



Replacement Heifer Development: Part II - Nutrition

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Introduction

Nutrition is the most costly component of heifer development. Heifers must be bred to calve at two years of age. It is imperative that heifers reach 65 percent of estimated mature weight prior to breeding. Nutrition management during the development period can have a great impact on lifetime productivity.

Heifers generally need to gain 1.25 to 1.75 pounds per day from weaning to breeding to reach the target weight. Replacement heifer development in Georgia usually occurs during the fall and winter months. When these heifers need additional supplementation, they may be fed a combination of small grain pastures, hay, and grain. Typically, cattle producers develop heifers using hay plus a supplement. Therefore, determine hay quality to accurately determine the necessary supplementation needed to balance the ration. Producers who fail to analyze their hay take risks that may result in heifers not receiving a balanced ration. Nutritional requirements for heifers are different from lactating or dry cows. Heifers require a higher quality diet than mature cows and must be fed separate from the mature cow herd.

Feeding Options

A well-designed feeding program starts with a feed nutrient analysis. Feed samples can be submitted to the University of Georgia Feed and Environmental Water Lab. Sample submission forms and information about forage testing can be obtained by contacting the county extension agent. Upon request, an extension animal scientist will custom balance a ration based on analyses of the forage and feed stuffs available.

Table 1. Nutrient requirements for a 650-pound developing heifer^{ab}

Daily gain Lbs/day	Nutrient			
	TDN % of diet	Crude protein % of diet	Calcium % of diet	Phosphorus % of diet
1.0	61.0	10.5	0.28	0.16
1.5	68.5	11.0	0.35	0.19
2.0	74.0	12.0	0.43	0.22

^a Adapted from the nutrient requirements of beef cattle, 2000.

^b Based on heifers consuming 2.3% of body weight per day on a dry matter basis.

Hay

The majority of cattle producers develop heifers using hay-based diets. Grass hay will not provide enough energy for heifers to gain at optimal rates. Therefore, supplement heifers with grains, by-product feeds, and/or high quality winter annual pasture. Nutrient requirements of a 650-pound developing heifer are listed in Table 1. Feeding hay that is greater than 12 percent protein will require an energy supplement that is at least 9 percent or higher in crude protein. High quality hay (TDN \geq 55 percent) fed with approximately 0.75 to 1 percent body weight of a dry grain supplement should provide gains of at least 1.5 pounds per day. Suggested supplements and feeding amounts for a 650-pound heifer to gain 1.5 pounds per day are listed in Table 2. Hay quality will have a dramatic effect on daily gains. Test hay for nutrient content prior to feeding to ensure supplementation is adequate. By testing the hay, a feed can be selected that meets the energy and protein requirements of the heifer and, in turn, reduces feed costs. Hay intake should be 1.75 to 2.0 percent of body weight when the heifer is fed grain at 1 percent of body weight. If hay intake is lower than the recommended level, then hay quality is likely poor. In addition, monitor body condition. A body condition score (BCS) of six is recommended and a good indicator that heifers are gaining at adequate levels.

Table 2. Hay quality and supplementation required for a 650-pound replacement heifer to gain 1.5 pounds per day^a.

Quality of hay	Crude Protein	TDN	Daily Supplement Required
Excellent	11.2 & over	62 & over	3 lbs of corn, or corn gluten feed, or soybean hulls, or distillers grains, or whole cottonseed, or a commercial range cube
Good	9.5 to 11.1	58 to 62	5.5 lbs of corn gluten feed or 5.5 lbs of soybean hulls or 5.5 lbs of a 50:50 corn gluten soyhull mix or 5 lbs of distillers grains or 3 lbs of soybean hulls and 2 lbs of cottonseed or 4.5 lbs of corn and 1 lb of cottonseed meal or 5.5 lbs of a commercial range cube
Fair to good	8.2 to 9.5	55 to 58	6 lbs of corn gluten feed or 3 lbs of corn gluten feed and 3 lbs of soyhulls or 5.5 lbs of corn and 1 lb of cottonseed meal or 6 lbs of 50% corn gluten feed/50% soybean hulls mixture or 6 lbs of a commercial range cube or 3 lbs of whole cottonseed and 3 lbs of corn
Poor to fair	7.0 to 8.2	52 to 55	4 lbs of corn gluten feed and 4 lbs of soybean hulls or 7.5 lbs of soybean hulls and 1 lb of cottonseed meal or 4 lbs of whole cottonseed and 4 lbs of corn
Very poor	5.0 to 7.0	49 to 52	Do not feed

^a Recommended feeding amounts assumes the heifer is a BCS of 5.0

Winter annual pastures

Winter annual pastures such as wheat, rye, oats, and ryegrass can provide sufficient nutrients for developing heifers with only a mineral supplement required. The primary problem with using winter annuals is there will likely be a period of time of little or no grazing. Gains will be reduced significantly when grass is below 4 inches in height. Offer high quality hay plus supplement until sufficient grazing is available. The key to winter annuals is beginning supplementation as soon as grazing becomes limited.

New research has shown that high levels of protein in winter annual forages can reduce reproductive efficiency (*Beck et al., 2005*). Most winter annual pastures (wheat, rye, ryegrass) are very high in protein. Fescue is used in some parts of the state and may affect reproductive efficiency in a similar way. When protein is degraded in the rumen, ammonia is formed, which is then transported to the liver where it is converted into urea. This will

increase the blood urea nitrogen (BUN) levels. When BUN is elevated, reduced reproductive efficiency has been observed (*Beck et al., 2005*). It has been shown that the high levels of urea in the blood will reduce the pH in the uterus causing poor fetal survivability in early pregnancy. This has only been documented when cows have continuous access to winter annual pasture. A study conducted at the University of Arkansas compared the reproductive efficiency of heifers grazed on either wheat and ryegrass pastures or fed a drylot ration of 75 percent grain and 25 percent hay (*Beck et al., 2005*). Heifers were grazed or fed the grain-based ration for five months prior to breeding. Daily gain of the heifers was approximately 1.22 pounds per day for each group. Heifers were synchronized and artificially inseminated (AI) once and then clean-up bulls were placed with the heifers for 56 days. There was no statistically significant difference in either AI or overall pregnancy rates between the two groups. However, some trends were noticed in pregnancy rates. Overall pregnancy rates for grain-fed heifers were 88 percent and pregnancy rates for heifers that grazed wheat and ryegrass pastures were 69 percent. Heifers that grazed the winter annuals calved 14 days later than heifers fed the grain-based diet during development. Conceiving early in the breeding season is especially important for heifers, as this will allow them more time to breed back after having their first calf.

The reduced pregnancy rates from grazing winter annual pastures have only been observed when animals had continuous access to the pasture. Often, cows are limit grazed a few hours a day and supplemented with hay. There should be few or no problems with reproduction when using this feeding strategy. If animals are allowed to graze continuously during the early part of the breeding season, then do not feed any supplemental protein. There may be some alleviation of the problem if low protein grains such as corn are fed during this time to increase the use of nitrogen in the rumen, which should lower BUN levels.

Warm season annual/perennial pasture

Fall born heifers are weaned in the spring and will spend a portion of the development period on summer forages. Bermudagrass is the primary summer perennial forage used for heifer development in Georgia. Heifers will usually gain about 1 pound per day grazing bermudagrass. However, this can vary considerably with variety (Tifton 85 would produce greater gains than other varieties), forage availability, and time of year. In most cases, heifers will need some supplementation when grazing summer perennial forages to maintain adequate gains. Heifers should gain adequately when fed 0.25 to 0.5 percent body weight of a high (≥ 20 percent) protein supplement. Warm season annual pastures such as pearl millet and sorghum/sudangrass can provide gains of approximately 1.5 pounds per day (*Hill et al., 1995*) with no supplementation. If higher gains are desired, supplementation guidelines would be similar to bermudagrass.

Corn silage

Corn silage is another feeding option that works well for developing heifers. Corn silage should only need a protein supplement to provide adequate gains for heifers. The protein supplement (at least 20 percent protein) should provide 1 pound of supplemental protein per day. Commonly used feeds to supply additional protein are soybean meal, cottonseed meal, commercial pelleted supplements or a high protein by-product feed such as corn gluten feed, distillers grains, or cottonseed. In general, a ration will consist of 85 to 90 percent silage (30 to 35 percent dry matter) and 10 to 15 percent dry supplement to achieve gains of 1.5 to 1.75 pounds per day. It is critical to have feed analyzed for nutrient content. This will determine the appropriate amount of supplemental protein, energy, and proportion of silage required in the diet.

Limit fed grain/by-products

Grain-based diets can be limit fed to properly develop replacement heifers (*Beck et al., 2005*). This feeding system requires increased management because heifers will gain too rapidly for proper development if allowed free-choice access to a grain-based diet. Limit fed diets generally consist of 80 percent concentrate, consisting of grain, by-product feeds, and protein supplements. The remainder consists of a roughage source and a mineral supplement. Feed intake is usually 2.0 to 2.3 percent of body weight to achieve gains of 1.5 to 2.0 pounds per day. This feeding system requires bulk storage of feeds and some mechanism to mix and deliver feed into

bunks. There are many combinations of feedstuffs that can be used to maintain proper weight gains. Consult with a nutritionist prior to feeding to make sure the diet is properly balanced and correct amounts are fed each day to maintain desired weight gains.

Ionophores

Ionophores (ex., Bovatec® and Rumensin®) have been shown to reduce age at puberty in replacement heifers by 14 to 28 days. Heifers that reach puberty earlier are more likely to breed early in the breeding season and continue producing a calf every 12 months. Rumensin® has been shown to consistently reduce age at puberty in many research trials (*Sprott, et al., 1988*). Less research has been conducted using Bovatec®, but it has been shown to reduce age at puberty in heifers with low weight gains (0.75 pounds per day) during the development period (*Goehring, et al., 1984*). Ionophores have the added advantage of improving feed efficiency and increasing weight gains.

The easiest method to feed ionophores is via a free-choice mineral mix. Most manufacturers have mineral mixes available that contain an ionophore for use in growing cattle. However, consumption by individual animals can vary. Monitor intake of minerals closely, both for under- and over-consumption. Bovatec® is used in many mineral supplements because mineral intake is often greater when compared with Rumensin®. If low consumption is a problem, then mixing the ionophore supplement with grain and hand-feeding is an option to consider. However, the ionophore supplement must be thoroughly mixed with the supplement to ensure equal distribution among heifers. In addition, follow label directions to ensure proper amounts of the mineral supplements are fed.

Timing of Gain

Research has demonstrated the importance of timing of the weight gain. If heifers are growing more slowly than you expected and must gain rapidly to reach their target weight before breeding, lost weight gain can be made up rapidly without any loss in pregnancy rates. As long as heifers reach the target body weight before breeding, the timing of weight gain is not very important. Kansas State researchers fed heifers to gain 0.55 pounds per day until the last two months before breeding, and then fed the heifers to gain 2.5 pounds per day for the last 60 days before breeding (*Lynch, et al., 1997*). Another group of heifers were fed to gain 1.31 pounds per day for the entire development period. Both groups of heifers were equal in reproductive performance. However, heifers fed to gain 2.5 pounds per day the last 60 days were actually more efficient and consumed 12 percent less feed than the heifers fed to gain at a constant rate due to compensatory gain. This heifer development protocol will usually be implemented when lower than expected hay quality reduces gains. Always evaluate heifers at least 60 days prior to the start of the breeding season to have enough time to adjust rations so target weights are reached. Request help from the county extension agent to properly adjust the ration to ensure desired gains are attained.

Calving to Re-breeding

In almost every herd, first-calf heifers are the most difficult group to get re-bred. Providing supplemental feed to improve body condition score (BCS) for acceptable pregnancy rates is an economical practice. However, this is the most difficult time period to increase body condition score. Research has shown that first-calf heifers having a BCS of four at breeding time will have pregnancy rates of approximately 50 percent, and first-calf heifers having a BCS of five at breeding time will have about a 90 percent pregnancy rate (*Bell et al., 1990*). Even in well developed heifers, body weight and condition can be rapidly lost after calving if they are fed only

hay or grazed on poor quality pasture. To maintain a high re-breeding rate, producers can supplement existing forages or hay, graze winter annual pasture, or early wean the calf.

When feeding hay, plan to supplement energy and possibly provide additional protein to meet demands of lactation, growth, and reproduction of the first-calf heifer. Table 3 lists example supplementation amounts for heifers in early lactation fed hay of various quality. It is important to assess both body condition score and nutrient content of the forage prior to starting a supplementation program. Body condition scoring will identify the growth rate needed to achieve the desired body condition, and the nutrient content of the forage will show what nutrients are deficient. Ask for help when formulating a supplement to ensure that the proper amounts and composition of nutrients are fed. A multitude of feedstuffs can be fed to first-calf heifers. By-product feeds are an increasing source of winter supplementation in the Southeast. They are often competitive with corn and oilseed meals. In addition, some by-product feeds have a moderate protein content, which reduces feed costs compared with a traditional corn/soybean meal mixture or a commercial protein supplement. In addition, by-product feeds such as soybean hulls, wheat middlings, corn gluten feed, distillers grains, and citrus pulp are low in starch but high in digestible fiber. These by-products can be fed at higher levels than corn before intake and digestibility of forage is depressed. When high levels of supplement are required, a low starch by-product feed is recommended.

Supplementing cows using winter annual pastures is a choice of many producers. Winter annual pastures are high in quality and they provide extra energy and protein for lactating heifers while decreasing the feeding of hay. Heifers can be fed approximately half of their daily energy needs from winter pasture along with good hay (55 percent TDN) to maintain body condition. Intake of pasture is difficult to determine, but plan for five to eight hours of grazing per day to keep heifers in adequate condition.

Table 3. Hay quality and supplementation required for a lactating first calf heifer^a

Quality of hay	Crude Protein	TDN	Supplement Required
Excellent	11.2 & over	62 & over	None
Good	9.5 to 11.1	58 to 62	2 lbs of corn gluten feed and 2 lbs of soybean hulls or 4 lbs of corn gluten feed or 3 lbs corn and 1 lb of cottonseed meal or 4.5 lbs of 20% range cube or 3.5 lbs of whole cottonseed
Fair to good	8.2 to 9.5	55 to 58	6 lbs of corn gluten feed or 4 lbs of corn and 2 lbs of cottonseed meal or 6 lbs of 50% corn gluten feed/50% soybean hulls mixture or 7 lbs of 20% range cubes or 6 lbs of whole cottonseed
Poor to fair	7.0 to 8.2	52 to 55	8 lbs of corn gluten feed or 7 lbs of soybean hulls and 2 lbs of cottonseed meal or 9.5 lbs of 20% range cubes or 5 lbs of cottonseed and 3 lbs of corn or 6 lbs of corn gluten feed and 3 lbs of soybean hulls
Very poor	5.0 to 7.0	49 to 52	7 lbs of corn gluten feed and 4 lbs of soybean hulls or 8.5 lbs of soybean hulls and 2.5 lbs cottonseed meal or 12 lbs of 20% range cube 4.5 lbs of whole cottonseed and 4.5 lbs of corn gluten feed

^a Recommended feeding amounts assumes the heifer is a BCS of 5.0

Summary

Nutrition costs are the most expensive component of a heifer development budget. It is critical to have all feedstuffs analyzed for nutrient content prior to feeding. A balanced ration can then be developed to achieve the desired rate of gain. Many forages and concentrate supplements can be used to successfully develop heifers. Feed heifers separate from the mature cow herd at all times. Ionophores should be fed and can be purchased in a commercial mineral mix. Contact the local county extension agent for information about testing feeds for nutrient content.

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