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High Temperature and Reproductive Performance in the Ewe

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Interest has increased about the adverse effects of high summer temperatures upon reproductive performance of sheep and other domestic animals. This interest has, of course, been greatest in the more southern areas that experience higher temperatures for longer intervals of the day and over more days. However, results from some studies indicate that even relatively moderate summer conditions may impair reproductive performance.

Such impairment may result from an effect upon either the male or the female, or upon both. It is generally accepted that the fertility of the ram is adversely affected during intervals of hot weather by a decrease in semen quality. This is due to the effect of high temperature upon spermatogenesis, the formation of sperm. The term "summer sterility" has been used to describe this condition.

There are several points in the reproductive process of the female that may be influenced, and the nature of the effect appears to differ with the amount of heat stress experienced by the animal. The following steps in the reproductive process have been shown to be influenced by temperatures or temperature-relative humidity conditions that typically occur during summer months:

1. Impairment of Ovarian Function

   This effect does not appear to occur as readily as others. When it does occur, the most obvious result is usually failure of animals to exhibit estrus (heat). With few exceptions, this condition has been induced experimentally only with relatively high constant temperatures in experimental chambers.

2. Failure of Fertilization

   This result of elevated temperature appears to occur at somewhat lower temperature conditions. In this instance, estrus occurs normally but the egg or ovum is not fertilized. Fertilization failure may be due to either the egg itself or an influence of the female's reproductive tract upon the sperm prior to its meeting the egg. The available evidence would indicate that both mechanisms are involved. Fertilization failure usually results in return to estrus within the range of the normal estrous cycle.

3. Embryonic Death

   This adverse effect appears to be of greatest concern under normal summer conditions. In many instances of experimental exposure to high temperature, ovulation and fertilization do occur and the embryo begins what appears to be normal development. However, at some point in its development the embryo dies. The best available information indicates that the embryo seems to be particularly susceptible to high temperatures during a short interval immediately surrounding the time of fertilization. This effect appears to be upon the egg itself. An egg that has been subjected to such conditions does not survive when transferred to the reproductive

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tract of a female that has not been subjected to elevated temperatures. In laboratory animals, it has been demonstrated that a six-hour interval surrounding the first division of the new embryo is the most temperature susceptible stage of development. Exposure to high temperatures at that early stage does not, however, cause death at that time. Instead, death appears to occur at a relatively late stage of development, after about 1/5 or more of gestation has been successfully completed. Such death usually results in failure of the ewe to return to estrus for some interval longer than the usual estrus cycle.

(4) Birth of Weak, Light Weight Lambs

Where gestation extends over the hot summer months, lower birth weights and survival have been reported. Results of a Texas study are summarized in Table 1 where animals were exposed to either a constant 90°F temperature or to 90°F for 12 hours per day throughout gestation.

Neither hormone therapy nor alteration of feeding levels significantly altered the detrimental effect of the 90°F temperatures. However, one report from North Carolina has indicated that simple confinement of ewes to shaded areas prevented the adverse effects upon birth weight and viability of lambs.

All of the above effects are basically due to the inability of the female to maintain normal body temperatures when exposed to high environmental temperatures. Therefore, any management practice that reduces heat production or increases heat elimination would tend to decrease the harmful effects of high temperature. The interval surrounding mating appears to be a particularly important time, and the simple practice of avoiding movement of animals from one area of a farm to another during hot weather could be beneficial as exercise greatly increases heat production. Shearing may actually be harmful when the breeding flock is exposed to the sun as the fleece protects against the heat of solar radiation. However, in shaded areas the absence of the fleece would be advantageous for maintenance of normal body temperatures.

Little is known of the precise physiological mechanisms associated with heat stress and reproductive performance of the female. However, this is a current area of research at a number of locations with the common objective of determining such physiological mechanisms along with better recommendations for alleviating the condition.

Table 1. Influence of length of exposure to 90°F temperature stress upon birth weight and lamb survival a/

<table>
<thead>
<tr>
<th>Treatment</th>
<th>No. ewes</th>
<th>Av. birth weight (lb.)</th>
<th>Per cent lambs surviving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-stressed</td>
<td>21</td>
<td>9.5</td>
<td>100</td>
</tr>
<tr>
<td>12 hour stress</td>
<td>20</td>
<td>7.9</td>
<td>80</td>
</tr>
<tr>
<td>24 hour stress</td>
<td>29</td>
<td>5.7</td>
<td>55</td>
</tr>
</tbody>
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