

## Reproduction in Sheep and the Response to artificial Light

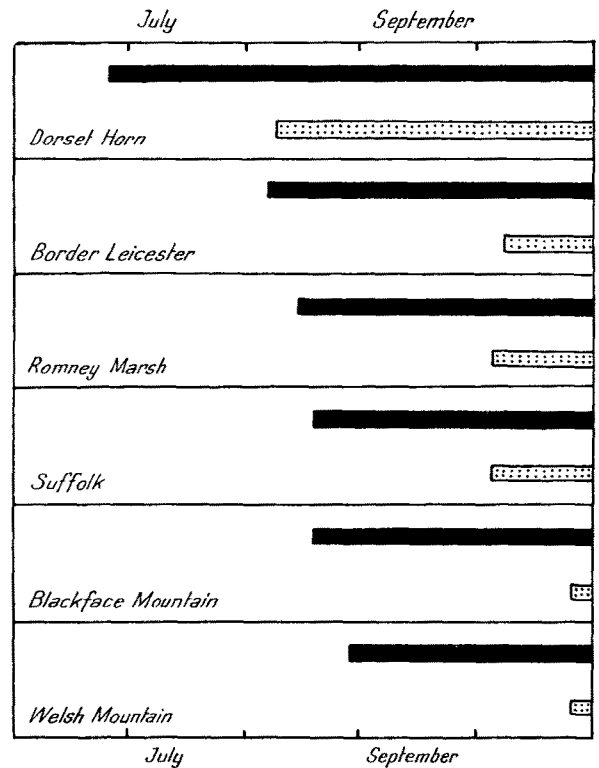
The sexual season of sheep is controlled by genetic factors (breed) and environmental factors of which the length of daylight is the major one, overriding meteorological factors (atmospheric temperature, humidity, rainfall, etc.) and nutrition (HAFEZ<sup>1</sup>). In grade Suffolk ewes, the onset of the sexual season is a response to decreasing daily amounts of light and occurs 13 to 16 weeks after the change from decreasing to increasing length of day light, this response occurs irrespective of the level at which the change over in trend of daily lighting occurs (YEATES<sup>2</sup>). A ratio of 1 part of light to 2 parts of darkness is sufficient to supply the contrast effect and to stimulate the activity of the pituitary gland (HART<sup>3</sup>), and hence the onset of the sexual activity of the ewe. Interrupting the long days of the summer anoestrus by two hours of darkness, gave no response in Hampshire, Southdown and Suffolk ewes (ROBINSON<sup>4</sup>).

Adult ewes of six pure British breeds (namely Dorset Horn, Border Leicester, Romney Marsh, Suffolk, Blackface Mountain and Welsh Mountain) were subjected to artificial light at the end of the sexual season (April 15, 1950). The animals were housed in two light-proof pens each supplied by two 5 feet 80 W daylight fluorescent lamps. The daily light rhythm used was 8 hours light to 16 hours darkness; a Venner electric time switch being incorporated in each pen's lighting circuit. Control groups of the six breeds were kept on pasture under natural conditions of daylight. Ochrud vasectomized rams were running continuously with both experimental and control groups, and oestrus was recorded every morning. The onset of the sexual season was hastened in the experimental breed groups by 44 to 70 days with an average of 57 days; the different breeds started to come in oestrus in the same order as they did in the controls. The latency of initiation (time lag from the start of light treatment to the response, first oestrus) was 10 weeks in the Dorset H., 16 weeks in the B. Leicester, 17 weeks in the Romney M., 18 weeks in the Suffolk and Blackface M. and 19 weeks in the Welsh M. (see figure).

It is concluded that a fixed light/darkness rhythm is sufficient to stimulate the sexual season of the ewe. Breeds originated at low latitudes (Dorset H. originated in Spain) show shorter latency of initiation than breeds originated at high latitudes (Blackface M., originated in Scotland) or at high altitudes (Welsh M. originated on the Welsh mountains). The different speeds of response in the different breeds are due to the fact that when the light treatment was started the breeds were at different phases of the annual reproductive cycle (different phases of anoestrus). It seems that any method of stimulating the gonads becomes more effective the closer to the sexual season it is applied. This may indicate an underlying autonomous hypophysial cycle.

In the ram, sperm quality is stated to differ during the season (GUNN<sup>5</sup> and others) and within breeds (MCKENZIE and BERLINER<sup>6</sup>) while the sexual desire is depressed during anoestrus owing to degeneration in the interstitial cells (MAQSOOD<sup>7</sup>). The lowered secretion rate of thyroxine induced by high temperature depresses the

activity of the ram's reproductive organs (BOGART and MAYER<sup>1</sup>). On the other hand, it has been demonstrated experimentally that the daylight environment plays a part in controlling the sexual performance of the ram (MOULE<sup>2</sup> and others). It is very likely that the response of the ram to daylight environment is complicated by other factors such as the atmospheric temperature and the consequent thyroxine secretion rate.



The different responses of different breeds of ewes to artificial light (8 hours light to 16 hours darkness). The bands represent the artificial sexual season.

In conclusion, the response of sheep to artificial light is dependent upon many factors the chief of which are the genetic make-up, the reproductive phase and the sex of the animal as well as the nature of the light treatment (ration and rhythm).

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### Zusammenfassung

Ein bestimmter Rhythmus von Licht und Dunkelheit genügt, um die Sexualperiode des Mutterschafes anzuregen. Bei verschiedenen Arten ist die Schnelligkeit der Reaktion different. Beim Widder kann die Wirkung des Tageslichts auch durch andere Faktoren beeinflusst werden, zum Beispiel durch die Außentemperatur. Die Reaktion von Schafen auf künstliche Beleuchtung hängt von der Art, von der sexuellen Phase, vom Geschlecht sowie von der Lichtmenge und vom Belichtungsrythmus ab.

<sup>1</sup> R. BOGART and D. T. MAYER, Bull. Mo. Agric. Exp. Sta. 1946, No. 402.

<sup>2</sup> G. R. MOULE, Aust. Vet. J. 26, 84 (1950).

<sup>1</sup> E. S. E. HAFEZ, Exper. 7, 353 (1951).

<sup>2</sup> N. T. M. YEATES, J. Agric. Sci. 39, 1 (1949).

<sup>3</sup> D. S. HART, J. Agric. Sci. 40, 143 (1951).

<sup>4</sup> T. J. ROBINSON (personal communication).

<sup>5</sup> R. M. C. GUNN, Pastoral Rev. 58, 1159 (1948).

<sup>6</sup> F. F. MCKENZIE and V. BERLINER, Bull. Mo. Agric. Exp. Sta. 1937, No. 265.

<sup>7</sup> M. MAQSOOD, Some Aspects of Thyroid Physiology in the Male (Cambridge Univ. Thesis for Ph. D. degree, 1951).