

A six-year investigation on reproductive performance of hybrid rabbits.

1. Pregnancy rate and numerical productivity at weaning as affected by season

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ABSTRACT - With the aim to clarify the effect of seasonal variation on reproductive performance of hybrid rabbits, a six-years investigation was carried out. Traits analysed were pregnancy rate of does and numerical productivity at weaning. The data set included: 33588 matings and subsequent pregnancy diagnosis; 245743 young rabbits at weaning. From the statistical analysis, pregnancy rate and numerical productivity at weaning appeared to be significantly ($P < 0.001$) affected by seasonal variation. Furthermore a statistically significant ($P < 0.001$) month influence was also found. Nevertheless a correlation between the two parameters needs to be performed to supplement our analysis.

Key words: Rabbit, Reproductive performance, Season effect.

INTRODUCTION - Within the European latitude, Hammond and Marshall (1925) and Boyd (1986) reported that wild rabbits have a well-defined seasonal cycle of reproduction: most pregnancies occur between February and early August with a peak in May.

This means that fertility is maximal for increasing day-length. Walter *et al.* (1968) showed that exposing domestic does to 16L:8D of constant lighting all year round considerably attenuates this seasonal variation normally associated with decreasing day-length periods. Even so, reproduction problems sometimes appear at the end of summer (Lebas *et al.*, 1997).

Therefore our research aimed to clarify the influence of seasonal variation on reproductive performance of hybrid rabbits. It was conceived a prolonged six-year investigation to better point out any eventual long-term effects. Furthermore a large number of observations is necessary to prove that relevant differences observed are statistically significant (IRRG, 2005).

In particular, the present paper reports the results concerning the two parameters: pregnancy rate of doe rabbits and numerical productivity at weaning.

MATERIAL AND METHODS - The six-year investigation was carried out at a farm, breeding hybrid rabbits, located in the North of Sardinia at latitude 40° 49' N, longitude 8° 50' E and at m.177 above mean sea level. Rabbits were fed a complete pelleted diet with no seasonal changes.

The lighting period was controlled and fixed at 16 hours per day. Natural mating was applied associated to a semi-intensive reproduction rate which has been the rule over the six years: rebreeding 10 to 11 days after kindling; weaning at about 32 to 35 days.

Pregnancy diagnosis (abdominal palpation) took place 15 days after each mating. The traits analysed were: pregnancy rate of does (number of does palpated as pregnant/number of mated does x 100) and numerical productivity at weaning (number of weaned rabbits per mated doe), as defined by IRRG (2005).

The data set included: 33588 matings and subsequent pregnancy diagnosis; 245743 young rabbits at weaning; uninterrupted recordings over 6 years. For all statistical analyses the GLM procedure of SAS (2000) was utilised.

Table 1. Number of matings, least squares means of pregnancy rate and numerical productivity at weaning, according to different seasons.

| Season | Matings (No.) | Pregnancy rate (%) | Weaned (No.) |
|-------------|---------------|--------------------|--------------|
| P-Value | - | *** | *** |
| Spring | 7916 | 70.8b | 7.45a |
| Summer | 8688 | 63.1a | 7.08b |
| Autumn | 8711 | 71.5b | 7.27c |
| Winter | 8273 | 69.1b | 7.49a |
| Pooled S.E. | - | 3.1 | 0.32 |

Means with different letters in the column differ significantly at $P < 0.05$ at least. ***; $P < 0.001$.

Table 2. Number of matings, least squares means of pregnancy rate and numerical productivity at weaning, according to different months.

| Month | Matings (No.) | Pregnancy rate (%) | Weaned (No.) |
|-------------|---------------|--------------------|--------------|
| P-Value | - | *** | *** |
| Jan | 2678 | 74.0cg | 7.42df |
| Feb | 2046 | 63.0b | 7.55e |
| Mar | 2435 | 70.7df | 7.37 d |
| Apr | 2340 | 72.2cefg | 7.50ef |
| May | 3141 | 69.6d | 7.49ef |
| Jun | 3088 | 65.6b | 7.26c |
| Jul | 2940 | 59.3a | 7.00b |
| Aug | 2660 | 64.5b | 6.99b |
| Sep | 2515 | 69.7de | 7.14a |
| Oct | 3048 | 71.8dg | 7.23c |
| Nov | 3148 | 72.9cfg | 7.45df |
| Dec | 3549 | 70.3de | 7.49ef |
| Pooled S.E. | - | 3.2 | 0.33 |

Means with different letters in the column differ significantly at $P < 0.05$ at least. ***; $P < 0.001$.

RESULTS AND CONCLUSIONS - From the statistical analysis of the six-year recordings, pregnancy rate of rabbit does appeared to be significantly affected ($P < 0.001$) by seasonal variation, as depicted in Table 1.

Furthermore a statistically significant ($P < 0.001$) month influence was observed, as pointed out in Table 2.

In accordance with our findings, Bassuny (1999) reported that pregnancy rate decreased significantly in summer when compared to the other kindling seasons, whereas Zerrouky *et al.* (2005) found that season had not a significant relevance on the same parameter.

The influence of season on reproductive efficiency observed in our study should be attributed to changes in temperature rather than in photoperiod, being the rabbits exposed to 16L:8D of constant lighting all year round. The summer, characterized by high temperatures in Sardinia, might have influenced the metabolic and hormonal status of does and had a carry-over effect that greatly reduced reproduction (Trammel *et al.*, 1989).

The decrease in fertility recorded in our research may be a consequence of a complex set of events in response to climatic heat. Such phenomena could be due to a marked decline in ovulation frequency (Farrel *et al.*, 1968), ovulation rate (Hahn and Gabler, 1971), number of implantation sites per doe and number of viable embryos per doe (El-Fouly *et al.*, 1977). The lower pregnancy rate may also be a result of either fertilization failure or early embryonic mortality (Marai *et al.*, 2002).

Moreover the poorer reproductive efficiency could be seen as the result of an indirect seasonal effect, as clarified by Lebas *et al.* (1997) reporting a responsibility of the reduction in body weight, caused by a lower feed intake, and not so much of the temperature itself. The reduced reproductive efficiency attributed to does during summer months could be also related to the male (Marai *et al.*, 2002). The impact of temperature on spermatogenesis acts on ejaculate volume, motility, sperm concentration and total number of spermatozoa per ejaculate, sperm abnormalities and dead sperm. Furthermore, and this seems to be the worst effect, temperatures in excess of 30°C reduce the bucks' sexual urge (Lebas *et al.*, 1997).

As concerns the number of weaned rabbits per litter, the general mean reported in the present study (7.32) can be assimilated with results obtained in well-managed French farms using selected strains of rabbits (Guerder, 2001). Also this trait was found to be significantly affected ($P < 0.001$) by season and month as shown in Tables 1 and 2. From Table 1 it may be assessed that the lowest number of weaned per litter was in correspondence to summer season, confirming the observations of Bassuny (1999).

The value of this parameter might be related to the detrimental effect of high temperatures on milk intake (lower for kits born in summer than those born in winter) and on milk efficiency (kg milk/kg meat), also found to be affected by season (Habeeb *et al.*, 1990a). When young rabbits start the solid feed consumption, here again the decreased feed intake and consequent scarce daily weight gain (Marongiu *et al.*, 2005) need to be considered as a possible cause of reduced litter size at weaning in summer. Furthermore exposure of adult female rabbits to heat stress adversely affects all their maternal cares towards the litter (Marai *et al.*, 2002). As a conclusion, our six-years investigation, featuring a considerable data set, underlines a significant effect of seasonal variation, mostly related to environmental temperature, on both the monitored parameters.

Nevertheless the numerical productivity at weaning, besides taking into account the viability of the young between birth and weaning, is also related to does reproductive efficiency (Lebas *et al.*, 1997). Therefore a statistical correlation between values of fertility and productivity, according to different months and seasons, needs to be performed as supplemented analysis to support our findings.

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