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Productive Potentials in Pure and Crossbred Rabbits in South Western Nigeria

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Abstract
This study was conducted using five purebred rabbits comprising New Zealand White (NZW), American Standard Chinchilla (CHL), Beveren (BVN), Zealand Red (NZR) and the Local Hare (L-Hare) through diallele crossbreeding experiment that generated 16 genotypes involving four straight breeds and 12 crossbreds respectively. The crossbreeding program of these rabbit genotypes was monitored to evaluate the genetic effect of sire strain on productive potentials in terms of age at sexual maturity (ASM), body weight at sexual Maturity (BSM) and gestation length. Genotypes significantly ($p<0.01$) affected all productive traits in which better performances were recorded in crosses than the original parents.New Zealand White recorded the longest maturing period with a mean of 196.50±1.24 days, followed by Local Hare (161.54±2.26days) while Beveren × Chinchilla had the shortest mean of 132.00±0.24 days. The higher maturing age of sires observed in New Zealand White was linked to the fact that this is a dual heavy breed which matured at a heavier weight. The longer age at sire's maturity noticed in Local Hare was due to the fact that the wild type rabbit is still under selection. Beveren × Chinchilla performed better closely followed by New Zealand Red × Chinchilla while Beveren Chinchilla pure lines had the least. BSM also followed the pattern of ASM as observed in gestation length (GLT).The study therefore underscored the importance of crossbreeding effect on the productive potentials of rabbits for sustainable livestock development in Nigeria.

Keywords: Rabbit, potential, sire, crossbreeding, strain

Introduction

Productivity, defined as the number of young per doe per unit of time depends on, the interval between successive kindling, litter size at birth and survival rate of the young.This phenomenon to a large extent is a function of reproductive capacity and reproductive ability of a sire in rabbit breeding program (Akanni *et al.,* 2011, Akanni, 2012). The present state of the economy coupled with the current recessionary trend, scarcity and high cost of production contributes to the poor production of animal protein which is required in high demands.The resurgence of interests in livestock industry in Nigeria as a result of economic recession experienced had called for research into economic traits in various species, breeds and strains of farm animals. Animal protein supply has also been reported inadequate because of low population of livestock in relation to human population, low level of animal productivity in terms of slow growth rate, slow reproduction cycle, slow milk, meat, and egg yield which has direct influence on general wellbeing and health of the ever increasing population (Adejinmi *et al.,* 2005; Fapounda *et al.,* 2005; Akanni, 2012).

Livestock production is a very essential part of livelihood for health, economic and social reasons. The perspective for livestock industry development points vividly to the capability of the enterprise in making substantial contributions to current efforts at ameliorating the incidence of endemic animal protein deficiency in developing countries like Nigeria. The enterprise can meet this challenge through accelerated animal protein production of livestock species that have relatively shorter reproduction cycles. For effective capacity building in exploring adequate science and technology innovations towards sustainable livestock development in Nigeria, the need to improve on the genetic, reproductive and productive potentials of livestock in Nigeria becomes imperative. This can be achieved by the introduction of non-traditional meat sources such as rabbits for small scale farmers for its meat and other by-products. Rabbit (*Oryctolagus cuniculus*) is becoming a popular farm animal that should receive detailed studies because of its genetic flexibility and variability, adaptability and productivity in a wide range of production system (Lebas *et al.,* 1986; Nodu, 2000, Akanni, 2012).

Materials and methods

The research was carried out at the Rabbitry Unit of the Department of Agricultural Education, Federal College of Education, Osiele, Abeokuta, Nigeria. Osiele ($7^0$10'N and $3^0$2'E) is in Odeda Local Government Area of Ogun State, Nigeria. The experiment was conducted using 16 does and 2 bucks from each of the pure line and their crosses. These animals were raised between March and September 2016 in an experiment that lasted

for 52 weeks. The experimental rabbits comprised five breeds: the New Zealand White (NZW), American Standard Chinchilla (CHL), New Zealand Red (NZR), Beveren (BVR) and the Local Hare (L-Hare). The parental (base) populations sourced were thoroughly quarantined, acclimatized and stabilized before the mating process in other to make them disease free and to ascertain good health condition of their offspring (crosses). A total of four22weeks old bucks and sixteen does were randomly selected from each breed and used as parents. The selected does were assigned to bucks for mating early in the morning.

Pregnancy diagnosis by abdominal palpation was carried out ten days post mating. Non-pregnant does were put up for mating again until conception occurred. The pregnant does were carefully monitored and provided with necessary management practices in terms of quality concentrate and forage diets, health care and availability of kindling boxes within their hutches. The gestation length of each rabbit breed and their crosses was properly observed. The litters produced in each genetic group were critically examined at birth for defects. The litter size, litter weight, average litter size and litter weight and individual kit weight per genotype were determined and recorded within 24 hours after kindling and continued on weekly basis throughout the period of the experiment. The mating outlines above were repeated in order to have more litters.

The kitten were maintained on does' milk from birth till weaning at 42 days of age, after which they were transferred to previously disinfected growers hutches and maintained till post weaning age of 84 days. At about pre-weaning age of 21 days the kits sex were determined while the disparity in number of kits at various ages due to mortality during the experiment were observed and recorded. Controlled breeding was practiced with four mating seasons in a year (Akanni, 2012).The experimental rabbits were fed commercial ration (produced by UNAAB Leventis Agro-Allied Industries Feed mill Kotopo, Abeokuta) that supplies 16.50% crude protein and 9.66 MJ/kg metabolizable energy in the morning, supplemented intermittently with 100g each of wilted Sweet potato, *Tridax* (Coat buttons) and Benth leaves in the evening throughout the course of the experiment. Fresh feed and clean water were supplied (*ad-libitum*) on daily basis throughout the experimental period.

Results and Discussion

The effect of genotype on sexual maturity among the seventeen genotypes is presented in Table1. Genotype significantly ($p<0.01$) affected age at sire's maturity (ASM) with New Zealand White having the longest period to maturing with a mean of 196.50±1.24 days, followed by Local Hare, New Zealand White × New Zealand Red, New Zealand White × Chinchilla, and Chinchilla while Beveren × Chinchilla had the shortest mean of 132.00±0.24 days and the others having means of 161.54±2.26days, 159.00±0.00days, 157.50±0.26days, 151.50±0.26days and 150.50±0.04 days respectively. Mean body weight at sire's maturity was significantly ($p<0.01$) affected by genotypes. The results from table 1 also revealed that Beveren had the heaviest body weight at maturity of 3094.50±1.14 g closely followed by Beveren × Chinchilla (3033.40±2.86g) while Local Hare had the least (1649.60±2.23g). Genotype significantly ($p<0.01$) affected gestation length. Data on length of gestation per genotype showed that longer days of gestation were recorded for Local Hare and New Zealand White (36.85±0.05 and 36.75± 0.26 days) while Beveren × Chinchilla and Chinchilla × Beveren had the lowest value of 28.00±0.20 and 28.05±0.25 days. The New Zealand Red and its crosses with New Zealand White (NZR × NZW) recorded 33.75±0.15 and 33.90±0.23 days, respectively.

The variation in the maturity age of sires across the genetic groups studied may be due to differences in their genetic make-up. The lower maturity age of sires noticed in Beveren × Chinchilla cross compared to other genotypes, may be due to its faster rate of sexual development, as hybrid of two purebred parents that have long time been selected for fast growth rate and high rate of litter production. Genetic factors have been observed to influence the rate of sexual maturity and high litter producing rabbits might come into production at an early age, as observed by Lebas *et al.* (1986) cited in Akanni (2012). These authors further reported that sexual maturity is reached at 32 weeks by New Zealand White bucks. In these same conditions, it was opined that sires could be selected and used for reproduction from the age of 20 weeks. The authors stressed further that the first manifestation of sexual behaviour appear at days 60-70 when the rabbit makes its first attempt at riding, coitus may occur for the first time at about 100 days, but the viability of the sperms could be low or nil in the first set of ejaculates.

They, however, recommended that the first mating should be between maturing age of 135-140 days. This report also agrees with the observation of Akanni *et al.* (2007) and Akanni (2009) in high litter producing American Chinchilla rabbits. The authors reported that although the onset of puberty varies from breed to breed, however higher litter producing breeders rabbits must attain a threshold age before they can commence litter (kit) production. The higher maturing age of sires observed in New Zealand White could be due to the fact that this is

a dual heavy breed which matured at a heavier weight. This is similar to the findings of Akanni (2011) and Akanni (2012) who observed a higher age at maturity in New Zealand White and Beveren rabbits and their crosses. The longer age at sire's maturity noticed in Local Hare could probably due to the fact that the wild type rabbit is still under selection as reported by Akanni (2012).It was further reported that crosses produced from distantly versus closely related breeds may express more hybrid vigour or genetic gain than crosses from closely related animals such as American Chinchilla versus Standard Chinchilla. This is because of the greater genetic differences represented in cross which is the basis of hybrid vigour. This is also in line with the works of Lebas *et al.* (1986) who reported that crossbreeding makes possible the optimum use of the nicking ability of the breeds or population crossed, which contribute to the quantity of rabbit meat produced by such a sire as observed in this study.

Table 1. Least square means ± SEM of sexual maturity of rabbit genotypes.

Genotypes	N	ASM	BSM	ADP	BDP	GLT
NZW	76	196.50±1.24^{a}	3136.20±2.41^{a}	186.75±0.26^{a}	2480.00±11.79^{a}	36.75±0.26^{a}
CHL	78	150.50±1.04^{b}	2887.50±2.41^{b}	139.25±0.11^{bc}	2064.00±13.44^{bcd}	31.25±0.11^{bc}
NZR	69	157.50±0.26^{b}	1349.60±0.23^{d}	148.75±2.25^{b}	2005.62±30.59^{abcd}	33.75±0.25^{b}
BVR	80	142.50±1.24^{bc}	3094.50±1.14^{a}	135.25±1.28^{c}	1430.25±19.40^{a}	29.25±0.28^{bcd}
L-HARE	16	161.54±2.26^{abc}	3099.60±2.23^{a}	178.71±0.25^{ab}	2945.62±30.59^{a}	36.75±0.45^{a}
NZW X CHL	80	151.50±0.26^{b}	3019.60±2.05^{a}	131.50±0.20^{cd}	2358.00±19.76^{ab}	30.50±0.20^{c}
NZW X NZR	71	159.50±0.26^{b}	2225.00±2.30^{bc}	122.00±0.20^{d}	2262.25±14.42^{abc}	30.00±0.20^{c}
NZW X BVR	77	144.00±0.00^{bc}	2839.00±0.00^{b}	140.00±4.02^{b}	2225.75±12.03^{abc}	29.03±0.02^{bcd}
CHL X NZR	67	137.00±0.27^{cd}	2229.45±2.73^{bc}	133.0±0.27^{cd}	2387.15±7.32^{ab}	31.01±0.27^{bc}
CHL X BVR	80	137.00±0.00^{cd}	2700.00±0.00^{b}	137.75±0.25^{bc}	2476.75±17.17^{a}	28.05±0.25^{d}
CHL X NZW	79	137.50±1.24^{cd}	1843.80±2.44^{c}	137.25±0.22^{bc}	1977.60±7.41^{cd}	31.25±0.22^{bc}
NZR X NZW	73	133.00±1.23^{d}	1921.90±2.92^{c}	118.00±1.23^{d}	1881.25±18.75^{d}	33.90±0.23^{bc}
NZR X CHL	70	138.00±0.27^{c}	1957.70±2.64^{c}	133.50±1.24^{cd}	2038.92±26.00^{d}	30.50±0.24^{c}
NZR X BVR	68	145.50±0.26^{bc}	2834.00±2.10^{b}	132.50±0.25^{cd}	2352.65±28.58^{ab}	31.50±0.25^{bc}
BVR X NZW	79	139.00±0.27^{c}	3001.50±0.06^{ab}	131.75±1.03^{cd}	2443.77±15.52^{a}	30.75±0.03^{c}
BVR X CHL	80	132.00±0.24^{d}	3033.40±2.86^{ab}	121.00±0.20^{cd}	2453.97±12.57^{a}	28.00±0.20^{d}
BVR X NZR	75	136.50±0.26^{c}	2757.80±2.39^{b}	135.50±1.19^{c}	2143.60±10.04^{abcd}	29.50±0.19^{bcd}

$^{a,b,c,d:}$ Means in the same column with different superscripts are significantly different ($p<0.01$); ASM = Age at sire's maturity (days); BSM = Body weight at sire's maturity (g); ADP = Age at dam's parturition (days); BDP = Body weight at dam's parturition (g); GLT= Gestation Length (days)

Conclusions and Recommendation

The better performance observed in Beveren × Chinchilla and Beveren × New Zealand Red revealed the effect of high degree of hybrid vigour over their parents; Chinchilla and Beveren optimized the nicking ability during hybridization of genes that generated better hybrids.It is therefore, recommended that crossbreeding programs, which is a better tool of enhancing the genetic potentials of rabbits for optimal productivity, in terms of better reproductive capacity, and productive ability should be employed in commercial rabbit breeding and production, as a scientific and technological innovation for sustainable livestockdevelopment in Nigeria.

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