1985

Twinning in Cattle

Sherrill E. Echternkamp
MARC

Keith E. Gregory
MARC

W. Gordon Hays
MARC

Larry V. Cundiff
MARC

Robert M. Koch
MARC

Follow this and additional works at: http://digitalcommons.unl.edu/hruskareports

Part of the Animal Sciences Commons


http://digitalcommons.unl.edu/hruskareports/65
Twinning in Cattle

Sherrill E. Echternkamp, Keith E. Gregory, W. Gordon Hays, Larry V. Cundiff, and Robert M. Koch

Introduction

The economic benefits of increasing reproductive rate indicate a need to determine the feasibility of increasing the frequency of twinning in cattle, either by selection or by an artificial method. Rate of reproduction has a major impact on life cycle costs of production for different meat animal species, and, thus, upon the production resources for which different species are competitive. For example, the average beef cow is capable of producing about 7% of her body weight per year in progeny market weight, but the comparable multiple is 8 in pigs and more than 70 in meat chickens. The objectives of this project focus on gaining the understood need to develop a technology for increasing the frequency of twinning in cattle. A comprehensive physiological examination of cattle that produce a high frequency of twins may establish the biological and/or environmental requirements for multiple births in cattle and the feasibility of increasing twinning frequency by selection, artificial induction, or by both. This experiment is being conducted to provide understanding relating to these considerations. Specific objectives of the experiment are: (1) determine the effectiveness of selection for multiple births in cattle; (2) develop and evaluate selection criteria for multiple births in cattle; (3) accumulate data that will contribute to an economic assessment of multiple births in cattle for varying resource situations; (4) establish husbandry requirements for herds of cattle that have a high twinning frequency; (5) determine the relative importance of multiple ovulation and embryo survival in contributing to multiple births in cattle in both spring and fall breeding; and (6) determine the usefulness of cows with high twinning frequency as “models” to gain understanding of biological factors that relate to embryo survival for both single and multiple births in cattle.

Procedure

Cows that have a high estimated breeding value for twinning have been acquired from private breeders and have been provided by cattle populations in other research projects at the Research Center. Emphasis has been on acquiring cows from breeds that are believed to have a relatively high twinning frequency; i.e., Holstein, Simmental, Brown Swiss, Charolais, Gelbvieh, Pinzgauer, and Shorthorn. Twinning frequency for these breeds is believed to average in the range of from 3.0 to 4.5 percent. Because of numbers available and because of the complete records available in many dairy herds, Holsteins have been acquired in a greater frequency than any other breed.

A program of superovulation and embryo transfer is used to increase number of progeny of cows that have highest estimated breeding value for twinning. The procedure is to include about 25 cows with highest estimated breeding value for twinning for two superovulation and embryo transfer cycles in each year (May and September). Cows included in the superovulation and embryo transfer program (donors and recipients) are exposed to breeding in the subsequent spring or fall breeding season. It is expected that about 100 calves will be produced by embryo transfer each year. Recipient females for the embryo transfer program are heifers and cows in the twinning project that have relatively low estimated breeding value for twinning.

Total number of breeding age females in the twinning project is 900. About 300 females are produced in the project each year, and they replace females that have lower estimated breeding value for twinning. Females from breeds that have a relatively high twinning frequency (Simmental, Brown Swiss, Charolais, Gelbvieh, and Pinzgauer) in other projects at the Research Center are placed in the twinning project immediately after production of their first set of twins, provided such action is compatible with the objectives of the effort in which they have been involved. The age limit on cows handled in this manner is three years.

Females in the twinning project are mated to males that have a relatively high estimated breeding value for twinning. We have imported semen from three Swedish Friesian bulls and from two Norwegian Red bulls whose daughters have twinned at a high frequency (about 10 percent).

Within the framework of achieving near maximum selection intensity for twinning frequency in the males used, matings are made in a manner so as to achieve and maintain a high level of heterozygosity in each animal produced in the twinning project and a milk level that is in general harmony with achieving postpartum intervals of no more than 60-70 days when cows are maintained in an environment appropriate for a high beef production response capability. An effort is made to limit the contribution of any breed to 30-35 percent in the resulting composite population. About 20 percent of males that have highest estimated breeding value for twinning are retained intact and developed for potential use as sires.

Cows that produce a high frequency of multiple ovulations and births are utilized as experimental models to obtain basic physiological information relating to ovulation, embryo survival, and postpartum reproduction. Ovulation rate is determined by rectal palpation of corpora lutea and by laparoscopy. Experiments predominantly focus on comparison of hypothalamic-pituitary-ovarian relationships between multiple and single ovulating cows. The role of the endocrine system in the regulation of ovulation rate and embryo survival is assessed in single and multiple ovulating cows through the establishment of hormone secretion profiles for both ovarian (estrogen, inhibin, progesterone, etc.) and pituitary (FSH, LH, prolactin, oxytocin) hormones, and through morphological and biochemical evaluations of follicular development and corpus luteum function. In addition, experiments are conducted to study uterine-embryo interactions and how these interactions are affected by number of embryos. We have observed a higher twinning frequency in fall relative to spring calving; the relative contribution of ovulation rate and embryo survival to this difference is being determined.

Results

A summary of preliminary results from the twinning project is presented in Table 1 and suggests the following.

Cows that have a history of producing twins either in private herds or at the Research Center continue to produce twins at a high frequency in this project; i.e., 18.3 percent twinning frequency subsequent to producing two sets of twins and 14.5 percent twinning frequency subsequent to producing one set of twins. Over all ages, normal twinning frequency of the breeds included in this project averages between 3.0 and 4.5 percent.

Daughters of cows that have produced two or more sets of twins produce twins at a frequency (8.1 percent) more than eight times as great as females of the same age and from the same breeds at the Research Center where selection for twinning has not been practiced. Twinning frequency is much lower in females producing their first and second calves than in adults.

*Echternkamp is a research physiologist, Reproduction Unit; Gregory is the research leader, Production Systems Unit; Hays is the cattle operations manager; Cundiff is the research leader, Genetics and Breeding Unit, MARC; and Koch is a professor of animal science, University of Nebraska-Lincoln, stationed at MARC.
Table 1.—Summary of preliminary results from twinning project (includes fall calving in 1984)

<table>
<thead>
<tr>
<th>No. cows</th>
<th>No. parturitions</th>
<th>No. sets twins</th>
<th>Twinning frequency (pct)</th>
<th>No. sets twins per cow</th>
</tr>
</thead>
<tbody>
<tr>
<td>113</td>
<td>437</td>
<td>295</td>
<td>67.50</td>
<td>2.61</td>
</tr>
</tbody>
</table>

Records since purchased and records of Research Center cows subsequent to producing two sets of twins

<table>
<thead>
<tr>
<th>No. parturitions</th>
<th>No. sets twins</th>
<th>Twinning frequency (pct)</th>
</tr>
</thead>
<tbody>
<tr>
<td>219</td>
<td>40</td>
<td>18.3</td>
</tr>
</tbody>
</table>

Records of daughters of cows with two or more sets of twins

<table>
<thead>
<tr>
<th>No. parturitions</th>
<th>No. sets twins</th>
<th>Twinning frequency (pct)</th>
</tr>
</thead>
<tbody>
<tr>
<td>284</td>
<td>23</td>
<td>8.1</td>
</tr>
</tbody>
</table>

Records on cows put in project after producing one set of twins

<table>
<thead>
<tr>
<th>No. parturitions</th>
<th>No. sets twins</th>
<th>Twinning frequency (pct)</th>
</tr>
</thead>
<tbody>
<tr>
<td>207</td>
<td>30</td>
<td>14.5</td>
</tr>
</tbody>
</table>