Forage-Based Replacement Heifer Management

Brad Austin[1], Joel Yelich[2], and Matt Hersom[3]
[1]Biological Scientist, UF/IFAS, Department of Animal Sciences, Gainesville, FL
[2]Associate Professor, UF/IFAS, Department of Animal Sciences, Gainesville, FL
[3]Assistant Professor, UF/IFAS, Department of Animal Sciences, Gainesville, FL

Introduction

The development of replacement heifers is one of the most expensive segments of a cow-calf enterprise. Productivity for beef cattle herds has been shown to increase when a high percentage of heifers become pregnant early in the first breeding season (Lesmeister et al., 1973). For this reason heifer management should not be an area that is over looked in the cow-calf enterprise.

The goal of any replacement heifer development program should be to grow heifers to a point where the majority of animals are pubertal and cycling at the start of the breeding season. Research has shown that heifers that calve at two years of age have increased lifetime productivity as compared to later calving heifers (Wiltbank et al., 1985). Heifers must be bred by 15 months of age to calve at two years of age. Ideally heifers should reach puberty at least one month prior to the beginning of the breeding season. Heifers are less likely to conceive on the puberal estrus as compared to the third estrus (Byerley et al., 1987). Taking this into account along with the fact that heifers are often bred one month prior to the cow herd, heifers must attain puberty by 11 to 13 months of age (Larson, 2007). For this to occur replacement heifers must have a relatively high plane of nutrition and a high rate of gain. The increased cost, associated with increased management, nutrition, labor, facilities, and equipment required to have heifers reach puberty prior to breeding at 15 months of age can be impractical in some situations. This paper will focus on developing replacement heifers to calve at two years of age.

Challenges

In Florida and across the southern Gulf Coast region, the development of replacement heifers differs greatly from other regions of the U.S. Many of the forages grown in the Gulf Coast region contain considerably lower levels of crude protein (CP) and total digestible nutrients (TDN) compared to forages grown in more temperate regions. Yearling heifers require a diet that is 8 to 9% CP and 50 to 65% TDN (Table 1). Most of the hay utilized by cattle producers in Florida is well below this need. Because of this heifers need to be supplemented to meet the nutrient requirements for acceptable weight gains.

Another challenge faced by ranchers in Florida and the Gulf Coastal region is the utilization of *Bos indicus* breeding. Heifers with *Bos indicus* breeding tend to mature slower and reach puberty at an older age than *Bos taurus* animals (Warnick et al., 1956). Peacock et al. (1976) noted that the percentage of Brahaman content in crossbred heifers in Florida had a direct negative correlation with the proportion of heifers calving as two-year olds. For a greater proportion of these heifers to reach puberty, they must receive a level of nutrition high enough to allow them to reach weights at which they can become pubertal. Nutrition is doubly important because of this.

The target body weights for development of heifers should be 65% of mature weight at breeding. As an example, a heifer with a mature weight of 1,100 lb should weigh 715 lb at breeding. If this heifer weaned at 500 lb in early September and was to be bred in early-March (182 days) the heifer would need to gain 1.18 lb/d to weigh 715 at the start of the breeding season. In comparison, a heifer with a mature weight of 1,200 lb would have a target breeding weight of 780 lb. If this heifer also weaned at 500 lb she would need to gain 1.54 lb/d to meet that target weight.

The nutrient requirements for heifers increase with greater body weights and greater body weight gains (Table 1). As previously stated, many of the forages and hays available in the fall and winter are low in

Table 1. Daily TDN and protein requirements of heifers at various weights and gains.[a]

Weight	Daily Gain	Dry Matter	TDN		Crude Protein	
(lb)	(lb)	Intake (lb)	lb/day	%	lb/day	%
500	0.5	11.6	6.3	54	0.97	8.4
500	1.0	12.2	7.2	59	1.19	9.8
500	1.5	12.6	8.1	64	1.41	11.2
500	2.0	12.7	8.8	69	1.63	12.8
500	2.5	12.5	9.4	75	1.84	14.7
700	0.5	14.9	8.0	54	1.19	8.0
700	1.0	15.8	9.3	59	1.42	9.0
700	1.5	16.2	10.4	64	1.64	10.1
700	2.0	16.3	11.2	69	1.85	11.4
700	2.5	16.1	12.1	75	2.06	12.8

[a]Nutrient Requirements of Beef Cattle, National Research Council, 1984.

TDN and CP. The concentrations of TDN and CP found in these forages will not meet the nutrient demands of heifers to gain 1.0 to 1.5 lb/d. To meet these requirements heifers must be supplemented. The amount of supplement needed to grow a 600 lb heifer at 1.0 or 1.5 lb/d for three different forage qualities is shown in Table 2. Residual bahiagrass pasture in the fall or mature hays often have values similar to forage one in Table 2 and would require 6 lb of a 75 % TDN supplement with 13.8% CP for 600 lb heifers to gain 1 lb/d. To gain 1.5 lb/d, an estimated 9 lb/d of 75% TDN supplement containing 13.4% CP would be required for heifers. Proportionally more supplement that had a TDN of less than 75% would be required to support these gains. The amount of supplement and protein concentration in the supplement are less for higher quality forages (Forages 2 and 3, Table 2), which provides economic incentive to manage pasture and hay for high quality.

Forage Quality

By increasing the quality of forage available to heifers the cost involved in supplementation will decrease as shown in Table 2. This can be accomplished through proper pasture management techniques, utilization of winter annuals, or proper hay field and harvest management. The utilization of round bale silage is one method of increasing forage quality through timely harvest. Hersom et al. (2007) examined the stored forage quality and forage yield of two different forage management systems. A hay harvest only system, which allowed for hay production when weather conditions allowed, and a round bale silage (RBS) system, which harvested the forage every 4 weeks, were compared. The RBS system resulted in two more cuttings of forage harvested, 55 tons more forage dry matter, and a greater TDN (57.1%) and CP (12.9%) compared to the hay only system (TDN=53.8%, CP=10.1%). The utilization of RBS by cow-calf producers has gained popularity over the years. Many producers are reluctant to consider RBS because of the cost; however, the investment in a wrapper and stretch wrap can easily pay for itself in the increase in forage quality and savings in supplementation over time. One important thing to note is that wrapping hay will not improve the quality of the hay. If hay pastures are not fertilized, managed properly, or cut at the right time, the forage that is harvested will be poor whether or not it is wrapped.

Dry hay and RBS, although commonly used, are not the only forages that can be used for replacement heifer development. Good winter pasture such as ryegrass, rye, oats, and wheat can all be used effectively in certain parts of the state. Corn or sorghum silages can also be used when they price into a ration. Regardless of what forage source is used, make sure that you know the nutritive value of that forage. The cost of testing forages can be recouped in supplement savings and animal performance. Forages should be the base of your heifer development system. Always

Table 2. Daily levels of 75% TDN supplement required for various gains of 600 lb heifers fed different hay qualities.[a]

	Forage #1[b]		Forage #2[c]		Forage #3[d]	
Gain	Supplement[e] (lb)	Protein[f] %	Supplement (lb)	Protein %	Supplement (lb)	Protein %
1.0 lb/d	6	13.8	4	10.3	2	4.5
1.5 lb/d	9	13.4	7	12.3	5	8.0

[a]Adapted from Kunkle et al., 2002.
[b]TDN=47%, CP=6%.
[c]TDN= 54%, CP=9%.
[d]TDN=58%, CP=12%.
[e]Supplement (lb/d) needed along with forage ad libitum.
[f]CP (%) needed in a 75% TDN supplement to meet requirements of a 600 lb heifer.

allow heifers the best pasture or hay available. By allowing heifers access to the best forage, less supplement will be needed to reach the nutrient level to meet the required gain for the heifers. Less supplement means decreased supplement cost and overall cost for developing heifers.

Supplementation

Energy is usually the limiting factor in achieving satisfactory gains in replacement heifers. To meet these demands, supplements with high TDN should be fed. Often these supplements, corn and other grains, are also high in starch or fermentable sugars that can decrease the rumen pH (Kunkle et al., 2002). If the rumen pH becomes to low, intake and digestibility of forages will decline. By-product feeds often are lower in total starch and sugars than comparable grains but contain comparable TDN. These by-products may be competitively priced with grain sources and provide similar heifer performance. Soybean hulls, citrus pulp, and wheat middlings have been shown to have greater weight gains when fed at high levels (1% of body weight) as compared to other feedstuffs (Kunkle et al., 1995).

Supplementation of replacement heifers with fat sources can provide additional energy to meet demands for growth. Fats are very energy dense. A small amount of fat can increase the energy of a supplement greatly. Fat supplementation should be limited to less than 5% of the daily dry matter intake because of potential negative effects on forage digestibility (Cappock and Wilks, 1991). Funston (2004) reported that nutritionally challenged heifers may experience reproductive benefits from fat supplementation. Whole cotton seed and distiller's grain are relatively high in fat (17% and 10% respectively) and could be used to provide fat/energy in replacement heifer rations.

Protein supplementation can increase intake of low quality forages, thus increasing available energy in the total diet. Natural protein sources, such as soybean meal and cottonseed meal, generally provide increased animal performance compared to non-protein nitrogen (NPN) sources such as urea. The use of NPN sources in heifer supplements should be limited to larger heifers, if used at all because light weight growing heifers cannot adequately utilize NPN and perform much better with natural protein souces. Protein supplements are generally more expensive than energy supplements. Meeting requirements and not overfeeding protein will help in keeping supplement costs down.

Heifers should be fed a complete mineral supplement or have access to a free-choice mineral supplement at all times. Salt, calcium, phosphorus, and trace minerals should be used. The levels of minerals offered will vary based on season, cattle, and region. A mineral supplement containing 25% salt, 14 to 18% calcium, 8% phosphorus, 0.4% zinc, 0.2% iron, 0.2% manganese, 0.15% copper, 0.016% iodine, 0.01% cobalt, and 0.002% selenium has been shown to be sufficient in many situations.

Management

There are many programs and products utilized in the development of replacement heifers. The goal

of any heifer development program should be to grow heifers to a point where the majority of animals are pubertal and cycling at the start of the breeding season. Heifers should always be managed separate from mature animals. Replacement heifers have greater nutrient requirements than mature cows and do not have the size to compete with cows for feed resources.

Before weaning, the development program that will be used to manage the heifers should be chosen. The feedstuffs to be used should be available and nutrient values should be known. Once the program is started there should be as few changes as possible, either in forage or supplement. Alteration of diet can have major effects on animal performance and potentially decrease gains. Any management program that will be considered needs to be monitored closely. Ideally, a few representative heifers should be weighed every 2 months to determine the average daily gain (ADG) and supplementation should be adjusted to make sure that heifers will reach the target body weights.

If possible heifers should be divided into groups based on body weight. Dividing heifers based on body weight will allow nutritional requirements to be met more accurately. Staigmiller and Moseley (1981) reported that separating heifers into heavier and lighter groups allowed the heifers to more closely attain their target body weights compared to a group that was not separated. The overall conception rate was also greater for the separate fed groups as compared to the not separated group (85% vs. 70%).

The most common method for developing heifers is to feed for a constant body weight gain throughout the development process. Often heifers are supplemented like the cow herd, every other day, as opposed to daily supplementation based on convenience. Data on supplementation interval is variable. Cooke et al. (2007) fed heifers on bahiagrass pastures equal amounts of a low-starch, high-energy supplement either daily or three times per week (3X) for 45 days prior to breeding. Heifer ADG was greater for daily-fed heifers compared to 3X heifers (1.98 vs. 1.60 lb/d). Age at puberty was less and pregnancy rates were greater in daily-fed heifers. Research from our lab has shown dissimilar results. In our experiment, the heifers with access to ad libidum bermudagrass RBS were supplemented either daily or 3X with dry distillers grain for a six month period. Heifers exceeded predicted gain for both treatments. Daily-fed heifers averaged 1.85 lb/d while 3X heifers averaged 1.83 lb/d. Daily-fed heifers had numerically greater puberty percentage at breeding as compared to 3X heifers (60 vs. 40%). Synchronized pregnancy rates were numerically greater for the 3X heifers compared to the daily-fed heifers (57 vs. 43%). Differences in the two experiments are possibly due to the differences in forage type and quality and supplement type. The RBS offered in the second experiment was greater in CP and TDN than the bahiagrass grazed in the Cooke trial.

Programmed feeding of heifers is another viable alternative for the development of heifers. Programmed feeding usually involves a period during the beginning of the development phase when heifers are supplemented to gain at a slower rate, usually less than 1.0 lb/d. This is followed by a phase in which heifers are fed to gain at a faster rate, usually greater than 2.0 lb/d, to reach their target bodyweight. This method takes advantage of compensatory growth in the heifer which can lead to increased feed efficiency and decreased supplement costs. Weekley (1991) compared developing heifers at a constant ADG for 5 months to developing heifers for the first three months at a lower rate of gain followed by rapid gains for the last 2 months. Heifers in the constant gain group gained 1.34 lb/d for the duration of the trial. The low-high gain heifers gained 1.17 lb/d for the first 3 months and 1.63 lb/d for the last 2 months. Heifers on the continuous gain treatment attained puberty 30 days earlier, but pregnancy rates were similar between treatments. Lynch et al. (1997) developed heifers to gain at an even rate of gain (1.0 lb/d) or at a reduced rate (0.25 lb/d) for the first 4 months followed by a greater rate of gain (2.0 lb/d) for the last 2 months in two consecutive years. Age at puberty did not differ in the first year, but was delayed in the late gaining heifers in the second year by three weeks. At breeding, body weights, body condition scores, and frame scores were similar between the two groups. Overall pregnancy rates were also similar between the groups. Late gaining heifers consumed 12% less feed the first year and 2.5%

less feed the second year compared to control heifers.

Additional Management Tools

One management tool that should not be neglected is deworming. Several studies have shown that heifers that were wormed at any point during the development phase attained puberty from one to two weeks earlier (Mejía et al., 1999, Purvis and Whittier, 1996) and had improved conception rates 7% (Purvis and Whittier, 1996, Larson et al., 1992).

Ionophores are another management tool that can be used in heifers to alter growth and age at puberty. Ionophores (such as monensin, lasalocid, and laidlomycin) are antimicrobial compounds that are commonly fed to cattle to improve feed efficiency. Ionophores alter the rumen microflora resulting in increased efficiency. Inclusion of ionophores in heifer diets has been shown to decrease the age at puberty, increase gain: feed ratios, and increase first-service conception rates. Purvis and Whittier (1996) found that heifers receiving ionophore reached puberty 10 days earlier than control heifers and had a 5% increase in conception rate. Mosely et al. (1977) found that more heifers supplemented with monensin reached puberty than control heifers (98% vs. 58%) and conception rates were increased by 7%.

Summary

Developing heifers is one of the greatest investments for cow-calf producers. The goal of any heifer development program should be to provide heifers the proper nutrition to meet the required gains to attain puberty by 14 months of age. A producer should know what the nutrient value of the forages and the supplements being provided. Determining the target body weight for heifers and providing the appropriate level of nutrition to achieve this body weight is essential regardless of the management scheme that is used.

Literature Cited

Byerley, D. J., R. B. Staigmiller, J. G. Berardinelli, and R. E. Short. 1987. Pregnancy rates of beef heifers bred either on puberal or third estrus. J. Anim. Sci. 65:645-650.

Cappock, C. E. and D. L. Wilks. 1991. Supplemental fat in high-energy rations for lactating cows: effects on intake, digestion, mil yield, and composition. J. Anim.> Sci. 69:3826-3837.

Cooke, R. F., J. D. Arthington, C. R. Staples, W. W. Thatcher, and G. C. Lamb. 2007. Effects of supplementation frequency on performance, reproductive, and metabolic responses of Brahman-crossbred females. J. Anim. Sci. 85:2564-2574.

Funston, R. N. 2004. Fat supplementation and reproduction in beef females. J. Anim. Sci. (E suppl):E154-161.

Hersom, M., D. Driver, B. Faircloth, and J. Wasdin. 2007. Utilization of round bale silage as a compliment to hay production. Florida Beef Report 2007. http://www.animal.ufl.edu/extension/beef/beef_cattle_report/2007/Forage3.pdf

Kunkle, W. E., R. S. Sand, and P. Garces-Yepez. 1995. Applying new strategies for raisingbeef heifers. 6th Florida Ruminant Nutrition Symposium. http://dairy.ifas.ufl.edu/files/rns/1995/Kunkle.pdf.

Kunkle, W. E., R. S. Sand, and P. Garces-Yepez. 2002. Strategies for successful development of beef heifers. http://edis.ifas.ufl.edu/AN100.

Larson, R. L. 2007. Heifer development: Reproduction and Nutrition. Vet. Clin. Food Anim. 23:53-68.

Larson, R. L., L. R. Corah, M. F. Spire, and R. C. Cochran. 1992. Effect of deworming with Ivomec® on reproductive performance of yearling beef heifers. Cattlemen's Day. Kansas State Univ. Pg. 52-54.

Leismeister, J. L., P. J. Burfening, and R. L. Blackwell. 1973. Date of first calving in beef cows and subsequent calf production. J. Anim. Sci. 36:1-6.

Lynch, J. M., G. C. Lamb, B. L. Miller, R. T. Brandt, Jr, R. C. Cochran, and J. E. Minton. 1997. Influence of timing of gain on growth and reproductive performance in beef replacement heifers. J. Anim. Sci. 75:1715-1722.

NRC. 1984. Nutrient Requirements for Beef Cattle. 6th rev. ed. Natl. Acad. Sci., Washinton D. C.

Mejía , M., A. Gonzalez-Iglesias, G.S. Díaz-Torga, P. Villafane, N. Formía, C. Libertun, D. Becú-Villalobos, and I. M. Lacau-Mengido. 1999. Effects of continuous ivermectin treatment from birth to puberty on growth and reproduction in dairy heifers. J. Anim. Sci. 77:1329-1334.

Mosely, W. M., M. M. McCartor, and R. D. Randel. 1977. Effects of monensin on growth and reproductive performance of beef heifers. J. Anim. Sci. 45:961-968.

Peacock, F. M., E. M. Hodges, W. G. Kirk, M. Koger, and A.C. Warnick. 1976. Reproductive behavior of crossbred heifers bred as yearlings. Florida Agric. Expt. Stn. Bull. S-236.

Purvis II, H. T., and J. C. Whittier. 1996. Effects of ionophore feeding and anthelmintic administration on age and weight at puberty in spring-born beef heifers. J. Anim. Sci. 74:736-744.

Staigmiller, R. B. and W. M. Moseley. 1981. Rumensin and puberty. Proceedings, The Range Beef Cow Symposium VII. Pg. 178.

Warnick, A. C., W. C. Burns, M. Koger, and M. W. Hazen. 1956. Puberty in English, Brahman and crossbred breeds of beef heifers. Proc. of Southern Agric. Workers.

Weekley, K.A. 1991. Nutritional management, breed of sire and zeranol effects on growth and reproductive traits in *Bos taurus* X *Bos indicus* beef heifers. M.S. Thesis. Univ. of Florida.

Wiltbank, J. N., S. Roberts, J. Nix, and L. Rowden. 1985. Reproductive performance and profitability of heifers fed to weigh 272 or 318 kg at the start of the first breeding season. J. Anim. Sci. 60:25-34.

Notes:

Notes: