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SYMPOSIA AND ORAL SESSIONS
Alpharma/Beef Species Joint Symposium:
Redefining the Replacement Heifer Paradigm

602 Pubertal issues for beef replacement heifers. C. L. Gasser,*
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Heifers that reach puberty and experience multiple estrous cycles before the onset of their initial breeding season have a greater probability for early conception and optimal lifetime productivity. Peripubertal changes include increases in LH secretion, estradiol production, follicular development, and reproductive tract size. Positive feedback stimulation from estradiol eventually causes a hypothalamic surge of GnRH, leading to a surge of LH from the pituitary and the initial ovulation. Attainment of puberty typically occurs around 12 to 14 mo of age in beef heifers but varies greatly. Genetic differences and environmental factors contribute to this variation. In typical US cow-calf operations, calves are generally weaned at approximately 200 d of age. The effect of postweaning management on age at puberty in heifers has been demonstrated, and there is considerable flexibility in the timing of gain from weaning to breeding. However, even when heifers are grown to the desired BW before the start of breeding, there remains a pronounced variation in the timing of puberty, which affects pregnancy rates. Less attention has been focused on the effect of preweaning management on age at puberty. Many changes occur during early reproductive development. Wave-like patterns of follicular development have been observed in heifer calves as early as 2 weeks of age. Some dramatic changes occur from about 2 to 5 mo of age, most notably the transient rise in LH secretion. Most components of the hypothalamic-pituitary-ovarian axis are fully competent by approximately 5 to 6 mo of age. Heifer calves with increased growth rates from birth to weaning have reached puberty at earlier ages. Precocious puberty has also been induced in most heifers with early weaning and feeding a high-concentrate diet. Nutritional control during early maturation in heifers exerts substantial influence on the timing of puberty. Understanding the mechanisms involved in reproductive development increases our ability to effectively manage replacement beef heifers for reproductive efficiency.

Key Words: heifer, puberty, development

603 Development systems for replacement beef heifers. R. N. Funston,*
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Studies in numerous species provide evidence that diet during development can partially control physiological changes necessary for puberty. Numerous studies have reported inverse correlations between postweaning growth rate and age at puberty and pregnancy rates in heifers. Thus, rate of postweaning growth was determined to be an important factor affecting age of puberty, which influenced pregnancy rates. This and other research conducted during the late 1960s through the early 1980s indicated puberty occurs at a genetically predetermined size, and only when heifers reach their target weight can high pregnancy rates be obtained. Guidelines were established indicating replacement heifers should achieve 60 to 65% of their expected mature body weight by breeding. Traditional approaches for postweaning development of replacement heifers used during the last several decades have primarily

focused on feeding heifers to achieve or exceed an appropriate target weight, and thereby maximize heifer pregnancy rates. Intensive heifer development systems may maximize pregnancy rates, but not necessarily optimize profit or sustainability. Since inception of target weight guidelines, subsequent research demonstrated the pattern of growth heifers experience before achieving a critical target weight could be varied. Altering rate and timing of gain can result in periods of compensatory growth thereby providing an opportunity to decrease feed costs. Recent research from our laboratory has demonstrated feeding replacement heifers to traditional target weights increased development costs without improving reproduction or subsequent calf production relative to development systems where heifers were developed to lower target weights ranging from 50 to 57% of mature BW.

Key Words: beef cattle, heifer development, target weight

604 Interactions of feed efficiency with beef heifer reproductive development. R. D. Randel*¹ and T. H. Welsh Jr.², ¹*Texas AgriLife Research, Overton,* ²*Texas AgriLife Research, College Station.*

The influence of nutrition on puberty in beef heifers is complex and under neuroendocrine control. The stores of body fat in mammals are a determinant of the onset and maintenance of puberty. Body fat stores are greater in heifers with higher residual feed intake than in their more efficient herdmates. A one-unit increase in residual feed intake resulted in a reduction of 7.54 d in age at puberty in *Bos taurus* beef heifers. However, *Bos indicus* influenced heifers which reach puberty at older ages were not found to have sexual maturity influenced by selection for residual feed intake. The strong influence of body fat stores on return to estrus after calving does indicate that selection for leaner beef heifers could affect reproductive performance relative to puberty and postpartum rebreeding of first calf heifers. The influence of intermediary metabolism through signals at the central nervous system regulates the GnRH pulse generator thereby influencing pituitary and ovarian function culminating with puberty and return to ovarian cyclicity following calving. Tropically adapted cattle (Santa Gertrudis and Brahman) selected for low residual feed intake had a lesser response of insulin to a glucose challenge than their less efficient herdmates. These studies indicate the possibility that animals with differing residual feed intake (efficiencies) may have differing intermediary metabolism and therefore differing rates of reaching puberty.

Key Words: heifers, feed efficiency, reproduction

605 Enterprise level implications of heifer development. R. L. Endecott*¹, A. J. Roberts², and J. T. Mulliniks³, ¹*Department of Animal and Range Sciences, Montana State University, Miles City,* ²*USDA-ARS, Fort Keogh Livestock and Range Research Laboratory, Miles City, MT,* ³*Department of Animal and Range Sciences, New Mexico State University, Las Cruces.*

Research emphasis has been placed on heifer development strategies in recent years, comparing traditional, more intensive systems to more

extensive systems using less feed and relying on compensatory gain to reach a target BW. Recent research has suggested that developing heifers to a lighter target BW at breeding (50–57% of mature BW compared with 60–65% BW) reduced development costs while not impairing reproductive performance. One limitation of most research concerning influences of nutrition on heifer development and cow reproductive performance is little or limited consideration of long-term implications. Longevity has a relatively low heritability; thus heifer development and other management strategies have a greater potential to affect cow retention. While limited information exists about the effects of heifer development strategies on cow longevity, data from other species implies that limiting caloric intake during juvenile development can increase lifespan. Establishing the effect of heifer development protocols on longevity is complex, requiring consideration for nutritional factors following the start of breeding and through subsequent calvings. Factors

to consider include the resulting maintenance requirements and behavior traits associated with development protocols. For example, developing to lighter target weights may be advantageous in maintaining positive energy balance or adapting to negative energy balance through the breeding season in many range settings. Likewise, heifers developed under a range setting may be better adapted to maintain desired metabolic status during breeding than heifers reared in a pen or developed at a high rate of gain. Adequate growth and development to ensure little calving difficulty can be of critical importance for longevity; however, providing additional supplemental feed during postweaning development to accomplish this may be less efficient than later in development. Ultimately, financial requirements of any development system must be evaluated in conjunction with duration of production to establish implications on production enterprises.

Key Words: replacement heifers, feed inputs, cow longevity