Available online at www.sciencedirect.com
ScienceDirect
Theriogenology 70 (2008) 569–572
Theriogenology
www.theriojournal.com

Developing replacement beef heifers

T.J. Engelken *

Veterinary Diagnostic and Production Animal Medicine, Iowa State University, College of Veterinary Medicine, Ames, IA 50011, United States

Abstract

The replacement heifer represents the next generation of genetic progress for the cow herd. Producers invest a substantial amount of capital in these females, even if they fail to become pregnant. In order to get a return on this investment, it is imperative that these heifers become pregnant early in the first breeding season, calve with a minimum of dystocia, breed back in a timely fashion, and then continue to be productive for a number of years. Practitioners working with heifer development programs need to emphasize a systemic approach that evaluates these females at critical times. These programs need to address such areas as weaning and nutritional management, genetic selection, prebreeding evaluation, the breeding season, and heifer management from pregnancy examination through the end of their first calving season. This increased level of scrutiny should not end until the heifer weans her first calf and is determined to be pregnant the second time. This type of program will ensure optimal reproductive rates, female longevity, and a positive return on the producer's investment.

Keywords: Heifer; Puberty; Nutrition; Reproduction; Genetics

1. Introduction

The replacement heifer represents the next generation of genetic progress for the cow herd. Producers invest a substantial amount of capital in these females, even if they fail to become pregnant. In order to get a return on this investment, it is imperative that these heifers become pregnant early in the first breeding season, calve with a minimum of dystocia at 2 years of age, breed back in a timely fashion, and then continue to be productive for a number of years. Therefore it is critical that replacement females be selected, grown, and managed to ensure adequate reproductive performance. Heifer development programs should be instituted in order to ensure that these females are meeting a set of performance parameters that includes both growth and reproductive targets. Practitioners have an opportunity to become involved with the management of these programs in order to have a positive affect on herd profitability.

2. Selection at weaning

Although there are some management practices that can be applied to potential replacements during the suckling phase, we obviously rely on the dam to nurture and care for the calf. Growth-promoting implants are an option that may be considered to increase average daily gain and weaning weight in calves. However, care must be taken to evaluate the potential negative affects of implants on subsequent fertility, and products need to be used according to label directions [1–3]. Although individual cow and calf identification is a management practice that is often underutilized in beef operations, it should be encouraged, as it improves the accuracy

* Tel.: +1 515 294 2192; fax: +1 515 294 1072.
E-mail address: engelken@iastate.edu.

0093-691X/$ – see front matter © 2008 Elsevier Inc. All rights reserved.
doi:10.1016/j.theriogenology.2008.05.032

of data collection and makes postweaning selection decisions easier.

The process of selection begins at weaning with the identification of potential replacements. Females should be selected based on age, weight, and productivity of their dam. Selection of replacements from calves born in the first half of the calving season will increase the chance of the female reaching puberty by the time the breeding season starts [4,5]. Since the age and breed of the potential replacement is already established by the producer, weaning weight becomes the primary selection parameter and basis for the developmental program. However, regardless of their birth date, the entire calf crop is typically weaned on the same date, so uniformity of the group of replacements may be an issue. Sorting heifers by weight and frame score is normally the first step in narrowing the pool of replacements at weaning. Economic considerations should be evaluated when there is a wide disparity in heifer weights. Heifers which are too large (frame score) or too light (weight) may be targeted for culling in order to improve the efficiency of the replacement program.

3. Nutritional management of the replacement heifer

Based on a heifer's genetics and expected mature size, a target weight can be selected and the feeding program tailored to meet the needed average daily gain [4–6]. Target weight is simply an estimation of the weight at which individual heifers will reach puberty. Provided we know the weaning weight, target weight, and number of calendar days before the start of the breeding season, rations can be constructed to ensure that heifers reach puberty in a timely fashion. Typically the rate of gain needed will fall into the 0.5–0.8 kg/d range and represent a total gain of approximately 91 kg for heifers of British breeding. Normal prebreeding weight should be close to 60–65% of the heifer's expected mature weight. Feeding ionophores to replacement heifers increased feed efficiency, average daily gain, and hastened the onset of puberty [7–9]. A daily dose of 200 mg/(head d) of monensin has been used effectively in these trials.

Research has shown that heifers breeding on their third estrus have a higher first-service conception rate (21–36%) than those bred at puberty [10,11]. Therefore, gains should be targeted to have heifers reach puberty at least 3 wk prior to the beginning of breeding. Heifers will normally reach puberty at 60–65% of their mature weight, but this will be affected by genetics, season of birth, and rate of postweaning gain. Selection of the target weight may be based on the average weight of the heifer group, a percentage of the expected mature weight, or extrapolated from the average frame score.

Following pregnancy examination, weight gains need to focus on having the heifers reach approximately 85% of their expected mature weight by the time they calve. Moderate daily gains in the range of 0.5 kg/d will usually be adequate to ensure that heifers reach their first calving with adequate frame, pelvis, and body condition. It is useful to remember that approximately 70–75% of fetal growth occurs during the last trimester of pregnancy and rations should be adjusted accordingly [5,6]. These adjustments need to include adequate protein, energy, and trace minerals. This is especially important for the first 3 mo after calving, if heifers are expected to be able to lactate, grow, and conceive in a timely fashion [12,13].

4. Considerations for the health program

The health program for the replacement heifer should be targeted against reproductive disease and help to optimize growth rate. The heifer's first breeding season, first pregnancy, and subsequent reproductive performance should all be considered when defining the timing, delivery, and antigens to include in the vaccination schedule [14]. The history of disease on the ranch, traffic patterns on and off the operation, and previous diagnostic information should also be evaluated when attempting to manage the disease risk. Vaccines that provide fetal protection against common viral and bacterial diseases should be utilized in these schedules and Beef Quality Assurance guidelines should be followed. Deworming schedules can vary greatly depending upon rainfall, temperature variation, and forage availability. The class of anthelmintic, level of pasture contamination with infective larvae, and the relative cost of the products will also impact strategic deworming programs [15,16]. Veterinary involvement in these decisions is critical for the successful application of current vaccine and parasite control programs.

Approximately 30–60 d prior to breeding, heifers should undergo a prebreeding evaluation [4,6,17]. This is the last step in determining whether or not a heifer will actually enter the breeding program. Heifers should be evaluated on their body weight, reproductive tract score, pelvic dimensions, body condition score, and structural correctness. There is a growing body of evidence that shows that female temperament is highly correlated with that of her calf, and that feeding performance of the offspring will be negatively affected [18,19]. There is anecdotal evidence that temperamental heifers have

lower conception rates to AI. At any rate, overly aggressive or easily frightened females should be considered for culling. Other heifers that fail to meet specific selection targets should be culled at this time as well. This evaluation should take place far enough in advance of the breeding season to allow adequate time for needed ration changes if accelerated growth is needed. This handling also represents a good opportunity to deliver vaccines and dewormers. This information should be summarized and reported in a format that will justify program decisions to the client.

5. Management of the first breeding season

Planning for the breeding season should begin early enough to allow time for bull selection (AI or natural service), as well as acquisition and implementation of the estrus synchronization protocol. Evaluation of sires should be based on their ability to pass a breeding soundness examination and their EPD values. Bulls with large scrotal circumferences and prebreeding bull exposure should be utilized, since this will hasten the onset of puberty in their progeny [4,5]. Progesterone-based synchronization programs do offer the advantage of inducing puberty in some heifers [20]. There are multiple protocols that can be utilized for estrus synchronization; these programs should consider cost, animal handling, and breeding options [21,22]. However, it is not possible to review all of those options for this presentation.

Early pregnancy detection may be a useful management tool to better define the timing of pregnancy, the sire of the calf, and the overall success of the breeding season. This may occur 30 to 45 d after the end of the AI period or following bull removal [23]. This practice is especially helpful, in that it gives an early indication of reproductive failure so that the practitioner can begin the diagnostic workup much earlier. Early examination of pregnancy may also be used to hasten the culling of nonpregnant or late-bred heifers in the event of forage shortages. Information concerning individual pregnancy status, the pregnancy rate of the group, culling information, and the pregnancy distribution should all be reported to the client [24,25].

Once heifers are determined to be pregnant, they need to be managed to calve in moderate body condition (average BCS of 5.5–6.0). Heifers calving in moderate condition usually have less dystocia, a shorter postpartum interval, and higher pregnancy rates after their second breeding season. Heifers should be dewormed between pregnancy examination and calving, and the health program should center on antigens that cause losses in mid- and late-gestation. Vaccines for calf scours should also be delivered according to label directions as needed.

Replacement heifers represent a relatively large capital investment on the part of the producer. Therefore, they need to be managed intensively to ensure that they breed, calve, and rebreed in a timely fashion. Events crucial to heifer development center on proper selection, nutritional management, breeding season management, and program evaluation. Careful monitoring of heifer growth and performance at these critical times is an important component of successful development. Practitioners are in a unique position to help their clients assess this part of their operation and make needed changes.

References

[1] King BD, Bo GA, Kirkwood RN, Guenter CL, Cohen RDH, Mapletoft RJ. The effect of zeranol implants on growth and pregnancy loss in beef heifers. Can J Anim Sci 1994;74:73–6.
[2] Gutierrez PH, Dalsted N, Odde K, Corah L, Deutscher GH. An economic evaluation of the effects of Synovex-C implants on replacement heifers. Prof Anim Scientist 1995;11:13–9.
[3] Floyd JG, Bartol FF, Kriese LA. Rational use of growth implants. In: Proceedings of the Southeastern Beef Production Management Series; 1996.
[4] Spire MF. Managing replacement heifers from weaning to breeding. Vet Med 1997;92:182–92.
[5] Corah LF, Hixon DL. Replacement heifer development. In: Beef cattle handbook. Ames, IA: MidWest Plan Service; June 1999 [Publication BCH 2100] p. 1–4.
[6] Larson RL, Randle RF. Heifer development: nutrition, health and reproduction. In: Youngquist RS, Threlfall WR, editors. Current Therapy in Large Animal Theriogenology. Saunders Elsevier; 2007. p. 457–63.
[7] Moseley WM, McCartor MM, Randel RD. Effects of monensin on growth and reproductive performance of beef heifers. J Anim Sci 1977;45:961–8.
[8] Lalman DL, Petersen MK, Ansotegui RP, Tess MW, Clark CK, Wiley JS. The effects of ruminally undegradable protein, propionic acid, and monensin on puberty and pregnancy in beef heifers. J Anim Sci 1993;71:2843–52.
[9] Floyd CR, Purvis HT, Lusby KS, Wettemann RP. Effects of monensin and 4-Plex on growth and puberty in beef heifers. Oklahoma State University Animal Science Research Report, P-943. OK Ag Exp Station; July 1995.
[10] Byerley DJ, Staigmiller RB, Berardinelli JG, Short RE. Pregnancy rates of beef heifers bred either on puberal or third estrus. J Anim Sci 1987;65:645–50.
[11] Perry RC, Corah LH, Cochran RC, Brethour JR, Olson KC, Higgins JJ. Effects of hay quality, breed, and ovarian development on onset of puberty and reproductive performance of beef heifers. J Prod Agric 1991;4:13–8.
[12] Marston TT, Lusby KS, Wettemann RP, Purvis HT. Effects of feeding energy or protein supplements before or after calving on performance of spring-calving cows grazing native range. J Anim Sci 1995;73:657–64.

[13] Lalman DL, Williams JE, Hess BW, Thomas KG, Keisler DH. Effect of dietary energy on milk production and metabolic hormones in thin, primiparous beef heifers. J Anim Sci 2000;78: 530–8.
[14] Spire MF. Immunization of the beef breeding herd. Comp Con Ed Pract Vet 1988;10:1111–7.
[15] Larson RL, Corah LR, Spire MF, Cochran RC. Effect of treatment with ivermectin on reproductive performance of yearling beef heifers. Theriogenology 1995;44:189–97.
[16] Williams JC, Loyacano AF. Internal parasites of cattle in Louisiana and other southern states. LSU Research and Extension Research Information Sheet #104, p. 1–20; August 2001.
[17] Hardin DR. The benefits of palpation before synchronization. Agri-Practice 1984;5:29–32.
[18] Vann RC, Baker JF, Randel RD. Relationship between measures of cow and calf temperament and live animal body composition traits in calves at weaning. J Anim Sci 2004;82(Suppl. 2):24 [abstract].
[19] Busby WD, Strohbehn D, Beedle P, King M. Effect of disposition on feedlot gain and quality grade. Iowa State University Animal Industry Report, AS Leaflet R2070; 2006.
[20] Engelken TJ. Estrus synchronization programs for beef herds. Vet Med 1995;90(Suppl.):19–28.
[21] Geary T. Synchronizing estrus in beef cattle. In: Cattle producer's library, reproduction section, CL405 2nd ed., Western Beef Resource Committee; 2002. p. 1–6.
[22] Kesler DJ. Review of estrous synchronization systems: CIDR inserts. In: Proceedings of Applied Reproductive Strategies in Beef Cattle; 2002. p. 47–59.
[23] Rice LE. Development of replacement heifers. In: Howard JL, Smith RA, editors. Current Veterinary Therapy. 4. Food Animal Practice. WB Saunders Company; 1999. p. 109–13.
[24] Traffas V, Engelken TJ. Breeding season evaluation of beef herds. In: Howard JL, Smith R, editors. Current Veterinary Therapy. 4. Food Animal Practice. W.B. Saunders Company; 1999. p. 98–105.
[25] Engelken TJ, Trejo C, Voss KV. Reproductive health programs for beef herds—analysis of records for assessment of reproductive performance. In: Youngquist RS, Threlfall WL, editors. Current Therapy in Large Animal Theriogenology. WB Saunders Company; 2007. p. 490–6.