

Replacement of Dry *Senna obtusifolia* for Wheat Offal in the Diets Of Chinchilla Rabbits: An Indirect Biological Control Of *Senna obtusifolia* Weed

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Abstract: A total of twelve eight weeks old Chinchilla rabbits of mixed sexes (6 bucks and 6 does) were used to evaluate the effect of replacing wheat offal with dry *Senna obtusifolia* in rabbit diets on rabbit growth performance and feed cost in a Completely Randomized Design (CRD). Three rations were formulated using, 0, 15 and 30 percent *Senna obtusifolia* to replace wheat offal in the rations. The rabbits were randomly divided in to three treatment groups; 1, 2 and 3, having four (2 bucks and 2 does) rabbits each. Each treatment group was further subdivided in to four replicates. The twelve rabbits were reared for eight weeks. They were fed and watered ad libitum. Data collected were subjected to one-way Analysis of variance. The results obtained revealed significant ($p < 0.05$) differences in all parameters considered. The rabbits fed 30% *Senna obtusifolia* had the highest final average weight of 1682.20g/rabbit, the highest average weight gain of 27.60g/rabbit /day, and the highest average feed intake of 77.60g/rabbit/day. There was neither ill health nor mortality figure in all the three rabbit treatment groups. More so, cost of feed/kg was reduced by 26.18%. It could be concluded from the results of this trial that dry *Senna obtusifolia* could replace up to 30% of wheat offal in chinchilla rabbit diets without detrimental effects on health and growth performance of the animals, and rabbits could be employed as an indirect biological method of controlling *Senna obtusifolia* weeds.

Keywords: diet, feed cost, growth performance, rabbit, *Senna obtusifolia*, wheat offal.

I. Introduction

Soaring livestock feed prices have triggered increase in cost of livestock management and rabbit management in particular. This phenomenon is manifested in the poor health (malnutrition) of people in developing countries due to low daily protein intake. Rabbit entrepreneurship is a reliable profit making business with high job opportunities for millions of unemployed youths in Africa. Nevertheless, feeding the rabbit remains the most limiting factor that determines profit level of the rabbit entrepreneur. This is much connected with the fact that rabbit feed ingredient (wheat offal-industrial product) is being competed for with other livestock, such as chickens, fish, sheep, goats, cattle, camel, and ducks. Rabbit meat is high in protein and low in fat, cholesterol, and sodium when compared to most of the meats in the world (Lukefahr, 1993). Countries with the highest production of rabbit meat are Italy, France, the former Soviet Union, China and Spain (Anne, 2005). Rabbit is prolific in nature and meat has great potential to meet the demand (nutrition need) of the people in developing countries and could be promoted in the developed countries as a healthful, natural meat and a small asset. Rabbits are sensitive to diet and the environment; rabbits eat only plants and are classified as non-ruminant herbivores (Anne, 2005). Rabbits are usually fed a commercial pelletized diet that is balanced in the necessary nutrients (protein, energy, vitamins and minerals). It is difficult to raise rabbits solely on greens-fresh grasses or legumes because they are not nutrient-dense. The over feeding of fresh greens may also cause indigestion (Anne, 2005). Rabbit rations should be made with high-fibre ingredients such as dehydrated alfalfa, soybean hulls, wheat offal and oats offal. Long –stem fiber be offered to rabbit to reduce boredom and support proper digestive function (American ranch, 2015). The Chinchilla rabbit was originally bred in France as a fur and meat animal, and was introduced to America in 1919. It is a medium breed with dark color at the base, ears with distinctive black lacing and fur is very dense (www.pests4).

Senna obtusifolia (L) Irwin and Barneby (1982) is a world notorious weed. Weeds are plants that grow where they are not wanted. The plant *Senna obtusifolia* belongs to the kingdom plantae, family fabaceae. A common annual legume plant grows wild in Northern Nigeria. Between October 2015 and March 2016, few towns in a state out of nineteen Northern states in Nigeria informally exported 790 tons of *Senna obtusifolia* seeds worth \$246,875 to other countries. The plant is considered a serious weed to farmers and agriculturists in many places in Nigeria. Older leaves of *Senna obtusifolia* if eaten frequently or in large quantities will cause diarrhea (Irwin and Barneby 1982). *Senna obtusifolia* is found in cropped land, pastures, roadsides, waste land, woodland and natural grasslands. It grows in a range of soil types, including heavy-textured and well aerated or sandy soils. In Georgia, USA, *Senna obtusifolia* was identified as the most troublesome weed statewide

averaged over all crops. It was present in all crops surveyed and across the state's climate gradient. If Senna obtusifolia is left uncontrolled for 2 – 4 weeks after planting, crop yields are drastically reduced (Irwin and Barneby 1982). Control of Senna obtusifolia is difficult and can be obtained only with a sustained combination of all available methods including herbicides. Apart from "America sicklepod" and "Chinese senna", Senna obtusifolia has a wide range of common names. It is also known in English as Foetid sassa or Cassia, Sickle Senna, Coffeeweed or Arsenic weed, coffee pod or java bean. Names in its native/local range are also including: Chinese – juemingzi, Japanese – ebisu-gusa, Portuguese – fedegoso (Irwin and Barneby, 1982) and in Northern Nigeria – "tafasa". Ismaila et al (2011) reported that dry Senna obtusifolia leaves indigenous to Mubi, Gongola state Nigeria contained 5.2 percent crude protein, 2.6 percent crude fibre, mineral elements such as calcium, copper, sodium and manganese and some anti nutritional factors like tannis, alkaloids, saponins and steroids. Senna obtusifolia grows in sub Saharan African. People in Northern Nigeria, Ethiopia, Sudan and Ghana eat the dry leaves of Senna obtusifolia, but animals in these places do not, possibly because of presence of some anti nutritional factors in the plant (Becker, 1986). Cattle will not eat on the growing plant of Senna obtusifolia although, they will eat it in silage and also the dry seed pods (Cock and Evans, 1984) . Ismaila (2011) recommended further research in to the use of Senna obtusifolia as food, medicine and livestock feed.

1.1 Significance of the trial

Protein is incredibly important in human diet. If we don't get enough from the diet, human health and body suffer. The essence of rabbit domestication is mainly for protein and income generation. Rabbit is an herbivorous rodent, that is, plant is the most important ingredient in rabbit feeding. Senna obtusifolia is a world notorious freely growing legume weed mostly controlled by the use of expensive herbicides, which are harmful to human health and dangerous to the environment. Feeding constitutes a major capital expenses in rabbit farming business. Therefore, there is the need for a trial on the use of Senna obtusifolia as plant fibre source in rabbit feed.

1.2 Aim of the trial:

The aim of the trial is to evaluate the replacement value of dry Senna obtusifolia for wheat offal in rabbit diets on Chinchilla rabbit's growth performance and feed cost.

1.3 Trial objectives:

Specifically, the trial sought to:

- i. To determine the level to which Senna obtusifolia can replace wheat offal in rabbit diet
- ii. To assess the effect of shade dried Senna obtusifolia on health and growth performance parameters of Chinchilla growing rabbits
- iii. To encourage rabbit farming business by reducing rabbit feed prices.

1.4 Trial hypothesis:

Ho: Hypothesis is tested at 0.05 level of significance.

Hoi: There is no significant difference in the mean final live weight gain of Chinchilla rabbits fed conventional source of fibre-wheat offal and rabbits fed non conventional source of fibre-Senna obtusifolia.

II. Materials And Method

2.1 Materials

The materials used for this trial are: twelve rabbit cages, twelve chinchilla rabbits (6 bucks and 6 does), MT-2000g electronic balance, Senna obtusifolia, cutlass, shovel, maize, corn stalk grinding machine, wheat offal, bone meal, premix-vitamins, soy beans, groundnut cake, salt, feeders, water and drinkers.

2.2 Trial location

The trial was carried out between September 2015 and April 2016 at the rabbitry unit of the Department of Agricultural Education, School of Vocational Education, Federal College of Education (Technical) Bichi (F.C.E.T.B), Kano State in the North-West geo-political zone of Nigeria. Bichi lies between latitude $8^{\circ} 14^{\prime} - 12^{\circ} 14^{\prime}$ E and longitude $12^{\circ} 14^{\prime} - 14^{\circ} 13^{\prime}$ N.

2.3 Data collection

The data collected during the trial included, initial body weight, final body weight gain, daily weight gain, daily feed gain, feed efficiency and feed cost/kg of feed (Abdulazeez et al 2014)..

2.4 Collection and treatment of Senna obtusifolia

Fresh seedless Senna obtusifolia weed plants were obtained at the premises of Federal College of Education (Technical) Bichi (F.C.E.T.B) and shade dried for two months in the rabbitry unit of Department of Agricultural Education, F.C.E.T.B, Corn stalk grinding machine was used to crush the whole Senna obtusifolia weed-plants (roots, stems, branches, leaves, seedless pods and flowers) in to particles sizes of between 1mm to 4cm. The essence of shade drying is to eliminate the threat of anti nutritional factors in the Senna obtusifolia.

2.5 Trial treatment diets

Three treatments of complete rabbit diets were formulated; conventional diet with wheat offal as control (treatment one =T1) and treatments two =T2 and three =T3 formulated with non conventional ingredient-*Senna obtusifolia*. Samples of the formulated rabbit diets were analyzed in Kappa Biotechnology Laboratory, Bodija, Ibadan, Oyo State, Nigeria (Tables 1, and 2)

Table 1. Rabbits diets formulations. Treatments (T) Percentage (%) composition of the trial rabbit diets.

Ingredient	T1	T2	T3
Maize	42.0	42.0	42.0
<u>Senna obtusifolia</u>	0.0	15.0	30.0
Wheat offal	30.0	15.0	0.0
Groundnut cake	15.0	15.0	15.0
Soy bean	10.0	10.0	10.0
Lime stone	1.0	1.0	1.0
Bone meal	1.0	1.0	1.0
Salt	0.4	0.4	0.4
Vit +premix	0.3	0.3	0.3
DLMethionine	0.2	0.2	0.2
Lysine	0.1	0.1	0.1
Total	100.0	100.0	100.0
Cal.Metab.ener.Kcal/kg	2700	2629	2627

T 1 = 30% wheat offal, T2 = 15% wheat offal + 15% *Senna obtusifolia*, T3 = 30% *Senna obtusifolia*.

Table 2. Proximate analysis of the treatment trial diets.

Nutrient	T1, composition	T2, composition	T3, composition
%CP	19.0	19.20	19.41
EE %	4.1	4.21	4.3
CF%	21.4	24.6	27.4
Ca%	0.73	0.79	0.93
P%	0.56	0.69	0.75
Moisture %	8.7	8.5	8.1
Ash	7.1	7.4	7.9
Niacin mg/100g	-	0.11	0.11
Alkaloid mg/100g	-	220.0	220.0
Saponins mg/100g	-	110.0	110.0
Tannis mg/100g	-	85.0	85.0

T 1 = 30% wheat offal, T2 = 15% wheat offal + 15% *Senna obtusifolia*, T3 = 30% *Senna obtusifolia*.

2.6 Trial animals – chinchilla rabbits

The twelve chinchilla rabbits used for this trial were purchased at eight weeks of age from a rabbit farmer in Bichi, and nursed further for another two weeks on a common commercial rabbit diet, and this served as a good adjustment period for the rabbits. The rabbits were weighed individually and distributed in to 3 three groups of similar initial weight. Each group of four replicates was allotted one of the treatment diets which contained 0, 15% and 30% of *Senna obtusifolia* respectively. Rabbits were housed individually in cages in complete randomization. Each rabbit was supplied 200g of the treatment diet and water each day for the eight weeks of trial.

III. Results And Discussion

3.1 Research hypothesis

Hoi: There is no significant ($p > 0.05$) difference in the mean final live weight gain of Chinchilla rabbits fed conventional source of fibre – wheat offal diet and Chinchilla rabbits fed non conventional source of fibre – *Senna obtusifolia*.

3.2 Re-hypothesis.

The non hypothesis (Ho) is rejected. There is significant ($p < 0.05$) difference in the mean final live weight gain of Chinchilla rabbits fed conventional source of fibre – wheat offal diet and Chinchilla rabbits fed non conventional source of fibre – *Senna obtusifolia*.

3.3 Discussion

The Mean Growth Performance and Cost Effectiveness of Replacing Wheat offal with *Senna obtusifolia* in Chinchilla Rabbits Diets are presented in Table 3, figure 1. Generally, feed consumption increased

with increased percentages of *Senna obtusifolia* in the diet, the results indicated that, there were significant differences ($p < 0.05$) among the treatment means (table 3, figures 1 and 2). The final body weight increased from 1483.75g to 1682.20g, daily feed intake from 57.75g to 77.60g, daily weight gain from 24.03g to 27.60g and efficiency of feed conversion from 2.37 to 2.79. Implying that, two months shade dry *Senna obtusifolia* weed plants could replace wheat offal in rabbit's rations up to 30 percent with promising growth outcomes. The results corroborated the reports of earlier researchers; Anne (2005) who reported that "rabbits eat only plants" and American ranch (2015), stated that "rabbits rations should be made with high –fibre ingredients and long - stem fibre to reduce boredom and support proper digestive function". The inclusion of dry *Senna obtusifolia* at the various percents in the diet did not depress the efficiency of the rabbits in terms of growth parameters and feed conversion, no signs of sickness and zero mortality was recorded. That is Chinchilla rabbits fed on *Senna obtusifolia* rations successfully. The findings in this trial disagree with the report of Becker (1986) who concluded that animals do not eat dry *Senna obtusifolia*, possibly because of presence of anti nutritional factors like, tannis, alkaloids and saponins in the plant.

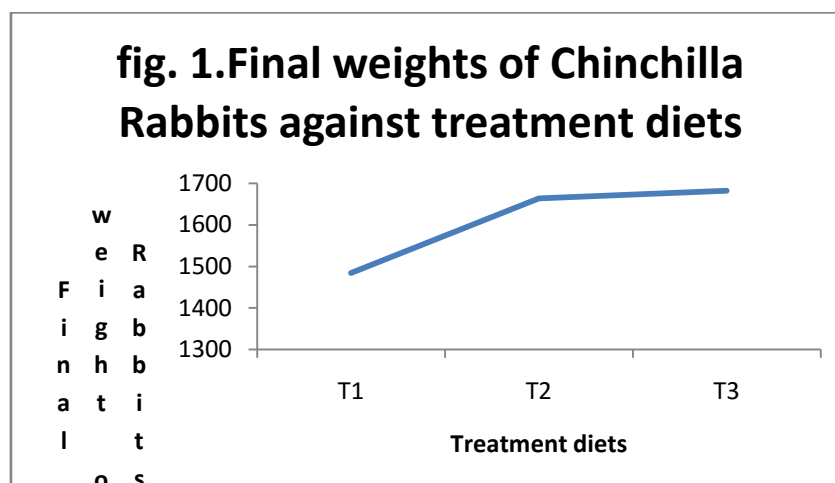
3.4 Cost Effectiveness of replacing wheat offal with Senna obtusifolia on cost of Chinchilla rabbit's diet.

The cost analysis indicates that feed cost per kilogram of Chinchilla rabbits decreased with the increasing percentages of *Senna obtusifolia* replacement. When wheat offal was replaced with 30 percent *Senna obtusifolia*, feed cost decreased from ₦60.00 (\$0.02) to ₦40.00 (\$0.13), a difference of about 26 percent (table 3). Given that feed cost contributes about 60-70 percent of the total cost of rabbit production, a 26 percent decrease is substantial enough to further enhance the profitability of rabbit farming.

Parameters	0	15.	30.0	S.E.D	Sig.
Ave. initial body weight (g)	682.03	682.30	682.10	0.84	-
Ave. final body weight (g)	1483.75 ^a	1663.43 ^b	1682.20 ^b	3.4	*
Ave. feed intake (g/d)	57.75 ^a	75.80 ^b	77.6 ^b	2.4	*
Ave. weight gain (g/d)	24.03 ^a	27.10 ^b	27.60 ^b	0.001	*
Feed conversion ratio	2.37 ^a	2.77 ^b	2.79 ^b	0.001	*
Cost of feed/kg of diet (₦)	60.00	53.00	40.00		
Cost of feed/kg in USA Dollars (\$)	0.20	0.17	0.13		
Mortality/ill health (%)	-	-	-		

*Significant difference ($p < 0.05$)

^{ab}Means followed by the same superscript within a row are not significantly different ($p > 0.05$).



T 1 = 30% wheat offal, T2 = 15% wheat offal + 15% Senna obtusifolia, T3 = 30% Senna obtusifolia

IV. Conclusion And Recommendations

Senna obtusifolia is a notorious legume weed plant endowed with essential fibre, metalizable energy, few essential mineral elements and some anti-nutritional factors. Eight weeks shade dry of *Senna obtusifolia* reduced the harmful effects of the anti nutritional factors – tannis, alkaloids, saponins etc, in the plants. The trial rabbits successfully fed on crushed dry stems, branches, pods, leaves and flowers of *Senna obtusifolia* ration for good eight weeks (fig.2) and 790 tons of *Senna obtusifolia* seeds worth \$246,875 were informally exported to other countries. Replacing wheat offal with 30 percent *Senna obtusifolia* has no adverse effect on the rabbit's growth, health, feed intake and feed utilization. It also leads to a considerable reduction in feed cost. Therefore, Food and Agricultural Organization (FAO), World Health Organization (WHO), Agriculturists, and Tropical

Countries should consider *Senna obtusifolia* as fodder (shade dry in to hay/silage) crop and not wild weed and, adoption of rabbits as indirect biological method of controlling notorious *Senna obtusifolia* weed against herbicides, the dangerous chemical method of controlling *Senna obtusifolia*.



Fig. 2. Chinchilla rabbits feeding on *Senna obtusifolia* formulated diet.

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