

**RESPONSE OF GROWING RABBITS FED GRADED LEVELS OF
YAM PEELS AS PARTIAL REPLACEMENT FOR MAIZE**

BY

GIBSON T. PWADADI

PGD/AS/08/0231

**DEPARTMENT OF ANIMAL SCIENCE AND RANGE MANAGEMENT,
SCHOOL OF AGRICULTURE AND AGRICULTURAL,
TECHNOLOGY FEDERAL UNIVERSITY OF TECHNOLOGY YOLA**

**A PROJECT SUBMITTED TO POST GRADUATE SCHOOL IN
PARTIAL FULFILLMENT FOR THE AWARD OF POST GRADUATE
DIPLOMA IN ANIMAL PRODUCTION AND RANGE MANAGEMENT**

SEPTEMBER 2011.

DEDICATION

This project is dedicated to the memory of my late father Mr. Ibrahim Bulibuli Pwadadi Farai and my Daughter Miss. Rejoice Gibson Pwadadi.

ACKNOWLEDGEMENT

I wish to acknowledge the unmerited favor and love of God on my life. I am specially indebted for the contribution and untiring efforts of my erudite supervisor, Dr. Yakubu Bobboi for his down to earth assessment of the project. I also wish to acknowledge the understanding and love of my wife, Mrs. Abiya Gibson Pwadadi and all my children for allowing me to pursue my dream.

I also wish to place on record my gratitude to Prof. M. S. Yahaya Dept, V. C. Admin Federal University of Technology, Yola for his encouragement and insistence on me to carry on with learning. I am also indebted to the HOD Dr. HD Nyako and to all members of staff of the Animal Science and Range Management Department.

CERTIFICATION

I certify that this project entitle **response of growing rabbits fed graded levels of yam peels as partial replacement for maize** was carried out and reported by Gibson T. Pwadadi in partial fulfillment of the requirement for the award of post graduate diploma in Animal Science and Range Management, Federal University of Technology, Yola and approved for its contribution to knowledge and literacy presentation.

APPROVED

Dr. B. Yakubu

Supervisor

Sign

Date

Dr. H. D. Nyako

HOD

Sign

Date

Prof. M.M. Abubakar

External examiner

Sign

Date

Prof. A. Nur

Dean , PGS

Sign

Date

TABLE OF CONTENTS

	Pages
Title page - - - - -	i
Dedication - - - - -	ii
Acknowledgment - - - - -	iii
Certification page - - - - -	iv
Table of content - - - - -	v
Abstract - - - - -	vi
List of tables - - - - -	vii

CHAPTER ONE: INTRODUCTION.

1.1. Background of the study - - - - -	1
1.2. Statement of the problem - - - - -	2
1.3. Objectives of the study - - - - -	3
1.4. Justification - - - - -	3

CHAPTER TWO: LITERATURE REVIEW.

2.1. Brief history of rabbits	-	-	-	-	-	-	-	-	5
2.2. Breeds of rabbits	-	-	-	-	-	-	-	-	5
2.2.1. American chinchilla	-	-	-	-	-	-	-	-	5
2.2.2. Flemish giant	-	-	-	-	-	-	-	-	6
2.2.3. New Zealand white	-	-	-	-	-	-	-	-	7
2.2.4. Angora	-	-	-	-	-	-	-	-	8
2.2.5. Dutch	-	-	-	-	-	-	-	-	8
2.2.6. Californians	-	-	-	-	-	-	-	-	9
2.3 Nutritional requirement of rabbits	-	-	-	-	-	-	-	-	10
3.3.1. Use of agricultural by-products in rabbit diet-	-	-	-	-	-	-	-	-	10
2.3.2. Cassava peels in rabbit diet	-	-	-	-	-	-	-	-	11
2.3.3. Potato peels in rabbits diet	-	-	-	-	-	-	-	-	11
2.3.4. Yam peels in rabbit diet	-	-	-	-	-	-	-	-	12
2.3.5. Effects of yam peels on the economy of production of rabbits	-	-	-	-	-	-	-	-	13
2.4. Management systems of rabbits	-	-	-	-	-	-	-	-	13

CHAPTER THREE: MATERIALS AND METHODS.

3.1. The study area	-	-	-	-	-	-	-	-	14
3.2.1. Experimental diets, design and animal management	-	-	-	-	-	-	-	-	14
3.2.2. Data collection	-	-	-	-	-	-	-	-	16
3.2.3. Proximate analyses	-	-	-	-	-	-	-	-	16
3.2.4. Data analysis	-	-	-	-	-	-	-	-	16

CHAPTER FOUR: RESULTS.

4.1. Proximate composition of yam peels and experimental diets	-	-	-	-	-	-	-	-	17
4.2. Growth performance of weaner rabbits fed graded levels of yam peels as replacement for maize	-	-	-	-	-	-	-	-	19

4.3.	Carcass yield and internal organs Weight of rabbits fed									
	graded levels of yam peels for maize	--	-	-	-	-	-	-	-	21
4.4.	Economic analysis	-	-	-	-	-	-	-	-	23

CHAPTER FIVE: DISCUSSION.

5.1.	Growth performance of rabbits fed graded levels									
	of yam peels for maize	-	-	-	-	-	-	-	-	25
5.1.1.	Feed intake	-	-	-	-	-	-	-	-	25
5.1.2.	Average daily Wight gain	-	-	-	-	-	-	-	-	26
5.1.3.	Feed conversion ratio	-	-	-	-	-	-	-	-	27
5.1.4.	Mortality	-	-	-	-	-	-	-	-	27
5.2.	Carcass yield and internal organs Wight of rabbits fed									
	graded levels of yam peels for maize	-	-	-	-	-	-	-	-	27
5.3.	Economic analysis	-	-	-	-	-	-	-	-	29

CHAPTER SIX: SUMMARY, RECOMMENDATION, CONCLUSION.

6.1.	Summary	-	-	-	-	-	-	-	-	31
6.2.	Recommendations	-	-	-	-	-	-	-	-	31
6.3.	Conclusion	-	-	-	-	-	-	-	-	32
	Reference	-	-	-	-	-	-	-	-	33
	Appendices	-	-	-	-	-	-	-	-	38

LIST OF TABLES

Table 1:	Ingredient composition of experimental diets	-	-	-						15
Table 2:	Chemical compositions of the experimental diets									
	and yam peel	-	-	-	-	-	-	-	-	18

Table 3: Growth performance of Rabbit fed - graded levels of Yam peels for Maize	-	-	-	-	21
Table 4: Carcass yield and internal organ weight rabbit fed graded level of yam peels for maize	-	-	-	-	22
Table 5: Economic analysis of rabbit fed graded levels of yam peels for maize	-	-	-	-	24

ABSTRACT

A study was conducted to determine the effect of replacing maize with yam peels in the growth performance, carcass yield and internal organs weight, and economy of production of weaner rabbits. Five diets were formulated using yam peels to replace maize at 0%, 25%, 50%, 75% and 100% as diets 1, 2, 3, 4 and 5 respectively. 15 weaner rabbits were allotted to the five dietary treatment and the diet were replicated three times with one rabbit per replicate in a completely randomized design. At the end of the experiment which lasted for nine weeks, two rabbits from each treatment were randomly selected and slaughtered to determine the influence of the replacement levels on carcass yield and internal organs weight results revealed that feed intake and average daily weight gain were significantly ($P < 0.01$) influenced by the replacement levels of yam peels for maize. Feed conversion ratio were however similar across the treatment. The average life weight were significantly ($P < 0.05$) higher in 100% level. The dressing percentage was highest (62.52%) in 75% while replacement levels of 0%, 50% and 100% were similar. Except for small and large intestine, all the internal organs were significantly affected by the replacement levels. Feed cost decrease from N56.26 in 0% to N 38.40 in 100% replacement level. Feed cost/kg (N/gain) also decrease from N276.65 in 0% to N 223.21 in 100% replacement level.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Rabbit production like other monogastrics, the most important aspect of its production is nutrition. Feeds account for between 70-80% of its cost of production. This has been attributed to the competition among humans, industries and monogastrics for conventional feedstuff like maize, soybean and sorghum. Hence, the quest for the replacement of the conventional expensive feedstuff with cheaper available alternative feeding stuff. Kitchen wastes such as plantain peels, cassava peels, yam peels are presently being explored by researchers. It is further reported that, the inclusion of plantain peels up to 75% with maize in the diets of growing rabbits produce no deleterious effects (Omole, *et al* 1981) Rabbits are given balanced feeds to increase the quantity and quality

Rabbits feed should contain: protein, carbohydrate, fiber, fats, vitamins, minerals and water. The quantity of feed required by rabbits depends on the age, breed, body weight, season and physiological status of the animal (Akinmutimi *et al*, 2006). Consumption of feed by rabbits also depends on the climatic condition. In ambient temperature of 30oC or above, the quantity of feed consumption reduces considerably

Cereal concentrates like: acha, wheat, sorghum, millet are commonly utilized as energy sources on rabbits diets, while plant protein like groundnut meal, soybean meal, sesame meal, palm kernel meal, cotton seed meal and

sunflower meal are good sources of fats. Roughages like green grass, grass legumes, yellow carrots, cowpea hay, groundnut humls, are used as sources of fibre to increase intestinal mobility. (Mutetikka, *et al* 1990).

(Byproducts of root *crops* and *tubers* such as *manihot esculentum* (cassava) *Cocoa cassia esculentum* (cocoa yam) *Diaiscoria rotundata* (yam) and *Ipomeabatata* (Sweet potatoes) are stable foods much of which are not fed to animals in the tropics, except cassava peels and yam peels, the rest are consumed directly with little processing (Aduku *et al.*, 1980)

Yam peels are an emerging feedstuff for rabbits. Some research work done with yam peels revealed that it can be successfully included in rabbit diets (Terry *et al.*, 1983). The flesh of yam is mostly commonly white or yellow, but some cultivars of *D. alatta* are distinctly violet. And those of *D. schimperverna* are orange. The species could be divided into those with *low* dry matter content (23-25%) (*D. cayenensis*, *D. liebrechesiana*, *D. rotundata*) with *D. esculenta* and *D. bulbefera* having intermediate values. In mineral content, ratios between the lowest and highest average by species vary between 1:2 and 1:3 except for sodium with ratio of 1:8 found between several species.

Starch content is between the range of 70.4 --72.9% except *D. cayenensis*, *D. liebrechesiana* and *D. rotundata* which have values greater than 80%. *D. dumetorum* and *D. alata* have the highest average grade protein (Terry *et al* 1983)

1.2 Statement of the Problem

It has been established that feed cost is a major constraint to rabbit production Cheeke, (1987), this high cost of conventional feed stuffs which are energy sources like maize, and sorghum can discourage would-be producers from embarking on the venture. The substitution of the aforementioned with yam peels as energy source will obviously be cost effective and is readily

available. Prices of the grains will be maintained and the rabbits will have alternative feeds, since yam peels are cheaper than maize and sorghum. A bag of sorghum or maize for example cost not less than N6, 000:00 in the market while a bag of yam peels costs only N800:00. Yam peels are cheaper than maize and sorghum

Rabbit meat is pearly palatable, with very high protein content and low fats. It is acceptable across religious and tribal lines. Rabbit meat has a gland flavor as compared to the meat of other animals. Tenderness reduces as the animal age and juiciness depends largely on the fat content. Protein in rabbit is higher than in most other meat at about 21%. Rabbit meat is low in fat (8%) and has a low proportion of stearic and oleic acid and a high proportion of polyunsaturated linolec acid, and legnoleic acid. (Akinmutimi, 2006). Some vitamins notably nicotinic acids and calcium pantothurate are higher in rabbits than in other meats. And mineral calcium and phosphorous are also high. Rabbit's meat therefore is a good source of protein. (Hutagalum, 1992).

1.3 Objectives of the Study

The objective of the study is to:

- (i) determine the growth performance of rabbits fed graded levels of yam peels for maize as energy source.
- (ii) assess the carcass yield and internal organs characteristics of rabbits.
- (iii) evaluate the economy of production of rabbits fed replacement levels of yam peels for maize.

1.4 Justification

Animal protein consumption in developing countries has been reported to be comparatively low when compared to developed countries. This problem has generally been attributed to shortage of animal protein products. This problem can be bridged by directing efforts at the production of animals that are highly

prolific with short generation interval. One of such is the rabbit. It has high fecundity within a short gestation period. They are fast growing and can obviously convert forage and kitchen wastes into meat with very high efficiency (Raharjo *et al.*, 1986)

Rabbit production is cheap, easy and requires a limited space. Not many people are aware that, with limited resources, high turnover could be realized and with a resultant high protein meat. This can lead to the availability of the meat at less affordable cost to the less privileged in the society. Advantage of rabbit production is that, rabbits are prolific and are easy to manage when compared to other large ruminants'.

Yam peels can therefore be used to replace maize in rabbit's diet so as to increase production at a lower cost. This will also increase the profit margin of the producer.

CHAPTER TWO: LITERATURE REVIEW

2.1 Brief history of rabbits

Rabbits belong to several genera in the sub-families leporinae and palaeologinae. The rodentia are the second order in the species of rabbits, they are distributed over most of the world's major land masses. Most, if not all rabbits in the broad sense has developed a system of digestion which serves a similar function to rumination. They partially digest their feed, the voided faeces are then reingested and final digestion takes place, this process is technically being known as coprophagy.(Robinson., *et al* 1985) The true rabbit, *Oryctolagus cunuculus* has several sub-species and is originally from south West-Europe and North Africa.

2:2 Breeds of rabbit

Aduku *et al.* (1990) stated that there are several hundred different breeds and varieties of rabbits throughout the world, varying in types of coat, color and sizes. The coat color may be solid black, blue, chocolate, fawn, grey, white etc. or with spots and mixed colors. A breed name depends on the location or place of origin, color of the coat, breeds, nomenclature or size.

2:2.1 American chinchilla

The American Chinchilla or "Heavyweight Chinchilla" is larger than the Standard Chinchilla but otherwise identical. Standard Chinchillas bred for large size produced this breed with an average of 9-12lb. Chinchilla Rabbits

originated in France and were bred to standard by Dybowski. They were introduced to the United States in 1919. (Jaziierz, *et al* 1995)

Bred to be a meat rabbit, the American Chinchilla Rabbit is a stocky, hardy pet. American Chinchilla Rabbits do not require regular grooming. Adult American Chinchilla Rabbits weigh different for each sex. Male 9-11lb and Females 10-12lb. These stocky rabbits have a slight curve to their medium length bodies, beginning at the nape of their necks and following through to the rump. They carry their ears straight erect. The American Chinchilla Rabbit was bred from large Standard Chinchilla Rabbits in order to produce a meatier rabbit. They were originally called Heavyweight Chinchilla Rabbits.

American Chinchilla Rabbits are good breeders, with an average litter of 7-10 babies.

2:2.2 Flemish giant

This fawn doe weighs about 9kg (20 lb). The Flemish Giant is a popular breed of domestic rabbit, most famous for its large size compared to other rabbits. The Flemish Giant has a minimum weight of 5 kg, and can live for up to five years or more.

As one of the largest breeds of domestic rabbit, the Flemish Giant is a semi-arch type rabbit with its back arch starting from the back of the shoulders and carrying through to the base of the tail giving a "mandolin" shape. The body of a Flemish Giant Rabbit is long and powerful with good muscular development and relatively broad hindquarters. Bucks have a broad, massive head in comparison to does. Does may have a large, full, evenly carried dewlap (the fold of skin under their chins). The fur of the Flemish Giant is known to be glossy and dense, and when stroked from the hindquarters to the head, the fur will roll back to its original position. ARBA standard has seven different colors, black, blue, fawn, light gray, sandy, steel gray and white. (*P. F.B. I., 2006*).

Due to its large size, the Flemish needs a large space to roam around. The House Rabbit Society, an international nonprofit rabbit rescue organization, recommends keeping the rabbit inside the home; in a very large pen or room(s). Some rabbits use litter boxes due to instinct or after observing cats and other rabbits do so. Rabbits using litter boxes may safely have run of the home provided adequate protections are in place for safety. The Flemish Giant will require more food compared to other breeds of domestic rabbit (many cups per day). Unlike other breeds, the Flemish Giant will only require mild attention to grooming due to its short-hair. It sheds its coat in Spring and Fall (*Wilson., 1995*).

2:2:3 New Zealand white

New Zealand white rabbits were bred for their meat and fur, but their body type helped to contribute to them becoming the favorite breed of domestic rabbit. New Zealand whites have well-rounded bodies; slender and muscular faces with round cheeks; large, long back feet; and small, short front feet (Rubin's). They have long perforated ears that stand straight up. Unlike the thick, snowy fur on their bodies, their ears have shorter fur that allows the delicate pale pink of their skin to show through (Rubin's). American rabbit breeders association (A.R.B.A.,2002) reported that, the most noticeable characteristic of New Zealand white rabbits is their bright eyes, which range in shade from pale pink to bright ruby red (Rubin's).

New Zealand white rabbits have large, broad, and muscular bodies. Bucks (males) weigh between 8-10 pounds, while the does (females) weigh between 9-12 pounds (Verhallen 23-35). In addition to their greater size, females are distinguished by the presence of a dewlap, which is flap of fur below the chin that is pulled for a nesting box during pregnancies.

The diet of a New Zealand white rabbit is not different from any of other rabbit breeds. A high quality feed pellet (protein ~ 15-16%), along with unlimited timothy hay and fresh water and exercise will maintain a healthy individual. (*Ruby, 1998*).

A female rabbit (doe) is fertile all year long. The gestation period is around 28–31 days. A few days before birth, a nest box should be provided for the new mother. The doe will pull fur from her dewlap and, along with hay or other materials provided, will create a nest. The young are called kittens and are born hairless with their eyes closed. Fur begins to grow in by day 5 or 6 and after 10 to 12 days the kits' eyes will open. At the age of three weeks their mother will begin to wean those off milk, meanwhile the kits will begin to eat hay and pellets. The average number of kits per litter is six but can range from two to twelve. Because rabbits are induced ovulators a Doe can become pregnant by the simple act of mating if conditions are right. A Doe can get pregnant soon after birth.

2:2:4 Angora

Angras are bred mainly for their wool because it is silky and soft. They have a humorous appearance, as they oddly resemble a fur ball. They Weigh: 2.0–3.5 kg (4.4–7.7 lb). (*Job, 1975*). Most are calm and docile but should be handled carefully. Grooming is necessary to prevent the fibre from matting and felting on the rabbit. These rabbits are shorn every three to four months throughout the year.

Rabbits of the angora breed are adorned with "fur," growths of wool on the ears and the entire face except above the nose, and front feet, along with their thick body, and wool. They are gentle in nature, but they are not recommended for those who do not groom their animals. Their wool is very thick and needs to be groomed twice a week.

2:2:5 Dutch

Although the name suggests that the Dutch rabbit is from the Netherlands, it was actually developed in England. They weigh 3.5 – 5.5 lb. During the 1830s rabbits were imported to England from Ostend in the Netherlands every week for the meat market. Amongst these rabbits was a breed known as the Petite Brabancon, as it originated from Brabant in Flanders. The Petite Brabancon may still be found in paintings from the fifteenth century. The Dutch rabbit has its genetic roots in this old breed. The Petite Brabancon would often display Dutch markings, and breeders in England selected those with even markings, fixing those markings into the breed we know today." The markings consist of a white wedge down the face (the blaze), round colored circles around the eyes and extending to the whisker bed (the cheek marking), white on the ends of the hind feet (the stops), a thin white line between the ears (the hairline), a wedge-shaped white marking on the back of the neck (the neck marking), part is called the saddle, and the line extending under the belly is called the undercut). Dutch rabbits are judged with the markings accounting for 50% of the total score, and the body type, fur, color and condition making up the other half. As the markings are a pure genetic trait, Dutch patterns can also appear in other breeds of rabbit. Dutch rabbits do well in the sport of rabbit hopping. They also make excellent pet and show rabbits. The Dutch rabbit is a compact breed (Iyayi and Awonusi,. 2005) the contrast line divide the colored section of the body from the white portion (the top).

2:2:6 Californians

The Californian was first bred from crosses between Chinchilla, Himalayan, and New Zealand rabbits in the 1920s, with the intent of creating a better commercial meat rabbit. It was first brought to the UK from the United States in the 1950s. The cooler of the points on the ears, feet, and tail can be black, chocolate, blue or lilac.

2.3 Nutritional requirement of rabbits

Rabbits are given balanced feed to increase the quality and quantity of production of wool, meat, fur and healthy kits. Rabbits feed should contain; protein, carbohydrates, fibre, vitamins, fats, minerals and water (Tewe,1988).Despite the fact that crop residues and agro-industrial by-products are currently used for various purposes, their importance as feedstuffs particularly for ruminants in small farm systems cannot be over-emphasized. With fewer fibrous agro-industrial by-products which are conventionally used in non-ruminant feeding, opportunities for offering them to ruminants or for improving their feeding value appear to be smaller and smaller due to rapid advances in nutritional sciences. Better utilization of these less fibrous feedstuffs for non-ruminant feeding in Southeast Asia can be obtained by increasing local production of protein feedstuff in order to keep up with the regional deficiency.(Khajareern *et al.*, 1980) reported that the deficiency of protein concentrates in Southeast Asia was 3.9 million tons or 62.4% of the requirement. Exploitation for novel protein feeds consequently appears to be of the first priority for animal nutritionists in this region.

2.3.1 Use of Agricultural by products in rabbit diet

Aduku *et al* (1999) observed that, the domestic rabbit is primarily herbivorous and will eat most type of green vegetation, hay, grains, tubers and root. Therefore, the rations may consist almost entirely of ingredient plant sources. The sensitivity of rabbit to quality of protein is not known. The fact that rabbit have been raised successfully on rather simple mixtures of plant products indicates that protein quality may not be too important.

Aduku *et al* (1990) reported that coprophagy is usually practiced by domestic rabbits as young as three weeks of age. It assumed that coprophagy, along with fermentation in the large intestine supply necessary amount of most vitamin B, provide assurance against amino acid deficiency, and permit further digestion of fibre and availability of other nutrients by a second passage through the digestive tract.

2.3.2 Cassava peels in rabbit diet

Cassava *peels* and *sieviate* which are by products of harvesting and processing constitute 25% of the whole plant. Cassava peels is the skin of the peeled while the chaff that results from processing the root into “foofoo” is called cassava root sieviate. (Aderemi and Nworgu, 2007).

Cassava peels can be used as a replacement for maize as energy source for feeding the rabbits (Akinmutimi *et al* 2006). Cassava (*Manihot utilissama*) one of the most productive tropical crops has been widely recognized as a cheap caloric source (Sonaiya and Omole, 1977; Tewe and Egbunike, 1988). The peel obtained from it is about 10-20% of the root and is available all year round in Nigeria with an annual yield of approximately 4 million metric tonnes during the processing of cassava roots (Hahn and Keyser, 1985). The utilization of this peel in livestock feeding would therefore help to solve the problem of its disposal as a waste product and also to reduce the cost of livestock production. Cassava peel contains 27.9% dry matter, 5.3% crude protein and 1.2% ether extract. It is relatively high in crude fiber (20.97%), and ash (5.93%). It contains 66.6% nitrogen free extract. However, it has a higher HCN content than the pulp (Manner and Gomez, 1973).

2.3.3 Potato peels in rabbit diet

Crude protein value of yam peels have been reported by (Akinmutimi *et al* 2007) to be 11.21% while Ajala (2006) gave crude protein value of sweet

potatoes to be 6.375. The gross energy values of 2.985 and 3.2kcal/g respectively for sweet potato peels and yam peels reveals their potential as alternative energy sources for maize in rabbit production. Supplementation with roots (cassava, sweet potato) and fruit (banana) may allow the animals to meet their water requirements as well as increasing energy intake. Thus, the simplest feeding system would be the free choice feeding of good quality tropical forages supplemented with roots, tubers and fruits. (Famunyan,. 1992).

2.3.4 Yam peels in rabbit diet

Yam peels are basic wastes or by-products when yam is peeled during processing for cooking and other purposes. Yam peels are however, fed to animals such as goats and sheep and largely sourced from yam processing centres, or kitchens. Yam peels may be fed directly soon after peeling, or sun dried for 4 – 7 days depending on ambient temperature, to dehydrate it thereby preventing microbial fermentation of the product or fungal infestation. (Scott 1987) had stated that the level of moisture required to prevent microbial growth in yam peels was below 12%.

Yam peel (*Dioscorea rotundata*) is one of the various farm wastes that have such potentials (Adeyemo and Borrie, 2002). Yam peel is cheaply available in Nigeria (Akinmutimi *et al.*, 2006). White yam peel consists of 11% crude protein with metabolizable energy of 2604kcal/g (Eka, 1985 and Akanno, 1998). The author also reported that *Dioscorea rotundata* peels are rich in amino acid.

Yam *peels* and sweet potato peels have been identified as alternative stuffs that can form major sources of energy in livestock and poultry feeds (Adeyemo and Borire, 2002). Sweet potato peel for example contains as much as 3.4 calories per gram (Jansen, 1989). The peels constitute about 10% of the yam or sweet potato tuber (Ijaiya and Awonusi., 2005). However, information on the

combined use of these peels meal in rabbit feed, to replace maize based diet is yet to be reported.

2.3.5 Effects of yam peels on the economy of production of rabbits

A lot of literature information have shown that, the cost of producing rabbits decreases with increasing level of unconventional feeds(Yakubu et al 2008).market survey in Yola and environs reveals that the price of maize ranges from #6000:00 to #8000:00 per bag in the open market ,while a bag of Yam peels (sun-dried) cost #800:00 only.

This has clearly shown the comparative advantage of using Yam peels in rabbit production.

2.4.0 Management systems of rabbits

Management systems practiced in rabbit breeding vary from place to place depending on the capability of the breeder. However, the two management practices can be done i.e. Intensive and Semi-Intensive.

Terry, (1983) states that, for efficient production in rabbits, the housing is an important aspect, as all the processes of life from birth till death of the animal and other activities take place in *these* enclosures. Rabbits are generally housed in either Open hutch system or Shed/Cage system.

Hutch System: - It is a self contained Cage, Cum-nest box with proper roof. Hutches are normally kept in the open in orchards or small holdings. This system is more hygienic and healthy for the animals.

Shed/Cage System: - In this system, all wire cages are arranged in suspended manner either in single or two or three tier system. This system is safe and easy to operate.

In two tier system tin or asbestos sheets are placed between the cages for proper disposal of faecal matter and urine.

CHAPTER THREE: MATERIALS AND METHODS

3.1 The study area

The experiment was conducted at the rabbit unit of department of Animal Science and Range management, Federal University of Technology Yola, Nigeria.

Yola bear a coordinate of Lat 9 and 11 North, and longitude 11⁰ and 14¹ easts. The climate is tropical with distinct dry and wet season. The rainfall starts in April and ends around Late October, November to April marks the dry season. It has an annual rainfall of about 700m to 1600mm and relative humidity that ranges from 5 to 42% and average maximum temperature of 39^{0C} Adebayo (1999). The natural vegetation of the location is Sudan Savannah which is characterized by grassland and dispersed shrubs, herbs and trees.

3:2:1 Experimental diets, design and animal management

Yam Peels was collected as kitchen wastes from restaurants in Yola. The Yam Peels was sun dried for 4 to 5 days and grounded to a coarse consistency before being used to formulate the diets.

Five experimental diets were formulated. The diets were designated T₁, T₂, T₃, T₄ and T₅ respectively. T₁ was maize based diet which served as the control, while T₂, T₃, T₄ and T₅ replaced maize at 25%, 50%, 75% and 100% dietary inclusion respectively.

Fifteen Weaner rabbits were randomly allocated to the five dietary treatments, and the diets were replicated three times in a completely randomized design, the rabbits were housed in individual cages.

The experiment lasted for 9 weeks. The diets and drinking water were offered *ad-libitum*. Rabbits used were of mixed breed. The experimental are shown on table 1 below;

Table 1: Ingredient composition of experimental diets

Ingredients	Replacement levels of yam peels for maize				
	0%	25%	50%	75%	100%
Maize	68.70	51.52	34.35	17.18	0.00
Yam Peels	0.00	17.18	34.35	51.52	68.70
G/nut Cake	18.00	18.00	18.00	18.00	18.00
Bone Meal	2.50	2.50	2.50A	2.50	2.50
Primix*	0.25	0.25	0.25	0.25	0.25
Methionine	0.20	0.20	0.20	0.20	0.20
Lysine	0.10	0.10	0.10	0.10	0.10
Salt	0.25	0.25	0.25	0.25	0.25
Maize offal	10.00	10.00	10.00	10.00	10.00
Total	100.00	100.00	100.00	100.00	100.00
Calculated Analysis					
Crude Protein	15	14.07	13.19	12.32	11.44
Crude Fibre	2.74	2.51	2.27	2.03	1.79
Ether Extract	2.66	4.03	3.38	2.73	2.08
Metabolizable	3085.04	3001.25	2917.44	2833.67	2749.88
Calcium	4.81	5.50	6.18	6.86	7.55

Phosphorus	2.75	2.44	2.14	1.84	1.54
------------	------	------	------	------	------

* Vitamin-Mineral Premix Provides per Kg the following; Vit. A 8000 IU; Vit D3 Premix ; 1600IU; Vit E; 51 U; Vit K 2mg; Thiamine B1 1.5mg; Riboflavin B2 4mg; Pirydoxine B6 1.5mg; Niacin 15mg; Vitamin B12 0.01mg; Pantothenic acid 0.5mg; Folic acid 5mg; Biotin 0.02g; Choline chlorite 0.2g; Mn 0.08g; Antioxidant 0.125g; Zn 0.095g; Fe 0.02g; Cu 0.005g; I 0.0012g; Se 0.2g; Co 0.2g.

3:2:2 Data collection

Data were collected for growth performance which include feed intake, daily weight gain, feed conversion ratio and mortality was recorded as they occur.

Data was also collected on the Carcass and internal organs characteristics which included; live weight, pelt, liver, legs, carcass weight and dressing percentages was calculated. Internal organs included, small intestine length and weight, large intestine length and weight, stomach, ceacum length and weight, gizzard, liver, kidney, lungs and esophagus. Economic analysis was also calculated to determine the least cost feed (N/gain), among the treatments.

3:2:3. Proximate analyses

The yam Peels and the experimental diets were analyzed for its proximate composition using the procedure described by AOAC (1990).

3:2:4 Data analysis

Data generated from the study was subjected to one way analysis of variance as described by Steel and Torrie (1980) and where significant differences occurred, means were separated using Duncan Multiple Range Test.

CHAPTER FOUR: RESULTS

4.1: Proximate composition of yam peels and experimental diets.

The proximate composition of the experimental diets, and yam peels are shown on Table 2. The range of dry matter of the experimental diets is between 98.0 -98.20. While that of the yam peels was 98.00, the crude protein varies from 10.20 in treatment I to yam 16.80 in treatment 5 while the crude protein in yam peels was 17.50. Doma et: al (1999) also reported a value of 53 -66.85 g/d. Also crude fibre had a range of 3.40 to 5.00 while that of the yam peels was 8.20. The ether extract had a range of 3.80 to 4.20 while that of the yam peels is 2.00. The nitrogen free extract had a range of 65.30 to 74.50 and the yam peels at 60.50. The CA had a range of 0.10 and 0.40 while the yam peels is 0.50. The phosphorus had a range of 0.30 to 0.34 and the yam peels had a 0.40. The value of ash ranges from 6.60 to 6.90 and yam peels had a value of 9.80.

Table 2: Chemical compositions of the experimental diets and yam peel

Nutrients	1	2	3	4	5	Yam peel
DM	98.20	98.20	98.1	98.20	98.20	98.00
CP	10.20	13.50	15.40	16.20	16.80	17.50
CF	3.40	4.30	4.30	4.40	5.00	8.20
EE	3.80	3.80	4.00	4.00	4.20	2.00
NFE	74.50	70.00	67.70	66.80	65.30	60.50
CA	0.10	0.28	0.30	0.38	0.40	0.50
P	0.30	0.30	0.32	0.32	0.34	0.40
ASH	6.60	6.60	6.70	6.80	6.90	9.80

DM: Dry matter

CP: Crude protein

CF: Crude fat

EE: Ether fat

NF: Nitrogen free extract

Ca: calcium

P: Phosphorous

4.2. Growth Performance of Weaner Rabbits fed Graded Levels of Yam Peels as Replacement for Maize.

The results of the growth performance of weaner rabbits fed graded levels of yam peels for maize are presented in Table 3. Feed intake was observed to be significantly higher ($P < 0.005$) in rabbits fed 100% yam peels meal compared with other treatments.

Feed intake was lowest in the control diet with value of 36.66g/day/rabbit. This was closely followed by the rabbits on 50% and 75% with a value of 53.63 and 48.67g/day respectively replacement level of yam peels for maize.

The average daily weight gain was significantly higher ($p < 0.01$) in 100% replacement level with a value of 8.76g/day and the lowest was observed in 0% replacement level with a value of 5.22.g/day. All other replacement levels were similar with a value of 8.04g/day, 7.71g/day and 6.97g/day for 25%, 50% and 75% replacement levels respectively. The feed conversion ratio was significantly ($p < 0.005$) higher in 100% replacement level with a value of 7.39, and the lowest at 0% with a value of 6.79. The intermediate values of the remaining treatments of 25%, 50% and 75% had values of 6.79, 7.08 and 7.05 respectively. Mortality rate did not follow any particular pattern, there was no mortality in 0% and 100% replacement levels, but mortality was recorded one each in 25%, 50%, and 75% respectively,

Table 3: Growth performance of Rabbit fed graded levels of Yam peels for Maize.

Parameters	Level of replacement of Yam peels Maize					SEM
	0%	25%	50%	75%	100%	
Feed intake (g)	36.66 ^d	54.26 ^b	53.67 ^{bc}	48.67 ^c	64.12 ^a	1.43 ^{***}
Average daily weight gain (g)	5.21 ^c	8.04 ^{ab}	7.7 ^{ab}	6.97 ^b	8.76 ^a	4.53 ^{**}
Feed conversion ratio	6.99	6.79	7.08	7.05	7.37	0.44
Mortality	0	1	1	1	0	

a,b,c, means on the same row with different super scripts are significantly ^{**} = P<0.01, ^{***} = P< 0.001)

ns: not significant

SEM: Standard error of means

4.3: Carcass yield and internal organs weight of rabbit fed graded levels of yam peels for maize.

The average slaughter weight (g) ranges from 766.66 to 1433.33 with a SEM of 75.75, and the average dressed weight (g) ranges from 439.33 to 800.00 with a SEM of 56.68. the dressing percentage had a range of 51.24 to 62.54 and a SEM of 2.27 the average live weight was 866.66 in 0% treatment to 1433.33 and with a SEM of 70.71 the weight of the shoulders range from 133.33 to 225.00 with SEM of 13.76 while the ribs had a weight of 78.33 to 158.33 and with an SEM of 21.31. The values obtained in the loins range from 95.00 to 186.66 with a SEM value of 13.29. The hindlimbs at values that range from 200.00 to 328.33 with SEM values of 29.72 the head had a value of 96.66 to 146.00 and with a SEM of 9.12.

The skin/pelt had a value range of 86.66 to 136.66 and with a SEM of 9.18 the liver had a value of 49.33 to 68.66 with a SEM value of 4.69 the kidney had a value range of 40.00 to 65.00 and with a SEM range of 8.16. The lungs had values that range from 23.33 to 36.66 and with a SEM value of 3.16. The body had a value of 26.00 to 32.00 and with a SEM of 0.55 the small intestine had values that range from 196.00 to 256.00 and with a SEM value of 25.03. The large intestine had a range value from 86.66 to 109.66 and with a SEM of 6.73. The ceacum had a range value of 37.00 to 64.00 and with a SEM value of 5.24. The stomach had a range value of 8.33 to 11.66 and with a SEM value of 0.78.

The values may not have agreed with values obtained by other researchers due mainly to differences in the years of research. Similarities in other areas which have not been specifically mentioned in this research.

Table 4: Carcass yield and internal organ weight rabbit fed graded level of yam peels for maize.

Parameters	0%	25%	50%	75%	100%	SEM
Average live weight (g)	766.66 ^c	1326.66 ^{ab}	1353.33 ^{ab}	1173.33 ^b	1433.33 ^a	75.75*
Average dressed weight (g)	439.33 ^d	790.00 ^a	800.00 ^a	653.33 ^{ab}	763.33 ^a	56.68*
Dressing percent	57.41 ^{ab}	51.2 ^b	56.06 ^{ab}	62.54 ^a	57.11 ^{ab}	2.27*
Average life weight	866.66 ^c	1333.33 ^a	1433.33 ^a	1100.00 ^b	1400.00 ^a	70.71
Shoulder	133.33	210.00 ^c	173.33 ^{ab}	170.00 ^{bc}	225.00 ^{bc}	1376**
Ribs	78.33 ^b	143.33 ^a	106.66 ^{ab}	106.66 ^{ab}	158.33 ^a	21.31*
Lions	95.00 ^c	146.66 ^{ab}	160.00 ^a	13.33 ^{bc}	186.66 ^a	1329*
Hind limbs	200.00 ^b	286.66 ^{ad}	320.00 ^a	268.33 ^{ab}	328.33 ^a	2972*
Head	133.33 ^{bc}	120.00 ^{abc}	145.00 ^a	96.66 ^c	133.33 ^{ad}	9.12*
Skin/pelt	100.00 ^{bc}	120.00 ^{ab}	136.66 ^a	86.66 ^c	120.00 ^{ab}	9.18*
Liver	49.33 ^b	68.66 ^a	50.00 ^b	46.66 ^b	50.00 ^b	4.69*
Kidney	40.00 ^{ab}	58.33 ^{ab}	65.00 ^a	33.33 ^b	43.33 ^{ab}	8.16*
Lungs	36.66 ^a	30.00 ^{ab}	23.33 ^b	23.33	30.00 ^b	3.16*
Body	26.00 ^c	29.33 ^d	30.00 ^b	27.33 ^c	32.00 ^a	0.55*
Small intestine	225.00	256.00	189.3.00	196.00	227.00	25.03 ^{ns}
Large intestine	91.66	104.33	102.00	86.66	109.66	6.73 ^{ns}
Ceacum	37.00 ^b	8.66 ^{ab}	11.66 ^a	8.33 ^b	9.33 ^{ab}	0.78*
Stomach	9.00 ^b	8.66 ^b	11.66 ^a	8.33 ^b	9.33 ^{ab}	0.78*

a,b,c,d, means on the same row with different super scripts are significantly * = P<0.05, ** = P<0.01, *** P<0.001)

ns: not significant

SEM: Standard error of means

4.4: Economic analyses

The total feed intake (g) of rabbits graded levels of yam peels for maize range from 2048.0 to 3536.6 while the feed cost (N/kg) range from N38.40/kg in 100% to N56.26/kg in 0%. This agrees with the report of Akimutimi *et.al* (2006) which states that the higher the inclusion level of yam peels in the diet, the lower the amount spent in the feeding. The cost of total feed in the (N/kg) ranges from N117.2 to N1,152.20 this indicates that the higher the maize component, the higher the cost of feeding. The total weight gain increases with yam peel inclusion from 0% which has a value of 416k to 100% which has 608.8g. The feed cost/kg (N/gain) had values the range from 153.88 to 276.65 at the various levels of inclusion.

Table 5: Economic analysis of rabbit fed graded levels of yam peels for maize

Parameters	0%	25%	50%	75%	100%
Total feed intake	2048	3216.5	3024.3	2734	3536
Feed cost (N/kg)	56.26	51.85	47.33	42.87	38.40
Cost of total feed intake (N)	1152.20	166.74	143.12	117.2	135.78
Total weight gain	416	750	700	761.6	608.3
Feed cost/kg (N/gain)	276.65	222.32	204.45	153.88	223.21

CHAPTER 5: DISCUSSION

5:1 Growth performance of rabbit fed graded levels of yam peels for maize.

5.1.1: Feed intake

Feed intake was observed to be significant between treatments. This is similar to those reported by Ekpenyong *et-al* (1990) similarly the value of 48.6 to 53.6 grams agrees with the finding Uddevic *et-al* (2005) who reported 47.40 to 50.10g per day for rabbit fed varying levels of cracked and cooked jack beans and soaked in water prior to cooking .Diet containing 32.50 to 55.00% maize and having 3.52 to 4.52 crude fibre contents ,however the DMI intake value obtained were lower than the 50.70 to 66.85g /day for rabbit fed malted and or unmalted sorghum Abubakar *et-al* (2006). Hon *et-al* (2009) also reported 57.90 to 63.30g per rabbit per day in rabbits fed diet of sweet orange fruits pulp meal but with no significance ($P < 0.05$) in the level of intake, similarly Ajayi *et-al* (2007) reported slightly higher result of 61.49 to 66.38 for rabbits fed diets containing graded level of blood with sun flower leaf mixture. The differences in value might be because of the nitrogen free extract obtained in the meal. It is possible that the yam peel meal improved palatability of the diet thus making the 100% level most palatable and acceptable. ALozie *et-al* (1987) in his study, feed intake was lowest in the control diet with a value of 36.66g/day/rabbit; this was closely followed by the rabbits on 50 and 70% replacement level with a value of 53.67 and 48.68/day /rabbit respectively. Their record was at variance with this studies which might be attributed to the geographic location of Yola and inherent temperature of Yola which is always high around April to March which coincided with the period of this study.

5:1:2 Average daily weight gain.

The average daily weight gain was observed to increase with yam peel inclusion ($P < 0.05$) level in the diet in this study .

Although Akinmutuni *et-al* (2006) reported no significance in the daily weight gain however, the result obtained in this study is supported by the report of Nwakpa *et-al* (2005) who recorded tremendous improvement in body weight gain as the level of yam peel meal inclusion increased in the diet. Similarly Ayoola and Akinbani (2011) reported that growth rate per day is significantly higher ($P < 0.05$) in rabbits fed 50% or above replacement level of diet when compared with the control. And he suggested further, that feeding rabbit diet with yam peel meals increase the growth performance of growing rabbits ,the result agrees with Abubakar *et-al*{ 2006} who suggested that all rabbits gain weight which are similar across the treatments when fed malted and un malted sorghum indicating that the intake of energy and protein were well maintained requirements .

Fasanya and Ajiya (2002) stated that rabbits can perform better on at least 16% crude protein. Iyayi (2001), also reported that additional level of fibre in diet of animals depresses growth.

However, Ekpenyong (1990) observed that the reason might be as a result of low lignin and other complex compounds in yam peel, thus making the fibre appreciably digestible, and that it could also be due to adequate methionine contents of the diet. Nwagu and Ogbosuka (2003) also reported 10.99 to 15.18g using ripped plantain peel meal as alternative energy source which is higher than the result obtained in this study .However the result obtained in this study shows that up to 25% inclusion levels of maize replaced with yam peels meal on rabbit diet can be used as an alternative energy source

5:1:3 Feed Conversion Ratio.

The feed conversion ratio was not significantly influenced ($P>0.05$) by the treatment diets. However numerical values show that rabbits on the control diet had a superior feed conversion ratio with a value of 6.99 whereas those on 100% replacement level seem to have inferior feed conversion ratio with a value of 7.39. The feed conversion ratio was shown to be significantly different ($P<0.05$) among the levels incrementally in this study. This result however disagree with the result of Akinmutum et-al (2006) who reported no significant difference in a study involving crushed mixed plantain and yam peel. This could be attributed to poor nutrient utilization. However significant difference in the feed conversion ratio reported in his study agrees with the report of Iyayi and Awoniso (2002) which states that yam peel meal can replace up to 50% of maize as an energy source in the diet of grower rabbits.

5:1:4: Mortality

Mortality rate did not follow any particular pattern, there was no mortality in 0% and 100% replacement levels, but mortality was recorded one each in 25, 50 and 75% respectively. There was no definite evidence to suggest that the mortality was due to the influence of the test diets.

5.2: Carcass Yield and Internal Organs Weight of Rabbit fed Graded Levels Maize.

The carcass yield and internal organ weight of rabbit fed graded level of yam peel as replacement of maize is shown on Table 4. The carcass yield was significantly influenced ($P<0.05$) by the replacement levels. The average live weight was significantly higher in 100% replacement level with a value of 1433.33g with the lowest observed in the control diet with value of 766.66g /rabbit in 25 and 50% replacement level were similar and rabbit on 75% were little bit higher with value of 1326.66g, 1353.33 and 1173.32 for 25, 50 and 75%

replacement level respectively .The average dress weight were similar in 25,50 and 100% replacement level. With those on the control with a value of 439.33g and 75% with a value 653.33g were similar. Dressing percentage was highest in 75% replacement level with a dressing percent of 62.54%.All the remaining treatments were similar. The average life weight of weaner rabbit of 25% and 50% were significantly ($P<0.05$) hgher in 25 and 50% and these was closely followed by rabbits on 75% replacement .and the lowest was observed in the control with a value of 866.66g. The weight of the shoulder was significantly higher (225g) in 100% replacement level and the lowest (133.33g) was observed in the control diet. Rabbits on control level of 25, 50 and 75% were similar. the weight of the rib were higher in 225 and 100% replacement level with a value of 143.33 and 158.33g for 25 and 100% replacement level higher the remaining treatment were similar .the weight of the loin were significantly ($P<0.05$) higher in 50% and 100% replacement level with value of 160g and 186g respectively .the hind limb were similar higher in 50% and 100% with a value of 320 and 328g respectively .A significant different was observed on the weight of the head across the treatment with treatment with 50%replacement level having the highest weight of 145g where those on 75% replacement level were the lowest with the weight of 96.66g.the weight of the skin /pelt was highest in 50% replacement level with a value 136.66g while the lowest was observed in 75% replacement level with a value of 86.66g. The weight of the internal organ were significantly influenced by the replacement level and the lowest weight of the river was observed in 75% replacement level with the value of 76.66g. All other replacement level was similar. And the weight of the kidney at 50% replacement level was the highest at 65.00g, and all other treatment was similar. The weight of the hinds seems to be higher in the control diet with the value of 36.66g, while the weight of the hinds on the other replacement was similar. The body length seems to be longer in 100% replacement level and 50% replacement levels with value of 32.00cm and

30.00cm respectively. The shortest was observed in 0.25 and 75% replacement levels with value of 26.00, 29.33 and 27.33cm respectively. The length of the small and large intestine were similar across the treatments with the longest in 25% with a value of 256.00cm and the shortest in 50% with a value of 189.30cm. Ceacal length however was influenced by the replacement level with rabbits on 50% replacement level, having the highest caucus length with a value of 64.00cm and the lowest was 0% replacement level with a 37.00cm. The length of the stomach was highest in 50% replacement level with a value of 11.66 and the lowest in 75% replacement level with a value of 8.33cm.

5.3: Economics analysis

The economic analysis of rabbit feed graded level of yam peel is shown on the Table 5. Feeds cost in ₦/kg reduces from ₦56.26 in the control to 38.40 in 100% replacement level. Feed cost per /kg (N/gain) was highest in the control with value of 276.65/kg/gain to the lowest N155.58 in 75% replacement level. The result is in agreement with the result of other workers who reported that increasing the inclusion level of cheaper sources of feed ingredients led to the reduction in feed cost.

Yakubu *et-al* (2008) also observed reduction in feed cost and production cost below control diet. The increase cost /kg body weight gain differential saving on the cost of feeding and relatively cost benefit /kg body weight gain with increasing levels of urea treated rice offal showed the economic efficiency of potential replacement of maize with urea treated rice offal. Hence the result obtained in this study implies that in terms of benefit accruing to farmers of 75% replacement level gave the best result. The result also agrees with the finding of Akinmutimi and Onen (2007) which state that farmers will not embark on production without giving thought on the likely sales and/or revenue from the ventures product. And that saving in fix cost was achievable as a result of the use of yam peel meals; sure there is availability of the yam peel in the

study area. A farmer can collect as much as he desire, processed and stored for onward use at the very minimal cost Agunbiade et-al (2002).

CHAPTER 6: SUMMARY, RECOMMENDATION, CONCLUSION

6.1: Summary

The research was undertaken in the rabbit unit of Federal University of Technology Yola, Nigeria.

Fifteen weaner rabbits were bought and housed in individual cages. The rabbits were placed on five dietary treatments and diets replicated three times in a completely randomized design and fed ad-libitum. The experiment lasted for a period of 9 weeks and the rabbits used were of mixed breed.

Data was also taken on the Carcass and internal organs characteristics which include live weight, pelt, liver, legs, carcass weight and dressing percentage. Internal organs include small and large intestine length and weight, liver, kidney, legs and esophagus were analyzed using the one way analysis of variance and where significant difference occurred means were separated using the Duncan Multiple Range Test.

At the end of the study, appreciable growth was observed in all the rabbits, but rabbits on 100% replacement level of Maize for Yam peels showed higher growth performance and with good feed conversion level. The 100% replacement level had the highest feed intake though mortality was recorded in 0% and 100%, 25%, 50% and 75% did not record any mortality.

In all the parameters taken for the carcass yield and internal organs weight, the dressing percentage were similar to those reported by other workers.

6.2: Recommendations

Based on the results obtained in this study, the following recommendations were made:

1. Yam peels can be used to replace Maize at 100% without any detrimental effect on performance.
2. Yam peels can be used to reduce cost of production since the peels are cheap and readily available.
3. Rabbit multiplication centers should be set up to provide breeding stock for farmers.

4. Inputs for the cultivation of Yams should be subsidized to farmers for an increased production which will result in increased Yam peels availability.

6.3: Conclusion

It can be concluded therefore that, Yam peels can be used as replacement for maize in the diet of rabbits without any detrimental effects on growth performance, carcass yield and internal organs weights, heamatology and biochemical indices of weaner rabbits.

REFERENCES

Adebayo, A. A. (1999) Climate 11 In; **Adamawa State in Maps**. (edit) Adebayo, A. A. and Tukur, A.L. Paraclate Publishings, Yola.Nigeria.Pp 27-31. Department of Geography, Federal University of Technology, Yola.

Aderemi, F.A. and Nworgu, F.C. (2007) Nutritional Status of Cassava Peels and Root Sieviate biodegraded with *Aspergillus niger*. *American Eurasian of Journal Agric Environ. Sci.* 2:308 – 311.

Adeyemo, A.I. and Borire, O.F. (2002) *Response of giant snail (Archachina Marginata) to graded levels of yam peel meal based diet*. *Journal of Nigerian Society of Animal Production*, 3:4-6

Aduku, A.O. and Okolusi, J.O (1980) *Rabbit Management in the Tropics. Production, Processing, Marketing, Utilization, Economics, Practical Training, Research and Future Prospects*.

Aduku, A.O. and Okolusi, J.O. (1990) *Rabbit Management in the Tropics. Living Books Series, GU, Publications. Abuja.*

Akinmutimi, A.H., Odoemelam, V.U. and Obasienkong, S.F. (2006) Effects of replacing maize with ripe plantain and yam peels in the diet of weaner rabbits. *Medwell online journal of Animal and Veterinary Advances* 5 (a) 737 – 744.

Akinmutimi, A.H. and Anakebe, O.C. (2008) Performance of weaner Rabbits fed graded levels of yams and sweet potatoe meals in place of maize based diet. *Pakistan Journal of Nutrition*. 7 (5) 700 -704

Ajala, .A.A., (2001) *Intake and Digestibility of Potatoe Peel Yeast slurry diet by West African dwarf goats*, B.Sc. project. Michael Okpara University of Agriculture, Umudike.

Akanno,E.C., 1998 *The true metabolizable energy. Nitrogen corrected true metabolizable energy and true digestible protein of selected non –conventional*

feeding stuffs using poultry. B.Sc. thesis, Micheal Okpara university of Agriculture. Umodike, pp 4-28.

A.O.A.C, (1990) Association of official analytical chemist. Method of analysis (ised) Publication by Association of official analytical chemist. Washinton D.C

ARBA (2002) Wikipedia <http://www.rabbitgeek.com/abwrc>. 1 June 2010.

Cheeke, P.R, (1987) **Rabbit Feeding and Nutrition** Academic Press, San Diego. C.A.

Cheeke, P.R (1992) **Feeding system for tropical rabbit production, emphasizing roots, tubers, Plantains and Bananas in Animal Feeding.** M.David and solveig, N(Edits). Proceedings of the FAO Experts Consultation held in CIAT Cal, Columbia. 21-25 January 1999. FAO, Animal Production and Health Paper. NO.95 Rome, Italy Pp 235-249 <http://www.fao.org>.

Eka, O.U., The chemical composition of yam tubers. **Advances in yam research, the chemistry and technology of yam tubers.** Osujun, G.(ed) Publication by Biochemical Society of Nigeria in collaboration with ASUTECH, Enugu.

Ekpenyong, T.E.(1990) Toxic effects of feeding leucaena leaves to growing rabbits *Nutrition Reports International* **31**:345-350

Fomunyan, R.T., (1992) Roots, tubers, plantains and bananas in animal feeding: Economic aspect of banana and plantain use in animal feeding. The Cameroon experience. FAO Corporate document repository.

Philippine Franchise Business Investment. (2006) *Franchising Raising and Breeding rabbits.* (Google) Hahn, S.K., and Keyser (1985). Cassava a basic food in Africa. *Outlook on Agriculture.* **4**: 95 – 100

Hutagalum, R.I., (1992) Additives other than menthionine in cassava diets. Pp 18 – 32 Cassava as animal feed Proceedings. Cassava as animal feeds workshop. Edited by B. Nestle and M. Graham. University of Guelph, Canada. EDRC – 095: Ohawa.

Ijaiyi, A.T and Awonusi,E.P. (2005) Effect of replacing maize with yam peel meal on the growth performance of weaner rabbits. *J. Sustainable tropical Agricultural Resources. Pp 91-93*

Iyayi, A.T., and Awonusi, E.P., (2001). Effects of replacing maize with yam peel meal on the growth performance of weaner rabbits production. **Proceedings of 7th Annual Conf. Animal Sci. Ass of Nig.** (ASAN) Abeokuta, Nigeria.

Iyayi, A.T., and Awonusi, E.P., (2005). Effects of replacing maize with yam peel meal on the growth performance of weaner rabbits. *Journal of Sustainable Tropical Agric Research. 91 -93.*

Jansen, W.M., (1989) **European Table and Energy Value for Poultry Feedstuffs.** 3rd ed. Beekbergen Netherlands, Spel derholf, Centre.

Job, T.A., (1975) Utilization and Protein Supplementation of Cassava for animal feeding and effects of sources on cyanide detoxification. PHD thesis. University of Ibadan, Ibadan. Nigeria. Pp 540.

Jazimierz Szebiotko. Utilization of Agro-Industrial by-products and crop residues by monogastrics species in Europe. University of Agriculture. Institute of Food Technology of Plant Origin. Poznam, wojska, polskiego 31. Poland.

Kharjarem, J.S., Kharjarem, Bunsiddhi .D. and Churasatien, S. (1980). Utilization of cassava leaf meal as a protein source in cassava-based broiler rations. 1979. KKu-IDRC. Cassava/Nutrition Project Annual Report. Khon Kaen University, Khonkean, Thailand. Pp. 121-144.

Manner, J.H., and Gomez, G. (1973). Implications of cyanide toxicity in animal feeding studies using high cassava rations. Pp. 120-133 In: **Proceedings, chronic cassava toxicity workshop.** Edited by Nestle, B. and Mac Ityre, R. London, England.

Mutetikka, D.B., Wanyoike, M.M. (1990)The effect of supplementation to diet of Rhodes grass (*Choris gayana*) hay, maize (*Zea mays*) leaves and sweet

potato (*Ipomea batatas*) vines on performans of grower rabbits. *Journal of Applied Rabbit Research* 13 (in press).

Omole, T.A., and Onwudike, O.C. (1982). Effects of Palm oil on the use of cassava peel meal by rabbits. *Tropical Agriculturalist*. Macmillan Education. Ltd..

Omole, T.A., and Sonaiya, E.B. (1981). The effects of Protein source and methonine supplementation of cassava peel meal utilization by growing rabbits. *Nutrition reports International*. **23**(4): Pp. 729-737

Raharjo, Y.C. Cheeke, P.R. and Patton, N.M. (1986a) Growth and productive performance of Rabbits on a moderately low crude protein diet with or without methonine or urea supplementation. *Journal of Applied Rabbit Research* **11**:201-211.

Robinson K.L., Cheeke , P.R., and Patton , N.M. (1985) Effect of coprophagy on the digestibility of high-forage and high- concentrate diets by rabbits. *Journal of Applied Rabbit Research* **8**: 57-59

Ruby, T.F. Better utilization of crop residues by-products in animal feeding.

Scott, G.J. (1987). Sweet potatoes as animal feed in developing countries. Present patterns and future prospects. FAO. Corporate Document Repository.

Sonaiya E. B. and Omole , (1977) Cassava peel for finishing pigs N.u.t. Rep. Int. **16**(14):479- 486 Steel, R.G., and Torrie, J.H. (1980). Principle and procedure of

statistics. A Biometric approach and edition. McGraw Hill Book Co.

Terry, R.A., Mundell D.C., Oshourn, D.F. (1978) Comparison of two in vitro procedures using rumen liquor –pepsin or pepsin-celluiose for prediction of forage digestibility J. Brit. Grassld Soc. **3**:13-18

Udedibie A B I, Essien C A and Obikaonu H O 2005 Comparative performance of young growing rabbits fed diets containing cracked and Cooked Jackbean soaked in water prior to cooking. *Nigerian Journal of Animal Production* **32** (2):261-267.

Wilson, R.T. (1995). Livestock Production systems. The tropical Agriculturist. Macmillan Education. Ltd..

Yakubu, B., Yusuf, H.B., Osaka, E.A., Gworgwor, Z.M., Yuguda B.M ., and Bako M.I. (2008) Evaluation of Partial Germinated Masakwa Sorghum Cultivar (*Sorghum bicolor* (L) al A Moench) as Replacement for Maize in the Diets of Growing Rabbits. *Nigerian Journal of Tropical Agricultures* **10:59-65**

LIST OF APPENDICES

Appendix 1: Analysis of variance for feed intake

sv	df	ss	ms	f	p
Treatment	4	1192.38	298.09	48.40	.000
Error	10	61.58	6.15	-	-
Total	14				

Appendix 2: Analysis of variance for ADWG

sv	df	ss	ms	f	p
Treatment	4	21.89	5.47	8.88	0.03
Error	10	6.16	0.61	-	-
Total	14				

Appendix 3: Analysis of variance for feed conversion ratio

sv	df	ss	ms	f	p
Treatment	4	.055	0.13	0.23	0.91
Error	10	5.80	5.81	-	-
Total	14				

Appendix 4: Analysis of variance for AVLW

sv	df	ss	ms	f	p
Treatment	4	689333.33	172333.33	11.489	0.001
Error	10	150000.00	15000.00	-	-
Total	14				

Appendix 5: Analysis of variance for Shoulder

sv	df	ss	ms	f	p
Treatment	4	15660.00	3915.00	6.89	0.006
Error	10	5683.33	568.33	-	-
Total	14				

Appendix 6: Analysis of variance for ribs

sv	df	ss	ms	f	p
Treatment	4	12290.00	3072.50	2.89	0.79
Error	10	10633.33	1063.33	-	-
Total	14				

Appendix 7: Analysis of variance for loin

sv	df	ss	ms	f	p
Treatment	4	16073.33	4018.33	7.58	0.004
Error	10	5300.00	530.00	-	-
Total	14				

Appendix 8: Analysis of variance for hind limbs

sv	df	ss	ms	f	p
Treatment	4	31543.33	7885.83	2.98	0.074
Error	10	26500.00	2650.00	-	-
Total	14				

Appendix 9: Analysis of variance for had

sv	df	ss	ms	f	p
Treatment	4	4133.33	1033.33	413	0.031
Error	10	2500.00	250.00	-	-
Total	14				

Appendix 10: Analysis of variance for skin

sv	df	ss	ms	f	p
Treatment	4	4560.00	1140.00	4.50	0.024
Error	10	2533.33	253.33		
Total	14				

Appendix 11: Analysis of variance for river

sv	df	ss	ms	f	p
Treatment	4	950.93	237.73	3.60	0.046
Error	10	660.00	66.00	-	-
Total	14				

Appendix 12: Analysis of variance for kidney

sv	df	ss	ms	f	p
Treatment	4	2090.00	522.50	2.61	0.099
Error	10	2000.00	200.00	-	-
Total	14				

Appendix 13: Analysis of variance for lungs

sv	df	ss	ms	f	p
Treatment	4	373.33	93.33	3.11	0.066
Error	10	300.00	30.00	-	-
Total	14				

Appendix 14: Analysis of variance for body

sv	df	ss	ms	f	p
Treatment	4	65.60	16.40	17.57	0.00
Error	10	9.33	0.93	-	-
Total	14				

Appendix 15: Analysis of variance for small intestine

sv	df	ss	ms	f	p
Treatment	4	8632.67	2158.17	1.15	0.389
Error	10	18798.67	1879.87	-	-
Total	14				

Appendix 16: Analysis of variance for large intestine

sv	df	ss	ms	f	p
Treatment	4	146619.27	146619.27	1072.56	0.000
Error	10	1360.67	136.07	-	-
Total	14				

Appendix 17: Analysis of variance for caecum

sv	df	ss	ms	f	p
Treatment	4	34945.07	34945.07	424.09	0.000
Error	10	824.00	82.42	-	-
Total	14				

Appendix 18: Analysis of variance for stomach

sv	df	ss	ms	f	p
Treatment	4	1325.40	1325.40	710.04	0.000
Error	10	18.67	1.87	-	-
Total	14				

Appendix 19: Analysis of variance for heard

sv	df	ss	ms	f	p
Treatment	4	0.000	0.000	0.000	0.000
Error	10	0.000	0.000	-	-
Total	14				

