Feeding and Management of Dairy Steers

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Abstract

Finished dairy steers and a few heifers are 16.2% of U.S. fed steer and heifer beef production. Holstein steers and a few heifers are 13.9% of the fed steer and heifer supply. These Holstein cattle have the propensity to yield high quality beef and are estimated to account for 33% of USDA Prime beef production in 2015. Sexed semen use is reportedly having greatest impact in matings involving the less desirable fraction of Jersey cows. Emphasis is placed on provision of 150 to 200 g colostral immunoglobulins to male dairy calves within the first few hours after birth. Complete castration of these bull calves in their first month of age is equally important to avoid the expense associated with stags. The goal for Holstein steer production is to have them achieve 28% body fat by 1400 to 1550 lb, thus yielding USDA Choice or Prime carcasses weighing 850 to 950 lb. This requires a finishing diet with an energy density of at least 0.62 Mcal NEg/lb DM. Effective feedbunk management is critical to sustaining steer performance. Holstein steers are more susceptible to liver abscesses than are native steers and heifers.

Introduction

Dairy steers are an important source of beef production in the U.S. The breed composition of the dairy steer population reflects the breed composition of the dairy herd from which they are produced. Since Holstein is the dominant dairy breed, Holstein steers are the principal breed of dairy steer, though Jersey and Brown Swiss breeds are also represented. "Dairy beef" refers to any dairy herd progeny that are developed to be ruminating cattle (therefore excluding bob and special-fed veal) and harvested at an age that qualifies them for the USDA Prime, Choice, or Select quality grades. The term is not intended to include beef from culled dairy cows or mature dairy bulls. Beef cattle breeds will be termed "native" breeds. This term is based on 3 motivations. First, muscle food derived from dairy breeds, native breeds, and their crossbreds is always referred to as beef. Use of the term "native" allows for distinguishable reference to "native beef" and "dairy beef", rather than use of the redundant term "beef beef" from beef breeds. Secondly, cattle belonging to beef breeds are often referred to as "colored" cattle, but that term should be discomforting to an industry that welcomes racial diversity. Thirdly, "native" is a categorical trade term of the leather industry which uses the terms "native steers", "native dairy steers", "native cows" and "native dairy cows" to report hide market prices (Jacobsen, 2017).

The large-frame dairy breed cows produce steer progeny that also have large frame scores. Consequently, these large frame dairy steers are prone to achieve USDA Choice carcass composition at 1400 to 1700 lbs. Steers with

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body weight (**BW**) of 1640 lb and a dressing percentage of 61% would yield a carcass of 1000 lb. Carcass weights in excess of 1000 lb can incur carcass price discounts (Schaefer and Schaefer, 2016). The ideal live weight at which finished Holstein steers should achieve 28% body fat and be marketed for slaughter is 1400 to 1550 lb. This endpoint is achieved only when forethought is given to initiation of the finishing phase diet and when the finishing phase diet has a sufficient energy density, which is at least 0.62 Mcal Net Energy for gain (**NEg**) per pound DM. Emphasis in this paper will be placed on finishing Holstein steers, since they are the major contributor to dairy beef production and most knowledge of dairy steer production is based on the Holstein breed.

Significance of Dairy Beef Production

USDA Agricultural Marketing Service annual reports and the scientific literature were used to quantify the contribution of dairy steers to U.S. commercial beef production and fed steer and heifer beef production (Boetel, 2016). The assemblage of assumptions, statistical data, and calculations is shown in Table 1. Finished dairy steers and heifers account for 16.2% of federally inspected steer and heifer beef production. Since Holstein cattle constitute 86% of the dairy cow population (NAHMS, 2016), Holstein steers and the few finished Holstein heifers are 13.9% of the fed steer and heifer supply. As Dykstra (2016) discussed, the recent cyclical decline in U.S. beef cow population and stability of the U.S. dairy cow population have the consequence that the proportional contribution of dairy steers to U.S. fed cattle supply has increased in recent years. It is reasonable to surmise that the Holstein contribution makes this population the largest purebred contribution to U.S. beef production. This view is based on the presumption that most native cattle in the fed steer and heifer supply are crossbred cattle. Dykstra (2016) summarized the results of 4 National Cattlemen's Beef Association Beef Quality Audits and reported that Holstein carcasses achieved average and high Choice quality grades at the rate of 25% compared to 18.9% for native cattle. Furthermore, the audit results indicated that 12.9% of Holstein carcasses were graded Prime, while 2.1% of native carcasses were Prime. Using this percentage for Prime and the Boetel (2016) tabulation of Holstein beef production, Holstein beef accounted for 33% of Prime beef in 2015. Since the correlation between estimated breeding value for milk production and marbling score is small and positive (0.21; Tyler, 1970) ,there is reason to believe that continued selection for milk production in the Holstein breed will not compromise the ability of finished Holstein progeny to produce beef carcasses of high quality. Likewise, it is noteworthy that dairy cows contribute 1.9 billion pounds of beef annually, which was 8% of U.S. commercial beef production in 2015 (Table 1). The tenderloins and rounds of these cows are separated and merchandised as whole muscle cuts. Clearly, the dairy herd is an important component of the U.S. beef industry, and this utilization returns a financial benefit to dairy enterprises.

Sexed Semen and Crossbred Dairy Beef

The commercial availability of sexed semen has enabled dairy enterprises with sufficient replacement females to choose alternative sire breeds for mating with less desirable dairy cows. The most common native breeds chosen for dairy female insemination are Angus, Simmental, Limousin, Simmental-Angus, and Limousin-Angus (M. Faust, Senior Research Director, ABS, personal communication). Approximately 4.5% of semen units going into dairy females are from native breed bulls (M. Faust, ABS, personal communication). This practice is especially prevalent in Jersey herds as a method for adding value to male progeny in preference to producing relatively low value (Mueller et al., 2010) Jersey bull calves. Jersey females account for up to 30% of the native semen units used in dairy females (M. Faust, personal communication). Jersey steers have much slower growth rates than Holstein steers (Lehmkuhler and Ramos, 2008); yet, the Jersey breed has long been recognized as having beef tenderness that excels relative to native cattle breeds (Ramsey et al., 1963), and a propensity to deposit marbling so that these carcasses qualify for USDA Choice quality grade (Koch et al., 1976; Jiang et al., 2013). Given this combination of characteristics, a variety of native breeds could be considered for production of half-blood Jersey steers and heifers that would have enhanced growth and carcass yield characteristics.

Desirable Finished Dairy Beef Cattle

A reasonable thumb rule is to expect steer progeny to finish at a weight which is similar to the weight of mature cows in the herd. A finished steer is defined as an animal that has 28% body fat, which coincides with the small degree of marbling, the threshold for the USDA Choice quality grade (Guiroy et al., 2001). Heifers will achieve this carcass compositional endpoint at a lighter body weight than their steer mates. There seems to be no literature data available from which to estimate mature BW of Holstein cows. Therefore, personal communication with auction market managers has led to the supposition that such weights are 1400 to 1700 lb.

When anabolic implants are inserted into Holstein steers, their effect is to increase the shrunk BW at which the 28% empty body fat endpoint is attained. Perry et al. (1991) implanted 570 lb Holstein steers with an implant containing 140 mg of trenbolone acetate and 28 mg estradiol and harvested these steers at an ultrasound-determined marbling score that coincided with USDA low Choice. The implanted steers had 46 lb more BW, 31 lb more hot carcass weight, and 15 lb more empty body protein. The implanted steers also achieved the carcass compositional endpoint in 16 fewer days. Use of anabolic implants in Holstein steers yields a high return on investment; however, the starting weight, feeding program, and implant program must receive forethought to avoid overweight and/or under-finished steers. The Holstein breed is already late-maturing and has a large frame. The use of implant technology in Holstein steers further emphasizes that these cattle receive a high energy finishing diet ($\geq$ 0.62 Mcal NEg/lb DM) from 770 lb BW or lighter so that they achieve the Choice quality grade, before their carcass weight incurs discounts at greater than 1000 lb.

An appropriately finished Holstein steer is shown in Figure 1. This is an animal that has a body condition score of 7 at a desirable BW with a carcass weight assumed to be 870 lb. This should be the target in beef production from Holstein steers. Since the actual carcass measurements were not available from the steer pictured in Figure 1, appropriately finished Holstein, Jersey and Brown Swiss steers are shown in Figure 2. These steers have fat coverage over their ribs, hooks which are not prominent, some fullness in their briskets due to fat deposition, and evidence of fat pones on both sides of the tailhead. They are relatively young cattle since their muzzles are not elongated, which occurs in older steers.

Jersey steers are likely to incur carcass weight discounts because of light carcass weights (Lehmkuhler and Ramos, 2008). Lehmkuhler and Ramos (2008) found that diets containing 30% and 20% roughage prior to a 10% roughage finishing diet did not change overall gain efficiency, and average daily gain (**ADG**) was diminished by only 3%. Phase feeding could be used to avoid underweight carcass discounts on Jersey steers, but the duration of overall animal ownership and carcass weight produced will be much less desirable relative to Holstein steer production. Growth rate of the Jersey steers was 70% of Holstein steer growth rate. On the other hand, Holstein steers have greater risk for overweight carcass discounts so they should be started on a high-energy finishing diet by 770 lb.

Pre-Weaning Male Calf Management

The focus of this paper will be on post-weaning nutrition and management of dairy steers. Other papers in this proceedings will address pre-weaning management of dairy heifers and pre-weaned dairy bull calf management was previously reviewed by Chester-Jones et al. (1998). Nutritional and health management of dairy heifers and dairy bull calves is nearly identical. Three topics deserve special mention for dairy male calf rearing methods. The first is colostrum feeding. Since dairy heifers are the future of the dairy herd, it is reasonable to expect that dairy herd managers give preferential treatment to heifer calves in terms of colostrum feeding. Unfortunately, too often dairy bull calves receive no or insufficient quantities of colostrum (Peters, 2014). This results in immunologically deficient steers that consequently have additional challenges to their health and growth.

Many producers now measure the immunoglobulin status of their calves by evaluating serum concentrations of immunoglobulin G (**IgG**) or total serum proteins within 24 to 48 hr after birth (Schaefer et al., 2017). Failure of passive immunity transfer (**FPT**) is declared for < 10 g IgG/L or serum total proteins of < 5.0 to 5.2 g/dL. Adequate quality and quantity of colostrum is a basic need for calves within 8 hr after birth. Challenges include variation in colostral antibody concentrations, inability to measure IgG concentration at the farm level, disease vector contamination of colostrum (e.g., transmission of the causative organism for Johne's disease), and insufficient IgG to prevent FPT. Colostrum supplements (< 100 g IgG/dose) or colostrum replacers (> 100 g IgG/dose) are readily available exogenous sources if maternal colostrum is deficient or unsafe. Freezing colostrum to create colostrum banks is another option. Pasteurization of colostrum is now commonly used to prevent pathogen contamination on many farms. Feeding 4 L of colostrum at the first feeding after birth is an ideal quantity. Absorption of 150 to 200 g Ig within the first few hours after birth is the goal.

The second topic is castration, which should not occur until both testicles can be palpated in the scrotum. When descension of both testicles has not occurred and castration is done, one testicle remains in the body cavity and eventually produces testosterone. Such an animal is termed a stag. It develops secondary sex characteristics resembling those of a bull. The additional masculinity of the stag is evident in quality of its beef, causing packing plants to discount them to a value resembling that of cow carcasses. It is an expensive mistake if a cattle feeder sells a stag and only marginally less expensive for the cattle feeder to surgically remove a testicle remaining from the erroneous first castration.

Castration should be done either pre- or post-weaning but at a time when the procedure will not add to the stress of weaning. Castration done sooner rather than later in the life of the bull calf minimizes stress and growth retardation while healing occurs. Knife castration followed by administration of a disinfectant is the preferred method of castration for bull calves because it "only involves counting to two" to be certain of complete castration. Elastrator bands are the other commonly applied castration method. Again, it is imperative with this method that both testicles be located in the scrotum before the elastrator band is released to strangle the contents of the scrotum. Since this method can result in tetanus as a secondary consequence, it is necessary that administration of a tetanus toxoid occur. Immunization prior to castration is preferred so that the calf has a pre-established immunity by the time the Clostridium tetani bacteria, which might be present, produce their toxin at the site of the elastrator band infection. Since circulating colostral antibodies could reduce the antigenicity of the immunization, knife castration seems more straightforward and certain. Advice of a veterinarian should be sought if elastration will be the method of castration.

The third topic is age at weaning (Schaefer et al., 2017). The current nutritional paradigm for dairy heifer calves is to feed large amounts of milk (milk replacer or whole milk) and wean later (e.g., >7 wk) when calf starter intake is adequate (minimum of 1.5 lb/day, for 3 days). The goal for dairy steer calves is to wean early (28 to 42 days) and promote feed DM intake so producers can take advantage of the efficient growth up to 400 lb BW. Adjustments should be made for both cold and heat stress conditions. The choice of texturized or pelleted calf starter should be based on both economics and the ability to provide a high energy diet (0.58 to 0.60 Mcal NEg/lb) with 18% crude protein. Use of digestible fiber sources in calf starter formulations has been very beneficial. Protein sources often constitute the most expensive part of starter diet formulations. Any diet transitions should be accomplished in individual housing prior to moving to group pens. An example would be a transition from coarse-textured starter to a whole corn-pelleted supplement program. The growth target for the nursery phase is to double initial BW by 56 days of age, with hip height growth of 4 inches or more.

Post-Weaning Feeding Strategies

The gain efficiency of young dairy steer calves is very high. Expected (Chester-Jones and DiCostanzo, 1996) growth during the period up to 400 lb BW has been shown to be 2.51 lb/day with 7.50 lb DM/day intake and 0.33 gain-to-feed efficiency (**GF**). Since Holstein steers are weaned onto a high-concentrate diet, there is no need to offer them grass hay diets upon receiving them into a feedlot, as would be the case for recently-weaned native calves. Their initial diet should include some long forage to stimulate rumination, but the basal receiving diet can be 0.56 Mcal NEg/lb.

The preferred method for raising and finishing Holstein steers is to begin by weaning them onto a high-concentrate starter diet, followed by sustained feeding of this high-energy diet until the desired finished weight is achieved. This method results in finished Holstein steers that are referred to as "calf-fed" cattle. Advantages of this method are that yardage expense and interest expense on calf purchase cost are minimized, ADG and gain efficiency can be expressed to the full genetic potential of the cattle, and these steers at 1400 to 1450 lb BW result in high dressed yield, mainly Choice and Prime carcasses. There is no risk of carcass weight discounts for calf-fed Holstein cattle because there is no need to take them to heavier weights to achieve the necessary body condition score.

An important adjunct to the calf-fed finishing strategy was provided by Miller et al. (1986). They evaluated inclusion of 30% hay in the starter diet fed to 330 lb BW and found it to be beneficial to the starter phase and starter-grower-finishing ADG. Although gain efficiency was improved when an "all-concentrate" (80% rolled corn, DM basis) diet was fed during the grower and finisher phases, hay in the starter diet was presumably beneficial to rumen development, and this benefit had a carryover benefit for ADG until harvest at 1,000 lb BW. Additional titration of hay inclusion percentage in the post-weaning, starter phase diet has not been reported in the literature in recent decades. This long forage particle stimulation of early rumen development should be incorporated into the nutritional design of the starter phase.

For the sake of organization, assume the starter phase spans from weaning until 330 BW. Thereafter, there could be a grower phase which spans 330 lb to 770 lb, followed by a finisher phase from 770 to 1450 lb. It is not essential that the diet fed during the grower phase be different than that which is fed during the finisher phase. In fact, this is the design of the calf-fed program that has been implemented in recent decades in the U.S. desert Southwest. In the calf-fed system of the Southwest (Zinn, 2015), Holstein steers enter the feedlot at 300 lb BW at 100 to 120 days of age, remain on feed for 349 days, have ADG of 2.88 lb/day, and are harvested at 1294 lb BW (which reflects 4% shrink). Forages are in short supply in the Southwest, unlike the Midwest. Current representative production numbers in Midwest and Northern Plains feedlots are as follows (T.M. Peters, DeKalb Feeds, Rock Falls, IL 61071; 2016; personal communication). Holstein steers enter at 475 lb BW and are on feed for 330 days consuming 20.9 lb DM/day, gaining 2.88 lb/day, and resulting in GF of 0.138 with harvest occurring at 1425 lb BW. Finishing diets may include 25% corn distillers grain, 12.5 to 15% as hay or forage, 5% commercial supplement, and 55% corn. The corn is either dry and/or high-moisture that has been coarsely processed. Wet or dry coproducts from the ethanol industry are utilized. When they contribute energy in the form of corn oil rather than starch, they support industry standard feedlot performance while diminishing the risk of acidosis.

The chosen energy density of the finishing diet ($\geq$ 0.62 Mcal NEg/lb DM) is based on balancing rumen health (which is a function of dietary energy sources, cost of effective fiber sources, feedbunk management, and duration of feeding the finishing diet) and carcass characteristics at harvest (which are a function of weight, implant program, and marbling score). High Plains feedyard consultants most commonly recommend an energy density for commercial feedlot finishing diets (Samuelson et al., 2016) of 0.68 to 0.70 Mcal NEg/lb. Their NEg concentrations are made possible by the inclusion of steam-flaked corn which has 0.76 Mcal NEg/lb, whereas high-moisture corn has 0.71 Mcal NEg/lb (NASEM, 2016). Since forage to concentrate ratios have been referenced in the Midwest, equivalencies between forage to concentrate ratios and dietary NEg concentrations are presented in Table 3. This author has finished calf-fed Holstein steers using 10% corn silage diets calculated to provide 0.65 Mcal NEg/lb DM. With the advent of kernel processors on corn silage harvesters, 10% seems to be the minimal advisable level of corn silage inclusion. Peters (2014) contends that continuous feeding of high-energy diets with 10 to 12% forage from light feeder BW to harvest BW may result in a stall-out period of slow growth, presumably due to metabolic complications related to sub-clinical acidosis, which arises in connection with the long duration of this finishing diet. This has not been observed in 6-head pen studies at UW-Madison.

Feedbunk management is a critical skill that must be implemented perceptively and on a consistent basis for Holstein steer feed intakes and growth rates to be sustained at a high level. Pens must be fed: 1) a diet which has a consistent composition from day to day, 2) at a consistent time(s) of day, 3) with a consistent manner of diet distribution, and 4) to allow equal access to the diet for all cattle in the pen. The feedbunk for each pen should be viewed at a consistent time of day. Based on this bunk reading, an amount of diet should be offered that will be eaten by the pen of cattle within the succeeding 24 hr, with only crumbs of diet remaining. Preferably, all cattle adopt the habit of coming to the bunk to eat fresh feed when it is offered because appetite is an easy, meaningful method for daily assessment of cattle health. The goal of bunk management is to provide a ration that satisfies appetite without underfeeding, which restricts performance or overfeeding, which results in feed wastage. The assertion here is that skillful, consistent bunk management will circumvent the stall-out period referenced by Peters (2014). Daily provision of a total mixed ration (**TMR**) allows for greater control of feed additive intake, greater ability to recognize pen feed intake fluctuation, opportunity to integrate byproduct and/or moist feeds, ability to utilize forage more effectively, ability to decrease NEg concentration in diet promptly in response to incoming severe weather, and greater ability to notice sick animals.

When forages are readily available due to the cropping system necessitated by the farmland landscape, they may be fed in the 330 to 770 lb BW range. Forage-to-concentrate ratios can be adjusted whereby home-grown forages can be included in this grower period at up to 55% of the diet DM, followed by a high-energy finishing diet (DiCostanzo, 2005). When high forage diets of 0.34 and 0.39 Mcal NEg/lb were fed to Holstein steers beginning at 305 lb for 153 days to 625 lb BW and then followed by feeding a high-moisture corn diet (0.66 Mcal NEg/lb) until 335 days on feed, these steers displayed compensatory growth during the finishing phase (3.7 lb/day) so that their slaughter (1282 lb) and carcass (757 lb) weights, yield grades, and marbling scores were not different from steers continuously fed the high-moisture corn diet (Schoonmaker et al., 2004). Again, the constraint is to initiate the finishing diet so that Holstein steers can be finished at a desirable slaughter weight, by 1450 lb.

The self-fed, dry, whole corn and pelleted supplement program for finishing Holstein steers is used by small feedlots that do not have TMR mixing equipment and wish to capitalize on the low input of labor. Acidosis may result from inconsistent feed intake; though Eng (2005) surmised that Holstein steers are less likely to founder than native steers. The occurrence of this disorder has been attenuated by providing a palatable bedding source such as corn stalks or free choice long or chopped hay. In addition, a roughage level of 5 to 10% incorporated into the pellet has been successful (Traxler et al., 1995).

Apart from their higher energy requirement for maintenance (NASEM, 2016), the fulfillment of protein, mineral, and vitamin requirements for dairy steers can be guided by the recommendations in NASEM (2016). Yet, the ability to manage Holstein steers at light weights when their growth rate is rapid and gain efficiency is high affords an additional opportunity to enhance their performance via balancing the dietary supply of metabolizable amino acids to meet their metabolizable amino acid requirements.

Zinn et al. (2005) noted that calf fed Holstein cattle can increase BW by 1% daily and well-managed steers can attain ADG of 3.74 lb/day during their first 112 days on feed. They expressed concern that lysine, methionine, and threonine are growth-limiting amino acids for calf-fed Holstein cattle during this period. Salinas-Chavira et al. (2016) have since shown that balancing the diet to meet the metabolizable amino acid requirements of the calf-fed Holstein steer during the period from 285 to 625 lb improved ADG and GF, and the benefit on GF was sustained to 1275 lb. Fat inclusion at 5%

increases energy density of the diet and may be most beneficial to ADG in this early period of rapid growth that coincides with a constraint on gastrointestinal tract capacity.

Holstein steers have increased susceptibility to liver abscesses compared to native steers, and heifers (Amachawadi and Nagaraja, 2016). The 10-yr average incidence of liver abscesses in native heifers, native steers and Holstein steers was 13.9, 16.0, and 28.3%, respectively. The reason for this Holstein susceptibility is unknown. Liver abscesses result in liver condemnations as a human food source and account for additional carcass trim loss when they adhere to the diaphragm. Fusobacterium necrophorum and Trueperella pyogenes are considered to be the primary and secondary causative pathogens; however, Amachawadi and Nagaraja (2016) point out that bacterial isolations from abscesses of Holstein cattle have not been conducted. Dietary tylosin administered at 60 to 90 mg/head daily reduced the incidence of liver abscesses from 30 to 8% (Wileman et al., 2009).

Additional Management Considerations

Holstein steers apparently have greater water consumption than native steers. Although there is no known publicly available data to support this report, Eng (2005), Peters (2014) ,and Zinn (2015) have all made this comment. Consequently, pens of Holstein cattle are wetter and bedding requirements would be greater. It is also relevant that dietary salt inclusion not be excessive since this would exacerbate water consumption and urination. This author formulates diets for Holstein steers to contain 0.2% salt (DM basis).

The use of anabolic implants has not been been described in this paper, though they should be used in dairy steers. The choice of which potency of anabolic implant product and the frequency of their implantation must be considered in light of the arrival BW and duration of the grower and finisher phases. Chester-Jones (2010) has reviewed the literature and provided recommendations.

Conclusions

Holstein steers account for a substantial proportion of beef production from finished steers and heifers. It is important that these animals as neonatal bull calves receive an adequate dosage of colostrum, equivalent to that administered to their heifer mates. While consequences of inadequate colostrum provision have not yet been quantified, the long-term consequences for steer health are considered to be significant. Complete castration of bull calves is equally important because failure to do so has expensive consequences in terms of carcass value discounts. Holstein steers are large frame cattle which need to receive a high-energy finishing diet so that they will have adequate carcass fatness at a desirable carcass weight. This endpoint allows the inclusion of some forage in low-energy diets, provided the high-energy finishing phase begins in a timely manner so as to enable the steer to finish at an acceptable carcass weight. Since these steers may receive a high-energy diet for 11 mo, it is also essential that bunk management be consistently accurate in making the daily ration allocations. Holstein steers are susceptible to development of liver abscesses. While the reason for this susceptibility has been ascribed to the duration of the feeding the finishing diet, it is not clear whether the susceptibility is rooted in management or animal genetics.

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Table 1. Contribution of steers, heifers, and culled cows from U.S. dairy herd to U.S. commercial beef production in 2015[1].

Assumptions	Value	Reference
Calving interval of 13.1 mo; cows calving annually	91.6%	NAHMS, 2016
Dairy calves from U.S. calf crop	26%	-
Heifer component of calf crop to account for replacement heifer need and 1% for slaughter	53%	-
Calf death loss weighted for singletons vs twins	8.08%	Silva del Rio et al., 2007
Cow and replacement heifer death loss	6.8%	Shahid et al., 2015
Feedlot death and realizer[2] loss	3.77%	Peters, 2014
Commercial slaughter relative to federally inspected (FI) slaughter	1.01%	-
Components from USDA Agricultural Marketing Service for 2015		**Value**
Dairy cow inventory, thousands		9,307
Heifers for dairy cow replacements, thousands		4,710
Replacement heifers expected to calve within year, thousands		3,051
U.S. calf crop, thousands		34,302
FI dairy cow slaughter, thousands		2,915
FI cow carcass weight, lb		644
Steer dressed weight, lb		892
Heifer dressed weight, lb		818
Veal calf slaughter, thousands		453
U.S. commercial beef production, billion lb		23.698
U.S. beef production from FI steers and heifers, billion lb		19.697
Results of calculations as they pertain to dairy cattle		**Value**
Calves born after accounting for calving interval, thousands		8,905
Bull calves born, thousands		4,150
Heifer calves born, thousands		4,755
Surplus heifers, thousands		45
Heifers to beef sector after feedlot death and realizers, thousands		43
Steers and veal bull calves for slaughter after feedlot death and realizers, thousands		3,993
Steers to beef sector, excludes veal, thousands		3,565
Contribution of dairy cattle to U.S. commercial beef production		
Steer beef, billion lb		3.18
Heifer beef, billion lb		0.0354
Cow beef, billion lb		1.90
Steers, %		13.4
Heifers, %		0.1
Cows, %		8.0
Total dairy sector, %		21.5
Contribution of dairy steer and heifer beef production to U.S. FI steer and heifer beef production		
Steers, %		16.0
Heifers, %		0.2
Total dairy steers and heifers, %		16.2

[1]Boetel, B. 2016.
[2]A realizer is an animal that requires repeated veterinary treatment while hope remains for a full recovery, but later the

Table 2. Measurements of finished dairy beef steers pictured in Figure 2.

	Holstein (Figure 2A)	Jersey (Figure 2B)	Brown Swiss (Figure 2C)
Body weight, lb	1388	1150	1260
Dress, %	58.6	59.0	60.2
Carcass, lb	814	679	759
Fat thickness, in	0.28	0.28	0.25
Loin muscle area, in^2	12.2	10.5	12.2
Kidney, pelvic, heart fat, %	3.0%	3.5%	3.0%
USDA Yield Grade	3.0	3.1	2.7
USDA Maturity	A	A	A
USDA Marbling	Modest^{20}	Moderate^{60}	Modest^{10}
USDA Quality Grade	Choice	Choice-Plus	Choice

Table 3. Equivalencies between corn silage:high-moisture corn ratios and net energy for gain concentrations[1,2].

Corn silage Proportion (%)	Corn, high-moisture Proportion (%)	Net Energy Gain (Mcal/lb)
10	60	0.653
15	55	0.640
20	50	0.626
25	45	0.612
30	40	0.599
40	30	0.571
50	20	0.544

[1]Based on diet DM formula as follows: corn silage proportion; high-moisture corn proportion; modified wet distillers grain with solubles, 25%; and supplement, 5%.
[2]NEg values for diet ingredients (NASEM, 2016) were corn silage, 0.44 Mcal/lb; high-moisture corn grain, 0.71 Mcal/lb; and modified wet corn distillers grain with solubles, 0.74 Mcal/lb. Supplement was considered to be only minerals, vitamins, and additives with zero NEg value.

Figure 1. Appropriately finished Holstein steer that displays uniform fat coverage over the ribs, brisket fullness, and modest fat pones on both sides of the tailhead, characteristic of body condition score 7. Live weight of this steer is 1415 lb with dressing percentage estimated to be 61.5%. An ideal kind of steer that displays youthfulness and finish to be USDA yield grade 3 and high Choice with desirable muscle:bone ratio. (photos courtesy of Ron Mayer, JBS-Packerland).

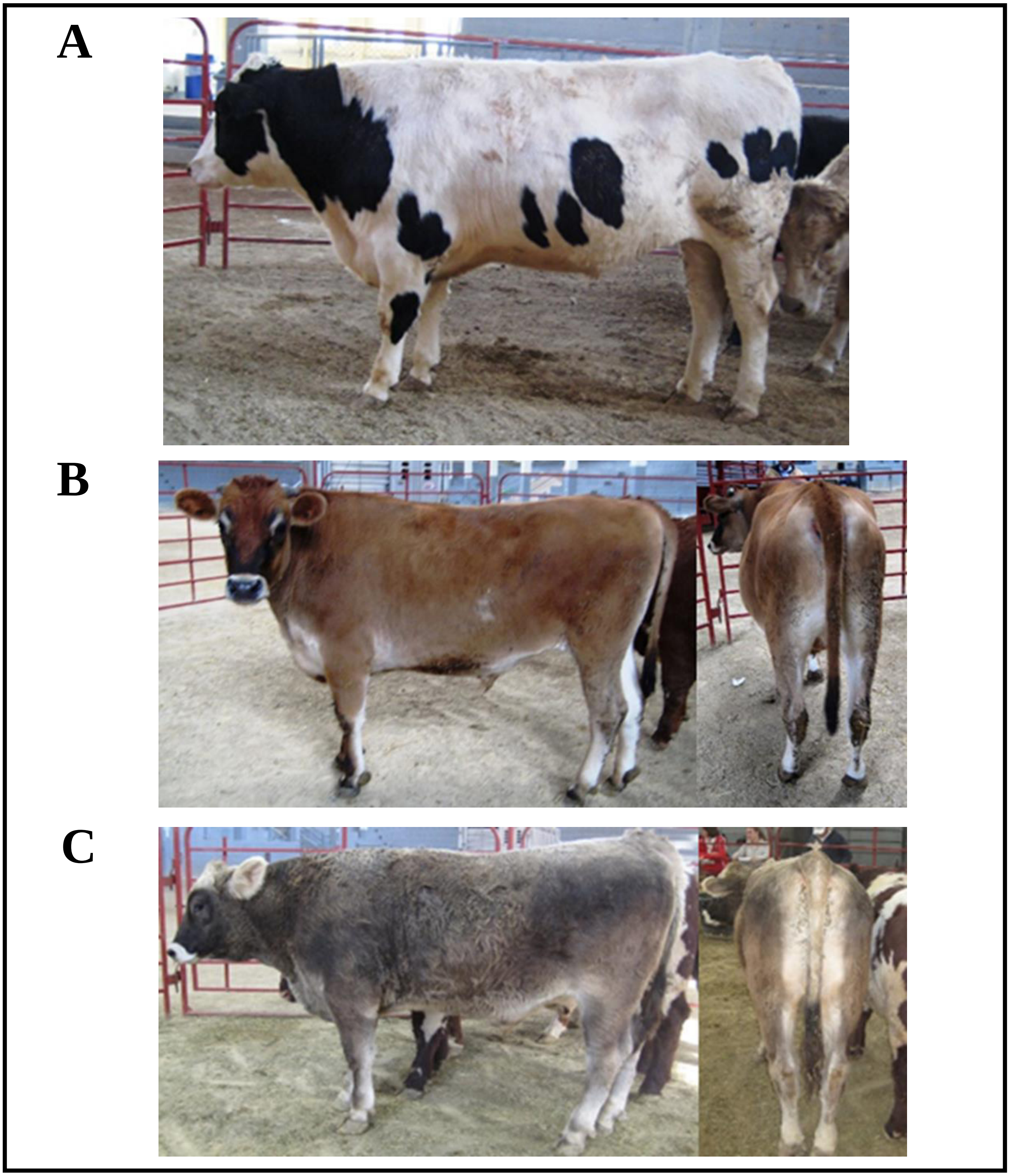

Figure 2. Appropriately finished dairy steers should display a body condition score of 7, on a scale of 1to 9, and weigh no more than 1550 lb and no less than 1200 lb BW, to avoid carcass weight discount. A) finished Holstein steer , B) finished Jersey steer, and C) finished Brown Swiss steer (photos courtesy of Ron Russell, UW-Madison). Weight, dressing percentage, and carcass yield and quality data for each steer are shown in Table 2.