

EFFECT OF MALE RABBIT MANAGEMENT ON SEMEN PRODUCTION

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Abstract - The characteristics of rabbit semen and the production of seminal doses suitable for artificial insemination were evaluated taking into account the effect of 1) obtaining 4 semen collections in one or two days, and 2) males displacement and gathering. Results obtained in this work indicate that there is a marked change in volume and in the number of seminal doses of the third and fourth ejaculates compared to first one ($p < 0,0001$). Semen concentration was higher for the first ejaculate in relation to third and fourth ones ($p < 0,05$). This effect was clearly detected when the four ejaculates were collected during the same day, but it was less marked when collection was split into two consecutive days, two each day. The two days collection schedule led to an increase of 23,8 % in semen doses production. Males displacement and gathering in small groups 3 hours before semen collection has revealed to be a simple but effective way to enhance ejaculates volume, without changes in concentration, so doses available for artificial insemination increase by 24% ($p < 0,01$).

INTRODUCTION

Artificial insemination (A.I.) is increasingly employed as a routine practice in commercial rabbit farms. The A.I. technique has been widely studied, considering technical aspects and physiological responses, mainly related to ovarian stimulation and induction of ovulation. Comparatively rabbit males have not received similar attention, and few works have focused on male performance. Although several works have studied rabbit semen characteristics (NELSON *et al.*, 1979; THEAU-CLEMENT and ROUSTAN, 1980; ADAMS, 1981; MCNITT, 1981; MENDEZ, 1984; BOUSSIT, 1989; CASTELLINI, 1990; BATTAGLINI *et al.*, 1992), only some of them refer to specific factors such as breed (KUTTNER *et al.*, 1975; AMIN *et al.*, 1983; DUBIEL *et al.*, 1984; EL-EZZ *et al.*, 1985), weight (EL-EZZ *et al.*, 1985), lighting regime (THEAU-CLEMENT *et al.*, 1994), season (CARVAJAL *et al.*, 1983; MENDEZ, 1984; BONANNO and COSTANZO, 1987; CASTELLINI, 1990), and sequential semen collection (MCNITT, 1981; ADAMS, 1982; CARVAJAL *et al.*, 1983).

Traditionally semen collection is performed on a basis of 2 ejaculates obtained every two days (ROUSTAN, 1982). Nowadays the demand for rabbit semen tends to concentrate on certain days of the week (GURRI, 1995), so male rabbit management has become an important aspect to improve the efficiency of semen production in specialized rabbit semen collection centres. This work attempts to find out whether semen collection can be concentrated in short periods of time (24 to 48 hours) and whether a simple method such as male grouping is effective in increasing the males performance as semen donors.

MATERIALS AND METHODS

New Zealand male rabbits were kept in a commercial farm separated from females, under a constant photoperiod of 16 hours of light/day. Semen was collected using an artificial vagina and volume was determined. Each ejaculate was examined under microscope to assess mobility and concentration. The percentage of mobile spermatozoa was subjectively estimated using a scale from zero i.e. no spermatozoa are mobile, to 3 i. e. more than 80% are mobile and move quickly.

Concentration was determined using a Burker's counting camera (BAGLIACCA *et al.*, 1987; ALVARIÑO, 1993). Ejaculates presenting a high number of impurities were not evaluated.

The number of useful doses for artificial insemination was determined considering the total number of spermatozoa produced in each semen collection (volume x concentration) and dividing this value by 25 million, the dose recommended per inseminated female (ALVARIÑO *et al.*, 1996).

Two experiments were carried out to determine the effect of 1) collection of four ejaculates in one day or in two days, and 2) males displacement and gathering on semen characteristics.

Experimental designs

Experiment I - 60 adult rabbit males were studied, divided in two experimental groups. In Group A semen collection was performed in two consecutive days, two ejaculates per day, the second 1 hour after the first. In group B all collections were made on the same day, three in the morning with an interval of 1 hour among them, and the fourth in the afternoon. The experiment was repeated one week later and males were interchanged, so that all of them were subjected to both semen collection schedules.

Experiment II - 59 adult rabbit males were studied during 5 weeks, alternating the management procedure. In week 1, 3 and 5 animals were taken out of their cages and gathered in groups of three for 15 minutes about 3 hours before semen collection. In week 2 and 4 no male manipulations were made. In every week two ejaculates were collected with an interval of 1 hour between them.

Statistical analysis of the results was carried out using the non parametric Analysis of Variance (CATMOD procedure) for means comparison of mobility and the ANOVA (GLM procedure) followed by the Duncan test to compare the means of volume, concentration and seminal doses (SAS, 1987).

RESULTS AND DISCUSSION

Results obtained in Experiments I and II are shown in Tables 1, 2 and 3. Semen characteristics and semen output changed markedly according to the collection order, in agreement with previous works (MCNITT, 1981; ADAMS, 1982; CARVAJAL *et al.*, 1983). Volume, concentration and semen doses decreased from the 2nd ejaculate onwards. Differences were outstanding when comparing concentration ($p < 0,05$), volume and semen doses ($p < 0,0001$) from third and fourth ejaculates in relation to first and second. No significant change in concentration or volume was detected between first and second ejaculates, although a decrease in volume and concentration led to a lower number of useful doses for A.I. ($p < 0,0001$).

Table 1 : Effect of collection order and grouping of 4 semen collections in one or two consecutive days on rabbit semen characteristics

		Volume (ml)	Concentration (spermatozoa/ml)	Useful semen doses for A.I.
Collection schedule	One day	0,63 ± 0,02 (161)	360,5 ± 15,3	9,21 ± 0,6 a
	Two days	0,64 ± 0,02 (189)	389,7 ± 16,5	10,3 ± 0,5 b
Collection order	1	0,75 ± 0,03 A (95)	426,8 ± 22,9 a	12,9 ± 0,9 A
	2	0,69 ± 0,03 A (93)	381,7 ± 24,1 ab	10,4 ± 0,8 B
	3	0,55 ± 0,02 B (90)	336,0 ± 20,6 b	7,1 ± 0,5 C
	4	0,54 ± 0,03 B (72)	350,0 ± 21,1 b	8,0 ± 0,7 C

() Number of ejaculates collected
a, b : Significant difference, $p < 0,05$
A,B: Significant difference, $p < 0,0001$

There was a tendency to a decrease in volume similar to previously reported (OSHIO *et al.*, 1987; PANELLA and CASTELLINI, 1990; BATTAGLINI *et al.*, 1992 GURRI, 1995), but we have not found an increase in

concentration from first to second ejaculates as other authors have (HOLTZ and FOOTE, 1978; AMIN *et al.*, 1987; PANELLA and CASTELLINI, 1990; BATTAGLINI *et al.*, 1992).

The semen collection schedule did not significantly affect the studied variables but the number of ejaculates collected under the two days schedule was higher (189 vs 161) than under one day collection, due to the failure of 50% of males to obtain the fourth ejaculate. The consequence was that mean available doses for A.I. was higher (10,3 vs 9,2, $p < 0,05$), and global production of useful doses for A.I. was increased by 23,8 %.

A significant interaction between collection schedule and collection order was found ($p < 0,001$), due to the volume decrease experienced when the four ejaculates are collected during the same day, but not when collection is split into two consecutive days.

Table 2 : Effect of the interaction between collection order and collection schedule on rabbit semen volume (ml \pm SEM)

		COLLECTION ORDER			
		1	2	3	4
Collection Schedule	One day collection	0,77 \pm 0,05 A (47)	0,75 \pm 0,04 A (46)	0,50 \pm 0,02 BC (46)	0,40 \pm 0,03 C (22)
	Two days collection	0,73 \pm 0,03 A (48)	0,62 \pm 0,03 AB (47)	0,61 \pm 0,04 AB (40)	0,60 \pm 0,04 AB (50)

() Number of ejaculates collected
A,B,C: Significant difference, $p < 0,0001$

Mobility values in Experiment I (2,49 \pm 0,05) were not affected by any of the studied factors, as previously reported (BATTAGLINI *et al.*, 1992).

Changing the environmental of the males exerts a beneficial effect on semen volume and semen doses for A.I. ($p < 0,01$) as well as on mobility ($p < 0,05$), while not affecting semen concentration. The result is that the number of semen doses suitable for insemination increases by 24%, from 11,1 to 14,6 ($p < 0,01$).

Table 3 : Effect of previous male stimulation on semen characteristics

	Volume (ml)	Concentration (Millions spz)	Mobility (0-3 Scale)	Doses for A.I.
Stimulated	0,78 \pm 0,03 A	450,6 \pm 18,2	2,68 \pm 0,04 a	14,6 \pm 0,9 A
Not Stimulated Males	0,64 \pm 0,03 B	429,6 \pm 20,1	2,51 \pm 0,06 b	11,1 \pm 0,8 B

A, B: Significant difference ($p < 0,01$)
a, b: Significant difference ($p < 0,05$)

It seems clear that four acceptable quality ejaculates can be obtained from bucks if collection is split into two consecutive days (two ejaculates per day). When semen demand is concentrated on a single day of the week, semen preservation during 24 hours can be carried out using commercial extenders (ALVARIÑO *et al.*, 1996) and the number of males can be reduced significantly.

A better male performance can be achieved simply by displacement and gathering of males in small groups during short periods of time. This environmental change enhances sexual behaviour and probably stimulates secretion of sexual glands increasing the volume of ejaculates. A similar relationship between active sexual behaviour and a higher volume of ejaculates was previously established (HOLTZ and FOOTE, 1978). The higher mobility found after this kind of males stimulation indicates a probable modification in the seminal fluid composition which should be confirmed. Similarly a higher number of live spermatozoa has been found in active sexual male rabbits (HOLTZ and FOOTE, 1978).

Further research is necessary to find out the optimum interval between males gathering and semen collection as the stimulus probably acts quickly and could be carried out perhaps only 15 minutes before semen collection. Besides

it would be interesting to confirm whether this environmental stimulus is effective when it is repeatedly applied, or whether males eventually get accustomed to it.

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