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Performance of Uda Rams Fed Graded Levels of Parkia Biglobosa Yellow Fruit Powder (YFP)

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Abstract: *A study was conducted to evaluate the effect of varying levels of Parkia biglobosa yellow fruit powder (YFP) on the performance of Uda rams. The animals were fed diets containing 0, 10, 20 and 30% inclusion levels of P. biglobosa yellow fruit powder (YFP) in a completely randomised experimental design replicated four times. Data were collected for 12 consecutive weeks on feed intake and live weight gain. Results indicated better feed conversion efficiency and growth performance with increase in the level of P. biglobosa YFP from YFP0 to YFP30 (P<0.05). Cost of feed/kg live weight was lower for animals fed diets containing high level of P. biglobosa yellow fruit powder (YFP30) (P<0.05). It was concluded that increasing the level of YFP of Parkia biglobosa as an energy source up to a level of 30% can enhance performance and reduce the cost of sheep production.*

***Keywords*:** *African Locust bean, Feed conversion, live weight gain, Sheep*

I. Introduction

Small ruminants in Nigeria feed mainly on forages and crop residues and are affected by seasonal weight fluctuation [1] . Seasonal availability of production inputs such as feed, water and quality pasture is great constraint to livestock production [2]. According to [3], the scarcity of energy and protein feedstuffs during the dry season is a major set-back to ruminant livestock production in Nigeria. During this period, the available forages are very low in dry matter and crude protein content. These results in a marked decrease in voluntary intake and digestibility [4, 5]. The prices of conventional energy ingredients have rose in addition to increased competition between humans and animals as a result of increased human population [6].

Researchers concentrate on alternative feed sources in order to reduce the cost of livestock production. One of the alternatives are multipurpose tree species (MPTs) in which *Parkia biglobosa*, is classified [7] . *Parkia biglobosa* is a perennial legume tree belonging to the sub-family *Mimosoidae* and family *Leguminosae* [7] . The plant is used as a source of food, medicine and timber with high commercial value [8]. In West Africa, the seeds of *P. biglobosa* provide rich source of vegetable protein for humans and livestock [9]. *P. biglobosa* is usually fermented to a tasty condiment used as a flavour intensifier for soups and stews [8] . The husks and pods are good feed for livestock [10] . The plant is a good source of tannins, saponins, gums, fuel and wood [10] . The seeds of many species of the genus *Parkia* have been investigated for their protein and amino acid contents [11] . The Yellow fruit pulp powder of the *P. biglobosa* is sweet to taste, which indicates the presence of natural sugars making it a potential energy source. The attractive yellow colour indicates presence of carotenoids, an important precursor of vitamin A while the sour taste shows the presence of vitamin C. The use of yellow fruit pulp in some parts of rural Africa as an alternative to grain is an indication of its edibility and non-toxicity [12, 13]. It was reported that the yield of the pods per tree varies between 25 to 52 Kg, seeds 6-13kg and Yellow powder (estimated as yield of pods less seeds) 18 to 37 kg on dry matter basis [14]. This study investigated the effect of graded levels of *Parkia biglobosa* yellow fruit powder (YFP) on the performance of Uda rams in Semi-arid Nigeria.

II. Materials And Methods

2.1 Experimental Site

The study was conducted at the Usmanu Danfodiyo University Livestock Teaching and Research Farm. The farm is located within the main campus of the University at about 10km North of Sokoto Metropolis in Wamakko Local Government area of Sokoto State. Sokoto is located in the Sudano-Sahelian zone in extreme North-Western part of Nigeria. It lies between longitudes $4^{o}8$'E and 6^{o} 54'E and latitudes $12^{o}0$'N and $13^{o}58$'N at altitude of 350m above sea level [15]. The mean annual temperature is 28.3^{o}C (82.9^{o} F). The maximum daytime temperature for most of the year is generally under 40^{o}C (104.0^{o}F). The low humidity of Sokoto state makes the heat bearable. Heat is more severe in the state in March and April. Weather in the state is always cold in the morning and hot in the afternoon except during the hamattan [16] . The rainy season is from late May to October and ranges between 500mm to 700mm. Due to low humidity; Sokoto state is more suitable for livestock production than for any other agricultural activity.

2.2 Sources and Processing of Experimental Feeds

The locust bean powder used in this experiment was purchased from Achida market in the outskirts of the metropolis. The remaining feed ingredients that included maize, rice offal, cowpea husk, premix, bone meal, salt, cowpea haulms, cotton seed cake and salt were purchased from Sokoto Kara market within the metropolis. Maize, cotton seed cake and cowpea hay are crushed to reduce the particle size. The locust bean tree and the various parts used are shown in figs 1- 4.

Fig.1 *Parkia biglobosa* (African Locust bean) Tree

Fig.2 *Parkia biglobosa* (African Locust bean) ripe Yellow pulp

Fig.3 Yellow Powder of *Parkia biglobosa* (African Locust bean) from a ruptured pulp

Fig.4. Displaying Yellow Powder of *Parkia biglobosa* (African Locust bean) from a ruptured pulp

2.3 Experimental Design and Diet Formulation

A completely randomized experimental design (CRD) was used with number of animals representing replication and graded levels of *P. biglobosa* yellow fruit powder (YFP) representing treatments. Four animals were allocated to each treatment each animal serving as replicate. The weight of the animals was balanced between treatments. Each animal was housed in a pen measuring 2m× 1m. Four complete experimental diets were formulated with graded levels of locus bean fruit powder at 0.00, 10.0, 20.0, and 30.0 % inclusion levels. The treatment diets were designated as treatments YFP0, YFP10, YFP20 and YFP30 in the experiments. Each group was assigned to one of the experimental diets and fed *ad libitum* in the morning for 12 weeks. Water was offered *ad libitum.* The gross compositions of the experimental diets are shown in Table 1.

TABLE 1: Gross composition of the experimental diets

Ingredients	**YFP0**	**YFP10**	**YFP20**	**YFP30**
Locust bean	0.00	10.0	20.0	30.0
Maize	17.0	10.0	4.25	0.80
Cowpea husk	7.60	9.60	9.70	9.90
Cowpea haulms	17.2	17.7	17.7	7.50
Rice offal	12.5	5.45	0.15	3.30
Cotton seed cake	42.3	43.8	44.7	45.0
Salt	0.50	0.50	0.50	0.50
Premix	0.50	0.50	0.50	0.50
Bone meal	2.50	2.50	2.50	2.50
Total	100	100	100	100

YFP= Yellow fruit powder

2.4 Experimental animals and their management

The apparently healthy rams were quarantined at the Livestock Teaching and Research Farm Usmanu Danfodiyo University Sokoto. The animals were dewormed with Albendazole^{R} based on the manufacturer's recommendation. The animal pens were cleaned and disinfected prior to the commencement of the experiment. Faeces and urine were removed every day from the pens to ensure adequate hygiene, prevent ammonia accumulation and minimum discomfort of the experimental animals. Feed and water troughs were cleaned every morning before feeding.

2.5 Data Collection

2.5.1 Live Weight

The animals were weighed individually at the beginning of the experiment and every week on the same day of the week using a weighing scale after feed withdrawal for about 14.0 hours to avoid error due to gut-fill. The mean weekly live weight of each treatment group was recorded.

2.5.2 Feed intake

Feed intake was obtained on daily basis by subtracting the left over from the actual quantity offered to the animals the previous day. Adequate measures were taken to avoid feed wastage.

2.5.3 Statistical Analysis

The data collected were subjected to Analysis of variance. Least significant difference (LSD) was used to separate the means. Regression analysis was used to find the relationship between live weight gain, feed

conversion ratio (FCR) and the graded levels of *Parkia biglobosa* yellow fruit powder. The data were analysed using Statview statistical Package [17].

III. Results

3.1 Proximate components of the test ingredient and the Experimental Diets

Proximate composition of the experimental diets showed that crude fibre is higher for treatments YFP0 and YFP10. The dry matter composition of the diets decreases with increase in the level of *P. biglobosa*. NDF, ADF, hemi-cellulose and lignin are higher for treatment YFP0 compared to the other treatments. The values for energy and crude protein were comparable between all the treatments (Table 3). The test ingredient (*P. biglobosa* yellow fruit powder) contained higher energy (more than 2500 ME/Kg) with low crude protein, ash and ether extract contents (Table 2).

TABLE 2: Proximate composition of *P. biglobosa* Yellow fruit powder (YFP)

Parameter	**Composition (%)**
Dry matter	94.89
Moisture	5.11
Crude Protein	5.01
Crude fibre	16.32
Ether extract	0.36
Ash	5.45
NFE	67.75
Energy (Kcal ME/Kg)	2586.07

TABLE 3: Proximate and Fibre components of the experimental Diets

	Treatments			
Parameter (%)	**YFP0**	**YFP10**	**YFP20**	**YFP30**
Dry matter (%)	94.68	94.4	94.4	93.5
Moisture (%)	5.32	5.60	5.59	6.50
Crude Protein (%)	14.3	14.1	14.2	14.3
Crude fibre (%)	21.8	21.9	21.2	19.8
Ether extract (%)	4.42	5.43	4.38	5.63
Ash (%)	11.4	8.29	10.8	9.58
NDF	45.2	44.3	42.0	37.9
ADF	29.6	29.3	29.8	29.1
Cellulose	21.2	21.6	22.1	22.0
Hemicellulose	15.6	14.9	12.2	8.81
Lignin	6.71	6.40	6.47	5.58
Energy (Kcal ME/Kg))	2530	2529	2522	2538

ADF- Acid detergent fibre, NDF- Neutral detergent Fibre YFP- Yellow fruit powder

3.2 Growth performance of Uda rams fed graded levels of *P. biglobosa* fruit powder

Results (Table 4) indicated no difference (P> 0.05) between treatments in dry matter intake, initial and final body weight, live weight gain and feed conversion ratio.

TABLE 4: Growth performance of Uda rams fed graded levels of *P. biglobosa*

Parameter	**Treatment**					
	YFP0	**YFP10**	**YFP20**	**YFP30**	**SEM**	**Prob.**
Average daily dry matter Intake (kg)	1.71	1.75	1.78	1.72	0.05	0.703
Initial body weight (kg)	31.0	31.0	31.5	31.0	2.29	0.902
Final body weight (kg)	49.3	49.5	52.3	52.3	2.58	0.947
Weight gain (kg)	18.3	18.5	20.8	21.5	1.08	0.651
Average daily weight gain (g/day)	217	220	247	256	12.9	0.879
Feed conversion ratio	8.04	7.97	7.24	6.80	0.42	0.922
Heart girth (cm)	89.1	89.5	90.2	92.6	3.99	0.624
Body length (cm)	66.1	63.3	63.0	64.4	1.49	0.581
a,b,c means in the same row with different superscripts are significantly different (P<0.05) YFP= Yellow fruit powder						

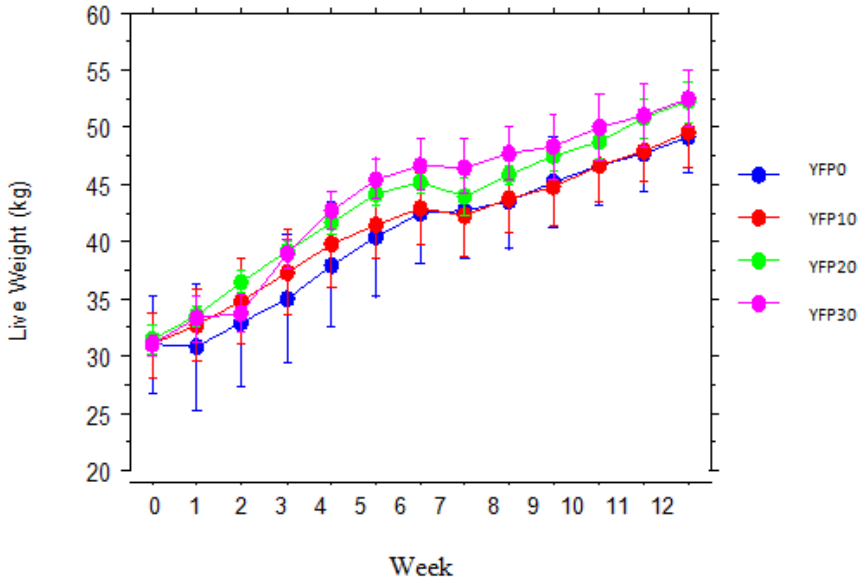
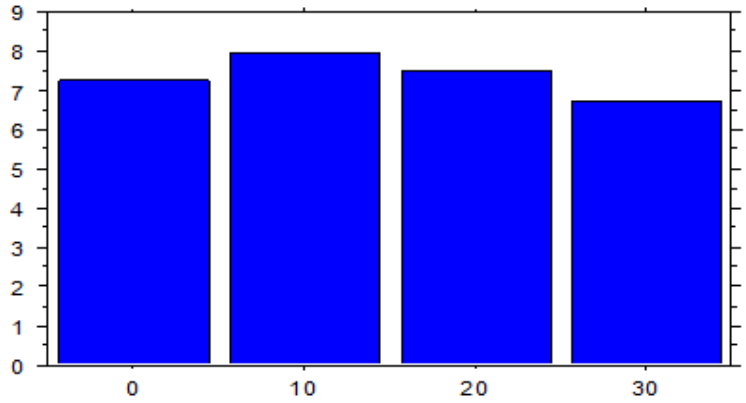


Fig 6. Live weight changes of Uda rams fed graded levels of *Parkia biglobosa* yellow fruit powder (YFP)

Fig 6 indicated no significant difference (P>0.05) in the live weight of the animals at the beginning of the experiment. There was a drop in live weight of animals in treatment YFP0 at the second week of the experiment and for all the treatment at week 7 of the experiment. The figure indicates a steady increase in live weight gain from week 7 to the end of the experiment. Animals placed on treatments YFP20 and YFP30 showed higher live weight at the end of the experiment (P<0.05). Treatments YFP0 and YFP10 are the same (P>0.05) in final live weight (P>0.05).

Feed conversion ratio and live weight gain (g/day) indicated an increased performance with increased level of *P. biglobosa* yellow fruit powder (P<0.05) (fig. 7 and 8) with animals in treatments YFP20 and YFP30 showing a better response compared to other treatments (Tables 5 and 6)

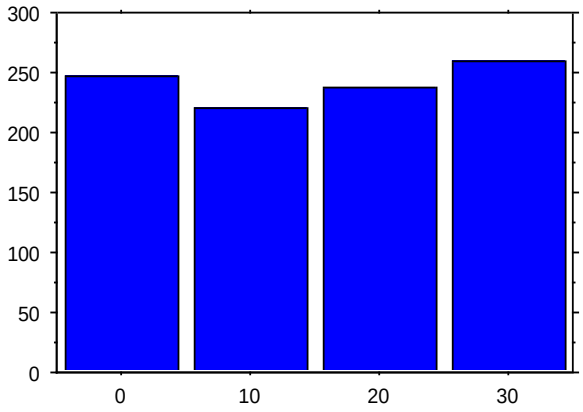


Inclusion level of locust bean yellow fruit powder (%)

Fig. 7. Effect of graded levels of *P. biglobosa* fruit powder on FCR

TABLE 5: Effects of varying levels of Locust bean yellow fruit powder (YFP) (%) on Dry matter conversion

Treatment comparison	Difference	Critical difference	Prob.	Sig.
YFP0,YFP10	-.726	.838	.0834	NS
YFP0,YFP20	-.244	.905	.5684	NS
YFP0,YFP30	.505	.795	.1917	NS
YFP10,YFP20	.483	.905	.2679	NS
YFP10,YFP30	.231	.795	.0055	S
YFP20,YFP30	.749	.866	.0840	NS



Inclusion level of locust bean yellow fruit powder (%)
Fig 8. Effect of graded levels of *P. biglobosa* YFP on Daily gain (g/day)

Table 6: Effects of varying levels of Locust bean yellow fruit powder(YFP) (%) on live weight gain

Treatment comparison	Difference	Critical difference	Prob.	Sig.
YFP0,YFP10	26.8	37.6	0.147	NS
YFP0,YFP20	8.93	40.6	0.641	NS
YFP0,YFP30	-12.5	35.7	0.460	NS
YFP10,YFP20	-17.9	40.5	0.358	NS
YFP10,YFP30	.-39.3	35.8	0.0337	S
YFP20,YFP30	-21.4	38.9	0.253	NS

Regressing Average daily gain (ADG) on graded levels of YFP indicated that a daily gain of 213g/day for treatment 0%YFP, unit increase in ADG will require additional level of 1.4% YFP (Fig. 9). Conversely, feed conversion ratio (FCR) decreased with increased level of YFP (fig. 10).

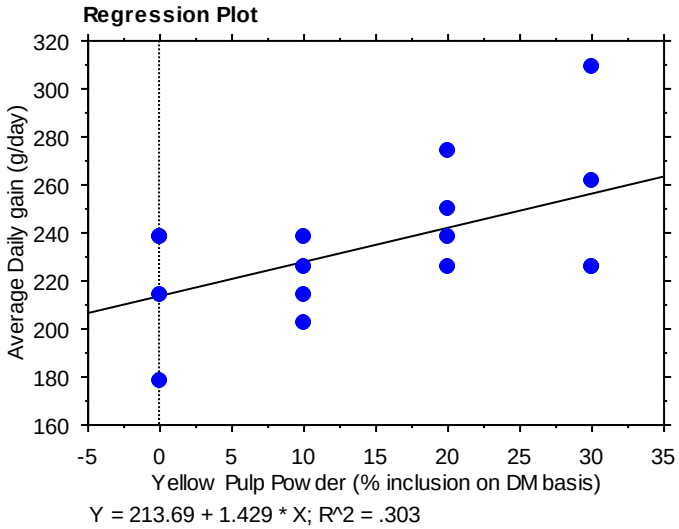


Fig 9. Regressing ADG on % inclusion of YFP

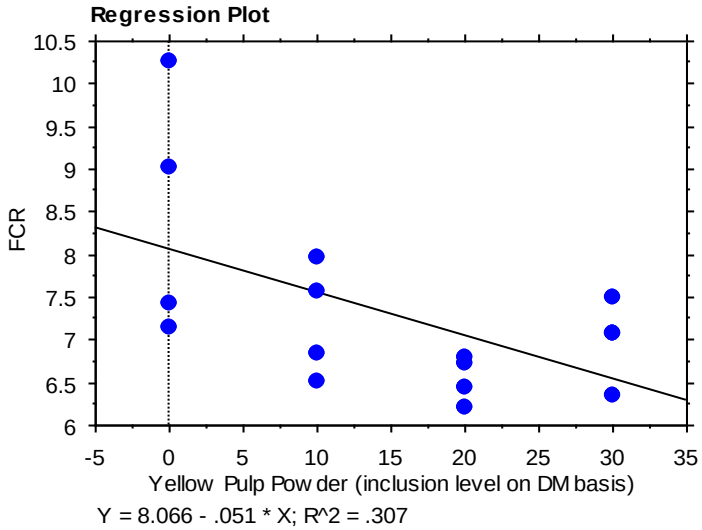


Fig 10. Regressing FCR on % inclusion of YFP

3.3 Cost feed consumed and cost of feed/ kg live weight

Cost of feed consumed/kg decrease with increase in level of *P. biglobosa* from treatment YFP0 to treatment YFP30. Total cost of feed consumed and cost of feed/kg live weight was lower for animals fed diets containing higher levels of *P. biglobosa* yellow fruit powder (YFP30) (P<0.05) (Table 7).

TABLE 7. Cost feed consumed and cost of feed/ kg live weight

Parameter	Treatment YFP0	YFP10	YFP20	YFP30	SEM	Prob.
Cost of feed/kg (₦/kg)	70.3	68.9	66.0	58.4	-	-
Total cost of feed consumed (₦)	10108[a]	10131[a]	9874[a]	8451[b]	278	0.00133
Cost of feed/kg live weight (₦/kg LW)	565[a]	549[a]	478[ab]	397[b]	28.0	0.00653
a,b,c means in the same row with different superscripts are significantly different (P<0.05) YFP- Yellow fruit powder						

IV. Discussion

4.1 Proximate and fibre constituent of diets and the test ingredient

The crude protein content is within the recommended values required for optimum microbial activity in the rumen. The values are above the 10-12% required for growth in sheep as outlined by [18]. Crude fibre, NDF, ADF, Hemi-cellulose and lignin decreased with increase in the inclusion level of *P. biglobosa* fruit powder due to less fibre content of *Parkia biglobosa* yellow fruit powder as observed by [19]. Decrease in the level of cowpea hay from YFP0 to YFP30 could also be responsible for the decreased fibre level. Digestible carbohydrate content of the test ingredient was similar to 67.3 % reported by [19] Gernah et al (2007). In addition, it was indicated by [10] and [20] that yellow fruit powder contains more fermentable carbohydrate than the seeds. Higher digestible carbohydrate contents might be responsible for high metabolisable energy content of the YFP (Table 2). Because of its carbohydrate content, the African locust yellow fruit pulp has been considered as a potential energy source [21]. The crude fibre content is higher than the value obtained by [19] but lower than those obtained from the seeds as observed by [20].

4.2 Growth performance of Uda rams fed graded levels of *P. biglobosa* fruit powder

Increased live weight gain and better feed conversion is a good indication of better utilisation of the test ingredient (*P. biglobosa* yellow fruit powder) by the experimental animals. Average Daily Body weight gain reported in this study was above those observed by [22] when they fed graded levels of *P. biglobosa* to Yankasa rams. The observed differences could be due to breed and age differences. Efficient utilization of feeds supplying energy on growth performance in ruminants was reported [23]. Increased level of YFP further showed better ADG and feed conversion efficiency (figs 9 and 10) of the animals. These confirm the report of [10] and [20] that high soluble carbohydrates contained in the YFP of *P. biglobosa* enhances rapid growth rate in livestock. The increase in dry matter intake from YFP0 to YFP30 further supports the trend in growth performance. The DM intake is higher than the values reported for sheep by [24].

4.3 Cost of feed consumed and cost of feed/kg live weight

Cost of feed/kg decreases from treatment YFP0 to YFP30 because of increase in the inclusion level of *P. biglobosa* fruit powder. Cost of feed consumed was significantly higher for the control (YFP0) because of high cost of feed/kg observed for the treatment. Cost of feed/kg live weight was lower for animals fed diet containing higher levels of *P. biglobosa* yellow fruit powder (YFP30) because of lower cost of feed/kg and total cost of feed consumed. This shows that inclusion of YFP of *P. biglobosa* can reduce the cost of livestock production. Cost of feed/kg live weight is an important economic indicator in sheep production [25].

V. Conclusion

It was concluded that yellow fruit powder of *Parkia biglobosa* can replace other energy sources such as maize in fattening small ruminants.

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