Title
Reproductive Tract Score: a tool for evaluating beef heifer reproductive potential

Authors
Mario Binelli¹, PhD, Assistant Professor
Thiago Martins¹, DVM, PhD, Post-doctoral fellow
Cecilia C. Rocha¹, DVM
Felipe A.C.C. Silva¹, DVM
João Bittar³, DVM, MS, PhD, Assistant Professor
Philipe Moriel⁴, PhD, Assistant Professor
Angela M. Gonella-Diaza², DVM, MSc. PhD, Assistant Professor
Lauren Butler⁵, MS, County Extension Director, Okeechobee County
Cindy Sanders⁶, PhD, County Extension Director, Alachua County

¹ Department of Animals Sciences, IFAS, University of Florida, Gainesville;
² North Florida Research and Education Center, IFAS, University of Florida, Marianna;
³ Department of Large Animal Clinical Sciences, College of Veterinary Medicine, University of Florida, Gainesville;
⁴ Range Cattle Research and Education Center, IFAS, University of Florida, Ona;
⁵ UF/IFAS Extension, Okeechobee County
⁶ UF/IFAS Extension, Alachua County
Introduction

Florida boasts a vibrant beef industry that provides economic, environmental and conservation services to the society. For example, in fiscal year 2017, the beef industry in Florida supported 118,191 full time and part-time jobs and added US$7.65 billion to the Gross State Product (Hodges et al., 2019). Because of current environmental and natural resources conservation concerns, the industry must strive for efficient use of resources. In cattle production systems, increased efficiency depends greatly on reproductive success. The most critical animal category in Florida cow-calf operations is the yearling heifer. Every year, approximately 200,000 yearling heifers will join the Floridian breeding herd as replacements. Reproductive success of replacements heifers will depend on their reproductive maturity, that is, how close are the heifers to reach puberty (Holm et al., 2009). For example, mature heifers will breed early in their first breeding season and that is critical for a lifetime success and stayability in the maternal herd (Cushman et al., 2013). The reproductive maturity of heifers can be measured by a method called “Reproductive Tract Score” or RTS (Anderson et al., 1991). The RTS measured prior to the beginning of the breeding season is associated with the reproductive performance of heifers, measured at the end of the breeding season (Holm et al., 2009). The objective of this publication is to explain the RTS methodology and to suggest how it can be implemented in a cow-calf operation. This report is intended to be used by County Extension Faculty educating producers on the subject of reproductive performance of heifers, and by producers that may need a system to evaluate reproductive potential of heifers prior to breeding.

Explaining the Reproductive Tract Score evaluation

The RTS is an evaluation that estimates the stage of development of the reproductive tract of a heifer (ovaries and uterus). The RTS evaluation should be conducted by a trained specialist, such as a large animal practitioner. Prior to the evaluation, the animal must be well restrained in a squeeze chute, with safe access to the rear part of the heifer (also called perineal region). The evaluation is performed via rectal palpation of the reproductive tract followed by trans-rectal examination of the ovaries by B-mode ultrasonography. The first step is the estimation of the diameter and tone of the uterine horns (Figure 1a). The second step is the identification and measurement of the diameter of the main ovarian structures: the largest follicle and the corpus luteum (CL; Figures 1b and c, respectively). The final step is to integrate these measurements using specific criteria, and that yields an RTS ranging from 1 to 5 (Table 1). An RTS of 1 is indicative of an infantile, underdeveloped reproductive tract, whereas RTS 4 and 5 represent heifers that are well developed and ready to breed. RTS 2 and 3 are intermediate scores. An experienced examiner takes between 1 and 2 minutes to evaluate each animal and provides the RTS to the producer in real-time. The RTS evaluation should be performed between 1 and 3 weeks prior to the beginning of the breeding season.
Fig 1. Illustration of structures examined during a RTS evaluation. a. Image of a bovine reproductive tract (partial). The diameter and tone of the uterine horns are estimated by rectal palpation. The dashed lines indicate the position in which the diameter of uterine horns is estimated. b and c. Ultrasonographic scan images of bovine ovaries showing follicles (black circular structures (b) and the corpus luteum (dark gray circular structure; c). Source: Binelli Lab.

<table>
<thead>
<tr>
<th>RTS</th>
<th>Uterine horn (diameter, tone)</th>
<th>Ovary</th>
<th>Length, mm</th>
<th>Height, mm</th>
<th>Width, mm</th>
<th>Ovarian structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Immature &lt; 20 mm diameter, no tone</td>
<td></td>
<td>15</td>
<td>10</td>
<td>8</td>
<td>No palpable structures</td>
</tr>
<tr>
<td>2</td>
<td>20- to 25-mm diameter, no tone</td>
<td></td>
<td>18</td>
<td>12</td>
<td>10</td>
<td>8-mm follicles</td>
</tr>
<tr>
<td>3</td>
<td>25- to 30-mm diameter, slight tone</td>
<td></td>
<td>22</td>
<td>15</td>
<td>10</td>
<td>8- to 10-mm follicles</td>
</tr>
<tr>
<td>4</td>
<td>30-mm diameter, good tone</td>
<td></td>
<td>30</td>
<td>16</td>
<td>12</td>
<td>&gt;10-mm follicles, corpus luteum possible</td>
</tr>
<tr>
<td>5</td>
<td>&gt;30-mm diameter, good tone, erect</td>
<td></td>
<td>&gt;32</td>
<td>20</td>
<td>15</td>
<td>&gt;10-mm follicles, corpus luteum present</td>
</tr>
</tbody>
</table>

Interpreting and applying the Reproductive Tract Score system to manage yearling heifers

The significance of the RTS is that it provides an objective measurement of the reproductive potential of the yearling heifer, that is associated with its fertility in the upcoming breeding season. To determine that association, we measured the RTS and the subsequent
reproductive outcome of 564 Bos indicus-influenced heifers over two breeding seasons in Florida ranches. All heifers were Reproductive Tract-scored 23 days prior to artificial insemination, estrus-synchronized and inseminated once, and then exposed to clean-up bulls in a 90-day breeding season. Pregnancy rates were measured twice, 30 days after the artificial insemination and 30 days after the end of the breeding season. Results on Table 2 show that pregnancy to the AI ranged from 17.4 to 46.3% for heifers having RTS 1 to 5, respectively. Accordingly, pregnancy rates at the end of the breeding season were from 69.6 to 87.2%, again consistent with the RTS measured prior to the beginning of the season. The greater proportion of RTS 5 heifers pregnant to AI suggests that most heifers detected pregnant at the end of the season probably bred early, compared to RTS 1 heifers.

Table 2. Reproductive performance of yearling Bos indicus influenced heifers according to the RTS

<table>
<thead>
<tr>
<th>Variables</th>
<th>RTS1</th>
<th>RTS2</th>
<th>RTS3</th>
<th>RTS4</th>
<th>RTS5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of heifers</td>
<td>46</td>
<td>98</td>
<td>61</td>
<td>31</td>
<td>328</td>
</tr>
<tr>
<td>Pregnant by AI, %</td>
<td>17.4</td>
<td>30.6</td>
<td>37.7</td>
<td>41.9</td>
<td>46.3</td>
</tr>
<tr>
<td>Pregnant by AI + natural service, %</td>
<td>69.6</td>
<td>79.6</td>
<td>88.5</td>
<td>80.6</td>
<td>87.2</td>
</tr>
</tbody>
</table>

Because the RTS of each animal is estimated at chute-side, the producer has the opportunity to make an immediate management decision. For example, the producer may decide to cull or defer breeding on heifers that are RTS 1 and 2, while keeping heifers of RTS 3, 4 and 5 in the breeding program. A large proportion of RTS 4 and 5 heifers indicate that the health, nutrition, and management programs of the ranch is aligned with the goal of having most heifers mature and able to breed early in the season. Conversely, a large proportion of RTS 1 heifers suggest that management adjustments may be needed. As a side note, remember that age of puberty attainment is associated with the proportion of Bos indicus genetics (Martin et al., 1992). Thus, a herd with a large proportion of Brahman genetics will have a larger proportion of immature heifers, and associated lower RTS prior to the breeding season, compared to a more taurus-based herd.

In summary, there is a large financial investment in the development of heifers, with the expectation that they will breed as yearlings. Maximum return to that investment will occur when heifers become pregnant at the beginning of the breeding season. In contrast, the worst outcome is having to sell an open heifer for beef, after having invested heavily on her development. The RTS measured before the breeding season will offer a prediction of what the reproductive performance of each animal in the group will be at the end of the season. Ranchers may use that evaluation to make real-time management decisions and adjustments to optimize use of resources and increase overall efficiency of the operation.

The Binelli Lab at the Department of Animal Sciences at UF/IFAS leads the “Know Your Heifer” extension program for heifer reproductive evaluation. For more information, please check the website (https://animal.ifas.ufl.edu/extension/beef/KYH/).
Acknowledgments

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References