

## Effect of rebreeding interval on reproductive performance and body weight changes of does during pregnancy

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### Abstract

*The effect of rebreeding interval on the reproductive performance and body weight changes of does during pregnancy was investigated using 24 multiparous crossbred (New Zealand White X California) does. The does were placed on three treatments comprising mating at 14, 21 and 28 days postpartum. The does were served 250g-concentrate meal (23% CP and 2600 kcal ME/kg) daily, while water was given ad libitum. Parameters monitored were doe willingness to mate, doe weights during pregnancy, feed intake, pregnancy rate, litter size and weight at birth, alive at birth and up to 21 days postpartum and stillbirth rate. Kits were weaned at 4 weeks of age. Results obtained showed that does mated 14 days postpartum lost more weight in the second week of pregnancy than the other groups. Rebreeding interval did not significantly ( $P>0.05$ ) affect doe weight gain in the 1<sup>st</sup>, 3<sup>rd</sup> and 4<sup>th</sup> weeks of pregnancy. Does mated 14-d postpartum had significantly ( $P<0.05$ ) higher feed intake during the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> weeks of pregnancy. Feed:gain ratio was higher for does mated 21-d postpartum than for other treatments. Pregnancy rate was higher in the 14-d group and lowest in the 28-d group. Willingness to mate also decreased with increasing rebreeding interval. Litter size at birth, number of kits alive at birth and up to 28 days postpartum were not affected ( $P>0.05$ ) by rebreeding interval as was the case for litter birth weight and percent stillbirths. Does mated 14 days postpartum however, had numerically more kits alive at birth and up to 28 days postpartum than the other groups. Litter weights were slightly higher for does mated 14 and 21 days postpartum than 28 days. It is concluded from this study that mating does 14 days postpartum under tropical conditions could increase the number of kits weaned per doe and hence increase profitability of the rabbit production enterprise.*

**Key Words:** Doe weight, pregnancy, rabbit, rebreeding interval, reproduction.

### Introduction

Prolificacy, defined as the number of viable offsprings produced per year, is influenced by a number of factors such as ovulation rate, conception rate, embryo mortality and rebreeding

interval (Smith and Somade, 1994). However, the level of postpartum fertility and rebreeding interval are of paramount importance in determining reproductive efficiency in livestock (Topps, 1977). Reducing the interval from

parturition to remating offers the greatest opportunity for increasing the output of weaned rabbits from the doe (Partridge *et al.*, 1984). The doe will theoretically, copulate and thereby induce ovulation during lactation (Partridge *et al.*, 1984). This gives the opportunity for farmers to increase the number of litters obtainable from the does per year. In commercial rabbit production outfits in European countries, the commonly used intervals are 1 or 9 days after parturition (Mendez *et al.*, 1986). Partridge *et al.* (1984) reported that in UK, does in large-scale production units were usually remated 14-21 days after parturition, giving an optimal output of 7 to 8 litters per doe per year. This gives the advantage of reducing the interval between parturition and of a higher rate of does willing to mate. Under tropical conditions, however, long rebreeding intervals of 30-60 days or more are observed which reduces the number of kits that could be raised per year. Schlolaut (1980) recommended that the number of litters per female per year be limited to two or three in developing countries.

Performance levels currently being obtained in developed countries for rabbits, are reported to be 45-60 young reared per doe per year from approximately six litters to eleven litters (Lebas, 1983; Partridge *et al.*, 1984; Rajadevan *et al.*, 1986). This level of production is not easily achievable under tropical conditions (Rajadevan *et al.*, 1986). The interaction between remating interval and diet has a significant effect on several traits such as litter size at weaning, productivity, mortality rate during lactation and litter weight at 21 d (Mendez *et al.*, 1986). Despite the considerable potential of early remating in terms of increasing the number of pups born per year, perinatal mortality remains one of the major factors limiting productivity in rabbits (Partridge *et al.*, 1984). To practise early rebreeding

therefore, there is a need to feed the does adequately. The high ambient temperature under tropical conditions does not allow for efficient intake of nutrient dense diets. This further limits the possibility of achieving very high reproductive efficiency under tropical conditions especially during hot seasons. This study was therefore designed to investigate the effect of early rebreeding on the reproductive performance and doe weight changes during pregnancy under tropical conditions.

## **Materials and Methods**

Twenty-four multiparous crossbred (New Zealand White X California) does, aged 12 to 18 months old and weighing 2.65 to 2.83 kg were randomly allocated to three rebreeding intervals namely 14 days, 21 days and 28 days postpartum. The does were mated to intact bucks in the morning and evening. After kindling, does were then allocated to the various treatments. The does were offered 250g of a 23% CP and 2600 kcal ME/kg diet (Table 1) in the morning at 8.00 hr and 100g forage (*Brachiaria* grass) was supplied in the evening at 16.00hr. Feed leftover was weighed daily. Clean water was supplied daily in earthen flat bottom pots. The does were kept in individual metal cages housed in a completely walled house. Nesting earthen pots were supplied by day 25 of pregnancy. The study lasted six months.

Does were weighed at the beginning of the study, mating and at weekly intervals during pregnancy and at kindling. Pregnancy rate was calculated as the number of does mated that kindled divided by the total number of does mated multiplied by 100. Willingness to mate was determined by observing the ease with which the does were mated that is whether the doe crouched at a corner of the cage and refused to be mated (unwilling)

**Table 1. Composition of Concentrate Diet Fed To Does.**

<b>Ingredients</b>	<b>Quantity (%)</b>
Maize	35.99
Groundnut cake	45.51
Maize offal	15.00
Bone meal	3.00
Salt	0.25
*Vit./mineral premix	0.25
<b>Calculated content:</b>	
Energy (Kcal ME/kg)	2597.21
Crude protein (%)	23
Crude fibre (%)	4.67
Ash (%)	3.23

\*Vit./mineral premix content per kg ration: Vit. A 1251 IU, Vit. D<sub>3</sub> 2750 IU, Vit. E 151 IU, Vit. K 0.002g, Vit. B<sub>2</sub> 0.006g, Nicotinic acid 0.035, Calcium D-Pantothenate 0.01mg, Vit. B<sub>6</sub> 0.0035g, Vit. B<sub>12</sub> 0.02g, Folic acid 0.001g, Biotin 0.0005g, Vit. C 0.025g, Cholin chloride 0.39g, Zinc bacitracin 0.02g, Methionine 0.2g, Avatec (Lasolacid) 0.09g, Manganese 0.1g, Iron 0.05g, Zinc 0.04g, Copper 0.002g, Iodine 0.00153g, Cobalt 0.000225g, Selenium 0.0001g.

**Table 2. Effect of Rebreeding Interval on Doe Weight at Mating and Kindling.**

<b>Doe weight (kg)</b>	<b>Rebreeding interval (days)</b>			<b>SEM</b>
	<b>14</b>	<b>21</b>	<b>28</b>	
Initial weight	2.83	2.82	2.65	0.17
Weight at mating	2.75	2.82	2.67	0.16
Weight at kindling	2.06	2.63	2.64	0.14

or whether there was lordosis and hence mating (willing). Kits were counted and weighed at birth, and at weekly intervals up to weaning at four weeks old. Data collected were subjected to analysis of variance test using general linear model and orthogonal pair-wise difference method was used to separate differences between means (SAS, 1987).

## Results

Table 2 shows the effect of rebreeding interval on doe weights. Doe weights at mating and kindling were similar ( $P>0.05$ ) for all treatments. Weight gain in the first week of pregnancy was higher for does on 28 d rebreeding interval compared with does on 14 and 21-d groups (Fig. 1). The does on 21-d rebreeding interval lost weight. In the second week of pregnancy, does mated 14 d postpartum lost significantly ( $P<0.05$ ) more weight than those mated 21d while the 28 d group gained weight. In the third week of pregnancy, all treatment groups gained weight. Weight gain also increased with increase in rebreeding interval. Does mated 28 d postpartum gained more weight than those mated

21 and 14 d postpartum. Weight gain was highest in the fourth week of pregnancy for all the treatments. Does mated 28 d had higher weight gain than the other groups while the 14 d group had higher weight gain than the 21 d group. Weight gain increased as pregnancy progressed in all cases especially in the fourth week of pregnancy.

Doe feed intake during pregnancy is shown in Fig. 2. Feed intake in the first and second weeks of pregnancy was significantly ( $P<0.05$ ) higher for does mated 14 d postpartum compared with 21- and 28-d groups. Does mated 21 d postpartum had the least feed intake. In the third week, however, feed intake was similar ( $P>0.05$ ) for does mated 14 and 21 d postpartum. Feed intake was significantly lower for the 28-d group. Feed intake in the fourth week of pregnancy was similar for all groups though intake was slightly higher in the 14-d group than the 21- and 28-d groups. The 14-d group had higher feed intake through out pregnancy.

Feed:gain ratio (Fig. 3) was higher in the first week of pregnancy for does mated 28 d

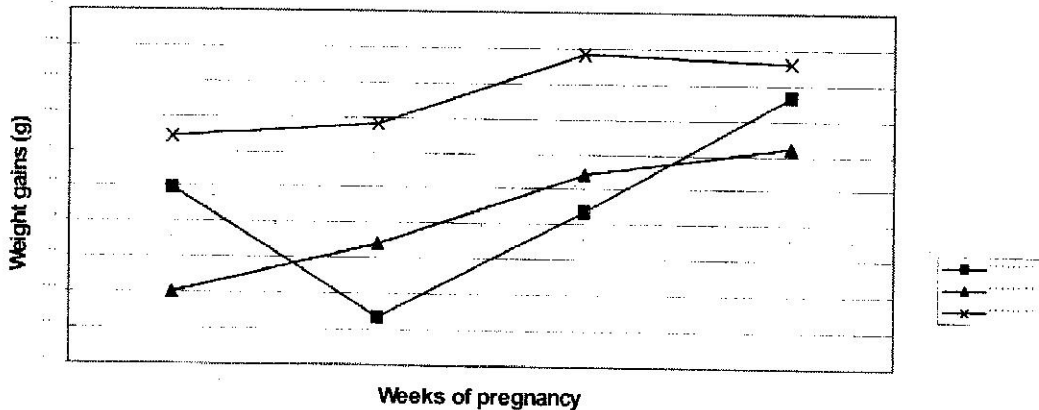


Fig. 1 Effect of rebreeding interval on doe weight gain during pregnancy

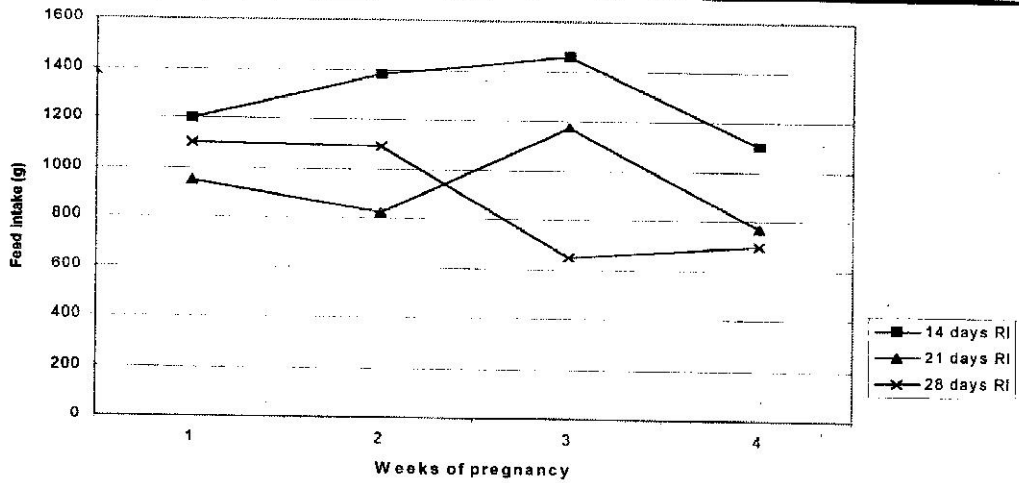


Fig. 2: Effect of rebreeding interval on feed intake (g) of does during pregnancy

Table 3. Effect of rebreeding interval on litter size, stillbirth and pregnancy rate of rabbits.

Parameter	Rebreeding interval (days)			SEM
	14	21	28	
Litter size at birth	6.67	6.80	5.80	1.03
Litter size alive at birth	6.50	4.20	4.80	1.00
Litter size 7-d postpartum	3.83	1.80	0.60	1.14
Litter size 14-d postpartum	2.83	1.20	0.60	1.01
Litter size 21-d postpartum	2.83	0.80	0.60	0.98
Litter size 28-d postpartum	2.67	0.80	0.60	0.96
Willingness to mate	High	Medium	Low	-
Stillbirth (%)	3.33	27.50	13.57	11.34
Pregnancy rate (%)	85.00	65.00	50.00	-

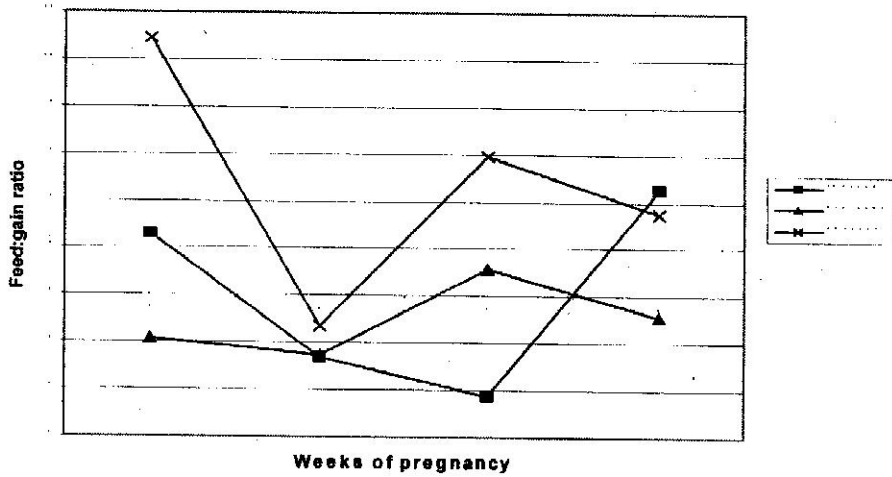


Fig. 3. Effect of rebreeding interval on feed:gain ratio

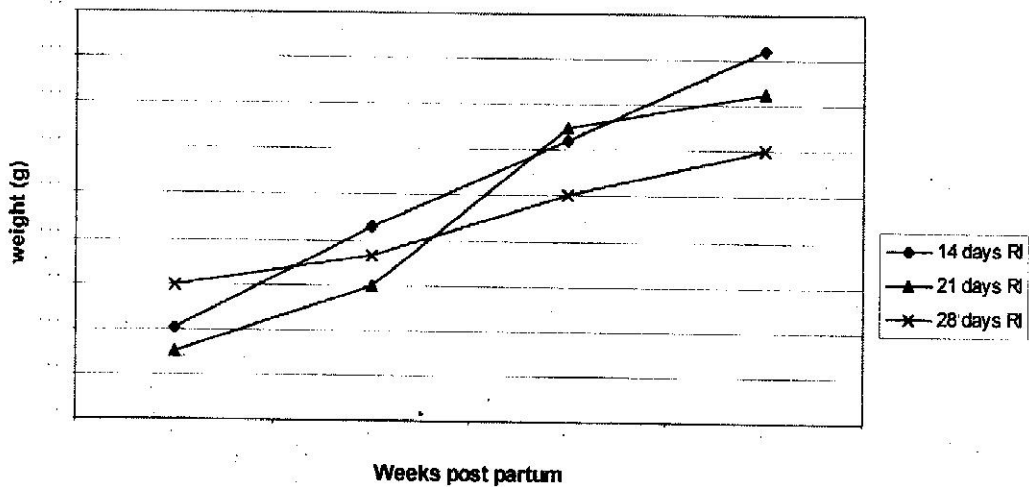


Fig. 4. Effect of rebreeding interval on average kit weight (grams) of rabbits.

**Table 4** Effect of rebreeding interval on litter weights (Grams) of rabbits.

Weight (g)	Rebreeding interval (days)			SEM
	14	21	28	
Litter weight at birth	296.67	223.00	230.00	36.11
Litter weight 7-d postpartum	575.00	350.00	450.00	143.65
Litter weight 14-d postpartum	850.00	550.00	550.00	349.94
Litter weight 21-d postpartum	1175.00	1300.00	750.00	394.55
Litter weight 28-d postpartum	1450.00	1450.00	900.00	465.23

postpartum and lowest for does mated 21 d postpartum. Negative feed:gain ratio was observed in the second week of pregnancy for all groups. In the third week of pregnancy, only the 14 d group had negative feed:gain ratio. Feed:gain ratio in the fourth week of pregnancy was higher for does mated 14 d postpartum than those mated 21 and 28 days postpartum. Feed:gain ratios obtained for does mated 28 d postpartum were higher than the other groups in the first three weeks of pregnancy. The 21- and 14-d groups utilized feed better than the 28-d group.

The effect of rebreeding interval on pregnancy rate, percent stillbirth and litter size of kits is shown in Table 3. Pregnancy rate decreased with increase in rebreeding interval. Pregnancy rate was higher for the 14-d group than the 21- and 28-d groups. Willingness to accept the male also decreased as rebreeding interval increased. The 14-d group accepted the male more readily than the 21- and 28-d groups. Percent stillbirth was lowest for does mated 14 d postpartum and highest for does mated 21 d postpartum. There were no significant ( $P>0.05$ ) differences in litter sizes especially at birth and alive at birth. Does

mated 14-d postpartum had slightly higher litter size alive and at 7, 14, 21 and 28 days postpartum than the 21- and 28-d groups.

Average litter birth weight decreased with increase in rebreeding interval (Table 4). Does mated 14 d postpartum had higher litter birth weight than those mated 21 and 28d postpartum. Average litter weights at 7 and 14 days postpartum were slightly higher for does mated 14-d postpartum interval than the 21- and 28- d groups. Average litter weight was higher by 21 days postpartum for does mated 21-d than 14- and 28-d groups while by 28 days postpartum, average litter weight gain was similar ( $P>0.05$ ) for the 14- and 21-d groups and lower for the 28-d group. Average weights of kits are shown in Fig. 4. Average weight of kits at 7 and 14 days postpartum was slightly but not significantly ( $P>0.05$ ) higher for the 28- and 14-d groups than the 21-d group. At 21 days postpartum, average weight of kits was slightly higher for the 14- and 21-d groups than the 28-d group. At 28 days postpartum however, average weight of kits decreased with increase in rebreeding interval. Kits raised by the 14-d group had higher weight than the 21-d and 28-d groups, while the 21-d

group had slightly higher weight than the 28-d group.

## **Discussion**

The loss of weight observed with the 21d group in the first week of pregnancy could be as a result of their low feed intake. The reason for this low feed intake is not clear as feed intake was supposed to increase after kindling, as was the case with the 28-d rebred group. Lebas *et al.* (1986) reported that after kindling, feed intake increases very rapidly and can exceed 100g dry matter/kg live weight a day. The loss of weight observed in the second week of pregnancy for does mated 14 d postpartum could probably be as a result of the taxing effect of pregnancy and lactation on the does. This would be so because does in this group were pregnant and lactating at the same time with little time for rest and hence accumulation of body reserves as was the case with the 28- and 21-d rebred does who were able to store more body reserves after lactation before the next pregnancy. Late mating has been reported to allow a wider resting period from weaning to parturition and allow does time to accumulate body reserves (Mendez *et al.*, 1986). Partridge *et al.* (1984) reported that weight gains of does were greatest when the suckling load was reduced. The 14-d rebred does were actually in the fourth week of lactation at this period while the 21- and 28-d groups were no longer lactating. Lower weight of does remated 1-d than 9-d was associated with the shorter time for reserve recovery between weaning and next parturition and the inability of the does to increase their feed intake to balance their energy requirements (Mendez *et al.*, 1986). The increase in weight gain of does observed in the third week could further buttress the point that does gain greater weight when the lactation load is reduced.

Higher feed intake observed for 14 d rebred does agrees with the result of Partridge *et al.* (1984)

who showed that 1-d remated rabbits had increased feed intake in the first three weeks of lactation. This result indicates a possible effect of additional lactation requirements on feed intake during pregnancy. Lebas *et al.* (1986) however, reported that when a doe is both pregnant and lactating, she will eat the same amount of feed as a doe that is lactating only and not more. The 14 d postpartum group were constantly trying to store some feed as body reserves especially as they only had two weeks within which to recover from lactation stress and prepare for the next lactation and the requirements of the growing foetus.

General decrease in feed intake with increase in rebreeding interval observed in the fourth week of pregnancy could be because the does were no longer lactating and therefore the need for more feed intake to meet the extra requirement for lactation was no longer there. This could also be as a result of a reduction in the size of the stomach due to the fast growing uterus. Lebas (1975) and Rajadevan *et al.* (1986) reported that the weight of the digestive system decreased by the fourth week of pregnancy and then increased during lactation. These weight changes are reduced if the does feed intake is restricted during pregnancy. Partridge *et al.* (1984) also reported that feed intake decreased as conceptus size increased. The feed:gain ratio obtained may not only indicate an efficiency of conversion of feed for weight gain. This is because some of the gain would be utilized in the developing foetus for development of organs and tissues and might not necessarily show as body weight gain.

The decrease in willingness to accept the male with increase in rebreeding interval agrees with Partridge *et al.* (1984) who reported that doe's willingness to mate appeared to decrease as postpartum remating interval increased. Decrease in pregnancy rate with increase in rebreeding



interval observed in this study also agrees with Prudhon *et al.* (1969) who reported that pregnancy was significantly higher in does mated after 9-17 and 10-20 days postpartum than those mated 0-6 and 1-7 days postpartum. However, Partridge *et al.* (1984) reported high conception rates for does remated at 1-d than 21-d postpartum. The does used by Partridge *et al.* (1984) have been routinely selected and remated at 24 h after parturition and this could therefore account for the high conception rates they obtained regardless of the remating interval used. Reports on the efficacy of early remating in rabbits have shown indications such as reduction in ovulation rate (Foxcroft and Hasnain, 1973a; Torres *et al.*, 1977), fertilization rate (Torres *et al.*, 1977; Mendez *et al.*, 1986), pregnancy rate and litter size (Prudhon *et al.*, 1969) and increase in embryonic loss (Foxcroft and Hasnain, 1973b; Mendez *et al.*, 1986) when rabbits were remated 0-7 days after parturition. Reproductive traits such as conception rate, prolificacy or litter size at weaning were reported to be generally higher in 25-d versus 1-d or 9-d remate rabbits (Mendez *et al.*, 1986).

Litter sizes at birth of 8.32, 8.94, 8.81 and 8.72 for does remated at 1, 7, 14 and 21 days reported by Partridge *et al.* (1984) are higher than those obtained in this study. Does mated 14 d postpartum however, had more kits alive at birth and at 7-d up to 28-d postpartum. Prudhon *et al.* (1969) reported that significantly fewer young were born live in does mated 0-6 and 1-7 days than those mated 9-17, 10-20, 20-28 and >30 days postpartum. Ovulation rates of lactating primiparous Californian does mated 12-18h or 25 days were reported to be 11.1 and 14.0 respectively (Torres *et al.*, 1977). Foxcroft and Hasnain (1973a) reported a significant increase in induced ovulation with increased postpartum interval to mating for Dutch Belted but not for

Large Albino rabbits. This would probably buttress the report of Partridge *et al.* (1984) who observed non-effect of remating interval on conception rate and litter size of does and indicated that the differences reported by various other authors could be as a result of the strains used.

Prenatal mortality of kits was low in this study. However, Lebas *et al.* (1986) reported that embryo losses were very extensive in rabbits with only 60-70% of the eggs becoming live rabbits. They further reported that most embryo mortalities occur in the 15 days before birth. Higher kit mortality rates at birth of 31% and 11% were reported by Partridge *et al.* (1984) for does remated at 14 and 21 days postpartum respectively. Mendez *et al.* (1986) however, reported that mortality of pups at birth was independent of treatment and it averaged 7.9% while Foxcroft and Hasnain (1973b) reported similar prenatal loss of embryos for suckling and non-suckling does following postpartum mating. High postnatal mortality observed in this study especially for the 21- and 28-d rebred group in the first week of life agrees with the results of Partridge *et al.* (1984) who reported that the bulk of postnatal deaths was observed in the first week of life, with mortality rates of 0.36, 0.42, 0.43 and 0.47 for does remated at 1, 7, 14 and 21 days postpartum respectively. Mendez *et al.* (1986) also reported increased mortality of young rabbits during lactation of 24% with a range of 5 to 54% for does remated at 1, 9 and 25 days postpartum.

Decrease in litter weights with increase in rebreeding interval observed in this study agrees with Partridge *et al.* (1984) who reported that pup birth weight, 21-day litter weight and 25-day litter weight all appeared to be unaffected by reducing the remating interval after parturition. Mendez *et al.* (1986) reported that

differences they recorded in litter weight at 21 d of age (280g) between 1-d and 25-d remating interval, suggest an effect of reproductive rhythm on the doe milk production. The differences in this study of 425-550g between 14- and 21-d rebred and 28-d rebred does, would indicate that does rebred at 14- and 21-d postpartum produced more milk than those bred at 28 days postpartum. Mendez *et al.* (1986) recorded increasing 21-d litter weight with increasing remating interval. In this study, the reverse was obtained with 21-d litter weight being lower than for the 28-d rebred group. This could be because all the kits were weaned at 28 days in this study regardless of the rebreeding interval while for Mendez *et al.* (1986), the weaning age increased as the remating interval increased (28, 30 and 42 days for 1, 9 and 25-d remating interval).

## Conclusion

It is concluded therefore, that though rabbits could be rebred at 14, 21 or 28 days postpartum without adverse effect on their performance, mating rabbits 14 days after kindling would immensely reduce the problems of does rejecting bucks during mating after long periods of rest. The increase in number of does that would be settled during breeding as a result of their high willingness to mate and high litter size coupled with the shorter rebreeding interval would increase the number of rabbits weaned and/or sold by farmers.

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