



Training rams to court and mate female goats



Agustín Orihuela^a, Rodolfo Ungerfeld^{b,*}

^a Facultad de Ciencias Agropecuarias de la Universidad Autónoma del Estado de Morelos, Avenida Universidad 1001, Colonia Chamilpa, Cuernavaca, Morelos 62210, Mexico

^b Departamento de Fisiología, Facultad de Veterinaria, Universidad de la República, Montevideo, Uruguay

ARTICLE INFO

Article history:

Received 23 March 2015
Received in revised form
31 December 2015
Accepted 4 January 2016
Available online 19 January 2016

Keywords:

Goat
Inter-specific stimulation
Learning
Sexual behavior
Sheep
Socio-sexual signals

ABSTRACT

As Saint-Croix rams (sheep) exhibit low seasonal reproductive changes, they could be effective in inducing a reproductive response during the non-breeding season in anestrus does (goats) of breeds whose bucks show low reproductive activity. Three management practices for training rams to court and mate anestrus does were compared. Yearling rams were: (1) housed with pregnant goats (PrG); (2) kept as a unisexual group, and exposed individually to a restrained non-receptive female goat four times a week (GoG); and (3) kept as a unisexual group, and during the first two sexual tests (week 1), a non-receptive ewe was used as stimulus immediately before being replaced by the non-receptive goat (EwG). Each ram was individually exposed to a non-receptive doe two times/week on weeks 0 (pre-treatment response), 1 and 4, and the rams' sexual behavior was recorded during 30 min. On Week 0, no ram displayed any sexual behavior. EwG and GoG rams displayed more sniffs than PrG ($P=0.025$ and $P=0.002$ respectively). The number of flehmens displayed by EwG and GoG rams was greater than the number displayed by PrG rams (EwG vs PrG: $P=0.006$ and GoG vs PrG: $P=0.028$). Rams prestimulated with goats (GoG) licked more than those housed with pregnant goats (PrG) ($P=0.009$); those stimulated with ewes (EwG) tended to lick more than PrG rams ($P=0.09$). Rams prestimulated with goats (GoG) kicked more times than those housed with pregnant goats (PrG) ($P=0.007$), without differences between EwG and PrG rams. Rams housed with pregnant goats did not display any mounting behavior (attempt to mount, mounts, or ejaculations) in any test. The number of mounting behaviors did not differ between groups in the first two tests. EwG rams performed more ($P=0.006$) and GoG rams tended to engage in more ($P=0.058$) attempted mounting than PrG rams. GoG rams mounted more times than EwG ($P=0.048$) and PrG ($P=0.017$) rams. Rams prestimulated with ewes (EwG) ejaculated more times than GoG and PrG ($P<0.0001$ for both) rams. Similarly, EwG rams had a significantly greater ratio of ejaculations/(mounts + ejaculations) throughout the tests than GoG ($P=0.0034$) and PrG ($P=0.0007$) rams. It was concluded that rams can be trained to court and mount female goats. Pre-stimulation with does or ewes before having them join the goats stimulated the display of sexual behavior. However, while in general prestimulation with goats resulted in more courtship behaviors, prestimulating with ewes seemed to be the best strategy to obtain the best results in mating behavior and serving capacity.

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1. Introduction

Northern Mexico is the main region in the country in production of goat milk and meat. In this region it is common that sheep and goats are maintained together as a single flock under mixed production systems (Degen, 2004; Animut and Goetsch, 2008). Most goat breeds show a seasonal reproductive pattern mainly determined by photoperiod (see reviews: Lincoln and Short, 1980; Delgadillo et al., 2004). Female Saanen and Alpino goats exhibit an anestrus

period from March to August (Sáenz-Escárcega et al., 1991). Sheep raised in this region are mainly of hair breeds such as Saint-Croix, a non-seasonal breeder, in which rams exhibit constant reproductive activity throughout the year (Aguirre et al., 2007; Sánchez-Dávila et al., 2011).

The sudden introduction of sexually active bucks to groups of anoestrus does induces ovulation and estrous behavior in most females (the buck effect; for review, see: Delgadillo et al., 2009). As this is an easy and inexpensive technique, it is commonly used by farmers to obtain out-of-season pregnancies, and thus produce kids according to seasonal market needs. However, bucks of these breeds also show seasonal changes in their reproductive activity, with a decrease from December to May that is observed even if

* Corresponding author. Fax: +598 26280130.
E-mail address: rungerfeld@gmail.com (R. Ungerfeld).

they receive high amounts of food (Duarte et al., 2008). Therefore, these bucks are ineffective in inducing cyclic activity in anestrus goats unless they are subjected to light regimen treatments in order to stimulate their effectiveness for the buck effect (Flores et al., 2000). However, it may be difficult for small farmers to include this management practice in their productive system.

Knight et al. (1983) demonstrated that both rams and bucks can stimulate ovulation in anovular ewes. Similarly, Ichimaru et al. (2008) demonstrated that exposure of anestrus goats to rams' wool, which in the ram is the main source of stimulating chemical signals (Knight and Lynch, 1980), provokes the activation of their GnRH pulse generator. This demonstrates that rams, similarly to bucks, can potentially stimulate hypothalamic activity and thus, pituitary and ovarian activity in anestrus does. However, a practical limitation of this practice is that rams might not recognize female goats as sexual partners. Therefore, it is important to train rams from non-seasonal breeds to recognize anestrus goats as possible sexual partners, and thus use them as teasers to stimulate the ovulation in anestrus goats. In this study we compared the effectiveness of three management practices for training non-seasonal Saint-Croix rams to court and mate anestrus does.

2. Materials and methods

2.1. Animals and husbandry

All experimental procedures were reviewed and approved by the Animal Care and Use Committee of the Universidad del Estado de Morelos, Mexico. The experiment was carried out in an experimental station located in Morelos, Cuernavaca (Mexico, 18°37'N, 99°19'W) during the month of September. Twenty four sexually naïve yearling Saint-Croix rams (50.7 ± 0.3 kg) had remained together as a single group since weaning at 2 months of age, isolated from ewes and does in an open-sided barn under natural lighting. All animals were fed a maintenance diet of forage and concentrate, and they had access to water *ad libitum*.

2.2. Experimental treatments

Rams were assigned to one of three treatments: (1) seven rams were housed with seven pregnant Saanen goats (body weight = 49.6 ± 0.7 kg) during the study period (PrG); (2) seven rams were kept as a unisexual group, and were exposed individually to a restrained non-receptive female goat for 15 min four times a week on Tuesday, Wednesday, Thursday and Saturday (GoG); and (3) 10 rams were also kept as a unisexual group but during the first two sexual tests (see Section 2.3) these rams were pre-stimulated with a non-receptive ewe during 15 min immediately before being replaced by the non-receptive goat of the sexual test (EwG). The groups were maintained in these conditions during 4 weeks.

To minimize variation in their response to the rams the does used to tease rams in the GoG and EwG groups, and the ewes used for teasing the EwG rams were secured in a portable station fixed in the middle of a 5×5 m pen. The station was equipped with plastic walls to isolate them from visual distractions and from the sight of other rams. The structure was similar to that used to feed them so they were used to it. They did not show pain or fear during the testing period and no female attempted to escape while restrained in the structure. Rams were released one at a time in random order and given freedom to display their sexual repertoire to the females.

EwG rams were allowed to display courtship to the pre-stimulus ewes. When one of these rams made any attempt to mount, it was held back by a person standing about 3 m from the back of the ram. This procedure was done to keep the rams sexually stimulated and to encourage them to mount the goat later during the first two

sexual tests. The non-receptive status of pre-stimulated animals was confirmed by previous detection using teaser males.

2.3. Sexual tests

All rams were evaluated using sexual performance tests that consisted of exposing rams individually to a non-receptive female goat for 30 min two times per week (Mondays and Fridays) on weeks 0 (pre-treatment response, tests -2 and -1), 1 (tests 1 and 2) and 4 (tests 3 and 4). During these tests only a non-receptive female goat was restrained in a portable station attached to the floor in the middle of the pen. The rams were tested using a random order over test days to control for testing sequence effects and variation due to time of day.

Sexual tests were performed between 08:00 and 14:00 h, in two contiguous 5×5 m² test pens, different from that in which rams were exposed to does. Two rams were tested simultaneously in these two pens by a single observer (the same observer in all tests). Pens were separated by solid walls which precluded visual contact between rams. A single observer monitored both pens and manually recorded behavioral data.

2.4. Sexual behaviors

During the sexual tests, the observer recorded whether or not the rams investigated and courted the stimulating female goat, recording when the ram sniffed the anogenital region of the goat, performed the flehmen reaction, licked the female, or when the ram raised his foreleg toward the female goat. In addition, the observer recorded the number of attempts to mount, the mounts (the ram becomes firmly planted on the ewe's rump) and the ejaculations (services, characterized by the ram tossing his head upwards while arching his back and thrusting his hips forward). The ratio of ejaculations/(mounts + ejaculations) was later calculated, and was considered as 0 when there were no mounts and ejaculations.

2.5. Statistical analysis

No rams displayed sexual behaviors in tests -1 and -2, performed on week 0 prior to exposure to treatments, which preclude statistical analysis. Therefore, only tests 1–4 were included in the analysis. The frequencies of each behavior were compared using a mixed model analysis of variance using the Mixed Procedure of SAS software (version 9.1.3, SAS Institute, Cary, NC, USA), considering the treatments (training method); the number of sexual test (repeated measure); and the interaction of the treatment and the number of sexual test as the main factors considered in the model. The ram was considered a random effect into each treatment. The level of significance was set at $P=0.05$. Results are presented as LSmeans and standard errors.

3. Results

In tests -1 and -2 no ram displayed sexual behaviors, which precludes statistical analysis. Therefore no results are presented.

3.1. Main effects in sexual tests

The main effects of the model are presented in Table 1. Treatments affected all the behaviors and there were significant interactions between treatments and the number of test for all the studied behaviors. The number of test affected the frequencies of kickings, mounts and ejaculations, and tended to affect the frequency of flehmen, lickings and mount attempts (Table 1).

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