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Efficiency of ovine artificial insemination in Ouled Djellal breed

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Abstract. In Algeria the artificial insemination is a common application in cattle and is at its beginnings in sheep. To assess the impact of this biotechnology on the control of reproduction in Ouled Djellal breed (OD), we conducted a study at the artificial insemination and genetic amelioration center (CNIAAG) in Biskra's department and at Bouchebaa's model farm in Constantine's Department. Our study focused on 350 ewes OD aged from 2 to 6 years and divided into two groups: (A) 300 ewes maintained at the farm Bouchebaa, rely on free mating, and (B) 50 ewes maintained at the CNIAAG – Biskra. Zootechnical performances are lower in group B (fecundity rate = 101% vs 66%, fertility rates = 86.70% vs 64% and prolificacy rate = 116,54% vs 103%, respectively for free mating vs AI); for the last two parameters, this difference was significant ($p < 0.02$). Concerning the success factors of AI, the statistical analysis revealed no significant difference for the age (9 months, 3, 4 or 6) or class (yearling or adult) ram used for the semen harvest. In conclusion we can say that the success rate of AI will never be similar to natural reproduction. So that farmers continue to show a limited interest for this technique. It should be noted that to date, the success rate recorded at AI sheep centers in Algeria vary from 46 to 76%. However in free mating it is almost impossible to determine the paternal ancestry of newborns.

Keywords. Artificial insemination – Free mating – Reproductive performance – Ouled Djellal breed.

Efficacité de l'insémination artificielle ovine chez la race Ouled Djellal

Résumé. En Algérie l'insémination artificielle d'application courante en élevage bovin, n'est qu'à ces débuts en élevage ovin. Pour évaluer l'impact de cette biotechnologie sur la maîtrise de la reproduction chez la race Ouled Djellal (OD) nous avons mené une étude pratique au niveau du centre d'insémination artificielle (CIA) [Wilaya de Biskra] et au niveau de la ferme pilote Bouchebaa [Wilaya de Constantine]. Notre étude a porté sur 350 brebis de race OD âgées de 2 à 6 ans et réparties en deux lots : (A) 300 brebis entretenus au niveau de la ferme Bouchebaa, misent en lutte libre et (B) 50 brebis entretenus au niveau du CIA, inséminées artificiellement. Les performances zootechniques sont les plus faibles pour le lot B (taux de fécondité = 101% pour la lutte libre contre 66% pour l'IA, taux de fertilité = 86,70% pour la lutte libre contre 64% pour l'IA et taux de prolificité = 116, 54% pour la lutte libre contre 103% pour l'IA) ; cette différence n'est significative ($p < 0,02$) que pour les deux derniers paramètres. Pour les facteurs de réussite de l'IA l'analyse statistique n'a pas révélée de différence significative quant à l'âge (9 mois, 3, 4 ou 6 ans) ou la classe (antenais ou adulte) du bélier utilisé pour la récolte de la semence utilisée pour l'IA. En conclusion nous pouvons dire que les taux de réussite de l'IA ne seront jamais similaires à la reproduction naturelle. Ce qui fait que les éleveurs continuent de manifester un intérêt mitigé pour cette technique. Précisons qu'à ce jour, les taux de réussite enregistrés au niveau des centres d'IA ovine en Algérie varient de 46 à 76%. Toutefois lors de lutte libre il est quasi impossible de déterminer l'ascendance paternelle des nouveaux nés.

Mots-clés. Insémination artificielle – Lutte libre – Performance de reproduction – Race Ouled Djellal.

I – Introduction

In Algeria, the sheep is a true national wealth, as can be appreciated through the high effective, which exceeds 22 millions (MARD, 2010) and the diversity of races (Chellig, 1992) that constitutes a good insurance for the future. However, breeding techniques currently used are general-

ly rudimentary and limit considerably the productive capacity of this species leading to a low productivity rate (Dekhili and Aggoun, 2006; Dekhili, 2010; Safsaf and Tlidjane, 2010) added to a relatively low carcass weight (Zouyed, 2005) thus contributing to a lack of red meat production. During the past five years, the price of kilogram of sheep meat has exceeded DA (Dinar Algerian) 1000 (around 9 Euro). Then, it is essential to find ways for improving the productivity of our sheep flock; this goes hand in hand with improving the control of reproduction, which is the centerpiece of the economic efficiency of any breeding. One of the major improvement methods is the artificial insemination that while permitting to limit the number of rams used, constitutes a sure means of genetic progress dissemination by the male pathway.

In Algeria, the creation of three regional centers of ovine artificial insemination COAI (wilayas of Naama: 2006, Biskra: 2008 and Tebessa: 2011) has led to the introduction of this technique in sheep and its national broadcasting. This technique already commonly applied in our cattle, is only in its infancy with respect to the sheep. Even so, the use of artificial insemination after control of oestrus in ewes can profit of all the benefits that offers this widespread biotechnology in the world; the complementarities of the two techniques (insemination and synchronization of estrus) is indisputable.

Synchronization techniques and induction of oestrus by hormonal treatments currently are experiencing a great development and a true popularization in our sheep farms, due to the awareness of farmers and the promising results obtained, thus demonstrating their success and efficiency in sheep in Algeria (Safsaf and Tlidjane, 2010). Whereas, the use of AI in sheep saw its numbers declined by almost 13,000 in 2008 to less than 2,000 in 2012; farmers are more reticent towards this technique, preferring the natural mating. The advantage of this technique in sheep is not only limited to obtain good results with the control cycles technique, but facilitates the establishment of selection schemes in the offspring as well. In this context, our work aims to show the effect of synchronization and AI on reproductive performances and productivity among the Ouled Djellal race.

II – Material and methods

1. Management of reproduction at Bouchebaa pilot farm

The Bouchebaa pilot farm: is located in the town of El Khroub (wilaya of Constantine eastern Algeria) at a latitude of 36°28'N and longitude of 6°62'E. The climate is Mediterranean continental semi-arid. At this farm, the study involved 21 breeding rams and 300 ewes, all these animals are Ouled Djellal race Hodna type and aged between 2 and 6 ans.

The breeding males are regularly subjected to a general and a special examination of the reproductive tract. Before being put to mating, they are prepared two months before by a flushing based on a milled mixture (90% barley, 10% corn + soya bean) at a rate of 600 g / animal / day and forage of oats, straw and water given *ad libitum*, and a vitamin-mineral supplement is included in the diet.

The induction and synchronization protocol of estrus in ewes is as follows. Sponges impregnated by the fluorogestone acetate (FGA) (Chronogest® – Intervet) 30 mg are put for 12 days. The day of the withdrawal of the sponge an intramuscular injection of 400 IU eCG (equine chorionic gonadotropin also called PMSG (pregnant mare serum gonadotropin)) (Folligon® – Intervet) is carried out. Forty eight hours after the withdrawal, the 21 spawning rams are distributed over five boxes each containing 30 sheep.

The management of reproduction, the planning for the implementation of the induction, the synchronization of oestrus and the mating protocol are detailed in Table 1. Pregnancy diagnosis was performed by ultrasound 45 days after removal of rams.

Table 1. Management and planning of reproduction in Bouchebaa pilot farm)

| | | Spring free mating (mating by group) | |
|-----------|---|--------------------------------------|-------------------------|
| | | First period of mating | Second period of mating |
| Rams | total number used | 21 | 21 |
| Sheep | number of sheep used in mating | 150 | 150 |
| Sex ratio | | 4 rams / 30 sheep | |
| Procedure | Put of sponge | 21 April | 3 May |
| | Remove of songe + PMSG | 3 May | 15 May |
| | Putting in reproduction (introduction of rams) | 5 May | 17 May |
| | Withdrawal of rams | 8 May | 20 May |

2. Preparation, synchronization and insemination of sheep at the AI center

COAI is located in the town of Ouled Djellal (wilaya of Biskra: south eastern Algeria), at a latitude of 34°25' N and a longitude of 5°40' E, the climate is arid. At this center, our study included a total of 50 Ouled Djellal ewes, aged between 2 and 6 years, and the semen used for AI is harvested from six rams (3 adults, 3 yearlings). The ewes are separated from males in a pilot farm annex to the center. A week before the establishment of the oestrus synchronization protocol, these ewes were prepared to mate by the distribution of an energy supplement based on barley (400g/animal / day) and a vitamin-mineral supplement, additional to fodder made of straw. This flushing lasted until the early weeks of gestation. The beginning of the synchronization protocol by vaginal sponges impregnated by the fluorogestone acetate 40 mg (FGA) (Chronogest® – Intervet) was conducted. on 20-04-2010 and ended on 03/05/2010, either a deposit of 14 days. The day of the withdrawal of the sponge (03-05-2010 at 07:30 h) it was injected to the animal by intramuscular 400 IU eCG (Folligon® – Intervet). Fifty five hours after the withdrawal (the 05/05/2010 at 14:30 h), an artificial insemination was performed with fresh semen of one of the six rams prepared in the center of AI in Ouled Djellal. Pregnancy diagnosis was performed by ultrasound on 10-07-2010 (about 65 days after AI).

3. Statistical analyses

The results were subjected to analysis using ANOVA and Chi 2 test (to one factor), by the Software Minitab 15 for determining the effect of the mating method on zootechnical performances and effect of age and / or class of the ram on the success of AI. The threshold of signification was set at $p < 0.05$.

III – Results and discussion

For the freestyle mating, on a total of 300 ewes exposed to males, we obtained the following results:

- Number of non-pregnant ewes: 40
- Number of pregnant ewes: 260
- Number of abortions: 06
- Number of lambs born (alive at birth, dead or runts): 303
- Number of lambs born alive at birth: 297

From these results we calculated: fecundity [number of offsprings born /ewes exposed to males (Chentouf *et al.*, 2003)], fertility [percentage of ewes lambing of ewes exposed to males (Dettmers *et al.*, 1976; Awotwi and Fynn, 1992)] and prolificacy [lambs born/ewe lambing (Dzakuma *et al.*, 1982)] rates, these parameters can be used in small ruminants as criteria for evaluation of reproductive efficiency :

- Fecundity rate = 101%
- Fertility rate = 86,70%
- Prolificacy rate = 116,54%

Table 2. Effect of artificial insemination on zootechnical performance of reproduction

| Zootechnical performance | Insemination | Free style mating | Signification |
|--------------------------|--------------|-------------------|-----------------|
| Fertility | 64% | 86.70% | p< 0.02 |
| Prolificacy | 103% | 116.54% | p< 0.02 |
| Fecundity | 66% | 101% | Non significant |

Zootechnical performance of reproduction are lower in AI group in comparison to the freestyle mating group, with a fecundity rate of 66% vs 101%, a fertility rate of 64% vs 86.70% and a prolificacy rate of 103% vs 116.54%. The differences are significant ($p < 0.02$) only for fertility and prolificacy. Belkasmı *et al.* (2010), found results which also go in the same direction, with lower fertility rates at AI than ours, 43% for AI against 90% for freestyle mating. Whereas prolificacy rates at AI are higher than ours with 152% but lower 108% for freestyle mating. Also Dekhili and Aggoun (2007) during freestyle mating obtained lower rates for prolificacy 109% while Dekhili. (2010) noted in ewes Ouled Djellal, conducted in an extensive breeding, fertility rates of around 93% and prolificacy rate of 110%. These differences are explained by the variability of the conduct and management of livestock. Whereas the weaker success rates of AI compared to freestyle mating could be explained by several factors: the axe of the centers action which is very weak because of the limited time of semen conservation (average 8:00) and therefore a risk of deterioration of sperm quality during the period of transport. To this handicap, we can add the limited lifespan of sperm in the diluents used, the usual anarchic management at our farms (often unbalanced nutrition especially during critical phases of pregnancy in sheep, lack of zootechnical and health surveillance by professionals, etc.), and the novelty of this technique in Algeria. This makes farmers continue to show a mild interest for this technique which, up to now, has not given good results (success rates recorded at the AI sheep centers in Algeria vary from 46 to 76%).

Otherwise we impute often wrongly to the ewes the balance-sheet of reproduction, while the responsibility of the male is also to be considered, as noted by Colas (1976). According to Augas *et al.* (2010) the role of ram is essential on the results of reproduction because it acts both on fertility and prolificacy (also depending on the aptitudes of the sheep). In our study the statistical analysis for the factors of success of the AI related to males, has not revealed any significant difference in age (9 months, 3, 4 or 6 years) or class (yearlings or adult) of the ram used for harvesting the semen used for AI.

According to Augas *et al.* (2010) in sheep, fertility rates obtained after a synchronized free mating are qualified as: bad (0 to 40%), medium (40 to 60%), and good (60 to 100%).

By analyzing the results obtained at the farm Bouchebaa we can say that the fertility rate obtained is considered to be good. This can be explained by certain rules of reproduction management:

- Respect of the estrus synchronization protocol.

- Preparation of rams by flushing, started two months before the beginning of the reproduction season.
- Male / Female Ratio: a ram / 6-7 ewes slightly lower than indicated by Augas *et al.* (2010) which recommend a ram / 4-5 adult ewes.

This method of reproduction presents as a main advantage, its ease of implementation compared to the AI or the mating by hand ; however, with this method, it is almost impossible to determine the paternal ancestry of newborns and therefore no selection program can be considered.

IV – Conclusions

This study shows that the rates of artificial insemination success are low, but even with these low rates this technique is important because it optimizes the aptitudes of reproduction of our livestock and preserve our sheep genetic patrimony by purification, improvement, and formalization (Genealogical card) of the Ouled Djellal race. So it is recommended to educate farmers about the benefits of artificial insemination, in order to ensure a better profitability in sheep farms. It is to be especially highlighted that the rams of OD race are resistant to photoperiod variation, which avoids the use of solutions that are often expensive (hormonal treatment or light) for the maintenance of males sexual activity.

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