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EFFECT OF GRAY FLANDER, NEW ZEALAND AND BALADI AS SIRE BREEDS ON PRE- AND POSTWEANING LITTER TRAITS IN RABBITS

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SUMMARY

Litter traits data were collected on 152 litters that gave 818 weanling rabbits kindled during the period from August 1997 to June 1998 which represented offspring of three sire breeds being Gray Flander (GF); New Zealand White (NZW), and Baladi (Bal.) and one dam breed (NZW). All sires of the three breeds (n=1 0) were mated to New Zealand White does (n=40). Gestation length, litter size and weight at different ages (kindling, 4, 8 and 12 weeks); daily litter gain (4-12 weeks); litter growth rate and pre- and post-weaning mortality rate were studied. The results showed that there were no significant differences among sire-breed groups for pre-weaning litter traits studied except litter weight at birth ($P<0.05$), while significant differences ($P<0.01$) among sire-breed groups for post-weaning litter traits (litter weight at both 8 and 12 weeks of age; daily litter gain at different intervals and litter growth rate from weaning at 4 weeks to 8 weeks of age as well as during the whole fattening period from weaning at 4 weeks to marketing at 12 weeks of age). The crossbred litters of GF x NZW had the heaviest weights at all ages except at 8 weeks, while the corresponding litters of Bal. x NZW recorded the lowest weights (490, 3237 and 11590 g vs. 421, 3011 and 10122 g, respectively).

There were significant differences ($P<0.05$) among parities for some pre-weaning litter traits (total litter size born; number born alive and litter weight at birth) and no significant differences among parities for post-weaning traits except for litter growth rate during the period from weaning till 8 weeks and during the whole period ($P<0.01$). The crossbred litters of Bal. x NZW had the lowest pre-and post-weaning mortality rates. No significant differences between sire-breed group by parity interaction on pre-weaning litter traits were observed. Highly significant effects ($P<0.01$ or $P<0.001$) for sire-breed group by parity interaction on post-weaning traits except litter growth rate during 4-8 and 8-12 week and mortality rate were found.

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According to the previous results it is recommended to use GF as a sire breed to mate NZW does under the Egyptian conditions.

Keywords: Rabbits, sire-breed, crossbred litters, post-weaning

INTRODUCTION

The performance of litter traits such as: litter size and weight at different ages (birth, weaning, 8 weeks of age and at marketing at 12 weeks of age), litter gain and growth from weaning to marketing and mortality rate are important to the profitability of rabbit production.

New Zealand White rabbits (NZW) is considered as the industry standard breed all over the world. This breed has scientifically proven merits for nest building behavior, milk production, litter size and viability of offspring (e.g. Lukefahr *et al.*, 1983a and 1984; Szendro and Kustos, 1988; Roberts and Lukefahr, 1992). In contrast to these findings for maternal traits, some studies have demonstrated inferiority of the New Zealand White breed for certain post-weaning growth traits (e.g. Brun and Rouvier, 1984; Ozimba and Lukefahr, 1991 and Nofal and Sandor, 1996).

Therefore, the NZW can be classified as a dam breed resource and accordingly used to test the magnitude of using others as breeds of sire for producing improved crossbreds concerning pre-weaning litter performance which has been proved to have low heritability estimates (Lahiri and Mahajan, 1982; Khalil *et al.*, 1987 and 1988 and El-Maghawry, 1990) as well as post-weaning litter traits.

The alternative breeds of sire chosen were the NZW as a foreign standard breed, Gray Flander (GF) as a foreign breed adapted to the Egyptian environmental conditions and Baladi (Bal.) as a native breed.

The purpose of the present study was to evaluate these sire breeds (GF; NZW and Bal.) mated to NZW does.

MATERIALS AND METHODS

This experiment was done at the rabbit farm located in Kafr El-Sheikh gGovernorate during the period from August 1997 till June 1998. Bucks and does were housed in suspended cages of a commercial type and a nest box was provided for each doe on the 23rd day of pregnancy.

Buck to doe ratio was 1:4 for random natural mating. Bucks and NZW does were used for breeding for the first time between 6-7 months of age. All rabbits were exposed to the same environmental conditions. Commercial diet (pellets ration) containing 17.8 % crude protein; 14.5 % crude fiber and 2700 Kcal digestible energy was used for feeding. Rabbits were fed *ad libitum* and water was freely supplied through a nipple drinking system. During the fattening period (4 -12 weeks of age) progeny were housed in cages of a commercial type, two rabbits per cage. Number of breeding does at the beginning of the experiment was 12, 16 and 12 mated to GF; NZW and Bal. bucks, respectively. Each doe produced between three and five litters throughout the period of experiment and all does gave 152 litters at birth. Does were palpated 12 days post-mating and those being open were immediately re-bred.

Bunnies were weaned at 4 weeks of age. Gestation length, litter size and weight at various ages (birth, four (weaning), 8 and 12 weeks of age), daily litter gain of different intervals (4-8; 8-12 and 4-12 weeks); litter growth rate during the previous intervals and mortality rate were recorded. Mortality rate was calculated as the percentage of dead bunnies at weaning to total litter size at birth for pre-weaning and the proportion of fryers surviving to marketing for post-weaning period. Litter growth rate was calculated according to the following equation (Brody, 1968).

Litter growth rate = (litter weight at the end of period - litter weight at the beginning) / 0.5 (litter weight at the end + litter weight at the beginning) X 100.

Statistical analysis:

Data were analyzed according to Harvey (1990) using the following model:

$Y_{ijk} = \mu + S_i + P_j + (S \times P)_{ij} + e_{ijk}$

Where, Y_{ijk} the observation on the ijk *th* litter,

μ= overall mean,

S_i = fixed effect of sire-breed groups (i = 1, 2 and 3),

P_j = fixed effect of j*th* parity (j=1, 2,... and 5),

$(S \times P)_{ij}$ = effect of interaction between sire-breed groups and parity and

e_{ijk} = random error.

RESULTS AND DISCUSSION

1- Pre-weaning litter traits:

Sire-breed group effect:

Least-squares means and standard errors of sire-breed group for pre-weaning litter traits are shown in Table 1. There were no significant differences among sire-breed groups for all pre-weaning litter traits except litter weight at birth ($P < 0.05$; Table 2). Results in table 1 shows that using Baladi bucks as sires resulted in producing litters with lighter weight at birth than when using either GF or NZW bucks, the difference was only significant between GF and Bal. bucks. These results indicate that mating Bal. buck had a significant effect on litter weight at birth. However, the significant difference between GF and Bal. shown at birth disappeared at weaning and that may be due to the little number per doe in this group (Bal. x NZW). Furthermore, the maternal effect during suckling period compensated the negative genetic sire effect (Roberts and Lukefahr, 1992). The results of GF and NZW sire groups agreed with those reported by Rouvier *et al.* (1973), Kadry and Afifi (1983), Ichalil and Mansour (1987), Afifi *et al.* (1989) and Youssef

Table 1. Least squares means and standard errors (±SE) of sire-breed group and parity subclasses for post-weaning litter traits*

Main effect	No.	GL (d.)	LSB(bun.)	LSA(bun.)	LWB (g)	LSW (bun.)	LWW (g)	PWM%
Sire-breed group								
GF	45	30.5±0.4	8.1±0.4	7.4±0.5	490±20.8a	5.7±0.5	3237±129	33.1±5.6
NZW	59	31.2±0.4	7.8±0.3	7.2±0.4	443±17.4ab	5.3±0.4	3072±114	32.9±4.8
Bal.	48	31.1±0.4	7.1±0.4	6.8±0.4	421±19.4b	5.2±0.5	3011±126	31.8±5.4
Parity								
1	39	30.3±0.4	6.8±0.4b	6.2±0.5b	430±22.7b	5.2±0.5	2953±138	31.9±5.9
2	34	31.0±0.5	8.3±0.5ab	7.4±0.5ab	470±22.7ab	5.5±0.5	2994±147	36.4±6.2
3	30	31.1±0.5	8.6±0.5a	8.5±0.5a	498±23.5a	5.6±0.6	3151±156	33.9±6.7
4	29	31. ±0.5	7.3±0.5ab	6.7±0.6b	426±24.9b	5.6±0.6	3138±155	25.5±6.8
5	20	30.9±0.6	7.2±0.6ab	6.8±0.7ab	434±29.8b	5.1±0.7	3343±192	35.1±8.2

- GL= Gestation length; LSB= litter size at birth; LSA= litter size born alive; LWB= litter weight at birth; LSW= litter size at weaning;

LWW= litter weight at weaning; PWM= pre-weaning mortality and bun.= bunnies.

a,b: Within each classification those means followed by the letter not differ significantly from each other, otherwise they do differ at $P<0.05$.

(1992). GF sire group recorded the largest and heaviest size and weight of litters compared to NZW and Bal. sire groups (Table 1).

This led to recommend the use of adapted foreign sire GF for small-scale breeders under the Egyptian environmental conditions to mate exotic NZW does.

Parity effect:

Least-squares means and standard errors for pre-weaning litter traits as affected by parity are shown in Table 1. There were significant (P<0.05) differences among parities in litter size and weight at birth (Table 2). Significant effect of parity on litter size was detected by many investigators (Rollins *et al.*, 1963; Randi, 1982 and Nofal and Sandor, 1996). These results indicate that the pattern of changes in litter size and weight at birth due to parity effects, may be due to changes in physiological efficiency of does which occurs with advance of parity (Hulot and Matheron, 1981). This may be related to the effects of age on ovulation rate; implantation site, embryonic mortality rates; viability of foetus and to differences in the intra-uterine environment during gestation length (Khalil *et al.*, 1988). The 3rd litter was the largest and heaviest one in size and weight while, the 1*st* ones showed the smallest and lightest means at all times.

Table 2: Least squares ANOVA of factors affecting pre-weaning litter traits[1]

Item	d.f.	GL	LSB	LSA	LWB	LSW	LWW	PWM
Sire-breed group (S)	2	ns	ns	ns	*	ns	ns	ns
Parity (P)	4	ns	*	*	*	ns	ns	us
S. x P.	8	ns	us	us	ns	ns	ns	ns
Residual mean square	137	7.04	6.90	8.67	16302.2	9.93	583940.3	1304.38

[1] Abbreviations of litter traits are used in Table 1.
ns = Not significant and * = P<0.05

Sire-breed group by parity interaction:

Pre-weaning litter traits were not significantly affected by the interaction between sire-breed group and parity (Table 2). These pre-weaning litter traits seem to be dependent mainly on the maternal effects.

2. Post-weaning litter traits:

Sire-breed group effect:

Least-squares means and standard errors of sire-breed group effect on post-weaning litter traits are shown in Table 3. Highly significant (P <0.05 or P <0.01) differences among sire-breed groups (Table 4) were observed in all post-weaning traits except L58, LSM and LGR 8-12 as well as MR (P<0.01). As expected, sire-breed group effect was important on most of these traits. The varying rates of physiological maturation among breeds, as well as absolute body weight differences at maturity may explain these results (Roberts and Lukefahr, 1992).

Table 3. Least squares means and standard errors (±SE) of sire-breed group and parity subclasses on post-weaning litter traits*

Main effect	No.	LS8(bun)	LW8(g)	LSM(bun)	LWM(g)	$DLG_{4-8\ wks}$	$DLG_{8-12\ wks}$	$DLG_{4-12\ wks}$
Sire-breed group								
GF	35	6.1±0.2	6246±234a	5.9±0.2	11590±393a	104±6ab	191±7a	147±6a
NZW	47	6.2±0.2	6322±208a	5.9±0.2	11424±348ab	112±3a	182±6ab	147±5a
Bal.	38	5.9±0.2	4547±228b	5.6±0.2	10122±382b	86±6b	167±7b	126±6b
Parity								
1	31	5.9±0.2	5982±246	5.7±0.2	10997±412	108±7	179±8	143.3±6
2	26	6.2±0.3	6084±267	6.0±0.2	11540±447	109±7	192±8	150.4±7
3	24	6.1±0.3	5879±286	5.9±0.2	10952±480	95±8	181±9	137.8±7
4	24	6.2±0.3	6087±283	5.8±0.2	10882±475	102±8	171±9	136.5±7
5	15	6.0±0.4	6010±351	5.8±0.3	10963±588	89±9	177±11	132.8±9

Main effect	No.	$LGR_{4-8\ wks}$	$LGR_{8-12\ wks}$	$LGR_{4-12\ wks}$	$MR_{4-12\ wks}$
Sire-breed group					
GF	35	60.7±03.0ab	60.3±1.5	110.6±2.3ab	15.3±2.1
NZW	47	65.7±2.7a	57.6±1.4	112.5±2.0a	12.2±1.8
Bal.	38	52.7±2.9b	59.8±1.4	103±2.3b	13.4±2.0
Parity					
1	31	66.6±3.2a	59.5±1.6	114.6±2.4a	12.5±2.2
2	26	66.4±3.4a	60.8±1.7	115.3±2.6a	14.0±2.2
3	24	55.7±3.7ab	60.7±1.8	106.4±2.8a	17.2±2.6
4	24	60.1±3.7a	57.4±1.8	108.1±2.8a	12.3±2.6
5	15	49.6±4.5b	57.9±2.3	100.3±3.4b	121.3±3.2

* LS8= Litter size at 8 weeks; LW8= litter weight at 8 weeks; LSM= litter size at marketing; LWM= litter weight at marketing; $DLG_{4-8\ wks}$= Daily litter gain from 4 to 8 weeks; $DLG_{8-12\ wks}$= Daily litter gain from 8 to 12 weeks, $DLG_{4-12\ wks}$= Daily litter gain from 4 to 12 weeks;
$LGR_{4-8\ wks}$= Litter growth rate from 4 to 8 weeks; $LGR_{8-12\ wks}$= litter growth rate from 8 to 12 weeks; $LGR_{4-12\ wks}$= litter growth rate from 4 to 12 weeks and MR= Mortality rate from 4 to 12 weeks.

a,b: within each classificatio those means followed by the same letter did not differ significantly from each other, otherwise they do at $P<0.01$.

Daily litter gain from weaning to marketing of both GF x NZW crossbred and NZW purebreds recorded higher least-squares means than Bal. x NZW crossbred (Table 3). In addition, average total litter weight at marketing was heavier in GF x NZW crossbred litters than in NZW ones. The results showed no significant difference between GF as adapted foreign sire breed in Egypt and NZW as foreign one for daily litter gain and growth rate during the whole fattening period from weaning to marketing (4-12 weeks of age). However, Bal. as a native sire breed had the advantage of decreasing mortality rate of crossbred progeny than GF (13.4 % vs. 15.3 %, Table, 3). Previous reports (Lukefahr *et al.*, 1983b; Masoero *et al.*, 1985; Brun and Ouhayoun, 1989; Ozimba and Lukefahr, 1991 and Reborts and Lukefahr, 1992) have demonstrated a comparable or even increased post-weaning growth in crossbred to purebred litters. The GF x NZW crossbreds tended to have the numerically better performances for litter traits (although in most cases mean differences were not significant) and in a larger experiment significant differences may have been more detectable.

Parity effect:

Table 3 shows least-squares means and standard errors for post-weaning litter traits as affected by parity. Results in table 4 indicate that there were no significant differences among parities for post-weaning litter traits except litter growth rate from weaning to 8 weeks and during the whole fattening period from weaning at 4 weeks to marketing at 12 weeks of age (P< 0.01). Similar results were obtained in other study by Roberts and Lukefahr (1992). Parity had no effect on litter traits (Khalil and Afifi, 1991).

Table 4. Least- squares ANOVA of factors affecting post- weaning litter traits [1]

Item	d. f.	LS 8	LW 8	LSM	LWM	DLG 4 - 8 wks	DLG 8- 12 wks
Sire-breedgroup(S)	2	ns	**	ns	**	**	*
Parity (P)	4	ns	ns	ns	ns	ns	Ns
S x P	8	**	***	***	***	**	
Residual mean squares	105	1.9	1842312.7	1.4	5185446.5	1329.2	1751.2
Item	**d. f.**	**DLG 4-12 wks**	**LGR 4-8 wks**	**LGR 8-12 wks**	**LGR 4-12 wks**	**MR**	
Sire-breedgroup(S)	2	**	**	ns	**	Ns	
Parity(P)	4	ns	**	ns	**	ns	
S x P	8		ns	ns	*	ns	
Residual mean squares	105	1162.7	309.8	76.6	176.2	98.5	

[1]Abbreviations of post weaning litter traits are used in Table 3.

ns = Not significant, * = P< 0.05, ** = P< 0.01 and ***= P <0.001.

Sire-breed group by parity interaction:

Highly significant effects of interaction between sire-breed group and parity for most post-weaning litter traits were obtained ($P< 0.01$ and $P<0.001$). However, it is difficult to separate the main cause of this interaction, or to state a practical recommendation to make use of it.

CONCLUSION

It could be concluded that from the practical point of view it is recommended to use of GF bucks to mate NZW does for producing commercial hybrid rabbits under Egyptian conditions.

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