BIO-ECONOMICS OF FEEDING SWEET POTATO MEAL AND ITS WHOLE MEAL TO WEANER RABBITS

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ABSTRACT
An experiment was conducted to evaluate the bio-economics of feeding sweet potato and its whole meal to weaner rabbits. Thirty weaner rabbits averaging 0.35 kg were randomly allotted to 5 treatment groups in a completely randomized design. Each treatment group was replicated 3 times. Sweet potato meal and its whole meal replaced maize at 20 % inclusion level. Treatments 1, 2, 3, 4, and 5 contained the control, sundried sweet potato meal (SSPM), Boiled sweet potato meal (BSPM), whole sundried sweet potato (WSSPM), and whole boiled sweet potato meal (WBSPM), respectively at 20 % levels of inclusion. The weaner rabbits were fed *ad-libitum* throughout the experimental period. Significant differences were observed for growth performance of the rabbits in average daily weight gain, average daily feed intake and feed conversion ratio in the weaner rabbits using sweet potato and its whole meal. Significant differences ($P<0.05$) were also observed in bio-economics of production of weaner rabbits using the test diets. The cost per kg feed, cost of total feed consumed per rabbit and cost per kg weight gain of the rabbits fed the test diets were significantly lower than the control diet. For gross margin, CSSPM and CBSPM were the same but significantly higher than the control. It was concluded that using sweet potato and its whole meal can be a good feeding method in rabbit production.
Key words : Alternative Feed Stuff, Effect, Sweet Potato Meal, Weaner Rabbits

Introduction:

Sweet potato (*Ipomoea batatas* (L) Lam) is a tropical crop with a relatively short vegetative cycle, the tubers of which are usually for both human and animal consumption (Woolfe, 1992). Sweet potato is now used mainly as feed for animals. Both forage and tuber have been used widely as an alternative feed for livestock in tropical countries. The roots have low protein, fat and fibre content, but high nitrogen-free extract, which thus indicates their potential value, mainly as an energy source. The vines have low carbohydrate content but are higher in fibre and protein, and their principal value is as a source of vitamins and protein.

The chemical composition of the leaves, stems and tubers varies depending on the time of harvesting as well as on genotypic differences. The leaves have superior contents of DM and CP compared with stems (An, 2003). Crude protein content in DM of sweet potato vines ranges from 16% to 29% (Dung, 2001),

There is competition between man and livestock for maize in Nigeria. Maize serves as a staple food for Nigerians and also as good energy source for livestock. Due to this competition and its scarcity as a result of low production level in Nigeria (Durunna et al., 2000) maize is costly resulting in high cost of livestock feeds. Maize is the major source of energy in monogastric animals' feeds become of its high starch content giving it about 3400 kcal/kg feed metabolisable energy (Olomu, 1995).

If the problem of low protein intake of Nigerians, which is less than the recommended 35g/head/day (FAO, 1982) is to be solved through accelerated animal production, there is the need to replace maize with alternative feedstuff such as sweet potato meal processed in different forms, sun-dried Sweet Potato Meal (SSPM), Boiled Sweet Potato Meal (BSPM), Whole Sun-dried Sweet Potato Meal (WSSPM), Whole Boiled Sweet Potato Meal (WBSPM). These could be considered as alternatives to maize in formulating diets for monogastric animals especially rabbit because it is relatively less costly than maize. Maize a conventional feed ingredient is very expensive and contributes to high cost of animal products, consequently discouraging livestock farmers from venturing into the enterprise. Rabbit being a white meat of low cholesterol content and highy prolific is highly desired for meat by many people in Nigeria.

Njike (1998) reported that for Nigeria to be able to meet up with its protein intake requirement, there should be increased production of animal protein annually. Rabbits are the most favourable choice to meet the protein needs of Nigerians. They are highly prolific, have short gestation period, and grow very fast with high feed conversion efficiency and provide quickest return on investment (Aduku and Olukosi, 1990). This informs the choice of rabbit as experimental animal for this trial,

The objective of this study was to determine the effect of sweet potato meal and Whole sweet potato meal based diets on performance of weaner rabbits and the economics of production of rabbits fed such diets.

Materials and Methods

The experiment was carried out at the Rabbitry unit of National Root Crops Research Institute, Umudike. The sweet potato used in this study was also obtained from this same institute. The sweet potato was harvested washed and divided into four parts. One part was chipped, sun-dried and then milled (sun-dried Sweet Potato Meal) (SSPM). The second part was boiled, chipped, sun-dried and then milled (Boiled sweet potato Meal) (BSPM). The third part was chipped, sun-dried milled and then mixed with milled sun-dried sweet potato leaves at the ratio of

5:3 (whole sun-dried Sweet potato Meal) (WSSPM). The fourth part was boiled, chipped, sun-dried milled and then mixed with milled sun-dried sweet potato leaves at the ratio of 5:3 (whole Boiled Sweet Potato Meal) (WBSPM). The resulting samples which partially replaced maize in the diets at 20% levels in treatments 2, 3, 4 and 5 were then incorporated into the diets, which was presented as mash. While treatment 1 (control) is a maize based diet that contain no sweet potato.

Samples of the feedsfed were collected and analysed for their proximate compositions according to AOAC (1990) methods.

Experimental Animals

Thirty weaner rabbits averaging 0.35kg were randomly allotted into five treatment groups of six (6) rabbits each. Each treatment group was replicated thrice with two (2) rabbits (male and female) per replicate. The groups were randomly assigned to five (5) isocaloric and isonitrogenous diets in completely randomized design (CRD), five (5) experimental diets were formulated such that Treatment 1 (control) contained no sweet potato meal, Treatment 2 contained sun-dried sweet potato meal (SSPM), Treatment 3 contained boiled sweet potato meal (BSPM), Treatment 4 contained whole sun-dried sweet potato meal (WSSPM) and Treatment 5 contained whole boiled sweet potato meal (WBSPM) Other fixed ingredients were added to meet the needs of weaner rabbits for vitamins and minerals. All experimental rabbits were given feed and water ad-libitum. Records of mean final weight gain, average daily weight gain, average daily feed intake, and feed conversion ratio were taken. The experimental diets were fed for 10 weeks.

Economics of the diets

Economics of the diets were determined as described by Ukachukwu and Anugwa (1995), and modified by Ekwu (2008). It involves:

$$\text{Cost/kg feed} = \frac{\text{total cost of producing 100kg of feed}}{100}$$

Cost of feed consumed ($\underline{N}$)= cost/kg of feed X total feed consumed

Cost/kg weight gain = cost/kg of feed X feed conversion ratio

Revenue = Price of 1kg meat X mean weight gain

Gross margin = Revenue – cost of production

Data analysis

The data collected on performance and parameters of economics of production were subjected to analysis of variance (ANOVA) and means separated where there were significant differences by Duncan multiple range-test as outlined by steel and Torrie (1980). The package used was SPSS.

Table 1: Percentage Composition of Experimental Diets

INGREDIENTS	T1 Control	T2 SSPM	T3 BSPM	T4 WSSPM	T5 WBSPM
Maize	32.00	12.00	12.00	12.00	12.00
Sun-dried sweet potato Meal (SSPM)	-	20.00	-	-	-
Boiled sweet potato Meal (BSPM)	-	-	20.00	-	-
Whole Sun-dried sweet potato Meal (WSSPM)	-	-	-	20.00	-
Whole Boiled Sweet Potato Meal (WBSPM)	-	-	-	-	20.00
Wheat offal	50.00	50.00	50.00	50.00	50.00
Groundnut meal	14.20	14.20	14.20	14.20	14.20
Bone Meal	3.00	3.00	3.00	3.00	3.00
Salt	0.50	0.50	0.50	0.50	0.50
Vit.min. premix	0.30	0.30	0.30	0.30	0.30
Total	**100**	**100**	**100**	**100**	**100**
Calculated Composition					
Crude protein (%)	18.09	17.83	17.80	17.93	17.84
Crude Fibre (%)	3.35	5.75	6.75	6.55	6.35
Energy(ME/Kcal)	2409	2206	2204	2202	2205

Table 2: Proximate Composition of Sweet Potato Meal and Whole Sweet Potato Meals

Nutrients (%)	SSPM	BSPM	WSSPM	WBSSM
Crude Protein(CP)	8.68	8.53	9.19	8.75
Crude Fibre(CF)	8.16	6.75	9.90	9.10
Ether Extract(EE)	9.19	8.00	9.00	10.55
Nitrogen Free Extract (NFE)	64.78	60.50	69.00	69.25

Results and Discussion

Growth Performance of the Weaner Rabbits

The growth performance (Table 3) showed significant differences ($p<0.05$) among the treatments for average daily weight gain, average daily feed intake and Feed conversion ratio. There was a significant difference among the treatments for average daily weight gain. Treatment 5 (WBSPM) (18.13 g) was similar ($P>0.05$) to treatment 1 (control) (18.47 g) but significantly ($P<0.05$) higher than treatment 4 (WSSPM) (17.89 g) which was also higher than treatments 3 (BSPM) (16.09 g) and 2 (SSPM) (16.33 g) that were similar ($P>0.05$). The average daily weight gain of the rabbits fed whole boiled sweet potato meal based diet (WBSPM) compared very well with that of the control diet. Since raw sweet potato tubers contain medium levels of trypsin inhibitors that are sufficient to decrease protein digestibility (Bradbury *et al*., 1992) which could consequently affect the weight gain of the rabbits. Moist heat treatment are effective in eliminating trypsin inhibitor activity in sweet potato (Zhang *et al*.,2001) therefore, the significant value observed in treatment 5 could be as a result of better detoxification occasioned by the processing method and also the leaves incorporated in the diet that encouraged better nutrient availability.

Table 3: G**rowth Performance of Weaner Rabbits fed differently processed sweet potato Meal based diet**

PARAMETERS	TREATMENTS				
	(T1) CONTROL	(T2) SSPM	(T3) BSPM	(T4) WSSPM	(T5) WBSPM
Mean initial live weight (kg)	0.35	0.35	0.34	0.36	0.36
Mean final live weight(kg)	1.65[a]	1.50[b]	1.46[c]	1.61[a]	1.63[a]
Average Daily weight gain(g)	18.47[a]	16.33[c]	16.09[c]	17.89[b]	18.13[a]
Average Daily feed intake(g)	50.00[a]	43.00[c]	42.00[d]	45.00[b]	45.00[b]
Feed conversion ratio	2.70[a]	2.62[b]	2.67[a]	2.54[c]	2.47[d]

Letters with different superscripts are significantly different from each other

Significant differences ($p<0.05$) were observed for average daily feed intake. Treatment 1 (control) (50 g) was significantly higher than treatments 4 (WSSPM) (45 g) and 5 (CBSPM) (45 g) that were similar ($P>0.05$) but higher ($P<0.05$) than treatments 2 (SSPM) (43 g) and 3 (BSPM) 42 g that were themselves different ($P<0.05$). The higher feed intake values observed in treatments 4 (WSSPM) and 5 (WBSPM) could be as a result of leaves incorporated in the diets. This agrees with the report of Olorunnisomo (2007) mixing sweet potato forage and roots resulted in better intake and weight gain.

The feed conversion ratio (FCR) shows significant differences ($P<0.05$) treatment means and varies from 2.70 to 2.47 with the control diet (treatment 1) having the poorest value (2.70) and the WBSPM (treatment 5) having the best value 2.47. The best value observed for WBSPM could be as a result of the method of processing and leaf meal included in the diet. This agrees with the report of Hoang *et al.* (2004) that root mixed with vine meal at ratio 1:1 improves feed efficiency.

Economics of Production of the Weaner Rabbits

Significant differences ($p<0.05$) were observed for all the parameters of bio-economics of production among the treatments means (Table 4). The values of cost per kg feed, cost of total feed consumed per rabbit and cost/kg weight gain followed the same pattern, treatment 1 (control) was significantly higher ($p<0.05$) than treatments 2, 3, 4 and 5 which were themselves similar ($P>0.05$). The costs observed in treatments 2, 3, 4 and 5 were lower than that of the control diet. This is in line with the report of Ukachukwu and Anugwa (1995) that least cost feed formulation seeks to achieve cost input minimization and output maximization.

No significant difference ($p>0.05$) was observed for Revenue among the treatment means (Table 4). Treatments 2 (₦297.26), 3 (₦292.93), 4 (₦325.86) and 5 (₦330.20) were comparable to the control diet (₦336.26). In terms of gross margin, treatments 4 (₦193.06) and 5 (₦196.76) were similar ($P>0.05$) but significantly higher ($p<0.05$) than treatment 1 (₦117.39) however, they are slightly similar to treatments 2 (₦180.66) and 3 (₦168.86). Treatments 4 (WSSPM) and 5 (WBSPM) yielded better economic gains.

Table 4: Bio- economic of Production of Weaner Rabbits Fed Sweet Potato meal and composite Sweet Potato Meal Based Diets.

Parameters	T1 Control	T2 SSPM	T3 BSPM	T4 WSSPM	T5 WBSPM
Cost/kg Feed(₦)	66.O6[a]	42.06[b]	42.20[b]	42.16[b]	42.36[b]
Cost of Total Feed Consumed/ rabbit (₦)	218.87[a]	116.60[b]	124.06[b]	132.80[b]	133.43[b]
Cost/kg weight gain (₦)	178.36[a]	110.47[b]	112.81[b]	107.22[b]	104.91[b]
Revenue(₦)	336.26	297.26	292.93	325.86	330.20

Gross Margin(₦)	117.39[b]	180.66[ab]	168.86[ab]	193.06[a]	196.76[a]

CONCLUSION AND RECOMMENDATION:

Treatment 5 (WBSPM) gave a better average daily weight gain and feed conversion ratio than other experimental diets which suggests it to be superior to other experimental diets. Using sweet potato and whole sweet potato meal can be good feeding method in rabbit production since it is a low cost feedstuff that yielded revenue and gross margin that is comparable to that of the control diet. Therefore, use of sweet potato meal and whole sweet potato meal based diet should be encouraged in rabbit production in order to maximize profit.

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