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# Effect of Breed and Postweaning Rate of Gain on Onset of Puberty and Productive Performance of Heifers

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# EFFECT OF BREED AND POSTWEANING RATE OF GAIN ON ONSET OF PUBERTY AND PRODUCTIVE PERFORMANCE OF HEIFERS

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## Introduction

Age at puberty is an important production trait in beef cattle where heifers are bred to calve at 2 years of age, especially when a restricted breeding season is used. It is not only important that heifers breed and conceive, but, for maximum efficiency, they should breed and conceive early in the breeding season. Thus, age at puberty may be an important selection trait for identifying breeds most suited for efficient utilization of feed resources. Several researchers have demonstrated large differences among breed or breed cross in age at puberty of heifers. Other researchers have demonstrated that undernutrition may result in increased age at puberty, subnormal conception rate, and underdeveloped udders. Overfeeding, however, may result in weak heat symptoms, subnormal conception rate, high embryonic mortality, decreased mammary gland development, and decreased milk production. Thus, proper nutrition during the developmental period may have both short and long term effects on heifer productivity. The purposes of the present study were to describe the effects of breed and postweaning growth rate on the onset of puberty, milk production, and productivity of heifers.

## Procedure

Angus (A, 68), Hereford (H, 93), Red Poll (R, 61), Brown Swiss (B, 47), Charolais (C, 36), and Simmental (S, 90) heifers were used in a study designed to evaluate the effects of breed and postweaning rate of gain on the onset of puberty and subsequent productive performance. Heifers were grouped at weaning such that one-third of the A, H, and R (small) heifers were fed in each of three pens as were one third of the B, C, and S (large) heifers. One pen of heifers of each type was fed to gain at either a low (L, 0.9 lb/day), medium (M, 1.3 lb/day), or high (H, 1.8 lb/day) rate. Heifer weights were determined at 28-day intervals throughout the 184-day feeding period and periodically thereafter. Hip height was measured. At the end of the 184-day feeding period, approximately one-half of each group of heifers was moved to pasture and one-half was kept in the feedlot through breeding (70 days), then moved to pasture. Puberty was evaluated by twice daily visual observation from about 1 month post-weaning through the breeding period. All heifers were managed under typical management conditions after breeding. Date of parturition, calf birth weight, and survivability were evaluated. Milk production of a sample of six heifers from each breed and post-weaning treatment group was determined at approximately 50, 90, and 130 days postpartum by the weigh-suckle-weigh technique. Cow rebreeding performance and calf weaning weight were evaluated.

## Results

Heifer weight (Table 1) differed among breeds at all times. Increased

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nutrition levels postweaning resulted in increased heifer weight and height. These differences were large immediately after the postweaning nutritional treatment but decreased thereafter. No differences in heifer weight were observed, due to postweaning nutritional treatment, at 930 days of age (after weaning first calf), indicating the nutritional treatments had no long-term effects on heifer weight.

Average age at puberty for Angus, Hereford, Red Poll, Brown Swiss, Charolais, and Simmental heifers was 409, 430, 359, 329, 390, and 351 days, respectively, and weight at puberty was 703, 677, 456, 675, 787, and 728 lb. Heifers fed the low, medium, and high rations were 393, 366, and 370 days of age and weighed 657, 692, and 785 lb at puberty. These results demonstrated breeds differ widely in both age and weight at puberty. Breeds that have been selected for high levels of milk production tended to reach puberty earlier than those selected for beef. These results also demonstrate postweaning nutrition can have a large influence on both age and weight at puberty. The low level of feeding resulted in delayed puberty, however, no advantage of the high level of feeding over the medium was observed.

Calf birth weight (Table 2) was influenced by breed but not by heifer nutritional level postweaning. Milk production differed among breeds and among nutritional treatments at 50 days postpartum (Table 3). Similar trends were observed at 90 and 130 days postpartum. Calf weaning weight was different among breeds (Table 2) and among heifer nutritional treatment groups. A large portion of the nutritional treatment differences was due to small differences in date of birth since all calves were weaned at a similar time.

These results demonstrate large breed differences among breeds for growth, puberty, and productivity traits. It should be emphasized, however, that the breed ranking for these characteristics varies depending on environmental and management conditions. In this study, for example, productivity favored heifers having high levels of milk production, however, productivity of these heifers would be expected to be less favorable on more limiting pasture situations. Effects of postweaning nutrition were primarily short-term in nature, however, data were presented that indicated low nutrition levels postweaning resulted in delayed onset of first estrus and somewhat decreased milk production. Conversely, data were presented that demonstrated that no long-term advantages resulted from feeding heifers to gain 1.8 lb/day postweaning. In fact, the data suggested some detrimental effects of high postweaning nutritional treatment.

**Table 1.—Effect of breed, postweaning nutritional treatment, and subsequent management on heifer weight [1,2]**

| | | Age (Days) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Main effect | No. | 198 | 382 | 403 | 450 | 550 | 635 | 930 |
| Breed: | | | | | | | | |
| Angus | 78 | $^{4}$432 ± 4 | $^{5}$690 ± 7 | $^{5}$708 ± 7 | $^{5}$774 ± 7 | $^{4}$776 ± 7 | $^{4}$913 ± 9 | $^{4}$946 ± 13 |
| Hereford | 93 | $^{3}$395 ± 4 | $^{4}$624 ± 7 | $^{4}$655 ± 7 | $^{4}$723 ± 7 | $^{3}$739 ± 7 | $^{3}$867 ± 7 | $^{4}$957 ± 11 |
| Red Poll | 61 | $^{3}$397 ± 4 | $^{3}$613 ± 7 | $^{3}$646 ± 7 | $^{3}$706 ± 9 | $^{3}$732 ± 9 | $^{3}$867 ± 9 | $^{3}$900 ± 13 |
| Brown Swiss | 47 | $^{7}$507 ± 7 | $^{6}$754 ± 9 | $^{6}$778 ± 9 | $^{6}$862 ± 9 | $^{5}$904 ± 9 | $^{5}$1034 ± 11 | $^{5}$1012 ± 15 |
| Charolais | 36 | $^{5}$485 ± 7 | $^{8}$781 ± 9 | $^{7}$805 ± 9 | $^{7}$880 ± 11 | $^{6}$926 ± 11 | $^{6}$1105 ± 13 | $^{7}$1195 ± 20 |
| Simmental | 90 | $^{6}$494 ± 4 | $^{7}$765 ± 7 | $^{8}$783 ± 7 | $^{6}$867 ± 7 | $^{5}$902 ± 7 | $^{5}$1041 ± 7 | $^{6}$1105 ± 11 |
| Nutrition treatment: | | | | | | | | |
| Low | 131 | 454 ± 4 | $^{3}$628 ± 4 | $^{3}$657 ± 4 | $^{3}$725 ± 7 | $^{3}$796 ± 7 | $^{3}$946 ± 7 | 1003 ± 11 |
| Medium | 138 | 452 ± 4 | $^{4}$710 ± 4 | $^{4}$739 ± 4 | $^{4}$803 ± 7 | $^{4}$838 ± 7 | $^{4}$981 ± 7 | 1023 ± 9 |
| High | 136 | 450 ± 4 | $^{5}$774 ± 4 | $^{5}$789 ± 4 | $^{5}$869 ± 7 | $^{5}$853 ± 7 | $^{5}$986 ± 7 | 1028 ± 11 |
| Management: | | | | | | | | |
| Feedlot | 200 | 452 ± 2 | 710 ± 4 | $^{4}$754 ± 4 | $^{4}$814 ± 4 | $^{3}$823 ± 4 | $^{3}$961 ± 4 | 1008 ± 9 |
| Pasture | 205 | 450 ± 2 | 701 ± 4 | $^{3}$703 ± 4 | $^{3}$789 ± 4 | $^{4}$836 ± 4 | $^{4}$981 ± 4 | 1028 ± 9 |

[1] Mean weight in pounds ± SE.
[2] Nine Angus, 13 Hereford, 2 Red Poll, 5 Charolais, and 8 Simmental heifers did not conceive during the breeding season so were not included at 635 or 930 days of age. One additional Red Poll, 4 Brown Swiss, and 1 Charolais were removed prior to 930 days of age.
[3 4 5 6 7 8] Means within a main effect and column with different superscripts differ ($P<0.05$).

**Table 2.—Effects of heifer breed and postweaning nutritional treatment on calf birth date, birth weight and weaning weight [1]**

| Main effect | Number born | Birth date | Birth weight (lb) | Number weaned | Adjusted weaning weight (lb) |
|---|---|---|---|---|---|
| Breed: | | | | | |
| Angus | 69 | $^{3}$93 ± 5 | $^{4}$71 ± 1 | 59 | $^{3}$421 ± 7 |
| Hereford | 70 | $^{3}$90 ± 5 | $^{4}$70 ± 1 | 62 | $^{2}$377 ± 7 |
| Red Poll | 61 | $^{2}$76 ± 6 | $^{3}$75 ± 1 | 52 | $^{4}$454 ± 7 |
| Brown Swiss | 47 | $^{2}$77 ± 7 | $^{5}$90 ± 2 | 35 | $^{6}$518 ± 9 |
| Charolais | 35 | $^{4}$100 ± 8 | $^{6}$95 ± 2 | 22 | $^{5}$485 ± 11 |
| Simmental | 85 | $^{3}$93 ± 5 | $^{4}$84 ± 1 | 63 | $^{6}$516 ± 7 |
| Nurtitional treatment: | | | | | |
| Low | 114 | 89 ± 4 | 81 ± 1 | 94 | $^{2\,3}$465 ± 7 |
| Medium | 125 | 84 ± 4 | 82 ± 1 | 106 | $^{3}$472 ± 7 |
| High | 128 | 92 ± 4 | 80 ± 1 | 93 | $^{2}$450 ± 7 |

[1] Mean ± SE.
[2 3 4 5 6] Means within a main effect and column with different superscripts differ ($P<.05$).

**Table 3.—Effects of breed of heifer and postweaning nutrition treatment on milk production and calf weight [1]**

| | | Days postpartum | | | | | |
|---|---|---|---|---|---|---|---|
| | | 50 | | 90 | | 130 | |
| | No. | Calf weight (lb) | Milk production (lb/day) | Calf weight (lb) | Milk production (lb/day) | Calf weight (lb) | Milk production (lb/day) |
| Breed: | | | | | | | |
| Angus | 18 | $^{4}$174 ± 7 | $^{4}$18 ± 1 | $^{4}$267 ± 9 | $^{4}$14 ± 1 | $^{4}$342 ± 11 | $^{4}$13 ± 1 |
| Hereford | 16 | $^{3}$139 ± 7 | $^{3}$13 ± 1 | $^{3}$210 ± 9 | $^{3}$11 ± 1 | $^{3}$271 ± 11 | $^{3}$11 ± 1 |
| Red Poll | 17 | $^{4}$176 ± 7 | $^{5}$20 ± 1 | $^{4}$273 ± 9 | $^{4}$15 ± 1 | $^{4}$362 ± 11 | $^{5}$16 ± 1 |
| Brown Swiss | 18 | $^{6}$216 ± 7 | $^{8}$28 ± 1 | $^{6}$329 ± 7 | $^{6}$23 ± 1 | $^{5}$421 ± 9 | $^{6}$20 ± 1 |
| Charolais | 17 | $^{5}$199 ± 7 | $^{6}$22 ± 2 | $^{5}$302 ± 9 | $^{4}$15 ± 1 | $^{5}$399 ± 11 | $^{4}$13 ± 1 |
| Simmental | 17 | $^{5}$199 ± 7 | $^{7}$25 ± 1 | $^{5}$307 ± 9 | $^{5}$19 ± 1 | $^{5}$410 ± 11 | $^{5}$17 ± 1 |
| Nutrition treatment: | | | | | | | |
| Low | 35 | 185 ± 4 | $^{3}$19 ± 1 | 284 ± 7 | 15 ± 1 | 373 ± 7 | 15 ± 1 |
| Medium | 35 | 190 ± 4 | $^{4}$23 ± 1 | 287 ± 7 | 17 ± 1 | 377 ± 9 | 15 ± 1 |
| High | 33 | 176 ± 4 | $^{3}$20 ± 1 | 271 ± 7 | 16 ± 1 | 355 ± 9 | 16 ± 1 |

[1] Mean SE.
[2] Twenty-four hr milk production was estimated as the differences in calf weight before and after nursing, after being penned separate from the dam for 12 hr, times 2.
[3 4 5 6 7 8] Means within a main effect and column with different superscripts differ ($P<0.05$).