

New light control method - light extension

By Johanne Cameron, M.Sc. (CEPOQ, La Pocatière, QC), François Castonguay, PhD, and Mireille Thériault, M.Sc. (Agriculture and Agri-Food Canada, Québec, QC)

Adapted from a presentation to the 2011 Profitable Flock Expansion Seminars held in Atwood and Napanee, Ontario in November, 2011.

In the light control program (AAFC type CC4) described in the last issue of Sheep Canada, the facilities required for sheep undergoing long daylengths simply involve having a warm section of the barn for lambing. But providing the necessary short daylength is more difficult because it requires a closed area, blocked off from outside light but comfortable enough for mating in the summer. This is difficult or impossible on farms where the barns are open-sided, made of transparent fabric or where they have slatted sides. It is also unworkable for operations that rely on being able to graze their sheep, unless they bring the animals in and out at scheduled times each day. The light extension project was conceived as a solution for these producers.

Principles of light control

Before explaining the light extension principle, let us review light control concepts:

1. In order for ewes to cycle in response to a period of short days (SD), they must first have been exposed to a period of long days (LD). This is why LD and SD sequences are alternated in the conventional light control program (three months of LDs in the winter, followed by three



A group of ewes on a traditional light control system enter an old chicken barn with no windows to begin their short days (SD) period.

months of SDs in the spring) as well as in the AAFC type CC4 program (four months of LDs, followed by four months of SDs, year-round). This method allows for estrus induction at a specific time after ewes start the SD period.

2. The duration of light that defines a SD or a LD depends on what the ewe has experienced in the past. Simply put, a ewe exposed to 12 hours of light per day will perceive this as a LD if she was previously exposed to eight hours of light per day, but will perceive it as a SD if she was previously exposed to 16 hours of light per day.
3. The difference between the LD and SD periods must be at least six hours of light (eight is optimum), so that the animal perceives a significant lighting difference and changes its sexual activity.

With these principles in mind, we wondered if the natural light outside could act as a SD. The fluctuations in light observed outdoors between seasons were a major constraint. The shorter days in late summer and fall are a natural SD period. But after the shortest day of the year (December 21st; about eight hours), the days gradually lengthen (by two to four minutes per day) until June 21st, when they are about 16 hours long. In order for this time of year to seem like a SD period to the animals, they would have to be exposed beforehand to much *more* than 16 hours of light per day. Therefore, to use natural outdoor light for the SDs, we would need to extend the length of the LDs to 22 hours of light per day, which is where this project got its name.

The light extension program

Starting from the AAFC type CC4 lighting schedule described in detail

in the last issue of Sheep Canada, we took the same production model and replaced the SDs of eight hours of light with natural daylight, and extended the LDs of 16 hours of light to 22 hours of light per day.

The project began in the fall of 2007 and involved three groups of Dorset females from CEPOQ. One group of ewes underwent the conventional AAFC type CC4 program (LD - 16 hours/day; SD - 8 hours/day). The second group was exposed to the light extension protocol. The third group received only naturally occurring light at all times. Ewes in all three groups underwent the same intensive production schedule, targeting three lambings in two years. They were mated at the same time and received the same care (shearing, vaccination, hoof care, feeding, etc.). All of the ewes underwent two months of LDs (16 hours of light) and two months of SDs (eight hours of light) at the beginning of the study, before the three treatments were applied.

The research team then monitored the performance of the animals over a two-year period, from the fall of 2007 to the spring of 2010 (Table 1).

The control ewes (natural light only) were surprisingly fertile (75%) when mated out-of-season (June 2008). This could have resulted from the natural ability of the CEPOQ Dorset flock to breed out-of-season,



The extension light control program was developed to make it possible for producers with open barns such as this one to still practice light control.

or from the fact that the rams used to breed all three groups of ewes (even the controls) were subjected to light control to improve their out-of-season breeding ability.

For the two other matings in the control group, fertility was as expected for ewes exposed to natural daylight: greater than 90% in season, and around 80% at the end of the breeding season.

The overall performance (annual fertility of 86.4%) of the females exposed to the conventional AAFC type CC4 protocol was comparable to that

obtained during previous trials on this schedule (see Spring 2012 issue of Sheep Canada).

For the females exposed to the light extension protocol, the results obtained were somewhat encouraging, with nearly 80% fertility during the June 2008 mating. However, their performance did not significantly exceed that of the control ewes. Under these conditions, we are unable to draw any clear conclusions about the light extension protocol. To determine its effectiveness, a much larger study involving a greater number of animals

Table 1. Fertility and prolificacy in three groups of ewes.

		TREATMENT		
Date of mating	Data	AAFC type CC4	Extension	Control group
Ram introduction #1	Number of ewes	31	34	32
Out-of-season period	Fertility	83.9 %	79.4 %	75.0 %
Jun 12 to Jul 17, 2008				
Ram introduction #2	Number of ewes	30	33	29
End of breeding season	Fertility	93.3 %	93.9 %	79.3 %
Feb 6 to Mar 13, 2009				
Ram introduction #3	Number of ewes	28	31	28
Normal breeding season	Fertility	82.1 %	83.9 %	92.9 %
Oct 5 to Nov 9, 2009				
Final average	Fertility	86.4 %	85.7 %	82.4 %

would have to be conducted, in various environments and using several groups of ewes mated at various times out-of-season and, above all, using breeds with little or no natural out-of-season breeding ability.

Requirements for using the new light extension protocol

The light extension protocol has some requirements in terms of buildings. Producers wishing to use this protocol must have a warm area for lambing. When the ewes are in the natural light period (SDs), they must not be in the same area as ewes in LDs, or next to them; otherwise they will be partly exposed to the LD treatment.

The protocol requires alternating between LD periods (LD building) and SD periods (in natural light). As a result, two separate buildings or areas will be required: a heated section for lambing (which will be in LD) and another section where the animals are exposed to daylight at the designated

time on the schedule (open-sided, transparent fabric, slatting, natural ventilation, etc.).

The most important prerequisite for applying either method of light control, or for any intensive production, is excellent livestock management. Thus, any producers wishing to use this light extension protocol must have sound management in terms of feeding and flock husbandry (livestock care, shearing, hoof care, controlling livestock density, cleaning buildings, removing manure, washing, disinfecting, etc.).

Deviations from the protocol, as well as suboptimal body condition in breeding females, will result in lower fertility. Light control protocols should not be implemented haphazardly or at just any time of the year. Support from a properly trained and qualified advisor is required. Remember that any management protocol must be adapted to the circumstances of the production system to obtain the desired results.

Costs involved in the light extension technique

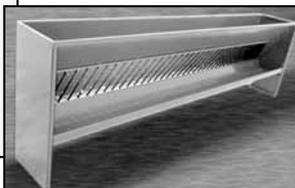
Producers who wish to use the light extension technique and who already have several livestock areas or buildings will not incur any extra costs to set up a facility for SDs (in contrast to traditional light control where these would have to be perfectly lightproof and adequately ventilated). However, the lengthening of the LD period may mean higher electrical bills. This is why businesses with open buildings will benefit the most from this type of protocol. In sheep barns that let the light in and have sufficient light intensity during the day, it is conceivable that operators could turn the lights on at sunrise and off at dusk in order to ensure that the animals receive 22 hours of light/day. In this way, less electricity is needed than with a conventional light control program. Approximately six hours of electricity will be needed each day during the summer and 14 hours during the winter. Table 2 shows the extra costs

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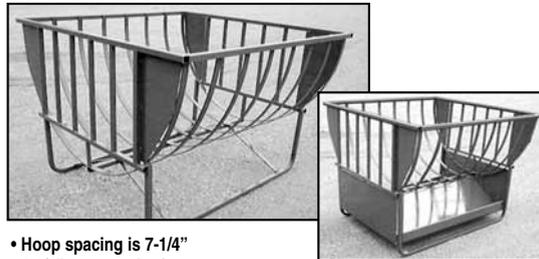
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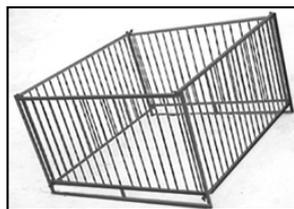


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Table 2. Total annual costs of using the light extension technique (lighting and ventilation) by regimen (intensive or moderate), and type of existing buildings.

	LONG DAYS	SHORT DAYS	100W LIGHT BULBS	28W LIGHT BULBS
INTENSIVE REGIMEN*	Isolated barn stable (gestation and lambing)	Isolated barn stable (end of lactation and matings)	Lighting = \$12.31 Total = \$17.12	Lighting = \$3.45 Total = \$8.25
	Isolated barn stable (gestation and lambing)	Natural ventilation, isolated (end of lactation and matings)	Lighting = \$10.28 Total = \$12.82	Lighting = \$2.88 Total = \$5.42
	Natural ventilation, isolated (gestation and lambing)	Isolated barn stable (end of lactation and matings)	Lighting = \$7.74 Total = \$7.86	Lighting = \$2.17 Total = \$2.29
	Isolated barn stable (gestation and lambing)	Isolated barn stable (end of lactation) and cold barn (matings)	Lighting = \$12.17 Total = \$16.15	Lighting = \$3.41 Total = \$7.39
MODERATE REGIMEN**	Isolated barn stable (gestation, lambing) / cold barn (post-weaning)	Closed cold barn (matings)	Lighting = \$10.28 Total = \$12.77	Lighting = \$2.88 Total = \$5.36
	Natural ventilation, isolated (gestation, lambing) / cold (post-weaning)	Closed cold barn (matings)	Lighting = \$7.74 Total = \$7.80	Lighting = \$2.17 Total = \$2.23

* Intensive regimen – 1.5 lambings/ewe/year. The lambs are transferred to SD during lactation = isolated barn.
 ** Moderate regimen aimed at 1.35 lambings/ewe/year. The lambs are not transferred with their mothers to SD.

that will be incurred, depending on the breeding regimen and the facilities used for the LD and SD periods.

Conclusion

All sheep production systems are affected to some degree by seasonality. Producers need to extend lamb production over the entire year, not only to keep their position in the market, but also to ensure regular income. As business managers, producers must achieve this goal as efficiently as possible. Accelerated production programs have often been criticized for increasing productivity but not making a proportionate profit.

Hormonal methods of inducing out-of-season breeding are expensive and often disappointing. Producers investing time, money and effort in out-of-season breeding practices have

high expectations in terms of technical/economic outcomes. In reality, there is room for significant improvement.

By using a light control program, such as the AAFC type CC4 program or one of its variations, a good balance can be struck between productivity and profitability. This new method results in excellent fertility and prolificacy performance throughout the year. When using it, indispensable management parameters can be integrated into livestock operations and optimal use made of existing buildings.

The light extension protocol could be very beneficial for producers who do not have light-tight buildings. Further studies must be conducted, however, to determine if this program can be applied on a larger scale, and with highly seasonal breeds.

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CIDR®: Protocols and efficiency under investigation

By Élise Blais, Laval University, Québec, QC, François Castonguay, PhD, Agriculture and Agri-Food Canada, Québec, QC, and Catherine Element-Boulianne, CEPOQ, La Pocatière, QC.

Efficiency of reproduction outside the breeding season is a key factor affecting the productivity and profitability of sheep production. A number of methods are available to perform out-of-season breeding: genetic selection, the ram effect, light control, CIDR®, MGA (melatonin), etc. Although light control has become more popular in recent years, hormonal methods of inducing estrus outside of the breeding season are still widely used.

As the Veramix® sponge has not been manufactured in Canada since 2007, sheep producers have had to switch to new techniques for estrus induction and synchronization. Some have turned to light control, while others have decided to use a product similar to the vaginal sponge, the CIDR® (Controlled Internal Drug Release), which was approved for use in Canada in 2010. According to producer testimonials, the results with this intra-vaginal device do not meet expectations. As a result, a project entitled *Using the CIDR® for controlling ewe reproduction in the anestrus season* has been established.

Objectives

The project, which began in the summer of 2011, will be conducted in three phases over three breeding periods outside of the normal breeding season (spring and summer of 2011, 2012 and 2013). We will first determine its efficacy in Québec's commercial sheep flocks. We then want to characterize the product's physiological effect and test various protocols. Lastly, we will ensure technology transfer of the selected protocol, by conducting tests on a large number of ewes.

A three-year project ...

Phase 1 was initiated last summer with a number of sheep producers in the Eastern townships. These breeders, who own nearly 6,000 ewes, filled out a questionnaire regarding the general characteristics of their enterprise and the way they use the CIDR®. This initial step will enable us to depict how the product is commonly used and the fertility rates previously obtained. At the same time, we tracked various groups of synchronized ewes and collected relevant data such as body condition, mating management, ram/ewe ratio, ram preparation, etc. This will allow us to



evaluate factors that could have affected the results, and determine whether the results reported by producers are obtained under the best possible management conditions.

In **Phase 2**, the first experiment will be conducted to provide a better understanding of the sequence of physiological events surrounding ovulation when using the CIDR®. In the spring of 2012, a group of prolific hybrid ewes will be housed at the CEPOQ for testing various protocols of the intra-vaginal device (treatment duration, time of PMSG injection, use of prostaglandins, etc.). Serum progesterone concentration before, during and after the hormonal treatment, and the time of estrus onset, are a few of the parameters that will be measured.

The second part of Phase 2 will be conducted during the summer of 2012, with three Eastern townships sheep producers. We will evaluate the protocols that were deemed promising during the first experiment in the spring, and identify one that yields the best results under commercial conditions. Data on body condition of the ewes at the beginning of the treatment, estrus induction rate, ultrasound pregnancy rate, rate and distribution of lambings and prolificacy will be analyzed.

Phase 3 of the project will take place in the summer of 2013 and will help confirm the efficiency and repeatability of the CIDR® utilization protocol selected in Phase 2. This treatment will be repeated on a large number of ewes on several farms, in order to validate results in different environments and therefore come up with reliable recommendations.

Do you feel like sharing your experiences using the CIDR®?

If you are interested in the project and would like to contribute to it, do not hesitate to contact us to discuss your method of using the CIDR® and your results, and to help us build our databank. You will then be at the forefront for obtaining privileged information on this topic.

Contact us:

elise.blais.1@ulaval.ca
francois.castonguay@fsaa.ulaval.ca
Or visit the website of the
Groupe de recherche sur les ovins
at www.ovins.fsaa.ulaval.ca

This project is carried out in partnership with the *Syndicat des producteurs de moutons de l'Estrie*, André Charest, regional sheep production advisor at the MAPAQ's Direction régionale de l'Estrie, and Richard Bourassa, veterinarian at the Sherbrooke Veterinary Clinic. Thank you to the *Conseil pour le développement de l'agriculture du Québec* and Agriculture and Agri-Food Canada for project funding.

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Is Canadian sheep research important to you?

In the last two years, Sheep Canada has profiled some of the practical, applied sheep research that is being done at the Centre d'expertise en production ovine du Québec (CEPOQ) research station in La Pocatière, Québec. Projects have included investigations on light control, genetics and reproductive technologies.

These projects are carried out through a partnership between a research scientist working for Agriculture and Agri-Food Canada in Québec City (Dr. François Castonguay), a number of graduate students at Laval University and the people at the CEPOQ research centre.

Given that the research centre is operated by the Fédération des producteurs d'agneaux et moutons du Québec (FPAMQ) and the graduate students work for the university, it seems as though Dr. Castonguay's research is a bargain for the Canadian taxpayer.

However, in the latest round of budget cuts, the federal government has seen fit to terminate Dr. Castonguay, the only federally-funded sheep researcher in Canada, leaving him only one more year to complete his projects.

If this bothers you, you might want to let the federal government know. You could write a letter to the federal Minister of Agriculture (see address below) or to your own MP. You could also ask your provincial and/or local sheep associations or clubs to write to the minister, to let him know that the sheep industry cares about Canadian sheep research. You don't even have to put a stamp on the letter!

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