

BEEF PRODUCTION WITHOUT MATURE COWS

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Summary

Mature beef cows must be fed year-round to produce one weaned calf; on average, there is either no net change or a slight decline in the mature cow's value for beef over her lifetime. If the mature-cow herd is eliminated by means of having each first-calf heifer replace herself with a heifer, every animal in the enterprise is growing at all times. With this All Heifer, No Cow (AHNC) model, yearling heifers are bred with sexed semen, weaned early after calving, and slaughtered before 30 months of age to produce a high quality carcass. This greatly reduces the amount of feed needed per pound of beef produced while also decreasing water use and production of greenhouse gases as well as manure.

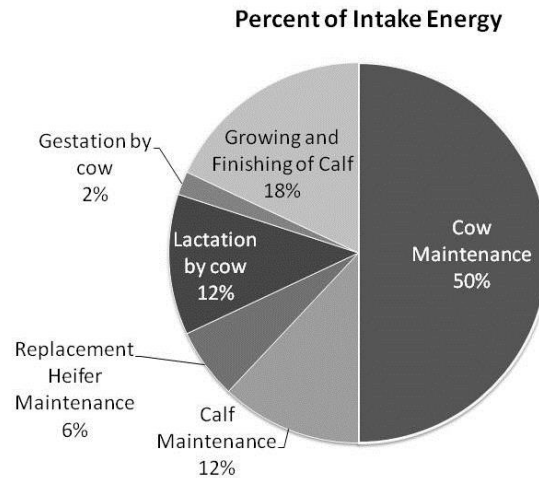
Introduction

Beef cattle production in North America is generally considered to be organized into two segments: the cow/calf enterprise and the feedlot/fattening enterprise, although there often is a stocker phase between these two. Maintaining the cow/calf part of this system includes replacing cows culled due to age, injury, non-pregnancy, poor performance, and having bulls as needed. It is estimated that about 70% of the nutrients consumed for routine beef production are attributed to the cow/calf enterprise and about 30% to the stocker/feedlot part of the system.

A cow/calf enterprise produces calves and cull cows and bulls. Typically about 20% of cows are culled annually, and there is considerable cost in raising heifers to replace them. With this system, nutrients go to growth of calves and replacements, pregnancy, lactation, and maintenance (that portion of nutrients needed to keep animals alive independent of growth, lactation, and pregnancy). Calves typically are weaned at about seven months of age and then go to feedlots for fattening or become stockers for several months before going to feedlots, or being bred as replacements. From this overview, it is obvious that the majority of animal-months in the typical cow/calf enterprise are based on older cows, and their total nutritional needs greatly exceed the needs of the calves and replacements for cows that are culled. Integrated over the entire cow/calf enterprise, about 30% of nutrients consumed can be attributed to pregnancy, lactation, and growth, while the other 70% are for maintenance, primarily of the cows. In accounting for all nutrients in beef production life cycle, nearly 50% go for maintenance of the cowherd, for which expenditure no beef is produced since the cows do not grow after they reach three years of age.

Figure 1 illustrates graphically the proportions of intake energy used for various functions in a typical beef production system in the United States. Note the large proportion of energy that is required for the maintenance functions of the mature cow herd.

Figure 1. Conceptual illustration of units of intake energy devoted to various physiological functions in a traditional beef production system in the United States.



Note that the percentages in the above figure will vary somewhat depending on breed, management system, and other factors.

Project

We have begun to study quantifying limits to commercial adoption of an AHNC system. We estimate that the AHNC system eliminates the need for the approximately 50% of nutrients consumed in the total beef enterprise that simply go to maintaining the bodies of older cows for their lifetimes, but recognizes that more nutrients are required for growth because 100% of animals are growing. We will assess the fringe benefits to our proposed system, as well as the additional system costs.

Our idea is simple: breed heifers with sexed semen to produce females so that each heifer replaces herself with a heifer. If the system worked perfectly, it would be entirely self-sustaining – it is not! In addition, all animals in the system are growing at all times and there is no herd of mature cows; all animals are less than 30 months of age. The proposed system is not entirely self-sustaining due to factors that include: deaths of some calves, less than 100% accuracy of sex-selected sperm, and failure of some heifers to become pregnant. However, the AHNC systems could be up to 75-80% self-sustaining, thus requiring only a small percentage of heifers from outside of the system to be added each year.

The overall objective is to determine, in fact, how well this system performs and to what extent economic benefits match the theoretical benefits of producing beef with fewer nutrients, greenhouse gasses, and waste products. The proposed system requires use of sexed semen, early weaning, and fattening heifers to be slaughtered at 28-30 months of age. While each of these components has been researched fairly thoroughly, there has been limited investigation of these together in a system.

The fringe benefits of an AHNC system are substantive; perhaps the main one is that there are no nursing, growing first-calf heifers to breed. Pregnancy rates for first-calf heifers are notoriously low, resulting in culling many of these prime females unless inordinate amounts of high-density feed are supplied. There also are no old cows, which are prone to problems with their feet and legs, mastitis, diseased eyes, and other age-related ailments. Also, all the beef

produced is from young, growing animals, whereas with conventional systems about 20% of the beef is from old, culled cows that are severely discounted in market value. Because a minimal number of male calves are produced in this system, there is also an animal welfare benefit due to decreased numbers of calves needing castration. A marked genetic benefit is that generation interval is greatly reduced on the female side, which results in about twice the opportunities to make genetic progress per unit time.

There are additional costs with the AHNC system. All calvings are from heifers, which on average have higher rates of dystocia than cows. However, selection of easy-calving service sires greatly reduces the seriousness of this risk. Also, most calves will be heifers, which average about five pounds lighter at birth than bulls, and therefore have reduced incidence of dystocia. Perhaps the greatest additional cost is lower fertility with sexed than conventional semen. However, sperm sexing procedures are improving rapidly, so this fertility gap should narrow substantively within the next year. As alluded to earlier, due to imperfect sex selection (currently just over 90% accuracy), some inevitable deaths, and a few non-pregnant heifers, some heifers from outside must be added to the system each year. That number may be slightly higher than requirements in conventional beef-production systems for replacing culled cows, but the cost per replacement likely will be lower because replacements are younger, smaller, and productive sooner.

Heifers grow slightly less efficiently than steers, although use of anabolic implants can compensate for this. There also is the possibility of discounts for carcasses of 28- to 30-month-old heifers that may have slightly hardened bones as a result of pregnancy. However, such meat has been thoroughly studied and has excellent eating qualities; thus recovering merited price and grade would be a matter of education.

The extra costs of the proposed system appear to be more than offset by the fringe benefits, but the overriding value is not having to feed and manage a cow herd. Management for the proposed system needs to be at a high level, and to some extent, labor substitutes for feed, possibly resulting in more jobs per unit of beef produced.

Current Opportunity

There are about 29 million beef cows in the United States, the lowest number since the early 1950s (USDA, 2013). That number is very likely to increase as drought conditions improve and grain prices decline from historic highs. There also are hundreds of millions of beef cows in other countries, so the proposed research can have international impact. The combination of increasing world population from the current 7 billion to a projected 9 billion people, plus the increasing standard of living in most developing countries, is predicted to result in an increased demand for meat over the next few decades. With the system to be studied, up to a 30% increase in beef production may be possible without increasing the net amount of feed required, and with concurrent decreased greenhouse gas generation.

We began this project by purchasing 54 commercial Angus-based heifers that were inseminated with female-sexed polled Hereford semen after appropriate synchronization of ovulation with a 14-day CIDR followed by prostaglandin 16 days later and GnRH + AI 66 hours later as recommended by the Beef Reproduction Taskforce. The heifers were checked for pregnancy and have been with a polled Hereford cleanup bull. These bred heifers and their resulting crossbred calves will be available for this research project, although they could be sold as bred heifers, pairs after calving, or calves and cows after weaning. This illustrates one of the

major advantages of the proposed system, the ability to enter and exit the program at many life-stage points as feed and cattle prices dictate. However, for this research we plan to study the entire life cycle into the next generation including how the resulting calves perform through calving and slaughter. In order to generate annual income, the system requires a second set of animals. We plan to purchase an additional 60 commercial heifers to breed the next year.

For this project, we combine a number of proven management practices including crossbreeding, creep feeding, early weaning, fence-line weaning, sexed semen, easy-calving service sires, ovulation synchronization that is progestin-based to hasten puberty (probably only an issue for a few percent of heifers), and having cattle on pasture as much as possible. The first calves produced will be Hereford crosses. The next generation likely will involve crossing with a third breed of males.

Even without considering ownership of land, the cow/calf segment of the beef cattle industry is capital intensive, particularly if retaining ownership of calves until slaughter. The proposed system is similarly capital intensive, with the bulk of income from 28- to 30-month-old fattened heifers. With conventional cow/calf operation, income usually is from seven-month-old calves, much sooner than 30-month-old heifers. Starting an AHNC system requires a large capital outlay and one can enter the system in various ways that have different capital requirements, feed and labor resources, etc. Alternate entry points merit evaluation.

For this project, our starting point is purchased 650- to 750-lb Angus-based commercial heifers in spring. These are readily available each year, primarily as stocker heifers that typically go to pasture or feedlots. Most eventually end up as the approximately three million beef heifers that are fattened for slaughter annually in the United States. Spring timing for entry fits our available ranch grass and other resources. Another option is starting the second group four to eight months after the first group for fall calving to garner an earlier income stream and use complementary grazing resources to spring calving cattle.

The initial capital requirements are lowest with the youngest heifers and highest with pairs. However, the time-to-income is considerable with the younger animals, and relatively short if starting with pairs (which might be only those pairs with heifer calves); all of this needs to be balanced with input costs along the way.

Evaluation of resulting carcasses

Heifers will be transitioned to full feed during the two weeks prior to weaning, and then placed on a standard finishing ration formulated to gain about 4 lbs per day. They will be fed 0.5 mg/head/day of melengesterol acetate daily and given an anabolic implant when placed on a finishing diet. The exact ration will depend on ingredient costs and availability, but will be thoroughly documented. Heifers should achieve finish weight after 75 days on feed, but may be fed up to two weeks longer to produce a finished carcass.

The proposed system will not be economically viable unless the carcasses of the 28- to 30-month-old heifers can be marketed for similar value as other fattened cattle. Animal carcasses older than 30 months of age are severely discounted by packers. Because it is difficult to verify age exactly, packers and graders frequently use degree of bone ossification as a surrogate criterion, which is not entirely reliable. Unfortunately, pregnancy hormones hasten bone ossification in first-calf heifers, so carcasses appear older than they are. The data available indicate that eating qualities such as juiciness, tenderness, and flavor are acceptable for carcasses from 2 1/2-year-old parous heifers.

Satisfying the Public Interest

The program envisioned is especially appropriate to increase beef production over the next decade because the recent drought has decimated beef cow herds, and much of the beef from the proposed system would come from calves produced by heifers that otherwise would have been fattened and slaughtered without having a calf. This would be especially beneficial for the current “overcapacity” of feedlots and slaughterhouses; it would create jobs. Use of sexed semen to produce females helps this system even more.

