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HERITABILITY OF PRE AND POST-WEANING WEIGHTS IN RABBITS.

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INTRODUCTION

In recent years, management systems of the rabbit industry have become more and more intensive and artificial insemination is increasing in importance (2).

The actual state of the art of this reproduction technique allows the use of fresh semen and almost all the does in the A.I. programs are inseminated by a pooled semen taken from several bucks. The use of deep frozen semen could give be the best both for economic and genetic purposes, but until now more studies have been needed to improve it (2). When artificial insemination is used, it is not possible to know who the sire is, and moreover pups in the same litter could be half-sibs.

In the present study, the heritability of some growth characters was computed without establishing any special breeding program, but just using observations obtained from a practical situation.

Weights at 16 d (pre-weaning), 28 d and 70 d were studied. Several authors observed the genetic determination of these traits (5,6,7) and all of them pointed out a strong maternal and dominance effect when the heritability was computed on the female basis.

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MATERIALS AND METHODS

Research was carried out at the experimental station of the "Istituto di Zootecnica Generale di Perugia", using New Zealand white rabbits.

The management system was semi-intensive and the rabbit were weaned at 20 d of age. The number of experimental observations were:

360 weights at 16 d;
2650 weights at 28 d;
2130 weights at 70 d.

Because of the special practical situation used, the heritabilities of the studied traits (weights at 16 d, 28 d and 70 d) were computed by intraclass correlation "between does".

The random effect of the buck can not be estimated if the females are artificially inseminated by a pooled semen of several males and therefore its variance is associated to the error variance. Statistical analysis was carried out according to the following mixed model:

$$Y_{ijklo} = \mu + \alpha_i + \beta_j + \gamma_k + \delta_l + b(N)_{ijklo} + e_{ijklo}$$

where:

Y_{ijklo} = experimental item (weight at 16 d, 28 d, 70 d);
μ = overall mean;
α_i = random effect of the i.th doe;
β_j = fixed effect of the J.th sex;
γ_k = fixed effect of the K.th parity;
δ_l = fixed effect of the l.th month of birth;
b = partial regression coefficient of the dependent variable on the independent variable: number of rabbits born/litter (N);
e_{ijklo} = random error associated on the o.th observation.

Experimental observations were processed by the proc GLM and VARCOMP of statistical package SAS (8). In the model related to the weight at 16 days the sex effect was not included; these experimental observations were in fact the average weight of the litter.

RESULTS AND DISCUSSION

Analysis of variance referred to in Table 1, shows significant effects in almost all the factors of the model. In more detail, the number of rabbits/litter had the highest influence (covariance) on the three observed characters. Only sex effect was not significant, as a matter of fact the L.S. Means of males and females (Table 2) were not very different both at 28 days of age (516.9 vs 509.3) and at 70 days of age (1904.9 vs 1900.3). Determination coefficients of the setted models (Table 1) decreased when the age of the rabbits increased (0.35 - 16 d; 0.29 - 28 d; 0.18 - 70 d), this trend is probably related to the nature of the studied factors; in fact number of rabbits/litter and parity have a strong effect on pre-weaning (6). On the contrary, the month of birth has a remarkable environmental effect also when the rabbit is close to market age.

The L.S. means by parity (Table 3) show, as expected, that the weight of rabbits born at first delivery are always lighter than these of rabbits born in the following parturitions. No rabbits by the 9th parity reached 70 d of age. As a matter of fact, these animals had a rapid growth rate (301.7 - 16 d; 554.1 - 28 d) and therefore attained market size early. An explanation of this superiority may be that only the best producing does are allowed to reach the 9th parity by the breeder (3).

The month of birth effect (Table 4) is mainly related to the temperature in the different months. As observed by BATTAGLINI e COLL. (1) and others (9), high temperatures (during summer) determine a decrease in the slaughtering weight; on the contrary, lower temperatures in autumn and winter are related to the heaviest weights. Because of this rabbits born between October and March show the most favorable weights.

Random genetic variances of the three characters and heritability coefficients are referred to Table 5. The h^2s computed in this pratical situation are very close to those estimated by others on the buck variance basis in suitable experimental breeding programs (4).

Because of the smaller maternal effect, heritability coefficients of the weights were expected to be lower as the age of the rabbit increased; on the contrary, the h^2 of the weight at 16 days of age showed the lowest value, which is probably due to the different kinds of studied characters (mean weight of the litter at 16 d and individual weights at 28 d and 70 d).

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TABLE - 1 - Analysis of variance (Values of "F") of the fixed and covariance effects. Determination coefficients of the models.

Effect	Weight 16 d	Weight 28 d	Weight 70 d
SEX	-	1	1
PARITY	7.69***	1.95**	2.61**
MONTH	42.91***	39.74***	30.01***
NUMBER/LITTER	631.62***	541.82***	73.31***
R^2	0.35	0.29	0.18

**: P = 0.01
***: P = 0.0001

TABLE - 2 - L.S. Means of the weights by sexes.

Sex	28 d	70 d
MALE	509.3	1900.3
FEMALE	516.9	1904.9

TABLE – 3 – L.S. Means of the weights by parities.

	PARITY								
	1	2	3	4	5	6	7	8	9
Weight 16 d	241.6A	287.2B	276.1B	274.1B	269.5B	252.7A	277.2B	272.9B	301.7C
Weight 28 d	380.2A	404.7B	419.3B	430.1B	417.6B	394.0	439.7C	423.2B	554.1D
Weight 70 d	1686.8A	1745.5B	1739.9B	1756.5B	1720.6B	1771.5B	1765.0B	1745.1B	-

TABLE – 4 – L.S. Means of the weights by months.

	MONTH											
	1	2	3	4	5	6	7	8	9	10	11	12
Weight 16 d	288.1A	298.1A	299.0A	265.5B	250.2B	276.9AB	260.3B	231.8C	217.4C	279.9AB	320.1A	276.9AB
Weight 28 d	519.6A	496.5A	465.1A	438.2B	383.3B	436.7B	401.6AB	356.0B	322.5B	461.9A	466.7A	402.5B
Weight 70 d	1821.1A	1824.8A	1818.2A	1721.6B	1649.7B	1640.6B	1608.7B	1569.8B	1535.6B	1912.3A	1955.6A	1838.3A

TABLE – 5 – Genetic variance and coefficients of heritability.

	Weight 16 d	Weight 28 d	Weight 70 d
σ^2	1341.79	6234.80	14722.67
h^2	0.46	0.78	0.56

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The weights of rabbits from 398 litters were observed at 16, 28 and 70 days of age. The total number of observations were 360 (average litter weight) at 16 d, 2650 (individual weights) at the weaning (28 d) and 2130 individual weights at the market age (70 d). For the statistical analysis of the data was setted up a mixed model related to the following effects: mother of the rabbit, parity, month of birth, litter size, sex (28 and 70 d weights only). Because of the lack of informations about the bucks that sired the does in the several parities (A.I.), the genetic random effect of the father was not estimated. The heritability estimations ranged from 0.40 to 0.80.

EREDITABILITA' DI ALCUNI PESI PRE E POST-SVEZZAMENTO NEL CONIGLIO

In 398 nidiate è stato rilevato il peso a 16, 28 e 70 giorni di età, il numero totale di osservazioni è risultato: 360 (peso medio delle nidiate) a 16 d, 2650 (peso individuale) allo svezzamento (28 d), e 2130 a fine ciclo (70 d).
L'analisi statistica dei dati è stata effettuata secondo un modello misto che considerava: madre del coniglio, ordine di parto, mese di nascita, numerosità della nidiata, sesso (solo per i pesi a 28 e 70 d). A causa della mancanza di informazioni, l'effetto genetico del "padre del coniglio" non è stato considerato. I coefficienti di ereditabilità stimati variano da 0,40 a 0,80.