COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY • COLLEGE OF AGRICULTURE

ASC-144

Management Considerations in Beef Heifer Development:

Breed Type, Weight & Height, Reproductive Tract Scores

D. J. Patterson, K. D. Bullock, W. R. Burris, and J. T. Johns

Because decisions about selecting and managing replacement beef heifers can affect the future productivity of an entire cowherd, programs to develop breeding heifers have focused on the physiological processes that influence puberty. The timing of puberty is critical to whether a heifer remains in the herd and whether lifetime productivity is optimized.

Age at puberty is most important as a production trait when heifers are bred to calve as 2-year-olds and in systems that impose restricted breeding seasons. The number of heifers that become pregnant during their first breeding season and within a defined period correlates with the number that exhibit estrus early in the breeding season. Heifers that calve first as 2-year-olds produce more calves during a lifetime than do heifers that calve first at three years of age or older.

The decision to breed heifers as yearlings involves careful consideration of both the economics of production and of such characteristics as the reproduction status, breed type or genetic make-up of the heifers involved. Differences in the age at which heifers are first exposed for breeding depend on three factors: management systems, forage quality and availability, and adaptation of respective breed types to specific environmental conditions.

Numerous studies have reported both between-breed and within-breed differences in age and weight at puberty as well as subsequent reproduction in beef cattle. To achieve optimum production levels, it is important to know the relationships between puberty traits and measures of productivity for effective utilization of selection, heterosis and complimentarity. Breed differences, sire and dam effects within a breed, and heterosis or hybrid vigor contribute to genetic control of age at puberty.

Age at puberty can be decreased in three ways:

- by selecting a breed with a younger age at puberty,
- by selecting within a breed for younger age at puberty, or
- by crossbreeding with another breed that has a similar or younger age at puberty.

Diversity Among Breeds

Table 1 groups breed crosses as to their biological type and four other criteria. The table summarizes data from the Meat Animal Research Center for 19 F_1 crosses grouped into seven biological types based on relative differences (X lowest, XXXXXX highest) in growth rate and mature size, lean-to-fat ratio, age at puberty, and milk production. These data show that faster-gaining breed groups of larger mature size reach puberty at later ages than do slower-gaining breed groups of smaller mature size. Breeds that have had a history of selection for milk production (e.g., Gelbvieh, Brown Swiss, and Simmental) tend to weigh less at puberty than do those with the same genetic potential for growth and mature size that are not selected for milk production (e.g., Charolais, Limousin, and Chianina).

Heifers sired by breeds with a large mature size tend to be older and heavier at puberty than do heifers sired by breeds with a smaller mature size. The relationship between mature size and age at puberty can be offset by associations with milk production (i.e., heavier milking breeds or lines within a breed, will reach puberty at younger ages and lighter weights). When these interpretations are expanded to mature cows, it is evident that the additional nutrient requirements of cows of large size and higher milk production potential must be met or the intervals from calving to first estrus will increase and conception rates will decline.

Matching the Development Program with Genotype

We know that most components of fertility that influence first calving and subsequent reproductive performance are not highly heritable. This suggests that management practices are most likely to influence the majority of factors related to reproductive performance. How we manage replacement heifer calves from the time they are weaned from their dams to the beginning of the first breeding period is extremely critical for their subsequent performance.

Studies indicate that puberty can be expected to occur at a genetically predetermined size among individual animals, and only when heifers reach target weights can high pregnancy rates be obtained. In other words, heifers with the genetic potential to reach a heavier mature weight must attain a heavier prebreeding weight before their first breeding season. Using the standard set by the Beef Improvement Federation for nine frame-size classifications for U.S. breeding cattle (Table 2), producers can estimate body composition and energy requirements per pound of gain at various weights during the feeding period.

Optimum growth rates for replacement females of various body types are also available. These growth rates represent optimums for heifers that vary in mature size; they were established to maximize female lifetime productivity. These growth rates are listed in Table 3. The target weight principle calls for feeding heifers to a prebreeding target weight that represents 65% of the heifer's projected mature weight.

Reproductive Tract Score (RTS)

Heifers must reach puberty by 15 months of age if they are to conceive and calve by 24 months, but as many as 35% of all beef heifers fail to reach puberty by this time. We know that first-service conception rates for heifers that are bred on their first heat are lower than those of heifers bred on a second or subsequent heat. Therefore heifers should reach puberty one to three months before the average age at which they are to be bred. Earlier age at puberty in relation to breeding is to ensure that a high percentage of heifers are cycling and that the effects of lowered potential fertility at the first estrus are minimized.

Because age at puberty in beef heifers is difficult and labor intensive to measure directly, a method for evaluating the reproductive tract of yearling heifers has been developed. The reproductive tract scoring (RTS) system was designed to estimate pubertal status via rectal palpation of the uterine horns and ovaries. Scores are subjective estimates of sexual maturity, based on ovarian follicular development and palpable size of the reproductive tract. Each heifer is assigned a score of 1 (immature) through 5 (cycling) as described in Table 4.

The RTS values have been shown to be predictive of reproductive performance of yearling heifers, especially for pregnancy rates to synchronized breeding and to pregnancy rates at the end of the breeding season. Heifers with more mature reproductive tracts had higher pregnancy rates and calved earlier. Preliminary data indicate that tract scores can be used to evaluate the status of heifer development and time synchronization programs and the start of the breeding season. Scoring can be done as part of a yearling heifer evaluation and health program in conjunction with collection of *yearling weights*, *condition scores, pelvic measurements,* and *general processing*.

An RTS of 1 is assigned to heifers with infantile reproductive tracts, indicated by small, toneless uterine horns and small ovaries lacking significant structures. Heifers scored as 1 are likely the furthest from cycling at the time of examination. Heifers given an RTS of 2 are thought to be closer to cycling than those scoring 1, due primarily to the presence of small follicles and slightly larger uterine horns and ovaries. Heifers assigned an RTS of 3 are thought to be on the verge of cycling based on slight uterine tone in addition to the presence of follicles. Heifers assigned a score of 4 are presumably cycling, as indicated by good uterine tone, uterine size, and follicular growth. However, heifers with tract scores of 4 lack an easily distinguished corpus luteum due to the stage of the estrous cycle. Heifers with tract scores of 5 are similar to those scoring 4 except for the presence of a palpable corpus luteum.

Summary

The target weight principle of developing heifers to an optimum prebreeding weight seems to be the most feasible method ensuring that a relatively high percentage of yearling heifers reach puberty by the breeding season. A better understanding of the basic principles that govern onset of puberty in the heifer and the influence of nutrition on this sequence of events should lead to improved management practices and more predictable methods of ensuring puberty at an optimum age.

TABLE 1.
Breed crosses grouped in biological type on the basis of four major criteria[a]

Breed Group	Growth rate & mature size	Lean:fat ratio	Age at puberty	Milk Production
Jersey	X	X	X	XXXXX
Hereford-Angus	XX	XX	XXX	XX
Red Poll	XX	XX	XX	XXX
Devon	XX	XX	XXX	XX
South Devon	XXX	XXX	XX	XXX
Tarentaise	XXX	XXX	XX	XXX
Pinzgauer	XXX	XXX	XX	XXX
Brangus	XXX	XX	XXXX	XX
Santa Gertrudis	XXX	XX	XXXX	XX
Sahiwal	XX	XXX	XXXXX	XXX
Brahman	XXXX	XXX	XXXXX	XXX
Brown Swiss	XXXX	XXXX	XX	XXXX
Gelbvieh	XXXX	XXXX	XX	XXXX
Holstein	XXXX	XXX	XX	XXXXXX
Simmental	XXXXX	XXXX	XXX	XXXX
Maine-Anjou	XXXXX	XXXX	XXX	XXX
Limousin	XXX	XXXXX	XXXX	X
Charolais	XXXXX	XXXXX	XXXX	X
Chianina	XXXXX	XXXXX	XXXX	X

[a]X lowest XXXXXX highest.
Cundiff, 1986.

TABLE 2.
Body weight & height of breeding females of different frame sizes[1]

Frame score	205 day		426 day		Maturity	
	Height	Weight	Height	Weight	Height	Weight
1	35	356	41	580	44	880
2	37	375	43	618	46	953
3	39	396	45	653	48	1027
4	41	418	47	693	50	1100
5	43	438	49	728	52	1172
6	45	458	51	766	54	1247
7	47	480	53	803	56	1320
8	49	499	55	838	58	1393
9	51	521	57	880	60	1467

[1]Hip height (in.) based on Beef Improvement Federation standards. Weights (lbs) are expected averages for flesh condition (body condition score 5; Fox et al., 1988).

TABLE 3.
Optimum growth rate for breeding herd replacement females[1]

	Frame Size				
	1	**3**	**5**	**7**	**9**
Optimum weight at first estrus, lbs	580	653	728	803	880
Mature weight, lbs	880	1027	1172	1320	1467

[1]Optimum weight or target weights at which reproductive cycles are initiated are reinitiated as soon as possible without excess fat deposition that will inhibit milk production and reproduction (Fox et al., 1988).

TABLE 4.
Description of Reproductive Tract Score[a]

		OVARIES			
		Approximate Size			
Reproductive Tract Score	**Uterine Horns**	**Length (mm)**	**Height (mm)**	**Width (mm)**	**Ovarian Structures**
1	Immature <20 mm diameter, no tone	15	10	8	No palpable follicles
2	20-25 mm diameter, no tone	18	12	10	8mm follicles
3	25-30 mm diameter, slight tone	22	15	10	8-10 mm follicles
4	30 mm diameter, good tone	30	16	12	>10 mm follicles, Corpus luteum possible
5	> 30 mm diameter, good tone, erect	>32	20	15	>10 mm follicles, Corpus luteum present

[a]Reproductive tract score was determined approximately 1 month prebreeding by rectal palpation. Anderson, et al., 1991.

References

Anderson, K. J., D. G. Lefever, J. S. Brinks, and K. G. Odde. 1991. The use of reproductive tract scoring in beef heifers. Agri-Practice. 12(4):19.

Cundiff, L. V. 1986. The effect of future demand on production programs-biological versus product antagonisms. Beef Improvement Federation Proc. pp. 110-127.

Fox, D. G., C. J. Sniffen, and J. D. O'Connor. 1988. Adjusting nutrient requirements of beef cattle for animal and environmental variations. J. Anim. Sci. 66:1475.

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, C. Oran Little, Director of Cooperative Extension Service, University of Kentucky College of Agriculture, Lexington, and Kentucky State University, Frankfort.

Issued 3-95—5M