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COMPARISON OF DOES' PERFORMANCES UNDER HIGH AND MODERATE TEMPERATURE IN A GREEK COMMERCIAL FARM

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ABSTRACT: The reproductive performances of intensively reared does were evaluated under farm conditions in Greece, during the summer (hot) and winter (moderate) period. Litter size at birth (respectively 6.9 *vs* 7.8 live young), litter size at weaning (5.95 *vs* 7.06) and pre-weaning mortality rate (16.94% *vs* 9.60%) were significantly affected during hot period, while litter weight and individual weight at birth did not seem to differ between hot and cold period (461 g *vs* 466 g; and 68 *vs* 65 g, respectively). Rectal temperature of does and respiration rate were higher in the hot period (39.09°C *vs* 38.93°C; 128.08 respiration/min *vs* 115.37 respiration's/min; $P<0.001$). The effects of parity order and animals revealed that parity order significantly influenced total born, born live, stillborn and weaned rabbits, litter weight and individual weight at birth, as well as the does' respiration rate. However, the interaction between parity and period was not significant for any of the recorded parameters.

Key words: rabbit, does, performance, high ambient temperature.

INTRODUCTION

The "thermoneutral zone" for rabbits is between 15-25°C (CERVERA and CARMONA, 1998). Rabbits are much more tolerant to low temperatures than high temperatures and above 35°C they can no longer regulate their temperature, so heat prostration

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sets in. It is well known that as a result of high ambient temperature reproduction suffers, while body temperature and respiration rate can be highly affected (FAYEZ *et al.*, 1994). The present study aimed to quantify the effect of hot season on some reproductive and physiological parameters of does during a one year period, on a commercial Greek farm.

MATERIALS AND METHODS

The influence of high ambient temperature on rabbits was studied in a commercial rabbit farm 50 Km west of Athens, in central Greece. Natural ventilation was used. All animals were kept in the same building but in different chambers. Water spraying was applied when internal ambient temperature rose above 27° C, to reduce environmental heat stress. Based on the recordings of farm ambient temperature and relative humidity the whole year was divided in two sub periods, hot and cold. Farm ambient temperature and relative humidity were recorded daily by a thermohygrograph (Fischer® 425). The temperature of the thermohygrograph was calibrated on a weekly basis using a psychrometer. The hot period was considered from July to October 2000 and May to June 2001, while the moderate period was from November 2000 to April 2001.

A total of 809 females and 20 males New Zealand White hybrids were used from June 2000 to July 2001. They were kept indoors, in individual wire cages and a 16L: 8D hours schedule was applied. Does were kept under natural environmental conditions. When ambient temperature rose over 30°C, bucks were kept in an air-conditioned room at approximately 25°C (minimum 20°C). Artificial inseminations with eterospermic semen were applied following a 42 days reproduction scheme. Ovulation was induced with 0.2 ml of GnRH at the time of insemination, while 20 IU of PMSG had already been injected 72h prior to insemination. Pregnancy diagnosis was performed by palpation 2 weeks after insemination. Empty does were re-inseminated 20 days after the last insemination. Young were weaned at the age of 35 days old. All animals were fed *ad libitum* using a commercial diet with crude protein

content ranging from 15.9% to 16.6%, ether extract from 2.4% to 3.7% and crude fiber from 15.4% to 16.4%. Water was provided *ad libitum.*

The recorded parameters, related to reproductive performances of the does were: total and born live(No), stillborn (No), litter weight at birth (g), weaned rabbits (No) and pre-weaning mortality (%). Females, whose litters were checked at weaning, were part of the group from which measurements of litters at birth had been taken. However the number of observations between the two groups differs because some does and litters were missing at the weaning control, while some observations were made randomly on a limited but representative number of litters. The rectal temperature (°C) and the respiration rate (respiration/min) of a small number of does were checked simultaneously with their litters within 48h after delivery. Respiration was measured subjectively by observation.

Analyses of variance were performed by Statgraphics Plus Version 2.1 (1996), using period (hot and moderate), parity order (1^{st}-2^{nd}, 3^{rd}-4^{th}, 5^{th}-6^{th}, 7^{th}-8^{th} and 9^{th} parity) and animals as the main effects.

RESULTS AND DISCUSSION

Average, maximum and minimum values of temperature and relative humidity by month and by period (hot and moderate) are presented in Table 1.

During hot period the number of total and born live significantly decreased ($P<0.001$) and the number of stillborn significantly increased ($P<0.001$) as shown also by SIMPLICIO *et al.*, (1988) and MARAI *et al.* (1996; 2000). No influence was observed on litter weight and mean individual weight at birth. As a result of high ambient temperature the number of weaned rabbits decreased ($P<0.001$), while pre-weaning mortality increased ($P<0.001$). An explanation could be found in the field study of MAERTENS and DE GROOTE (1989). They observed a significantly reduced feed intake during a heat stress period that impaired milk production of females.

Table 1: Average, maximum and minimum temperature and relative humidity during the trial in the farm house.

Period	Farm Ambient Temperature (0° C)			Farm Ambient Relative Humidity (%)		
	Average	Maximum	Minimum	Average	Maximum	Minimum
Hot (July 2000-October 2000, May 2001-June 2001)	19.50	35.00	6.00	54.16	96.00	65.00
Moderate (November 2000-April 2001)	12.37	22.00	4.50	72.73	98.00	32.00

Table 2: Effect of hot and moderate period on does' reproductive performance and physiological status.

Period	Hot [1]		Moderate [2]		Effect of temperature
Parameters	N	LSM±SE	N	LSM±SE	
TB	1343	7.38 ± 0.10	1352	8.05 ± 0.11	$P<0.001$
BL	1343	6.94 ± 0.10	1352	7.84 ± 0.11	$P<0.001$
Sb	1343	0.39 ± 0.04	1352	0.19 ± 0.04	$P<0.001$
LWB	621	460.7 ± 8.7	124	466.0 ± 4.7	NS
IWB	617	68.2 ± 1.1	124	65.0 ± 4.5	NS
WL	381	5.95 ± 0.09	913	7.06 ± 0.06	$P<0.001$
PWM	371	16.9 ± 1.16	907	9.6 ± 0.7	$P<0.001$
RT	285	39.1 ± 0.1	35	38.9 ± 0.2	NS
RR	265	128.1 ± 1.4	35	115.4± 2.9	$P<0.001$

TB: number of total born, BL: number of born live, Sb: number of stillborn, LWB: litter weight at birth (g), IWB: individual weight at birth (g), WL: number of weaned per litter, PWM: percentage of pre-weaning mortality, RT: rectal temperature (°C), RR: respiration rate (number of respirations per minute). [1]July 2000 to October 2000 and May 2001 to June 2001. [2] November 2000 to April 2001. N: number of observations (n. of litters for the first 8 parameters and n. of does for the last 2 parameters). LSM: least square means, SE: standard error of mean.

Table 3: Effect of parity order on does' reproductive performance and physiological status.

Parity order	1st - 2nd		3rd - 4th		5th - 6th		7th - 8th		9th		
	N	LSM ± SE	N	LSM± SE	N	LSM± SE	N	LSM± SE	N	LSM ± SE	
TB	558	7.72^{ab}± 0.18	665	8.02^{c}± 0.14	514	7.53^{a}± 0.17	485	7.88^{c}± 0.18	473	7.42^{a} ± 0.19	$P<0.05$
BA	558	7.28^{ab}± 0.16	665	7.74^{d}± 0.14	514	7.08^{a}± 0.15	485	7.60b^{c}± 0.18	473	7.25^{ab}± 0.19	$P<0.01$
Sb	558	0.39^{a}± 0.06	665	0.25^{b}± 0.05	514	0.42^{a}± 0.06	485	0.25^{b}± 0.06	473	0.16^{b}± 0.07	$P<0.01$
LWB	273	385.0^{a}± 17.9	194	399.7^{a}± 21.0	60	495.2^{b}± 41.7	156	497.0^{b}± 29.8	62	614.9^{c}± 78.4	$P<0.01$
IWB	273	53.2^{a}± 2.4	194	56.6^{b}± 2.7	60	72.6^{c}± 5.4	155	70.7^{c}± 3.9	59	79.9^{d}± 10.1	$P<0.001$
WL	201	6.70^{c}± 0.13	302	6.36^{b}± 0.11	307	6.10^{a}± 0.13	212	6.63^{c}± 0.12	272	6.73^{c}± 0.15	$P<0.001$
PWM	199	11.0^{a}± 1.6	297	15.1^{b}± 1.3	302	16.3^{b}± 1.6	210	12.4^{a}± 1.5	270	11.6^{a}± 1.8	NS
RT	93	38.8^{a}± 0.2	108	38.9^{b}± 0.1	42	38.9^{ab}± 0.1	74	39.0^{b}± 0.1	3	39.4^{ab}± 0.4	NS
RR	86	131.1^{b}± 3.9	101	118.2^{a}± 1.5	42	121.4^{a}± 2.0	67	118.7^{a}± 2.0	4	119.2^{a}± 6.3	$P<0.05$

TB: number of total born, BA: number of born alive, Sb: number of stillborn, LWB: litter weight at birth (g), IWB: individual weight at birth (g), WL: number of weaned per litter, PWM: percentage of pre-weaning mortality, RT: rectal temperature (°C), RR: respiration rate (number of respirations per minute).
N: Number of observations (n. of litters for the first 8 parameters and n. of does for the last 2 parameters). LSM: least square means, SE: standard error of mean.

Does' rectal temperature was not significantly higher in the hot period, while does' respiration rate was significantly higher (P<0.001) (Table 2). These results were in agreement with FAYEZ *et al.* (1994) and MARAI *et al.* (1996).

The effect of parity order (Table 3) was significant on the main recorded vital parameters; also the respiration rate was maximum in the class of 1^{st} –2^{nd} parity (P<0.05). While in the present study total born and born llive rabbits were maximum in the class of 3^{rd}-4^{th} parity, other researchers report that this happens in the 1^{st} (LAVARA *et al.*, 2000) or in the 2^{nd}-3^{rd} parity (SZENDRŐ., 2000). Stillborn rabbits were maximum in the class of 5^{th} –6^{th} parity, while SZENDRŐ. (2000) mentions that mortality at birth increases with parity. The minimum litter weight and individual weight at birth were observed in the 1^{st} –2^{nd} parity, slightly differing from the data of ROMMERS *et al.* (1999) where the minimum values coincided with the 1^{st} parity. The lower birth weight of rabbits born at the first parturition is due to the fact that these does still have not finished their own body growth, and because feed intake of the does is lower than thereafter (ROMMERS *et al.*, 1999). However, pre-weaning mortality and does' rectal temperature were not significantly affected by parity order. The interaction parity order * period was not significant for all of the recorded parameters (Table 4). The effect of animal was not significant on the litter weight at birth, in contrast to all the other parameters related to the litter (P<0.001) (Table 4). Reproductive rate was not checked in the present study, but it should be taken into account in future researches since it may have contributed to the modulation of the above results. As confirmed by other studies, high ambient temperature had a depressing effect on the physiological status and reproductive performance of rabbit does. These results suggest that natural high ambient temperature should be considered as an important stress factor impairing rabbit reproductive ability and thus researchers should address its amelioration through environmental, nutritional or genetic techniques.

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