A COMPARATIVE STUDY ON REPRODUCTIVE PERFORMANCE OF THREE RABBIT BREEDS UNDER NATURAL MATING AND ARTIFICIAL INSEMINATION

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ABSTRACT:

This study was carried out to evaluate three rabbit breeds, as affected by natural mating and artificial insemination on some productive and reproductive parameters. One hundred and sixty females were used in artificial insemination (AI) [64 New Zealand White (NZW), 48 Californian (Cal) and 48 Senawey (Sen)]. In artificial insemination, the semen was diluted with two semen extenders. Fifty two females were chosen (20 NZW, 16 Cal and 16 Sen) for natural mating. Number of services per conception (NSC), number of mated does (NM), number of pregnant does (NP), litter size at birth (LSB) and at weaning (LSW), gestation period (GP), bunny weight at birth (BWB) and at weaning (BWW), litter weight at birth (LWB) and litter weight at weaning (LWW) were recorded. Fertility rate (FR) and mortality rate (MR) were calculated. There was no significant effect of breed on GP and litter size. NZW rabbit had the heaviest BWB and BWW, LWB and LWW. Sen had the lowest MR under natural mating (Na). Using AI decreased FR, increased NSC, decreased LSB, LSW and MR. Second ejaculate and second dilunt or the interaction between them increased FR, LSB and LSW. The interaction between first ejaculate (E_1) with Cal or Sen had the lowest FR while second ejaculate (E_2) with the same breeds had the highest values.

Key Words: Rabbit, Natural mating, Artificial insemination, Productive and Reproductive parameters.

INTRODUCTION

Artificial insemination when applied to the rabbit has been used for experimental purpose for more than 50 years. An improvement in reproductive performance through AI is only possible with very careful attention to hygiene, proper apparatus and to the execution of the insemination itself (Abd El-Ghaffar, 1992). Artificial insemination of rabbits is potentially a very valuable tool for rabbit producers. Among other reasons, it allows for a dramatic reduction in the number of males needed in the breeding herd. It has been estimated that in a large commercial herd only one buck per 500 does would be needed to maintain normal reproduction schedules (Sinkovics, *et al.* 1983).

One of the most important factors which could affect the results is the diluent and it was very important to improve fertility rate and develop a reproductive performance (Castellini and Lattaioli, 1999). Gogol (1997) found in NZW rabbits that average FR was 80.53%. But Lavara *et al.* (2000) reported that, the average FR was 66%. However, Khalifa *et al.* (2000) did not find any significant differences in FR between NZW and Cal breeds. Khalifa *et al.* (2000) and Lavara *et al.* (2000) did not find any significant differences in NSC between NZW and Cal breeds. Abd El-Ghaffar (1992) and El-Kelawy (1997) did not find any significant differences in GP between NZW (31.2 d.) and Cal (31.5 d.) breeds.

There is insignificant difference in LSB and LSW between NZW and Cal rabbits (Tawfeek and El-Hindawy, 1991; El-Sayiad *et al.*, 1993 and EL-Kelawy, 1997). Khalifa *et al.* (2000) did not find any significant differences in LSB and LSW between NZW and Cal breeds. Maertens and Luzi (1995) found no significant difference in LSB between two diluents.

Alabiso *et al.* (1996) and El-Kelawy (1997) reported non significant difference in BWB and BWW between NZW (55.9 and 428.0) and Cal (57.2 and 441.0) rabbits. Alabiso *et al.* (1996) found that with using fresh semen diluted in a tris and glucose solution at a 1: 5 rate, the average of BWB and BWW was 64 g and 534 g, respectively and did not find any significant differences between the different diluents.

There is insignificant difference in LWB and LWW between NZW and Cal rabbits (Tawfeek and El-Hindawy, 1991., El-Sayiad *et al.*, 1993 and El-Kelawy, 1997). Khalifa *et al.* (2000) reported that, average LWB was 303.7 g and 287.1 g in NZW and Cal breeds, respectively and did not find any significant differences between the two breeds. Khalifa *et al.* (2000) reported that semen diluted with egg yolk tris extender, the average litter weight at birth was 269.8 g in both NZW and Cal breeds.

El-Kelawy (1997) reported non significant difference in MR from birth up to weaning between NZW and Cal rabbits. Alabiso *et al.* (1996) and Lavara *et al.* (2000) did not find any significant differences in MR between the different breeds.

The main objective of this work was to study the effect of breeds under Na condition and the effect of sequence of ejaculation and diluents under AI condition on reproductive performance of rabbits.

MATERIALS AND METHODS

Fifty two females were chosen (20 NZW, 16 Cal, 16 Sen) for Na, the body weight ranged between 2.5-3.5 kg. Animals were maintained under identical nutritional and management conditions. Through, the period of experiment, each animal received a concentrate commercial diet (Pellets) *ad – libitum* (Table, 1), barseem was offered daily to each animal *ad – libitum* during the experimental period, fresh water was available continuously via automatic watering troughs. The female was transferred to the box of male during the mating. Pregnancy was diagnosed at 10 days post-mating using palpation method. Mating was repeated again when the female was non-pregnant. Sixty four NZW females, fourty eight Cal females and fourty eight Sen females were used in AI. The semen was diluted with two semen extenders: -

1- Extender A (D1) (Abd El- Ghaffar, 1992) composed of:
   3.9 g glucose, 0.55 g sodium citrate, 100 ml distilled water, 5 ml fresh yolk and all the contents were shaked.
2- Extender B (D2) (Uzcatequi and Johnston, 1988) composed of:
   2.9 g sodium citrate, 20 g egg yolk, 77.1 ml distilled water, all the contents were shaked.

Five hundred I.U. penicillin G. sodium and 0.5 mg streptomycin were added to each 1ml of each extender. Split semen fractions were diluted 1:10 with each extender. The diluted semen was incubated in water bath at 40^{o} C.

In addition, all bucks were trained for artificial collection of semen by using the artificial vagina according to Breederman *et al*. (1964). A female rabbit was used as a teaser. After three weeks of adaptation period, semen was collected from each buck once weekly. Two successive ejaculates at 5 minutes intervals were obtained on each occasion. Each male was let to make a false mount prior to the actual mounting for semen collection.

Eighty ejaculates (40 first ejaculate and 40 second ejaculate) were obtained from each breed in a period of 10 weeks. So, a total number of 240 ejaculates were collected from all bucks. Artificially inseminated rabbits were induced to ovulate with glass rod and the insemination was after 4 hours from using the glass rod of each animal. The semen was diluted with extender in order to obtain in each inseminating dose, irrespective of its volume, 20-25x10^6 motile sperm cells. The does were inseminated on the second day postpartum. Pregnancy was diagnosed at 15 days post-mating using palpation.

<u>Reproductive performance traits:</u>

NSC at a given doe was considered as the total recorded number of services of this particular doe till conception. GP in days was calculated from date of fertile mating to delivery. LWB is the total number of offspring at 1^{st} day of delivery, the weight of offspring (Bunny) at birth and at weaning was recorded for each doe, LWB and LWW are the total weight of offspring at birth and at weaning was recorded for each doe. MR is the number of dead offspring up to weaning was recorded as percentage (%) of LSB. FR was calculated by dividing the number of pregnant does to delivery on the number of mated does x 100. The statistical analysis was computed using the general linear model (GLM) procedure of statistical analysis system (SPSS) and the statistical equation according to Steel and Torrie (1980).

Table (1): Composition and chemical analysis of the experimental pelleted diet.

Items	Growth period	Breeding period
Wheat bran	21.00	20.00
Berseem hay	28.00	28.00
Barley grains	32.00	30 .00
Soyabean meal	10.00	11 .00
Decorticated cotton seed meal	3 .00	4.00
Molasses	3.00	3.00
Bone meal	-	0.70
Limestone	1.00	1.00
Meat meal (60 % CP)	1.35	1.50
Sodium chloride	0.25	0.35
Vit. & Mineral Premix	0.30	0.30
Dl – Methionine	0.10	0.15
Total	100.00	100.00
Chemical analysis %		
Crude Protein (CP)	15.80	17.30
Ether extract (EE)	2.75	2.15
Crude Fibre (CF)	13.10	11.74
Digestible energy (DE) K cal / Kg feed*	2630	2600

* Calculated

RESULTS AND DISCUSSION

The means of GP (day) as affected by breed are presented in Table (2) and illustrated in Figure (3), results indicated that, there was no significant effect of breed on GP (day). These results are in agreement with those obtained by Tawfeek and El- Hindawy (1991), El- Sayiad *et al.* (1993) and El- Kelawy (1997).

Results in Table (2) and Figure (2), indicated that, the effect of breed on BWB was highly significant (P< 0.01). NZW rabbit had the heaviest weight at weaning (372.2 g) followed by Cal (354.04 g) then Sen rabbit (333.06), these results are in agreement with those given by Alabiso *et al.* (1996), El-Kerdawy and Rashwan (1998) and Mahmoud *et al.* (1998).

The effect of breed on LWB was significant (P< 0.05). Sen had the lightest BWB. In spite of there was no significant difference in the LWW but Sen rabbits had the lowest value. These results are in agreement with those obtained by Bodnar (1998), Ayyat and Marai (1998) and El- Kerdawy and Rashwan (1998). In general, Sen rabbit had the lightest BWB, BWW, LWB and LWW, these may be due to the weight of Sen breed is lower than the weight of NZW or Cal breed (Table 2, Fig 2).

The effect of breed and AI on NSC are shown in table (3) and illustrated in (figures 1 and 4). Sen rabbits need significantly higher NSC than NZW or Cal rabbits under Na conditions, these results are in agreement with those obtained by El-Darawany and El-Sayiad (1994) and Oudah (1990) and El-Kelawy (1997). While, there was insignificant difference dut to AI.

The fertility due to Na condition was higher than AI conditions, this perhaps due to AI need very careful attention to hygiene (Table 3, Fig 5).

There was no significant difference for LSB and LSW between the breeds under Na conditions or under AI conditions. These results are nearly similar with those obtained by Tawfeek *et al.* (1994), El-Kerdawy *et al.* (1998) and Mahmoud *et al.* (1998). But numircally, Na increased LSB or LSW. Sen rabbits showed significantly the highest MR under AI but it had the lowest value under Na conditions. On the other hand, Cal rabbits had the highest MR under Na conditions but there was no significant difference between it and NZW rabbits under AI conditions.

Results at Table (4) and Fig (4) indicated that the mean of NSC as affected by ejaculate are significant (P < 0.05) between the second (1.50) and the first (1.63) ejaculates. Second ejaculate increased significantly FR, increased LSB and LSW. The increasing of fertility, this effect of second ejaculate may be due to it has more concentration of sperm than first ejaculate. Results, also indicated that, the difference in LSB and LSW and MR of NSC, due to the interaction between breed and ejaculation was significant. The worst interaction effect was between Sen breed and the first ejaculation, it caused the lowest value for FR (58.33 %) and the highest value for MR (14.39 %). While the interaction between Sen or Cal breed with second ejaculation increased FR, but the interaction between Sen breed with first or the second ejaculation reduced MR.

Data at Table (4) also showed that, differences in the mean of LSB or LSW as affected by dilution are highly significant (P<0.01) between the second (5.89, 5.44) and the first (5.49, 5.04) diluents. The means of NSC as affected by dilution are significant (P<0.05) between the second (1.40) and the first (1.77) diluents. Results indicated also that the second diluents improved the fertility (71.25 %) against (56.25 %) for the first diluents.

The interaction between the breed with the dilution caused a significant difference in NSC, FR, LSB and LSW and MR. The interaction between the second diluents with NZW or Sen improved FR while the interaction between the Cal breed with first or second diluents reduced MR. The interaction between ejaculation and the dilutions had significant effect on NSC, FR, LSB and LSW and MR.

The interaction between first ejaculation and first diluents reduced FR (55.5 %) and increased MR (9.41%), while the interaction between the second ejaculation and second diluents increased FR.

Table (2): The effect of breeds under natural mating condition on reproductive performance in rabbits (mean ±S.E).

Classification	GP (Day)	BWB (g)	BWW (g)	LWB (g)	LWW (g)
Overall mean	31.58±0.08	56.69±0.48	355.36±4.23	349.53±8.40	1941.53±49.19
Effect of breed	NS	**	**	*	NS
NZW	31.65±0.12	59.24±0.47 ^{a}	372.20±7.25 ^{a}	355.82±12.83 ^{a}	1983.35±104.59
Cal	31.64±0.17	56.57±0.60 ^{b}	354.04±5.18 ^{b}	370.93±11.26 ^{a}	1969.64±59.63
Sen	31.42±0.15	53.23±0.53 ^{c}	333.06±4.20 ^{c}	315.67±17.13 ^{b}	1849.50±67.72

Means within a column within a classification followed by the same letter do not differ significantly from each other, otherwise they do differ significantly at p< 0.05.

NS = Not significant * P< 0.05 ** P< 0.01

GP= Gestation period, BWB= Bunny weight at birth, BWW= Bunny weight at weaning, LWB= Litter weight at birth, LWW= Litter weight at weaning.

Table (3): Fertility rate (%) and mortality rate (%) as affected by breed and mating way in rabbits.

Mating	Breed	NM	NP	NSC	FR%	LSB	LSW	MR%
				*		NS	*	
AI	NZW	64	42	1.52±0.07^{b}	65.63	5.55±0.09	5.17±0.12^{b}	6.85
	Cal	48	30	1.6±0.09^{a}	62.50	5.87±0.10	5.53±0.09^{a}	5.79
	Sen	48	30	1.6±0.09^{a}	62.50	5.80±0.19	5.13±0.25^{b}	11.55
	Mean	**53.3**	**34**	**1.57**	**63.78**	**5.74**	**5.28**	**8.06**
				*		*	*	
Na	NZW	20	17	1.17±0.12^{b}	85	6.00±0.19^{ab}	5.35±0.30^{b}	10.8
	Cal	16	14	1.14±0.13^{b}	87.5	6.57±0.23^{a}	5.57±0.17^{a}	15.2
	Sen	16	12	1.33±0.15^{a}	75	5.92±0.29^{b}	5.58±0.26^{a}	5.77
	Mean	**17.3**	**14.3**	**1.21±0.07**	**82.69**	**6.16±0.14**	**5.49±0.15**	**10.87**

Means within a column within a classification followed by the same letter do not differ significantly from each other.

NS = Not significant * P< 0.05 ** P< 0.01

AI = Artificial insemination, Na =Natural mating,
NM= Number of mated does, NP= Number of pregnant does,
NSC= Number of services per conception, FR %= Fertility rate.
LSB= litter size at birth, LSW= Litter size at weaning, MR %= Mortality rate.

Table (4): The ejaculate number, diluents and the interaction between them and the breed on reproductive performance in rabbits (mean ±S.E).

Classification	NM	NP	NSC	FR(%)	LSB	LSW	MR (%)
Effect of ejaculate			*		NS	NS	
E1	80	49	1.63±0.07[a]	61.25	5.67±0.11	5.20±0.15	7.99±2.10
E2	80	53	1.50±0.07[b]	66.25	5.75±0.10	5.32±0.12	7.55±1.55
Effect of diluent			**		**	*	
D1	80	45	1.77±0.07[a]	56.25	5.49±0.14 [b]	5.04±0.17 [b]	8.08±2.30
D2	80	57	1.40±0.07[b]	71.25	5.89±0.07 [a]	5.44±0.09 [a]	7.50±1.43
Interaction			*		*	*	
NZW x E1	32	21	1.52±0.10[b]	65.63	5.62±0.11[bc]	5.29±0.16[ab]	5.87±2.19
NZW x E2	32	21	1.52±0.11[b]	65.63	5.48±0.15[c]	5.05±0.19[b]	7.78±2.45
Cal x E1	24	14	1.71±0.14[a]	58.33	5.71±0.13[b]	5.43±0.14[a]	4.76±2.09
Cal x E2	24	16	1.44±0.13[c]	66.66	6.00±0.16[a]	5.63±0.13[a]	5.80±1.94
Sen x E1	24	14	1.71±0.14[a]	58.33	5.71±0.35[b]	4.86±0.43[b]	14.39±6.08
Sen x E2	24	16	1.50±0.13[b]	66.66	5.88±0.20[ab]	5.38±0.27[ab]	8.99±3.60
Interaction			*		*	*	
NZW x D1	32	18	1.77±0.12[ab]	56.25	5.28±0.16[b]	4.89±0.18[b]	7.04±2.54
NZW x D2	32	24	1.33±0.10[d]	75.00	5.75±0.09[b]	5.38±0.16[a]	6.67±2.17
Cal x D1	24	14	1.71±0.14[b]	58.33	5.71±0.19[b]	5.36±0.13[a]	5.61±2.10
Cal x D2	24	16	1.50±0.13[c]	66.66	6.00±0.09[a]	5.69±0.12[a]	5.06±1.94
Sen x D1	24	13	1.83±0.14[a]	54.17	5.54±0.39[b]	4.92±0.54[b]	12.20±6.88
Sen x D2	24	17	1.47±0.12[c]	70.83	6.00±0.17[a]	5.29±0.17[ab]	10.98±3.13
Interaction			**		*	*	
E1 x D1	40	21	1.90±0.11[a]	55.50	5.38±0.22[b]	4.86±0.29[b]	9.41±4.11
E1 x D2	40	28	1.43±0.09[c]	70.00	5.89±0.09[a]	5.46±0.12[a]	6.92±2.05
E2 x D1	40	24	1.50±0.10[b]	60.00	5.58±0.18[b]	5.21±0.21[ab]	6.92±2.45
E2 x D2	40	29	1.38±0.09[c]	72.50	5.90±0.10[a]	5.41±0.14[a]	8.06±2.01

Means within a column within a classification followed by the same letter do not differ significantly from each other.
NS = Not significant *** P< 0.05** **** P< 0.01**
NM= Number of mated does, *NP= Number of pregnant does,*
NSC= Number of services per conception, *FR %= Fertility rate.*
LSB= litter size at birth, *LSW= Litter size at weaning,* *MR %= Mortality rate.*

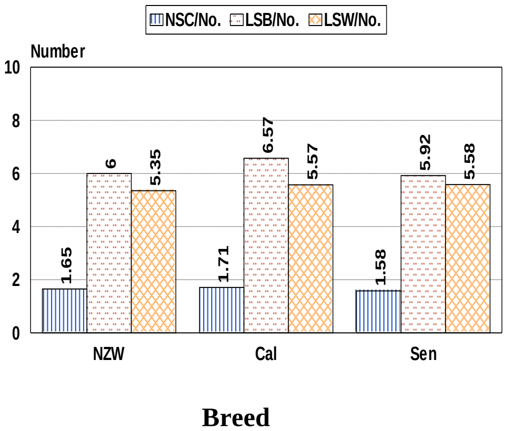


Figure (1): The effect of breed on number of services per conception (NSC), litter size at birth (LSB) and litter size at weaning (LSW) of natural mating in rabbits.

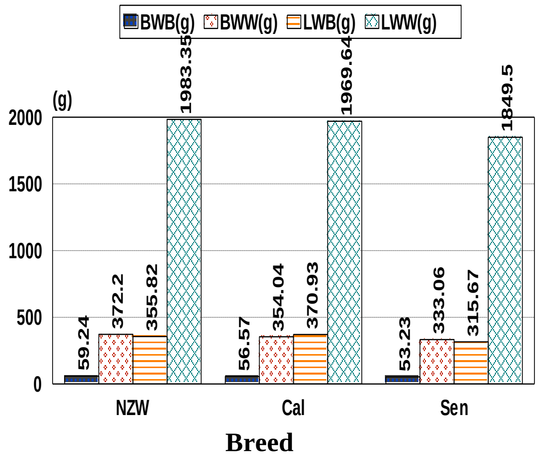
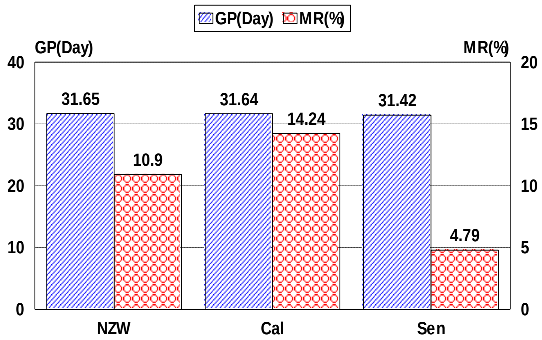
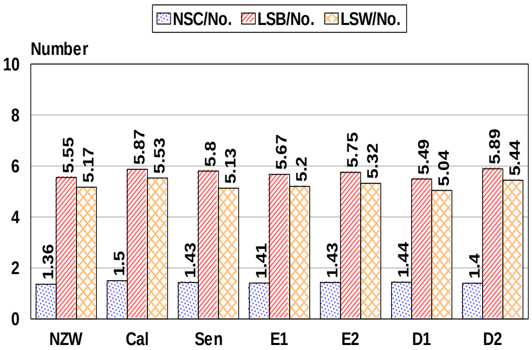


Figure (2): The effect of breed on bunny weight at birth (BWB), bunny weight at weaning (BWW), litter weight at birth (LWB) and litter weight at weaning (LWW) of natural mating in rabbits.



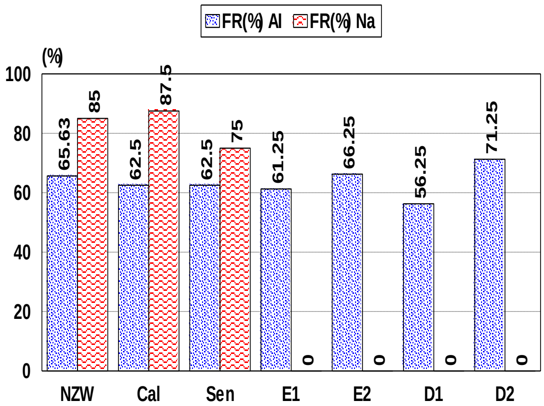
Breed

Figure (3): The effect of breed on gestation period (day) and mortality rate (MR) of natural mating in rabbits.



Breed Ejaculation Dilution

Figure (4): The effect of breed, sequence of ejaculation and diluent on number of services per conception (NSC), litter size at birth (LSB) and litter size at weaning (LSW) of artificial insemination in rabbits.



Breed Ejaculation Dilution

Figure (5): The effect of breed, sequence of ejaculation and diluent on fertility rate of artificial insemination (FR% AI) and effect breed on fertility rate of natural mating (FR% Na) in rabbits.

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دراسة مقارنة على الكفاءة التناسلية لثلاثة أنواع من الأرانب تحت

ظروف التلقيح الطبيعى والإصطناعى

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**** معهد بحوث الإنتاج الحيوانى- الدقى – الجيزة - مصر.**

أجريت هذه الدراسة لتقدير بعض الصفات والقياسات التناسلية والإنتاجية كنتيجة لتأثير سلالة الأرانب والتلقيح الطبيعى والإصطناعى.

- لقح عدد ١٦٠ أنثى (٦٤ نيوزلندى ابيض و٤٨ كاليفورنيا و ٤٨ سيناوى) تلقيحا صناعيا بتركيزين مختلفين من الحيوانات المنوية. وكذلك تم إختيارعدد ٥٢ أنثى (٢٠ نيوزلندى ابيض و١٦ كاليفورنيا و ١٦ سيناوى) لإجراء التلقيح الطبيعى.
- تم تسجيل البيانات الخاصة بعدد مرات التلقيح لكل إخصاب وعدد ووزن الأرانب الناتجة عند الولادة والفطام وكذلك تم حساب نسبة الإخصاب والنفوق.
- لا يوجد تأثير معنوى يرجع إلى السلالة على فترة الحمل وكذلك عدد النتاج.
- أرانب النيوزلندى الابيض تتميز بثقل وزن الأجنة عند الولادة والفطام وكذلك عدد النتاج عند الولادة والفطام.
- أرانب السيناوى كان معدل الخصوبة قليل وقلة نسبة النفوق وذلك تحت ظروف التلقيح الطبيعى.
- انخفاض نسبة الخصوبة وعدد مرات التلقيح وعدد الخلفات عند الولادة والفطام ونسبة النفوق وذلك تحت ظروف التلقيح الإصطناعى.
- وجد زيادة فى نسبة الخصوبة وعدد الخلفات عند الولادة والفطام عند استخدام القذفة الثانية والتخفيف الثانى.
- استخدام القذفة الأولى لتلقيح أرانب الكاليفورنيا والسيناوى أدى إلى انخفاض نسبة الخصوبة مع أن استخدام القذفة الثانية مع نفس السلالات أدى إلى زيادة نسبة الخصوبة.