

A STUDY OF REPRODUCTIVE AND GROWTH TRAITS OF A MATERNAL RABBIT LINE FOUNDED BY SELECTION OF HYPERPROLIFIC DOES

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Abstract - A comparison of reproductive and growth performance has been made between a new maternal line (HH), founded applying hyperprolific selection principles and embryo cryopreservation techniques; line V, - a top Spanish maternal line -, and AxV crossbred does, - a well spread crossbred doe in Spanish rabbit farms-. The comparison involved three farms, 269 does, 645 litters and 1635 records of daily gain. The recorded traits were total litter size at birth, born alive, litter size at weaning, live litter weight at birth, weaning weight (28 d), slaughter weight (63 d) and postweaning daily gain (28-63 d). Crude averages for the traits cited were, 10.2, 9.6, 7.9, 541.1 g, 545.7 g, 1936.9 g and 39.8 g/d. No significant differences were found out between types of does in reproductive traits except total litter size at birth that showed superiority of the HH females compared to the average of V and crossbred does ($p < 0.05$). Weights were recorded only in V and HH does of a farm. The comparison favored HH rabbits in weaning weight, slaughter weight and daily gain ($p < 0.01$).

INTRODUCTION

A new maternal line, called HH, has recently been founded applying hyperprolific selection principles and embryo cryopreservation techniques (GARCIA-XIMENEZ *et al.*, 1996). The objective of this foundation was to get a line performing, at least, as well as some top Spanish maternal lines that are available for rabbit meat production.

A large number of commercial farms, 28, supplied the hyperprolific does used in the foundation procedure. These farms were very heterogeneous respect to the does used for production, but all farms produced efficiently.

A desirable comparison from a genetic point of view would have been the comparison between the HH line with a sample of the commercial populations, to obtain an accurate estimate of the response achieved by the hyperprolific selection. Because of the heterogeneity, other way of appraising the practical result of the new line is to compare with a top maternal line and with crossbred does highly spread in commercial farms.

The aim of this experiment is to compare the performance of the HH line, with the V line, a well-known maternal line (BASELGA *et al.*, 1992) and with AxV crossbred does, well spread between Spanish rabbit farmers (line A is also a maternal line of the Department of Animal Science, U.P.V.). The comparison will be mainly on traits important for a maternal line, as litter size, litter weight at birth and individual weaning weight.

MATERIAL AND METHODS

Three types of animals were used in the experiment:

- animals pertaining to line V, a synthetic maternal rabbit line selected since 1984 for number of weaned with a BLUP under a repeatability animal model (ESTANY *et al.*, 1989).
- animals pertaining to the HH line, a new maternal rabbit line founded recently from hyperprolific females, as described by GARCIA-XIMENEZ *et al.* (1996)
- AxV crossbred females, being line A a maternal rabbit line selected for number of weaned with a familiar index since 1980 (BASELGA *et al.*, 1984).

The animals were placed in three different farms and were mated in each as follows:

- Farm 1: It is a nucleus farm in which males with females of line V and males with females of line HH were mated to produce offspring.
- Farm 2 and Farm 3 are two commercial farms with efficient results in which both HH and AxV crossbred females were mated with HH males.

The number of animals of each type in each farm is shown in Table 1.

Table 1 : Number of does with reproductive data

TYPE OF DOE ¹	TOTAL	FARM 1	FARM 2	FARM 3
VE	79	79	-	-
HH	137	89	24	24
HY	53	-	28	25

¹ VE: V line; HH: HH line; HY: AxV crossbreed.

The traits analysed were: number of born (TB), number of born alive (BA), number of weaned (NW), live litter weight at birth (LLWB), weaning weight at 28 days of age (WW), slaughter weight at 63 days of age (SW) and average daily gain during the fattening period (DG). The first three characters were measured in the three farms, but live litter weight, weaning weight, slaughter weight and average daily gain were only recorded in Farm 1.

The reproductive traits TB, BA, and NW have been analyzed under an animal model considering the following effects:

- *Farm-year-season* fixed effect with 9 levels (three year-seasons for each farm).
- *Physiological state of the doe*; fixed effect with 3 levels: primiparous and multiparous lactating and non lactating does.
- *Type of doe*; fixed effect with 3 levels: does of the V line, does of the HH line and AxV crossbred does.
- *Additive value of the doe* (random).
- *Permanent non additive effect of the doe* (random).
- *Residual* of the model.

LLWB has been analysed with the same model described above but with only 2 levels in *Type of doe* (V and HH does) and with the fixed effect *Year-season* (3 levels) instead of *Farm-year-season*.

The traits WW, SW and DG have also been analysed with an animal model but with the following effects:

- *Year-season of birth* as a fixed effect with three levels.
- *Parity*; fixed effect with three levels: first, second and rest of parities.
- *Litter size class*; fixed effect with eleven levels: level 1 for litters of less than 6 young born alive, level *i* for litters of *i*+4 young (*i*=2,3,...10) and level 11 for litters of more than 14 young.
- *Type of doe*; fixed effect with two levels as in LLWB.
- *Additive value of the animal* (random).
- *Litter in which an animal has born* (random).
- *Residual* of the model.

All the models have been solved using PEST software package (Groeneveld, 1990). The variance component ratios needed to solve the models have been taken from GOMEZ (1994) for TB, BA and NW, and from CAMACHO (1989) for the rest of traits. These genetic parameters are shown in Table 2.

Differences between types of does have been investigated testing significance of the contrasts between them.

Table 2 : Genetic parameters used.

PARAMETER	CHARACTER						
	TB ^a	BA ^b	NW ^c	LLWB ^d	WW ^e	SW ^f	DG ^g
h^2 (1)	0.08	0.08	0.06	0.15	0.13	0.20	0.18
p^2 (2)	0.07	0.07	0.06	0.10	-	-	-
c^2 (3)	-	-	-	-	0.14	0.07	0.05

a.- TB: number of born; b.- BA: number of born alive; c.- NW: number of weaned; d.- LLWB: live litter weight at birth (g); e.- WW: weaning weight (g); f.- SW: slaughter weight (g); g.- DG: daily gain (g/d).

(1) heritability; (2) ratio of permanent doe effects to phenotypic variance; (3) ratio of litter effects to phenotypic variance.

RESULTS AND DISCUSSION

A general description of the size of the experiment and the performance of animals involved is showed in Table 3. These results agree with the literature, considering that 42% of the litters are first parities and 74% came from purebred does (BRUN *et al.*, 1992; MAERTENS, 1992; BRUN and SALEIL, 1994).

The main objective of this experiment is to compare the HH does with other types of does. Consequently, thereafter only results on contrasts between types of does will be presented. Table 4 shows the comparisons for reproductive traits. There are not significant differences in total born, number of born alive and number of weaned between the three types of does. When comparing HH does versus the other types, the value of the difference in total born is 0.53 ± 0.28 ($p < 0.05$) favouring HH females.

Recent results comparing the last two generations of lines V and A (not published) show that line V has advantages with respect to line A in 1.4 total born, 1.1 born alive and 0.9 weaned. The similar performance of V does and crossbred does could be explained by heterosis effects matching the lower performance of A does (BRUN *et al.*, 1992).

Table 3 : Number of records, maximum, minimum, average and standard deviation

CHARACTER	N.REC	MAX	MIN	AVG	STD
TB ^a	645	19	1	10.2	2.8
BA ^b	645	18	0	9.6	3.3
NW ^c	565	14	0	7.9	3.0
LLWB ^d	342	900	0	541.1	166.8
WW ^e	2594	990	200	545.7	116.1
SW ^f	1642	2710	1200	1936.9	221.1
DG ^g	1635	53.40	24.10	39.8	4.2

a-g: see foot notes of Table 2.

Table 4 : Contrasts between types¹ of does.

CHARACTER	VE-HY	VE-HH	HY-HH	0.5(VE+HY)-HH
TB ^a	$.01 \pm .50^2$	$-.52 \pm .35$	$-.53 \pm .40$	$-.53 \pm .28$
BA ^b	$.29 \pm .60$	$-.17 \pm .41$	$-.46 \pm .47$	$-.32 \pm .33$
NW ^c	$.36 \pm .57$	$.10 \pm .38$	$-.26 \pm .45$	$-.08 \pm .31$
LLWB ^d	-	-3.40 ± 22.80	-	-

a-d: see foot notes of Table 2.

¹ VE: V line; HH: HH line; HY: AxV crossbreds.

² Contrast standard error.

We have only the comparison between line V and line HH for the traits involving rabbit weights. There is not significant difference between them for live litter weight at birth, but the differences for the other traits (Table 5), weaning weight, slaughter weight and daily gain are significantly favourable to HH rabbits ($p < 0.01$).

The results presented are pointing that the new HH line have reproductive performance similar to the V line and AxV crossbred does, but has better records for weaning weight, a very important feature in a maternal rabbit line, and postweaning growth traits as daily gain and slaughter weight. It has been reported (ROCHAMBEAU *et al.*, 1994) a decline in weaning weight when litter size is selected.

Table 5 : Contrasts between types¹ of does

CHARACTER	VE-HH
WW ^a	-22.49 ± 9.15^2
SW ^b	-67.54 ± 22.43
DG ^c	$-1.29 \pm .43$

a-c: see foot notes of Table 2.

¹ VE: V line; HH: HH line; ² Contrast standard error.

The results discussed are preliminary results, because the initial setting of the experiment continues producing new records and a replacement of the does is taking place in the three farms involved in the experiment. Thus a complementary comparison between the three types of does will be made in the next future avoiding some sources of differences between types of does as:

- cryopreservation. The HH does have been obtained after the transfer of vitrified embryos. The new HH does will belong to the next generation, and will be obtained without selection (CIFRE *et al.*, 1994; CIFRE *et al.*, 1995).
- adaptation. The HH does of the first setting were born in the farm of the Animal Science Department and moved to the farms 2 and 3. The replacement does were born in the farms where they will produce.
- heterosis. The small amount of heterosis expected in generation 0 for the HH does, will be almost negligible in HH of generation 1.

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Estudio de los caracteres reproductivos y de crecimiento en una línea de aptitud maternal fundada por selección de hembras hiperprolíficas - Se han comparado las características reproductivas y de crecimiento de una nueva línea de aptitud maternal en conejo de carne (línea HH, fundada por selección de hembras hiperprolíficas y haciendo uso de las técnicas de crioconservación de embriones) con las de la línea V (una línea de aptitud maternal de gran rendimiento y muy extendida en España) y con las de las hembras cruzadas AxV, también muy extendidas en la cunicultura española. La comparación se ha realizado en tres granjas distintas, con 265 hembras, 645 camadas y 1635 datos para la ganancia diaria durante el período de engorde. Los caracteres analizados fueron el tamaño de camada al nacimiento, el número de nacidos vivos y el número de destetados, el peso total de la camada nacida viva, y los caracteres de peso al destete (28 d), al sacrificio (63 d) y de ganancia diaria (28-63 d) durante el período de engorde. Las medias brutas obtenidas para estos caracteres y el conjunto de los animales fueron respectivamente de 10.2, 9.6, 7.9, 541.1 g, 545.7 g, 1936.9 g y 39.8 g/d.

No se encontraron diferencias significativas entre los tres tipos de hembras para ninguno de los caracteres reproductivos estudiados salvo para nacidos totales entre las hembras HH y el promedio de las hembras V y AxV, superando las primeras en 0.53 gazapos a las segundas ($p < 0.05$). Los caracteres ponderales sólo fueron recogidos en una granja y para las hembras HH y V, registrándose diferencias significativas a favor de las hembras HH para los tres caracteres, peso al destete, peso al sacrificio y ganancia diaria ($p < 0.01$).
