Evaluation of response to selection: effect of freezing on weaning weight and post-weaning daily gain in rabbits

Cifre J., Baselga M., Gómez E.A.

in

Baselga M. (ed.), Marai I.F.M. (ed.).
Rabbit production in hot climates

Zaragoza : CIHEAM
Cahiers Options Méditerranéennes; n. 8

1994
pages 241-245

EVALUATION OF RESPONSE TO SELECTION: EFFECT OF FREEZING ON WEANING WEIGHT AND POST-WEANING DAILY GAIN IN RABBITS[1]

Cifre, J.; Baselga, M; Gómez, E. A.
Departamento de Ciencia Animal
Universidad Politécnica de Valencia
46071 VALENCIA SPAIN

SUMMARY

The effect of freezing, thawing and transfering embryos on weaning weight, daily gain and slaughter weight is studied in rabbits. A significant and depressing effect has been detected on daily gain. The implications of this effect on the use of frozen embryos to evaluate genetic response to selection for daily gain are discussed.

Key words: frozen embryos, genetic response, daily gain, rabbit.

INTRODUCTION

An important question arising in all experiments and programmes of selection is the estimation of the genetic gain achieved after the programme has run for several generations. There are different approaches to tackle this problem. A classical and well accepted solution is to have a control population raised contemporaneously and under the same environment and husbandry than the selected population (Hill, 1972 a, b) but limited resources preclude sometimes the allowance for a control line. The opposite approach is to base heavily on theory and use mixed model methodology (Sorensen and Kennedy, 1984). Nevertheless, the results obtained with mixed model methods are highly dependent on the genetic parameters and model used (Thompson, 1986) and the acceptance of this methodology is not general. Other methods make use of some reproductive techniques (Smith, 1988) as frozen semen or embryos, allowing the contemporaneous comparation of gametes or animals pertaining to distant generations, minimizing the genetic drift.

Currently, recovering rabbits from frozen embryos is a well established technique (Renard *et al.*, 1982; Kasai *et al.*, 1992) that could be used in experiments of rabbit breeding to evaluate genetic changes, but it would be necessary to be sure that the technique itself has no effect on the traits involved in the genetic evaluation.

The purpose of this paper is to check if the process of freezing, thawing and transfering embryos affects its later daily gain, a common selection objective in sire lines of rabbits (Rochambeau *et al.*, 1989; Estany *et al.*, 1992).

MATERIAL AND METHODS

Three different groups of young rabbits are to be compared on weaning weight (WW), postweaning daily gain (DG) and slaughter weight (SW). All young are progeny of animals

[1] Research supported by CICYT AGF94-0577 (Spain).

pertaining to the 14^{th} generation of line V selected for litter size (Estany *et al.*, 1989). One group, the *control* group, is make up by rabbits born and raised by their dams after a natural mating and pregnancy. The other two groups come from deliveries of females becoming pregnant of pooled embryos previously *frozen* or *vitrified* (Losada, 1993).

The control group was weaned at 28 days after birth, as average, and the *frozen* and *vitrified* groups at 30 days. The weanings were carried out on tuesdays, the births of the control group occured mainly on tuesdays but for the other groups were sundays the most common days for delivering. The number of young recorded were 226 in the control group, 102 in the frozen group and 82 in the vitrified group.

After weaning all rabbits were fattened during a fixed period of five weeks. The weight at the end of the fattening was recorded and it is called slaughter weight.

The data have been analyzed under a model considering the following effects:

Treatment: fixed effect with three levels: control, frozen or vitrified.

Season: fixed effect with two levels: birth date between march and may (1993) or between june and july (1993).

Litter size class: fixed effect with eleven levels: level 1 for litters of less than five young born alive; level i for litters of i+3 young (i= 2, 3, ...10), and level 11 for litters of more than 13 young.

Doe: random effect of 62 levels taking into account the females supporting the pregnancy and the lactation. It has been assumed that the doe effects are uncorrelated.

Error: random effect of 410 levels.

The statistical methods used were REML (Patterson and Thompson, 1971) to estimate doe and error variance components, and GLS (generalized least squares) to estimate fixed effects using the variance components estimated by REML.

RESULTS AND DISCUSSION

TABLE I shows the variance components of doe and error effects estimated by REML. The doe intraclass correlations and their standard errors are also reported. We must note the higher intraclass correlation for weaning weight, agreeing with the well known fact that this trait has more important maternal effects (Estany *et al.*, 1992) than postweaning daily gain and slaughter weight.

TABLE I.- Doe (σ^2_d) and error (σ^2_e) variance components and doe intraclass correlation (ϱ_d).

CHARACTER	σ^2_d	σ^2_e	$\varrho_d \pm$ SE
WW[1]	3354	7586	0.31 ± 0.075
SW[2]	6711	27646	0.19 ± 0.057
DG[3]	2.63	10.34	0.20 ± 0.055

[1].- Weaning weight in g.
[2].- Slaughter weight in g.
[3].- Postweaning daily gain in g per day.

Arithmetical mean values of weaning weight, slaughter weight and postweaning daily gain were 618 g, 1853 g and 35.3 g/d respectively.

TABLE II.- Season effects expressed as difference between season 2 and season 1.

CHARACTER	GLSM ± SE[4]
WW[1]	-52.6 ± 13.38
SW[2]	-65.4 ± 23.89
DG[3]	-0.41 ± 0.464

[1].- Weaning weight in g.
[2].- Slaughter weight in g.
[3].- Postweaning daily gain in g per day.
[4].- Generalized least square means and its standard error.

TABLE III.- Litter size class effects as difference from class 1.

LSC[1]	CHARACTER		
	WW[2]	SW[3]	DG[4]
2	-30.7 ± 37.96[5]	-8.0 ± 67.79	0.58 ± 1.318
3	-78.6 ± 50.53	-80.6 ± 83.66	-0.11 ± 1.634
4	-205.7 ± 38.85	-214.0 ± 67.44	-0.28 ± 1.313
5	-207.7 ± 36.64	-159.0 ± 63.45	1.52 ± 1.236
6	-266.5 ± 39.26	-302.6 ± 67.26	-1.18 ± 1.311
7	-247.3 ± 34.41	-237.4 ± 60.28	0.28 ± 1.173
8	-325.3 ± 34.77	-330.2 ± 60.76	-0.37 ± 1.182
9	-336.7 ± 34.72	-388.1 ± 61.55	-1.59 ± 1.197
10	-364.3 ± 45.06	-390.8 ± 78.18	-0.84 ± 1.522
11	-323.9 ± 39.48	-281.0 ± 68.22	1.14 ± 1.329

[1].- Litter size classes.
[2].- Weaning weight in g.
[3].- Slaughter weight in g.
[4].- Postweaning daily gain in g per day.
[5].- Generalized least square mean for litter size class effect number two as difference from class 1 and its standard error.

The season effects are showed in **TABLE II**. They confirm the depressing effect of temperature on growth (Castellini and Panella, 1988; Torres *et al.*, 1992).

TABLE III reports on the litter size class effects. It is remarkable the linearity of these effects for weaning weight and slaughter weight, the similarity of them for these two traits and the irrelevance, non significancy, and non linearity of litter size class effects for daily gain **(TABLE IV)**. This result, again, it is indicative of the independence of daily gain respect to maternal effects.

TABLE IV.- Regression coefficient **(b)** of litter size class effects on litter size classes.

CHARACTER	b ± SE
WW[1]	-34 ± 4.9
SW[2]	-36 ± 7.5
DG[3]	-0.07 ± 0.113

[1].- Weaning weight in g.
[2].- Slaughter weight in g.
[3].- Postweaning daily gain in g per day.

TABLE V.- Contrast between *frozen and vitrified* group effects and *control* group effects.

CHARACTER	GLSM ± SE[4]
WW[1]	70.2 ± 15.06
SW[2]	14.1 ± 26.11
DG[3]	-1.72 ± 0.509

[1].- Weaning weight in g.
[2].- Slaughter weight in g.
[3].- Postweaning daily gain in g per day.
[4].- Generalized least square means and its standard error.

There were no significant differences between freezing effects and vitrifying effects on any character studied. The contrasts between these effects and the control group are showed in **TABLE V**, being significant the contrasts for weaning weight and daily gain. The first can be completely explained by the age of rabbits at weaning. The young of the control group were weaned at 28 days, while the other at 30 days. The daily gain at this age is around 34-37 g/d (Feki, 1994) and consequently the expected difference is 70 g as reported in **TABLE V**. Very important (-1.72 g/d) is the value of the contrast for daily gain. This result means that when comparing naturally reproduced animals with animals coming from frozen or vitrified embryos it will be necessary to add a correction factor (1.72 g/d) to the daily gain data of the latter. An alternative could be to compare no directly animals of the groups but their progeny. This solution has the advantage that diminishes the number of frozen or vitrified embryos required and the inconvenience of taking more time.

REFERENCES

CASTELLINI, C.M.; PANELLA, F. (1988) 4th Congress of the WRSA (2): 112-119. Budapest.

ESTANY, J.; BASELGA, M.; BLASCO, A.; CAMACHO, J. (1989) Livest. Prod. Sci. 21: 67-75.

ESTANY, J.; CAMACHO, J.; BASELGA, M.; BLASCO, A. (1992) Génét. Sél. Evol. 24: 527-537.

FEKI, S. (1994) Études comparatives des caractéristiques de croissance et de l'efficience alimentaire chez trois lignées de lapins. Tesis Master of Science, IAMZ, Zaragoza (Spain).

HILL, W.G. (1972a) Anim. Breed. Abstracts 40: 1-15.

HILL, W.G. (1972b) Anim. Breed. Abstracts 40: 193-213.

KASAI, H.; HAMAGUCHI, Y.; ZHU, S.E.; MIYAKE, T.; SAKURAI, T.; MACHIDA, T.(1992) J. Reprod. Fert. 89: 91-97.

LOSADA, R. (1993) Vitrificación de mórulas de conejo. Tesis Master of Science, IAMZ, Zaragoza (Spain).

PATTERSON, H.D.; THOMPSON, R. (1971) Biometrika 58: 545-554.

RENARD, J.P.; GARNIER, V.; PARVEX, R. (1982) 3èmes Journées de la Recherche Cunicole, Paris: communication n° 18.

ROCHAMBEAU, H. de; FUENTE, L.F. de la; ROUVIER, R.; OUHAYOUN, J. (1989) Génét. Sél. Evol. 21: 527-546.

SMITH, C. (1988) 3rd World Congress on Sheep and Beef Cattle Breeding 1: 159-171.

SORENSEN, D.; KENNEDY, B.W. (1984) J. Anim. Sci. 58: 1097-1106.

THOMPSON, R. (1986) Génét. Sél. Evol. 18: 475-484.

TORRES, C.; BASELGA, M.; GOMEZ, E.A. (1992) J. Appl. Rabbit Res. 15: 884-888.