Response of West African dwarf sheep to differently processed corncob meal based diets

*Fajemisin, A.N., Chineke, C. M., Fadiyimu, A.A and Fajemisin, A. J.

Department of Animal Production and Health, Federal University of Technology, Akure, Nigeria.

*debofajemisin@yahoo.co.uk

Abstract

A feeding trial was conducted to assess the response of West African Dwarf sheep to differently processed corncob meal based-diets. Sun-dried corncobs were collected at Teaching and Research farm of Federal University of Technology, Akure, treated with water, lye, urea, poultry litter and fermented for twenty-one (21) days. Five experimental diets were formulated and contained five differently treated corncob meals as follow: A (untreated corncob), B (water-treated corncob), C (lye-treated corncob), D (urea-treated corncob) and E (poultry litter-treated corncob). These processed corncob meals were incorporated as basal ingredients at 45% level. Thirty (30) WAD sheep (3 males and 3 females per treatment) were fed the five diets in a completely randomized design and the experiment lasted for sixty three (63) days. Dry matter intake, digestibility, nitrogen retention, weight gain and feed/gain ratio were significantly ($P < 0.05$) influenced by the inclusion of differently processed corncob meal in the diets. The highest crude protein (CP) intake, CP digestibility, nitrogen retention and feed/gain ratio values were recorded for sheep fed ensiled poultry litter-treated corncobs (diet D) and significantly ($P < 0.05$) differed from values recorded for sheep fed other diets. The haematological indices were not significantly ($P > 0.05$) influenced by the treatment except haemoglobin concentration. The results revealed that the inclusion of water, lye, urea, and poultry litter treated corncob meal in the sheep diets could satisfy the dietary protein and energy requirements of the sheep.

Key words: Corncobs, ensiled, lye, performance, urea, poultry litter, sheep

Introduction

The major problem of livestock production in Nigeria is feeding that stemmed from rising cost and scarcity of feed ingredients. Ruminant depends mostly on grasses and legumes which are not available all year round and the forage is of low protein quality especially during the dry season. Therefore, in order to reduce the cost of ruminant production without a decrease in its productivity and at the same time maintaining an efficient feed utilization, there is the need to look for alternative sources of protein and energy other than conventional cereal grain which are becoming expensive and are important to

man and monogastrics (Ademosun, 1992). Maize cobs as a crop residue represent important part of ruminant's diet especially when quality forage or grain feeding are not feasible. Although with little dietary value, it can be used as fibre source in [ruminant's](#) diet. However, feeding crop residues limit ruminant productivity by lowering intake because they hinder ruminal functions (Sarwar *et al.*, 2004). In order to improve the intake and digestibility of low quality crop residues, physical and chemical treatments have been explored. These treatments disrupt the cell wall by solubilizing hemicellulose, lignin and silica, hydrolyzing uronic acid and acetic

acid, esters and swelling cellulose (Jackson, 1977). These processes may improve the digestibility of the treated materials and the net yield of available digestible dry matter (Doyle *et al.*, 1986). Traditionally, poultry litter is used as fertilizer, it is also used in livestock feed as a cost saving measure compared to the other feed stuff materials particularly for beef animals (Hadjipanayiotou, 1984). Urea is a non-protein nitrogen compound which contains 45% nitrogen and used in livestock feeds such as when soybean meal and other plant proteins are high in price, more urea is used to replace plant protein in the ration of beef cattle and sheep (Homb, 1984). Thus, this study was conducted to assess the response of West African Dwarf sheep to differently processed corncob meal based diets.

Materials and Methods

Site of experiment and collection of materials

The experiment was conducted at the small ruminant unit of the Teaching and Research farm and Nutrition laboratory of Department of Animal Production and Health, Federal University of Technology, Akure, Ondo State, Nigeria. Poultry litter and corncobs were collected from the poultry unit of the Federal University of Agriculture, Akure, Ondo State, while the saw-dust ash was collected from a sawmill in Akure. Rice bran, palm kernel cake, premix, bone meal and salt were purchased from Bee-Jay feed mill located at Oluyole Estate, Orita-Obele, Akure.

Processed corncob meals and silage preparation

The corncobs were sun-dried for three (3) days, milled and divided into five equal parts. One part was untreated while other four parts were ensiled with water at ratio of 1 litre of water to 1kg corncobs (v/w), lye solution (2kg ash per 3litres of water) at

ratio of 1 litre to 1kg corncobs (v/w), poultry litter at ratio of 1kg of poultry litter to 1kg of corncobs (w/w) and 5% urea solution (5kg per 100 litres of water) at ratio of 1 litre urea solution to 1kg corncobs (v/w) respectively. The treated corncobs were fermented in plastic drums of 220 litres capacity lined with polythene, for 21days and the ensiled corncobs were air-dried for 4 days before incorporated into diets.

Experimental feeds preparation

Five experimental diets A, B, C D and E were formulated (Table 1) to contained the five various treated corncob meals as follow: A (untreated-corn-cob), B (water-treated corncob), C (lye-treated corncob), D (urea-treated corncob) and E (poultry litter-treated corncob). These processed corncob meals were incorporated as basal ingredients at 45% level into the experimental diets. Percentage proportion of rice bran, palm kernel cake, premix, bone meal, salt and vitamins-minerals premix were added to make complete diets.

Animal procurement and management

Thirty (30) WAD sheep with an average live weight of 16.67 ± 0.42 kg and age range of 12- 15 months were selected from sheep flock of University's Teaching and Research farm and treated against endo and ecto-parasites using Kepromec® at the rate of 1 ml per 10kg body weight.. They were randomly assigned to five treatments (3 males and 3 females per treatment) in a completely randomized design. The experiment lasted for a period of 63 days during which diets and water were given *ad libitum* to the sheep at 8.00am in the morning. The sheep were weighed before the commencement of experiment and were repeatedly weighed weekly in the morning before feeding to observe any weight change using spring-balance (hanging scale). The daily feed intake was

Table 1: Percentage composition (%) of processed corncob meal based-diets fed to West African Dwarf sheep

Ingredients	Diets				
	A	B	C	D	E
Corn cob meal	45.00	45.00	45.00	45.00	45.00
Palm kernel cake	30.00	30.00	30.00	30.00	30.00
Rice bran	23.50	23.50	23.50	23.50	23.50
Bone meal	0.50	0.50	0.50	0.50	0.50
Salt	0.80	0.80	0.80	0.80	0.80
Premix	0.20	0.20	0.20	0.20	0.20
Total	100	100	100	100	100

A= Untreated corncob, B= Water treated corncob, C=Lye treated corncob, D=Urea treated corn cob, E=Poultry treated corncob

determined by deducting the refusals from the quantity offered. The sheep were transferred to metabolic cages during the last fourteen days of the experimental period for a digestibility trial. The first 7 days was allowed for acclimatization while the last 7 days was used for separate collection of faeces and urine. The urine samples were collected in containers that contained 1ml each of 25 % H_2SO_4 in order to trap ammonia. Faeces and urine were collected daily, measured and stored in refrigerator until they are required for chemical analysis.

Laboratory analysis

The laboratory analysis was done in the Nutrition laboratory of the Department of Animal Production and Health, Federal University of Technology, Akure, Ondo State, Nigeria.

The samples of feed, faeces and urine were analyzed for chemical composition according to the methods of AOAC (1990). Neutral detergent fibre (NDF) and acid detergent fibre (ADF) were determined using the analytical procedures of Van Soest *et al.*, (1991), macro elements were determined by atomic absorption spectrophotometer (AAS) model 490 Gallenkamp, London after digestion using perchloric acid and aqua fortis.

Experimental design and Statistical analysis

The experimental design was of completely randomized design and all data obtained were subjected to analysis of variance (ANOVA) and treatment means were compared by the method of Duncan's Multiple Range Test using SAS (2008) version 9.2.

Results and Discussion

The proximate composition of the experimental diets are shown in Table 2. The dry matter of experimental diets in this study ranged between 84.65 (diet E) and 88.06 % (diet A) and these values favourably compared to the values reported by Fajemisin *et al.* (2012a) when cassava peel was substituted with graded levels of *Cajanus cajan* hay in goats' diets. The crude protein of experimental diets were adequate and above 8.00% CP recommended for ruminant's body maintenance (Norton, 2003) however, the CP contents of diets D (30.96%) and E (15.26%) were high compared to other diets. The high crude protein content of diets D and E observed were similar to the reported values by Aziza *et al.* (2006) when urea and poultry waste were ensiled with cereal forage, grasses and fed to WAD goats. Also, Sahoo *et al.*, (2002) reported that treatment of corncobs with urea improves the nutritive value as

Table 2: Chemical composition (%) of processed diets fed to West African Dwarf Sheep fed processed corncob meal based diets

Nutrients	Diets				
	A	B	C	D	E
Dry matter	88.06	85.37	84.79	84.88	84.65
Crude protein	14.55	16.15	17.01	30.96	15.26
Crude fibre	36.16	36.44	28.19	25.13	16.71
Ether extract	6.06	7.23	8.53	8.89	5.28
Ash	7.24	12.53	6.83	11.36	9.02
Nitrogen free extract	35.99	27.65	39.44	23.66	53.73
Neutral detergent fibre	71.28	67.98	54.00	61.40	59.00
Acid detergent fibre	45.84	46.00	36.14	50.50	44.84
Calcium	1.79	2.49	3.60	1.69	4.55
Magnesium	0.27	0.44	0.87	1.76	0.82

n=3, A= Untreated corncob, B= Water treated corncob, C=Lye treated corncob, D=Urea treated corncob, E=Poultry treated corncob

compared to urea supplementation just prior to feeding and Onimisi and Omega (2006) reported similar result that poultry litter can be used to replace soybeans without any effect. The fibre fraction contents recorded in this study agreed with those reported by Fajemisin *et al.* (2012b) when ensiled corncobs treated with or without water, lye and urea were fed to West African Dwarf sheep. The calcium and magnesium concentrations in the test diets were adequate and favourably compared to the values recommended for healthy sheep and goats by McDowell (1992).

Table 3 presents the nutrients intake by the WAD sheep. The dry matter intake (DMI) values were significantly ($P < 0.05$) influenced by inclusion of ensiled corncob meals in the diets and ranged from 200.25 (diet B) to 370.63g/day (diet E). The highest DM and CP intake values recorded for sheep fed diet E agreed with the findings of Fajemisin (1994) that poultry litter and urea (non-protein nitrogen) would enhance microbial fermentation and improves gut fill of small ruminants. This corroborate the

Table 3: Nutrients intake by West African Dwarf sheep fed processed corncob meal based diets

Parameters	Diets					
	A	B	C	D	E	SEM
Dry matter	302.34 ^{ab}	200.25 ^b	220.25 ^b	285.63 ^{ab}	390.63 ^a	19.13
Crude protein	43.99 ^c	32.34 ^c	37.46 ^c	88.43 ^a	59.61 ^b	5.87
Crude fibre	109.33 ^a	72.97 ^b	62.09 ^c	71.78 ^b	65.27 ^c	4.68
Ether extract	18.32 ^b	14.48 ^c	18.79 ^b	25.39 ^a	20.63 ^b	0.99
Ash	21.89 ^c	25.09 ^b	15.04 ^d	32.45 ^a	35.23 ^a	1.86
Nitrogen free extract	108.81 ^b	55.37 ^d	86.87 ^b	67.58 ^c	209.89 ^a	14.75
Neutral detergent fibre	215.51 ^a	136.13 ^b	119.07 ^c	147.04 ^b	181.61 ^{ab}	10.83
Acid detergent fibre	138.60 ^b	93.32 ^c	79.69 ^c	144.47 ^b	166.19 ^a	9.78
Calcium	3.41 ^c	5.74 ^b	12.0 ^a	2.19 ^c	2.86 ^c	1.01
Magnesium	0.51 ^b	1.02 ^{ab}	2.89 ^a	0.49 ^b	2.98 ^a	0.31

a,b,c = Means in the same row with the same superscripts are not significantly ($P > 0.05$) different.
A= Untreated corncob, B= Water treated corncob, C=Lye treated corncob, D=Urea treated corn cob, E=Poultry treated corncob

suggestions of Khan *et al.*, (2004) that high CP intake might be due to the inclusion of poultry litter as a source of non -protein nitrogen that enhanced microbial activities in the rumen of the sheep. It was reported by Nisa *et al.* (2004) that higher intake of NDF and ADF in lactating cows fed urea-treated corncobs was attributed to higher nutrient intake and improved digestibility of fibre fractions. Thus the high CF, NDF and ADF intake observed in this study might be attributed to improved protein contents of the diets and enhanced digestibility of the diets by the rumen micro-organisms (Fajemisin *et al.*, 2008).

The apparent digestibility coefficient values of DM, CP, NDF and ADF recorded for all the sheep fed the experimental diets was significantly ($P < 0.05$) influenced by the inclusion of differently processed corncob meals in the diets (Table 4). The highest apparent digestibility coefficient observed in sheep fed diet E suggested that ensiling poultry litter-treated crop residues with fermentable carbohydrate and protein can improve digestibility of the feed (Nisa

et al., 2004), which improved voluntary feed intake (Hogan, 1996). The research findings of Fajemisin *et al.* (2008) supported the fact that adequate nitrogen in diets D and E enhanced the activities of rumen microbes which eventually improved the CP digestibility in the diets.

The nitrogen retention, minerals balance, weight gain and feed/gain ratio were significantly ($p < 0.05$) influenced by the inclusion of processed corncob meals in the diets as shown in Table 5. The nitrogen retention values ranged between 4.00 (diets B and C) and 10.15 g/day (diet D). This observation might be attributed to feed intake, protein quality and digestibility of the diet and the nitrogen retention values corroborated the reported values by Fajemisin *et al.* (2012b). However, the nitrogen retention values observed in this study were favourably compared to the values reported by Jokthan *et al.* (2009) when Yankasa sheep was fed rice straw supplemented with Pigeon pea forage. The weight gain ranged between 4.76 (diet A) and 40.79g/day (diet E) and this could be

Table 4: Nutrients digestibility by West African Dwarf sheep fed processed corncob meal based diets

Parameters	Diets					SEM
	A	B	C	D	E	
Dry matter	58.43 ^{ab}	70.50 ^{ab}	68.41 ^b	63.07 ^b	80.26 ^a	2.01
Crude protein	56.05 ^b	75.23 ^{ab}	64.70 ^{ab}	80.98 ^a	79.64 ^a	2.56
Crude fibre	57.60 ^a	73.11 ^{ab}	67.28 ^{bc}	72.88 ^c	77.53 ^{bc}	1.87
Ether extract	57.70 ^c	63.60 ^b	66.23 ^b	68.91 ^a	67.64 ^a	1.16
Nitrogen free extract	63.48 ^b	67.70 ^b	61.53 ^b	65.47 ^c	73.53 ^a	1.15
Neutral detergent fibre	60.94 ^{ab}	76.70 ^a	68.10 ^b	66.00 ^{ab}	78.30 ^a	1.85
Acid detergent fibre	66.18 ^b	76.84 ^{ab}	62.91 ^c	73.43 ^{ab}	83.54 ^a	1.10

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

A= Untreated corncob, B= Water treated corncob, C=Lye treated corncob, D=Urea treated corn cob, E=Poultry treated corncob

Table 5: Nutrients utilization by West African Dwarf sheep fed processed corncob meal based diets

Parameters	Diets					SEM
	A	B	C	D	E	
Nitrogen retention (g/day)	5.38 ^c	4.00 ^c	4.00 ^c	10.15 ^a	7.72 ^b	0.67
Calcium balance (g/day)	2.68 ^a	0.75 ^c	0.99 ^d	1.68 ^c	2.30 ^a	0.20
Magnesium balance (g/day)	0.91 ^a	0.06 ^c	0.09 ^{bc}	0.52 ^{ab}	0.61 ^a	0.10
Initial liveweight (kg)	15.67	15.67	15.73	15.60	16.33	0.24
Final liveweight (kg)	15.97 ^b	16.17 ^b	16.46 ^{ab}	17.87 ^{ab}	18.90 ^a	0.43
Weight gain (g/day)	4.76 ^c	7.94 ^d	11.59 ^c	36.03 ^b	40.79 ^a	4.04
Feed/gain ratio	63.52 ^a	25.22 ^b	19.00 ^c	7.93 ^d	9.09 ^d	5.44

a, b, c = Means with the same superscript in a row have no significance difference ($P > 0.05$).

A= Untreated corncob, B= Water treated corncob, C=Lye treated corncob, D=Urea treated corn cob, E=Poultry treated corncob

Table 5: Nutrients utilization by West African Dwarf sheep fed processed corncob meal based diets

Parameters	Diets					SEM
	A	B	C	D	E	
Nitrogen retention (g/day)	5.38 ^c	4.00 ^c	4.00 ^c	10.15 ^a	7.72 ^b	0.67
Calcium balance (g/day)	2.68 ^a	0.75 ^c	0.99 ^d	1.68 ^c	2.30 ^a	0.20
Magnesium balance (g/day)	0.91 ^a	0.06 ^c	0.09 ^{bc}	0.52 ^{ab}	0.61 ^a	0.10
Initial liveweight (kg)	15.67	15.67	15.73	15.60	16.33	0.24
Final liveweight (kg)	15.97 ^b	16.17 ^b	16.46 ^{ab}	17.87 ^{ab}	18.90 ^a	0.43
Weight gain (g/day)	4.76 ^c	7.94 ^d	11.59 ^c	36.03 ^b	40.79 ^a	4.04
Feed/gain ratio	63.52 ^a	25.22 ^b	19.00 ^c	7.93 ^d	9.09 ^d	5.44

a, b, c = Means with the same superscript in a row have no significance difference ($P > 0.05$).

A= Untreated corncob, B= Water treated corncob, C=Lye treated corncob, D=Urea treated corn cob, E=Poultry treated corncob

attributed to the protein quality of the diets (Table 2), nutrients intake and digestibility by the sheep. This observation was similar to the findings of Alokun (1998) in Yankasa sheep fed banana foliage and elephant grass. The values of the feed/gain ratio ranged from 7.93 (diet D) to 63.52 (diet A) and were better than the values (8.01-65.13) reported by Alokun and Adeleye (1991) when corncob diets supplemented with protein were fed to West African Dwarf sheep. The results of minerals balance revealed that the diets contained adequate calcium and magnesium contents (Table 1)

and this observation agreed with the recommendation of McDowell (1992) for healthy sheep and goat.

Haematological parameters of the sheep determined are presented in Table 6. The haematological indices were not significantly ($P > 0.05$) influenced by the treatment except haemoglobin. The highest values of PCV (36.30%), RBC ($13.72 \times 10^6/\text{ml}$), WBC ($28.72 \times 10^3/\text{ml}$) and Hb (12.11g/dl) were observed in the sheep fed urea-treated corncob diet (diet D). Since the observed average values of the haematological indices were within the recommended values for healthy sheep and goats (Plumb, 1999), it implied that the diets

supplied adequate protein and energy (Daramola *et al.*, 2005). In addition, the blood cells of the sheep could have had sufficient blood pigment for proper transportation of oxygen (Adebosin, 2009) and immunity against infections (Plumb, 1999).

Conclusion

The results obtained in this study showed that nutritive value of corncobs treated with water, lye, urea and poultry litter and fermented for 21 days can be enhanced and efficiently utilized by sheep. The ensiled poultry litter and urea treated corncobs enhanced feed efficiency which improved the performance of the WAD sheep. The nitrogen retention values were positive for all the sheep and sheep fed diet that contained urea treated corncobs had the best nitrogen retention and feed conversion ratio compared to other sheep fed other diets. Thus, crop residues processed biochemically would enhance sheep performance, reduce feed scarcity during dry season and good outlet for disposal of crop residues.

References

- Adebosin, O.G. 2009.** Performance and Minerals Elements Availability in goats fed *Ficus gmelina* and *Detarium* leaf meals supplement. M.Sc. Thesis. Department of Animal Production, Faculty of Agriculture, University of Ilorin, Ilorin, Nigeria.
- Ademosun, A.A. (1992).** Nutritive evaluation of Nigeria forages, the effects on stage of maturity on the nutritive value of *Panicum maximum*. *Nigerian Agricultural Journal* 10: 170-187.
- Alokan, J.A. and Adeleye, I.O.A. (1991)** Protein supplementation of corncob diets for West African Dwarf sheep. *West African Journal of Biological Applied Chemistry* 36: 14-17
- Alokan, J. A., 1998.** Performance of Yankasa sheep fed banana foliage and elephant grass. Proceeding of the silver Anniversary of the conference of the Nigerian Society of Animal Production, held at Gateway hotel, Abeokuta, Nigeria: In Oduguwa, O O, Fanimi A O, and Osinowo O A (Eds) pp51-52.
- A.O.A.C. 1990.** Association of official and analytical chemist official method of Analysis, 16th edition Washington D.C.
- Aziza, M.R., Moujahed, N. and Kayouls, E. 2006.** Strategy of utilization of local available crop residues and by-product for Livestock feeding in Tunisia. *Topicultural* 2: pp 68 – 73.
- Daramola, J.O., Adeloye, A. A., Fatoba, T.A. and Soladoye, A.O. 2005.** Haematological and biochemical parameters of West African Dwarf goats. *Livestock Research for Rural Development*. 17 (8) 2005.
- Doyle, P.T., Devendra, C. and Pearce, G.R. (1986).** Rice straw as a feed for ruminants. Australian Government Printing Services, Canberra.
- Fajemisin, A. N. (1994).** Utilization of poultry dropping by sheep fed cassava waste-based diet. M. Sc. Thesis Presented to the Department of Animal Science University of Ibadan pp 5-56.
- Fajemisin, A.N; Alokan, J.A; Aro, S.O; Olowofeso, O and Fawolu, T.S. 2008.** Nutrient intake, digestibility and weight gain by West Dwarf sheep fed rumen content-

- poultry droppings mixed diets. *Proceedings of 33th Annual Conference of Nigerian Society for Animal Production* held at Olabisi Onabanjo, University, Ayetoro Ogun State, Nigeria, March 16-20th 2008. pp 583-586.
- Fajemisin, A.N., Fadiyimu, A.A., and Alokun, J.A. (2010)** Performance and nitrogen retention in West African Dwarf goats fed sun-dried *Musa sapientum* peels and *Gliricidia sepium*. *Applied Tropical Agriculture*. 15 (Special issue 2): 88-91.
- Fajemisin, A.N., Omotoso, O.B., Fadiyimu, A.A. and Shuaibu, Y.A. (2012a)**. Nutrients intake and utilization by West African Dwarf goats fed cassava peels substituted with *Cajanus cajan* hay. *Proceedings of 17th Annual Conference of Animal Science Association of Nigeria* held at International Conference Centre, Opposite Radio House, Area 8, Abuja, Nigeria. September 9-13th 2012. pp. 636-639
- Fajemisin, A.N., Chineke, C.M., Fadiyimu, A.A., Fajemisin, A.J. and Alokun, J.A. (2012b)**. Dietary effects of ensiled corncobs treated with or without water, lye and urea on performance characteristics of West African Dwarf sheep. *Proceedings of 17th Annual Conference of Animal Science Association of Nigeria* held at International Conference Centre, Opposite Radio House, Area 8, Abuja, Nigeria. September 9-13th 2012. pp. 575-578.
- Hadjipanayiotou, M. (1984)**. Studies on the use of poultry litter as ruminant feed in Cyprus. *Animal Production*. 35:157-161.
- Hogan, J. (1996)**. Feed intake ruminant nutrition and production in the tropic and subtropics. ACIAR, Canberra, Australia. pp.47.
- Homb, T. (1984)**. Wet treatment with sodium hydroxide, Straw and other Fibrous by-products as Feed, (Sundstol, F., Owen, E., Eds.), Elsevier, Amsterdam.
- Jackson, M. G. (1977)**. Review article: The alkali treatment of straws. *Animal Feed Science and Technology*. Volume 2: 105-130.
- Jokthan, G.E., Lakpini, C.A.M., Adamu, A.M. and Akpa, G.N. (2009)** Effect of supplementing rice straw with Pigeon pea forage on performance of Yankasa sheep. *Nigerian Journal of Animal Production* 36 (11): 134-142.
- Khan M. A., Sarwar, M., Nisa, M and Khan, M.S (2004)**. Influence of enzose on feeding value of urea treated corn cobs in lactating crossbred cows. *Asian-Australian Journal of Animal Science*. 7:70.
- McDowell, L.R. (1992)**. Minerals in Animal and Human Nutrition. 1st edition. Academic Press, New York, USA. 16: 431-436.
- Nisa, M., Sawar M., and Khan M. A (2004)**. Nutritive value of urea treated wheat straw ensiled with or without corn steep liquor for lactating Nili-Ravi buffaloes. *Asian-Australian Journal of Animal Science*. 6:825.
- Norton, B.W. (2003)**. The Nutritive values of trees legumes as dietary supplement for ruminants. In: Forage tree legumes in Tropical Agriculture. Editors Guttridge, R.C. and Shelton, H.M.

- pp 171-191
- Onimis, P.A. and Omega, J.J. (2006).** Evaluation of poultry litter as feedstuff for growing rabbits. *Animal. Feed Science. Technology* 13: 237-248.
- Plumb, D.C. (1999).** Veterinary Drug Handbook. Iowa State University Press. Veterinary C l i n i c a l Pathology. Practice Publishing Co. Pages 99-115.
- Sahoo, B.M., Sarawat, L., Haque, N and Khan, M.A. (2002).** Influence of chemical treatment of wheat straw on carbon–nitrogen and energy balance in sheep *Small Ruminant Research* 44 (3): 201- 206.
- Sarwar, M., Khan, M.A. and Nisa. M (2004).** Effects of Organic Acid or Fermentable carbohydrates on Nitrogen Fixation and Chemical Composition of Urea treated Wheat straw. *Asian – Australian Journal of Animal Science* 1:98.
- SAS. (2008).** SAS/STAT User's Guide. Version 9.2 for Windows. SAS institute Inc; SAS Campus Drive Carry, North California, U.S.A.
- Van Soest, P.J., Robertson, J.B. and Lewis, B.A. (1991).** Method for dietary fibre, neutral detergent fibre and non starch polysaccharides in relation to animal nutrition. *Journal of Dairy Science*, 3583-3597.

Received: 10th November, 2014

Accepted: 15th February, 2015