Beef Heifer Development

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KEYWORDS

• Beef heifer • Puberty • Reproductive soundness examination of heifers
• Estrous synchronization • Artificial insemination

KEY POINTS

- In order to become pregnant early in the breeding season as a heifer, deliver a live calf, and become pregnant early in the breeding season as a first-calf (primiparous) cow, management of heifer development must optimize nutrition, heifer maturity at the onset of breeding, bull fertility, and overall reproductive success.
- Examination of yearling heifers before breeding can provide information on the current pubertal status of the group and allow better predictions regarding success of the breeding season.
- Data used in the evaluation of breeding soundness of replacement heifers include body weight, days of age, reproductive tract maturity, and potentially pelvic area; the optimum timing of a reproductive soundness examination will depend on the nutrition, breeding, and marketing plans for specific herds.
- Using the Kansas State University 3-point system (R, I, and P), veterinarians classify prebreeding heifers as ready, intermediate, and problem.

INTRODUCTION

Replacement heifer management has a large influence on the reproductive success of beef herds. Overall herd productivity increases when a high percentage of heifers become pregnant early in the first breeding season and a high percentage of first-calf heifers (primiparous cows) conceive early in the breeding season for a second pregnancy.[1–4] In order to become pregnant early in the breeding season as a heifer (nulliparous), deliver a live calf, and become pregnant early in the breeding season as a first-calf (primiparous) cow, management of heifer development must optimize nutrition, heifer maturity (puberty) at the onset of breeding, bull fertility, and overall reproductive success.

The authors have received grants, or research contracts, from the National Cattlemen's Beef Association, the United States Department of Agriculture, Zoetis Animal Health, Merck & Company, CEVA Biomune, Boehringer Ingelheim Vetmedica, and Merial Animal Health.
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Vet Clin Food Anim ■ (2016) ■–■
http://dx.doi.org/10.1016/j.cvfa.2016.01.003 vetfood.theclinics.com
0749-0720/16/$ – see front matter

PUBERTY

- Puberty is reached when a beef heifer is able to express estrous behavior and ovulate a fertile oocyte.
- Maturing of the neuroendocrine system induces the maturation and ovulation of the first oocyte as well as the hormonal changes that induce the first expression of behavioral estrus.
  - A gradual increase in gonadotropic (luteinizing hormone and follicle-stimulating hormone) activity causes the neuroendocrine system to mature.[5,6]
- The first ovulation is usually not accompanied by external indications of estrus.[7] It is generally thought that a certain amount of progesterone is needed for a period of time preceding ovulation in order to induce estrus behavior and for the following cycle to be of normal length.
  - Fertility to a mating associated with the pubertal estrus is reduced compared with the fertility of subsequent estrous cycles[8]; therefore, heifers should reach puberty at least 21 days before the first day of the breeding season.
- Once the heifer has gone through a cycle with corpora luteal (CL) development or has been exposed to sufficient progesterone levels from other sources (eg, progesterone-impregnated intravaginal insert or feed-grade progestogen), the following cycles are normal.[9]

PUBERTY: INFLUENCE OF AGE

- The onset of puberty is primarily influenced by age and weight within the breed.[10–12]
- The average age at which cohorts of beef heifers reach puberty has been reported to range from 292 days to 678 days (9.6–22.0 months); with the average age at puberty for cohorts of the *Bos taurus* breed and *Bos taurus*–crossbred heifers commonly used in North America reported to be from 303 days to 429 days (10–14 months) (**Table 1**).
- Although reporting average age at puberty provides valuable information, this value represents a level at which approximately 50% of the heifers have reached puberty. Usually a percentage of the replacement heifer cohort reaching puberty much higher than 50% is desired by the time of the start of the breeding season.
- In order for primiparous cows (first-calf heifers) to give birth to their first calf at about 22 to 23 months of age so that they have 90 to 100 days between calving and the start of the breeding season, they must become pregnant by 388 to 418 days (12.7–13.7 months) of age and should reach puberty at least 21 days before the first day of the breeding season, that is, by 367 to 397 days (12.0–13.0 months) of age.
  - Crossbred heifers will reach puberty at a younger age than heifers that lack heterosis.[21]
  - Because of differences in nutritional management and genetic selection, replacement heifers from different herds are expected to vary around the age-at-puberty estimate reported by Freetly and Cundiff[19] (1997), so that in many herds, the expected date to reach puberty is close to or after the desired onset of breeding for herd replacements.
- Knowing information such as the age when you expect 90% (or an appropriate target percentage based on overall herd goals) of a herd's heifers to reach puberty and the length of time required for 90% of primiparous cows to resume fertile cycles after calving allows you to determine how much pressure to place on age when selecting replacement heifer candidates (**Table 2**).