EFFECT OF REMATING INTERVAL, WEANING AGE AND PARITY ON RABBIT DOE PERFORMANCE UNDER HEAT STRESS

Guillén O.[1], Villalobos O.[1], García J.[2]*

[1]Departamento de Zootecnia, Facultad de Agronomía, Universidad del Zulia, Maracaibo, Venezuela
[2]Departamento de Producción Animal, E.T.S.I. Agrónomos, Universidad Politécnica de Madrid, Ciudad Universitaria, 28040 Madrid, Spain
*Corresponding author: javier.garcia@upm.es

ABSTRACT

Forty three cross-breed New Zealand, California, Butterfly, Dutch and Satin rabbit does were first mated with an average weight of 3.58±0.44 kg. Once confirmed pregnancy, rabbit does were randomly assigned to two treatments: in the treatment A the does were mated 14 d after parturition and litters were weaned at 35 d of age; in the treatment B the does were mated 21 d after parturition and litters were weaned at 42 d of age. A commercial pelleted diet was offered *ad libitum*. The following measurements were recorded for six months (the first three parities): eliminated does, doe weight at birth and at weaning, doe feed intake, number of mating per doe to get pregnant, number of kits and kit mortality, litter weight and litter feed intake, feed efficiency. Inside the farm the temperature-humidity index during the sun light period ranged form 28 to 32, which can be considered as moderate/severe heat stress. In the rabbit does of treatment B the number of kits at weaning decreased by 36% (P=0.026) in comparison to does of treatment A and the parturition interval increased (+2.6 d with respect the expected interval). Feed efficiency tended to be lower by 25% (P=0.093) in the B group. No effect of treatments was detected on total eliminated does (7.55% on average), weight of rabbit does at birth (3.66 kg) and at weaning (3.79 kg), feed intake (72.0 g/kg $BW^{0.75}$/d), fertility (91.7%) and the number of kits born alive (5.80). Parturition interval tended to increase between the third and the fourth parity (P=0.073). Kit mortality at birth was high (15.9%), and tended to be lower at the first parturition compared the following two ones (P=0.12). Kit mortality during lactation increased with parity number (P=0.029). Most of mortality of suckling rabbits (95%) occurred during the first 21 days of lactation. Accordingly, feed efficiency impaired with parity number (P=0.014). Parity number did not affect total eliminated does, weight of rabbit doe at birth or at weaning, feed intake, fertility and number of kits born alive. These results show that rabbit doe productivity impairs when lactation is extended and along successive reproductive cycles.

Key words: Remating interval, Age at weaning, Parity, Rabbit doe performance, Heat stress.

INTRODUCTION

The impairment of rabbit doe performance under heat stress conditions is well described both in experiments carried out during summer in Spain or Egypt (Méndez *et al.*, 1986; Marai *et al.*, 2002b) or in climatic chambers (Fernández-Carmona *et al.*, 1995; Fernández-Carmona *et al.*, 2003). In these studies it is observed that a hot climate reduced feed and digestible energy intake, milk production, litter size and growth, and rabbit doe weight, and increased kit mortality. Heat stress not only reduced rabbit doe productivity but also growth performance of fattening rabbits (Simplicio *et al.*, 1988; Pla *et al.*, 1994; Chiericato *et al.*, 1995; Ayyat and Marai, 1997). In this sense, under dry tropical conditions, Villalobos (2007) observed an increase of mortality of weaned rabbits lighter than 450 g, which accounted for 25% of the weaned rabbits.

Accordingly, under heat stress conditions reproductive management and age at weaning may play an important role to optimize rabbit doe and growth performance. The objective of this work was to study if a delay of age at weaning affect negatively rabbit doe performance.

MATERIALS AND METHODS

Forty three cross-breed New Zealand, California, Butterfly, Dutch and Satin rabbit does were first mated with an average weight of 3.58 ± 0.44 kg (std. deviation) by using twelve male rabbits weighing 3.42 ± 0.52 kg. Once confirmed pregnancy rabbit does were randomly assigned to the two treatments. In the first one rabbit does were mated 14 d after parturition and litter was weaned at 35 d of age, and in the second one they were mated and weaned 21 and 42 d after parturition, respectively. Each rabbit doe was mated twice for two different males, and males mounted twice per day. A commercial pelleted diet containing (estimated, g/kg DM) 165 crude protein, 360 neutral detergent fibre and 45 acid detergent lignin, was offered *ad libitum*. The following measurements were recorded for six months (the first three parities): eliminated does, doe weight (at birth and at weaning), rabbit doe feed intake, number of mating per doe to get pregnant, number of kits and kit mortality, litter weight and litter feed intake, feed efficiency.

The experiment was conducted at Ana Maria Campos Experimental Farm facilities which climate condition is characterized as tropical very dry forest (Holdrige, 1978). The farm is an open-air building equipped with a ventilator to favour air recycling and a mesh (80% shade) in the windows to avoid animals were exposed to the sun. Animals were housed in flat-deck cages of 500 × 100 × 500 mm (0.5 m^2) equipped with one nipple drinker and one hopper feeder (30 cm available) each one. Water was filtered before stored in the farm water-tank. The temperature-humidity index (THI) was calculated according to Marai *et al.* (2001): THI = db^oC – [(0.31 – 0.031 RH) × (db^oC – 14.4)], where db^oC is dry bulb temperature in Celsius degrees, and RH is the relative humidity as percentage. According to Marai *et al.* (2002a) there is heat stress when THI is higher than 28.9, and under 27.8 there is no heat stress.

Results obtained from doe rabbits and its litters were analyzed by a repeated measures analysis using MIXED procedure of SAS (Littell *et al*., 1996). Model included treatment (two combinations of day of postpartum mating and weaning age), parity number and its interaction. Variances and covariances matrix structure was modelized according to compound symmetry structure (Littell *et al*., 1998). Means comparison was made by t-test when partum effect was significant. All variables in tables are corrected means by minimum square. Statistical analysis was made using the Statistical Analysis System, SAS (version 8.2).

RESULTS AND DISCUSSION

Inside the farm the THI during the sun light period was higher than 28, which according to Marai *et al.* (2002a) would be considered as moderate heat stress, whereas during the night it maintained lower than 28. However, at midday THI reached to 32 which can be considered very severe heat stress.

Rabbit does mated at 21 d and weaned at 42 d of lactation (treatment B) compared to those mated at 14 d and weaned at 35 d (treatment A) decreased ($P<0.026$) the number of kits at weaning (by 36%) and prolonged the parturition interval, that was delayed 2.6 d with respect the expected one (Table 1). Feed efficiency tended also to be lower (by 25%; $P=0.093$) in the B group. No effect of treatments was detected on total eliminated rabbit does, weight of rabbit does at birth and at weaning, feed intake, fertility and the number of kits born alive that averaged 7.55%, 3.66 and 3.79 kg, 72.0 g/(kg $BW^{0.75}$ × d), 91.7% and 5.80, respectively. It seems that a longer lactation period stressed additionally (to heat load) rabbit doe which affected negatively its productivity and also the kit survival during lactation. However, fertility remained high compared to previous studies performed under hot conditions (Marai *et al.*, 2002b).

Parturition interval tended to increase between the third and the fourth parity ($P=0.073$). The values obtained are very close to those observed by Fernández-Carmona *et al.* (2003) in template conditions and with a more intensive farm management, and better than those recorded by these authors under hot conditions.

Table 1: Effect of remating interval (14 vs. 21 d post partum), weaning age (35 vs. 42 d of age) and parity on rabbit doe performance

	Treatments (T)[1]		Parity (P)			Prob.		
Remating interval/Weaning age, d	A 14/35	B 21/42	1	2	3	T	P	TxP
No. partum	59	48	41	38	28			
Total eliminated (%)	7.56±3.38	7.54±3.74	6.80±4.17	10.1±4.31	5.76±4.61	0.99	0.77	0.90
Weight of rabbit doe (kg)								
Birth	3.73±0.075	3.59±0.084	3.65±0.060	3.64±0.061	3.69±0.062	0.24	0.47	0.99
Weaning	3.81±0.088	3.77±0.10	3.78±0.069	3.84±0.072	3.75±0.083	0.79	0.24	0.33
Fertility (%)	92.4±2.69	91.1±2.92	91.3±3.26	90.3±3.34	93.6±3.61	0.74	0.80	0.71
Parturition interval(d)	50.9±2.29	60.5±3.21	51.6±2.18	52.6±2.32	62.9±4.49	0.019	0.073	0.69
No.born alive	5.82±0.38	5.78±0.42	5.61±0.40	5.90±0.40	5.88±0.43	0.93	0.81	0.38
No.weaned kits	3.33±0.34	2.14±0.38	3.12±0.37	2.57±0.38	2.52±0.44	0.026	0.43	0.28
Kit mortality (%)								
At birth[2]	19.8±3.82	12.1±4.24	11.2±3.73	20.1±3.76	16.7±4.01	0.18	0.12	0.20
Birth-21 d lactation[3]	47.8±5.68	57.8±6.21	41.7±5.94	57.5±6.07	59.2±6.70	0.24	0.054	0.82
Birth-weaning[3]	48.5±5.38	63.4±5.96	43.1^{a}±5.86	60.3^{b}±5.99	64.4^{b}±7.02	0.070	0.029	0.44
Rabbit doe feed intake between births (g/d/kg$BW^{0.75}$)	74.1±2.62	70.0±3.44	70.2±2.46	74.9±2.92	71.1±4.46	0.35	0.39	0.37
Feed efficiency (g weaned kits/g feed intake rabbit doe+litter)	0.234±0.022	0.175±0.026	0.274^{a}±0.026	0.197^{ab}±0.029	0.142^{b}±0.036	0.093	0.014	0.33

[1]n=24 and 19 rabbit does for treatments A and B. [2]Expressed over total born. [3]Expressed over number of born alive.

Feed intake of rabbit does was similar to the lowest values reported by Fernández-Carmona *et al.* (1995 and 2003) and no effect of parturition number was detected. Kit mortality at birth was high (15.9%), as also recorded by Fernández-Carmona *et al.* (2003), and tended to be lower at the first parturition compared the following two ones (P=0.12). Kit mortality during lactation increased with parity number (P=0.029) and was even higher than that obtained by Fernández-Carmona *et al.* (1995). Most of mortality of suckling rabbits (95%) occurred during the first 21 d of lactation, which might indicate a low milk production of rabbit does in this experiment. Accordingly, feed efficiency impaired with parity number (P=0.014). On the opposite, parity number did not affect total eliminated does, weight of rabbit doe at birth or at weaning, fertility and number of kits born alive which mean values have been previously shown. No interactions were detected between treatment and parity number (P≥0.20).

These results show that rabbit doe productivity impairs when lactation is extended and along successive reproductive cycles, possibly due to its progressive weakening, and its inability to recover properly under our heat stress conditions.

ACKNOWLEDGEMENTS

Authors are grateful to CONDES (Consejo de Desarrollo Científico y Humanístico) from Zulia University for the financial support to maintain the experimental rabbit farm Ana María Campos (belonging to the Agronomy Faculty of Zulia University), also to the Microbiology Department from the Veterinary Faculty of Zulia University, and to Javier González (Nanta, S.A.) for their technical help.

REFERENCES

Ayyat M.S., Marai I.F.M. 1997. Effects of heat stress on growth, carcass traits and blood components of New Zealand White rabbits fed various dietary energy-fibre levels under Egyptian conditions. *J. Arid Environ., 37, 557-568.*

Chiericato G.M., Boiti C., Canali C., Rizzi C., Ravarotto L. 1995. Effects of heat stress and age on growth performance and endocrine status of male rabbit. *World Rabbit Sci., 3 (3), 125-131.*

Fernández-Carmona J., Cervera C., Sabater C., Blas E. 1995. Effect of diet composition on the production of rabbit breeding does housed in a traditional building and at 30ºC. *Anim. Feed Sci. Technol., 52, 289-297.*

Fernández-Carmona J., Alqedra I., Cervera C., Moya J., Pascual J.J. 2003. Effect of lucerne-based diets on performance of reproductive rabbit does at two temperatures. *Anim. Sci., 76, 283-295.*

Holdrige L.E. 1978. Ecología basada en zonas de vida. *Trad. de 1ª ed. Revista Inglesa por Humberto Jiménez Saa. IISC, San José. 276 pp.*

Littell R.C., Milliken G.A., Stroup W.W., Wolfinger R.D. 1996. SAS® System for mixed models. *SAS Institute Inc., Cary, NC, USA.*

Littell R.C., Henry P.R., Ammerman C.B. 1998. Statistical analysis of repeated measures data using SAS procedures. *J. Anim. Sci., 76, 1216-1231.*

Marai I.F.M., Ayyat M.S., Abd El-Monem U.M. 2001. Growth performance and reproductive traits at first parity of New Zealand white female rabbits as affected by heat stress and its alleviation under Egyptian conditions. *Trop. Anim. Health Prod., 33, 451-462.*

Marai I.F.M., Habeeb A.A.M., Gad A.E. 2002a. Reproductive traits of male rabbits as affected by climatic conditions, in the subtropical environment of Egypt. *Anim. Sci., 75, 451-458.*

Marai I.F.M., Habeeb A.A.M., Gad A.E. 2002b. Rabbits' productive, reproductive and physiological performance traits as affected by heat stress: a review. *Livest. Prod. Sci., 78, 71-90.*

Méndez J., de Blas C., Fraga M.J. 1986. The effects of diet and remating interval after parturition on the reproductive performance of the commercial doe rabbit. *J. Anim. Sci., 62, 1624-1634*.

Pla M., Fernández Carmona J., Blas E., Cervera C. 1994. Growth and some carcass traits of adult rabbits Ander high ambient temperature. *World Rabbit Sci., 2 (4), 147-151.*

Simplicio J.B., Cervera C., Bias B. 1988. Effect of two different diets and temperatures on the growth of meta rabbit. In: Proc. *4th World Rabbit Congress, 1998 October, Budapest, Hungary, Vol. 2, 74-77.*

Villalobos O. 2007. Efecto de la densidad sobre los parámetros productivos y calidad de la canal en conejos de engorde criados en condiciones de bosque muy seco tropical durante el periodo seco. *Universidad del Zulia, Venezuela*.