ASPECTS OF SMALLHOLDER GOAT FARMING SYSTEMS IN RIVERS STATE (II): CASSAVA, PLANTAIN AND YAM PEELS UTILIZATION

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ABSTRACT
The study assessed aspects of smallholder West African Dwarf (WAD) goat farming systems and domestic food crop wastes utilization over a 4-week on-farm study. It was conducted on two farms (Farm 1 intensively managed; Farm 2 semi-intensively managed)to estimatelive weight changes (LWC) and manure quality. A total of 8 WAD goats with 4 per farm were fed equi-mixture of cassava, yam and plantain peels offered at about 3% of body weight for the 4 weeks. The neutral detergent fibre (NDF) content was below 40% for all three feed resources although, plantain peel recorded the best ($P < 0.05$) ash and crude protein (CP) contents but, the least dry matter (DM) content. Goats on the semi-intensively managed farm gave the most stable live LWC. The recorded faecal matter showed a great promise for use as organic manure to support crop production, especially, for those who also grow food crops and vegetables as a sustainable intensification strategy. Cassava and plantain peels are recommended as supplemental feed resources for goats, especially under smallholdings during the dry season given their low NDF and relatively high CP contents.
Keywords: By-products, goat, manure quality, peels utilization.

INTRODUCTION
On-farm cut-and-carry grazing systems where only forage is fed, may limit farm animalnutrition and productivity, especially when such forage is of poor qualityresultingto low productivity (Peter and Lascano, 2003; Carr *et al.*, 2005). Due to this and other constraints, smallholder goat farmers use household crop wastes as complementary feeding resources leading to heavier and healthier animals compared to those denied supplemental household wastes (Onwuka *et al.*, 1997).This way, domestic wastes are utilized as feed resources and converted into useful animal products rather than becoming environmental nuisance (FAO and IFAD, 2001; Adebayo, 2008; Aro *et al.*, 2010). Besides supporting livestock nutrition, it can improve crop production using goat manure as organic fertilizer to minimize production cost, improve profit margin and serve as part of sustainable land fertility management practice (Pandey *et al.*, 2000; Anderson *et al.*, 2005). Therefore, the study was conducted to determine the quality of cassava, plantain and yam peels under small holder intensive and semi-intensive goat farming systems in two University of Port Harcourt host communities in Rivers State.

MATERIALS AND METHODS
On-farm feeding trial
The on-farm research was carried out on two smallholder goat farms (Farm 1 intensive system; Farm 2 semi-intensive system) using cassava, yam and plantain peels. Cassava peels were obtained from local farmers, while yam and plantain peels were obtained from commercial plantain and yam roasters close to the goat farms. The peels were sun-dried for 48 hours before mixing and in equal proportions of cassava:yam:plantain peels ratio of 1:1:1 at 3% the live bodyweight per animal and fed to the animals in equal rations at about 08.00 and 16.00 hours daily for four weeks. Clean water was provided ad libitum. The study was laid out as split plot with 2 main plots (two goat farms), 4 sub-plots (number of weeks for the feeding trial) and 4 replications (number of goats per farm) giving 8 WAD goats weighing 19.5 ± 1.2 kg (Farm 1) and 18.4 ± 1.2 kg (Farm 2) average live weights. Live weight changes were recorded once a week for the 4 weeks, then final body weights recorded on both farms.

Chemical analyses

Samples of cassava, yam and plantain peels were collected, weighed then, oven-dried at 60°C for 72 hours to determine DM content. The dried samples were later ground through a 1.00 mm sieve and stored in airtight polythene bags before taken for laboratory analysis. Crude protein (CP) was determined using the Kjeldahl methodas N%× 6.25. Ash content was determined by burning the dried samples of known weight in a muffle furnace at 550°C for 1-hour. Faecal samples were collected, bulked, and analyzed to determine DM, N, Phosphorus (P) and Potassium (K). All analyses followed standard procedures (AOAC, 2002) while, organic matter (OM) was computed as the difference between %ash and 100% DM.

Statistical analyses

Data were subjected to analysis of variance (ANOVA) as split plot with 2 main plots (2 farms) and 4 sub-plots (4 weeks on study) with 4 replications (4 WAD goats per farm). Data werelater sorted by farm then, analyzed as completely randomized design (CRD) with weeks as 4 treatments and animals as 4 replications (SAS, 2000). Where significant differences occurred, mean separation was done using least significant difference (LSD) at the 5% probability level.

RESULTS AND DISCUSSION

Table 1 shows significant differences ($P< 0.05$) in nutrient content for the three most preferred domestic wastes by WAD goats.TheDMand OM contents ranged from 409 g/kgand 868 g/kg in cassava peel to 159 g/kg in plantain peel and 895 g/kg in yam peel, respectively while, NDF ranged from 248 g/kg in plantain peel to 330 g/kg in cassava peel. Crude protein ranged from 51 g/kg in cassava peel to 98 g/kg in plantain peel while, ash content ranged from 105 g/kgin yam peel to 161 g/kg in plantain peel. Plantain peel showed better nutritive value than other peels in given its least NDF and highest CP and ash recorded but, the very low DM content suggests difficulty in drying, storage and energy availability for the animals when consumed.

Figure 1 shows the live weight changes (LWC) of the goats from week 1 to week 4 for the two farms. Both the weekly LWC and cumulative LWC indicate that, weights for Farm 1 were constantly fluctuating while, those for Farm 2 increased steadily and smoothly. This conflicts with results that showed confined goats had better weight gains than those under semi-intensive system (Imasuen and Ogedegbe, 2014). The difference may be because, the four weeks of confinement was too short for the goats to adjust their physiological state to confinement.

The faecal matter (Table 2) contains 24.7 g/kg, 14.7 g/kg, and 8.4 g/100g of nitrogen (N), phosphorus (P) and potassium (K), respectively. This implies 1 kg of the manure will give 24.7g N, 14.7g P and 8.4g K. This is a good potential source for use as manure in crop production because, of the high proportion of the major nutrients needed by the soil for optimum crop productivity and may also be sold to make additional income by the farmers and improve their livelihood, reduce production cost and minimize or prevent pollution associated with use of synthetic fertilizer for crop production thereby contribute to sustainable land fertilitymanagement (Anderson *et al.*, 2005).

CONCLUSION

The potential of domestic wastes (cassava peel; plantain peel; yam peel) tohelp resolve part of the challenges such as feed insecurity faced by smallholder goat farmers in the study area is promising. Based on the positive results from the study, up-scaling the studies to more farms in more LGAs and communities of the 23 LGAs in Rivers State is required to provide the needed data to support evidence-based policy recommendations for promoting integrated smallholder goat farming systems for sustainable intensification. That way, the project will be contributing to the achievement of SDG Goal 2 (End hunger, achieve food security and improved nutrition and promote sustainable agriculture).

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REFERENCES

Adebayo, A.O. (2008). *Using cassava waste to raise goats. Project 2008-4345. World Bank*

Development Marketplace. [Online] Available at: http://www.feedipedia.org/node/8149 [Accessed 31 December 2016].

Anderson, J.B., Jolly, D.A. and Green, R. (2005). *Determinants of farmer adoption of organic production methods in the fresh-market produce sector in California: A logistic regression analysis.* San Francisco, Western Agricultural Economics Association.

AOAC (2002). Official Methods of Analysis, 17th ed. Association of Official Analytical Chemists, Gaithersburg, MD, USA.

Aro, S.O., Aletor, V.A., Tewe, O.O. and Agbede, J.O. (2010). Nutritional potentials of cassava tuber wastes: A case study of a cassava starch processing factory in south-western Nigeria. *Livestock Research for Rural Development,* 22(11), *Article #213.* Retrieved December 23, 2016 from http://www.lrrd.org/lrrd22/11/aro22213.htm.

Carr, P.M., Poland, W.W. and Tisor, L.J. (2005). Forage legume regeneration from the soil seed bank in western North Dakota. *Agronomy Journal,* 97(2), pp. 505-513.

FAO and IFAD.(2001). *Strategic environmental assessment.: An assessment of the impact of cassava production and processing on the environment and biodiversity.* 5th Vol. ed. Rome: Food and Agriculture Organization of United Nations & International Fund for Agricultural Development.

Imasuen, J.A. and Ogedegbe, S.A., (2014). Growth and physiological performance of West African Dwarf goats reared under two different management systems. *Journal of Research in Forestry, Wildlife and Environment,* 6(2): 48-53.

Onwuka, C.F.I., Adetiloye, P.O. and Afolami, C.A. (1997). Use of household wastes and crop residues in small ruminant feeding in Nigeria. *Small Ruminant Research,* 24: 233-237.

Pandey, A., Soccol, C.R., Nigam, P., Soccol, V.T., Vandenberghe, L.P.S. and Mohan, R. (2000). Biotechnological potential of agro-industrial residues-II: Cassava bagasse. *Bioresource Technology,*74(1): 81-87.

Peters, M. and Lascano, C.E. (2003). Forage technology adoption: linking on-station research with participatory methods. *Tropical Grasslands,* 37: 197-203.

SAS. (2000). *The Statistical Analysis System (SAS) System for Windows.* Release 8.01. SAS Institute, Carry, USA.

Table 1: Nutrient composition (g/kg DM) of three most preferred domestic wastes by goats

Parameter	Cassava peel	Plantain peel	Yam peel	Mean±SE
Dry matter	409±7.0^{a}	159±0.9^{c}	258±2.4^{b}	275±3.4
Organic matter	868±7.0^{c}	839± 0.9^{a}	895±4.2^{b}	867±4.0
Neutral detergent fibre	330±7.0^{a}	248±0.5^{c}	281±0.2^{b}	286±2.6
Crude protein	51±2.5^{c}	98±1.3^{a}	64±3.8^{b}	71±2.5
Ash	132±3.2^{b}	161±5.5^{a}	105±0.7^{c}	133±3.1

^{a,b,c}Means with different superscripts in the same row are significantly different ($P<0.05$). SE = Standard Error.

Table 2: Gross manure quality [g/kg DM] of goat faecal matter

Parameter	Content
Dry matter	658
Organic matter	694
Ash	306
Nitrogen	24.7
Phosphorus	8.4
Potassium	14.7

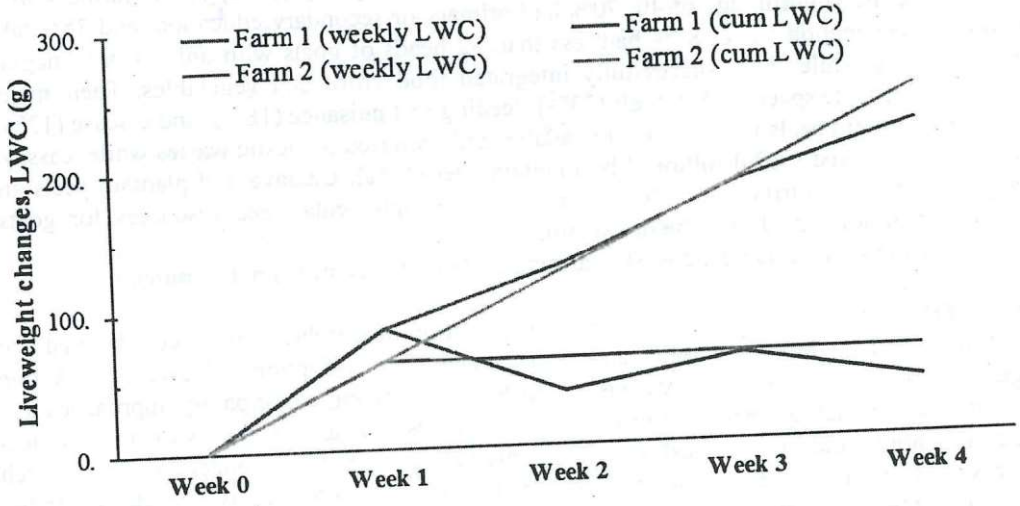

Figure 1: Weekly weight changes of goats fed domestic wastes