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EVALUATION OF BREEDING PERFORMANCE OF A LOCAL ALGERIAN RABBIT POPULATION RAISED IN THE TIZI-OUZOU AREA (KABYLIA)

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ABSTRACT: A total of 287 females of a local Kabyle population of rabbits were studied at the University of Tizi-Ouzou (Algeria) over 6 years. The females were mated for the first time at the age of 4.5 months and remated 10-12 days after parturition. The females were characterized by a medium to small adult weight (2.81 ± 0.38 kg) and a rather low prolificacy at birth and weaning (7.2 ± 2.5 total born, 6.1 ± 3.0 born alive and 5.4 ± 2.3 weaned). Based on the registration of 1377 mating attempts, acceptance of mating and conception rates were $74.3 \pm 3.8\%$ of presented does and $73.3 \pm 4.3\%$ of mated does respectively. The Algerian hot summer season did not seem to affect parameters of practical importance such as fertility or litter size at weaning. The only significant effect ($P < 0.01$) was a reduction of litter weight at weaning (-13%) compared with the average of the 3 other seasons (2070 vs 2368 g at 28 days). Acceptance and conception rates were not significantly affected by mating number. At first parturition, total number of kits (6.6/litter) was significantly lower than that of multiparous does (7.3 to 7.4), and individual birth weight of first litter kits was 10% lower than that observed for subsequent litters (51.4 g on average). On the other hand, it must be emphasised that for this sample of the Kabyle population, the kit's individual weight at weaning did not vary significantly with parturition number. Birth to weaning mortality was the lowest for parturition of rank 4 and more (9.8% vs 14.4 to 16.9% for previous ones).

Key words: rabbit, local population, Algeria, reproduction, season.

INTRODUCTION

In Algeria, there is a great necessity for increasing animal production to fulfil the ever growing demand for animal proteins. Rabbits provide an excellent source of

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protein for human consumption and may play a significant role in solving a part of the meat shortage in Algeria. Rabbits are characterised by a high reproduction ability with a short generation interval, so they can produce a high quantity of meat in a short period. The utilisation of local genetic resources requires a characterisation of the population existing in the country. Some measurements have already been made (BERCHICHE *et al.*, 2000; ZERROUKI *et al.*, 2001; 2002; 2003). The present study is a continuation of this work and describes the reproductive performance of does of this local population raised in the Kabylia region of Algeria (around Tizi-Ouzou). The growth performances of the young rabbits of this population have been described separately (LAKABI *et al.*, 2004)

MATERIAL AND METHODS

Animals

The work was carried out at the Animal Unit of the University of Tizi-Ouzou for six generations (each one being studied over one year of production) on a total of 287 reproductive females. The 32 females and 6 males making up the “G0” generation were acquired in 1998 from farmers in the Tizi-Ouzou region, and were roughly representative of the local rabbit population. To produce each of the five following generations (G1 to G5), about 40 females and 8 males were chosen from offspring of the best females (adapted to the breeding system, reproducing regularly and in a good state of health). Each generation was divided into families, composed of 1 male and 5 or 6 females descended from other families of the preceding generation, so as to minimise inbreeding.

Management

The breeding unit consisted of 46 breeding cages divided among three cells. The animals were housed individually in wire mesh cages arranged in a flat deck arrangement. The animals of the G0 and G1 generations received the same commercial rabbit feed containing 16.6% crude protein and 12.3% crude fibre. Another feed was formulated by the laboratory and fed to animals of the following

generations (17.8% crude protein and 14.4% crude fibre). The pelleted feed was given *ad libitum* and watering was automatic. Natural lighting was used for G0 to G2, but for G3 to G5, the lighting period was controlled and fixed at 16 hours per day. For each generation, the reproductive process was initiated mostly in the autumn. The reproductive rhythm was semi intensive (minimum interval of 10-12 days between kindling and natural mating attempt). Females were presented to a male for the first time when they were 4.5 months old. A diagnosis of gestation was made by abdominal palpation of the doe 10 days after mating. The females that proved negative or which had refused the male, were presented again to a male the following day. If they refused, they were not re-presented to a male until the following week. Females were eliminated after 5 successive failed matings (refusal or sterile). Receptivity was defined as the proportion of females which had accepted service, and fertility or conception rate as the proportion of mated females giving birth. Litter size and weight were determined at birth and at weaning (28th day after parturition).

Statistical analysis

Two models of analysis of variance were used. Both included the fixed effects of the generation (6 levels) and of the mating season (4 levels: autumn, winter, spring, summer). For the analysis of receptivity and conception rates and of mating weight of does, the effect of the mating order (5 levels: 1, 2, 3, 4, 5 and more) and the physiological status (lactating or not at mating) of the females within mating number were added. For the analysis of litter data (size, weight, mortality), the effect of parity order (4 levels : 1, 2, 3, 4 and more), the season of kindling and the physiological state of the females (lactating or not at fertile mating) within litter number were added. All the analyses were done with the SAS software (SAS, 1988). Only effects of mating or parturition number and of season are presented in the present paper. Results obtained after three successive mating failures were not taken into account in the analyses.

RESULTS AND DISCUSSION

Average characteristics of the local Kabyle population

The average doe's weight at mating was 2.8 kg (Table 1), a value similar to the 2.89 kg previously described for this population, but on the basis of a lower number of observations (ZERROUKI *et al.*, 2001). This value makes it possible to classify this population in the group of the small breeds such as *e.g.* Dutch or Himalayan rabbits (FFC, 2000).

Table 1: Effect of season and mating order on reproduction parameters and weight of does.

| | Receptivity rate (%) | Conception rate (%) | Weight at mating (g) |
|-------------------------------|-------------------------|------------------------|-------------------------|
| <i>Number of data</i> | 1377 | 1025 | 1025 |
| General mean | 74.3 | 73.1 | 2809 |
| RSD | 3.8 | 4.3 | 377 |
| <i>Effect of season</i> | NS | NS | *** |
| Autumn | 80.5 | 73.0 | 2763 ^a |
| Winter | 77.7 | 66.1 | 2864 ^b |
| Spring | 74.7 | 74.7 | 2864 ^b |
| Summer | 67.4 | 79.5 | 2702 ^a |
| <i>Effect of mating order</i> | NS | NS | *** |
| 1 | 77.3 | 65.8 | 2578 ^a |
| 2 | 72.4 | 71.5 | 2786 ^b |
| 3 | 76.6 | 75.2 | 2819 ^b |
| 4 | 75.3 | 73.8 | 2899 ^{bc} |
| 5 and more | 72.6 | 75.7 | 2975 ^c |

RSD: residual standard deviation.

Means within a row with different superscript differ ($P < 0.05$).

NS: Not significant. *** $P < 0.001$.

The mean receptivity rate of the studied population (74.3%) was similar to that observed by GARCIA and PEREZ (1989) for New Zealand does bred with the same reproductive frequency. The fertility and the prolificacy at birth or at weaning of the females of this local population were low (73.0%, 7.2 total born, 6.1 born alive and 5.4 weaned rabbits per litter, Table 2) compared with results obtained in well-managed French rabbit farms using selected strains of rabbits (77.1% and 7.7 weaned per litter; GUERDER, 2001). In Egypt, GALAL and KHALIL (1994) recorded conception rates in Giza White females in the region of 76% and in France KOEHL and VAN DER HORST (1998) recorded an average conception rate of 74.7% for the local "Normand" breed. On the other hand, KENNOU and BETTAÏB (1990) found a lower fertility rate of only 61% for does of local Tunisian population. Births outside the nest box and the poor maternal behaviour of some females, resulting in the loss of their whole litter, could partly explain the reduced prolificacy observed at birth in terms of kits born alive and the high proportion of kits counted as stillborn. The individual mean weight of the kits (49.4 g at birth and 451 g at weaning) was in agreement with the modest adult live weight of the studied population (2.8 kg). Mortality between birth and weaning recorded over the course of the study was 13.3%, a value between the 11.4% and the 15.7% obtained in France for birth to weaning mortality calculated on the basis of live kits maintained in the litters (after culling) and on the basis of the kits effectively born alive, respectively (GUERDER, 2002).

Effect of season

The season had a significant influence only on some of the reproduction traits of the females. The summer, characterized by high temperatures in Algeria (average of 30°C), did not affect significantly the receptivity and fertility of females (Table 1), whereas ARVEUX (1988) emphasised the difficulties of inducing fertile mating in hot weather. In fact, the highest receptivity rate was recorded in autumn (80 %) and the lowest in summer (67.4 %).

The lowest litter size at birth was observed in summer (*e.g.* 5.4 born alive *vs* 6.0 to 6.72) as it was for example observed in Spain by GARCIA *et al.* (2000) with selected strains. But at weaning, the differences between seasons were reduced (Table 2). Birth to weaning mortality was not significantly affected by season, but it was

numerically higher for autumn litters (19.6% vs 12 to 14.8%) perhaps related to the larger litter size. Individual kit's weight at birth or at weaning was not affected by the season. But due to the effect of litter size, litter weight at birth or at weaning was the highest in winter and the lowest in summer. In the same way, HASSAN *et al.* (1994) found a very clear reduction in litter weight at weaning for animals born in June or July in Egypt.

Effect of mating or parity order

The receptivity rate was not significantly affected by mating order (Table 1). In the same way, when mating was accepted by the female, the conception rate was not significantly affected by mating number despite a numerically lower value for the first matings. These results disagree with those of LAVARA *et al.* (2000), which observed a significantly better conception rate for nulliparous than for older rabbit does after artificial insemination (84% vs 63-67%).

At first parturition, total number of kits (6.6) was significantly lower when compared to that of multiparous does (7.3 to 7.4) as was, for example, observed by KOEHL and VAN DER HORST (1998) for the local French "Normand" breed managed in a similar way. But the differences in litter size in relation with parturition number were not significant for the number of kits born alive or weaned. Individual birth weight of first litter kits was 10% lower than that observed for subsequent litters (51.4 g on average). This lower weight was also related to a lower mother's weight. Female's weight was lower at first mating than in the following matings (2578 vs 2975 g for 5 matings and more). On the other hand, it must be emphasised that for this sample of the Kabylia population, the kit's individual weight at weaning did not vary significantly with parturition number. Mortality at weaning was the lowest for parturitions of rank 4 and more (9.8% vs 14.4 to 16.9% for previous ones).

Table 2: Effect of season and does parturition number on litter traits.

| | Litter size | | | Kits individual weight (g) | | Litter weight (g) | | Young mortality (%) | |
|-------------------------------|-------------------|-------------------|-------------------|----------------------------|-------|-------------------|--------------------|---------------------|--------------------|
| | Born alive | Total born | At weaning (28 d) | At birth | 28 d. | At Birth | 28 d. | Still-born | 0-28 d. |
| | | | | | | | | | |
| <i>Number of data</i> | 660 | 740 | 536 | 659 | 536 | 659 | 536 | 660 | 536 |
| Mean | 6.08 | 7.17 | 5.41 | 49.4 | 451 | 292 | 2289 | 16.4 | 13.3 |
| RSD | 2.54 | 2.43 | 2.26 | 9.9 | 112 | 113 | 803 | 23.2 | 20.2 |
| <i>Effect of season</i> | ** | ** | NS | NS | NS | *** | ** | NS | NS |
| Autumn | 6.42 ^a | 7.25 ^a | 5.14 | 50.5 | 471 | 325 ^a | 2281 ^a | 12.6 | 19.6 |
| Winter | 6.72 ^a | 7.68 ^a | 5.60 | 51.2 | 480 | 330 ^a | 2501 ^b | 13.1 | 14.8 |
| Spring | 6.03 ^a | 7.37 ^a | 5.55 | 49.0 | 446 | 294 ^b | 2321 ^{ab} | 18.4 | 12.0 |
| Summer | 5.44 ^b | 6.63 ^b | 5.06 | 49.0 | 432 | 261 ^c | 2070 ^a | 19.8 | 12.0 |
| <i>Effect of parity order</i> | NS | ** | NS | *** | NS | *** | ** | NS | * |
| 1 | 5.80 | 6.63 ^a | 5.16 | 46.4 ^a | 444 | 259 ^a | 2125 ^a | 14.2 | 14.6 ^{ab} |
| 2 | 6.22 | 7.28 ^b | 5.29 | 50.0 ^b | 453 | 305 ^b | 2226 ^{ab} | 16.2 | 16.9 ^a |
| 3 | 6.20 | 7.40 ^b | 5.33 | 51.1b ^c | 465 | 310 ^b | 2362 ^{bc} | 17.4 | 16.9 ^a |
| ≥4 | 6.25 | 7.40 ^b | 5.60 | 53.0 ^c | 465 | 321 ^b | 2441 ^c | 16.1 | 9.8 ^b |

RSD: residual standard deviation.

Means within a column with different superscript differ ($P < 0.05$).NS: Not significant. * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

CONCLUSIONS

This 6 years study confirms the first results obtained with this Kabylean rabbit population (ZERROUKI *et al.*, 2001). It is characterised by a low adult weight (2.8 kg), a moderate conception rate after natural mating (73.1%) and a relatively low prolificacy at birth and at weaning (7.2 total born with 6.1 live born and 5.4 weaned per litter born). For this population, the hottest Algerian period characterized by high temperatures (average of 30°C) has no significant effect on mating acceptance rate or on conception rate, nor on litter size at weaning. The only significant effect with practical consequences is a reduction of 11% of the litter weight at weaning (28 days).

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