

## EFFECTS OF GENOTYPE, GESTATION LENGTH AND LITTER SIZE ON THE BIRTH WEIGHT, LITTER WEIGHT, THIRD AND FIFTH WEEK BODY WEIGHT OF CROSSBRED KITS

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### ABSTRACT

Future performance of rabbit is hinged on many factors of which the birth weight, gestation length, and the litter size are most important. One hundred cross bred kits from five breeds of rabbits (Dutch-belted (DUC), Rex, Californian white (CAL), New Zealand White (NZW) and locally adapted strain (LOC)) were used to confirm this assumption. The study was carried out at the rabbit unit of the Livestock Farm of Teaching and Research Farm at the Federal University of Technology, Akure. The rabbits were fed *ad libitum* with grower's mash which was wet with water to avoid dustiness; this was supplemented with forages (*Tridax procumbens* and *Talinium triangulae*) in the evening. Individual birth weight, litter weight, litter size and weekly body weight were recorded before meal in the morning. Genotype exerted significant influence ( $P < 0.01$ ) on the individual and litter weight at birth as well as on the body weight of the kits at 21<sup>st</sup> and 35<sup>th</sup> days. The kit kindled from mating CALxDUC breeds had the highest mean body weight from birth ( $91.90 \pm 9.84g$ ) to 35<sup>th</sup> days ( $368.25 \pm 17.36g$ ) while the crosses of DUCxCAL recorded the lowest mean body weight from birth ( $74.25 \pm 1.78g$ ) to 35<sup>th</sup> days ( $332.60 \pm 12.54g$ ). There were also significant differences ( $P < 0.05$ ) for the individual and litter birth weights, body weights at 21<sup>st</sup> and 35<sup>th</sup> days based on the duration of gestation among the does. Does with short gestation length (29 days) had kits with light body weight compared to those with longer periods of gestation (34 days). More so, kits belonging to a large litter size (7) had the light body weight at birth as well as 21<sup>st</sup> and 35<sup>th</sup> day ( $69.93 \pm 1.63g$ ,  $209.57 \pm 3.70g$ ,  $319.11 \pm 9.22g$ ) thereby revealing significant influence ( $P < 0.05$ ) of litter size on the body weight of kits which was different from kits of lesser litter size. Based on the results of the experiment carried out, a crossbreeding involving breeds of sires and does is recommended to produce offspring with better performances.

**Keywords:** Genotype, Gestation length, Litter size and Body weight.

### INTRODUCTION

Rabbit production has recently gained attention in developing countries such as Nigeria because of its high level of tolerance to seasonal variations with high reproduction capacity, short gestation length and relatively high weight gain per day (Finzi, 2000). It is being raised insufficiently to meet the level of protein requirement of man due to the unawareness of the populace about the nutritive value of rabbit meat. However, it is one of the sustainable and inexpensive means of providing high quality animal protein to supplement the deficiency arising from the dependency on plant protein for Nigerians (Onifade *et al.*, 1999). Rabbit meat is high in protein and low in fat, calories and cholesterol when compared to the meats obtained from other livestock (Samkol and Lukefahr,

2008). They grow rapidly and their growth rate is comparable to that of broiler chickens (Yakubu and Ayoade, 2009). There is no taboo or beliefs against the consumption of rabbit meat and their competition with man for grains is minimal. Rabbit production is quiet enticing due to their numerous advantages. Rabbit manure is great fertilizer with relatively high level of nitrogen, phosphorus, potassium and good source of secondary nutrients (Lukefahr *et al.*, 1998). Worms raised from rabbit manure can be used in fish farming (Hemenway, 2009). Rabbits have 21 autosomal chromosome pairs and 1 sex chromosome pair. The litter size (Nofal *et al.*, 2005) and survivability of the kits are major determinant that enhance successful rabbit production. Likewise, the overall performance and sustainability of the animal is greatly

influenced by its live body weight (Chineke, 2005) and selection of the best choice of genotypes used in breeding (Oyegunle *et al.*, 2015). Thus, the aim of this study was to find out the effects of genotype, gestation length and litter size on the individual kit birth weight, litter birth weight and the weight gain at 3<sup>rd</sup> and 5<sup>th</sup> week post parturition.

## MATERIALS AND METHODS

The experiment was carried out at the Teaching and Research Farm, Livestock section (Rabbit unit) of the Federal University of Technology, Akure, Nigeria. Rabbits were kept in the hutches that were in the rabbit pen according to their breeds. Kindling boxes were provided for pregnant does few days to parturition so it can provide beddings as source of warmth for the kitten. Rabbits were fed with grower's mash after weaning; water was regularly supplied to the rabbits. The live birth weight, bodyweight at 21<sup>st</sup> and 35<sup>th</sup> day for crossbred kits were recorded weekly in the morning before feeding them. The Weighing of kits from birth to the third week was carried out using a sensitive scale.

### Statistical Analysis

The data collected from the study were analyzed using the mixed model least-squares and maximum likelihood computer program (SAS, 2008) which uses Henderson's Method 3 to estimate the observable variance components due to genotype ( $\sigma_g^2$ ), gestation length ( $\sigma_{gl}^2$ ), litter size ( $\sigma_l^2$ ) and error ( $\sigma_e^2$ ) by equating computed mean squares to their expectations and solving for the components. The model used was:

$$Y_{ijk} = \mu + B_i + C_j + D_k + e_{ijk}$$

Where  $Y_{ijk}$  = observation on the  $i$ th rabbit of the  $i$ th genotype of the  $j$ th gestation length of  $k$ th litter size.  $\mu$  = overall mean of all observations

$B_i$  = effect of the genotype of rabbit,  $i = 1, 2, 3, 4, 5$  (NWZ x REX, DUC x CAL, REX x LOC, CAL x DUC and LOC x NZW).

$e_{ijk}$  = random error.

## RESULTS AND DISCUSSIONS

The cross from CALxDUC had the best performance in terms of individual and litter birth weight, body weight at 21 and 35 days while alternating the breeds when mating resulted into the kindling of kits with the lowest

individual birth weight as well as body weight at 21<sup>st</sup> and 35<sup>th</sup> day. Although, no statistical difference ( $P > 0.05$ ) was observed in NZW x REX and LOC x NZW. LOC x NZW kit had the least mean litter birth weight value of  $357.15 \pm 26.20g$  which is well detailed in (Table 1.0). Genotype exerted significant influence on the individual and litter weight at birth, 21<sup>st</sup> and 35<sup>th</sup> day as the set of genes received from parent and the environment provided for gene expression could be attributed to the differences in genotypic performances of the kits (Chineke, 2005). This result corroborated with the results of Obike and Obi (2010) who recorded higher values for Californian and Dutch breeds which could be partly induced by the presence of major genes that enhance growth performance in the two rabbits. The outcome of the length of gestation effect on the weight gained by the crossbred kits is presented in Table 2. The gestation length of doe experimented upon varied from 29 to 34 days. Does that kindled within short period had the least birth weight and even as they mature to the 5<sup>th</sup> week while those that kindled late had the highest body weight all through the study which was in agreement with the findings of Ayoola (2016) but opposed to the report of Orunmuyi *et al* (2006), who stated that gestation length did not significantly exert any influence on weaning weight. Table 3 shows that litter size exerted significant influence on the individual and litter weights at birth in addition to body weight at 21<sup>st</sup> and 35<sup>th</sup> days which was in concordance with the findings of Ayoola *et al* (2016) who also established the fact that there was a significant effect of litter size on the body weight of kits from birth to weaning. Kits present in the least litter (2) had the heaviest individual birth weight and body weight at 21<sup>st</sup> and 35<sup>th</sup> days whereas kits found in the largest litter (7) had light body weight at birth as well as 21<sup>st</sup> and 35<sup>th</sup> days. The heavier birth weight of the former may be contributed by sufficient intra-uterine nourishment available to cater for the growth and development of the foetus unlike the larger litters where they were competition among the foetus within the doe for nutrients. So, kits that belong to lesser litter develop rapidly and in turn grow stronger than those in larger litter even in its post-uterine life due to easier access to the teat of

the doe. This was backed up by findings by Chineke, (2006), who also affirmed that litter size was a significant source of variation for individual kit weight and litter weight. There was consistent increase in individual kit weight but the litter size of 2 kits was superior in individual kit weight when compared with the litter size of 7 kits.

#### CONCLUSION

The study revealed that crossing Californian with Dutch gave rise to kits that possess superior performance in terms of heavy weaning body weight and size compared to other crosses which could form a basis for selection process in rabbit production. In addition, litters should be even – up among does to ensure better growth performance of kits and more attention provided for does with long gestation period.

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**Table 1: Effect of genotype on the least squares means of individual and litter birth weights and body weights at 21 and 35 days**

Genotype	No	INDBW	LITBW	BW21	BW35
NZWxREX	20	84.75±2.09 <sup>b</sup>	375.95±22.13 <sup>ab</sup>	233.25±4.81 <sup>b</sup>	357.80±10.07 <sup>ab</sup>
DUCxCAL	20	74.25±1.78 <sup>d</sup>	391.70±26.29 <sup>ab</sup>	218.10±5.14 <sup>c</sup>	332.60±12.54 <sup>b</sup>
LOCxNZW	20	84.60±4.24 <sup>b</sup>	357.15±26.20 <sup>b</sup>	232.05±8.16 <sup>b</sup>	349.50±13.90 <sup>ab</sup>
CALXDUC	20	91.90±9.84 <sup>a</sup>	420.10±28.93 <sup>a</sup>	246.35±12.53 <sup>a</sup>	368.25±17.36 <sup>a</sup>
REXXLOC	20	78.95±3.34 <sup>c</sup>	396.45±13.07 <sup>ab</sup>	225.80±6.56 <sup>b</sup>	345.75±11.33 <sup>ab</sup>

abcd: means with different superscripts within the same column are significantly different (p<0.05). INDBW: individual birth weight, LITBW: litter birth weight, BW21: body weight at 21<sup>st</sup> day, BW35: body weight at 35<sup>th</sup> day.

**Table 2: Effect of gestation length on the least square means of individual and litter birth weights, body weights of kits at 21<sup>st</sup> and 35<sup>th</sup> days**

Gestlngth	No	INDBW	LITBW	BW21	BW35
29	20	66.75 ± 0.51 <sup>d</sup>	379.60 ± 21.85	207.20 ± 5.00 <sup>c</sup>	319.40 ± 12.43 <sup>b</sup>
30	25	72.16 ± 1.09 <sup>c</sup>	396.84 ± 19.57	213.76 ± 3.97 <sup>c</sup>	329.04 ± 10.40 <sup>b</sup>
31	33	89.42 ± 2.39 <sup>b</sup>	381.82 ± 21.45	245.45 ± 4.51 <sup>b</sup>	366.24 ± 7.91 <sup>b</sup>
32	20	88.25 ± 1.91 <sup>b</sup>	392.30 ± 24.61	236.60 ± 4.57 <sup>b</sup>	362.50 ± 8.35 <sup>b</sup>
34	2	217.00 ± 3.00 <sup>a</sup>	434.00 ± 0.00	395.50 ± 1.50 <sup>a</sup>	564.00 ± 1.00 <sup>a</sup>

abcd: means with different superscripts within the same column are significantly different (P<0.05). Gestlngth: gestation length, INDBW: individual birth weight, LITBW: litter birth weight, BW21: body weight at 21<sup>st</sup> day, BW35: body weight at 35<sup>th</sup> day.

**Table 3: Litter size effect on the least squares means of individual and litter birth weights, body weights at 21<sup>st</sup> and 35<sup>th</sup> day**

Litter size	No	INDBW	LITBW	BW21	BW35
2	4	148.75 ± 39.42 <sup>a</sup>	297.50 ± 78.81 <sup>b</sup>	318.00 ± 44.75 <sup>a</sup>	454.50 ± 63.23 <sup>a</sup>
3	3	119.33 ± 2.03 <sup>b</sup>	358.00 ± 0.00 <sup>ab</sup>	275.67 ± 2.85 <sup>b</sup>	420.00 ± 6.51 <sup>ab</sup>
4	12	92.60 ± 1.63 <sup>c</sup>	334.20 ± 25.80 <sup>b</sup>	253.00 ± 3.82 <sup>c</sup>	375.60 ± 11.54 <sup>bc</sup>
5	25	90.76 ± 1.85 <sup>c</sup>	366.00 ± 22.68 <sup>ab</sup>	245.56 ± 5.18 <sup>c</sup>	375.76 ± 8.64 <sup>bc</sup>
6	30	72.77 ± 1.06 <sup>d</sup>	390.80 ± 15.58 <sup>ab</sup>	215.83 ± 3.53 <sup>d</sup>	330.50 ± 8.33 <sup>cd</sup>
7	28	69.93 ± 0.93 <sup>d</sup>	440.96 ± 20.80 <sup>a</sup>	209.57 ± 3.70 <sup>d</sup>	319.11 ± 9.22 <sup>d</sup>

abcd: means with different superscripts within the same column are significantly different (p<0.05). INDBW: individual birth weight, LITBW: litter birth weight, BW21: body weight at 21<sup>st</sup> day, BW35: body weight at 35<sup>th</sup> day.