# PRODUCTIVITY OF RABBIT DOES SUBJECTED TO ARTIFICIAL INSEMINATION AND NATURAL MATING

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**Abstract** - In order to offer a further contribution to the diffusion of the A.I. technic in Sicilian rabbit breedings, in which it is not much utilized, a comparison with the N.M. was effected.
The trial began on 28 Hyla nulliparous rabbit does, 11 of which were naturally mated and 17 artificially inseminated, and whose reproductive (fertility and prolificity) and productive performances (live weight, milk quantity, litter growth, food intake) were controlled for 11 months.
Just after A.I., effected by fresh semen diluted in a Tris and glucose solution at a 1:5 rate, the females were injected with 10 µg synthetic GnRH.
A semi-intensive reproductive rhythm was used for both groups. The litters equalization, the suckling programmation up to the 21st day after the delivery and weaning at 28 days were effected.
On the whole, fertility was 77.3% and 68.9%, and the total number of rabbits born per delivery was 8.5 and 7.9, respectively for N.M. and A.I. does, with no significant difference.
In relation to receptive does only, fertility was 72.7% and 84.6% for nulliparous does, 78.8% and 79.3% for lactating does, 77.4% and 81.8% for non-lactating does, respectively for N.M. and A.I. groups.
Among the non-receptive does of the A.I. group, the lactating does showed a higher incidence and a fertility of 48.3%.
The A.I. group realized a higher milk production in the 21 days after the delivery (3774 vs 3389 g, $P \leq 0.01$), and the individual weight of the rabbits of this group was higher at 21 days (327 vs 296 g) and at weaning (534 vs 492 g, $P \leq 0.05$).
The A.I. technic did not negatively affect the reproductive performances, the milk production and the rabbits' growth up to weaning, confirming the validity of its application in rabbit breedings.

## INTRODUCTION

The quantity of milk produced by a rabbit doe is important in order to assure the growth and the health of young rabbits in their first month of life, related as they are to the final productive results at slaughtering, and therefore to the economical efficiency of breeding.
The milking aptitude in all animal species is a genetic characteristic, and it is greatly affected by environmental factors; among which the reproductive technics could have a main role as for the rabbit.
Lately the technic of artificial insemination (A.I.) has spread in rabbit breedings, especially in industrial ones, for the known advantages given mainly to the management (CASTELLINI, 1995; FACCHIN, 1995).
In Sicily this reproductive method has met with some reluctance in rabbit breedings, and it is sometimes discarded after the first experiences, because it is believed to be unproductive. In order to offer a contribution to the local diffusion of the technic, a further comparison of the A.I. technic with natural mating (N.M.) was effected, on the basis of traditional reproductive parameters, milk production and rabbit growth until weaning.

## MATERIAL AND METHODS

The experiment was carried out over a 11-month period, from December to October, in the rabbit farm of the "Istituto di Zootecnica Generale" of the "Università di Palermo"; it began on 28 Hyla nulliparous rabbit does.
The does were housed in a metallic building, partially air-conditioned, in flat-deck cages with external nestbox; they were provided 16 hours light per day and a commercial rabbit feed with 22.3% CP and 15.7% CF on d.m..
The does were split into two homogeneous groups on the basis of their body weight, one was constituted by 11 does subjected to N.M., and the other one by 17 does subjected to A.I..
The does receptivity was deduced by their vulva colour, by classifying "receptive" the females presenting a swollen vulva with intense colour (red and purple), and "non-receptive" the females with a pale vulva.
A.I. was effected by a glass pipette with a dosage of 0.6 ml polyspermic fresh semen taken from Hyla bucks housed in the same building, diluted in a Tris and glucose solution at a 1:5 rate. Just after insemination the females were injected i.m. with 10 µg synthetic GnRH (Fertagyl, Intervet).
The A.I. interventions were conducted every 21 days, with a semi-intensive reproductive rhythm. A semi-intensive rhythm was adopted also for the N.M. does: the mating was effected 8-10 d after the delivery or 18-20

d after the non fertile mating. The non-receptive does were tried to mate in following days until the mating occurred.
The does which did not result pregnant after the third insemination or mating were eliminated. The litter size was standardized to the average of the rabbits born on the same day, preferably within each experimental group. For 21 days after delivery the does were allowed to enter the nestbox to suckle the young rabbits only once a day. The litters were weaned 28 days after the birth.
Both A.I. and N.M. were effected about 2 hours after suckling, in order to avoid the interference of the prolactin peak, which rises just after the suction, on the reproductive hormones (CASTELLINI, 1995).
The following data were recorded: the deliveries; the number of total and live rabbits born per delivery; the weekly milk production by double weighing the does before and after suckling for 21 days after delivery; the litter weight, the doe weight and the doe food intake, from delivery to weaning.
The statistical elaboration of the percentage variables was effected by $\chi^2$. The other variables were elaborated by analysis of variance (reproductive variables) considering the factors group (N.M. and A.I.) and physiological phase (nulliparous, lactating and non-lactating does), and by analysis of covariance (productive variables) considering the factors group (N.M. and A.I.), order of delivery (1st, 2nd, 3rd and ≥ 4th), physiological state (lactating and lactating-pregnant does), and litter size or doe live weight at delivery as covariate. The differences between the least means were tested by Student "t" test, for level of probability equal to 0.05 and 0.01.

## RESULTS AND DISCUSSION

The percentages of deliveries, as reported in the Table 1, did not result significantly different between the groups, even though it was slightly higher in the N.M. does (77.3 vs 68.9%). In relation to the receptive does only, in every physiological phase (nulliparous, lactating and non-lactating does) the percentages of deliveries of the A.I. does were higher than the ones realized by the N.M. does, even though the differences are not significant. In all physiological phases the non-receptive does of the A.I. group showed a lower fertility than the receptive does of the same group, with significant differences for the nulliparous (25.0 vs 84.6%, P≤0.05) and the lactating does (48.3 vs 79.3%, P≤0.01).

**Table 1: Fertility in relation to physiological phase**

| | | N.M. | A.I. | |
|---|---|---|---|---|
| Rabbit does | n. | 11 | 17 | |
| Total inseminations | n. | 75 | 119 | |
| Total deliveries | % | 77.3 | 68.9 | |
| | | | Receptive does | Non-receptive does |
| Nulliparous does | % | 72.7 (11) ab | 84.6 (13) a | 25.0 (4) b |
| Lactating does | % | 78.8 (33) A | 79.3 (29) A | 48.3 (29) B |
| Non-lactating does | % | 77.4 (31) | 81.8 (33) | 54.5 (11) |

Within brackets the number of rabbit does.
A, B = P≤ 0.01; a, b= P≤ 0.05.

Therefore the lower global percentage of deliveries of the A.I. does was determined by the higher incidence of the non-receptive does among the lactating does (50.0%, Table 1); in fact in the latter the effect of the antagonism of the prolactin to the reproductive hormones is probably responsible for the lower receptivity and the lower fertility, in agreement with other authors (RODRIGUEZ *et al.*, 1989; THEAU-CLEMENT and ROUSTAN, 1992; FORTUN-LAMOTHE and BOLET, 1995). On the other hand, the lactating does of the N.M. group showed a higher percentage of refusal to mate than the non-lactating does (46.9 vs 31.2%); nevertheless, in this case, the lactating does, being necessarily receptive to mating, even if after repeated attempts, did not show a lower fertility, but they showed an analogous result to the receptive lactating does of the A.I. group (78,8 vs 79,3%).
The other reproductive parameters are reported in the Table 2.
As for the number of total and live rabbits born per delivery and of the rabbits weaned per weaning, the differences between the groups were not remarkable.
In the trial the N.M. does realized a higher average number of deliveries (5.3 vs 4.8), which involved a shorter kindling interval (46.3 vs 55.4 d, P≤0.01).

The number of rabbits weaned per delivery resulted lower in the N.M. group than in the A.I. does (5.0 vs 6.2), even if not significantly. The birth-weaning mortality of rabbits in the N.M. group, higher than in the A.I. group (26.5 vs 8.8%, P≤0.01), was mostly determined by the losses of whole litters which occurred immediately or few days after delivery. Consequently the A.I. does showed a higher percentage of weanings (81.7 vs 63.8%, P≤0.05), and a higher average number of weanings (3.9 vs 3.4), though this latter with no significant difference.

The percentage of does culled was rather low in both groups (36.4 vs 35.3% respectively in the N.M. and A.I. group).

The productive parameters of the lactating does up to 21 days after the delivery are reported in the Table 3.

In every group the milk production increased from the first to the third week, as it was reported in a previous trial (BONANNO *et al.*, 1995).

In any of the three weeks the milk production was higher for the A.I. does, with significant differences in the second (1355 vs 1211 g, P≤0,01) and in the third week (1480 vs 1319 g, P≤0.01). Also the global milk production in the 21 days after the delivery differed significantly between the groups (3774 vs 3389 g, P≤0.01).

The cause of the lower milk production in the N.M. group cannot be due to the different reproductive rhythm and so to the different overlap between lactation and pregnancy; in fact, since the delivery-mating interval lasted 10 days on average, and it was practically analogous to the time elapsed for the A.I. does (11 days), for both groups the lactation-pregnancy overlap began only in the third week, whereas the differences appeared in the first week. For the same reason the cause cannot be the higher incidence of the lactating-pregnant does in the N.M. group (69.4 vs 55.9%). As it is known, the effect of the pregnancy on the lactating does involves a reduction of the milk production, more evident when the overlap between lactation and pregnancy begins early.

Therefore this result seems to be casual, due to the low number of does in the N.M. group, and in all probability it is not ascribable to the different reproductive method.

On the other hand, the higher milk production of the A.I. does, even though it was casual, might be related to a high hematic level of prolactin and, for the interference of the prolactin to the release of FSH and LH, due to a lower response to the GnRH according to RODRIGUEZ *et al.* (1989), it might be related to a lower receptivity (THEAU-CLEMENT and LEBAS, 1994; BONANNO *et al.*, 1995), that is responsible for the lower fertility recorded in the lactating does of the A.I. group.

The conversion ratio, calculated as the ratio between the milk quantity and the litter weight gain, resulted equal to 1.9 in both groups, affected by the same energetic milk efficiency.

In the 21 days of lactation the weight variation and the food intake of the does did not show any difference between the groups.

**Table 2: Other reproductive parameters (least means)**

| | | N.M. | A.I. |
|---|---|---|---|
| Total rabbits born/delivery | n. | 8.5 | 7.9 |
| Live rabbits born/delivery | n. | 6.8 | 6.8 |
| Weaned/delivery | n. | 5.0 | 6.2 |
| Weaned/weaning | n. | 7.9 | 7.6 |
| Deliveries/doe | n. | 5.3 | 4.8 |
| Kindling interval | d | 46.3 A | 55.4 B |
| Weanings/deliveries | % | 63.8 a | 81.7 b |
| Weanings/doe | n. | 3.4 | 3.9 |
| Does culled | % | 36.4 | 35.3 |

A, B = P≤ 0.01; a, b= P≤ 0.05.

**Table 3: Productive parameters of the lactating does (least means)**

| | | N.M. | A.I. |
|---|---|---|---|
| Lactations | n. | 36 | 59 |
| Milk production | g | | |
| 0-7 d | | 843 | 930 |
| 7-14 d | | 1211 A | 1355 B |
| 14-21 d | | 1319 A | 1480 B |
| 0-21 d | | 3389 A | 3774 B |
| Conversion ratio 0-21 d (milk/litter weight gain) | g/g | 1.9 | 1.9 |
| Variation of doe weight 0-21 d | g | +264 | +221 |
| Food intake of doe 0-21 d | g | 7063 | 7106 |

A, B = P≤ 0.01.

**Table 4: Productive parameters of the weaned litters (least means)**

| | | N.M. | A.I. |
|---|---|---|---|
| Litter size | n. | | |
| 0 d (1) | | 8.9 | 8.3 |
| 21 d | | 8.0 | 7.6 |
| 28 d | | 8.0 | 7.6 |
| Rabbits' loss/litter 0-28 d | n. | 1.0 | 0.6 |
| Live weight of a single rabbit | g | | |
| 0 d | | 63 | 64 |
| 7 d | | 129 a | 141 b |
| 14 d | | 218 | 231 |
| 21 d | | 296 | 327 |
| 28 d | | 492 a | 534 b |
| Weight gain | g | | |
| 0-21 d | | 228 A | 261 B |
| 0-28 d | | 429 a | 469 b |

(1) After equalization.
A, B = P≤ 0.01; a, b = P≤ 0.05.

The parameters relating to the young rabbits are reported in the Table 4. The litter size at the birth, at 21 days and 28 days after the birth did not show any relevant difference between the groups, neither did the single rabbit weight at the birth.
During suckling, from their birth up to 21 days after their birth, the young rabbits of the A.I. does showed a higher weight gain (261 vs 228 g $P<0.01$), due to a higher milk intake, which caused their weekly weight to be higher than the young rabbits of the N.M. does. Therefore the body weight at 21 days resulted higher in the rabbits born of A.I. does (327 vs 296 g). The weight gain from birth up to 28 days was also higher in the rabbits born of A.I. does, and in this group it made it possible to produce a significantly heavier rabbit at the weaning (534 vs 492 g, $P\leq0.05$).

## CONCLUSION

The reproductive and productive data achieved in the trial confirmed the applicability in breeding and the advantages of the A.I. in the rabbit does.
The lower fertility recorded on the non-receptive does of the A.I. group, mainly in the suckling phase, can be improved through PMSG inoculation so as to induce the oestrus (ALABISO *et al.*, 1994; BONANNO *et al.*, 1995).
The prolificity, the milk production of the rabbit does and the growth performance of the young rabbits up to the weaning do not appear to be influenced by the different reproductive methods. In any case, the low productive performances recorded with N.M. does, probably ascribable to the low number of the does in the group, requires further verifications on a larger sample of rabbit does.

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**Aspetti produttivi di coniglie sottoposte ad inseminazione artificiale ed a monta naturale** - Allo scopo di offrire un ulteriore contributo alla diffusione della tecnica di I.A. negli allevamenti cunicoli siciliani, dove è poco affermata, è stato effettuato un confronto con la M.N..
La prova è stata avviata su 28 coniglie nullipare Hyla, 11 in M.N. e 17 in I.A., delle quali sono state controllate, per un periodo di 11 mesi, le prestazioni riproduttive (fertilità e prolificità) e produttive (peso vivo, quantità di latte, crescita della nidiata, consumo alimentare).
All'atto della I.A., effettuata con seme fresco diluito in una soluzione di Tris e glucosio nel rapporto 1:5, le coniglie venivano inoculate con 10 µg di GnRH sintetico.
E' stato adottato un ritmo riproduttivo semi-intensivo per entrambi i gruppi. Sono stati attuati il pareggiamento delle nidiate, l'allattamento programmato fino a 21 d e lo svezzamento a 28 d d'età.
Nel complesso sono stati registrati, rispettivamente per la M.N. e la I.A., un tasso di gestazione pari a 77,3% e 68,9%, ed un numero di nati totali per parto di 8,5 e 7,9, con differenze non significative.
Con riferimento alle sole coniglie recettive, le percentuali di parto sono state pari a 72,7% e 84,6% per le nullipare, 78,8% e 79,3% per le allattanti, 77,4% e 81,8% per le non allattanti, rispettivamente per la M.N. e la I.A..
Tra le coniglie non recettive del gruppo I.A., le allattanti hanno mostrato una maggiore incidenza ed una fertilità del 48,3%.
La produzione di latte fino a 21 d è risultata superiore nel gruppo sottoposto a I.A. (3774 vs 3389 g, $P\leq0,01$), così come il peso del singolo coniglietto a 21 d (327 vs 296 g) ed allo svezzamento (534 vs 492 g, $P\leq0,05$).
La tecnica della I.A. non ha influenzato negativamente le prestazioni riproduttive, la produzione di latte delle fattrici e la crescita dei coniglietti fino allo svezzamento, confermando la piena validità della sua applicazione negli allevamenti cunicoli.