International Journal of Animal Biology
Vol. 1, No. 5, 2015, pp. 182-186
http://www.aiscience.org/journal/ijab

Effect of Line and Season on Productive Performance of Rabbits

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Abstract

Study the effect of line, season and their interaction is very important in rabbits breeding. The productive performance of Alexandria and V lines was studied in tropical climate of Egypt. All rabbits used were normal and healthy. Data from 240litters were studied during autumn and spring seasons. The significant differences between the two lines can be summarized in litter weight at weaning and slaughter age which was significantly higher in Alexandria than in V-line. Also, the mortality rate was significantly higher in V-line than in Alexandria. Raising rabbits during spring season (March-May) is better than autumn (September-November) in terms of both productive and reproductive efficiency. The results of productive traits at weaning age in the present study indicated an excellent caring of Alexandria and V lines rabbits.

Keywords

Rabbits, Line, Season, Interaction, Productive Performance

Received: June 5, 2015 / Accepted: June 11, 2015 / Published online: July 20, 2015

1. Introduction

In tropical countries as Egypt the high temperature handicaps the success of rabbit production (El-Sheikh *et al*., 2011). One of the possible solutions for the problem of the increasing shortage of meat production in Egypt is through developing animal production using small ruminant as rabbit. Domestic rabbits have been considered as one of several alternative species quite suitable source of animal protein in the developing countries (Hanaa *et al*., 2014). Moreover, the rabbit has the capacity to convert both high concentrate feeds and roughage with increased efficiency when compared with large animal species (Hassan *et al*., 1994). However, information on the effect of different seasons on the productive performance of broiler rabbits under tropical conditions is lacking. In general, study of genetic and non-genetic factors affecting on productive traits in rabbits is important issue in order to reach highest rates in commercial production (El-Sabrout *et al*., 2014). Therefore, the present study was undertaken to study both effects of breed and season on productive performance of two rabbit lines (V and Alexandria) in addition to their adaptability to the climatic conditions of this area.

2. Materials and Methods

2.1. Experimental Animal

V and Alexandria lines of rabbits have been used from the stock available at rabbitry of the Poultry Research Center of the Poultry Production Department. A number of 70 does of V-line and 60 does of Alexandria rabbits were used during the experimental period 2014/2015. V-line is a synthetic maternal line originated in 1982 at the Department of Animal Science of the Universidad Politecnica de Valencia, Spain **(**Estany *et al*., 1989**)** and was imported to Alexandria University. Alexandria line is a new synthetic paternal rabbit line, it was established and developed at the nucleus breeding rabbit unit of the Poultry Research Center, Faculty of Agriculture, Alexandria University (El-Raffa, 2005 and 2007).

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2.2. Housing and Management

Rabbits of this study were housed in a rabbitry and were fed commercial pelleted diet containing 18% crude protein, 13% crude fiber and 2600 Kcal/Kg (Table 1). The breeding rabbits were offered the diet *ad libitum* until 4 months of age and they received a restricted quantity (140-150 g. per day) thereafter until the first mating. By using high standard hygiene and good management, the happening of dangerous diseases was largely avoided and rabbits have never been treated with any kind of systematic vaccination.

Table 1. Formula of experimental diet.

Ingredients	Gross composition (%)
Corn	25.00
Soybean meal (44%)	20.00
Barley	33.00
Claver hay	17.10
Molasses	3.00
Limestone	1.00
Soduim chloride	0.30
Vitamins & Minerals (premix)	0.50
Coccidostat	0.10
Total	100.00

2.3. Reproductive Management

The mean of females-old was 5 months of age at first mating at the beginning of the breeding season (September until May). The breeding rabbits were divided into families; each family was made by three does and one buck that was chosen to avoid breeding of close relatives relationships. At the mating time, each doe was transferred to the buck's cage, and they left with bucks about 5-10 minutes after success of the first copulation and then returned to their cage. Does were abdominally palpated 14 days after mating to detect pregnancy and those which remained not pregnant were returned to the same assigned buck at the next mating date.

2.4. Studied Traits

- Litter size at 21(LS21), 28 (LS28) (weaning) and 63 (LS63) days of age.
- Litter weight in grams at 21 (LW21), 28 (LW28) (weaning) and 63 (LW63) (slaughter) days of age.
- Litter mortality rate in percentage during 21-28 (M1), 28-63 (M2) and 21-63 (M3) days of age.

2.5. Statistical Analysis

Data of productive traits were statistically analyzed using SPSS statistical program (2011). The statistical model was:

$$Y_{ijk} = \mu + S_i + L_j + SL_{ij} + e_{ijk}$$

Y_{ijk}: The observed value of the dependent variable,

μ: The overall mean,

S_i: Fixed effect of the i^{th} season,

L_j: Fixed effect of the j^{th} line,

SL_{ij}: The interaction between season and line,

e_{ijk}: The random error.

3. Results

Usually litter traits (litter size and weight at different ages) are regarded as the best estimates of number and weight of young produced by the doe since they constitute a function of all pre-weaning effects. Litter size and litter weight at weaning as composite traits reflect the contribution of fertility, maternal behavior, milk production, pre-weaning growth and survival (El-Maghraby *et al*., 2007).

3.1. Litter Size at 21, 28 and 63 Days of Age

Least square means and standard errors for litter size at 21 (LS21), 28 (LS28) and 63 (LS63) days of age and their analysis between different lines and seasons studied, are presented in Table (2). The results showed insignificant differences in litter size between lines, seasons or their interaction at different ages studied.

Table 2. Least square means and standard errors for litter size of Alexandria and V-line at 21 (LS21), 28 (LS28), and 63 (LS63) days of age as affected by lines and seasons, and their analysis.

Factors		Does No.	LS21	LS28	LS63
Seasons					
Autumn		130	8.92 ±0.20	8.77 ±0.26	8.58 ±0.25
Spring		110	9.10 ±0.22	8.91 ±0.28	8.76 ±0.22
Lines					
Alex		110	8.62 ±0.28	8.44 ±0.25	8.26 ±0.22
V-line		130	9.39 ±0.23	8.93 ±0.21	8.87 ±0.20
Seasons ×	Lines				
Autumn	Alex	60	8.60±0.25	8.52±0.22	8.35±0.18
	V-line	70	9.22±0.23	8.95±0.21	8.89±0.21
Spring	Alex	50	8.65±0.22	8.30±0.21	8.24±0.20
	V-line	60	9.47±0.27	8.99±0.20	8.89±0.20
ANOVA					
SOV	df			Significance	
Seasons	1		NS	NS	NS
Lines	1		NS	NS	NS
Seasons × Lines	1		NS	NS	NS
Error	239				

NS: Not Significant.

3.2. Litter Weight at 21, 28 and 63 Days of Age

The results of litter weight at 21 (LW21), 28 (LW28) and 63

(LW63) days of age between different seasons and lines studied, and their analysis, are presented in Table (3). The results showed that Alexandria line and spring season had statistically significant higher litter weight than that for V-line and autumn season. Also, the line by season interactions for litter weight were statistically significant at the different ages.

Table 3. Least square means and standard errors for litter weight of Alexandria and V-line at 21 (LW21), 28 (LW28) and 63 (LW63) days of age, as affected by lines and seasons, and their analysis.

Factors		Does No.	LW21(g.)	LW28(g.)	LW63(g.)
Seasons					
Autumn		130	$2735.08^{B} \pm 3.29$	$5120.23^{B} \pm 4.01$	$11182.16^{B} \pm 9.33$
Spring		110	$2890.07^{A} \pm 3.43$	$5311.41^{A} \pm 4.13$	$12800.39^{A} \pm 9.35$
Lines					
Alex		110	$2985.11^{\alpha} \pm 3.22$	$5060.31^{\alpha} \pm 4.12$	$12484.49^{\alpha} \pm 9.40$
V-line		130	$2873.16^{\beta} \pm 3.30$	$4997.13^{\beta} \pm 4.25$	$11247.34^{\beta} \pm 9.40$
Seasons×	Lines				
Autumn	Alex	60	$2940.12^{b} \pm 3.11$	$5210.46^{b} \pm 4.31$	$11557.31^{b} \pm 8.12$
	V-line	70	$2715.13^{d} \pm 3.22$	$5033.20^{c} \pm 4.28$	$11083.34^{d} \pm 9.63$
Spring	Alex	50	$3052.22^{a} \pm 3.21$	$5461.12^{a} \pm 4.37$	$12625.73^{a} \pm 9.42$
	V-line	60	$2814.53^{c} \pm 3.23$	$5120.83^{b} \pm 4.49$	$11265.20^{c} \pm 9.41$
ANOVA					
SOV	df			Significance	
Seasons	1		***	***	**
Lines	1		***	**	***
Seasons×Lines	1		***	***	**
Error	239				

Means in the same column with different superscript letters are significantly different for each effect.
**Significant P≤ 0.01
***Significant P≤ 0.001

3.3. Mortality Rate

The results of mortality rate of offspring during 21-28 (M1), 28-63 (M2) and 21-63 (M3) days of age in percentages between different seasons and lines studied, and their analyses, are shown in Table (4). The results showed statistically significant differences for mortality percentages between seasons and between lines, and their interactions during the all intervals studied. Also, the mortality rate was significantly higher in V-line than in Alexandria line.

Table 4. Least square means and standard errors (LSM±SE) for mortality rate (%) for litter of Alexandria and V-line among different seasons studied during 21-28 (M1), 28-63 (M2) and 21-63 (M3) days of age in percentages, and their analysis.

Factors		Does No.	M1(21-28)		M2(28-63)		M3(21-63)	
			Abs	(LSM±SE)	Abs	(LSM±SE)	Abs	(LSM±SE)
Seasons								
Autumn		130	5.30	$2.34^{A} \pm 0.10$	6.62	$2.61^{A} \pm 0.12$	11.92	$3.53^{A} \pm 0.12$
Spring		110	4.78	$2.26^{B} \pm 0.11$	6.06	$2.45^{B} \pm 0.12$	10.84	$3.23^{B} \pm 0.11$
Lines								
Alex		110	4.45	$2.12^{\beta} \pm 0.09$	5.35	$2.30^{\beta} \pm 0.11$	9.73	$3.15^{\beta} \pm 0.13$
V-line		130	5.69	$2.40^{\alpha} \pm 0.12$	7.43	$2.68^{\alpha} \pm 0.12$	12.08	$3.88^{\alpha} \pm 0.15$
Seasons×	Lines							
Autumn	Alex	60	4.73	$2.22^{c} \pm 0.10$	5.55	$2.36^{c} \pm 0.11$	10.32	$3.11^{c} \pm 0.13$
	V-line	70	5.86	$2.44^{a} \pm 0.10$	7.67	$2.79^{a} \pm 0.10$	13.55	$3.91^{a} \pm 0.15$
Spring	Alex	50	4.12	$2.21^{c} \pm 0.11$	5.04	$2.27^{d} \pm 0.11$	10.13	$3.00^{d} \pm 0.12$
	V-line	60	5.48	$2.29^{b} \pm 0.08$	7.12	$2.53^{b} \pm 0.11$	12.60	$3.59^{b} \pm 0.13$
ANOVA								
SOV	df					Significance		
Seasons	1			**		**		**
Lines	1			***		***		***
Seasons×Lines	1			***		***		***
Error	239							

Means in the same column with different superscript letters are significantly different for each effect.
Abs: Absolute value, **Significant P≤0.01, ***Significant P≤ 0.001

4. Discussion

4.1. Litter Size at 21, 28 and 63 Days of Age

The results of Table (2) indicated that both of rabbit lines of the present study have good inherited and environmental characteristics reflected in higher litter size and little mortality throughout the experimental period.

Similar finding was detected by Sorhue *et al*. (2013) with New Zealand and California rabbits. Nunes and Polastre (1988) with Norfolk rabbits reported a non-significant effect of season of kindling on litter size; moreover, it is not important to know which the best year for a doe performance because it will not be repeated again. Sometimes season effect is not clear because of the existence of partial or complete confounding with any other fixed effects (such as season) or random effect. Seasonal variation on litter traits due to kindling season, is a reflection of differences in seasonal climate conditions in geographical location of the rabbitry.

Gharib (2004) observed general trend indicating that litter size had a curvilinear relationship with season of kindling, where this trait seems to be low during autumn and increases during winter and spring and decreases again during summer.

4.2. Litter Weight at 21, 28 and 63 Days of Age

Gupta *et al*. (2002) indicated that litter size at birth is the most important non-genetic factor influencing body weight of rabbits at different ages from weaning up to marketing. The inverse relationship between litter size and kit weight at weaning can be attributed to the fact that each dam has a limited capacity for providing her young with nourishment during pre- and post- natal growth until weaning and accordingly the share of each young decreases, resulting in lighter weights and less gains and to the decrease in management care of doe rabbits for their young (Tawfeek, 1995). Moreover, litter weight was affected by series of insemination (repetition). It seems however, that these traits were also influenced by the method of nursing, namely the duration of controlled suckling (Eiben *et al*., 2004).

Generally, the peak of milk production incidence at approximately 21 days after parturition in standard breeds of rabbits. Tawfeek (1996) found that litter weight at 21 or 28 days old reflect the doe performance, specially milk production. Lukefahr *et al*., (1990) stated that litter weight at weaning, as a composite trait reflects the contribution of fertility, maternal behavior, growth rate and viability. Productivity of rabbit as a function of growth traits and knowledge of these major components are essential to improve production. Body weight and growth traits in litter bearing animals like rabbits are good indicators of their mothering ability (Poornima *et al*., 2002). The results of the present study for litter weight at 21 and 28 days of age, reflect a good mother performance ability (milk production) for both Alexandria and V lines of rabbits.

4.3. Mortality Rate

Similar finding was observed by Torjan *et al*. (1979) who reported that season of kindling was found to show significant effects on pre-weaning mortality percentages. Marai *et al*. (1996) indicated that pre-weaning mortality was higher in summer than in winter season, due to the effect of heat stress on the sensitive young offspring, in addition, to decrease of dams' milk production as a result of the general reduction of metabolic activity in such conditions.

El-Maghawry (1997) stated that mortality rate of young rabbits controlled by both genetic and non genetic factors (diseases, litter size at birth, month, season, parity, feeding and management). These factors play a considerable role in mortality rate of young rabbits. Pre-weaning (21-28 days old) mortality percentage of kit rabbits is of vital importance in commercial rabbit farming, where it plays a major role in determining the net financial income of the farms (Rashwan and Marai, 2000). With the increase of litter size and decrease of mortality, income becomes more elevated (Szendrő *et al*., 1996).

5. Conclusion

From this experiment, the results of litter size at different ages showed insignificant differences between lines and seasons. Whereas, the results of litter weight at different ages showed that Alexandria line and spring season had significantly higher than that for the V-line and autumn season. Moreover, it was concluded that different seasons under tropical climate have significant effects on litter weight and mortality rate at different ages. The superior weight during spring proved to be a better season for broiler rabbit production under conventional management conditions. The spring season presented the most beneficial values for rabbit performance in a tropical climate. Also, it is possible to conclude that both lines were good in the tropical climate and could be used for profitable meat production.

Acknowledgment

Sincere thanks to Prof. Dr. Alaa El-Raffa, Professor of

Poultry Breeding, Poultry Production Department, Faculty of Agriculture, Alexandria University for his support and assistance in our research.

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