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# Producer's Guide to Pasture-Based Beef Finishing



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# Producer's Guide to Pasture-Based Beef Finishing



Can cattle be finished on pasture? With proper management, the answer is a resounding "Yes".

## Introduction

*Greg Halich*

Beef cattle were routinely finished locally in Kentucky and other parts of the upper south before the 1950s, primarily on pasture with some grain or by-products from distilleries and grain processing mills. Cattle were typically born, raised, and finished on the same farm then sent to a local butcher where the meat was sold in nearby communities and cities. After the Second World War grain and transportation costs decreased dramatically and supermarket chains that required a large, steady supply channel were established. The combined effect of these changes made finishing in large centralized locations more economical. Over the next couple of decades the finishing industry consolidated, and feedlots sprang up across the Great Plains to finish the bulk of the nation's cattle.

However, now the cattle feedlot finishing paradigm dominant for the past 50 years is being challenged. Corn prices have doubled since 2005, transportation costs have increased significantly, and new environmental regulations are increasing the compliance costs of centralized feedlots. Moreover, there is a growing consumer movement focused on purchasing healthier foods and another focused on purchasing locally produced foods.

All of these changes are creating opportunities for farmers in the upper south to raise and finish cattle on forages and sell into local markets, much like they would have two generations ago. They may use either a pure pasture-based production system or a grain-on-grass production system where the bulk of the animal's diet comes from pasture and is supplemented with grain or by-products. Both of these approaches are quite different from the standard industry practice of finishing cattle on a diet of almost exclusively grain in large confinement operations.

Although demand has increased and the relative cost structure has decreased for locally finished beef, significant producer challenges remain. Few cattlemen have experience finishing beef cattle. Bringing animals to a finishing weight in a reasonable timeframe is no easy task, requiring a fundamental understanding of how beef cattle mature as well as understanding the capabilities and limitations of various forages. Processing can also be a challenge where issues such as federal inspection, aging, and scheduling harvests are potential problems. Marketing may be the biggest obstacle to selling pasture-finished animals. Most livestock farmers currently sell into commodity markets, which require minimal interaction with buyers. Selling grass-finished or grain-on-grass finished beef, however, generally requires considerable interaction with potential customers. All these obstacles present challenges for producers entering the market for pasture-finished beef production. The primary objective of this publication is to help producers identify and overcome these as well as other challenges.

# Market Segments

*Greg Halich, Fred Martz, and Lee Meyer*

The market for pasture-finished beef has grown considerably in the last few years, mainly due to two distinct market trends. First, a growing consumer segment is placing emphasis on healthy eating as opposed to price. These consumers are concerned with the conventional agricultural system, particularly with pesticides, antibiotics, steroids, and hormones. Related to cattle, many of these same consumers are concerned with their perception of unhealthy growing conditions in feedlots. They may also want a product leaner than conventionally produced beef. These consumers are willing to pay a premium for what they believe is a healthier product.

Second, a growing consumer segment is placing emphasis on food that is grown locally. This segment overlaps somewhat with the healthy eating group but is also somewhat distinct. These consumers believe locally produced foods are, in general, superior to foods grown and packaged hundreds or thousands of miles away. In addition to a potentially perceived healthier product, these consumers may also associate local foods with lower transportation and other energy costs (e.g. refrigeration). However, potentially more important to these consumers is their economic support for the local community. Being able to meet the person who grows the food and get to know them on a personal level is an intangible benefit to these consumers. They can ask specific questions to the actual grower: How was the food was produced? What pesticides were applied, if any? How is the land cared for? How were the animals treated? These are important questions for many in this consumer segment.

What exactly defines "local" is not clear. To some individuals, it will mean the small community they live in. For others, it may mean being in same county, region, or even state. Regardless of how individuals define local, these consumers are willing to pay a premium to help sustain a healthy soil, land base, and rural community.




Naturally raised beef has become a popular market segment in recent years.

These two market trends, healthy eating and local movements, have merged to create considerable opportunities in the last few years for pasture-based beef production sold in local markets. How far this market will ultimately go is still unknown. But as of yet, there seems to be much unmet demand, and a lot of potential production growth to meet this demand.

## Pure Grass or Grain-on-Grass Finished

Some consumers only want a pure grass (forage) finished beef product. However, there are probably more potential customers that are willing to have some degree of concentrate (grain) during the finishing phase. Much of this final demand will depend on educating the consumer on the pros and cons of pure grass vs. grain-on-grass finishing. It is important to finish cattle to a carcass grade of at least high select to insure adequate juiciness and tenderness of the resulting meat. Since the energy content of pasture may be highly variable throughout the growing season, a combination of pasture and limited grain feeding will generally result in a more consistent product compared to a pure forage-finished animal.

Pasture finishing systems are better viewed as a continuum between a pure grass-finished and pure grain-finished product rather than as two binary systems. A grain-on-grass system where supplement is only fed during the last two months at low levels is much closer to the pure

grass-finished system than the alternative approach. Once consumers realize this distinction, there should be more opportunities for this type of grain-on-grass production system. The American Grassfed Association (www.americangrassfed.org) has two protocols for certification through their organization. Even the more stringent of the two programs allows small amounts of concentrate during emergency situations (e.g. drought). The other program allows for moderate amounts of supplement to be used during the finishing phase. These two programs are detailed later in the Production section.

Some consumers perceive pure grass-finished beef as the only possible product for them, regardless of price differences or supply availability. They may believe it is the only healthy alternative to conventionally raised beef. Or they may just want to differentiate themselves from other consumers, like buying an expensive wine. Whatever the reasons may be, these consumers are typically prepared to pay a premium for the product.

As explained in more detail in the production section, pure grass-finished beef often has a less consistent product and is more difficult to produce throughout the year. Finishing outside of the period from early summer through late fall will result in more difficulty obtaining a quality and consistent product. For frozen meat, this limited finishing season is not particularly a problem, as animals can be finished during the best growing period and put in inventory for later sales. Or, if selling as freezer beef, sales can be concentrated during this optimal finishing period.

Grain-on-grass systems can more easily avoid seasonality and consistency problems because they can supply additional energy needed in the diet for finishing during periods when pastures are low in energy or when stored forages (typically low in energy compared to quality pasture) are needed. Grain-on-grass systems are more likely to produce a product with a high degree of marbling that tastes more like the beef consumers are familiar with.

## Health Attributes of Pasture-Finished Beef

Major health attributes perceived by consumers as being beneficial in pasture-finished beef include the potential to be:

- Naturally raised
- Higher in beneficial fats (CLAs and Omega-6 to Omega-3 ratio)
- Leaner
- Organic

Although there are other potential health attributes, these four are the most common and will be the focus of this section.

### Naturally Raised

"Naturally raised" is a USDA marketing label for cattle raised without antibiotics, steroids, or added growth hormones. This term is also known as ASH-free (Antibiotics, Steroids, Hormones). Many consumers perceive the use of these three cattle treatments, which are common in feedlot finishing, as the potential cause of various health problems in humans. Thus they are willing to pay a premium for an ASH-free product. However, in terms of antibiotics, many consumers may actually be concerned with the *routine use* of this drug. Treating an occasional animal for a life-threatening situation (e.g. pneumonia) may not be a problem for them compared to routine sub-therapeutic use of the antibiotics to promote feed conversion efficiency. Thus it is important to know what your potential customers really want and to make sure it is consistent with your actual production system.

### Healthy Fats (CLAs and Omega-6 to Omega-3 Ratio)

Conjugated linoleic acid (CLA) is a fatty acid that is believed to have merit in protection against cancer, diabetes, heart disease, and obesity. Beef from cattle finished on pasture has been shown to contain elevated levels of CLA compared to feedlot finished cattle. Studies in Missouri and elsewhere have shown these levels to be roughly three to five times greater than in feedlot-finished cattle. Ruminants (cattle, sheep, and goats) are a unique source of CLA because of the specific biochemical reactions that take place in the rumen. Interestingly, studies in Missouri demonstrated that limited grain feeding (just under half the energy intake for the last 60 days) while on pasture did not significantly reduce these CLA levels. So it may be that grain feeding by itself does not reduce CLA levels but that removal from a pasture diet does.

A human diet relatively low in Omega-6 and relatively high Omega-3 fatty acids is thought to deter atherosclerosis. The ideal ratio, according to the American Heart Institute, is in the range of 1:1 to 2:1 (Omega-6: Omega-3). Pasture-finished beef is commonly in or near this range. When ruminants are finished with high grain levels this ratio increases because the relative amount of Omega-6 increases much more rapidly than Omega-3. Missouri data indicates that grain can be fed on pasture in small to moderate amounts and still keep the Omega-6: Omega-3 ratio near this ideal. Although the specific benefits from high CLA levels and low Omega-6: Omega-3 ratio are not conclusively known, it is still an important marketing attribute for many potential customers.

*"Naturally raised" is a USDA marketing label for cattle raised without antibiotics, steroids, or added growth hormones.*

### Lean Meat

Some beef consumers want (or think they want) lean meat with very little fat and marbling. This potential attribute of pasture-finished beef is somewhat of a contradiction from the previously listed health benefits (high CLA levels and low Omega-6: Omega-3 ratio). In other words, specific fat in the first two cases is good, but fat in the third case is bad. Ignoring this contradiction, lean beef can be a potential marketing angle for consumers believing leaner meat is healthier. It is relatively easy to produce cattle with lean meat: choose leaner breeds or just don't fully finish your cattle. However, you will experience a lower meat yield per animal which must be balanced with any potential price premiums. Also, many of your other customers, and some of those who think they want a lean product, may not be satisfied with the end product. Food preparation techniques such as slow cooking and/or the use of marinade for some cuts may help to partially overcome these quality issues.

### Organic

"Certified Organic" is a USDA verified label that means cattle were never given antibiotics or growth hormones, were fed an organic vegetarian diet (free of genetically modified organisms, pesticides, and herbicides), and were on organic certified pasture. Organic also means that the animal was processed in an organically certified processing plant. This label may be the Cadillac of health claims, targeted to the most discriminating consumers. Production costs will be higher with organic pasture-finishing operations, especially if grain is fed, since the cost of organically raised feeds such as corn can be twice the cost of conventionally raised feeds. The cost of organic certification itself can also be significant, particularly for small farmers. Also be aware that there is a cost for organic certification which varies widely. As an interesting note, you can be certified organic and finish cattle mostly on grain as long as the cattle have access to pasture and get 30 percent of their nutrition from grazing during the appropriate months.

## Market Segments Summary

It is important to understand that there are distinct market segments of consumers choosing the production methods and health attributes previously described. Successful marketers will study both the size of these segments and the price premiums those consumers are willing to pay. If for example, most of your potential customers are looking for a product that is mostly grass fed and has no added steroids, hormones, or routinely used antibiotics (sub-therapeutic), then you should probably target that combination for your production system. Beware of producing a "Cadillac" product if you are not confident that you have a customer base willing to pay the premium price you will need to cover the additional costs.

# Production Systems

*Jeff Lehmkuhler, Greg Halich, Ray Smith, and Fred Martz*

This section describes the basics of finishing cattle on pasture. For the purposes of this publication, a "finished" animal will have at least .20 inches of backfat and have reached or exceeded a USDA Select grade.

For most cattle producers, finishing animals on pasture will be a completely new experience. Although a lot of farmers will have grown calves to 700 to 800 pounds, few have experience in taking an animal to 1200 pounds or more by two years of age. Probably the most common mistake made by beginners is harvesting animals that are not physiologically mature. As an example, it is common to see medium-framed Angus steers harvested at 950 pounds that should be in the 1150 to 1250 pound range before being properly finished. These animals will be lean, will have minimal marbling, and will have extremely low meat yields. Typical reasons given for these immature harvest weights include:

- They thought the animal was heavier.
- They knew roughly what the animal weighed but thought this was an acceptable finishing size.
- They were selling by the half sides and customers want small portions.
- They ran out of time as they reached the end of the pasture season.

While some of these are practical reasons for harvesting an immature animal, there are ways to get around them with proper planning. Examples are detailed later in this section. For now, it is more important to realize that the most common problem with animals harvested in a pasture-based system is that they are not fully finished. Estimated finishing weights to reach this physiologic maturity are provided later in this section.



Are these steers finished? Not quite. They were harvested two months later. The steer on the left weighed 1,132 pounds at harvest and graded low choice. The steer on the right weighed 1,189 pounds and barely made select. They probably weighed about 100 pounds less each at the time of the photo. The steer on the left had a smaller frame, thus a better finish at a lower weight.

In planning your production system, it is typically best to work backwards after you determine when you want to have your animals finished for a particular market. This approach will help determine how fast the animals should gain as well as what calving season might be best suited to hit this target. You can then determine if your current forage base needs to be modified, how much concentrate needs to be fed within a grain-on-grass system, and what quality your winter forage feed needs to be. Unfortunately, the opposite approach is often taken. Producers start with their current system and keep the animal until they think it is ready for harvest, or they harvest the animal when the consumer wants it, regardless of its finish. This approach may work adequately in a grain-on-grass system where you can rely on supplementation for half of the energy content, but it will generally give poor results in a pure forage-based system where performance is seasonally dependent.

Planning your production system is critical with pasture-based finishing. Failure to synchronize your production system with your marketing plan is like trying to get to a new destination without a map. You may end up getting there, but you will likely make many wrong turns along the way. When planning your production system, start with your target market—your intended destination. Your entire production system should focus on how to manage the cattle so that you will reach this target market in an efficient manner.

As an example, assume your target market is freezer beef (quarter or half carcass) that your customers will want between September and November. If these same customers are accustomed to and desire beef with a high degree of marbling, your finishing target will likely be a high select or better meat grade. Your production system should focus on developing a highly marbled product that will be ready for sale during the fall. If you calve during the spring, you will need exceptional gains during the winter feeding period to finish by the second fall.

## Pure Forage vs. Grain-on-Grass

One of the most important production decisions to make with pasture-based finishing systems is whether to use a pure forage diet (pasture, hay, haylage, etc.) or to supplement with grain. The method chosen will have major implications on the remainder of the production process as well as with marketing. In general, grain supplementation will allow more flexibility in the production process and will make it easier to finish cattle. To get a finished and adequately marbled animal on a pure forage diet will require a higher degree of management. Also, it will typically take a longer period of time to finish an animal on a pure forage system as energy intake and gains will be lower. Which of these systems best fit your operation will depend on factors such as your target market, calving season, forage base, and desired finishing window, as well as your personal philosophy.

The grain-on-grass production process varies widely. Grain-on-grass systems as described in this publication assume that no more than half of total energy intake is from concentrates and that animals will at minimum be grazing pastures during periods of active vegetative growth. This process generally means 1.0 percent or less concentrate intake on a dry matter basis based on bodyweight. Typically, finishing cattle offered a high concentrate diet have an average total intake ranging from 2.25 to 2.75 percent of body weight on a dry matter basis. Higher grain feeding levels will for practical purposes more closely resemble a feedlot diet. However, there are some producers who grow calves on forage during the grazing season followed by 60



Grain supplementation: Supplementing a pasture diet with grain allows for an earlier harvest and more consistent finishing quality. The earlier harvest is particularly important with spring-born calves that you are trying to finish before their second winter.

days or so of feeding a predominately high concentrate diet on their farm mimicking a conventional finishing system for a shortened time period. This type of system can work well for some producers if you have the corresponding market for it. This publication will focus on systems using forage during the entire feeding period and will not cover conventional finishing systems.

With some grain-on-grass systems, a partial grain diet is fed continuously after weaning. In others, grain is fed only during the last few months before processing or during periods of low forage availability and quality. The goal of a good grain-on-grass system should be to optimize the forage resource while maintaining moderately high gains during inclement periods. The end result is a product with higher quality consistency compared to a pure forage diet for most producers. As tall fescue and other cool-season forage quality begins to decline in early summer, animal performance will also drop off. To maintain a high level of gain during the summer, you will need either energy supplementation or a high degree of forage management that does not rely on predominately fescue pastures.

The grain-on-grass approach allows for an easier transition to a finishing system for most producers compared to a pure forage approach. The use of concentrate feedstuffs and co-product feeds provides a mechanism to more consistently obtain the high rates of gain desired for finishing. The forage base and forage management can gradually be improved allowing for a transition to an all-grass system if desired. Additionally, the use of concentrates arguably results in a more consistent end product in most situations, especially during winter when animals are to be finished on stored feeds or during times of low pasture quality and/or availability. Table 1 highlights the broad differences between the two systems, including advantages and disadvantages. Specifics of both systems are described in greater detail later in this section.

**Table 1. Comparison of pure-forage to grain-on-grass production systems in the upper south**

| Pasture production system | General management required | Typical animal age at finishing | Finishing seasons | Marketing |
|---|---|---|---|---|
| Grain-on-grass | Select grade fairly easy to obtain | 18-24 months for select grade | Year round with good management | Premium price possible for "local" product |
| Pure forage | Good management needed to obtain select grade | 22-30 months for select grade | Limited seasonal availability except with exceptional management | Premium price likely in most situations |

Note: Finished animal assumes select grade with 0.20" of backfat or greater.

## Calving Seasons

The calving season will have a profound impact on your finishing options as it provides the starting point for the overall production system. Again, you should work backwards from your targeted finishing window(s) to determine how well your calving season fits. This method may require a shift in the breeding and subsequent calving season to ensure that calves are available to enter the finishing system when needed. The other option is to purchase feeder calves to fit your targeted windows.

The majority of beef operations in the United States are spring calving, meaning calves are born near the time that the spring pastures are greening up, usually January through May. In most operations with a defined calving season, the majority of the calves will be born within a 60 to 90 day window, allowing for greater uniformity of the calf crop. In Kentucky, the typical spring calving season is from February through early May. A typical weaning age is six to eight months. Most of these calves are subsequently weaned in the fall between September and November. The major advantage of spring calving is that forage quality and availability are closely in synch with the increased forage needs and nutrient demands of the cow. This approach allows for lower quality winter forage compared to fall calving.

Fall calving generally refers to calves born in August through October. It is common for larger operations to have both a spring and fall calving herd. This practice provides an opportunity to maximize investments made in bulls as they are used on two different herds in the same year. Because the breeding season occurs during the cooler months of early winter, cows suffer fewer reproductive problems associated with heat stress. Fall calving herds grazing endophyte-infected tall fescue have shown better conception rates compared to cows bred in late May and June. There is also typically less precipitation in the fall, resulting in less mud and a more favorable calving environment. Finally, cow-calf operations may opt for fall calving for marketing reasons, as feeder calf prices are normally higher in the spring (when calves are weaned) compared to the fall months.

*The majority of beef operations in the United States are spring calving, meaning calves are born near the time that the spring pastures are greening up, usually January through May.*



Eight to nine hundred pound steers grazing in early November: Fall-born calves from the previous year with good management will easily finish by the next fall (23 to 26 months old).

Although most cow herds could be characterized as spring or fall calving, undefined or year-round calving is still fairly common. This calving option provides distribution of calves for finishing and marketing throughout the year. However, this system results in management and marketing difficulties (for the commodity market) and is typically discouraged.

In general, fall calving herds are better suited for finishing cattle in the upper south in a pure forage system if you are trying to finish calves by the time they are two years old because spring-born calves would have to finish at 19 to 21 months old by the end of their second fall. Even with good gains on stored forage during the winter (1 lb/day) these spring-born calves would only go through one spring/early summer season (when gains are highest) after weaning, and it would be difficult to get them into the 1150 to 1250 pound range before the end of the fall grazing season without grain supplementation. Most likely they would have to be held over another winter and finished the following spring. Fall-born calves would reach their second spring after weaning by the time they are 18 to 22 months old and can get into the 1150 to 1250 pound range with good management without any supplementation by the time they are 23 to 27 months old.

Due to the variability in calving dates, you will still have a range of calf weights at weaning time even with a defined calving season. For example, if we use a typical 90-day calving season, a 550 pound average weaned steer, and 80 pound birth weight, this calving range would easily result in a 200 pound variance between the heaviest and lightest calves at a seven month average weaning age. It is important to account for this weight difference if you are selecting animals to finish from within your herd. If you are trying to finish all your animals at the same time, this initial weight variance will be a challenge that must be overcome. On the other hand, this variance may be desirable if you intend to market cattle over an extended period of time, as is the most common practice.

*To be successful with pasture-based finishing, a focus on forage management will be paramount.*

## Managing Permanent Pastures

To be successful with pasture-based finishing, a focus on forage management will be paramount. In most areas of the upper south, pastures will typically be comprised of endophyte-infected tall fescue mixed with bluegrass, orchardgrass, and various legumes. Advantages of tall fescue are high productivity, low fertility needs, and good persistence even under heavy grazing pressure. However, the forage also provides challenges related to endophyte alkaloids in the endophyte-infected fescue, which typically decreases forage intake, reduces hair coat shedding, increases core body temperature, and ultimately lowers performance. Consequently, infected tall fescue is not an ideal forage on which to finishing cattle, particularly during the summer months. It is much better during the spring and again in late fall/early winter when the effects of the endophyte will not be as severe and temperatures will not result in heat stress.

There is some debate on whether the tall fescue endophyte produces off-flavors in pasture-finished cattle. Unfortunately, there is not much research to definitively answer the question. An often cited Auburn University study (http://www.aaes.auburn.edu/comm/pubs/highlightsonline/winter97/toxic.html) found beef finished on infected tall fescue was unacceptable to consumers. However, this work was never published in a scientific peer-reviewed journal and involved only five steers per forage type treatment. Other research investigating the acceptability of beef produced from tall fescue demonstrated no differences in tenderness or juiciness scores compared to those that were finished in a drylot receiving a corn and hay ration in Missouri.

Based on the limited amount of research, careful and deliberate management of existing tall fescue pastures is recommended rather than tilling under the entire farm and replanting with other grasses. Furthermore, concerns over soil erosion on shallow topsoil found on most hill farms makes recommendations related to complete renovation of pastures a risky endeavor. Gradual renovation of the forage base is a more practical strategy.

Tall fescue, like any cool-season forage, will have a disproportional amount of its annual forage production in spring and early summer. Productivity is reduced during July and August as temperatures increase and soil moisture levels decrease. Moreover, the effects of the endophyte are generally the worst during this summer period. Thus it may be desirable to have warm-season annuals (e.g. sorghum-sudangrass, pearl millet, crabgrass) or warm-season perennials (e.g. gamagrass, switchgrass, johnsongrass) that can be utilized during this summer period. Another option is to move finishing animals to the best pastures with a lower fescue component and to place dry cows and/or calves intended for the commodity market on the pastures with higher fescue concentrations.

Utilizing tall fescue-based pastures for finishing animals requires a high level of management to maintain quality and increase the digestibility and subsequent energy yield of forages. First and foremost, utilizing tall fescue requires keeping a high legume content in the stand to both increase forage quality and dilute the amount of endophyte alkaloids consumed. The ease of frost-seeding ladino-type white clover and red clover offers a viable strategy to increase legume content in fescue stands (http://www.uky.edu/Ag/Forage/agr261%20(2).pdf). Individual plant survival in the upper south averages two to three years for red clover and three to four years for ladino clover.

Seeding alfalfa into tall fescue stands will also increase animal performance and, due to its deeper root system, provide better summer production compared to other cool-season forages. Well-managed alfalfa-grass stands increase both quality and yield of the pasture, greatly improving overall production. Grazing varieties of alfalfa have been developed, but hay varieties can be utilized successfully under



Ideal mix of clover/grass for finishing cattle: Pasture sward 8 to 12 inches tall with lots of clover has potential for high gains.

well-managed rotational grazing systems. Many stocker producers in Kentucky have found that alfalfa/orchardgrass pastures provide a high quality, high yielding forage, with a wide forage production window. These two forage species complement each other well. They also make an excellent quality stored forage either as hay or silage when harvested during periods of excess pasture growth.

However, alfalfa has a number of disadvantages in pasture situations. It is difficult to establish into an existing sod, has high fertility requirements compared to other legumes, and is generally difficult to keep in a pasture without good management. Also, many pasture soils in the upper south do not have adequate drainage or are not deep enough to support quality alfalfa production.

Annual lespedeza is a warm-season annual legume that was once widely utilized in the fescue belt. It has potential for providing high-quality summer pastures with minimal input. Lespedeza can be frost-seeded just like clover with good establishment success (http://www.ca.uky.edu/agc/pubs/agr/agr86/agr86.pdf). In the upper south, its peak production period will be during July and August when fescue and other cool-season forages are usually at their low point in terms of both quantity and quality. Because it is an annual, the stand must either successfully reseed itself or be manually seeded each year.

Where complete renovation of a pasture is both practical and desired, orchardgrass and endophyte-free or novel endophyte fescue varieties are cool-season grasses particularly well-suited for the upper south (http://www.uky.edu/Ag/Forage/ForageVarietyTrials2.htm). They have excellent forage quality when managed correctly and have good summer production for cool-season grasses. Their biggest drawbacks are the initial establishment costs and stand persistence. Orchardgrass and endophyte-free fescue tend to die out of pasture stands after five to six years in the upper south. Novel endophyte varieties generally survive ten or more years. Legumes should be added to these grasses with the same general recommendations as with endophyte-infected fescue.



Annual lespedeza: Good stand of annual lespedeza in mid-July that was frost seeding into pasture in late winter. Lespedeza is an excellent quality forage for use in July and August.

## Grazing Management

Effective finishing on pastures, especially those that are tall fescue-based, requires keeping the grass in a vegetative state. As pasture plants mature, the nutritive value declines as well as animal intake of the forage. In addition, the endophyte alkaloids in tall fescue will be concentrated in the stem and seed heads, and livestock should be prevented from consuming this mature forage. Mowing in late spring is recommended in order to remove the seed heads and promote vegetative regrowth.

Rotational grazing will assist in keeping the grass vegetative. However, effective rotational grazing does not have to be an elaborate multi-paddock system. Even dividing a pasture into halves will allow the beginning of rotational grazing. Further improvement comes from dividing the pasture into three or four paddocks. Roy Blaser coined the phrase "Middleburg 3 Paddock System" in the 1960s, based on his research at the Virginia Tech Middleburg Research Station in northern Virginia. His research showed that the largest improvement in carrying capacity and forage productivity comes from subdividing a single pasture into three paddocks. Additional paddocks continued to increase overall production but at decreasing rates. It should be noted that when grazing forage crops like alfalfa, which require longer rest periods (30 days) and shorter grazing periods (less than seven days), six or more paddocks are recommended.

In the early 1990s, Jim Gerrish along with other researchers at the University of Missouri developed the "Management-intensive Grazing" (MiG) concept. This grazing technique emphasizes both grazing and animal management. Ten or more paddocks, grazing periods of three or fewer days, and rest periods of 24 to 30 days are recommended. Improved pasture growth rates as well as forage quality have been documented compared to a three



Rotational grazing calves in early spring: Cattle should be moved quickly in spring to avoid the last paddocks in the grazing system becoming overmature.

paddock system. For finishing animals, it was determined that a grazing residual of at least four inches should be left when animals are moved out of the paddock to maintain a high plane of energy intake.

A reasonable stocking density that provides ample forage intake will improve animal performance. In general, the stocking rate for finishing animals on a tall fescue-based pasture system in the upper south region will be no more than one 1,000 pound animal per acre during the grazing season and potentially much lower. The actual stocking rate will be highly variable, depending on the productivity of the pasture and the type of management employed. High stocking densities which limit forage availability will lead to reduced animal performance and should be avoided with finishing animals. It is best to err on the side of understocking with finishing animals.

Probably the easiest method to finish cattle in an all-forage system is to graze a few animals at very low stocking densities on high-quality pasture. The key to this system is to make sure the animals have the very best forage available at all times. Since grazing pressure is kept low, one to two paddocks are all that is necessary. Two is best so that you can periodically graze-down one paddock with other animals or clip it mechanically, which provides a fresh paddock for the finishing animals to graze while the other is recovering. This method is not efficient in terms of stocking density, but effective in terms of gain per animal.

Another option for maximizing gains on finishing animals is to use of a leader-follower system in which finishing animals have first access to a pasture. This allows for a high degree of diet selection where these animals can glean off the more palatable and higher quality forage. A study at Virginia Tech showed increased daily gains of 15 to 20 percent for the leader group compared to traditional rotational grazing (http://anr.ext.wvu.edu/r/download/195208). The finishing animals are then followed by other cattle such as growing stock, bred heifers, or dry cows to graze the remaining forage and increase utilization. This system produces high gains for the finishing animals while still having a high overall stocking rate and good utilization of the pastures. The downside is that it requires a higher degree of management.

Table 2 shows a range of expected gains of yearling steers for various forages by season in the upper south. However, actual gains can fall outside the range shown, especially on the low side. Animal performance is directly related to both the availability and the quality of forage. As forage availability becomes limited, animal gains will decline. Tall fescue and other cool-season forages rapidly decline in quality as they enter the reproductive phase and seedheads begin to develop. Management that strives to keep ample vegetative forage available to finishing animals is essential. Good management of the forage base is typically more important than the forage species. For example, a well-managed fescue-clover pasture will provide better gains than a poorly managed orchardgrass-clover pasture.

Additional forage information can be found from a variety of good sources, including the Kentucky Beef Book, Chapter 2 (http://www.uky.edu/Ag/AnimalSciences/extension/pubpdfs/kybeefbook.pdf). For a more comprehensive overview of forage production and utilization refer to *Southern Forages* by Garry Lacefield, Don Ball, and Carl Hoveland.

**Table 2. Estimated yearling steer gains by forage type and season average daily gain (lbs/day) in the upper south**

| | Spring (A-M-J) | | | Summer (J-A) | | | Fall (S-O-N) | | | Winter (D-J-F-M) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Forage Type | Low | Avg. | High | Low | Avg. | High | Low | Avg. | High | Low | Avg. | High |
| Fescue (> 90%) | 1.1 | 1.4 | 1.7 | 0.1 | 0.4 | 0.7 | 1.2 | 1.5 | 1.8 | 0.9 | 1.2 | 1.5 |
| Fescue-clover | 1.5 | 1.8 | 2.1 | 0.4 | 0.7 | 1.0 | 1.3 | 1.6 | 1.9 | 1.0 | 1.3 | 1.6 |
| Fescue-bluegrass-clover | 1.8 | 2.1 | 2.4 | 0.6 | 0.9 | 1.2 | 1.3 | 1.6 | 1.9 | 1.0 | 1.3 | 1.6 |
| Orchardgrass-clover | 1.9 | 2.2 | 2.5 | 0.9 | 1.2 | 1.5 | 1.4 | 1.7 | 2.0 | | | |
| End free fescue-clover | 1.9 | 2.2 | 2.5 | 0.9 | 1.2 | 1.5 | 1.4 | 1.7 | 2.0 | | | |
| Bluegrass-clover | 2.1 | 2.4 | 2.7 | 0.9 | 1.2 | 1.5 | 1.2 | 1.5 | 1.8 | | | |
| Alfalfa/alfalfa-grass | 2.2 | 2.5 | 2.8 | 1.5 | 1.8 | 2.1 | 1.7 | 2.0 | 2.3 | | | |
| Warm season annual | | | | 1.6 | 1.9 | 2.2 | 1.3 | 1.6 | 1.9 | | | |
| Small grains | 2.2 | 2.5 | 2.8 | | | | | | | 2.0 | 2.3 | 2.6 |

Notes: Average gain assumes medium/high forage availability (low to moderate stocking rate) and good management. Late summer and fall gains can drop significantly if forage availability is low. Med/large framed yearling steers. Heifers gains approximately 10% lower.

## Annual Pasture Options

Summer annuals such as sudangrass, sorghum-sudangrass, pearl millet, crabgrass, and even greenleaf corn are sometimes used for finishing cattle during the summer. Compared to perennial pasture, annual pasture crops are expensive but can still be cost effective in many situations. They generally will have higher overall production levels compared to cool-season perennial pastures. More importantly, they have much higher summer production levels which results in better overall forage distribution, helping to fill the summer slump. Although there is much variation on forage quality between the summer annuals, they will generally produce better gains during the summer compared to perennial pastures. Summer annuals should only be used on good soils with low soil erosion potential.



Late winter grazing of cereal rye: Cereal grains have excellent forage quality at this time of year.

Winter annuals (e.g. rye, wheat, annual ryegrass) provide opportunities for high-quality winter and early-spring grazing, but the dependability of winter forage production in the upper south is highly variable. Thus, winter annuals are best used when you are trying to finish a limited number of animals during the winter period. Winter annuals fit well as a double crop with summer annuals but are sometimes drilled into existing pastures in the fall (see *Extending the Grazing Season* at http://www.uky.edu/Ag/Forage/agr199.pdf). When using an all-forage finishing protocol, you will need to be careful to avoid grazing both summer and winter annuals after they develop grain. Consult your local extension office for potential options and for information related to the fertility, seeding rates, and varieties before planting (see *Managing Small Grains for Livestock Forage* at http://www2.ca.uky.edu/agc/pubs/agr/agr160/agr160.htm).



Yearling steers being fed hay in deep snow: Winter feeding is one of the biggest costs for finishing animals on pasture.

## Winter Feeding and Forage Stockpiling

Winter feeding will typically be one of the biggest costs for a pasture-based finishing operation. In general, the higher the winter gains you are trying to achieve, the higher will be your winter feeding cost. So it is advisable to target winter gains that are just high enough so that the animals will comfortably finish by your targeted end point. For example, the gain needed for spring-born calves that will be finished the following fall after weaning (18-22 months old) will be well over one pound per day during the winter, while spring-born calves that will be finished early the next summer (26-28 months old) could get by with much lower winter gains. There are other times, such as if you are marketing to the early grilling season (e.g. Memorial Day), where you will have to increase gains during the winter.

Another consideration is that as the rate of gain during the winter period increases, the rate of gain during the subsequent grazing season decreases due to compensatory gain, where the rate of gain is greatly enhanced for a period of time when cattle are moved from a low plane of nutrition to a high plane of nutrition. However, this increased gain will not completely offset the reduced winter performance, resulting in additional time required to reach optimal slaughter weight compared with higher winter gains.

Also keep in mind there is a fair amount of debate as to the minimum rate of gain needed over the winter to subsequently obtain adequate marbling and tenderness during the final months of finishing. Some research suggests low winter gains may cause problems if you are trying to reach higher marbling rates. However, the exact rate is not conclusive. It appears that there should be no problems with gains over one pound per day. It is likely that you could go below this threshold in many situations as long as you have high gains in the last few months of finishing. Until research better answers this question, it is suggested that target gains not drop below .75 pounds per day during the winter. If you are trying to finish animals during the winter feeding period, you will need gains that are considerably higher, which will require exceptionally high-quality stored forage.

Winter feeding periods for the upper south will typically require the use of stored forages. Hay is the most commonly used forage for this purpose. Attention should be given to harvesting forages at a maturity stage that emphasizes quality rather than maximum yield. For instance,



Making hay from excess pasture: This pasture was grazed twice in early spring, set aside for six weeks, and cut for hay in early June. Quality was excellent compared to traditional hay cut at this time.

harvesting grass at the boot stage rather than the late flowering stage will increase the gain potential of the hay.

Purchasing hay for finishing animals is another option, especially where you are targeting high winter gains. Pure alfalfa, alfalfa-grass mixes, or other legume-based hays will generally provide the highest quality hays for finishing purposes. Again, stage of maturity when cut is the most important consideration. While buying high-quality hays may seem like an expensive option, the true cost of making hay is higher than most people realize. You will also generally have better control over the quality of the hay if you can purchase hay based on forage testing and from multiple sources.

Balage is another stored forage option that has increased in popularity in recent years as a method to harvest hay during the rainy spring season when conventional baling is difficult. This allows grass to be more easily harvested in the boot stage (prior to heading) when it has excellent forage quality. The boot stage often occurs around mid-May in the upper south which makes it extremely difficult to find harvest windows for conventional hay making. Harvesting forage as balage allows cutting on one day and often baling the next, greatly decreasing the required harvest window. However, proper moisture levels must be obtained at baling to reduce the risk to spoilage, about 50-60% moisture with grass and 45-50% with legume/grass mixture (see http://www.uky.edu/Ag/Forage/Baleage%20FAQ%20-Hancock%20Sears%20Smith%20SENA%20Review.pdf.)

Stockpiling forage for grazing in the late fall and winter is a way to reduce dependency on stored forages, and works particularly well in the upper south. In order to have sufficient forage in August to stockpile fescue pastures, you will need a lower overall stocking density or have alternative forages to graze cattle on during this period. The inclusion of warm-season annuals and/or perennials can provide this opportunity. (See Stockpiling for Fall and Winter Pasture at http://www2.ca.uky.edu/agc/pubs/agr/agr162/agr162.pdf) and Profitability of Stockpiling Tall Fescue Pastures, updated each year based on current prices and climatic conditions (See http://www.uky.edu/Ag/AgEcon/pubs/ProfitStockpilePastures.pdf ). Tall fescue is an excellent forage to stockpile for late fall and winter grazing. Removing cattle from fescue pastures in early to mid-August and applying nitrogen will increase yield, especially when soil moisture is adequate. The ideal method to graze stockpiled fescue is strip grazing. This method provides one to three days of forage at a time and improves forage utilization.

Research has shown that the endophyte in tall fescue has less impact on animal performance in the cooler fall and winter months. Additionally, the alkaloid concentrations have been found to decline as winter progresses, further reducing the impact on the animal. Stockpiled tall fescue pasture quality remains high into mid-winter and is typically higher in digestibility and protein than average quality hays. This high quality will support good levels of performance during this period, which is particularly important for finishing animals when high winter gains are needed.

Supplementation with concentrates can be useful in winter feeding to obtain the desired rates of gains. Producers just starting out with finishing animals may find this system attractive. The lower the forage quality is, the greater the rate of supplementation that will be

*Stockpiling forage for grazing in the late fall and winter is a way to reduce dependency on stored forages, and works particularly well in the upper south.*

necessary to achieve a desired rate of gain. The use of supplement will also allow for greater consistency in the end product over a longer period of time. Winter supplementation should complement the forage, and hay testing is recommended to determine the rate of supplementation needed. In most situations, the recommendations will be similar to those for supplementing grazing cattle.

In summary, the winter feeding regiment should be to a large degree, dictated by the desired finishing window. If the desired finishing window can be readily achieved without pushing the calves hard through the winter, then you can back off on the targeted winter gains. If you are trying to finish spring-born animals in less than 24 months, you will likely require high gains during the winter. Table 3 shows estimated winter gains for a 900-pound steer. A pasture-based finishing planning tool is available at http://www.uky.edu/Ag/AgEcon/pubs/BeefPastureFinishing.xlsx that can be used to help in the planning process.



## Grain Supplementation during Grazing Season

There are several reasons to consider supplementation during the grazing season. Supplementation will improve animal performance when grazing endophyte-infected tall fescue by diluting the consumption of endophyte alkaloids and will also increase the energy level of the diet. Supplementation during July and August, when both forage quality and availability are low, is particularly helpful in the upper south in maintaining rates of gain necessary for finishing at this time with little to no reliance on alternative forages such as summer annuals.

Those who want to market their beef under a certification system can start by reviewing the American Grassfed Association's (AGA) system. The AGA has developed two protocol systems— grassfed and grass pastured. The grassfed protocol allows emergency use of supplementation up to 25 percent daily intake and 1 percent lifetime intake. The grass pastured protocol allows for 20 percent of daily intake during the growth stage and 30 percent of daily intake during the finishing stage. Both protocols have approved supplements. Since standards may have changed or been updated since the time of publication, go to the AGA's standards page (http://www.americangrassfed.org/about-us/our-standards/) to get details of these certification systems.

Strategic supplementation during periods of low forage availability and quality will provide greater efficiency (more gain per unit of supplement) compared to year round supplementation. Table 4 shows expected increases in gains from .5 percent and 1.0 percent supplementation of common forage types in the upper south at various seasons. The information in this table can help determine realistic gains for a grain-on-grass system and how those gains relate to the required gains needed to reach the desired finishing window.

Providing supplement free-choice typically results in high rates of feed consumption (greater than 1.5% bodyweight) and low forage intakes. This system may be fine for some producers given their specific market. However, calling this type of production system "pasture-based" is debatable. Ultimately your market and customers will have to answer this question. Grain-on-grass supplementation in this publication is defined as focusing on managing

**Table 3. Estimated winter gains (lbs/day) for a 900-pound steer**

| | Forage | | |
|---|---|---|---|
| Winter feed | Low-quality | Average-quality | High-quality |
| Alfalfa hay | 1.1 | 1.7 | 2.3 |
| Cool-season grass hay | 0.0 | 0.4 | 1.1 |
| Cool-season grass hay + supplement[1] | 1.5 | 1.9 | 2.3 |
| Grass/clover hay | 0.7 | 1.0 | 1.2 |
| Grass/clover hay + supplement[1] | 2.1 | 2.3 | 2.5 |
| Stockpiled fescue[3] | 0.9 | 1.2 | 1.7 |
| Stockpiled fescue + supplement[1] | 2.2 | 2.4 | 2.8 |
| Corn silage[2] | 2.4 | 2.9 | 3.4 |
| Grass silage | 0.5 | 1.1 | 1.7 |
| Small grains silage | 0.5 | 1.5 | 2.3 |

Projected using software based on the National Research Council Requirements for Beef Cattle. TDN levels as follows: alfalfa hay 55/60/65; grass hay 45/50/55; grass/red clover hay 53/55/57; balage 50/55/60; stockpiled fescue 53/58/65; corn silage 65/70/75; sorghum-sudan silage 50/55/60; small grains silage 50/58/65.

[1] 1% bodyweight supplementation.

[2] Supplementation of 1.5 lbs of soybean meal were included in this diet.

[3] Tall fescue with high levels of endophyte will have lower intakes and performance will be less than reported above.

**Table 4. Estimated pasture gains with supplementation (lbs/day) for an 850-pound steer**

| Pasture type and supplementation | Spring (A-M-J) | Summer (J-A) | Fall (S-O-N) |
|---|---|---|---|
| Fescue | 1.7 | 0.5 | 1.6 |
| Fescue + 0.5% soyhulls | 2.1 | 1.1 | 2.0 |
| Fescue + 1.0% soyhulls | 2.4 | 1.6 | 2.6 |
| Fescue-clover | 2.0 | 0.8 | 1.8 |
| Fescue-clover + 0.5% soyhulls | 2.3 | 1.7 | 2.3 |
| Fescue-clover + 1.0% soyhulls | 2.6 | 2.3 | 2.7 |
| Orchardgrass-clover | 2.2 | 1.2 | 1.7 |
| Orchardgrass-clover + 0.5% soyhulls | 2.5 | 1.6 | 2.0 |
| Orchardgrass-clover + 1.0% soyhulls | 2.9 | 2.2 | 2.5 |

Projected using software based on the National Research Council Requirements for Beef Cattle using a body weight of 750 lb in spring, 900 in summer and 1,000 lb for fall. A feed supplement partial conversion of efficiency of 5.5 and 7.0 were used for 0.5% and 1% supplementation rates to estimate gain of supplemented calves. There are many forages such as alfalfa and sorghum-sudangrass where supplementation is not recommended due to the high quality of the forage.

forages for optimal quality and utilizing supplements only to maintain an adequate level of performance.

When considering which supplement to use in a pasture-based system, it is important to recognize that the animal's rumen is naturally adapted to a forage-based diet and that the use of a high starch supplement should not be fed at high rates. Feeding high levels of a starch-based supplement will result in a rumen microflora shift, reduced ruminal pH (more acidic), and a decrease in the efficiency of forage digestion. Generally, it is recommended that not more than 3 pounds per 1,000 pounds (.3%) of body weight be offered of a high-starch feed such as corn, wheat, or barley to minimize the impact on fiber digestion. Fibrous co-products which are high in digestibility such as soybean hulls, corn gluten feed, wheat middlings, beet pulp, and dried distillers grains are supplements that will not negatively impact forage digestion.

The seasonality of forage quality and availability should be considered when developing a supplementation program for finishing cattle. For example, during the summer feeding rates of 1.0 percent of body weight may be required to achieve daily gains of 2.3 pounds (as a result of declining forage quality and heat stress) while feeding rates of .5 percent of body weight may achieve the same gain while grazing in the fall. If the focus is on optimizing forage utilization, the supplementation program should be flexible to complement forage quality and availability. Typically, the greater the rate of supplementation the lower the efficiency of feed conversion. Producers should implement a forage testing program and provide a supplement that achieves the nutritional requirements for the desired rate of performance.

There may be reasons to use strategic supplementation for finishing cattle other than improved performance. For example, during early spring when wild onions may limit the harvest window for some operations (due to off-flavored meat), the use of stored forages with supplementation provides a route to continue harvesting animals during this time frame. Another reason would be to allow for higher stocking rates on the pasture by supplementing during the summer.

## Breed, Frame Size, and Finishing Weight

Few traditional cattle producers have taken a calf to an optimal finishing weight and consequently may have a difficult time assessing when an animal is ready for harvest. The optimal finishing point will vary depending on breed, frame size, sex, and other animal characteristics as well as the requirements of the end market. You will not know with certainty if you achieved your targeted goal until after the animal is slaughtered and the carcass has been graded. (Beef carcasses are not routinely graded by many processors so you may have to arrange to have this done.) However, using basic information and a few tools detailed in this publication, you can come up with a reasonably accurate estimate of when your animals are ready. This section will help producers understand what "finished" means in different situations and how to estimate when their animals have reached this point.

### Breed

There is much debate about which breed of cattle is best suited for a pasture-based finishing system, yet there is no single genetic base that will be best in all situations. The ideal breed will be determined to a large degree by the product desired by your target market. If the target is a lean product, then larger framed, continental breeds may be well suited to the system. In contrast, if a freezer beef consumer desires a well-marbled animal while only wanting 75 pounds of beef (quarter carcass), small framed breeds such

*If the focus is on optimizing forage utilization, the supplementation program should be flexible to complement forage quality and availability.*



Kentucky beauty: The ideal grass-finishing phenotype cow with a moderate-small frame height and deep, thick body. Her first calf is standing by her side.

as the Lowline, Jersey, or Dexter may best suited to this system. In between these two extremes are a variety of breeds that would work well (see Table 5). Identifying genetics that will work for your system also requires being productive under the environmental conditions in your region. For example, breeds or genetic lines that do not shed their winter hair coat in spring will experience greater heat stress and lower performance during the summer months in hot humid regions of the upper south.

If you are targeting a reasonably well-marbled end product, you should probably avoid the large-framed breeds for pasture-based finishing. It will be difficult to get these animals to marble well with-

**Table 5. Common breeds of cattle by mature size**

| Smaller beef | Smaller dual purpose | Smaller dairy |
|---|---|---|
| Galloway/Belted Galloway | Amerifax | Jersey |
| Devon | Normande | |
| Highland | Red Poll | |
| Lowline | | |
| White Park | | |
| **Medium-large beef** | **Medium-large dual purpose** | **Medium-large dairy** |
| Angus | Gelbvieh | Ayrshire |
| Hereford | Pinzgauer | Guernsey |
| Red Angus | Salers | |
| South Devon | Tarentaise | |
| **Larger beef** | **Larger dual purpose** | **Larger dairy** |
| Charolais | Maine Anjou | Brown Swiss |
| Chianina | Simmental | Holstein |
| Limousin | Shorthorn | |

Source: Adapted from The Kentucky Beef Book (ID-108)

out a high-grain diet, although with intense management it can be done. A general recommendation for the upper south would be to maintain a high percentage of British breeding (at least 75%) in the cows which have a small to moderate frame score.

For those desiring a higher level of marbling for specialty marketing, use of sires with high accuracy Expected Progeny Difference (EPDs) for marbling through artificial insemination is recommended. This strategy is good for enhancing the carcass genetics in progeny and future replacement females. Similarly, if smaller framed cows are producing ribeye and T-bone steaks smaller than desired, use of a proven bull (EPD accuracy >.95) in the top percentile for ribeye area is expected to improve the size of the ribeye area of the progeny compared to the average bull in same breed. To learn more about using EPDs, readers are encouraged to read the *Beef Sire Selection Manual* (http://www.uky.edu/Ag/AnimalSciences/farm/beefpub.html#breedingmanagement).

## Frame Size

Frame size refers to the overall body size of an animal and varies among breeds and within breeds. Frame size is commonly referenced when marketing feeder calves in graded sales as small, medium, and large. In general, smaller framed animals work better for pasture-based finishing. They finish in a shorter period of time and will generally marble easier compared to large-framed animals.

You can estimate frame size by measuring the height at the hip down to the ground for a given age and gender of animal to derive a frame score. Once you have taken these measurements, you can use Table 6 in conjunction with the sex and age to get an estimate for the frame score, which provides a numerical proxy of cattle frame size.

**Table 6: Relationship between hip height (inches) and frame score**

| Age in Months | Frame score—heifers | | | | | |
|---|---|---|---|---|---|---|
| | 3 (S) | 4 (S/M) | 5 (M) | 6 (M) | 7 (M/L) | 8 (L) |
| 6 | 38.2 | 40.3 | 42.3 | 44.4 | 46.5 | 48.5 |
| 12 | 43.0 | 45.0 | 47.0 | 49.0 | 51.0 | 53.0 |
| 18 | 46.5 | 47.5 | 49.5 | 51.4 | 53.4 | 55.3 |
| **Age in Months** | **Frame score—steers** | | | | | |
| | 3 (S) | 4 (S/M) | 5 (M) | 6 (M) | 7 (M/L) | 8 (L) |
| 6 | 39.7 | 41.6 | 43.7 | 45.7 | 47.7 | 49.7 |
| 12 | 45.8 | 47.8 | 49.8 | 51.8 | 53.8 | 55.8 |
| 18 | 49.3 | 51.3 | 53.2 | 55.2 | 57.2 | 59.2 |

Note: Measure to hip height and use table to estimate frame score based on age and sex.

This frame score can then be used to estimate the expected slaughter weight of the finishing animals. Previous feedlot research investigating the relationship between frame score and finishing weight provides this basis. Because of slower rates of gain, pasture-based finishing will have more skeletal growth compared to feedlot-finished animals, which increases the harvest weight. However, pasture-finished animals are also typically harvested with less backfat compared to conventionally finished beef, which decreases the harvest weight. Using these two modifications in combination with the previous research on conventionally finished animals provides some general guidelines with respect to frame score and expected slaughter weights. Table 7 summarizes these relationships and estimates finishing weights given a variety of frame sizes for both steers and heifers.

While the frame score gives us an estimate of the weight at which animals will finish, you still need to determine when they have reached this last stage. Many producers will not be able to weigh their cattle on a regular basis and thus will need a proxy to determine when their animals are finished (although comparing the actual weight when processed to their best estimate will help calibrate this estimation in the long run). Body conditioning scoring provides this tool.

Most cow-calf producers are familiar with body condition scores. Body condition scoring of beef cows ranges from 1 (an emaciated animal) to 9 (an animal that is excessively conditioned). This system can be



An ideal grass-finishing phenotype steer: Moderate-small frame height but deep, thick body. This steer is probably finished at this point but will go another to the three months before harvest.

**Table 7. Estimated finishing weights of pasture-finished cattle attaining .25-inch backfat**

| Frame size | Frame score | Heifer Estimated finish weight | Steer Estimated finish weight |
|---|---|---|---|
| Small | 3 | 930 | 1,020 |
| Small/medium | 4 | 1,010 | 1,110 |
| Medium | 5 | 1,080 | 1,200 |
| Medium/large | 6 | 1,160 | 1,290 |

Notes: Based on "Evaluation of the USDA Standards for Feeder Cattle Frame Size, and Muscle Thickness" A.D. Grona, J.D. Tatum, G.C. Smith, and F.L. Williams Journal of Animal Science 2002 80:560-567. Results adjusted to account for older age of pasture finishing animals (5% increase in weight) and to account for decreased backfat level (6.25% reduction in weight for each .1" reduction in backfat). Add 65 lbs for heavy-muscled animals and subtract 65 lbs for light-muscled animals.

applied to finishing animals, and Figure 1 shows the rough relationship between body conditioning score and carcass grade. For most cattle types, a body condition score of 6 to 8 is a good target to reach a USDA grade of upper Select to Choice. Animals should begin to show a blocky appearance with fat around the tailhead and smoothness over the ribs and hip bones, and the brisket should begin to fill out. Unfortunately, animals are often slaughtered at body condition scores less than 6, and owners are disappointed that the cattle did not grade Choice. To obtain marbling, you need an appreciable amount of total body fat, meaning that the animal must begin to appear as if it is "fattened."

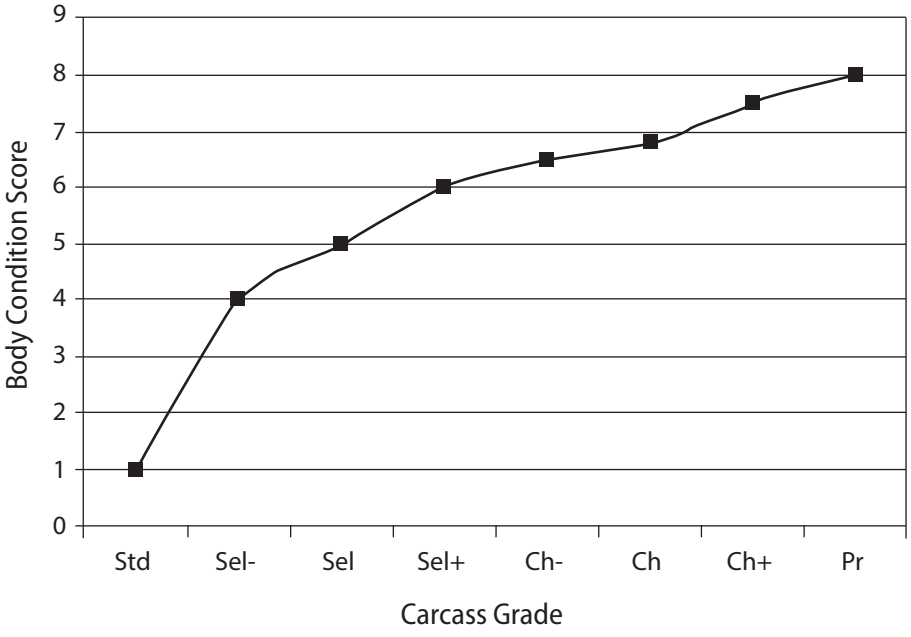
Keep in mind that the recommended finishing weights and body conditioning scores are intended to be a rough guide. Many factors will affect finishing weights, and you should make appropriate adjustments as necessary. However, these general guidelines can be a valuable tool for the beginning finisher. For example, if you are trying to finish a large-framed steer to low Choice, you will quickly understand that a 1,000 pound slaughter weight will not come close to achieving the desired finish level. By knowing the expected slaughter weight in combination with anticipated animal performance, you can more precisely estimate harvest windows for your target market. This information can then be used to help plan your grazing and winter feeding programs.

Ultimately, you will need to create a production system that allows you to have finished animals ready for the time period that your market requires them. A specially designed pasture-based finishing tool is available to help in this planning process (http://www.uky.edu/Ag/AgEcon/pubs/BeefPastureFinishing.xlsx). To use this tool, you will need to account for

- Calving/weaning season
- Average weaning weights
- Realistic gains during the grazing season and winter feeding period

Through this process you will be able to determine if this production system is able to hit your targeted finishing period for this particular market. You will also get a better idea of the winter gains and pasture gains necessary to achieve this target finish date. You may find out that your particular breed/frame size and calving dates are not well-suited for your target market or that you will need to adjust your production practices.

Figure 1. Relationship between body conditioning score and carcass grade



# Processing and Meat Quality

*Gregg Rentfrow*

A farmer wanting to sell processed beef to the general public must find and work with a federally inspected meat processor. Furthermore, you need to ensure all areas (harvest, fabrication, and further processing) of the meat plant are inspected. You need to communicate your intentions to the meat processor, as the inspection legend must appear on every package of meat through the point of purchase.

Only a small percentage of meat processors are federally inspected. The majority are custom-exempt plants. An animal harvested and processed at a custom-exempt plant cannot be legally sold after it is processed. All cuts must be labeled "not for sale" and are intended to be consumed by the owner(s) of the animal. You are breaking the law if you sell custom harvested and fabricated meat products.

The following are also ***illegal*** scenarios:

- Animals harvested on the farm, then taken to a federally inspected plant for fabrication into retail cuts
- Animals harvested under federal inspection, then transported and fabricated into retail cuts at the farm
- Animals harvested under federal inspection, transported to a state health department inspected grocery store where they are cut into retail packages, then sold at a farmers market

Bottom line: All meat has to be inspected before it can be sold.



How finished is this carcass? A 736-pound carcass from an 1,195-pound liveweight grass-finished steer. The steer graded low select and yielded 522 pounds of wrapped meat (not including by-products).

## Freezer Beef

Selling freezer beef is often an easier option than selling individual retail cuts, but it requires the most consumer education. Freezer beef is a term used when individuals wish to purchase a whole, half, or quarter of a beef carcass. This option has the advantage of allowing large quantities of meat to be sold at one time, reducing marketing costs. A group of people interested in freezer beef can purchase a live animal and work with the farmer to deliver it to the meat processor. Since the consumers own the animal, it can be processed at a custom-exempt meat processor as long as it is not resold. Sharing freezer beef is gaining popularity and is commonly known as a beef share. Alternatively, the farmer can facilitate this process by finding customers who want to purchase a portion of an animal. In either case, the end customers must technically own the live animal before it is slaughtered if it is processed at a custom-exempt facility.

A common question from potential freezer beef consumers is: How much freezer space do I need? A good rule of thumb is one cubic feet of freezer space will store 30 pounds of meat. The space may need to be increased if packages of meat are oddly shaped and do not stack well.

Consumers unfamiliar with purchasing freezer beef may not understand the concept of cutting loss and shrink. Thus, the farmer may have to explain why just 440 pounds of beef was received from a 715-pound carcass or an 1100-pound animal. Examples are shown later in this section to help communicate these apparent discrepancies to customers.

## Finding a Meat Processor

Kentucky has more than 120 meat processors throughout the Commonwealth. Check with your local county extension office (http://www.ca.uky.edu/county/) to find a meat processor close to you. Although locating a processor is easy, finding one you can work with can be a challenge. Once you locate a meat processor, visit the plant and talk to the owners before you schedule your animal for harvest.

Conduct your own inspection during your visit. The following items provide a good starting point for locating a processor you are comfortable using.

**Foyer**—Is it clean and tidy or is it dirty and unkempt?

**Smell**—Does the plant smell like a normal meat processing facility or does it smell sour and musty? (The normal smell in a meat processing facility may be objectionable to some, but it should not have an offensive, foul odor.)

**Meat**—If there is meat on display, does it look like something you would want to serve to your family or sell to your customers?

**People**—Are the employees friendly? Do they greet you when you walk in the door or do you feel like you are inconveniencing them?

*If you do not understand what your meat processor is saying to you, do not be afraid to ask questions, and if it is still unclear, contact your local extension agent or your extension meats specialist for further explanation.*

## Working with a Meat Processor

Working with a meat processor can be intimidating. Like other professionals, processors have their own language and often assume you understand the terminology. If you do not understand what your meat processor is saying to you, do not be afraid to ask questions, and if it is still unclear, contact your local extension agent or your extension meats specialist for further explanation. A key to your success is your ability to work closely and effectively with your meat processor.

The meat processor will ask how you want your carcass fabricated, again often assuming you understand all the options available for fabrication. Some will have a checklist of retail cuts they offer, while others will rely on you to tell them how you want the carcass fabricated. Beef cut charts can be obtained free (in state) from the Kentucky Cattlemen's Association (859-278-0899 http://www.kycattle.org/) or for a small charge from the Cattlemen's Beef Board (http://www.beefretail.org/beefcutcharts.aspx). These charts will make it easier to work with your meat processor when you are asked how you want your carcass processed.

## Aging

With most processors of pasture-finished beef, carcasses will hang in a cooling room before they are processed into cuts. This practice is called dry aging. Aging beef carcasses increases tenderness; the longer it is aged the more tender it will be. However, there is a point when the gains in tenderness do not outweigh the amount of the dehydrated surface that has to be removed and/or the actual tenderness the consumer can detect. The optimal balance is typically reached in 10 to 14 days. Some meat processors will only age carcasses for seven days due to limited cooler space, or they may not age trim carcasses (<.2" of backfat) for more than five days due to excessive surface dehydration. Discuss aging options with the processor before bringing the animal in for slaughter. Dry aging produces a unique flavor compared to the conventional wet aging done by the commodity beef industry (see flavor section).

## 30-Month Rule

Bovine spongiform encephalopathy (BSE), more commonly known as Mad Cow Disease, forever changed the beef industry. Several firewalls were put in place to prevent the potential of an infected animal entering the food chain. For example, the feeding of ruminant by-products back to ruminants has been outlawed, and downer (non-ambulatory) cattle cannot enter the food chain. Also, specified risk material (i.e. nervous system tissues) from cattle older than 30 months cannot be rendered with materials from cattle younger than 30 months of age, according to the Food and Drug Administration. Thirty months of age or older appears to be the age in which BSE symptoms can be observed. The rendering industry turns fat, bone, and other carcass waste into usable products like lubricants, cosmetics, etc. Due to challenges with rendering companies, many meat processors no longer process animals over 30 months of age. Most processors will ask the approximate age of the animal, prior to harvest. Please be honest with the processor, as they will use the dentition score (examination of the teeth) to determine the age of the animal.

## Dressing Percentage

The proportion of the live weight that will enter the cooler in the form of a carcass is referred to as the "dressing percentage". The dressing percentage can be calculated as:

**Dressing % =**
**(Hot Carcass Weight ÷ Live Weight) x 100**

The dressing percentage for cattle will vary substantially depending on a number of factors. All else being equal, grain-finished cattle will generally have a higher dressing percentage compared to grass-finished cattle. However, fully finished grass-finished cattle can yield as well as or better than grain-finished cattle. Table 8 shows the range in dressing percentage commonly seen for grain, grain-on-grass, and grass-finished operations.

There are many factors that can affect the dressing percentage of an animal. Anything that adds to the live weight but does not appear on the carcass will decrease the dressing percentage.

Factors that will *decrease* dressing percentage:

- Mud and/or manure caked on the hide
- Gut fill
- Horns
- Abscesses or bruises that must be cut off the carcass before it enters the cooler
- Light muscled animals (e.g. dairy cattle)

Factors that will *increase* dressing percentage:

- Excessively fat animals
- Empty digestive tracts or stomachs at the time the live weight is recorded
- Heavy muscled animals

**Table 8. Average dressing and cutout percentages for beef cattle**

| | Percentage | | |
|---|---|---|---|
| Finished On | Dressing | Cutout | Final meat yield |
| Grain | 60-64 | 67-73 | 40-46 |
| Grain-on grass | 57-64 | 65-73 | 37-46 |
| Grass | 53-64 | 64-73 | 34-46 |

Note: These estimates assume a reasonably finished animal and can be lower for an immature animal.

In addition, dressing percentage can be affected by the time between when the live weight was taken and when the carcass weight was recorded. Some meat processors do not weigh live animals; thus the animals must be weighed at the farm prior to shipping. A lengthy time between leaving the farm and weighing the animal will allow more time for the digestive tract to empty. Commonly cattle that are not fed 24 hours prior to harvest can lose 50 to 100 pounds. Therefore, the dressing percentage of an animal weighed on the farm may be lower than expected. Animals weighed immediately prior to slaughter will likely have a higher than average dressing percentage.

Cutout percentage refers to the weight of final packaged product divided by the carcass weight. This percentage is generally consistent between grass-finished and grain-finished but will still vary. Animals that are not fully finished will have low cutout percentages.

## Final Meat Yield

If we start with a 1200 pound live-weight animal and get a 60 percent dressing percentage, we have a carcass weight of 720 pounds. How much actual meat will the processor package from this carcass? A good rule of thumb is that grain-fed beef carcasses will produce 25 percent steaks, 25 percent roasts, 25 percent ground beef, and 25 percent waste (bones, fat, gristle, etc.). However, there are several factors that will affect the actual amount of meat you will take home from the meat processor:

- Carcass fatness and the amount of external fat remaining on the retail cuts. (Typically ¼-inch of external fat is left on retail cuts; however, some consumers prefer less fat. Therefore, a fatter carcass will yield less meat.)
- Bone-in verses boneless cuts. (The skeletal system can be 15 to 20 percent of the carcass weight. Therefore, less total poundage can be expected with boneless cuts.)
- Carcass muscularity. (Heavy muscled carcasses will yield more retail cuts.)
- Animal finish. (Animals not properly finished will have a higher percentage of bone in the carcass and less meat compared to a finished animal.)
- Bruising, abscesses, and/or other carcass abnormalities. (Although these abnormalities are not common, if they do occur they have to be removed from the carcass, reducing the amount of take home meat.)
- Type of ground beef. (Lean ground beef will require more fat to be removed, thus lowering the amount of take-home product.)
- Aging beef carcasses. (Aging beef carcasses will increase the tenderness of the retail cuts. The optimum aging time is between 10 to 14 days. However the longer a carcass is aged the higher the cutting loss. As a beef carcass dry ages the surface becomes dehydrated, therefore the dehydrated surface has to be removed, thus lowering the yield. Furthermore, trimmer carcasses, less than .3" backfat, are more susceptible to surface dehydration thus further lowering the yield.

According to work completed at South Dakota State University, the following can be expected from a 1200-pound grain-fed beef animal. *These are only estimations and can vary by 25 pounds or more.*

- Boneless steaks and roasts: ⅛-inch trim, with 90 percent lean/10 percent fat ground beef ≈ 425 pounds of product.
- Bone-in steaks and roasts: ¼-inch trim, with 80/20 ground beef ≈ 500 pounds of product
- Some bone-in and boneless steaks and roasts: ⅛-inch trim with 80/20 ground beef ≈ 490 pounds of product.
- 1200-pound Holstein (dairy animal), boneless steaks and roasts: 1/8-inch trim, with 90/10 ground beef ≈ 396 pounds of product.
- Very fat beef animal, boneless steaks and roasts: ⅛-inch trim, 90/10 ground beef ≈ 348 pounds of product.

Note that grass-fed animals will typically have lower yields when not properly finished. These estimates are not concrete numbers but are intended to be guidelines as to what to expect. As mentioned before, many factors can affect and influence the amount of final product. Table 8 shows the range in cutout percentages and final meat yield percentages commonly seen for grain, grain-on-grass, and grass-finished operations.

## Marbling

Marbling refers to the flecks of fat inside the muscle, and the observed amount determines the USDA beef quality grade. The age of the animal at the time of harvest and the amount of marbling present in the ribeye at the 12th/13th rib interface are used to calculate the USDA beef quality grade. The age of the animal at the time of harvest predicts the potential tenderness of the meat, as the steaks and roasts will be tougher from older animals (>30 months). The amount of marbling, predicts the palatability of the meat. The more marbling, the more flavorful and juicy the steak will be. The nine levels of marbling range from "abundant" to "practically devoid." Marbling develops through the excess consumption of calories in the diet, although there are other factors (e.g. genetics) that can affect marbling development. Marbling is easily achieved in a grain-fed finishing system but is challenging in a grass/forage finishing system.



Good marbling is possible in pasture-based finishing systems with proper management.

Grain-finished beef animals generally spend the majority of their lives on pasture but will go "on feed," consuming a grain-based diet, for the last 100 plus days immediately prior to harvest. This last stage is when the majority of the marbling develops. The animal is typically 16 to 18 months of age at harvest, weighing 1200 to 1400 pounds. A grass/forage-finished animal remains on pasture. Typically, these animals will grow slower and weigh less than grain-fed cattle at the same age. Therefore, to develop marbling these animals generally need to be finished at an older age. Careful attention needs to be paid to forage and livestock management to ensure the beef animal reaches maturity before the 30-month rule becomes a factor.

## Packaging

Most meat processors will give you an option to have your meat overwrapped with white butcher paper or vacuum packaged. Vacuum packaging will cost more but is typically well worth the cost. Freezer burn occurs when moisture escapes from the meat surface and refreezes, forming ice crystals or snow on the surface. In addition, lipid oxidation (fat rancidity) can still occur within the freezer as oxygen can react with the fat. The flavor of freezer burn or oxidized fat on meats has been described as stale, old, painty, or cardboard-like. Vacuum packaging reduces and/or eliminates the incidence of freezer burn and lipid oxidized meats. Vacuum packaging may cost more, but it will increase meat quality for extended freezer storage periods and reduce consumer complaints.

## Processing Costs

One of the largest hurdles to selling locally produced beef is overcoming the high processing costs. These costs are much higher for locally produced beef compared to the large packing operations located near the feedlots. Normally, a meat processor will charge a slaughter fee and a processing or fabrication fee. Furthermore, some will charge an additional packaging fee if you want your steaks and roasts vacuum packaged. Slaughter fees can range from $25 to $100 per head. Processing/fabrication fees can range from $0.35

*One of the largest hurdles to selling locally produced beef is overcoming the high processing costs.*

to $0.65 per pound of hot carcass weight. It is important to note that the majority of the meat processors will charge via the hot carcass weight, which is different than the cold carcass weight. Most carcasses will lose 3 to 5 percent weight during the first 24 hours due to evaporative cooling. Therefore, the cold carcass weight will be less than the hot carcass weight.

If we have a 1200 animal with a 720-pound hot carcass weight (60% dressing percentage), with a kill fee of $50 and processing fee of $.50 per pound, the processing bill would be:

| | |
|---|---|
| **Processing Fee Costs (720 lb X $.50/lb ) =** | **$360** |
| **Kill Fee** | **$50** |
| **Total Cost** | **$410** |

If we ended up with 450 pounds of packaged meat, our processing cost would be almost $1 per pound of packaged meat. If the meat sold for an average of $5 per pound, processing costs would account for nearly 20 percent of the overall price.

## Flavor

What an animals was fed and how it was aged can influence the flavor of your beef. The majority of the beef consumed in the United States is grain-fed and wet-aged. Farmers promoting forage-fed beef will need to educate their customers about the flavor. Forage-fed beef has a different flavor profile than traditional grain-fed beef due to the forages the animals consumed. Also beef purchased from a grocery store has been wet aged, meaning the carcass was fabricated into wholesale primal cuts 24 hours postmortem, sealed in a vacuum bag, placed in a box, and aged during transportation to the grocery store. Local meat processors will generally only dry-age beef. Dry-aged beef has a flavor that has been described as nuttier or earthier when compared to traditional wet-aging. Once again, customers will need to be educated on the flavor and aroma difference of dry-aged beef.




Farmers market: A great place to find customers looking for pasture-finished beef.

## Selling at a Farmer's Market or a Roadside Stand

Farmer's markets and roadside stands are popular outlets for selling your beef. Only work with and sell at Kentucky Department of Agriculture–registered farmers markets and roadside stands. Some farmers markets require you to register and pay a membership fee to sell at their organizations. More information on selling at farmers markets, including nearby locations, can be found in the *Kentucky Farmers' Market Manual and Resource Guide* (http://www.kyagr.com/marketing/documents/_20142015FarmersMarketManual.pdf). Other states have similar listings. Missouri farmers markets can be found at: http://agebb.missouri.edu/fmktdir/.

Meat is a perishable item, therefore refrigeration will be needed when selling at a farmers market or roadside stand. A storage unit must maintain a temperature of ≤0°F for frozen meats and ≤41°F for fresh meats. A refrigeration unit is ideal, but an ice chest cooler can be used as long as the meats are not floating in ice water.

## Conclusion

Selling beef from your farm is an excellent way to promote your farm's name and capitalize on the popularity of locally produced foods. Several selling options are available, such as selling freezer beef or individual retail cuts at a farmers market or a roadside stand. Regardless of the option you choose, make sure you are operating within the letter of the law. Contact your local county extension office or Kentucky Cabinet for Health and Family Services Food Safety Program (http://chfs.ky.gov/dph/info/phps/food.htm) for further information.

# Marketing

*Greg Halich, Lee Meyer, and Fred Martz*

Once you have determined what type of product you plan to produce (see the Market Segments section), you must determine how to best sell that product. Three broad ways you can sell pasture-finished beef are:

- Bulk sales (freezer beef)
- Retail sales (individual cuts and bundles of cuts)
- Wholesale markets (live animals)

Each approach has its own unique set of advantages and disadvantages, and no single method is best for all producers. Each method needs to be evaluated based on your marketing skills and personal temperament to find the best fit with your production system.

Be prepared for the great amount of time and work that marketing will take. Determine how marketing fits with your other time commitments and learn which marketing methods work well for you and which ones may not lend themselves to your specific circumstances. Create a well-thought-out marketing plan before you start finishing animals.

A complete marketing plan should include:

- Short-term and long-term goals
- Customer analysis to determine customer preferences, customer demographics, and market outlets to reach customers
- Pricing strategy
- Advertising and promotion strategy
- Contingency plan
- Evaluation

Most of these items will be covered to some degree in this section. However, it is beyond the scope of this publication to go into the details of developing a detailed marketing plan. There are many good publications available to help you through this process including:

- *Building a Sustainable Business—A Guide to Developing a Business Plan for Farms and Rural Businesses* (http://www.sare.org/Learning-Center/Books/Building-a-Sustainable-Business)
- *FFA Marketing Plans—A Primer* https://www.ffa.org/SiteCollectionDocuments/cde_marketingplan_guidebook.pdf

Make sure you work through your own marketing plan, even if it is basic. You may not be able to have a detailed plan for all the sections, but the very process of going through the plan will help you realize where you need to spend time to further develop the plan.

## Bulk Sales (Freezer Beef)

Bulk sales, also known as freezer beef, is probably the easiest and most popular way of getting started with selling pasture-finished cattle. Freezer beef typically involves selling large portions of an animal at one time as opposed to individual cuts.

### Custom vs. USDA Inspection

All meat sold must be inspected, either in a USDA-inspected facility or in a state-inspected facility. (Missouri offers state inspection while Kentucky does not.) However, if you are buying the animal and having it harvested and processed for your own use, the beef may be processed in a "custom-exempt" facility that is not USDA inspected. This option is only available if the animal is sold before it is processed. The producer may still arrange for the processing.

The most typical portion sizes are a quarter or half of an animal, but other sizes are possible. A quarter-animal is typically not a physical quarter section of the animal but an equal portion of all cuts from one side.

Selling bulk beef can be facilitated in one of two ways. First, a group of customers can pool together to buy a single animal and work with the farmer to deliver the animal to the meat processor. Alternatively, the farmer can facilitate this process by finding customers that want to purchase a portion of the animal. In either case, the end customers would technically own the live animal, or a portion of it, before it is slaughtered and be exempt from inspection. They would still have the option of using a USDA-inspected plant if so desired.

There are four main advantages to having customers technically taking ownership of the animal before processing. First, you can use a custom-exempt processor rather than a federally inspected processor, potentially lowering processing costs as well as transportation costs. Second, having the customer take ownership of a live animal before processing will limit your potential liability. Third, since you are selling portions of animals as opposed to individual cuts, you will avoid the potential problem of selling out on some cuts of meat and having others that are difficult to sell. However, the fourth and potentially biggest advantage of marketing freezer beef is that you are selling in large portions. A quarter steer would typically be around 90 to 130 pounds of meat. Thus you will have relatively few customer transactions and your marketing costs will be kept to a minimum.

*A bulk beef marketing technique that is starting to gain popularity are beef buying clubs—an informal arrangement of a small group of buyers who want to share a whole animal or a portion of an animal.*

Unfortunately, large amounts of physical product are also probably the biggest disadvantage of this system. Having minimum orders of 90 to 130 pounds of meat will severely limit the number of potential customers. Most people do not have the freezer space for this volume. Selling in portions of less than a quarter animal is a potential way to get around this problem. The biggest constraint with selling smaller portions is with the processor. It becomes progressively more difficult to divide cuts equally for less than a quarter of an animal. Invariably, some customers will not be happy with their distribution, and it only takes a few incidents with unhappy customers for processors to become wary dividing beyond quarters. Additionally, processors end up spending extra time with the physical delineation of smaller portions, so unless they are paid extra for this service, they have little incentive to want to deal with these challenges. The best way to get around this constraint is to find customers that would buy a quarter animal together. This practice is best if they know each other, but with creativity and diplomacy, you can potentially pool other customers together.

If you are starting out with just a couple animals, targeting friends, friends of friends, coworkers, and family members may be all you need for marketing purposes. If you expand slowly enough and have a quality product, you can potentially grow the operation by word of mouth from satisfied customers. This approach is a good option for most producers and requires minimal marketing expense.

A bulk beef marketing technique that is starting to gain popularity are beef buying clubs—an informal arrangement of a small group of buyers who want to share a whole animal or a portion of an animal. A key to the success of this arrangement is to have at least one knowledgeable buyer who can facilitate this process and answer questions that the other buyers have. The processor can help by providing smaller packages as they will be easier to divide equally than fewer large packages. This process will not be precise, and one buyer may get an arm roast while another gets a shoulder roast. The main goal is for each buyer to go home with a cooler full of beef, confident that they got a fair deal.

Without an established sales outlet, it is not advisable to try to market too many animals as bulk beef at once. If for some reason you cannot grow the business slowly, you will need to take a more aggressive marketing approach, including such methods as advertisements in local newspapers and online outlets (e.g. Craigslist), signs at the farm, leaflets/brochures at health stores, workplaces, and hospitals, etc. If you intend to post advertisements or distribute leaflets or brochures, be aware of restrictions on advertising at the various locations you want to use. If you use this strategy, you need a marketing alternative for the finished cattle that are not sold as freezer beef. The local stockyard will likely be this alternative, but be prepared to accept a relatively low price for a few large animals.

Regardless of how you find your customers, be clear on how they will be expected to pay. Is the price based on live weight, hanging weight, or actual pounds of meat? If the customers are expected to pay processing fees, make sure they understand how these fees will be determined and how much they will likely cost. If charging by the pounds of wrapped meat, will they have to pay extra for by-products (bones and organs)? Will you require a deposit before they pick up the beef? If you are getting customers from advertising (people you do not know), consider requiring deposit before the animals are processed. If animals are processed at a custom-exempt processor and a customer backs out of a deal, you cannot legally resell that product. This restriction is one of the biggest risks with selling freezer beef.

Make sure customers know how much meat they are likely to get and that this beef may taste different from beef purchased at the grocery store. With many processors, the customer will have an opportunity to give custom cutting instructions (type of cuts and sizes of cuts), usually for an added fee. Ideally, you should provide your customers with resources to help in all these decisions.

You will need to decide what price to charge for your product, which is one of the most difficult and important decisions you will make. You cannot simply sell at a price you think is needed to provide your desired profit. Pricing depends on your local market. You need to find out what other producers are charging and determine a reasonable range. When trying to break into a local market, you will often have to start out by selling in the low end of this range. Quick internet searches are potentially useful, but keep in mind that the prices you find may be for very different markets than what you have. In general, the price per pound will be considerably lower compared to selling your meat in individual packages.

When researching prices, be sure you understand whether advertised prices are by carcass weight or by the actual weight of the meat. Carcass

weight price will be considerably lower. Selling by carcass weight is probably the easiest method of selling freezer beef but is also confusing for most first-time customers. Most customers will not know how to compare carcass weight price to the prices of meat sold as retail cuts (what they are used to). Most customers will not understand how much loss of weight occurs between when the carcass is hung on the rail and when the final cuts are processed (i.e. carcass shrink and cut-out loss). To avoid having your customers feel they have been taken advantage of, you must educate them about the processes and show realistic examples of how much final meat they should expect.

Table 9 provides an example of how you can help your customers become more knowledgeable.

Keep in mind that regardless of how you sell freezer beef, you need to do everything you can to keep the process as easy as possible for your customers. If you can find a way to include processing costs in your bill (so that they are paying only one person) or to include them for "free," you will greatly reduce uncertainty for your customers.

**Table 9. Pricing Example Comparing Pricing per Actual Pound of Meat vs. Hanging Weight**

| **Base Information** | |
|---|---|
| Live steer weight | 1,100 lbs |
| Hanging Weight | 640 lbs |
| Hanging Weight (¼ animal) | 160 lbs |
| Packaged meat | 440 lbs |
| Packaged meat (¼ animal) | 110 lbs |
| **Retail Weight Pricing (¼ animal)** | |
| Price per pound | $4.90 |
| Total pounds | 110 |
| **Total Cost** | **$539** |
| **Hanging Weight Pricing (¼ animal)** | |
| Price per pound | $2.74 |
| Total pounds | 160 |
| Cost for ¼ Animal | $439 |
| Processing Cost (¼ animal) | $100 |
| **Total Cost** | **$539** |




Selling locally produced beef at farmers markets has becoming increasingly popular in recent years.

Given all these constraints and challenges, freezer beef is still a great way to get started with pasture-finishing cattle. It is possible to sell a thousand pounds of meat while only dealing with six to eight different customers. You may be able to use only word-of-mouth advertising and not have to hold a single package of meat in inventory.

## Retail Sales (Individual Cuts)

Retail sales, selling individual packages of meat or bundles of meat, is another option for selling pasture-finished beef. Instead of selling in bulk at lower prices as with freezer beef, retail sales typically involve smaller quantities per order, but higher prices. The most common avenues for retailing beef are farmers markets, on-farm outlets, grocery stores, restaurants, CSAs (community supported agriculture organizations), and internet/mail order sales.

### Farmers Markets

Farmers markets, organized markets where local producers sell directly to the public, are probably the most popular outlet for retain sales. Their popularity has grown considerably in the past ten years. A big appeal for many consumers is the ability to source fresh, locally produced, high-quality products directly from the producer. Consumers are typically willing to pay a premium for products at farmers markets compared to conventional food stores.

Have a neat, well-kept booth when selling at farmers markets. Have clear signage that displays the variety of meats available and the price for each cut. To help customers decide what to buy, display photos of various cuts of beef and describe the best uses for each cut. Pictures and beef cut charts can be obtained free (in state) by contacting the Kentucky Cattlemen's Association (859-278-0899 http://www.kycattle.org/) or for a small charge from the

Cattlemen's Beef Board (http://www.beefretail.org/beefcutcharts.aspx).

Marketing skills (salesmanship) are of paramount importance in this type of setting. Many potential customers will tend to stand back from the vendors. You have to draw them in, make them feel at ease, and help them learn about your products. Many books are available that teach salesmanship and are good resources to help you get started.

Selling meat products at farmers markets requires specialized equipment such as a trailer or covered truck bed, and portable freezer/generator combinations or coolers. The importance of coolers and freezers cannot be overemphasized. You will want to make sure your product stays frozen or at the proper temperature. State or local health inspectors will occasionally check the temperature in your freezer (as well as inspect your weighing scales and products). If you are not in compliance with the rules you may be fined and/or shut down. Contact your local health department to make sure you will be in compliance. The *Kentucky Farmers' Market Manual and Resource Guide* http://www.kyagr.com/marketing/documents/_20142015FarmersMarketManual.pdf contains guidelines for meat sales (pp. 76-80).

A main advantage of selling at farmers markets is that you will have access to a large number of potential customers. A farmers market allows you to network and build a long-term customer base. By selling individual packages of meat, you have a chance to reach those customers who will not buy hundreds of pounds of meat in bulk. Another advantage is that you will generally sell at higher prices per pound than you would by selling freezer beef.

However, there are a number of disadvantages to selling through farmers markets. First and foremost is the time commitment, which includes preparing for each day's market, traveling to and from the market, and being at the market while it is open. You may easily spend four to six hours each day the market is open. You need to be consistent in terms of showing up on certain days and during the same hours. If customers are expecting you and you are not there, they will likely find someone else who is. Since you will have to commit so much time, make sure the market is well attended by potential customers. Try to get into the best market within a reasonable distance. You also need to be a "people" person. If you do not enjoy meeting and talking with strangers then this marketing method probably is not for you.

## On-Farm Sales

On-farm sales are probably the next most common form of retail sales. As the name implies, customers come directly to the farm to purchase meat. On-farm sales can work well in some situations because many potential consumers want to see the farms that they buy products from and see how the animals are raised. As a consequence, image is extremely important. Cleanliness and a neat premise are essential. Do things to emphasize the pastoral setting, contentment of animals, and




On-farm advertising: Attractive display helps create a local feel.

healthfulness of your meat products.

Location is important for on-farm marketing. Ideally, you want to be on a well-traveled road near a major population center. Good signage, local advertisements for special promotions, and regular store hours are important factors for attracting customers. You want to make your farm a destination. Having dedicated rest rooms, parking areas, and increased liability insurance should also be considered for this type of sales. Check with your local health department for rules related to meat sales, which vary by region.

Two contrasting philosophies exist for on-farm sales. The first is the low volume, low investment model with a few freezers, shared space (no dedicated building), and limited hours (or when customers show up or call). This method can be a good complement to farmers market sales. The other side is the higher volume, higher investment model where typically a dedicated building or a portion of a building are used. This type of on-farm sale may have a walk-in freezer or multiple large chest freezers dedicated for this purpose. It will also typically have substantial store hours and may have a dedicated employee to run it. Often, they will sell other products such as local vegetables or other local value-added products. A significant increase in resources and time is needed to go from the low to high volume model, and few pasture-finishing beef producers will be in a position to go with the latter.

## Grocery Store Sales

Grocery store sales are another possible but challenging option for selling retail cuts. The best possibilities are small independent retailers with upscale meat departments. The two most common problems in selling to grocery stores are that prices are typically low and you will not likely have much flexibility on distribution and delivery for the majority of stores that sell fresh

meat. The latter of these problems causes the most concern for small and medium-sized producers because it means you will need a steady supply of fresh meat. Occasionally, you may find an independent retailer who will carry frozen cuts of meat, making sales to that particular store a viable option. The main advantage of this method is that you can move a large amount of product with a relatively low marketing cost. However, in most cases, grocery store sales are not a viable option for small and mid-sized producers.



Chefs are used to buying at wholesale prices but are willing to pay a premium for local products, particularly if it will enhance their restaurant's image. A chef at one of the finest establishments in Nonesuch, Kentucky, created this beautiful bourbon braised beef dish with meat from a local farmer.

### Restaurant Sales

Restaurant sales were a promising way to market beef in the early years of the pasture-finishing movement. During this period, the restaurant market was wide open and there were few suppliers. However, many of the producer/chef relationships have already been established, and in many cases you will need to find restaurants that have not previously considered serving locally sources beef. As a consequence, the restaurant market is difficult to break into. That said, locally grown food continues to gain popularity among chefs. Chefs like to buy from farms that have established name recognition, which helps promote their business. Selling to restaurants requires that you call on chefs or the restaurants buyers to let them know about your products. Realize that chefs are usually quite busy and have limited time to hear your sales pitch, so it needs to be succinct and to the point. Be prepared to give the chef product samples to help in this process.

Chefs are used to buying at wholesale prices but are willing to pay a premium for local products and/or quality products, particularly if it will enhance their restaurant's image. To help negotiate prices, you should know the wholesale prices for each cut, which vary by market. Use the USDA's Daily National Car lot Meat Report (http://www.ams.usda.gov/mnreports/lsddb.pdf ) as a baseline minimum to start from, which shows the national daily wholesale price. The local price will be higher and a good starting point is to take the report price, then add a 30 to 50 percent markup (for non-premium beef types). For example, if the report price for boneless round is $3.00 per pound, a 40 percent markup will bring this up to $4.20 per pound, which is a reasonable place to start. If you are producing a premium product (such as pure grass-finished or organic), your price will likely be higher. Keep in mind that chefs are accustomed to negotiating with potential suppliers. If you set your price a bit too high, they will typically let you know this and you can always come down on price. You will, however, have difficulty raising your prices once you have agreed to a deal.

Restaurant sales initially require a significant time commitment, but marketing costs will decrease substantially over time as you develop long-term relationships. A key advantage of restaurant sales is that they can be combined with other marketing outlets to allow you to increase production volume and gain efficiencies in production, processing, and marketing. A key disadvantage is the increased risk. If you have one or two large restaurant customers and lose them, you will have to quickly find new markets for that product.

Restaurants typically have limited storage space so timely delivery of products is required. This is a problem for most small to mid-sized producers when dealing with non-frozen cuts of meat. Another potential issue is that restaurants often only want a few cuts (e.g. steaks), so you would need a separate market for the other cuts. Again, this issue is typically going to be more of a problem for small and mid-sized producers.

Since most pasture-finished beef producers typically have limited inventory, ask about opportunities to supply cuts for menu features or for catering events. Some chefs will buy whole sides or primals so they can break the carcass into the cuts they want and make use of the bones and trim. This will save you processing costs and reduce inventory management problems, so you can reduce your selling price accordingly.

### Community Supported Agriculture (CSAs)

Community supported agriculture (CSAs) is gaining in popularity for selling pasture-finished beef. CSAs consist of a community of individuals who pay an annual subscription for a "package" of product supplied to them on a regular basis. The consumer pledges support to a farming operation, making a meaningful connection between consumer and producer, as they each share risks and benefits. CSAs primarily focus on produce, but some are starting to offer a variety of products, including meats and value-added (processed) products. CSA members typically pick up their package of goods at the farm or some other convenient location, simplifying marketing and transportation logistics for the producer. CSAs offer regular access to customers who will likely fit your preferred customer profile (e.g. those interested in local products).

While there have been a few experimental meat-based only CSAs, they have not generally been very successful. It is probably better to partner with an established CSA. Meat is most frequently offered as an option with these CSAs rather than included automatically like most items. Each week, the subscriber will be given an option to buy various cuts of meat which can be modified to match inventory. New software allows CSA managers to make the process easier by offering subscribers a list of products. This software takes orders until the inventory is exhausted, and then bills the subscriber's credit card. Several programs are available, including CSAware (www.csaware.com) and Farmigo (www.farmigo.com).

A key to success is to partner with a well-managed CSA. Selling to these groups can be extremely efficient when pick-up points are organized and deliveries are made at a central location. Many producers are moving in this direction and doing less marketing at farmers markets to decrease their marketing costs. The CSA method may be one of the most promising outlets for smaller beef producers. Finding a CSA partner with a similar production philosophy who wants to add beef is the key challenge.

### Online Marketing

Selling retail cuts of meat online is also gaining in popularity. Producers can do business on the internet either by maintaining their own individual web site or participating in a directory listing. Online systems can access customers from around the country. You can promote your product online with farm pictures, news stories, pricing, advertisements, recipes, and promotions.

One of the biggest hurdles to this marketing system is the added transportation to get frozen meat to its destination before it thaws. Some transit companies maintain systems for one- to two-day deliveries, and this procedure is used routinely by some producers. Meat must be packed and shipped in cold appropriate packages (e.g. styrofoam with dry ice). The type of shipping (number of days) can change based on the current temperature (i.e. shipping must be quicker in the summer than the winter). To cover these added costs, the final price to the consumer will be substantially higher. However, many people are willing to pay increased prices for the convenience of having the meat shipped directly to their door. Meat processed in a state-inspected facility is limited to sale in that state, so if you expect to sell to customers in other states make sure to have your beef processed in a federally inspected facility.

Payment collection is a bit more complicated with this marketing method as you will not have direct physical contact with your customer. Although you can require a check to be sent in advance of shipment, this method will deter some buyers. Setting up an account with a credit card company so that customers can pay by credit card is probably a better option. Another option for small producers is to set up a "PayPal" account, which is becoming more common. With this method customers can pay with their PayPal account or a regular credit card. You will have to set up an account and pay a fee, but you will get paid by customers immediately when making a sale.

### Summary of Retail Sales

In general, small-volume producers will find retail sales a challenge. The best avenues for most small and mid-sized producers are probably farmers markets and CSAs. Successful marketers using other types of retail sales usually need to create an identity (brand). Many successful pasture-based beef producers work in partnership with other beef producers (to have enough volume) or with produce growers (to offer a broader product line for CSAs). Options such as grocery store and online marketing are appealing, but most farmers find that the obstacles outweigh the benefits for these retail avenues.

*Online systems can access customers from around the country. You can promote your product online with farm pictures, news stories, pricing, advertisements, recipes, and promotions.*

## General Marketing Considerations for Retail Sales

### Advertising

Entire books are written on advertising and they are a good place to get started. Advertising for retail sales will depend on the market outlet. For on-farm sales, look for directories published by local/sustainable food organizations. Some examples are www.marketmaker.com, www.eatwild.com, and www.localharvest.org. These sites are easy to register with and will help buyers find your product. Many state departments of agriculture also list farmers who sell directly to consumers.

Although external web sources are an easy first start, a personal web page can help you reach consumers who are seeking local food and products. A web page can also help you network with chefs, journalists, and potential buyers after meeting them in person. An effective web page showcases your farm and your product. It should be welcoming and easy to navigate, providing important details such as contact information and details on the products you sell. Pictures of you, your farm, and your animals will appeal to customers, along with a compelling story about your farm's history and your farming practices.

You can create a functional web page yourself. However, it is often worthwhile to hire a professional if you want a seamless and professional-looking site. Many web companies can also help you with branding and logos. Keep in mind however, that websites are rarely static and need to be updated periodically.

If you choose to sell at farmers markets, you will need promotional material about your farm and your production system, and signage for your products (what is available and at what prices). A brochure about your operation can be used to provide information about your farm and production system, which can also be used for other retail sales types. Your brochure should be simple and portray a clear image of your operation. A few pictures and graphics are helpful, but keep it simple. Your main message should consist of a few sentences. Describe how your beef is produced in layman's terms. Detail how they can get your product and summarize by explaining why the potential customer should buy your beef (healthy eating, sustainably produced, etc.). Avoid criticism of other products or sellers and focus instead on the positive attributes of your product.

If you have drafted the brochure without hiring a professional, you should have someone with good editorial skills and knowledge in the subject area review the brochure for content, style, and message. You may even want to give them samples of your product so that they have firsthand experience with it. Effort at this stage is well-spent. Once you create an image, it is difficult to change it. So make sure your first effort enhances this image and does not detract from it.

### Labels

All beef products must be inspected (federal or state) and labeled for retail sale. Using the processor's label will be cheaper than developing your own, but brand identification is important and many retailer marketers will want to develop their own label to help in this process. Many producers will start out using their processor's label and later develop their own. It is better not to invest in your own label until you settle on your production system and develop your product image. The USDA Food Safety and Inspection website has a variety of useful fact sheets covering key topics related to labeling, including the following:

Label Submission and Approval System (LSAS) (http://www.fsis.usda.gov/wps/portal/fsis/topics/regulatory-compliance/labeling/labeling-procedures/label-submission-and-approval-system/lsas)




USDA inspected beef: This is the processor's label that can also be used for selling retail cuts.

Meat and Poultry Labeling Terms (http://www.fsis.usda.gov/wps/portal/fsis/topics/food-safety-education/get-answers/food-safety-fact-sheets/food-labeling/meat-and-poultry-labeling-terms/meat-and-poultry-labeling-terms)

Food Product Dating (http://www.fsis.usda.gov/wps/portal/fsis/topics/food-safety-education/get-answers/food-safety-fact-sheets/food-labeling/food-product-dating/food-product-dating)

Additional publications on labeling (http://usdasearch.usda.gov/search?utf8=%E2%9C%93&affiliate=fsis&query=label+fact+sheets&commit.x=0&commit.y=0)

Consultant "expeditors" who specialize in getting labels approved are available at a reasonable cost to help you deal with the USDA regulatory system. Ask your processor about these expeditors, or search for "meat inspection consultants," and then check references to make sure they are reputable.

### Insurance

Most basic farm insurance policies do not cover selling packaged meat. Check with your farm insurance policy agent and find out what your current policy covers. In most cases, it probably will not cover you selling a finished product directly to consumers. Typically, you will want coverage for what the insurance industry calls "premises exposure" and "products or completed operations." Premises exposure covers accidents that happen at your farm or farmers market stand when you have customers for a product. Some farmers markets may have premises exposure coverage that may cover this type of liability for you while at the market. Products or completed operations policies cover problems that occur with your packaged meat product (e.g. spoilage, contamination). If you are selling live animals and your customers are having them processed then you may not need these types of insurance.

Costs for these coverage types are typically based on the level of sales. There is usually a minimum charge that covers up to a certain level of sales. For example, one of the authors of this publication has sales of roughly $15,000 per year but would pay the same premium if he doubled his sales. These minimums and overall costs can vary tremendously by insurance company. Some insurance agents do not have much experience with these types of specialized policies, so make sure they understand exactly what you will be doing and what type of coverage you want. Be persistent and contact other insurance companies if you are quoted something that seems unreasonable. Some farmers place their retail sales operation under an LLC to further limit their risk exposure.

### Pricing

Spend time getting to know prices your competitors are charging for their product. Go to various retail outlets to collect pricing information. You will find beef products from a whole range of production systems. You are ultimately interested in those production systems that most closely resemble yours. Shop both mainstream and specialty stores. Internet searches are also useful for ballpark figures, but many of these sources will likely be located in different geographic areas (markets). If you are selling through a grocery store, price your product at 60 percent to 80 percent of the retail price for that product to account for the store's cost and markup. If you are selling directly to consumers, you can sell near the retail price for that product.

In most cases, pricing will depend on the local supply and demand for your product (selling through the internet would be an exception to this rule) and will be influenced by your advertising program and expansion goals. If you are trying to break into a new market and have an aggressive expansion goal, you will likely need to price your product well below the current market price. If you are looking at slowly getting into direct marketing you have more pricing strategy options.

### Inventory Management

When selling individual packages, you may find that you are selling out of certain cuts while having a hard time selling others. If you find yourself in this situation, reconsider your pricing strategy and decrease prices on cuts that are building up in inventory. Market diversity is also beneficial for solving this problem. Some outlets may demand mostly ground beef while other customers may demand mostly steaks. If you are selling retail at a farmers market and you have a hard time selling certain cuts that are unfamiliar to your customers, providing recipes and literature on those cuts can help with sales. Sometimes the meat processor can also help balance cuts (providing more roasts vs. ground or vice versa). Learn as much as you can about meat cutting and how different cuts of beef are used in food preparation. Help your customers find uses for cuts they may not be familiar with. Share recipes with customers, both your own favorites and those of satisfied customers.

It is best to move excess product into a different market rather than dramatically discount prices in your primary market. For example, you may want develop a relationship with a caterer who can use excess roasts or ground beef and sell these at a discount.

## Wholesale (Live Animal) Markets

The final method to sell pasture-finished beef is through wholesale markets. With this method, you sell the live finished animal to someone who will take care of the processing and marketing. You may sell to a branded beef program or alliance that has established a large market and specific protocols but does not have the capacity to produce all the finished cattle. You may also sell to an individual who is good at marketing but doesn't have time or the resources to produce all that they want to sell. Finally, you may sell to a processor that also sells retail and/or to wholesale markets.

In selling live animals wholesale, you will have substantially reduced costs for processing and marketing as well as reduced risk associated

*In most cases, pricing will depend on the local supply and demand for your product (selling through the internet would be an exception to this rule) and will be influenced by your advertising program and expansion goals.*



Wholesale beef cattle market.

with these activities. You will also typically sell at a lower price and have a lower profit potential on a per animal basis, but this method allows you to concentrate on the production side and let someone else worry about the processing and marketing. Thus, wholesale markets may be a viable option if you are good at finishing cattle but do not want to do the marketing to sell a final product.

Wholesale markets are more similar to selling into the commodity market than direct sales. When selling to a wholesaler, you must follow production and record-keeping protocols established by the wholesaler. Common protocols are avoidance of antibiotics and growth hormones. Carefully compare prices and contracts/commitments. Ask questions. For example, if your wholesaler's sales are lower than expected, will they still purchase the cattle you planned on selling? What will happen if your animals are not ready by a predetermined time? These questions must be answered before you can evaluate the risk involved with this type of production. Some wholesalers may require a formal contract. This contract is a legal document, and you should have legal counsel look over it. Determine what the consequences will be if you are unable to fulfill your contract obligations and if there is any bond or enforcement mechanism to the contract.

Also consider the pricing details. Cattle can be sold on a carcass basis ("hanging weight") or live weight basis with a schedule of premiums and discounts for yield, grade, and other quality attributes. Determine how the profitability of these options compare to retaining ownership of the animals and marketing the meat yourself (freezer beef or retail). You can use a spreadsheet developed to evaluate wholesale vs. direct marketing profitability to help with this process (http://www.uky.edu/Ag/AgEcon/pubs/BeefPastureFinishing.xlsx).

## Marketing Summary

Pasture-finished beef can be marketed in numerous ways. Meeting your customer's needs and desires is the key. Most customers want moderately well-finished beef that is wholesome and healthy, and they may want the opportunity to connect with the farm that is selling the beef. Marketing takes time and effort, but it will generally pay off in the long run.

Bulk sales (freezer beef) are probably the easiest (low-hanging fruit). If the customer base can be developed and managed, freezer beef can be a high-volume sales method. Retail sales are more varied/complex and require more marketing savvy. Wholesale markets are more like commodity markets and relieve the grower from most marketing aspects, allowing more time to attend to production management. All of these marketing methods have their place in the right situation and can lead to successful results.

# Profit Potential

*Greg Halich*

## Background

Corn and other concentrate feeds were relatively cheap in the last few decades leading up to 2005. Corn prices typically stayed in the $1.75 to $2.25 per bushel range. However, as ethanol production started using significant amounts of corn, corn prices began to rise. In 2005 the U.S. was using about 10 percent of its corn crop for ethanol production, and by 2011, the U.S. was using 40 percent of its corn crop for ethanol production. As a result, corn and other concentrate feed prices increased dramatically. Since 2005, the price of corn has been in the $3 to $8 per bushel range. As a result, feedlot finishing costs increased significantly and shifted the profitability advantage toward pasture finishing.

Table 10 shows an example of the relative finishing costs for an 800 pound steer purchased at the beginning of November and finished to 1,275 pounds in either a feedlot or pasture-finishing system that used no grain. Various corn prices ($2-7/bu) and pasture charges ($50-150 per head, analogous to feed costs for the pasture) are used so that multiple scenarios can be evaluated.

Assumptions for the feedlot:

- 7.2 feed conversion ratio
- 3.25 pounds per day gain
- $.28 per day yardage fee (no markup on grain)
- 1.0 percent death loss

Assumptions for pasture-finishing operation:

- 75 pounds per day gain winter
- Winter feed costs $130
- $.20 per day winter labor
- 1.75 pounds per day gain pasture
- $.10 per day summer labor
- 0.5 percent death loss

**Table 10. Feedlot vs. pasture finishing relative cost differences (800 lb to 1,275 lb steer.) (Positive numbers indicate cost advantage for feedlot.)**

| Pasture charge (per animal) | Price per bushel corn | | | | | |
|---|---|---|---|---|---|---|
| | $2.00 | $3.00 | $4.00 | $5.00 | $6.00 | $7.00 |
| $50 | $55 | -$14 | -$84 | -$153 | -$222 | -$291 |
| $75 | $80 | $11 | -$59 | -$128 | -$197 | -$266 |
| $100 | $105 | $36 | -$34 | -$103 | -$172 | -$241 |
| $125 | $130 | $61 | -$9 | -$78 | -$147 | -$216 |
| $150 | $155 | $86 | $16 | -$53 | -$122 | -$191 |

Notes: Feedlot: 7.2 feed conversion ratio; 3.25 lb/day gain; $.28/day yardage no markup on grain; 1.5 lb soybean meal and 2 lb hay; 1.0% death loss. Pasture-finished: winter feed costs $130; .75 lb/day gain winter; $.20/day winter labor; 1.75 lb/day gain pasture; $.10/day summer labor; 0.5% death loss; 4% interest both systems.

As can be seen from Table 10, feedlot finishing has the clear profitability advantage when corn is priced at $2 per bushel. However, between $3 and $4 per bushel the cost advantage shifts. At $4 per bushel the pasture-finishing scenario is more profitable in all but the highest pasture charge scenario ($150 per animal). Pasture charge refers to the value or rent on the pasture that is required per animal and includes anything that has direct or indirect cost for the pasture, including a rent or rent equivalent, fencing maintenance and depreciation, fertilizer, bush-hogging, etc. Going from $3 to $4 per bushel and using the $100 pasture charge, the cost difference goes from $36 cost advantage per animal for the feedlot to a $34 cost advantage per animal for the pasture finishing operation. With $5 corn, the cost advantage to the pasture finishing operation increases to $103 per animal.

Note that this is just one of many examples of possible finishing systems. Specifically, it will cost more for the pasture-finishing operation if cattle are finished during the winter months and possibly at other times of the year. But the important implication is that we are no longer in the scenario ($2/bu corn) where feedlot finishing will always be the cheaper option. There are now many opportunities for competitively finishing cattle on pasture.

## Profit Potential

Determining a realistic profit potential for a pasture-based beef finishing operation is usually a difficult process for most people. In many cases, it will require you to split the farm into two or more enterprises on paper (e.g. cow-calf and finishing operation). It will also require you to break down your costs into categories and allocate them to these different enterprises. Knowing these costs can help you determine a realistic break-even price for your product and/or give you a rough idea of the profit potential before you start a finishing enterprise. This section is designed to guide you through this assessment by providing a general framework that can be used by beginners as well as those who are already finishing animals.

If you already have a beef enterprise (cow-calf or stocker) the first step in this process is to delineate the finishing operation from your current operation. If you have a cow-calf operation, you will "sell"

the calves you plan to finish into the finishing operation at your normal weaning weight and at the price that you would receive at the sales barn. If you currently have a stocker operation, you will "sell" calves from the stocker operation to the finishing operation at the normal weight and at the price that you would receive at the sales barn. These are not literal sales but are used for your own internal accounting purposes. Unless you delineate these different enterprises, you will not be able to determine if the finishing enterprise is actually profitable or if it is being subsidized by the preceding enterprise (or vice versa).

You will first need to estimate revenues and costs for your current enterprises. A good place to start is with enterprise budgets which are available in most states through the cooperative extension service. Cow-calf and stocker enterprise budgets for Kentucky can be found at: http://www.uky.edu/Ag/AgEcon/pubs/extBudgetBeef200829.xls.

Although there will be default costs and revenues for each item, they are general estimates and can vary substantially by producer. They will also likely need to be updated due to market changes. Go through these budgets with a county agent, livestock extension specialist, or experienced farmer in your area to make sure you are using realistic numbers.

The cost of the calf will likely be your largest overall cost to the finishing operation. However, there are many other costs that also need to be accounted for with pasture-finished animals, most of which are not easy to estimate unless you keep good records. Assuming that these calves will have to be overwintered at least once, hay/feed will likely be one of your biggest costs. If you buy your hay and/or feed, this cost can be easily estimated. For example, if the estimated average calf weight is 850 pounds during four months of winter (122 days), and we assume the calf consumes 2.5 percent of its bodyweight in hay with a 20 percent waste rate, the resulting calculations for total hay usage would be:

$$\left[\frac{\text{Avg.Weight} \times \text{Consumption Rate}}{\text{1-waste rate}}\right] \times \text{[Total Feeding Days]}$$

$$\left[\frac{850 \times 0.025}{1\text{-}0.20}\right] \times [122] = 3240 \text{ lbs of hay (1.62 tons)}$$

If you buy this hay for $70 per ton (delivered price), the total hay cost per calf equals 1.62 tons x $70 per ton, or $113. If you make your own hay and/or feed, estimate what this hay costs you to produce. Most operations do not have good records to use in estimating costs (especially depreciation and overhead), so using the market rate for similar quality hay may be your best proxy. Be aware though that most small producers have extremely high production costs for hay, thus you may want to use a price higher than the market rate for hay.

Pasture costs such as fertilizer, lime, seeding clovers, and bush-hogging also need to be accounted for. Many of these costs do not occur every year, so they should be prorated on a per-year basis. As an example, if you put down an average of $100 of P and K per acre every five years, then your prorated cost would be $20 per acre per year. Make sure you also account for machinery costs. Even if you are using your own tractor to spread the fertilizer, you have the direct cost of fuel and the indirect costs of repairs, depreciation, and labor. If you hire a custom operator to put down fertilizer for you, the cost will probably



How much did it cost to make this hay? Most farmers don't have a good idea of their machinery costs. Using custom rates published by many land grant universities can be a good approximation.

*Most producers do not formally include a land charge. If your preference is to exclude this charge, realize that your final "profit" also includes a return to the land.*

be $5 to $7 per acre in addition to the fertilizer. If you apply fertilizer yourself, your total costs will probably be similar to hiring someone if you account for depreciation and your time. In general, using a custom rate for machinery cost is a good way to estimate the total combined costs. Custom machinery estimates are available for many states. Estimates for Kentucky can be found at http://www.uky.edu/Ag/AgEcon/pubs/CustomRatesKY.pdf. For example, the average rate for bush-hogging was $18.00 per acre in 2014. A reasonable estimate for all the pasture costs listed above would be $20 to $50 per acre per year.

Fencing and water infrastructure is another important pasture-finishing cost. This cost accounts for depreciation, interest, and maintenance on these capital investments. Although you don't pay these items year to year (you usually pay them up front), they depreciate over time and thus need to be accounted for. A reasonable estimate is $15 to $30 per acre per year for basic perimeter fencing (no subdivisions). The actual amount will depend on the pasture size and shape (costs for large pastures will be less than for small pastures), as well as the fencing type (cost for high-tensile will be less than for woven-wire). These costs can be much lower with semi-permanent electric fencing although with a potential for increased problems as well as higher yearly maintenance and labor. A reasonable estimate for water infrastructure (water lines, water tanks, etc.) is $2 to $10 per acre per year. A reasonable estimate for combined fencing and water infrastructure would be $20 to $40 per acre per year. Once you come up with your per acre estimate, multiply your estimate by the number of acres required per finishing animal. If you keep finishing animals on pasture for more than one year, you must account for multiple years. For example, if you need 1.0 acres of pasture per animal the first year and 1.5 acres of pasture per animal the second year, you are using 2.5 acres of pasture per finishing animal overall. If you estimate that your combined fencing and water infrastructure cost is $30 per acre per year, then in this case your total fencing/water infrastructure cost would be: $30 x 2.5, or $75 per finishing animal.

Consider charging a cost for the land itself. If you rent pasture, this cost obviously needs to be included as a direct (cash) cost. However, if you own the land you still should account for the cost in some way. Some producers prefer to formally account for the cost by "charging" themselves a land cost based on the value of the land without fencing and water infrastructure. For example, if the raw land was worth $2,000 per acre and they felt they needed a 3 percent return on this land (or they have a 3% loan on the land), then they would charge the finishing operation:

$2000 x .03 = $60 per acre per year

Most producers do not formally include a land charge. If your preference is to exclude this charge, realize that your final "profit" also includes a return to the land.

A way to come up with a reasonable estimate for combined fencing-infrastructure/land cost is to use a simple technique that provides a range for this value. The minimum value is the going per acre rate for pasture in your area for land of similar quality and attributes. The maximum value is the rental rate that is just high enough that you would be willing to rent the pasture out at that price. In other words, if you would be willing to rent the pasture out, then it has exceeded your value for your own pasture use. A per-acre rate somewhere between these two values would be an acceptable pasture charge.

Labor is another cost that is treated differently by different producers. If you have hired labor, this cost needs to be formally accounted for as a direct cost to the finishing operation. However, you should still consider accounting for your own or your family's labor. Just as with land, some producers don't like to formally account for this cost by charging their labor to the finishing enterprise. In this case, a portion of your final "profit" will be a return to your labor.

Machinery costs need to be accounted for in all aspects of the finishing operation. Hay feeding typically uses a tractor (although there are ways to get around using one). The best way to estimate tractor time for feeding purposes is to determine the average hours you will run the tractor in a typical week of feeding hay, and then divide this total by the number of animals you are feeding. Next, multiply this amount by the total number of weeks you would typically feed hay. The result will be a reasonable estimate of total tractor time used for feeding hay per finishing animal. Then multiply this number by your estimated cost per tractor hour. A reasonable cost range for tractor time used in feeding hay is $10 to $25 per hour (not including labor) depending on tractor size.

Other variable costs include mineral, water, vet, and other medical costs. Mineral cost can reach $20 or more per finished animal but can be much lower if you are taking a minimalist approach. Water costs will depend to a great extent if you use municipal water that is piped to the property. If your water supply is a

spring, pond, or creek you may have no cost for this item. Veterinarian and medical costs are highly variable and will depend on whether the calves are bought in or raised on the farm.

Trucking can be an important cost, especially if you are taking only a few animals to finish at a time and the processing plant is located far away. If you bring in your finishing animals as stockers, transportation to the farm should also be included. For example, if you have 20 calves trucked in at a total cost of $100, your inbound trucking cost would be:

$100/20 = $5 per finishing animal

Most pasture-based finishers, especially in the early stages of market development, will only take a few animals to be processed at a time. This approach can lead to high per-animal outbound transportation costs. If, for example, you take two animals to be processed at a total trucking cost of $80, then your outbound transportation cost would be $40 per finished animal. In some situations, you must add to the transportation cost(s) of getting the finished product to the final consumer. Transportation cost is an easily overlooked item that can add up quickly with small operations. The examples used above assume that you hired the trucking done. If you have your own truck and stock trailer, you will likely have lower direct costs, but after accounting for all your costs (labor, repairs, depreciation, and overhead), your transportation costs could easily be higher than if you hired out your transportation.

Chances are that if you already have a stocker operation, you will understand the importance of accounting for interest. The most important cost to apply interest to is the price of the calf. If you borrow money to buy calves, charging the interest based on the rate of the loan makes perfect sense. However, even if you purchase calves with your own capital or if they are being "sold" from your cow-calf operation, you should still account for interest. If you use your own capital to buy a $1000 calf, that is $1000 that you had to take out of a bank or investment account that was hopefully drawing interest. You might argue that $1000 taken from a low-interest savings account is negligible. However, if we look at a more typical example where we buy 20 calves, the cost is $20,000. Hopefully, you are not keeping that kind of money around in a low-interest savings account. Another way to look at this situation is that you could have put the $20,000 you spent on calves in an investment account. If that capital will be tied up in the calves for a year, an appropriate interest rate would be a one-year CD rate. Holding calves from weaning to finishing may take 1.5 years or more, so interest can add up. Starting with a $1000 calf at a 5 percent interest rate and holding it for 18 months would result in an interest cost of approximately $80.

The cost of death loss is easily overlooked but it is necessary to account for it. Estimate the cost of the calf when it was brought into the finishing operation as well as any additional costs that were incurred on that calf (feed, interest, vet, etc.). If you are trying to break down your costs on a per-animal basis, you must transform the cost of the death loss on a per-animal basis. In other words, the cost of this loss will be allocated to the other animals that were finished. Use the following formula:

$$[\text{Cost of Calf} + \text{Ave. Additional Costs}] \times \left[\frac{1}{\left(\frac{1}{\text{death loss \%}}\right)\text{-}1}\right]$$

Minimizing death loss is crucial with a finishing operation as you will have a much higher value in a finishing animal than with a 500-pound stocker calf.

Processing costs are one of the biggest cost disadvantages that pasture-based finishers have compared to conventional finished cattle in large feedlots. Processing costs will generally range from $275 to $500 per animal, depending on animal size, facility type (federal inspection, etc), and packaging method. Typically, the processing cost will include a per-animal kill fee ($25-50) combined with a charge per pound ($.30-.60) of dressed carcass weight. For example, if the processor charged a $30 kill fee in conjunction with a $.50 per pound processing fee, the total cost for a 700-pound dressed carcass would be:

$30 + 700 lb x $.50/lb = $380

This cost does not include transportation to and from the processing facility.

When estimating total revenue, several important parameters must be estimated. Two of the most important are dressing percentage and cutout percentage. Dressing percentage is the proportion of dressed carcass weight in relation to the animal live weight. Dressing percentages are typically lower for pasture-based finishing than conventionally finished animals and will range from 53 to 64 percent. The lower part of this range is often seen with immature animals that are not finished. Few producers consistently hit the upper end of this range even with fully finished animals. Cutout percentage is the proportion of final product (packaged) in relation to the

*Processing costs are one of the biggest cost disadvantages that pasture-based finishers have compared to conventional finished cattle in large feedlots.*

dressed carcass weight and typically ranges from 64 to 73 percent for pasture-based finished animals. Multiply the dressing percentage by the cutout percentage to get the final meat yield (%) relative to the animal live weight. As an example, if your dressing percentage is 60 percent and your cutout percentage is 68 percent, the final meat yield would be roughly 41 percent (.60 x .68 = .408). See Table 8 in the Processing and Meat Quality section for guidance on appropriate numbers to use here. A 2 to 3 percent change in either dressing percentage or cutout yield will have a major impact on profitability, so it is important to estimate these parameters carefully.

Another important parameter when estimating total revenue is the proportion of product not sold. This parameter includes processed meat that goes bad and cannot be used (e.g. freezer burn, thawing) or that is given away (e.g. free samples at the farmers market, returns from unhappy customers). While product not sold is highly variable by individual operation, a reasonable estimate is 1 to 5 percent.

## Pasture-Based Finishing Budget Example

Table 11 presents an example of a pasture-based beef finishing budget. Although the budget example is meant to be as realistic as possible, costs may quickly change with time and will also vary substantially by producer. Modify the numbers based on your own experience and situation. Although your estimates will likely differ from those presented here, this budget example provides a general framework to help get you started.

Important assumptions for this particular example include:

- 800-pound steer purchased for $1.60 per pound in fall
- One winter of hay feeding
- Pure forage diet (no grain)
- Steers finishing the following fall

**Table 11. Pasture-based beef finishing budget example 2014 (per finished animal)**

| Costs (per animal) | |
|---|---|
| Calf (800 lb x $1.60) | $1280 |
| Hay | $100 |
| Concentrates (grain) | $0 |
| Pasture charge | $75 |
| Pasture maintenance | $25 |
| Labor | - |
| Other machinery | $15 |
| Vet/medical | $5 |
| Mineral | $10 |
| Water | $10 |
| Trucking | $45 |
| Other | $10 |
| Interest | $35 |
| Death loss | $10 |
| Processing cost | $400 |
| **Total costs** | **$2,020** |

| Revenue (per animal) | |
|---|---|
| Finished weight (lb) | 1,150 |
| Packaged product (lb) | 460 |
| Unsold product (lb) | 5 |
| Sold product (lb) | 455 |
| Average price/lb (packaged) | $5.25 |
| Total revenue | $2,389 |
| Total Cost | $2,020 |
| **Return to labor/mgt/capital** | **$369** |

Note: Assumes calf kept one winter and two grazing seasons. Based on 2014 prices.

The sample budget assumes the producer is not directly accounting for labor cost (as is typically the case). Thus the resulting net return will actually be the return to labor and management. In other words, this figure needs to be large enough so that it accounts for the value of the producer's time (both actual labor on the farm and planning). Marketing in particular may take up considerable time and is a commitment that many beginning producers underestimate.

In this example, the estimated return to labor, management, and capital was $369 per head. The potential producer would then have to decide if this expected return was large enough to justify the expected labor, management, and capital requirements as well as the expected risk.

Small changes in certain parameters can have large impacts on the net profit. Price is an obvious one. A $.25 per pound change in average package price will impact profit by about $110 per animal in this example. A 25 pound change in meat yield will impact profit by about $125 per animal. Thus the profitability results are quite sensitive to small changes in both price and meat yield. It is probably better for planning purposes to be conservative in the numbers you use for these estimates.

Note that the costs used in this example assumed reasonably efficient production practices, particularly related to machinery costs. Pasture-based finishing operations, like all agricultural enterprises and particularly livestock operations, can quickly get into trouble if they are not careful controlling costs. Few operations of small to moderate scale can afford new tractors or other major pieces of equipment if they want to make a reasonable profit. You need to be careful to not become overcapitalized (having too much depreciation and overhead for your scale of operation). For example, it is typically cheaper to buy hay than

*One of the most common mistakes in pasture-finishing is processing animals before they are fully finished, which will have negative ramifications in both meat yield and meat quality.*

to make it yourself for small to mid-sized cattle operations if that means having one tractor instead of two and a full array of hay equipment. Be honest with yourself in terms of what you really need to have versus what you want to have.

Overall, pasture-finished beef production can be quite profitable compared to conventional beef production in many situations. However, you need to account for the additional labor required for this system, particularly related to marketing. There is also more risk involved with this production system compared to conventional beef production, and this risk also needs to be accounted for. As previously seen, small changes in meat prices and yields can have major changes on profit. However, for many potential producers, pasture-finished beef production may be a good option to complement their existing beef production system.

### Increase in Profit from fully Finished Animals

One of the most common mistakes in pasture-finishing is processing animals before they are fully finished, which will have negative ramifications in both meat yield and meat quality. Of course there will be additional costs in keeping the animal for a longer period of time and those need to be accounted for. The following partial budget is meant to demonstrate how to evaluate and compare these two situations.

Most cow herds are spring calving and many producers in this situation will try to finish animals by their second fall so that they will not have to take them through another winter. These calves will typically be 19 to 21 months old at this point. With a grain-on-grass system where calf gains are consistently high throughout the year these animals could reach 1100 to 1250 pounds by fall. However, with a pure-forage approach these animals will likely be in the 950 to 1050 pound range. An option in this situation would be to hold these animals over the winter and then put them on pasture for two and a half to three months in the spring/early summer.

Assumptions for the extended scenario:

| |
|---|
| 5 months of hay feeding |
| .5 pounds per day gain during the winter |
| 2.5 months on pasture in spring |
| 2.3 pounds per day gain during the spring |

Using these assumptions, the steer would weigh 1,250 pounds by mid-June.

Increased costs for the extended scenario:

| | |
|---|---|
| 2.0 tons of hay x $75/ton | $150 |
| Interest | $35 |
| Additional Processing | $105 |
| Other Costs (mineral, vet., etc.) | $50 |
| Total Increased Costs | $340 |

Pasture cost is not included in this partial budget because the animal will only be on pasture from beginning of April through mid-June, which in the upper south is a period of excess pasture growth. In other words, most of the forage consumed by this animal during this spring period would not be otherwise utilized. Had the animal been kept through August, for example, we would have to charge for the pasture.

The final meat yield on the fully finished animal will be greater on a percentage basis than the unfinished steer because we would add mostly muscle and fat to the steer, and very little frame.

A conservative increase would be 4 percent in overall meat yield.

| | |
|---|---|
| 1,250 lbs x 42% yield | 525 lbs meat |
| 1,000 lbs x 38% yield | 380 lbs meat |
| Increase in yield | 145 lbs meat |
| 145 lbs increased meat yield x $5.00 per lb = $725 increased revenue | |
| $725 increased revenue – $340 increased costs = $385 increased gross profit | |

The increase in gross profit does not account for the likely increase in meat quality from a better finished animal. But long-term this quality benefit could have important implications in terms of repeat customers. We would also need to account for the increase in labor cost to keep these animals through the winter. If we already have animals that will be fed through the winter, the increase in labor would be minimal. If these were the only animals on the farm during the winter the labor cost per animal could be quite high. But assuming the first scenario we would have a tremendous increase in net profit. As a comparison, most stocker operators typically look for margins of $75 to $150 per animal (not including labor). The importance of fully finishing animals cannot be overstated but is still probably the most common problem seen in pasture-finishing animals.

## Summary—Pasture Based Beef Finishing

New and expanded local demand for pasture-based beef has created opportunities in the upper south for cattle farmers who want to tap into this market. This new market will not be for everyone. Challenges

and risks not associated with conventional cow-calf and stockering enterprises are detailed in this publication. Some risks are entirely out of the control of the producer: Is the new consumer demand just a fad that may pass in a few years? Will pasture-finished beef eventually become a commodity with lowered product prices? These and other questions must be evaluated by those considering pasture-based beef finishing.

A high profit potential is available for those who are willing to take these risks and can consistently produce a high-yielding finished animal that consumers enjoy eating. Three of the authors of this publication are currently pasture-finishing cattle (two with a pure-forage approach and one with a grain-on-grass approach) and can personally attest to the profit potential. As with any new enterprise, however, the learning curve is steep, and success requires a commitment to working through the many production, marketing, and processing details. This reference guide provides a foundation for this process.

The resource section at the end of this publication provides additional sources of information that may prove useful. Contact information for the authors is also provided at the end of this publication. Let us know if you have any questions.

Best of luck!

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## Resources

### Books

Gerrish, Jim. 2004. *Management-Intensive Grazing: The Grassroots of Grass Farming.* Green Park Press.

Judy, Greg. *Comeback Farms: Rejuvenating Soils, Pastures and Profits with Livestock Grazing Management.* Green Park Press.

Nation, Alan. 2005. *Grassfed to Finish: A Production Guide to Gourmet Grass-Finished Beef.* Green Park Press.

Salatin, Joel. 1996. *Salad Bar Beef.* Polyface.

*Southern Forages* (5th ed.). Garry Lacefield, Don Ball, and Carl Hoveland. 2015. International Plant Nutrition Institute.

### Tools and Budgets

Pasture Finishing Worksheet for Beef Cattle. Greg Halich. 2015. Helps you plan your production systems and meet your marketing windows, and estimates profitability of finishing cattle on pasture. http://www.uky.edu/Ag/AgEcon/pubs/BeefPastureFinishing.xlsx.

Grazing and Hay Cost Calculator. Greg Halich and Samantha Kindred. 2015. Estimates overall grazing and hay costs. Also estimates machinery, labor, and nutrient values (for hay). http://www.uky.edu/Ag/AgEcon/pubs/GrazingHayCostCalc.xlsx.

University of Kentucky Beef Budgets. Helps estimate profitability of spring and fall cow calf operations. http://www.uky.edu/Ag/AgEcon/pubs/extBudgetBeef200829.xls.

### Websites

American Grassfed Association: http://www.americangrassfed.org

Eat Wild: www.eatwild.com

Forage Website. Plant and Soil Sciences, University of Kentucky: www.uky.edu/Ag/Forage

Kentucky County Extension Offices: http://www.ca.uky.edu/county/

Master Grazer Website. Plant and Soil Sciences, University of Kentucky: http://www2.ca.uky.edu/grazer/

### Extension Publications

Custom Machinery Rates Applicable to Kentucky. Greg Halich. 2015: http://www.uky.edu/Ag/AgEcon/pubs/CustomRatesKY.pdf.

Extending the Grazing Season. Ball et al. 2008: http://www.uky.edu/Ag/Forage/agr199.pdf

Forage-Animal Management Systems. Blaser et al. 1986. Virginia Agricultural Experimental Station Bulletin 86-7. http://anr.ext.wvu.edu/r/download/195208.

Kentucky Beef Book. http://www.uky.edu/Ag/AnimalSciences/extension/pubpdfs/kybeefbook.pdf.

Kentucky Farmers' Market Manual and Resource Guide. http://www.kyagr.com/marketing/documents/_20142015FarmersMarketManual.pdf.

Profitability of Stockpiling Tall Fescue Pastures. Greg Halich. 2015. http://www.uky.edu/Ag/AgEcon/pubs/ProfitStockpilePastures.pdf.

*Renovating Hay and Pasture Fields.* Garry Lacefield and Ray Smith. 2009. http://www.uky.edu/Ag/Forage/agr261%20(2).pdf.

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