits are detailed in Table 1. Generally, the diets differed in their chemical contents. The DM contents of the Dried Fermented Sorghum residue (DFSR) and Poultry growers mash (GRM) were high while the protein (N x 6.25) levels were relatvely high in both *Gliricidia* leaves (GRL) and DFSR. The very high crude fibre level in *Imperata* forage supplemented with sorghum residue (DFRS) and yam peels (YMP) respectively in that order. DM intake ranged from 65 - 114g/d. The diets administered to the rabbits were well digested (70.4 to 78.41%). Nitrogen utilization results are shown in Table 2. All the rabbits used were in positive nitrogen balance (0.96 to 1.59g/d retained N) at the end of the experiment, although the values were highest with the sorghum residue and *Gliricida* trials. Very high proportions (55 - 70%) of the Nitrogen intake (NI) were retained by the rabbits except for those in the Sorghum residue (DFSR) trial. Urinary and faecal N excretion levels were highest for rabbits on the Sorghum residue where the highest DM intake as well as the highest feed/gain ratio were recorded. *Tridax* treatment had the least feed/gain ratio.

Table:1 Chemical composition of the forage and agro-industrial by-products fed to the rabbits (g $100g^{-1}$ DM)

Names of the feed (as fed)	Dry Matter	Crude Protein	Ash	Crude Fibre	Ether Extract	Nitrogen Free Extractives
Herbage						
Gliricidia sepium	23.08	23.46	6.75	19.54	3.25	47.00
Tridax procumbens	15.05	12.32	11.36	16.52	3.96	55.84
Inperata cylindrica	29.99	7.11	7.50	35.00	2.58	47.81
By-products and concentrates						
Yam peels *(Dioscorea sp)*	27.21	8.64	6.30	9.06	1.12	74.88
Sorghum Residue (dried Fermented)	85.71	20.19	8.21	16.00	4.28	50.60

TABLE 2: Effects of some forage and agro-industrial by-products on performance characteristics of rabbits.

Performance characteristics	1 (IMP + GRM) Imperata+ Growers Mash	2 (IMP + YMP) Imperata+ Yam Peels	3 (IMP + DFSR) Imperata+ Sorghum Resid.	4 (TDX + GRM) Tridax+ Growers mash	5 (GRL) Gliricidia
Total Dry matter Intake (g/d)	74.01±1.70	102.48±4.99	113.84±2.51	61.94±6.24	65.88±7.94
DM Intake (g/d)(Herbage)	9.80±2.32	54.95±4.31	62.42±2.86	12.5±4.32	65.88±7.94
DM Intake (g/d) (Concentrate)	63.95±5.74	48.36±5.53	51.08±4.81	49.28±5.62	-
Average Daily Gain (g/d)	13.67±2.36	13.06±4.20	6.88±3.31	18.50±4.14	6.25±2.08
Apparent DM Digestibility (%)	86.43±5.62	83.14±3.68	78.12±1.87	80.49±1.64	81.79±0.59
Feed/gain	5.41	7.85	16.55	3.35	10.54
Nitrogen Intake (NI) (g/d)	1.59	1.29	2.37	1.38	2.49
Nitrogen Excretion (g/d)					
- Fecal N	0.41	0.32	0.71	0.30	0.62
- Urinary N	0.15	0.17	0.36	0.13	0.28
Retained Nitrogen (RN) (g/d)	1.03	0.80	1.30	0.96	1.59
Digested N (DN) (g/d)	1.18	0.97	1.66	1.08	1.87
RN/NI (%)	64.78	62.02	54.85	69.56	63.86
RN/DN(%)	87.23	82.47	78.31	88.89	85.03
N- Digestibility (%)	73.94	74.93	70.04	78.41	75.12

IMP = *Imperata cylindrica;* **GRM** = Grower's mash, **YMP** = Yam Peels , **DFSR** = Sorghum Residue, **TDX** = *Tridax procumbens*, **GRL** = *Gliricidia sepium*

a,b,c = Means with identical superscripts in a row are not significantly different (P>0.05).

Data on water utilization are presented in Table 3. Water intake from both feed and tap water sources ranged between 146.95 and 380.89 ml/day with *ad lib* supply. However, 17 - 21% of the water consumed were excreted in the faeces/urine. This did not include the unquantified fluid lost through the skin. More water was lost through urine than via feces. Water intake, relative to body weight, ranged between 17.58% and 25.49%. Urinary water output was highest for animals on the *Gliricidia* treatment. Water balance values obtained (Table 3) were lowest for the *Tridax* treatment. Water balance was found to vary directly with the amount of water consumed by the rabbits.

Table 3: Data on Water Utilization by Rabbits Fed the experimental feeds

Parameters measured	DIETS 1 (IMP+GRM) Imperata+ Growers Mash	2 (IMP+YMP) Imperata+ Yam Peels	3 (IMP+DFSR) Imperata+ Sorghum Resid.	4 (TDX+GRM) Tridax+ Growers mash	5 (GRL) Gliricidia
Av. Water Intake (ml/d)	151.08^{c}	380.89^{a}	259.53^{b}	146.95	313.50^{a}
Total Water Intake as % Body wt.	20.12±4.43^{b}	41.37±5.71^{a}	23.54±1.96^{b}	25.49±2.04^{b}	24.89±5.10^{b}
Feed water Intake (ml/d)	84.00±6.43^{c}	254.06±17.48^{a}	160.73±5.98^{b}	80.95±10.46^{c}	239.75±41.65^{a}
Tap water Intake (ml/d)	117.08±8.46^{a}	126.83±65.32^{a}	98.80±24.09^{b}	66.00±9.21^{c}	73.75±1.08^{b}
Faecal Water Output (ml/d)	7.24±1.75^{b}	25.52±10.53^{a}	22.01±2.54^{a}	5.08±2.86^{b}	8.94±1.05^{b}
Urinary Water Output (ml/d)	19.31±6.92^{c}	53.31±22.64^{a}	29.38±6.87^{b}	24.35±5.61^{b}	55.5±12.83^{a}
% of Water excreted	17.57	20.70	19.76	20.04	20.57
Water Balance (ml/d)	124.53^{c}	302.06^{a}	208.24^{b}	117.52^{c}	249.01^{b}

IMP = *Imperata cylindrica:* GRM = Grower's mash, YMP = Yam Peels

DFSR = Sorghum Residue, TDX = *Tridax procumbens.* GRL = *Gliricidia sepium*

a,b,c = Means with identical superscripts in a row are not significantly different (P>0.05).

DISCUSSION

The browse species fed to the rabbits are rich in their contents of nutrients, especially crude protein contents except for *Imperata cylindrica* leaves, which, like the other known grasses and leaves, is low in nitrogen and quite high in crude fibre contents. This, however, tends to limit its use as livestock feed except in cases where high fibre levels are desirable. The intention in this study was to put a supposed weed into use in livestock feeding. The very low DM content of *Tridax procumbens* had implications for both water and feed intakes by the rabbits and could be more sustaining during the dry season months and in areas with low water supply. The high DM intake by the rabbits on the *Imperata* herbage trial was principally to satisfy appetite, considering its relat*ively* low nutrient content.

The ADG values observed in this study were fairly low although they conform with the result obtained with rabbits in developing countries with high environmental temperatures. (Cheeke, 1986; Balogun and Etukude, 1991; Deshmukh and Pathak, 1991, Aganga *et al.,* 1991). Ajayi *et al*, 2007), Akinfala *et al* 2003) but lower than values obtained by Lukefahu and Ruiz-feria (2003). The low feed/gain ratios in the *Tridax* and DFSR treatments respectively could be ascribed to their low energy contents resulting in high feed intake. The caloric density in the other trials may have been higher thus resulting in reduced feed intake (Beynen, 1988).

The RN/NI values in this study indicate that these diets could support tissue formation by rabbits. The values are comparable to those of Singh *et al.* (1988) who fed low CP diets to rabbits. The rabbits were not diarrheic as shown by their loosing more water in the urine than faeces.

CONCLUSION

Diets containing between 7% and 24% crude protein levels used in combination in this study can sustain rabbits' performance. All the feed types used here are available in rural areas in tropical regions and their usage could be a way of further enriching the feed inventory at rural level. Very minimal cost was incurred in acquiring them, as they are mostly agro-industrial by-products and forages. The use of these forage resources is therefore encouraged for least cost rabbits production.

REFERENCES

Aganga, A.A.; Aduku, A.O., Abdulmalik, M. and Sekoni, A. (1991). Effect of different protein sources and their levels on the reproduction of breeding rabbits. J. Appl. Rabbit Res. 14:30-33.

Ajayi , A.F; G.O. Farinu; O.O. Ojebiyi & T.B. Olayemi (2007). Performance evaluation of Male weaner rabbits fed diets containing graded levels of blood-wild sunflower leaf meal mixt. World journal of Agric. Sci. 3(2): 250-255

Akinfala, E.O; Matanmi O and A.O. Aderibigbe (2003) Preliminary studies on the response of weaner rabbits to whole cassava plant meal basal diets in the humid tropics. Livestock Res. for Rural development 15(4): 5pp

A.O.A.C. (1990), Association of Official Analytical Chemists. Official methods of Analyses. 15th Ed. Washington D.C. USA. Pp 69-88

Beynen, A.C. (1988). Dietary fat level and growth performance by rabbits. J. Appl. Rabbits Res. 11: 21-24

Cheeke, P.R. (1986). Potential of rabbit production in tropical and sub-tropical agricultural systems. J. Anim. Sci. 63: 1581 - 1586.

Cheeke, P.R. and Patton, N.M. (1979). Utilization of Alfalfa by rabbits. In: The Domestic Rabbit, Potentials. Problems and current research. Proc. Symp. First Annual meeting of A.S.A.S.U Tucson, Arizona Pp. 25 - 28.

Deshmukh, S.V. and Pathak, N.M. (1991). Effect of different protein and energy levels on growth performance and nutrient utilization in New Zealand rabbits. J. Appl Rabbit. Res. 14: 18 - 24.

Huss, D.L. (1982). Small Animal for farms in Latin America, World Anim. Rev. 43: 24 - 29

Lukefahi, S.D. and C.A. Ruiz-felia (2003) Rabbit growth performance in a sub-tropical and semi-avid environment: effect of fur clipping, ear length and body temp. Lust Res. for Rural Dev. 15(2). 5pp

Mcleod, M.N. (1974). Plant tannins - Their role in forage quality Nutri. Abs. and Revs. 44(11): 803 - 815

N.P.C (2007). National Population Commission. Nigerian National Population Survey. Federal Government of Nigeria.

Onwuka, C.F.I. (1992). Tannins and Saponin contents of some tropical browse fed to goats. Trop. Agric. (Trinidad) 69 (2): 176 - 180

Rostogi, R.K. (1985): Low input system of Rabbit production in relation to small farmers in Trinidad. In Proc. of colloquim on Carribean farming systems and alternatives for development. Pp. 249 - 257

Schlolaut, W. (1985). A compendium of Rabbit Production appropriate for conditions in developing countries. GTZ. Eschborn, Germany 261 pp.

Singh, B.; Makkar, H.P.S. and Krishna, L. (1988). Utilization by growing rabbits of a low crude protein diet with or without urea and groundnut cake supplementation. J. Appl. Rabbits Res. 11: 25 - 29

Somade, B. (1982). Influence of two environments on the reproductive perfomance of New Zealand White rabbits. J. Anim Prod. Res. 2(2): 113 - 122.

Steel, R.G.D. and Torrie, J.H. (1980). Principle and Practice of Statistics: A biometrical approach. 2nd. ed. McGraw-Hill Book Co., New York.