EFFECT OF DOE CHARACTERISTICS ON REPRODUCTIVE PERFORMANCE

BY

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SUBMITTED

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DECLARATION

I hereby declare that this project titled **"EFFECT OF DOE CHARACTERISTICS ON REPRODUCTIVE PERFORMANCE"** was written by me in the Department of Animal Production and Health, Federal University Oye-Ekiti, Ekiti State under the supervision of Dr.(Mrs) M. Orunmuyi. No part of this work has been presented in any previous work for an undergraduate degree in any university. Information obtained from any literature has been duly acknowledged in the project and a list of references provided.

.... 15/03/2019 ....

OLUSEGUN OLUWAKAYODE IBUKUN **DATE**

CERTIFICATION

This is to certify that this project titled **"EFFECT OF DOE CHARACTERISTICS ON REPRODUCTIVE PERFORMANCE"** by Olusegun Oluwakayode Ibukun meets the regulations governing the award of the degree of Bachelor of Agriculture of Federal University Oye-Ekiti, Ekiti State and approved for its contribution to knowledge and literary presentation.

DR. MRS. M ORUNMUYI

....

PROJECT SUPERVISOR **DATE**

DR. A.H. EKEOCHA

.... 15/3/19

HEAD OF DEPARTMENT **DATE**

DEDICATION

This project is dedicated to the almighty God who has never failed me, and to my late mother, MRS. COMFORT OLADUNNI ADEKANYE who, through her untiring and unsparing efforts, contributed immensely to my upbringing in life.

It is also dedicated to my father, MR.E.S.ADEKANYE and my brothers, AYOKUNLE, OLUWATOBI, ANUOLUWA and OLUWATOSIN.

ACKNOWLEDGEMENT

All thanks to the almighty God, the author of my life: one who has brought me this far in his abundant grace; may his name be glorified.

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To my late mother, Mrs. Adekanye, continue to rest in the bosom of our Lord Jesus Christ.

Also, I want to say a big thank you to my brothers, numerous to mention. I love you all.

I wish to express my gratitude to my friends and colleagues who have contributed immensely to the success of this research. Also, to my siblings for the love and togetherness we share as family. I pray we all excel in life.

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ABSTRACT

This study was conducted to determine the effect of doe reproductive performance of local and exotic dam in regards to their reproductive characteristics such as conception rate, pregnancy rate, kindling rate and litter size in a tropical environment. The study shows the interaction between reproductive performance and dam breed, parity, teat number, and fur score. A total of twenty (20) matured does and five (5) matured bucks were used for the experiment. The does were either local or exotic breed. The mating was designed such that a local breed buck was crossed with a local breed doe and an exotic breed buck with an exotic breed doe. The does were divided into 2 groups with 10 local does in a group and 10 exotic does in a group. The rabbits were fed compounded feed of 2550 Kcal/kg metabolisable energy, 18% crude protein, and 15% crude fibre. The experiment lasted for nine months and data collected were subjected to analysis of variance using the GLM procedure of SAS (1999).

The result obtained showed that there were differences between breeds in regards to doe weight at mating, doe weight after mating, doe weight at birth, gestation length, number of kits born, number of kits born alive, number of kits born dead, individual kit weight, litter weight and average litter weight at birth. From the result, it can be concluded that exotic breed have a better reproductive performance than local breed. Therefore, doe reproductive performance can be improved through breed manipulation such as cross breeding.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background study

The human population growth in developing countries including Nigeria is still increasing rapidly, hence the need for alternative sources of protein to meet up with the population challenge (Mailafia *et al*., 2010). This is because increasing population is equivalent to increasing number of people to be fed and so increasing demand for food products. Owen *et al.* (2008) surmised that in order to maximize food production and meet protein requirements in Nigeria, viable options need to be explored and evaluated. Among such alternatives is rabbit because of its prolificacy, quality of meat and ability to thrive on feed products that humans do not consume and converting such feed products to meat that humans can consume (Owen *et al*,2008).

Rabbits are herbivores and so do not compete with humans for their food. They efficiently convert fodder food to meat. It has been reported that rabbits can turn 20 percent of the proteins they eat into edible meat (FAO, 1997). Comparable figures for other species are 22 to 23 percent for broiler chickens, 16 to 18 percent for pigs and 8 to 12 percent for beef (FAO, 1997). Also, rabbits are characterized by small body size, short gestation period, high reproductive potential, rapid growth rate and, genetic diversity. (Mailafia *et al.*, 2010). Rabbit meat is high in protein and low in fat content (Jenny and Julie, 2014). Rabbit production is less capital intensive as rabbits can be fed on crop residues, weeds, waste fruits, vegetables and poultry droppings while the housing systems and equipment such as cages, feeders and so on can be made using readily available materials such as split bamboo and raffia palm (Mailafia *et al.*, 2010). These characteristics make it possible for poor farmers to be able to handle rabbit farming effectively since it involves low capital and labour investment.

Rabbit production can therefore be used to alleviate the animal protein deficiency experienced in Nigeria (Ajala and Balogun, 2004). However, despite the merits of rabbit farming, it is faced with so many limitations in Nigeria. Such limitations and problems include inadequate market for products and inadequate skill on the part of farmers for rabbit management particularly reproduction management (Awojobi *et al.*,2011). Awojobi *et al.* (2005) reported that the problem highlighted above could be due to dearth of information as regards reproduction management of rabbit.

The continuity of any animal production farm is dependent on continuous supply or generation of offspring from the breeders stock. This means that any problem with reproduction will also affect the continuity of the farm.

Chineke (2006) worked on evaluation of rabbit breeds and crosses for pre-weaning reproductive performance in humid tropics. In his study, crossbreds from select breeds namely New Zealand White, Chinchilla, Dutch belted and Croel breeds were assessed for effects of genotype and parity of dam on Individual kit weight, litter weight, average litter weight and litter size at birth. His results showed significant effects of both genotype.

Obike and Ibe (2010) also studied the effect of genotype on pre-weaning growth performance of the domestic rabbit in a humid tropical environment and while their study involved the use of three rabbit breeds, namely New Zealand White, Chinchilla and Dutch, significant differences were recorded among genotypes for pre-weaning growth performance at all the ages (21 to 56 days) studied. Also, an observed superiority of purebreds over crossbreds was recorded.

Also, the decision on when to mate is very critical as it determines the success or failure of any breeding programme. Re-breeding or re-mating interval is the time between a successful parturition and another mating or conception. Smith and Somade (1994),reported that the interaction between re-mating interval and the reproductive performance has a significant effect on several traits such as conception rate, gestation length, litter size, weaning weight, litter weight, body weight of doe, mortality, growth rate and milk production of dams. This shows that re-mating interval does not only have effect on reproductive traits but also on growth parameters. It has been shown by Cheeke (1983) that rabbits could be mated 24 hours after kidding since rabbits are induced ovulators. McNitt *et al.,* 1996 also ed-If early re-mating is successful, there is a possibility of increasing reproductive rate (*Saha et al., 2013).* However, short re-mating intervals after kidding may not allow for adequate recovery of the body reserve of the does and consequentially, there may be a decrease in growth and reproductive performance and increase in kit mortality (Saha *et al.,* 2011).

A proper understanding of postpartum reproductive physiology in the domestic rabbit within the confines of the limitations of the tropical environment will assist in establishing the most effective ways of managing rabbit production for optimal growth and performance (Awojobi *et al.,* 2011).

1.2 JUSTIFICATION

This study showed effects of doe characteristics on the reproductive performance. The study is aimed at determining effects of doe reproductive performance on local and exotic dam in regards to their reproductive characteristics such as conception rate, pregnancy rate, kindling rate and litter size in a tropical environment.

Since it has been established that rabbits can be remated 24 hours after kindling, thereby increasing reproductive rate and making it possible to breed many offspring within the minimum time possible, it is important to investigate whether or not doe characteristics will significantly affect the reproductive performance.

1.3 OBJECTIVES OF THE STUDY

1.3.1 Broad objective

The aim of this research is to examine the effect of doe characteristics on reproductive performance.

1.3.2 Specific objective

- To determine the effect of dam breed on reproductive performance, the effect of teat number on reproductive performance, the effect of fur score on reproductive performance and the effect of parity on reproductive performance and the interaction between these factors.

CHAPTER TWO

2. 0 LITERATURE REVIEW

2.1 Origin and Distribution of Rabbits

Analysis of mitochondrial DNA (mtDNA) has been widely used in the genus *Oryctolagus* and suggests that modern European rabbits had the same roots as the European wild rabbit, *Oryctolaguscuniculus,* which was discovered in the Iberian Peninsula by the Phoenician in about 5000 BC (Hardy *et al.,* 1995; Monnerot *et al.,* 1996; Fuller *et al.,* 1997). Arthur (1989) and Gonzalez-Redondo (2006) also suggested that the domestic rabbit (*Oryctolagus cuniculus*) originated from the European wild rabbit which is game specie reared on farms in countries such as Spain, France, and Portugal. Stephen (2006) reported that Romans also kept hares and then switched to rabbits from Spain in the Roman leporarium from which they were easily harvested for kitchen use, and thus spread the rabbit to many lands. The Romans kept rabbits in walled enclosures (leporaria) and there is evidence that they brought them to Britain, but they did not survive at this time (FAO, 1997).However, these facts do not necessarily mean rabbits were domesticated (Stephen, 2006). Rather, the domestic breeds of rabbits we know today had their roots in the French monasteries where, from the early middle Ages, they were kept in hutches and raised as a food source (Stephen, 2006).Sanford (1996) stated that the rabbits did not spread quickly as they did in later centuries, for 800 years later; none of the Greek writers mentioned rabbit, which suggests that it had not reached the eastern Mediterranean by then. Although the Romans were responsible for the spread of the rabbit out of Spain, they did not attempt to produce artificial breeds from a domesticated stock; they merely fattened them for food or left the rabbits to live as they would in the wild, except that they were kept in enclose hutches, arrears, or warrens (Clutton-Brock, 1999). Clutton-Brock (1999) further mentioned that the extremely fast rate of reproduction of the rabbit, combined with their burrowing habits, enabled them to escape from the Roman warrens and rapidly invades the countryside, but they probably did not reach the British Isles until the Norman period. Rabbits were also carried by sailors and let loose on oceanic islands so that they could breed and provide a store of fresh meat that would be readily available for passing ships. It is for these reasons that rabbits are now found all over the world and on almost all islands from Lundy to the Falklands (Clutton-Brock, 1999). France with, certainly after the war II, the largest rabbit industry in the world, has been the leader in this field, followed perhaps by Italy and Spain (Sanford, 1996).

2.2 Taxonomy of Rabbits

Scientific names are very important and widely used by scientists throughout the world to easily identify what specie is being referred to (Husein, 2015). This is because a hare in Nigeria may be completely different from a hare in the United Kingdom (Husein, 2015). Taxonomy was developed by Linnaeus (1735) where he classified living organisms using different levels and statuses (Husein, 2015). Following this system, rabbit can be classified as follows;

Domain	—	Eukarya
Kingdom	—	Animalia
Phylum	—	Chordata
Sub-phylum	—	Vertebrata
Class	—	Mammalia
Order	—	Lagomorpha
Family	—	Leporidae
Genus	—	Oryctolagus
Species	—	cuniculus

2.3 Domestication of Rabbit

Rabbit domestication dates back no further than the present millennium (FAO, 1997). The wild rabbit *Oryctolagus cuniculus* is thought to have been discovered by Phoenicians when they reached the shores of Spain about 1,000 BC (FAO, 1997). The Romans ate fetuses or newborn rabbits, which they called laurices, and are believed to have spread rabbit throughout the Roman Empire as a game animal (FAO, 1997). It is known that monks were in the habit of eating laurices during Lent as they were considered "an aquatic dish" known as sic (FAO, 1997). Several breeds of rabbit were known in the sixteenth century and this is the first indication of controlled breeding (FAO, 1997). Domestication can therefore be traced to the late middle ages, probably mainly the work of monks, since it provided them with a more delectable dish than the tougher wild rabbits (FAO, 1997).

2.4 Importance of Rabbits

Rabbits are raised for several purposes. The major products derived from rabbits include meat, fur, and wool (Cheeke, 2005). Rabbits are also used for laboratory experiments, exhibition and as pets (Cheeke, 2005). Rabbits have been promoted as tools in poverty alleviation programmes (Dolberg, 2001; Owen *et al.,* 2005). This could be on account that rabbit farming requires low investment and yields early benefits, and probably because of their subsistence on renewable resources for feeding, housing and general management. Lukefahr (1999) stated that small-scale rabbit projects could be used as a vehicle for the poor to help themselves. According to Sandford (1996), the domestic rabbit is called the "poor man's pig". This is because, a number of variety of use to which rabbit is put by man include; supply of food (the most extensive of all the uses), very high grade wool, serves as a source of miscellaneous products, assists in laboratory and experimental work, and could be kept as exhibition, pet or companion animal and could be used in educational work of varied sorts (Sanford, 1996).

Rabbit furs for clothing purpose have been used for hundreds of years (Sanford, 1996). The skins can be used in the production of toys, craftwork and garment and can be in cottage industries for such purposes.Rabbits are bred as pets, for genetic studies, for laboratory experimentation, and for their meat and furs; domestic rabbits' furs are sold under the trade names of arctic seal, clipped seal, and lapin (Redmond, 2009).

2.5 Breed characteristics and color varieties of Rabbits

The term 'breed' can be used in a number of different ways but in the rabbit world it is a group of animals, or populations which resemble each other (Sanford, 1996). Breeds of rabbits had been produced from these three ways; occurrence of mutation which is the mechanism which controls the inherited characters producing a particular colour or type of fur may be changed, thus producing an entirely new character (Husein, 2015). The second method is by combination of characters existing in two or more breeds (Husein, 2015). The third system is by selection for particular characteristics carried to such a degree that a strain differing greatly from the original stock is produced (Husein, 2015). All these ways, and variations of them, have been used or have occurred in the production of the present breeds and varieties of domestic rabbits (Sanford, 1996). Sanford (1996) further stated that the common breeds of rabbits are Angola white, Flemish giant, New Zealand white, New Zealand red, British giant, California white, Sussex, Smoke pearl, Chinchilla and Chinchilla giant, among others.

According to the American Rabbit Breeders Association (ARBA) cited by NAFIS (2012), there are over 47 distinct rabbit breeds. The domesticated rabbit has extremely diverse characteristics, varying in colour through every grade, shade, and mixture, from pure white to all black; in coat from very short to long, silky hair capable of being woven; and in style of ears from the prick ear—erect, small and almost as stiff as metal—to the floppy, broad, soft-skinned lopped ear, which hangs to the ground (Redmond, 2009). According to Sanford (1996), all domestic rabbits throughout the world are the same species, *Oryctolagus* significant effect (p>0.05) on most of reproductive traits measured (% conception, Gestation length (days), Litter size at birth (kits), Litter weight at birth (g), and Average kit weight at birth (g)). Conception rate recorded was discovered to be significantly (p<0.05) highest when natural mating was practiced while all other reproductive traits were non-significant (p>0.05). It was also observed that breeding system had a significant effect on average kit weight when artificial insemination was practiced, while other post-partum litter traits (Litter size at birth (kits), Litter weight at birth (g), Average kit weight at birth (g), Litter weight at week 8 (g), and Average kit weight at 8 weeks(g)) were not significant (p>0.05).

2.5.1 New Zealand White

The New Zealand White breed has good growth characteristics and is capable of attaining slaughter weight of 1.3-2.5kg live weight within 8-10 weeks (Husein, 2015). This claim is dependent on feeding regime. It is a commercial breed that grows to a weight of 4-5.4kg and has all-white colour (Husein, 2015). Its fur is marketable. It has good mothering instinct and so is considered as 'dam breed' (Sanford, 1996).

Plate 2.1: New Zealand White (Source: Sanford, 1996)

2.5.2 Californian White

This is a commercial breed developed in the United States (Husein, 2015). It has broad shoulders and meaty back and hips and hence is a good meat type breed with good dressing percentage (Sanford, 1996). It is white except for its ears, nose, feet and tail which are either dark grey or black. It is recognized by four colours – Normal (black points), Chocolate, Blue and Lilac (Husein, 2015). It is an ideal sire breed for interbreeding with other breeds for purposes of meat production (Sanford, 1996). Adults weigh between 3.5 and 4.75kg.

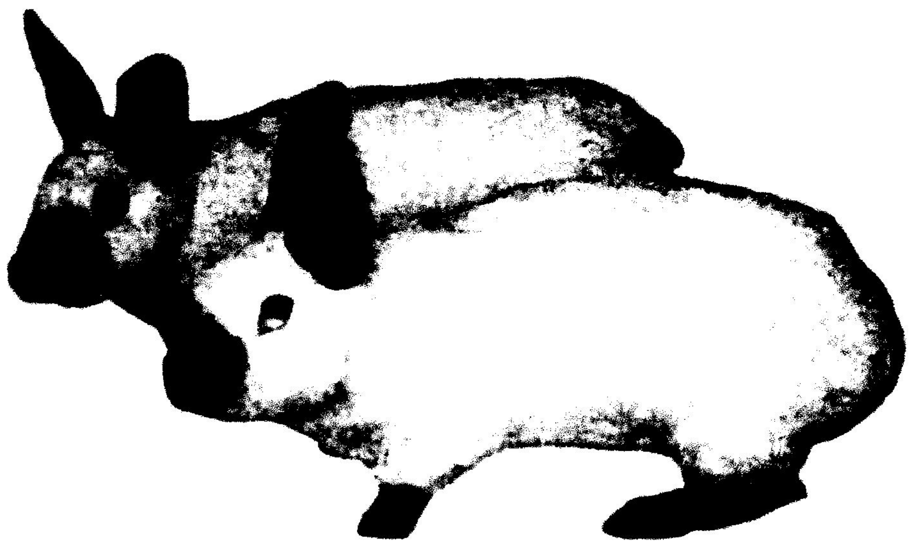

Plate 2.2: California White (Source: NAFIS, 2012

2.5.3 Flemish Giant

This is one of the largest breeds with adult bucks weighing not less than 4.9kg, nor adult does less than 5.4kg (Husein, 2015). Interbreeding it with other breeds yielded other Giants such as the British Giant and improved its characteristics (Sanford, 1996).

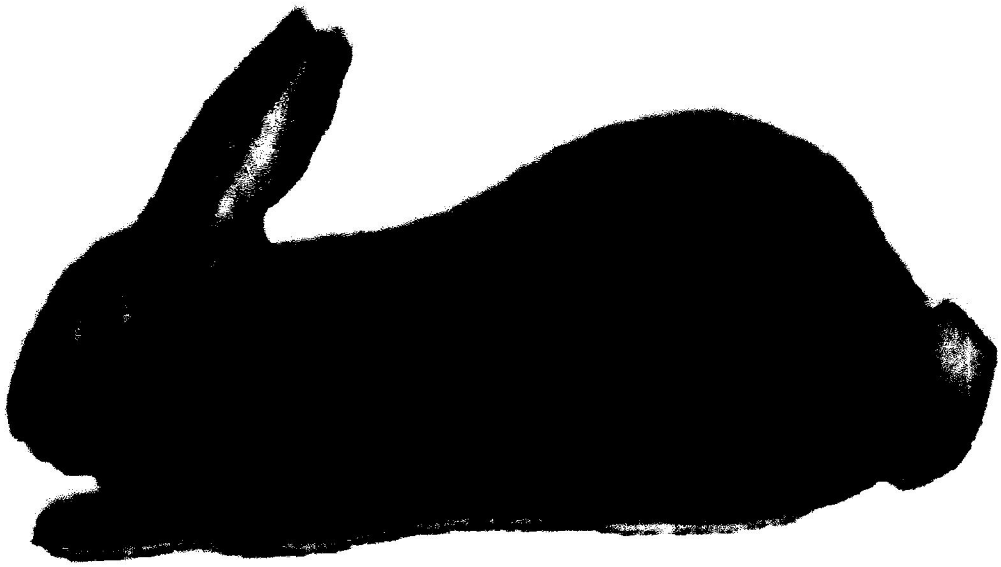

Plate 2.3: Flemish Giant (Source: NAFIS, 2012)

2.5.4 Chinchilla

Originally bred for fur and meat, they are short and stocky with a nice rounded back (Husein, 2015). There are three (3) chinchilla breeds: Standard, American, and Giganta Chinchilla (Sanford, 1996). It weighs between 2.5 and 3kg or more depending on the type. Pelts of the Chinchilla rabbit which are impossible to imitate with dyes are usually more expensive than other normal fur-breed skins (Husein, 2015).

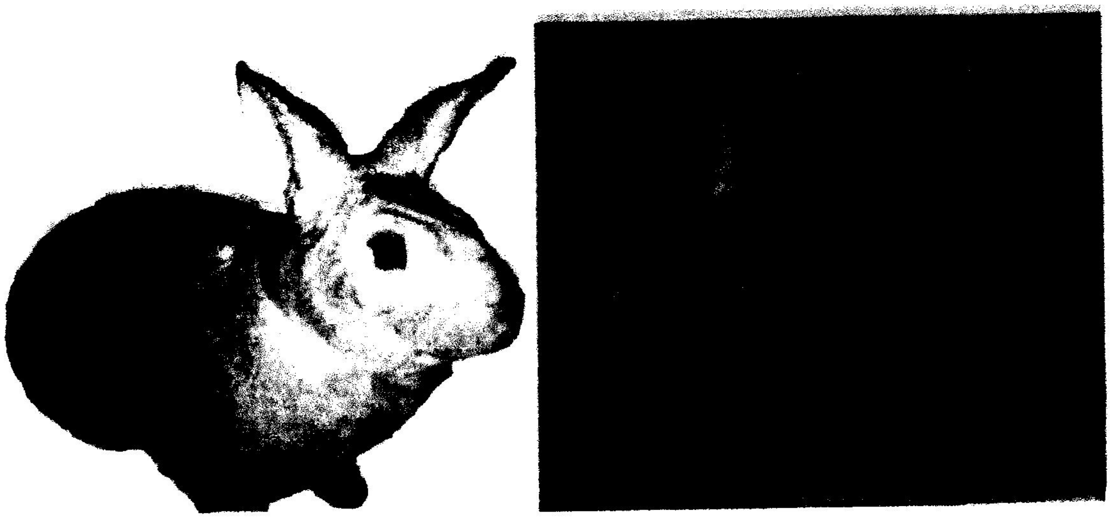

Plate 2.4: Chinchilla (Source: Sanford, 1996)

2.5.5 Angora

This breed is mainly bred for its wool. Mainly because of the wool they produce, they require regular grooming. It is therefore more suited as a pet than for meat (Husein, 2015). This breed is recognized in white and twelve different colours (Husein, 2015). However, majority of Angoras bred are white (Sanford, 1996). English Angora has much finer coat and weighs on average about 2.75kg as against 3.6kg or more for French Angora and slightly over 4kg for the larger German Angora (Husein, 2015).

Plate 2.5: Angora (Source: NAFIS, 2012)

2.5.6 Dutch

Fairly small but compact with shorter forelegs. There are eight different colours of Dutch, viz; Black, Blue, Chocolate, Tortoise shell, Pale Grey, Brown Grey, Steel Grey, and Yellow (Husein, 2015). The breed weighing below 2.25kg has good meat properties, although on the small side (Husein, 2015). When other breeds are crossed with Dutch, traces of the Dutch pattern are liable to be exceedingly difficult to eradicate (Sanford, 1996).

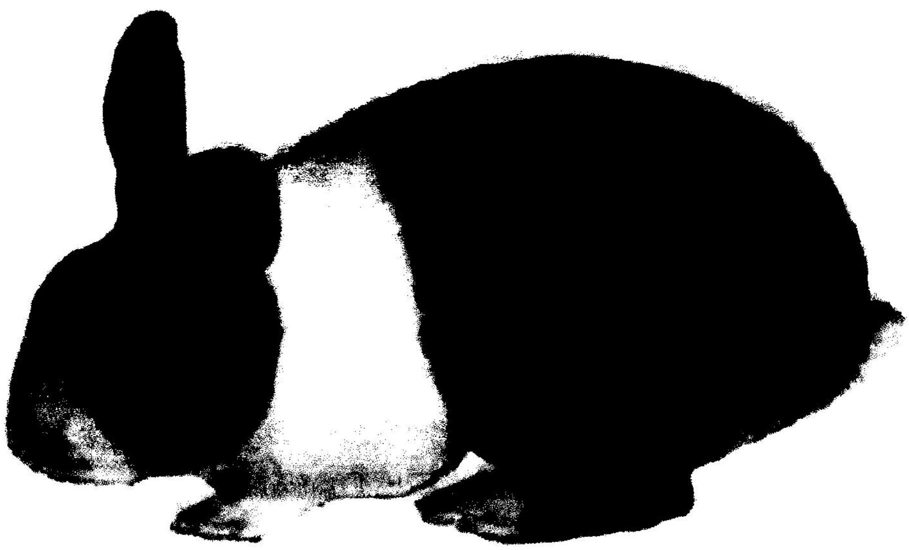

Plate 2.6: Dutch (Source: NAFIS, 2012)

2.6 Rabbit's Reproductive Behavior

The farmer's ability to breed his animals successfully has a high dependence on the fertility status of the animals used. Also, the advantage of raising rabbits for human consumption rests on their potential biological efficiency (Awojobi *et al.*, 2011).However, the gap between biological potential and practical achievement is still wide in terms of reproductive performance (Awojobi *et al.*, 2011). The relevance of sexual behavior in farm animals can be assessed using various parameters. Umesiobi *et al.,* (2000), reported that parameters for measuring reproductive performance in female animals include: conception rate, litter size, milk production and fecundity. The reproductive performance of the male could be measured using the sperm concentration, sperm motility, live/dead spermatozoa and proportion of morphologically deformed sperms (Herbert, 1992; Umesiobi *et al.,* 1998; Umesiobi *et al.,* 1999; Ogbuewu *et al.,* 2007).

Rabbits are induced ovulators and can be rebred within 24 hours after parturition (Awojobi *et al.*, 2011). Thus, it is theoretically possible to produce over 11 liters per doe per year (Cheeke, 1986). This intensive type of production could not be obtained in developing countries, but it is quite feasible to produce 3 to 5 liters per year (Cheeke, 1986). This is an advantage on the part of a rabbit farmer and breeder because there wouldn't be need of waiting for too long to rest the doe before re-mating. This means that as many kits can be generated from a single doe within a little period of time. The implication of this induced ovulation in rabbit breeding is that several filial generations can be gotten within little time. However reproductive efficiency and the doe's physiology can be affected by postpartum re-mating interval (Awojobi *et al.*, 2011). This assertion implies that if a doe is rebred continuously just immediately after a safe delivery in an attempt to maximize reproduction in the stock, the reproductive efficiency and health of the doe may be altered and this would definitely have impact on the kits yet to be weaned.

In a study conducted by Awojobi *et al.,* (2011) to evaluate the effects of reducing the re-mating interval after parturition on sexual activity, fertility, gestation, parturition and litter characteristics of rabbits, it was reported that conception rate was highest in the does remated 21-28 days post-partum (98.8%) and lowest in the 10-20 days post-partum (68.4%). Gestation length was significantly shorter ($p<0.05$) in the does remated10-20 days, post-partum (30.7 days), than those re-mated 1-9 days post-partum (31.6days) and those remated 21-28 days post-partum (31.7 days). Litter size and weight at birth were not significantly affected. Kit's mortality was lower ($p<0.05$) in the 21-28 days group (25.6%) compared to 10-20days group (57.4%) and 1-9 days group (58.8%).Litter weight (total and alive at birth) was heavier ($p<0.05$) during the rains (295.9 and294.9 g) than dry season (250.1 and 243.3 g).

2.7 Feeding Behaviour of Rabbit

The domestic rabbits are primarily herbivorous and consume most types of grains, forages and hay. Diets, whether home grown or commercially prepared consist of ingredients from plant sources. Since rabbits can utilize a certain amount of forage, they have a place in food production by making use of some noncompetitive feeds

(Nworgu *et al.,* 2001; Biobaku and Dosumo, 2003; Herbert *et al.,* 2005; Omoikhoje *et al.,* 2006). Forage can contribute up to 50% of rabbit diets (Sanni *et al.,* 2005), although there is improvement in performance of rabbit fed concentrate and forage compared to feeding forage or pellets alone (Onwudike, 1995; Biobaku *et al.,* 2003; Taiwo *et al.,* 2004). For maximum performance, combination of *Centrosema pubescens* and concentrates in 50:50 ratios is the most efficient and should be used by rabbit farmers to increase production at a reduced cost (Nworgu *et al.,* 1998).

2.8 Problems of Rabbit Production

In Nigeria, as is the case for most developing countries, a major limitation to the development of smallholder rabbit production is the absence of reliable sources for quality genetic stocks of rabbits (Oseni *et al.,* 2008). Wilson (1995) pointed out that limited supply of high performance breeding stock retards rabbit production. Diseases are also part of the problems rabbit production is facing. According to Sanford (1996), the most common diseases of rabbits are coccidiosis, ear and skin mange, snuffles, mastitis, inflammation of the eyes, epizootic hemorrhagic diseases and coenurosis.

In the tropics generally, as it is with other livestock, heat stress poses a serious limitation to rabbit production (EL- Raffa, 2004). Heat stress reduces feed intake, impairs growth, decreases fertility and increases kit mortality (EL- Raffa, 2004). High ambient temperatures can cause infertility in breeding rabbit's and 30°C is considered the threshold, beyond which infertility may result (Lukefahr and Cheeke, 1990). Adaptation to heat stress, particularly under hot and humid zones, has been extensively reviewed by El-Raffa (2004) who noted that heat stress is ranked as the most important problem facing the rabbit industry in the tropics and in arid regions, as compared to poor quality diets, diseases and/or parasites. Heat stress reduces feed intake, impairs growth, decreases fertility and increases kit mortality (El-Raffa, 2004).

Apart from all the problems listed above, another limitation to rabbit production in Nigeria and the tropics in general is inadequate skill on the part of farmers for rabbit management, particularly reproduction management (Awojobi *et al.*, 2011). This is basically due to the dearth of information as reported by Awojobi *et al.* (2005). The introduction of cycled production and artificial insemination (AI) has improved management and productivity of the doe in Europe (Awojobi *et al.*, 2011).However, cyclic production is giving way to the development of different reproduction protocols since continuous postpartum rhythm decreases fertility rate and length of reproductive activity (Parigi-Bini *et al.*, 1989) and only a few does can sustain a fixed postpartum rhythm (Castellini *et al.*, 2003).In Nigeria, there is dearth of information on the physiology of the domestic rabbit after parturition (Awojobi *et al.*, 2011). A proper understanding of postpartum reproductive physiology in the domestic rabbit within the confines of the limitations of the tropical environment will assist in establishing the most effective ways of managing rabbit reproduction for optimal performance and also enable an avenue for mapping out strategy for improving reproductive performance (Awojobi *et al.*, 2011). Though, commercial rabbit production is still in its infancy in Nigeria (Awojobi *et al.*, 2011),therefore the availability of correct information on reproduction management is one of the catalysts needed for the development of the rabbit industry.

2.9 Doe Performance Traits

2.9.1 *Litter size*

The doe in rabbits is known to be polytochous and the number of kits born and raised to weaning is an indicator of doe performance (Mcnitt *et al.,* 1996). Litter size at birth and at weaning has been the objective of selection in several studies involving rabbit populations (Gomez *et al.,* 1996). However, response to selection, when estimated, has been slow (de Rochambeau *et al.,* 1994) because of their low heritability (Baselga *et al.*, 1992). Litter size at birth is highly dependent on ovulation rate, uterine capacity and embryonic or fetal survival in the doe (Argente *et al.,* 2003), while litter size at weaning depends on litter size at birth, nest quality and survival rates of the litter (Lebas *et al.,* 1997). Khalil (1993) reported LSB and LSW as 7.1 and 5.3 respectively for NW and 6.7 and 4.99 kits for the CC. Elsewhere Laxmi *et a*l., (2009) reported 5.76 and 4 for the NW and 6.08 and 3.85 for the FG. These results and those from other studies vary from even the same genetic group

2.9.2 *Reproductive Longevity*

Longevity, a non-traditionally studied trait, is defined as the age at which a doe either dies or is culled from the production herd (Lukefahr and Hamilton, 2000). Long living animals able to maintain a high rate of reproductive performance during successive lactations are of great interest in animal production to reduce the replacement cost of the animals and in terms of animal welfare. Piles *et al.,* (2006) described reproductive longevity as the period between the age at first successful mating, assessed by pregnancy diagnosis and at first kindling to the time the doe is culled or dies or the ability of the female to delay involuntary culling. Other studies were carried out involving number of litters/ parturitions or length of life (Sanchez *et al.,*2008) or number of mating or age at culling (Lukefahr and Hamilton, 2000). Breed differences in doe reproductive longevity would affect cumulative litter production and replacement costs that impact herd profitability. In meat rabbit production, the doe replacement rate is about 120% (Rafel *et al.,* 2001) with about 50% of the dead or culled does replaced during their first 3 production cycles (Rosell, 2003) or at between 1 to 2 years to be replaced by a new generation (Piles *et al.,* 2006). At this age, the quality of the carcass is deemed to be of good quality. The main problems associated with high replacement rate are the replacement cost of the does, the greater frequency of less mature females (young does are still growing and are less immunologically mature at parturition, showing lower litter size and more health problems), and sometimes the management and pathological problems related to introduction of animals from other farms (Piles *et al.,* 2006). All of these considerations lead to a strong interest in increasing reproductive longevity, defined as the ability of the female to delay involuntary culling. Despite its importance, longevity has not been included in rabbit selection programs. Theilgaard *et al* (2007) reported the LP line of the NW to attain parities of above 25 and suggested its use in breeding programs to harness this trait. The difficulty in improving longevity through conventional breeding methods is mainly due to its low heritability and the time needed to obtain relevant information. However, in mice, it has been shown that reproductive life and number of parities can be improved by selection on phenotypic performance (Farid *et al.,* 2002).

2.10 Factors Affecting Reproductive Performance

2.10.1 *Parity*

Studies concerning parity i.e. previous exposure to litter, have been carried out and they show that experience with the young may influence subsequent parental behavior and development of the litter through a process that involves learning or hormonal priming. Multiparous mothers' exhibit increased maternal responsiveness to the young, and this behavior is relatively stable across the pre-weaning stages as compared to the primiparous mothers (Carlier and Noirot, 1965; Bridges, 1978;Wright and Bell,1978). Litter development is also affected by the history of experience of the parent where liters from the multiparous does are usually heavier and develop faster than those from primiparous does (Wright and Bell 1978; Myers and Master 1983; Ostermeyer and Elwood, 1984).

2.10.2 *External Environmental Factors*

There are limited genetic studies in the tropics where climate, diet management and stock sources differ markedly from the temperate countries (Mcnitt *et al.,*1996). Rabbit populations in tropical environments have heterogeneous history involving multiple breed introduction and crossings that might explain the higher heritability observed in the various doe production traits (Lebas *et al.,* 1997). Seasonal variation in conception rates, total litter size at birth and kits born alive were reported in the United States of America (Ross *et al.,* 1961, Sittman *et al.,* 1964). Mcnitt and Lukefahr (1983) also noted seasonal effects on reproduction in rabbits in Oregon, U.S.A. and Malawi. Abdel-Samee (1995) and Marai *et al.* (2001) reported the effects of heat stress on reproductive performance of rabbits in Egypt, respectively.

2.10.3 *Breed/genetic group*

Several studies have shown breed or genetic group differences in doe performance in terms of age at first successful mating, longevity and litter survival rates from birth to weaning (Mcnitt and Lukefahr, 1990). Large breeds e.g. FG take longer to attain sexual maturity at between 6 to 8 months (Lebas *et al.,*1997) compared to small and medium sized breeds like the NW. Khalil (1993) found the NW to raise more and heavier kits from birth to weaning compared to the CC.

2.11 Doe Effects on Performance of Rabbit Kits

2.11.1 Milk production of the doe

The nutrient intake of rabbit kits during the first three weeks of their life comes from the doe' milk. The individual milk intake therefore contributes to their growth and development as well as their survival before weaning. Milk intake of the kits is strongly dependent on the size of the suckling litter and the milk production of the doe (McNitt and Lukefahr, 1990). Milk production is affected by the number of factors such as breed or strain, parity, the physiological state of the doe influenced by the re-mating interval, the chemical composition of the diet and the feed intake level of the doe. Milk composition could also be relevant for the development of the kits during the pre-weaning period (Maertens, 1992).

2.11.2 Litter size

The number of suckling kits affects the individual milk intake of the kits and influences body growth (Lebas, 1969). Babile *et al.*(1982) observe that litter size in the pre-weaning period not only affected body growth but also influenced subsequent reproduction performance. Kits reared in litters of five were significantly heavier at 120 days of age than kits raised in litters of 11 kits (3442 vs 3097 g, respectively).

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Description of experimental site

The research was carried out at the Rabbit Unit of Teaching and Research Farm, Federal University Oye-Ekiti, Ekiti State, Nigeria. The University is located within the South-western Nigeria at latitude 7° 10' N, and longitude 3° 2' at altitude 76mm above sea level. The annual mean rainfall in this location is 1037mm, with average temperature of 27.6°Ce, and relative humidity of 80% (Google map, 2018).

3.2. Experimental Animals

Twenty (20) matured does and five (5) matured bucks were used for this experiment. The does were either local breeds (mixed breed) or exotic breeds (Hyla breed). The mating was designed such that a local breed buck was crossed with a local breed doe and an exotic breed buck with an exotic breed doe. There were ten does in each breed.

3.3. Housing and Environment

The experimental animals were individually caged in partitions measuring 0.9m x 0.6m x 0.45m. Cages made of wooden frames with wire netting on the sides and the base in a flat-deck system were used for this experiment. Feed and water were provided in earthen pots secured to prevent spillage. Cages were kept indoors in a closed building roofed with iron sheet with cross ventilation. Natural ventilation with no thermal insulation or cooling system was employed for the purpose of this experiment. Does were kept under natural lighting throughout the period of the experiment.

3.4. Breeding System

Mating was done using mature bucks (mating ratio of 1 buck to 5 does). A doe was presented for mating for 24 hours. Presentation for mating was done once and after 15-18 days, the does were checked if they were pregnant by palpating their abdomen. The body weight of each doe was taken and recorded before mating, at 2 and 3 weeks after mating. After three matings, does that showed no sign of pregnancy were culled from the population.

3.5. Management of the Experimental Stock

- **Tagging**: each of the experimental animals was properly tagged for proper identification, adequate record taking, and error free documentation of data.
- **Feeds and feeding:** The experimental rabbits were fed compounded feed of 2550 Kcal/kg metabolisable energy, 18% crude protein, and 15% crude fibre. Fresh fibrous forages also were presented to the rabbits once in a day to maintain the gut integrity. Clean and fresh water was supplied to the rabbits on a daily basis throughout the research period. The table below shows the various feed ingredients that was compounded for the experimental rabbits and the proportion each of the ingredients in the overall feed.

Table 3.1: Feed formulation formula of the feed used for the experiment.

Ingredients	Percentage composition (%)
Maize	45
Soya bean meal	10
Groundnut Cake	10
Palm kernel Cake	10
Wheat Offal	19.5
Bone meal	2
Oyster Shell	1.5
Premix	0.25
Salt	0.25

3.6. Data Collection

The following data were recorded and computed during the experiment:

- **Conception rate**: The number of does that accepted mating that tested positive to pregnancy diagnosis by abdominal palpation on the 12th day after mating relative to the number that were mated expressed as a percentage.
- **Pregnancy rate**: The number of does that kindled relative to number of does mated expressed as a percentage.
- **Kindling rate**: The number of does that kindled relative to the number of does in each experimental grouping expressed as percentage.
- **Gestation length**: The number of days from mating to kindling.
- **Litter size**: These comprise litter size (total and alive) at birth and weekly litter size until weaning at four weeks of age. Litters were not standardized after birth.

- **Re-breeding interval**: The actual number of days after parturition when the doe was remated.
- **Parturition interval**: The number of days between parturitions.
- **Mortality**: Kit mortality was recorded on a weekly basis across treatment and season.

3.7. Statistical Analysis

Measurements were analyzed with breeds of dam as factor of variation. All data collected were subjected to analysis of variance using the GLM procedure of SAS (1999), employing the model: doe

breed, teat number, fur score and parity

$$Y_{ijkl} = \mu + D_i + T_j + F_k + P_l + e_{ijkl}$$

where

Y_{ijkl}= individual observation;

μ= general population mean;

Di= effect of breed ;

T_j=effect of teat number;

F_k=effect of fur score;

P_l=effect of parity

e_{ijkl}=Significant means were separated using the Tukey's option of the same package.

CHAPTER FOUR

4.0 RESULTS

Table 1 shows the effect of doe breed on reproductive performance of rabbits. The results showed that there was significant difference in the number of kits born dead,($P<0.001$) between the local and the exotic does. The highest number of mortality at birth was recorded for local breed (1.39) against (0.21) for the exotic breed. However, the result also showed no significant differences in all other parameters observed.

Table1: Effect of doe breed on reproductive performance

PARAMETERS	Doe breed 1(exotic)	Doe breed 2(Local)	SEM	LOS
DW AT MATING(kg)	2.07	1.92	0.05	NS
DW 14 DAYS AFTER MATING(kg)	2.26	2.06	0.06	NS
DW 21 DAYS AFTER MATING(kg)	2.33	2.15	0.05	NS
DW 28 DAYS AFTER MATING(kg)	2.40	2.23	0.03	NS
GESTATION LENGHT	32.79	32.15	16.38	NS
NO KITS BORN	4.86	5.38	1.13	NS
NO BORN ALIVE	4.64	4.00	1.13	NS
NO BORN DEAD	0.21^{b}	1.39^{a}	0	***
LITTER WEIGHT AT BIRTH(kg)	0.24	0.22	0.00	NS
DOE WEIGHT AT BIRTH(kg)	2.14	2.01	0.03	NS
KT WEIGHT AT 7 DAYS(kg)	0.08	0.06	0.01	NS
KT WEIGHT AT 14 DAYS(kg)	0.12	0.08	0.02	NS
KT WEIGHT AT 21 DAYS(kg)	0.15	0.10	0.03	NS
KT WEIGHT AT 28 DAYS(kg)	0.18	0.14	0.03	NS

Note: Means with different superscript on the same row are significantly different

NB. DW=DOEWEIGHT; KT= KIT.

EMS=Standard Error of Mean LOS=Level of significant; NS=Not significant.

*= significant at $P< 0.05$

**= very significant at $P< 0.01$

***= highly significant at $P<0.001$

Table 2 shows the effect of teat number on reproductive performance of rabbit, from the table, the weight of does at mating showed significant differences between teat number 7and teat no. 9.(P<0.05), However, teat no 7 and 8 were not significantly different. Also, does with 8 and 9 teats were similar in weight .Highest value was recorded for doe with nine teats (2.22g) and the lowest for seven teats (1.84g). For the number of kits born dead, there were significant differences (P<0.001), between does with seven teats and does with eight teats. Highest value was observed in doe with seven teats (1.25) and the lowest in does with eight teats (0.46).

Doe Weight at birth, showed significant difference between animals with seven and nine teats (P<0.05), however, there were no significant difference between those with seven and eight teats while those with eight and nine teats had similar weights. The highest value was recorded for doe with nine teats (2.20g) and the lowest for doe with seven teats (1.94g). Other parameters in the table showed no significant differences.

Table .2 Effect of Teat Number on Reproductive Performance

PARAMETERS	TEAT NO.7	TEAT NO.8	TEAT NO.9	SEM	LOS
DW AT MATING(kg)	1.84[b]	1.88[ab]	2.22[a]	0.05	*
DW 14 DAYS AFTER MATING(kg)	2.11	2.06	2.33	0.06	NS
DW 21 DAYS AFTER MATNG(kg)	2.14	2.16	2.40	0.05	NS
DW 28 DAYS AFTER MATING(kg)	2.21	2.24	2.47	0.03	NS
GESTATION LENGHT	31.75	33.00	32.10	16.38	NS
NO OF KITS BORN	6.00	4.62	5.40	1.13	NS
NO BORN ALIVE	4.75	4.15	4.40	1.13	NS
NO BORN DEAD	1.25[a]	0.46[c]	1.00[b]	0	***
LT WT AT BIRTH(kg)	0.23	0.24	0.22	0.00	NS
DW AT BIRTH(kg)	1.94[b]	2.03[ab]	2.20[a]	0.03	*
KT WT AT 7 DAYS(kg)	0.04	0.10	0.05	0.01	NS
KT WT AT 14 DAYS(kg)	0.05	0.14	0.07	0.02	NS
KT WT AT 21 DAYS(kg)	0.06	0.17	0.09	0.03	NS
KT WT AT 28 DAYS(kg)	0.08	0.23	0.10	0.03	NS

Note: Means with the same superscripts on the same row are not significantly different.

NB: DW=DOE WEIGHT; KTWT=KIT WEIGHT; LT WT=LITTER WEIGHT.

EMS=Standard Error of Mean LOS=level of significant; NS=Not significant.

*= significant at $P < 0.05$

**= very significant at $P < 0.01$

***= highly significant at $P < 0.001$

Table 3 shows the effect of fur score on reproductive performance of rabbit does., It was observed that the number born were significantly influenced by the quantity of fur removed by the doe., Number of kittens born, number born alive, litter weight at birth and doe weigth at birth all favoured the does that had score 3 in fur pulling. However, number of kittens born dead was highest with those with lowest fur score. Other parameters did not show significant difference.

TABLE 3 Effect of Fur score on reproductive performance

PARAMETERS	FUR SCORE (0)	FUR SCORE (1)	FUR SCORE (2)	SEM	LOS
DW AT MATING(kg)	1.85	1.83	2.09	0.05	NS
DW 14 DAYS AFTER MATING(kg)	1.94	1.99	2.28	0.06	NS
DW 21 DAYS AFTER MATING(kg)	2.04	2.02	2.37	0.05	NS
DW 28 DAYS AFTER MATING(kg)	2.08	2.06	2.47	0.03	NS
GESTATION LENGHT	31.33	31.86	32.94	16.38	NS
NO BORN	6.33^{a}	4.14^{b}	5.29^{ab}	1.13	*
NO BORN ALIVE	3.33^{ab}	3.14^{b}	5.00^{a}	1.13	*
NO BORN DEAD	3.00^{a}	1.00^{b}	0.29^{c}	0	***
LT WT AT BIRTH(KG)	0.18^{ab}	0.16^{b}	0.27^{a}	0.00	*
DW AT BIRTH(kg)	2.04^{ab}	1.84^{b}	2.18^{a}	0.03	*
KT WT AT 7 DAYS(kg)	0.00	0.07	0.08	0.01	NS
KT WT AT 14 DAYS(kg)	0.00	0.09	0.12	0.02	NS
KT WT AT 21 DAYS(kg)	0.00	0.10	0.15	0.03	NS
KT WT AT 28 DAYS(kg)	0.00	0.11	0.21	0.03	NS

Note: Means with the same superscript on the same row are not significantly different.

NB: KT WT=KIT WEIGHT. DW=DOE WEIGHT.

EMS=Standard Error of Mean; LOS=Level of Significant; NS=Not significant.

*= significant at $P < 0.05$

**= very significant at $P < 0.01$

***= highly significant at $P < 0.001$

Table 4 shows the effect of parity on doe reproductive performance of rabbit. Doe weight at mating and at 28 days after mating showed significant differences between parities (P<0.05),. There was an increase from parity one to four and started reducing.

Highest number born was observed in Parity 4 and parity two (5.75) respectively. Parity one, parity three and parity five were not significantly different. Number born alive was highest at parity four (5.00) and lowest number born alive was recorded for parity three (2.00). Parities one, two and five were statistically similar.

Number of kits born dead also showed significant differences between parities .(P<0.001), Parity two had the highest value (1.25) and lowest value was recorded for Parity five (0.00).

Doe weight at birth also showed significant differences between parity one and parity four (P<0.05), highest value was observed in parity four (2.37g) and lowest for parity one. (1.92g).Parities two, three and four were not significantly different from each other . From the results, it can be observed that there were no significant differences in kits weight, litter weight at births, gestation period, doe weight at 14 and 21 days respectively.

Table 4 Effect of parity on dam reproductive performance

PARAMETERS	P 1	P 2	P 3	P 4	P 5	SEM	LOS
DW AT MATING(kg)	1.75^{b}	2.06^{ab}	2.13^{ab}	2.34^{a}	2.25^{ab}	0.05	*
DW 14 DAYS AFTERMATING(kg)	1.92	2.22	2.20	2.53	2.45	0.06	NS
DW 21 DAYS AFTERMATING(kg)	2.03	2.29	2.28	2.57	2.50	0.05	NS
DW 28 DAYS AFTERMATING(kg)	2.10^{b}	2.36^{ab}	2.34^{ab}	2.69^{a}	2.55^{ab}	0.03	*
GESTATION LENGHT	31.91	33.38	32.00	32.40	33.00	16.38	NS
NO BORN	5.18^{ab}	5.75^{a}	2.50^{b}	5.75^{a}	4.00^{ab}	1.13	*
NO BORN ALIVE	4.36^{ab}	4.50^{ab}	2.00^{b}	5.00^{a}	4.00^{ab}	1.13	*
NO BORN DEAD	0.82^{b}	1.25^{a}	0.50^{c}	0.20^{d}	0.00^{e}	0	***
LIT. WEIGHT AT BIRTH(kg)	0.22	0.24	0.23	0.25	0.15	0.00	NS
DW AT BIRTH(kg)	1.92^{b}	2.08^{ab}	2.13^{ab}	2.37^{a}	2.25^{ab}	0.03	*
KT WT AT 7 DAYS(kg)	0.06	0.06	0.08	0.09	0.18	0.01	NS
KT WT. AT 14 DAYS(kg)	0.07	0.08	0.12	0.15	0.25	0.02	NS
KT WT AT 21 DAYS(kg)	0.09	0.08	0.20	0.20	0.30	0.03	NS
KT WT. AT 28 DAYS(kg)	0.10	0.12	0.33	0.26	0.32	0.03	NS

Note: Means with the same superscript the same row are not significantly different.

KT WT, KIT WEIGHT; DW, DOE WEIGHT; LT WT, LITTER WEIGHT: P, PARITY.

SEM: Standard error of mean. LOS: Level of significant; NS, Not significant

*= significant at **P< 0.05**

= very significant at **P< 0.01

***= highly significant at **P<0.001**

CHAPTER FIVE

5.0 DISCUSSION

5.1 Breed Effect

Analytical results from this study showed differences in doe weight at mating, doe weight after mating, doe weight at birth, gestation length, number of kit born, number of kits born alive, number of kit born dead, individual kit weight, litter weight and average litter weight at birth. These differences were as a result of the genetic make-up of the doe and the environment suitable for the gene expression. However, Ozimba and Lukefahr (1991) attributed differences noticed in individual performance to strong maternal effects of doe and milk production more than genetic effects.

From Table 1 it can be observed that the exotic breed had better performance than the local breeds, although the values observed had no significant differences. Observation made by Odubote and Somade (1992) revealed that the performance of exotic breed were significantly higher than local breed. Fadare and Fatoba (2018) also reported breed differences in performance of does. The significant effect of breed on number born dead could be attributed to genetic make-up which made the exotic breed superior to the local breed.

5.2 Teat Number

The significant effect of teat number on doe weight at mating, number of kits born dead and doe weight at birth support the reports of Ferguson *et al*. (1997) who reported a large negative correlation (– 0.51) between litter size and milk consumption by individual kits, and they found that kits in smaller litters were more uniform.

5.3 Parity

The significant effects of parity reported in this study contradicted the report by Hassanien and Baiomy (2011) and Chineke (2006) who reported that parity effects were of no significant effects on litter size at birth but was in line with reports by Das and Yadav (2007), Chineke

(2005) and Khalil (1993) who reported significant parity effects. The increase in number of kits born at parity four could be due to related factors such as increased number of ova released as the doe advanced in age and body size, but the same figure was observed in parity two. The disparity in results could have been influenced by residual maternal effects of parity. The introduction of exotic and locally adapted breeds in this study could also have led to significant effects of parity. This is consistent with the results of Yamani *et al.* (1991), Vāsquez– Martinez *et al.* (1999) and Prayaga and Eady (2002) who found that litters from primiparous does had lower birth weights. Although traits measured at days 7 to 28 did not differ statistically across parities, but highest value was recorded for parity five. Advantage in litter growth in higher parities might be due to higher physiological efficiency of the older does in terms of milk secretion and mothering ability from more kindlings and higher maturity. Khalil (1994) and Vāsquez–Martinez *et al.* (1999) reported lower milk production from primiparous does compared with multiparous does.

Fur score

Fur score affected number of kits born, number of kits born alive, litter weight at birth and doe weight at birth significantly. Does that pulled higher Fur score had the highest number of kits born alive and highest number of kits that survived till weaning. Numbers of kits born dead were recorded for Does that pulled few or no fur. This could be as a result of maternal behaviour such as nest preparation and genetic make-up of the doe.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATION

6.1 CONCLUSION

Exotic breed does have a better reproductive performance than local breed does.

Higher weights was noticed in kits of exotic breed does

Teat number had an effect on number of kits born and number of kits born dead and weight of doe at birth, in which does with seven teats had a higher number of kits born dead while does with nine teats had higher weights at parturition.

Fur score has an effect on number of kits born, number of kits born alive, litter weight at birth and doe weight at birth.

6.2 RECOMMENDATION

- Since breed, parity, teat number and fur score were major factors in this study, doe reproductive performance should be improved through breed manipulation such as cross-breeding and selection for good traits.
- Breeders need to exploit the preponderance of additive genes in the rabbit population to bring about improvement in the reproductive and growth traits.

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