RESPONSE OF WEST AFRICAN DWARF BUCKS TO *CAJANUS CAJAN* HAY BASED DIETS

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ABSTRACT

This study aimed at producing pasture-based feeding system using Cajanus cajan hay based complete mixed ration. Cajanus cajan pasture was established on a nitrogen depleted soil. A portion of the pastureland (5m x5m) was fertilized with poultry manure (PM), at 3t/ha 2 weeks before planting, other portion (5m x 5m) was fertilized with urea (UF) at 30 kg/ha 2 weeks after planting (WAP), while the Control plot (5m x 5m) had no fertilizer (NF) application. Differently fertilized C. cajan forage were harvested at 12 WAP and were dried using solar cabinet to produce hay. Complete mixed rations were formulated with hay at 50% inclusion level with other conventional feedstuffs at fixed quantity (rice husk (20%), wheat offal (18%), GNC (10%), salt (1%), premix (1%)) and produced either as pelletised (P) or unpelletised (UP) to make 6 diets. Diet 1 was the no fertilizer (NF) C. cajan hay-based pellet, while diets 2(UFP) and 3 (PMP) were urea and PM C. cajan hay-based diets. NFUP,UFUP and PMUP were the unpelletised form of the no fertilizer, urea fertilizer and poultry manured hay based diets respectively laid out in 2x3 factorial arrangement and were fed to West African Dwarf goats (bucks) 9-12 months with an average weight of 6.01±0.9kg in a trial that lasted 84 days. . Results showed that goats fed PMP had the best average daily weight gain (56.31g/day), total weight gain (4.73kg) and least feed conversion ratio of 6.30. Consequently, inclusion of poultry manure C. cajan hay at 50% level and in pellet form greatly improved the performance of the growing bucks and thus, recommended as an off-season feed for ruminant production.

Keyword: *Cajanus cajan*, pasture, pellets, poultry manure, solar cabinet drying,

INTRODUCTION

Small ruminant constitutes a major category of the livestock that are kept by many households and serves as source of income. It principally serves as a source of animal protein in the diet of the populace (Ahmed *et al.,* 2020). Most of the animals in the tropics are fed with low quality forages that are fibrous, coarse and have low nutrient compositions as the season progresses towards the drought (Omotoso *et al*., 2020). Herbaceous forage legumes have been identified as potential supplements for ruminants (Oyaniran *et al*., 2018) but the constraint to their use in feeding ruminant all year round is the decline in both nutrients' quality and quantity of forages during dry season. Forage conservation remains the best choice for ensuring continuity of supply of feeds during off season because adequate levels of nutrients are retained in them to meet their use by the animals in dry season (Davies and Onwuka, 1996). Pigeon pea (*Cajanus cajan*) is a multi-purpose nitrogen-fixing crop that provides the seed as human food and poultry feed, the leaves and young stems as animal fodder. The pea has been reported to contain 91.48 - 93.05% dry matter, 18.56 - 19.00% crude protein, 19.23 - 27.12% crude fibre, 4.50 - 7.06% ether extract, 8.47 - 9.45% Ash and 46.70% nitrogen free extract (Alokan, 2008; Adebisi *et al.,* 2020). Hence, the crux or concern of this study was to assess the response of WAD bucks fed *Cajanus cajan* hay based diets as off-season feed for ruminant.

MATERIALS AND METHODS

The study was carried out at the Teaching and Research Farm and the Nutrition Laboratory of the Animal Production and Health Department, Federal University of Technology, Akure, Nigeria. Pigeon pea forages were harvested from an already established pasture that were fertilized with poultry manure (3t/ha) two weeks before planting, while urea was applied two weeks after planting (WAP) (30kg/Ha), the third plot was the control with no fertilizer application. The forages were harvested at 12WAP at 40cm height above ground level and subjected to solar drying (locally fabricated solar

cabinet, temperature ranges between 48-55^{0}C between 12noon and 5pm). The forages were spread out in the cabinet and were carefully turned for uniform drying for 3 - 4 days to make hay. Thereafter, differently fertilized *C. cajan* hay were incorporated at 50% inclusion level with other feed ingredients at fixed quantity (Table 1) and were thoroughly mixed and made into a complete mixed ration. Meanwhile, a portion of each diet was pelletized (6mm diameter) by extrusion at 40^{0}C for 6 hours to make six diets, designated as diet 1 – 6 (check Table 1) i.e. NFP, UPF, PMF, NFUP, UFUP and PMUP. The diets were fed to twenty-four (24) growing WAD bucks, age range from 9 to 12 months with an average live-weight of 6.01±0.9kg. Before data collection, the goat-bucks were stabilized by prophylactically treating them against ecto- and endo- parasites using ivermectin (1ml/50Kg); oxytetracycline long acting at the rate of 1ml per 10kg body weight and vaccinated against *Peste-Petit dé Ruminanté* (PPR) using PPR vaccine. These animals were randomly assigned into six dietary treatments of four replicates and the feed trial lasted 84 days, in a 2x3 factorial arrangement in a Completely Randomized Design experiment - two modes of presentation (Unpelletised and pelletised) and three levels of fertilizer application (No fertilizer application, poultry manure (PM) and urea fertilizer). Feed intake was taken, and the goat-bucks were repeatedly weighed weekly in the morning before feeding to monitor weight change. Samples of feed, faeces and urine were subjected to chemical analysis and all data collected were subjected to statistical analysis of variance (ANOVA) using the General Linear Model (GLM) procedure of Minitab 18 Software Package.

Table 1: Gross composition of the experimental diets

Ingredients (%)	NFP	UFP	PMP	NFUP	UFUP	PMUP
Cajanus cajan hay	50.00	50.00	50.00	50.00	50.00	50.00
Rice husk	20.00	20.00	20.00	20.00	20.00	20.00
Wheat Offal	18.00	18.00	18.00	18.00	18.00	18.00
Groundnut cake	10.00	10.00	10.00	10.00	10.00	10.00
Premix	1.00	1.00	1.00	1.00	1.00	1.00
Common Salt	1.00	1.00	1.00	1.00	1.00	1.00
TOTAL	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

RESULTS AND DISCUSSION

The mode of feed presentation to animal is very important in animal feeding and assimilation. Pellets is a form of feed ingredients conservation in a form that is more guaranteed in the level of procurement and continuity of supply to maintain feed quality (Andriyani *et al*., 2021). The mode of

Table 2: Nutrient composition of the experimental diets fed to WAD bucks

	Pelletized			Un-pelletized (Mash)			
Parameters (%)	**NFP**	**UFP**	**PMP**	**NFUP**	**UFUP**	**PMUP**	**SEM±**
Dry matter	93.94^{a}	93.31^{a}	94.00^{a}	87.14^{c}	85.89^{c}	89.01^{b}	0.83
Crude protein	22.58^{b}	27.26^{a}	23.42^{b}	21.93^{b}	26.03^{a}	22.84^{b}	0.50
Crude fibre	24.76^{d}	21.57^{e}	34.92^{b}	33.61^{b}	30.63^{c}	39.86^{a}	1.50
Ether extract	3.76^{c}	2.53^{d}	2.83^{d}	5.98^{a}	4.01^{bc}	4.72^{b}	0.30
Ash	8.66^{a}	8.83^{a}	9.31^{a}	4.56^{c}	5.94^{b}	6.67^{b}	0.45
Neutral detergent fibre	54.88^{c}	44.15^{e}	56.62^{b}	56.91^{ab}	46.22^{d}	58.32^{a}	1.38
Acid detergent fibre	36.97^{a}	27.52^{b}	26.78^{b}	37.24^{a}	28.11^{b}	27.23^{b}	1.12
Acid detergent lignin	16.34^{ab}	13.41^{de}	12.98^{e}	17.40^{a}	15.00^{bc}	14.57^{cd}	0.40

^{abc}*Mean values within rows with different superscripts are significantly different (p<0.05).*

presentation (pellet/ mash) had significant effects on all the parameters determined on the chemical composition of the experimental diets as DM of pellets were higher than the mash, this is in agreement with the findings of Oyaniran *et al.* (2018), higher DM enhanced average daily feed intake, rumination and digestion, and consequently promoting average daily gain of the animal (Li *et al.,* 2021). The highest CP content was observed in UFP which was also similar to UFUP, the high CP content of UFP and UFUP may be as a result of the nitrogen content of urea (46%), which was applied

to the soil and absorbed by the forages. All the CP content recorded for both mash and pellets were above the 7-8% range for optimum functioning of the rumen microorganisms for maintenance and 10% for production (NRC, 2007), This implies that the crude protein was adequate and would support effective rumen activities, maintenance and production of the animals. The fibre content in diet is an essential component of ruminant's diets which must be adequate to support rumination and balance microbial ecology. The CF contents of the diets were adequate to support the digestion of nutrients mediated through mastication, microbial fermentation in the rumen, and rate of passage in the gastro-intestinal tract (Li *et al.,* 2021). NDF is an indicator of fibre content of ruminant feed that plays a major role in the digestive process as it affects feed intake, rumen fermentation, and nutrient utilization, feeding behavior, and production performance (Shi *et al*., 2023). Ahmed *et al.* (2020) investigated the effect of complete pellet feed on commercial goat production under the stall-feeding system in Bangladesh and found out an increase in the nutrient intake of pellets, which agrees with the findings in this study. However, fertilizer type had no significant (P>0.05) effect on the intake and energy content, although bucks fed PM *Cajanus cajan* hay-based diet had the highest DMI (286.58 g/day). The high voluntary DMI could be as result increased surface area of the ingredients due to grinding and pelleting which reduces segregation, reduces dustiness and wastage of feed, thereby preventing selective feeding, improving the chance of feeding a whole and balanced diet (Malik *et al.,* 2021).

Table 3: Nutrient intake (g/day) by WAD bucks fed experimental diets

SOV				DM	CP	CF	EE	Ash	NDF	ADF	ADL
Fertilizers	NF			273.98	67.01^{b}	84.70^{b}	13.89^{a}	21.18^{c}	167.10^{b}	111.28^{a}	50.29^{a}
	UF			274.75	80.13^{a}	74.95^{c}	9.27^{c}	23.09^{b}	136.76^{c}	83.00^{b}	41.95^{b}
	PM			286.58	70.14^{b}	111.17^{a}	10.70^{b}	25.15^{a}	178.38^{a}	81.46^{b}	41.04^{b}
	SEM			4.74	1.31	1.71	0.21	0.39	1.72	1.47	0.76
Feed Forms	Pellet			347.31^{a}	90.45^{a}	100.60^{a}	11.25	33.11^{a}	192.33^{a}	112.54^{a}	52.71^{a}
	Mash			209.65^{b}	54.40^{b}	79.95^{b}	11.32	13.17^{b}	129.17^{b}	71.30^{b}	36.14^{b}
	SEM			3.87	1.07	1.39	0.17	0.32	1.41	1.20	0.62
Fertilizer x Feed Forms	Diet 1	NF	P	343.49^{a}	82.56^{b}	90.53^{b}	13.75^{a}	31.66^{b}	200.67^{b}	135.18^{a}	59.75^{a}
	Diet 2	UF	P	343.54^{a}	100.36^{a}	79.42^{c}	9.31^{c}	32.51^{b}	162.55^{c}	101.32^{b}	49.37^{b}
	Diet 3	PM	P	354.89^{a}	88.42^{c}	131.84^{a}	10.68^{b}	35.15^{a}	213.76^{a}	101.10^{b}	49.01^{b}
	Diet 4	NF	U-P	204.47^{b}	51.45^{e}	78.86^{c}	14.03^{a}	10.70^{e}	133.54^{e}	87.38^{c}	40.83^{c}
	Diet 5	UF	U-P	206.21^{b}	59.89^{d}	70.48^{d}	9.23^{c}	13.67^{c}	110.97^{f}	64.68^{d}	34.52^{d}
	Diet 6	PM	U-P	218.26^{b}	51.86^{e}	90.50^{b}	10.71	15.14^{c}	143.01^{d}	61.82^{d}	33.08^{d}
	SEM			16.92	4.64	4.89	0.48	2.46	8.86	6.08	2.28

^{abc}Means within the same column with different superscripts are significantly different (P<0.05). SOV: Sources of variation; NF: No fertilizer; UF: Urea-fertilized; PM: Poultry-manured; P: Pelletized; U-P: Un-pelletized; NDF: Neutral detergent fibre; ADF: Acid detergent fibre; ADL: Acid detergent lignin; DM: Dry matter; CP: Crude protein; CF: Crude fibre; EE: Ether extract

Bucks fed PMP (poultry manure fertilized hay-based pellets) had the highest nutrient intake and this might be as a result of palatability and observed firmness of the pellets which encouraged mastication. Bucks fed PMP had the highest weight gain and best FCR; this might be attributed to the palatability thereby leading to considerably high DM intake, crude protein intake, better digestibility of the diet and best nitrogen retention value, thus improving microbial population in the rumen, microbial protein availability to the goats and better energy-nitrogen ratio, which consequently improved the growth of the animals, this agreed with the finding of this study and in line with the results of (Omotoso and Arilekolasi, 2019) who reported that weight gain is dependent on dry matter and protein intake and nutrients' digestibility. The difference in FCR obtained may be attributed to influence of fertilizer type and feed forms used, while the best FCR recorded in PMP may be traced to the higher voluntary feed intake, protein quality and improved nutrient digestibility. Consequently, all the goats fed pelletized diets had improved weight gain, nutrient intake and FCR compared to those fed the mash.

CONCLUSION

It could be concluded that; (i) addition of other conventional ingredients to solar dried *Cajanus cajan* hay at 50% inclusion level to produce a complete ration (mash or pellets) contained adequate nutrients required for proper physiological function of growing bucks; (ii) bucks fed *C. cajan* pelletized diets had higher intake of nutrients which resulted to better performance; and (iii) bucks fed PMP (poultry

manure fertilized hay-based pellets) recorded best performance and thereby recommended as off-season feed for ruminants.

Table 4: Performance characteristics of WAD bucks fed experimental diets

Source of variation				Initial wt. (kg)	Final wt. (kg)	Wt. gain (kg)	ADWG (g/d)	FCR
Fertilizers	NF			6.11	8.86	2.75^{b}	32.68^{b}	8.66^{b}
	UF			6.20	8.30	2.10^{c}	25.00^{c}	11.91^{a}
	PM			6.07	9.68	3.60^{a}	42.85^{a}	6.62^{c}
	SEM			0.61	0.58	0.14	1.69	0.66
Feed Forms	Pellet			6.11	9.90^{a}	3.78^{a}	45.04^{a}	8.08^{b}
	Mash			6.14	7.99^{b}	1.85^{b}	21.98^{b}	10.05^{a}
	SEM			0.50	0.47	0.12	1.38	0.54
Fertilizer x Feed Forms	Diet 1	NF	P	6.03	9.68	3.65^{b}	43.45^{b}	7.96^{bc}
	Diet 2	UF	P	6.23	9.21	2.98^{c}	35.48^{c}	9.91^{b}
	Diet 3	PM	P	6.08	10.80	4.73^{a}	56.31^{a}	6.30^{c}
	Diet 4	NF	U-P	6.20	8.04	1.85^{d}	22.02^{d}	9.29^{bc}
	Diet 5	UF	U-P	6.16	7.38	1.22^{e}	14.52^{e}	14.20^{a}
	Diet 6	PM	U-P	6.07	8.55	2.47^{c}	29.52^{c}	7.39^{bc}
	SEM			0.30	0.39	0.29	2.39	0.93

^{abc}Means within the same column with different superscripts are significantly different (P<0.05). NF: No fertilizer; UF: Urea-fertilized; PM: Poultry-manured; P: Pelletized; U-P: Un-pelletized; ADWG: Average daily weight gain; FCR: Feed conversion ratio.

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