



Towards a Sustainable Reproductive Sheep Management: Use of Photoperiod-Treated Rams to Increase Lamb Production in an Organic Farm



Carlos Palacios¹ and José-Alfonso Abecia^{2*}

¹*Departamento de Construcción y Agronomía, Facultad de Ciencias Agrarias y Ambientales, Universidad de Salamanca, Spain*

²*Department of de Producción Animal y Ciencia de los Alimentos, Facultad de Veterinaria, Universidad de Zaragoza, Spain*

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***Corresponding author:** José-Alfonso Abecia, Instituto Universitario de Investigación en Ciencias Ambientales (IUCA) Dept de Producción Animal y Ciencia de los Alimentos, Facultad de Veterinaria, Miguel Servet, 177, 50013 Zaragoza, Spain, Tel: +34876554159; Email: alf@unizar.es

Abstract

The aim of this experiment was to determine the effect of the exposure of 45 days of long days without exogenous melatonin, on the results of a ram effect in June in a Churra sheep organic farm. Eight rams were divided into two groups, so that half of them exposed to 45 days of long days (16 h of light/day) from 15 Apr to 31 May (Artificial photoperiod, AP rams), and the remaining rams were under the natural photoperiodic conditions (NP rams). On 15 June, rams were introduced in two groups of ewes, which had previously been isolated from rams: AP-group (n=72), mated with AP rams, and NP-group (n=72), mated with NP rams. Proportion of ewes pregnant (fertility) was significantly higher in the AP-group of ewes (68%), compared with the NP-group (42%) ($P < 0.001$). No differences between groups were observed for the number of lambs born per lambing (prolificacy) (NP: 1.13 ± 0.06 ; AP: 1.18 ± 0.09), but the number of lambs born per ewe (fecundity) was significantly higher in the AP-group (0.81 ± 0.08) than in the NP-group (0.47 ± 0.08) ($P < 0.01$). In conclusion, the use of rams exposed to long days to be used in organic farms in spring is possible avoiding the use of exogenous hormones, providing a new and sustainable approach to the reproductive control of sheep flocks, especially in organic farms.

Keywords: Organic; Sheep; Ram effect; Light

Introduction

One of the main consequences of the conversion to the practices of organic livestock farming from the conventional management is the application of the official legal framework, especially regarding the use of hormones for the control of the sexual cycle. This is one of the main issues which must be faced when converting into organic production and this prohibition is a problem for sheep farms that intend to make a genetic improvement, since the use of artificial insemination is limited. In the European Union this regulation is under the Council Regulation for the Organic Production and Labelling of Organic Products [1].

The "ram effect" [2], which involves the reintroduction of males to a flock of ewes in anestrus that had been isolated from rams, has been used to advance the breeding season in commercial sheep flocks [3], and it is a useful alternative for organic farming, when the administration of hormones is not allowed. Although the ram's pheromones are the main stimulus

in the ram effect, the intensity of the sexual behavior displayed by the ram influences the quality of the response [4]. Thus, it is likely that the use of sexually-activated rams by light management and/or melatonin implants could improve the response of ewes after ram introduction.

In the last three years, our research group has developed management protocols for sheep flocks that have opened new expectations to the possibility of proposing sustainable systems in the reproductive management of sheep. Thus, we have shown that sexually activated rams in spring by exposure to long days for two months plus melatonin implants prolong the ovarian and estrous activity of Rasa Aragonesa ewes in spring, practically suppressing their seasonal anestrus [5], advance the reactivation of sexual activity of ewes in the middle of seasonal anestrus, when they lamb at the end of the reproductive season [6], or induce the puberty of ewe-lambs born in September [7]. In addition, these photoperiod-melatonin treated, sexually-

activated rams, when used in a ram effect, significantly increase the proportion of pregnant sheep and the number of lambs born per ewe in May [8]. In relation to the treatment, and focusing on the possibilities of organic farming, we have verified that the elimination of melatonin implants does not modify either testosterone secretion or sexual behaviour of rams [6]. However, the practical use of activating rams by only long days and its use in organic farms remain to be elucidated. The objective of this work was to study whether or not the use of rams exposed to 45 days of long days, without melatonin, for a ram effect in June, improves the reproductive performance of ewes in an organic sheep farm.

The experiment was conducted at an organic sheep farm located in Fariza, Spain (41 °N). The care and use of animals were in accordance with the Spanish Policy for Animal Protection RD1201/05, which meets the European Union Directive 2010/63 on the protection of animals used for experimental and other scientific purposes. Eight Churra rams were assigned to two groups: photoperiod-treated rams (Artificial Photoperiod, AP; n=4), exposed to 45 long days (16 h of light/d) between 15 April and 31 May, and control rams, exposed to the natural photoperiod (Natural Photoperiod, NP; n=4). Artificial light was provided in the morning (06:00 to 09:00) and the evening (16:00 to 22:00), controlled by an electronic timer, and light intensity was >300 lx at the eye-level of the animals [9]. At the end of the long-day period, AP rams were returned to the natural photoperiod. Control rams were kept in a shaded, open pen and exposed to natural photoperiod variations (15 h and 12 min, and 9 h and 10 min of light at the summer and winter solstices, respectively), so that they were not sexually activated in spring.

A total number of 144 Churra ewes (2-5 years old), isolated from rams at least five months before ram introduction, and in their third month after lambing, were assigned to one of three groups, which were balanced for live weight and body condition, and allocated to different pens: ewes mated with AP rams (AP-group, n=72), or ewes mated with NP rams (NP-group, n=72), between 25 June (ram introduction) and 10 August.

Pregnancy rate (number of pregnant ewes/number of ewes exposed to rams) was determined by transrectal ultrasound, 30 days after the introduction of the males, and confirmed after lambing. Fertility (number of ewes lambing/number of ewes exposed to rams), prolificacy (number of lambs born/number of ewes lambing) and fecundity (number of lambs born/ewes with rams) were determined at parturition. Percentages of pregnant ewes were compared by Fisher's exact probability test, and prolificacy and fecundity (\pm S.E.M.) were compared by ANOVA.

The introduction of AP rams produced significant differences in the proportion of AP-ewes pregnant (68%) in comparison with the NP-group (42%) ($P < 0.001$). No significant differences between groups were observed for prolificacy (1.18 ± 0.09 vs. 1.13 ± 0.06 lambs/lambing ewe, for AP and NP-groups, respectively), but fecundity of AP-ewes (0.81 ± 0.08 lambs/ewe) was significantly

higher ($P < 0.01$) than NP-ewes (0.47 ± 0.08 lambs/ewe). These results are similar to our previous reports in Rasa Aragonesa ewes in May, when rams exposed to long days and implanted with melatonin improved 22% lambing percentage [8]. In this experiment, our treated rams gave rise 0.34 extra lambs per ewe, also comparable to the Rasa Aragonesa experiment (0.44 extra lambs) [8]. Thus, the absence of the hormonal support in this organic farm was not an obstacle for rams to reach reproductive performances similar to the conventional treatments. Lambing curve (Figure 1) was similar in both groups and different to the classical lambing curves after a ram effect [10]. This could indicate that at least in part, differences between rams in the present experiment were due to differences in libido or semen quality, more than a different ovulatory response in the AP-group of ewes, as we have demonstrated before [11].

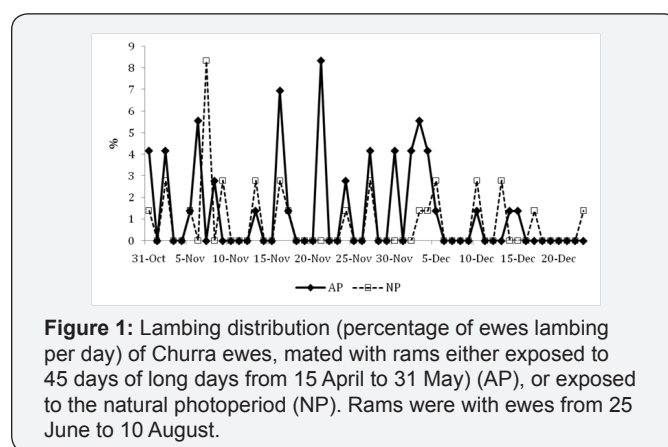


Figure 1: Lambing distribution (percentage of ewes lambing per day) of Churra ewes, mated with rams either exposed to 45 days of long days from 15 April to 31 May (AP), or exposed to the natural photoperiod (NP). Rams were with ewes from 25 June to 10 August.

Conclusion

In conclusion, the use of rams exposed to long days to be used in organic farms in spring is possible avoiding the use of exogenous hormones. These rams increased fertility and fecundity of ewes compared with control rams, providing a new and sustainable approach to the reproductive control of sheep flocks, especially interesting in organic farms.

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