  

Iowa Cow-calf Production – Exploring Different Management Systems

Sustainably Growing Iowa's Beef Herds: Evaluating Systems That Provide Economic Opportunities While Protecting Soil and Water Resources

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Acknowledgments

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Introduction

Overview of the Cow Systems Project

This project was designed to identify costs, environmental impacts, and best practices from Iowa cow-calf operations based on three production systems. Twenty-eight producers from across the state partnered with the Iowa Beef Center at Iowa State University to assess emerging beef cow management technologies, detail benchmarks, and summarize production and environmental data. Ultimately, the goal of the project was to develop decision aids and educational tools to assist Iowa cow-calf producers across all production systems and improve sustainability of the cow-calf segment in Iowa.

Photo by Erika Lundy.

For the purpose of this project, cooperating producers were categorized into one of three production management systems:

1. traditional grazing (grazing approximately 50 percent of the year);
2. extensive grazing (grazing 75 percent or more of the year); or
3. limited or no grazing (grazing less than 25 percent of the year).

Data collected included production cost records, forage quality, feeds and rations, soil samples to review fertility, and soil loss based on land use and conservation methods implemented. Cooperator case studies were developed to demonstrate successful practices in each production system. Example budgets and decision tools are being developed to assist new or expanding operations evaluate which system best fit individual operation resources.

Executive Summary

Iowa is home to 4.2 percent of the United States' beef cattle inventory, the seventh-largest number of any state in the country. As of January 1, 2018, Iowa had the tenth largest beef cow herd with 970,000 cows. Land use in Iowa has changed dramatically since 1997, with approximately two million less acres in cropland pasture and associated losses in hay production (88 percent loss), while beef cow numbers in the state have declined only 14 percent.

The state has abundant feed resources including forages, grains, and grain by-products. The current emphasis on improving water quality has added an incentive to increase both annual and perennial forages across the landscape, further supporting the beef industry. Beef cow-calf production has been successful in many different types of environments and with different types of resources.


Photo by Erika Lundy.

Although there are variations within each system and overlap between systems, this project characterized three systems. The traditional or conventional system consists of pasture grazing during the growing season and winter feeding of harvested or purchased feed in either a lot or open area. The second is an extensive grazing system which aims to have cows grazing at least 75 percent of the year with little supplemental harvested or purchased feeds. The last system is a limited grazing system where the majority of feed is harvested or purchased and cows are confined in a building or drylot for a majority of the time. In some cases there is limited grazing of small pastures or crop residue with this system for less than 25 percent of the year.

This project worked with 28 cooperating producers to assess emerging beef cow management technologies, summarize production and environmental data, develop decision aids and educational tools to assist Iowa cow-calf operators, and improve sustainability within all major cow-calf production systems in Iowa. Cooperating producers were categorized into one of the three management systems. Data collected included production cost records, forage quality, soil samples, and soil loss based on land use and conservation practices. Cooperator case studies were developed to demonstrate successful practices in each production system. Example budgets and decision tools to assist new or expanding operations evaluated which system best fit their individual resources.

On average, limited grazing herds had the highest cost of production in this project, followed by traditional herds, and extensive grazed herds had the lowest cost. However, there was much variation regardless of system type. All three systems have the potential to be low-cost operations provided managers pay attention to feed and ownership costs.

A summary of feed resources utilized by the cooperators suggest that a diverse mix of feedstuff and pastures are available. Each producer has the ability to utilize the wide range of available feeds by nutrient testing, supplementing as appropriate, and capitalizing on available resources. While pasture availability may be limited in some regions of the state, the cost per cow-calf pair is competitive with other regions of the U.S. due to productivity.

Each operation poses unique animal health issues. The principles of animal health practices are similar regardless of production system, but there may be differences in disease risk based on system and associated management practices.

When well managed, cow-calf enterprises can have a positive impact on the environment. Incorporating rotational or permanent pastures into crop rotations increases organic matter and reduces soil erosion. Feed production can impact the environment either positively or negatively. When corn silage is chopped, the addition of cover crops in the rotation reduces soil erosion. Long-term pastures increase soil organic matter and recycle phosphorus and potassium from manure. Manure provides phosphorus and potassium for forage or crop production, however nitrogen contribution can vary based on handling and system.

Opportunities to add value exist for beef cow systems. Limited grazing systems lend themselves to advancements in technology such as embryo transfer, while extended grazing systems have the ability to market grass fed beef direct to consumers.

Some keys to success are critical in all systems, such as optimum reproduction, feed cost management, risk management, use of good genetics, adoption of appropriate technologies, and optimum marketing of calves and cows. Financial management, debt management, and access to capital are also keys to business sustainability across all systems. Within systems, extensively grazed systems benefit from improved pasture management, parasite control, and minimizing machinery expenses. Traditional systems must reduce winter feed costs, improve pasture management, and utilize corn residue and cover crop grazing. Limited grazing systems must manage year-round feed costs, watch for health issues, take advantage of manure value, and control facility and machinery costs.

Photo by Erika Lundy.

Photo by Denise Schwab.

Chapter 1: Current State of the Beef Cow-calf Industry in Iowa

Iowa is home to 4.2 percent of the United States' beef cattle inventory, the seventh-largest number of any state in the country. As of January 1, 2018, Iowa had the tenth largest beef cow herd with 970,000 cows. Land use in Iowa has changed dramatically over the last 20 years, with over two million fewer acres in cropland pasture and associated losses in hay production (88 percent loss), but beef cow numbers in the state have declined only 14 percent (Figure 1.1). Since 2012, according to the United States Department of Agriculture (USDA) National Agricultural Statistics Service (NASS), beef cow numbers in Iowa have recovered to nearly 1 million head, however it is unlikely that the pasture base has increased at a similar rate.

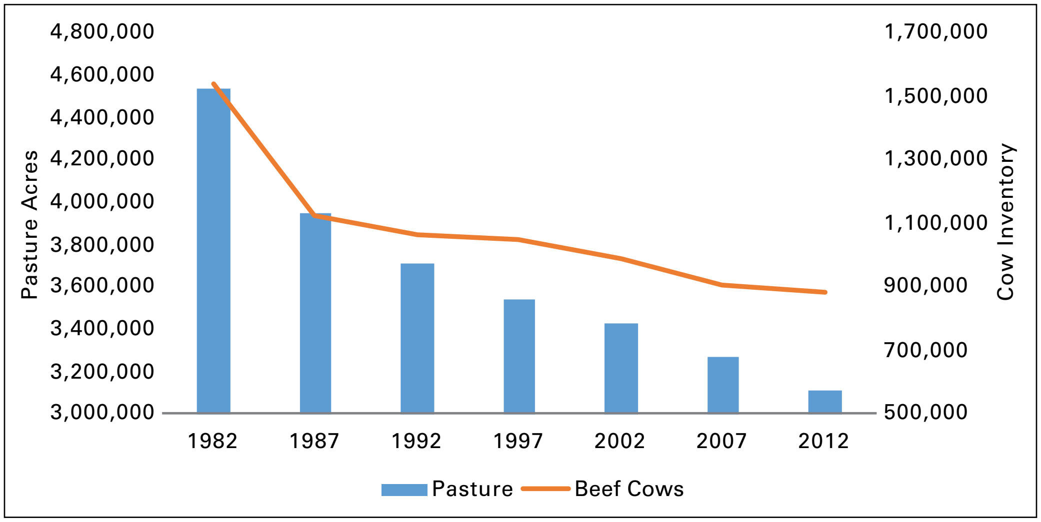

Figure 1.1. Number of pasture acres (left) and number of beef cows (right) in Iowa, 1982-2012.

Over the last 15 years, beef cow body weights have increased roughly 100 pounds based on cull cow slaughter weight changes. Beef production in 2017 was 26.2 billion pounds, with about 40 million fewer total cattle than 1975. Ultimately, the beef cattle industry is getting more beef from fewer cattle, and with fewer pasture acres. This indicates more efficient utilization of the existing forage resource base as well as enhanced productivity.

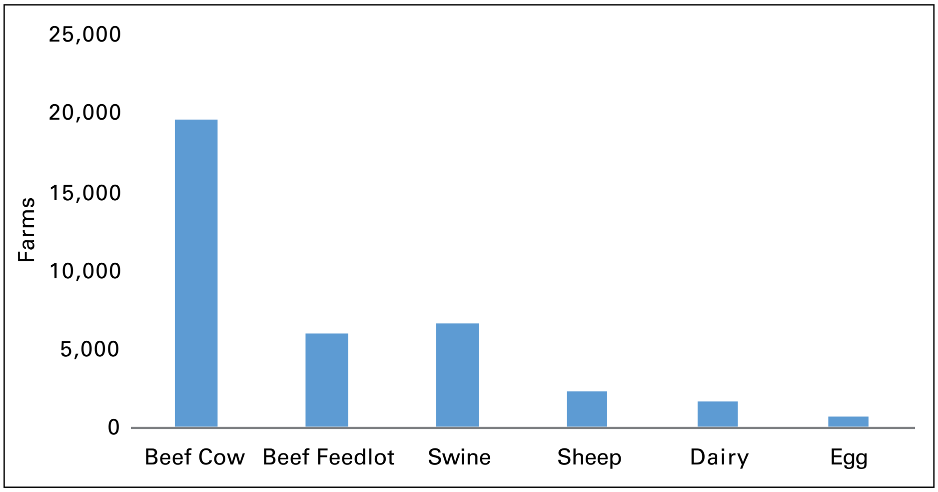

Figure 1.2. Numbers of operations by type of livestock, 2012.

With nearly 20,000 beef cattle operations in Iowa, nearly one in three farms have beef cows (Figure 1.2). The average beef cow operation in the state has 45 cows, however the size of operations vary widely from less than 10 head to more than

2,500 head (Figure 1.3). These operations range from small cow herds that utilize small pasture areas as part of a larger farming operation or acreage to larger more extensive operations that utilize a large forage base or integrate the beef cow operation into a more extensive farming system. Creative use of feed resources that can be developed as part of the overall farming enterprise represents the best potential for beef cow herd expansion in Iowa.

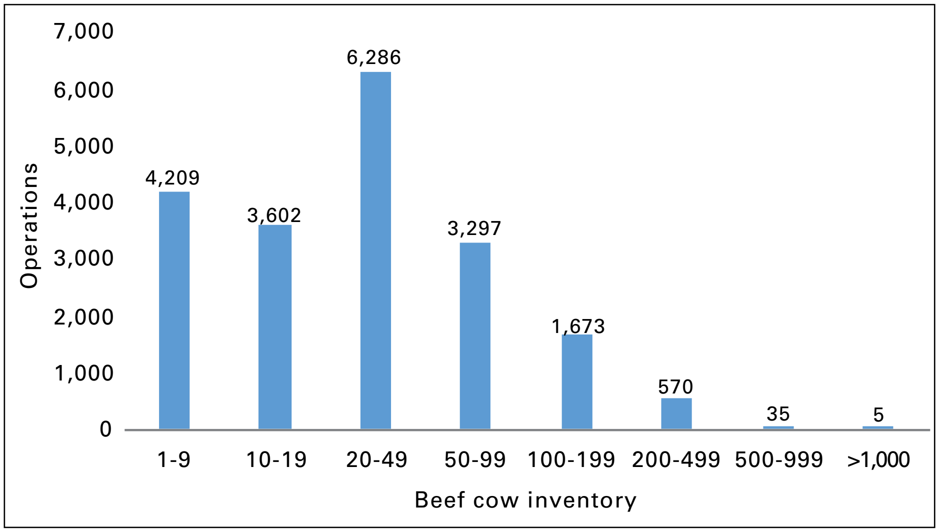

Figure 1.3. Beef cow operations in Iowa by size, 2012.

Beef cow operations are in every county in Iowa, but the highest concentrations have historically been in counties with more pasture and forage acres (Figure 1.4). These tend to be southern Iowa and along the rivers where the land is less suitable for grain production. A recent shift was seen in the 2012 USDA Census of Agriculture, with beef cow numbers increasing in northwest Iowa. This may be due in part to an increase in southern, drought affected cows filling some excess feedlot capacity, or to feedlots expanding into the cow business to control some of their own feeder calf supplies. Nevertheless, the data published in the 2017 USDA Census of Agriculture will determine whether this influx of cows was a short-term trend or has been maintained since 2012.

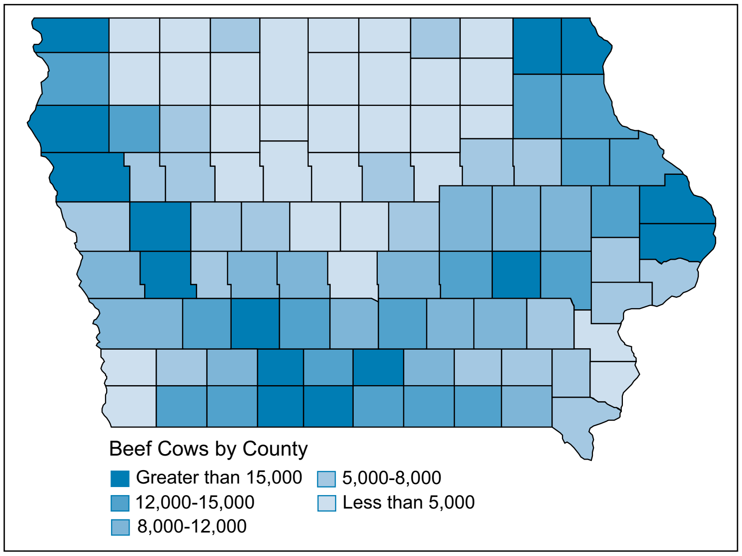

Figure 1.4. Beef cow inventory by county, 2012.

Resources – Land, Cattle, and Feed

Although the Iowa pasture base has been shrinking, the state has abundant feed resources, and a current emphasis on improving water quality has added an incentive to increase forages across the landscape. The Iowa Nutrient Reduction Strategy has established a goal of at least a 45 percent reduction in nitrogen and phosphorous leaving the state in water. Establishing perennial forages and using cover crops in cropping systems have been found to have the largest effect on reducing nutrient loads from Iowa farms. Iowa beef producers are leaders in the adoption of cover crops and over 85 percent of Iowa's pastureland is grazed by beef cows. Increased implementation of water quality programs provide the opportunity to both slow the shift in land use away from pasture as well as to increase the availability of high quality forages in the form of cover crops, therefore improving the

Photo by Erika Lundy.

forage base available for grazing cattle. The use of cover crops to both conserve soil and provide a feed source for cattle is of growing interest and provides potential for significant growth.

While the availability of pastureland in Iowa is limiting, the productivity of pasture is not. Grazing acres are expensive in many regions, but Iowa actually has a competitive advantage. Iowa has an estimated 13 million acres of corn stalks available for grazing or sustainable harvest. This represents an almost unlimited forage supply. Additionally, Iowa produces over 25 percent of the U.S. corn ethanol supply, making distillers grains widely available and typically at competitive prices locally. With proper supplementation and thoughtful consultation with a nutritionist, these two feedstuffs can form the base of a low-cost beef cow diet. This will be examined further in the feed section of this publication.

With 1.3 million head of cattle on feed in January 2018, Iowa is the fourth largest cattle feeding state in the nation. Iowa's vibrant beef cow industry contributes to the state's large and thriving cattle feeding industry. The quality of the feeder cattle raised or purchased and fed in Iowa, along with the feedstuffs used to finish the cattle, results in Iowa having a higher relative percentage of cattle grading USDA choice and prime. Opportunities exist to further add value to Iowa-born calves through cooperation and information exchange. The Iowa cow-calf industry is well equipped to participate in process verified programs.

Challenges

In 2014, the Iowa Beef Center conducted a statewide survey of cow-calf producers to evaluate the opportunities and challenges for growth in Iowa. Land use and land access were among the limitations identified for herd expansion. Competition from non-cattle production, including use of land for row crop production, the Conservation Reserve Program (CRP), and recreational use affected producers' ability to buy or rent additional hay or pasture acres according to 63 percent of the survey respondents.

Another challenge identified in the survey was the entry of young producers into beef cattle production. The average age of respondents was 60 years old, with less than 34 percent under the age of 54. Of those respondents, 44 percent expect to be raising beef cattle for less than 10 years. A staggering 33 percent of these producers have no succession plan in place. Environmental regulations (73 percent of respondents), land tax policy (55 percent), labor availability and cost (51 percent), expansion of row crop acres (50 percent), and capital availability and cost (41 percent) were viewed as obstacles for future generations to enter cow-calf production.

Long-term profitability of cow-calf operations fluctuate considerably over time, also challenging producers. Since the mid-1970's, the Livestock Marketing Information Center (LMIC) has estimated annual cow-calf returns based on a typical commercial, full-time spring calving and fall weaning operation. Those estimates are not survey based and do not represent an individual ranch or farm, but instead are developed for general context and market analysis purposes. They only include cash costs of production and pasture rent and do not include owner management or labor costs. Cow-calf returns for 2014 and 2015 exceed $500 and $300 per cow, respectively, when previously, returns over cash cost greater than $100 characterized very favorable years (Figure 1.5). These profit levels led cow-calf producers to "bid away" margins in the form of buying (or retaining) replacement females to expand their herds. These adjustments returned the cow-calf sector to more typical levels of profitability in the last several years.

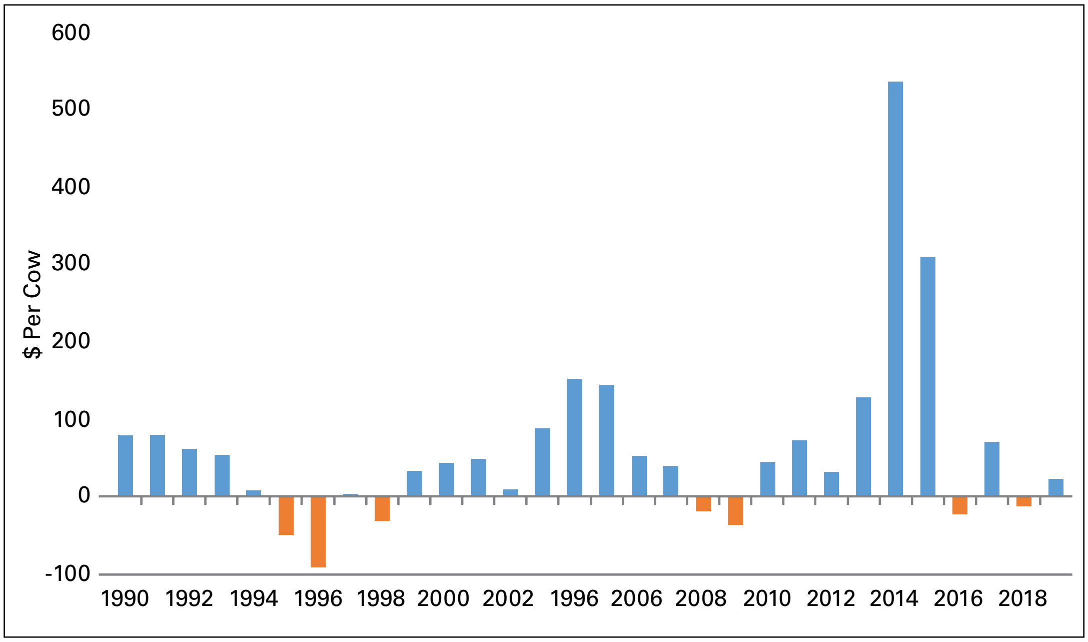

Figure 1.5. Estimated cow-calf returns above cash costs.

There is tremendous variability in profitability across producers. Using farm records from cow-calf enterprises enrolled in the Kansas Farm Management Association (KFMA) between 2012 and 2016, Dustin Pendell, professor of agricultural economics at Kansas State University, and Kevin Herbel, executive director of the KFMA, estimate there is a 0.38 correlation between gross income and profit of cow-calf operations and a -0.86 correlation between total cost and profit, clearly highlighting that total costs have a much greater impact on profit than gross income for cow-calf operations. This suggests that even in relatively low price years, some producers are likely still profitable because of their ability to manage costs.

Research has also found evidence of economies of size (i.e., decreasing costs as size of operation increases) in beef cow-calf production. Significant economies of size are achieved by moving from the 20-49 cow herd size to the 50-99 cow herd size. Between the 50-99 cow and 200-499 cow herd sizes, operating and operating plus capital costs per cow are much the same. Total economic costs, primarily due to charges for unpaid labor, reveal economies of size across all size groups, and the largest farms (>500 cows) have significantly lower costs per cow than all other farms. Capital and labor costs are much less on larger operations because they are able to spread fixed units of these resources over greater production.

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Chapter 2: Beef Cow-calf Systems – Overview and Characteristics

Beef cow-calf production has been successful in many different types of environments and with different types of resources. Previous data suggests that the costs and profitability between cow-calf operations have been extremely variable. This overview will characterize and describe three different production systems being used and explored primarily in the Midwestern United States. A production system, for this discussion, is referring to what resources are used and how the resources are connected and organized to make a successful beef cow-calf production operation.


Photo by Matthew Haan.

The main resources needed and used in beef cow-calf production, in addition to the animals themselves, are feedstuffs, labor, facilities, and equipment.

Although there are variations within each system and overlap between systems, cooperator herds in this project were described and characterized into three systems. The **traditional** or conventional system consists of pasture grazing during the growing season (approximately half the year) and winter feeding of harvested or purchased feed in either a lot or open area. Grazing methods and facilities vary widely across this system.

The second is an **extensive grazing** system which aims to have cows grazing at least 75 percent of the year with little supplemental harvested or purchased feeds.

The last system is a **limited grazing** system where the majority of feed is harvested or purchased and cows are confined in a building or drylot for a majority of the time. In some cases there is limited grazing of small pastures or crop residue with this system for less than 25 percent of the year.

Regardless of system, the goal of a producer is to utilize resources available to them to achieve a profit. Cost management and optimizing the value of calves is essential to be competive. Achieving an optimum reproductive rate, keeping animals healthy, and controlling feed cost while still meeting nutritional needs are essential parts of any system. The intent of this project is not to compare systems directly or to rank systems based on cost or productivity, but rather provide considerations when choosing a management system and discuss potential opportunities and challenges with each system.

Characteristics of Cow Systems

Traditional Beef Cow Management

Photo by Erika Lundy.

The traditional management of beef cow herds in Iowa has involved a mix of grazing during the growing season and feeding harvested forages in the winter months. This system can work for various sizes of operation if the pasture acres are available. Pasture acres determine the size of the operation. With the growing or grazing season stretching from April through October, this system has also worked well with a spring calving season.

Managed grazing technology such as subdividing pastures can be applied to large or small herds, and operations with 25-1,000 cows can efficiently deliver hay for wintering diets.

Feed has always been a major cost in beef operations. Past records summarized in 1997 in "A 13-Year Summary of the ISU Beef Cow Business Record" found that feed was the largest single cow cost category, with 45 percent of the feed cost being pasture (Figure 2.1). Harvested forages, purchased feeds, and non-forage raised feeds (grains) account for 27, 16, and 11 percent of feed cost, respectively.

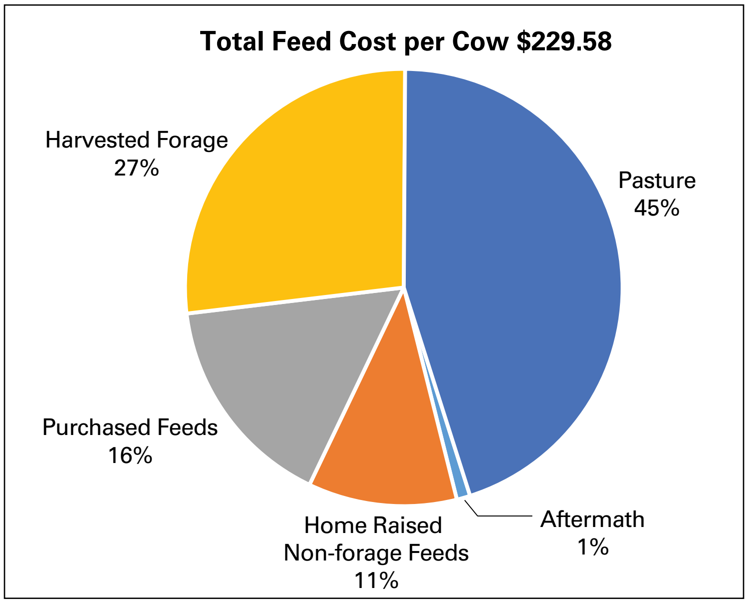

Figure 2.1. Beef Cow-calf Economic Feed Cost per Cow, Iowa 1997.

With increasing pasture costs, pasture productivity has been emphasized. Many operations have used managed grazing to increase pasture productivity and relied on hay, corn residue, and corn coproducts for winter feed sources. Management intensive grazing of pasture may increase grazing days by over 30 percent compared to continuous grazing. Iowa beef producers also may initiate corn residue grazing soon after harvest.

Further analysis of 225 observations from 1996-98 of commercial herds in Iowa and Illinois found that feed cost was the overriding factor driving return to labor and management (RLM) in both the financial and economic analyses. In both analyses, over 50 percent of the herd-to-herd variation in RLM could be explained by feed cost.

With higher cost and lower supply of hay, the importance of reducing hay harvest, storage, and feeding losses in traditional systems is critical.

Successful traditional systems need to use best management practices for both grazing and stored feed delivery. Getting more grazing days on the same pasture acres is a great way to reduce costs, and developing lower cost rations can reduce wintering costs. Reducing waste in storing and delivering forages for winter feeding is also important. Data reported by the University of Missouri in Table 2.1 demonstrates the range of losses expected in various feeding systems. Most producers in Iowa feed raised or purchased hay as the main feed resource in wintering beef cows.

Table 2.1. Estimated losses (percentage of hay offered) from different hay-feeding methods.

Bale type	With rack		Without rack	
	1-day supply	7-day supply	1-day supply	7-day supply
Small square bales	3.9 percent	4.1 percent	6.7 percent*	
Large round or square bales	4.9 percent	5.4 percent	12.3 percent*	43.0 percent*
Formed haystacks	8.8 percent	15.0 percent	22.6 percent	41.0 percent
Small round bales (fed in place on pasture)			10.0 percent	30.0 percent

*Bales spread or unrolled across pasture

Due to the loss of hay and pasture acres, and the cost of hay-based diets, many producers use other feed sources in traditional systems. These include low quality forages such as corn crop residues combined with corn and soybean coproducts. Many of the same ration strategies used in limited grazing systems also can help reduce costs on traditional systems.

Another cost containment strategy in traditional systems has been to get more grazing days on the managed pasture and crop residue acres and reduce the amount of stored feed consumed. Research has shown that, under positive weather conditions, one acre of corn residue can provide sixty days of grazing for a 1,000-pound animal (sixty animal-unit grazing days). Strip grazing can also extend the amount of grazing days. These practices are important for both extensive and traditional systems.

Extended or Year-round Grazing

As feed costs represent nearly 50 percent of the total costs associated with cow-calf production, minimizing the amounts of stored feeds like hay fed to beef cows provides an opportunity to significantly improve profitability of cow-calf enterprises. Unfortunately, since hay feeding is the traditional management approach for maintaining beef cows during winter and producers may have considerable investments in hay harvest equipment and storage facilities, some producers are reluctant to consider other approaches to meet the nutritional needs of beef cows during winter. However, hay feeding really should be considered a tool to manage the risks of winter weather limiting the ability of cattle to meet their nutritional needs by grazing due to inadequate forage mass or quality as well as excessive snow and, more importantly, ice cover. In this context, one may consider whether these risks are worth the investments involved in hay harvest, storage, and feeding and whether less expensive risk management options exist, particularly for young cow-calf producers lacking the capital to purchase hay equipment. Corn crop residues, cover crops, and stockpiled perennial forages provide resources to extend the grazing season into, or in some cases throughout, the winter in the Midwest. However, to optimize the value of these resources, appropriate management of production and allocation of the forages is essential.

Photo by Joe Sellers.

Corn crop residues represent a largely underused resource for grazing beef cows in Iowa and other Midwestern states. The amount of corn crop residues remaining after harvest approximately equals the amount of grain harvested. However, the husks and leaves which the cows will consume with any dropped grain comprise nearly 30 percent of crop residue weight. As cows may consume half of the available husks and leaves, a corn field yielding 180 bushels of grain per acre will supply nearly 1,500 pounds of grazable forage per acre. With the differences in forage quality, results of numerous studies in Iowa have shown that grazing 2.5 acres of corn crop residues per cow reduced annual hay needs by nearly 1,800 pounds per cow. Controlling allocation of corn crop residues to strips with electric fence that are opened every two to four weeks will extend forage quality and quantity later into the winter to better match the increasing nutrient requirements of spring-calving cows. Many producers do not utilize corn crop residue grazing because of concerns about soil compaction, but studies have shown that grazing corn crop residue does not affect and in some cases increases yields of subsequent crops, particularly if cows graze on frozen soils and are removed before spring thaw.

Cover crops such as small grains like rye, wheat, or oats or brassicas like radishes and turnips planted in row crop fields may provide high quality forage to supplement crop residues, particularly with adequate soil moisture. Spring wheat and oats grow rapidly in the fall and provide forage for fall grazing before being killed by winter conditions. Because of their winter hardiness, winter wheat and cereal rye are better suited to provide spring grazing. In order to maximize forage yield and winter survival, cover crops may be planted into standing crops by aerial or high clearance seeding. However, because of poor seed-soil contact, seeding rates of cover crops seeded by these methods should be two or more bushels per acre. Drilling at one bushel per acre is possible after row crops are harvested, but is most effective if done after harvest of corn silage or other early-harvested crops. If cover crops are to be used for grazing, it is essential to determine whether herbicides used for growing the row crop are compatible with grazing of specific cover crops. Furthermore, cow-calf producers need to be aware of some health problems like bloat, nitrate or sulfur toxicity, or grass tetany associated with growth conditions for specific small grain and brassica species.

If cow-calf producers have inadequate access to crop residue fields for winter grazing, perennial forages may be stockpiled in the late summer and early fall to provide forage for winter grazing. Because of their ability to grow at cool temperatures, grass species like tall fescue and orchardgrass are best for stockpiling. However, smooth bromegrass may be effectively stockpiled as well. Kentucky bluegrass, reed canarygrass, and all warm season grass species are unsuitable for stockpiled grazing. Legumes like red clover may be stockpiled for fall and early winter grazing, but because of high weathering losses, grazing of stockpiled legumes should be concluded by mid-winter.

Photo by Joe Sellers.

Keys to successful use of stockpiled forages include the length of the stockpiling period, nitrogen fertilization prior to stockpiling, and the method of allocation. While yield of stockpiled forage increases with the length of the stockpiling period, stockpiling should not begin before early August in Iowa to ensure high forage quality. Because the concentration of toxic alkaloids increase as endophyte-infected tall fescue matures, avoiding stockpiling before August is particularly important if the pasture contains endophyte-infected tall fescue. To prevent excessively mature stockpiled forage, stockpiling may be initiated by mechanical clipping with or without hay harvest or by grazing at increased stocking densities. Fertilizing with nitrogen at 40-100 pounds per acre will increase stockpiled forage yield and crude protein levels by 50-100 percent. However, applying greater than 50 pounds nitrogen per acre to endophyte-infected tall fescue will increase risks of fescue toxicity. To maximize the effectiveness of nitrogen fertilization on forage yield, the fertilizer should be applied as soon after the initiation of stockpiling as possible. Similar to crop residues, rationing stockpiled forage in strips with electric fence moved every 2-4 weeks will extend yield and quality throughout the winter to better match the nutrient requirements of spring-calving cows.

If adequate forage mass and quality in the form of crop residues or stockpiled forages are present in fields or pastures, the only factor limiting the availability of forage for grazing are weather conditions. While cows will readily graze high quality stockpiled forage through 12 or more inches of snow, grazing may be prevented by as little as 1/4 inch of ice. Thus, a risk management plan for short-term nutritional supplementation should be prepared before the initiation of winter grazing. This supplementation may be in the form of hay, harvested crop residues with or without grain processing coproducts like corn gluten feed or distillers grains, or limit-feeding of grain processing coproducts. Regardless of the feed used, pregnant cows should only be supplemented to maintain a body condition score of 5-6 on a 9-point scale as both thin and excessively fat cows may have reproductive problems.

Limited Grazing Cow-calf Production Systems

Lack of available pasture has led some cow-calf producers to consider and implement limited grazing production systems as alternatives to traditional pasture systems. Of course this requires delivering feed to the cows versus the cow harvesting the feed.

With pasture often unavailable in desired locations, some producers have explored implementing limited grazing systems rather than increasing, renting, or purchasing pasture acres. Limited grazing systems may allow producers to house cattle at a central location where they have better access to care for the cattle. Although feeding, bedding, and manure handling represent significant labor demands, this labor is more consistent than most grazing systems. Proximity to home and housing in a confined space may allow producers to check on animals more frequently, catch any health issues that may arise, and provide treatment when needed more easily as opposed to grazing systems. Particularly during breeding and calving season, the ability to check frequently and offer timely assistance can be a great advantage of limited grazing systems.

Photo by Erika Lundy.

Some producers have explored limited grazing systems as a means of expansion to bring in the next generation. Many young producers would like to return home and join the family business, but often that business must expand to support additional partners or employees. Limited grazing systems may allow producers to expand cowherds on a given land base. Various partners within the operation can then share in the daily management and labor required of limited grazing systems.

Limited grazing cow-calf production can be done in drylot settings or under a roof in deep-bedded buildings. Calving under roof or in drylots is not a new concept in Iowa. Many traditional producers utilize pastureland during the grazing season but have some type of confined winter feeding and calving area. Often times, cows are placed on a sacrifice paddock or drylot with varying degrees of access to shelter for a period of time during the winter months, leading up to and sometimes through the calving season. However, with reduced land access and high land prices, some producers are exploring more long-term confinement.

Photo by Denise Schwab.

Cow-calf production in drylot settings have been studied at North Dakota State University and the University of Nebraska-Lincoln and have demonstrated that cow-calf herds can be successfully managed in limited grazing systems. It is important to keep in mind, however, that their more western climates are drier and thus more accommodating to this type of system, and these studies do not include confinement under roof. It should also be noted that annual cow costs can be quite high in limited grazing systems. The most recent Nebraska study showed the confinement system was only competitive with grazing systems when corn stover residue was grazed throughout the fall and winter season.

When considering systems and land versus confinement facilities, producers must consider the attributes and long-term value of each investment. Producers must also consider costs associated with additional equipment that may be necessary for management of some systems. For instance, management of confinement facilities often require the purchase and maintenance of several pieces of equipment including tractor, manure spreader, mixer wagon, skid steer, bale processor, and possibly more. If already operating a feedlot and utilizing such equipment, it may make sense to spread the equipment cost and use over an additional enterprise. For start-up operations, however, purchase of this equipment can add significantly to initial investment costs and associated fixed costs.

One potential advantage of a limited grazing system is the ability to more effectively control diet, intake, and feed costs. Utilization of a total mixed ration (TMR) may facilitate the use of more cost-effective feeds and may allow producers to more precisely meet the nutritional requirements of cattle. Because of the reduced physical activity and a more controlled environment, it begs the question of whether nutrient requirements for maintenance of cows in these systems may be reduced. However, minimal research is available on this topic. Data from producers in this project did not indicate that limited maintenance diets are being used. Additional research is also needed regarding the long-term effects of reduced physical activity on the health, performance, and longevity of beef cows.

Photo by Denise Schwab.

Facilities must be designed and managed to allow adequate pen space and bunk space. Cows require significantly more space than feedlot cattle, and calves at side will require additional space. If utilizing a drylot scenario, a general rule of thumb is 500-800 square feet per pair, although appropriate square footage will vary depending on climate, drainage, and pen design. Adequate bunk space is also critical and, depending on design, bunk space is often a limiting factor in pen density. For fence-line bunk systems, a reasonable recommendation is approximately two feet of linear bunk space per cow and up to 2.5-3 feet of bunk space per pair. Based on common building dimensions this would result in 80-150 square feet per cow or per pair. The lower end of this range might be sufficient for dry cows, but during calving season and throughout lactation the upper end of this range is probably much more appropriate. In terms of animal health and welfare, these estimations should be thought of as minimums, as cattle could certainly benefit from more space. More research is needed on minimum space requirements for cows confined in buildings.

Once calves are born, calf safety becomes a concern, as injuries are very possible in these confined spaces. Creep or refuge areas should be provided for calves to allow a safe resting area out of harm's way. Additionally, feed bunks and waterers must be appropriate height to make them accessible for cows and newborn calves.

Regular management and maintenance of the bedding pack is extremely important for limited grazing systems. Buildings protect not only the animals but also the bedding and ground surface from the moisture of rain and snow. Maintaining a dry bedding pack is critical for animal health and welfare, especially during calving season. At the Iowa State University Armstrong Memorial Research and Demonstration Farm, approximately 5-6 pounds of bedding per head per day is used for feedlot cattle housed with 40-50 square feet of pen space per head. It is safe to assume it will take twice that much bedding to adequately bed cows and calves in confinement.

In limited grazing systems under roof, bedding is required throughout the entire year so bedding supply is very important and can represent a significant cost. In drylot systems, bedding is required primarily during the winter and during calving season. Producers using limited grazing systems need an adequate land base to supply feed and bedding. Corn stalk residue is commonly used for bedding and can be an important component of many rations. Cropland is also important as a site of manure distribution upon cleaning of the buildings. Like other production systems, limited grazing systems can take advantage of natural synergy between row crop and beef cattle production. The cattle operation can make good use of corn stalk residue both as a feed ingredient and as the primary source of bedding. The cropland can then make good use of the manure, applied as fertilizer.

Photo by Chris Clark.

Greater concentration of animals in limited grazing systems may facilitate the spread of disease. Contagious diseases may spread rapidly and outbreaks may be more intense as compared to grazing systems. Limited grazing producers should work with their veterinarians to develop herd health programs appropriate for limited grazing systems. Bedding management and sanitation are critical for health management of these systems. Additionally, biosecurity measures and vaccination programs may need to be strengthened to offset increased disease risk.

System Hybrids

Not all cow operations fit neatly into one of these three systems. Many incorporate components of multiple systems, such as Mike and Curt Clark's operation near Yale, Iowa. They had enough pasture close to home for about half of their 160-cow herd, but were frustrated by the challenges and cost of renting additional pasture. In 2014, when the cost of feed dropped to about the same level as pasture rent and their calving facilities were in need of a facelift, they decided to build a 320 foot long hoop barn and keep the cows close to home.

All cows are calved inside the confinement and newborns are segregated by age. Around June 1, approximately 80 pairs go to grass while the balance of the herd remains in the building. This strategy opens up additional pen space, which is beneficial as calves get bigger. Following weaning the calves are kept inside and backgrounded until they are marketed in January or February while the cows are turned out to pasture. They also background and breed their heifers, which are then sold as first-calf heifers the following year. By utilizing existing pasture for part of the year, and keeping the hoop full year round, they they are reducing their annual building cost per female.

The Clark brothers note slight differences to raising cows in confinement; a different management skill-set is needed, and the labor is a bit more intensive. However, the Clarks can be more proactive when it comes to observing herd health as it is easier to closely monitor cattle since they are seeing them up-close every day. This allows any infections or illnesses to be quickly diagnosed and treated, before they become a severe issue.

Herd health must be a top priority because the animals live in such close proximity to one another. The Clark brothers believe that a good vaccination program is vital. They use the same type of vaccination program as many other producers and have not made any significant changes since moving the cows and calves to confinement. They note that when an illness enters the facility, not only can they detect it early, but they can address the issue by using extra bedding to ensure the environment is dry and by medicating the waterers to mass treat all calves.

Feet and skeletal structure are often a concern when raising cows in confinement, but the Clark brothers have not seen any significant issues. They even share that the condition appears to be less stressful on the cows' structure. They utilize a cornstalk bedding pack that is 3-4 feet deep, which allows a softer surface for the cows to walk and rest on compared to hard, frozen, and uneven ground.

They offer several pieces of advice to those considering raising cows in confinement. First, ensure the calves have some type of creep area or safe haven to prevent calves from getting stepped on by the cows. Second, it is important to keep the cows dry by ensuring pens are properly bedded and cleaned. They use about 11-12 pounds of bedding per cow per day. Lastly, keeping up on management and records is critical to a successful operation.

Other Considerations Between Systems


Photo by Erika Lundy.

In most Iowa and Midwest situations, cow-calf production is not the only enterprise on the farm. The cow-calf system that is used needs to match or integrate with other systems in terms of feed availability, labor needs, manure use, and enterprise compatibility.

Considerations when selecting a cow system include:

- Land resources, availability, and cost
- Feed resources available
- Labor availability and seasonality
- Existing cow herd and structure
- Enterprises to share machinery and equipment
- Capital available
- Weather, particularly during calving season
- Technologies to adopt, such as estrus synchronization, artificial insemination, and embryo transfer

No one system is perfect; each have advantages and disadvantages to consider. Budgeting and cost control are also critical for every system.

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Chapter 3: Cost of Production of Alternative Systems

Previous research has shown that cost of production for cow-calf operations has a much greater impact on profitability than gross income, and that there is a wide range of costs between producers. Therefore, managing and controlling an operation's cost of production is important for long-term business profitability. From an analysis standpoint, cost information is important for partial budgeting and assessing operational changes.

Photo by James Russell.

Twenty-four cooperators submitted enterprise records of their cow herd over the three years of this project (2015, 2016, and 2017). Eighteen cooperators completed all three years of the project and six cooperators participated for one or two years. In total 62 herd-years of data, or annual records, were available for comparison. There were 21 herd-years of limited grazing records, 28 were in the traditional system, and 13 were in the extended grazing system.

Cooperators provided cow herd inventory, feed usage and costs, operating costs, machinery and building values, and completed two questionnaires during the project related to their management practices. As is typical for many cow-calf operations, some of the data is estimated, particularly for feed quantities that are not weighed when delivered and costs that are allocated among various enterprises, including equipment costs. All costs were calculated per breeding female, which included all cows and replacement heifers, and averaged for the beginning and ending inventory. Bulls were not included in the breeding female numbers.

Herds were divided into the three production systems based on days grazing pasture versus days fed stored feed. Limited grazing herds grazed pasture for 90 days or less and were fed stored feed most of the year, traditional herds grazed approximately half the year and were fed stored feed the remainder of the year, and extensive grazed herds were targeted to graze pasture for 270 days or more. Several of the extensive grazing herds were required to provide supplemental feed at various times throughout the year, either in the winter or during drought conditions.

Table 3.1 shows the average and range of total cost of production including cost of asset ownership and unpaid labor for all records and by system. As in previous beef cow enterprise summaries there is large variability in costs but the averages provide evidence of key differences in costs. On average, limited grazing herds had the highest cost of production in this project, followed by traditional herds, and extensive grazed herds had the lowest cost.

Table 3.1. Production costs per female.

	All Records		Limited Grazing		Traditional Grazing		Extensive Grazing	
Direct Costs	**Average**	**Range**	**Average**	**Range**	**Average**	**Range**	**Average**	**Range**
Stored Feed Cost	$306	$45-955	$543	$318-955	$217	$59-375	$118	$45-192
Pasture Cost	$117	$0-482	$22	$0-108	$149	$42-482	$203	$93-324
Residue Cost	$6	$0-82	$1	$0-11	$12	$0-82	$2	$0-7
Total Feed Cost	$430	$167-955	$566	$322-955	$378	$167-857	$323	$192-520
Non-feed Operating Cost	$254	$118-744	$248	$133-400	$274	$118-744	$218	$133-306
Indirect Costs								
Ownership Cost	$286	$140-1,059	$443	$195-1,059	$210	$142-333	$195	$140-245
Unpaid Family Labor	$116	$0-313	$97	$0-218	$121	$22-313	$135	$92-221
Total Cost/Female	**$1,095**	**$615-2,340**	**$1,353**	**$909-2,340**	**$984**	**$615-1,978**	**$869**	**$746-1,017**

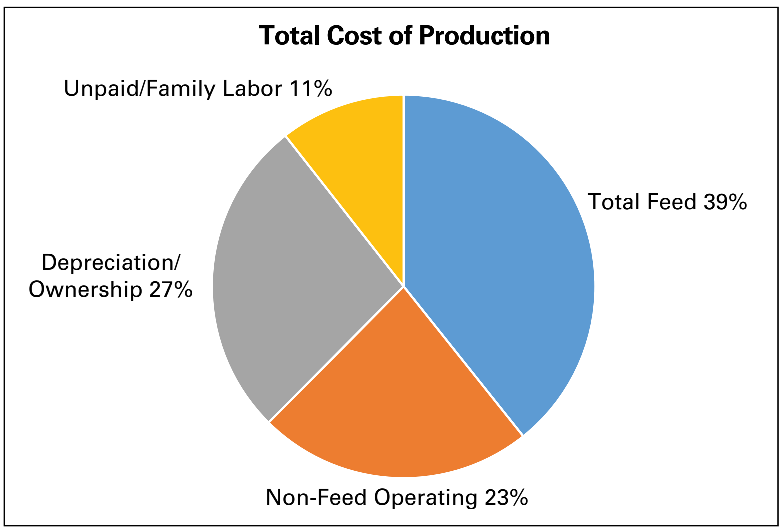

Figure 3.1. Total production costs – average of all herds.

Direct Operating Costs

Feed is the biggest single expense for cow herds, far larger than other direct costs. Figure 3.2 shows the average direct or cash costs for all herds.

Feed Costs

Many previous studies of cow-calf costs report that feed costs are the single largest cost for beef cow-calf producers, and this project also supports that observation. A 13-year summary of the ISU Beef Cow Business Records in 1997 and the Kansas Farm Business records summary from 2012-16 both showed that feed and pasture cost accounted for 48 percent of the total cost of production. In this project total feed cost across all systems was 63 percent of direct (cash) costs and 39 percent of total costs.

The most important factor for optimum production and profitability is to ensure the nutritional requirements based on production stage, genetics, body size, and environment are met. However, the combination of feedstuffs used to meet those requirements and the cost of ingredients can vary considerably. As such, to address differences in production costs, detailed feed cost data was collected. Feed cost was calculated in two ways; first based on the price cooperators provided, and second at a standardized market value to remove some of the variation between cooperators. In the data collection process cooperators were asked to put a value on the feedstuffs fed. Costs of producing feed or bedding on farm including machinery, labor, and land costs are assumed in the price of the harvested feed or bedding. Multi-year averages were calculated for feed costs for each of the 24 cooperators and averaged across the respective production systems.

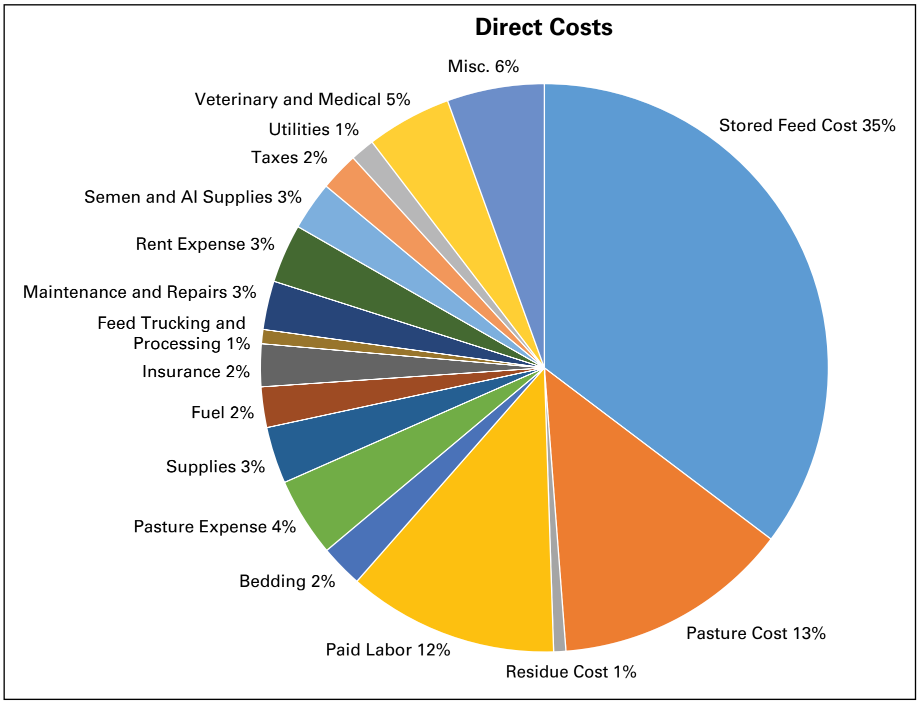

Figure 3.2. Direct operating costs.

Feed costs are separated into three categories – stored feed, pasture, and residue grazing, where stored feed represents all non-pasture feed costs (i.e., hay, supplements, harvested crop residues, grain) and residue grazing includes both crop residue and cover crops grazed.

Table 3.2 shows the average and range of annual feed costs (across all records and by system) based on the actual feed prices reported by cooperators, as well as using a standardized price for feeds. Standardized prices can be found in Appendix B. With both reported and standardized feed prices, feed cost for limited grazing operations was higher than that of traditional operations, with extensive grazing operations having the lowest cost. Half of the limited grazing production systems reported a creep feed cost ($112 per female per year), one-third of the traditional herds fed creep feed, while none of the extensive grazing cooperators fed creep feed. Creep feed cost was included in the stored feed category and charged against the cow herd. Post-weaning feed and costs were not included in any cow herd costs.

Photo by Chris Clark.

Pasture costs were calculated based on the rent actually paid or ownership costs provided by the cooperator. Actual reported pasture costs ranged from a low of $42 per female per year to a high of $482 per female per year, reflecting not only a large range in rented pasture costs across cooperators, but also differences in purchase price and grazing days. The average annual pasture cost per female was $117 per female per year. The average number of pasture acres per female was 1.8 acres for traditional grazing operations and 4.0 acres per female for the extensive grazing operations, reflecting the increased pasture needed for extended grazing. Grazing operations in the north half of the state averaged 1.6 acres per female, and those in the southern half of the state average 2.7 acres of pasture per cow. One component of the stocking rate difference between the two regions is most likely due to the length of the grazing season, as the average grazing season in the north half of the state has been reported to average 167 days while the southern half of the state average 208 grazing days.

Although operations reported in this project are limited, the results are consistent with a 2017 Iowa Beef Center survey of rented pastureland that reported an average stocking rate of 2.1 acres per cow-calf pair per grazing season with a range from 1.0-3.2 acres per pair, an average pasture rental rate of $58 per acre, and average annual pasture cost per female of $122.

In an effort to remove some of the variation of feed price valuation, costs of production were also calculated based on a standardized value for hay, corn silage, small grain silage, corn, and cornstalks based on the Iowa State University Ag Decision Maker Suggested Closing Inventory Prices (see Appendix B). Hay was standardized at $100 per ton, corn silage at $35 per ton, small grain silage at $40 per ton, cornstalks at $55 per ton, and corn at $3.50 per bushel. Actual feed costs were used for all other feedstuffs. Pasture cost was also standardized at a cost of $60 per acre based on the number of pasture acres actually grazed in the operation.

Table 3.2. Annual feed cost based on actual or standardized feed and pasture prices.

	Average All Records		Limited Grazing		Traditional Grazing		Extensive Grazing	
	Actual Prices	Standardized Prices	Actual Prices	Standardized Prices	Actual Prices	Standardized Prices	Actual Prices	Standardized Prices
Stored Feed Cost	$306	$314	$543	$519	$217	$251	$118	$121
Pasture Cost	$117	$103	$22	$12	$149	$107	$203	$242
Residue Cost	$6	$6	$1	$1	$12	$12	$2	$2
Total Feed Cost	$430	$423	$566	$532	$378	$370	$323	$365

Photo by Denise Schwab.

Looking at just stored feed or pasture alone does not tell the whole story. Stored feed and pasture cost are combined with crop residue and cover crop grazing for a total feed cost of $430 per female per year across all cow-calf systems.

An advantage of cow herds in the upper Midwest is the opportunity to graze crop residues to potentially reduce costs. Most cooperators may consider this “free feed” and had very little cost associated with residue grazing. While less than 25 percent of the cooperators grazed crop residue, those who did grazed an average of 59 days at a cost of $12 per female or only $0.20 per female per day. Some of the cooperators did not graze crop residue because they simply did not have access to residue in their region. A lack of fencing and available water sources are the two most frequently cited reasons for not grazing crop residue. Producers must balance the cost of building fence or developing a water source against the savings in feed costs by grazing crop residue. Another challenge to grazing both crop residue and cover crops is the extreme variability in weather risk. Producers need to have adequate forage supplies when the weather limits the ability to fall or winter graze crop residue or cover crops.

Herd Size or Region Effect on Feed Costs

There was about a $60 difference in stored feed costs based on herd size. The average cow herd size in this data set was 196, so records with less than 200 cows (38 records) were compared against records with more than 200 cows (24 records) in Table 3.3. According to the United States Department of Agriculture (USDA) 2012 Census of Agriculture, only 12.7 percent of Iowa beef cow herds had more than 200 cows, so the cooperators in this project were much larger than the state average.

Table 3.3. Annual feed costs based on herd size.

	Average All Records	<200 cows	>200 cows	Cornbelt (includes all records)	Grassland (includes all records)
Stored Feed Costs	$306	$330	$269	$363	$273
Pasture Costs	$117	$123	$108	$62	$150
Residue Cost	$6	$8	$3	$4	$8
Total Feed Cost	$430	$461	$381	$429	$431

Table 3.3 also compares feed and pasture costs for all records in the cornbelt region (northern Iowa) versus the grassland region (southern Iowa). Twenty three of the records were from operations north of Interstate 80 which was labeled the cornbelt of Iowa, and 39 records were from south of I-80 labeled as the grassland of Iowa. Stored feed costs were higher in the cornbelt region where many producers feed more harvested feed. The data also showed higher pasture cost per female for the grassland areas, where pasture and land rent is generally less expensive, but where more pasture acres and grazing days are available. Also more than half of the northern records were limit grazed operations with no pasture costs. The key message is that both northern and southern herds had about the same total feed costs.

Non-Feed Operating Costs

The average of total non-feed costs did not vary significantly by system, but the components of operating cost did. Custom and hired labor and benefits were the largest expenses for the limited grazing and traditional grazing systems but much smaller for the extensive grazing systems. Across all systems, veterinary medicine was the next largest expense, averaging $43 per female per year. There was less variation across systems in veterinary medical costs, although there was still much variation between producers. Other operating costs tended to vary by system. For the limited grazing systems, bedding, maintenance, and repairs tended to be higher than in other systems. Traditional grazing and extensive grazing systems had higher expenses in pasture related costs such as fencing, fertilizer, seed, lime, and herbicides. Again there was a large range in non-feed operating costs reported with a low of $118 per female per year to a high of $744 per female per year across all operations.

Photo by Samantha Jamison.

Several interesting observations were found that are likely due to inaccurate cow enterprise recordkeeping rather than true production differences. For instance, insurance and taxes were higher for the traditional grazing and extensive grazing systems than in the limited grazing systems. While this may be true, authors speculate that it might be easier to separate out property tax on pastureland rather than building and land in a confined system. About half of the limited grazing records utilize existing, older facilities but the other half have constructed new buildings, mostly hoop buildings, which should have increased the property tax on their building sites. Utility costs represent another questionable category. Limited grazing systems reported lower utility costs than did the other two systems. Some extensive grazing systems may utilize rural water or have separate utility bills for pasture water sources. Extensive grazing systems may focus on cattle production versus other enterprises so the cowherd may represent a greater proportion of total farm utility expenses. Considering watering strategies and electricity use, one might expect limited grazing systems to have greater utility expenses. These records may be accurate but it may also be that limited grazing systems did not appropriately allocate building site utility costs to the cowherd.

Table 3.4. Annual non-feed operating costs by system.

	Average All Records	Limited Grazing	Traditional Grazing	Extended Grazing
Bedding	$22	$25	$19	$17
Custom, contract, and hired labor	$108	$140	$100	$21
Pasture fence, fertilizer, seed	$39	$12	$47	$25
Cattle supplies and cow share of general supplies	$28	$21	$39	$16
Fuel, oil, and gas-cow herd share	$20	$23	$18	$22
Insurance-cow herd share	$21	$21	$21	$20
Maintenance and repairs-cow herd share	$24	$29	$23	$17
Rent expense	$29	$0	$34	$22
Semen and AI supplies	$24	$22	$24	$27
Taxes-cow herd share	$19	$5	$22	$34
Trucking and feed processing	$7	$9	$6	$6
Utilities-cow herd share	$11	$8	$11	$20
Veterinary and medical supplies	$43	$49	$32	$55
Dues, subscriptions and misc.	$46	$36	$45	$19
Total	**$253**	**$248**	**$274**	**$216**

What impact does herd size have on non-feed operating costs? In this project, those herds with more than 200 cows had a $26 lower production cost per female compared to herds with less than 200 cows, but it is interesting to look at where they differ. Two of the biggest differences are supplies and miscellaneous, where small operations have fewer cows to disburse the expense across. Larger herds had higher rent (other than pasture rent), hired or custom labor, fuel, and veterinary costs.

Table 3.5. Annual non-feed operating costs by herd size and region.

	Summary of 38 Records <200 Hd	Summary of 24 Records >200 Hd	All Cornbelt Records	All Grassland Records
Bedding	$20	$22	$12	$28
Custom, contract, and hired labor	$102	$101	$140	$69
Pasture fence, fertilizer, seed	$45	$31	$31	$41
Cattle supplies and cow share of general supplies	$37	$9	$18	$31
Fuel, oil and gas-cow herd share	$19	$22	$21	$20
Insurance-cow herd share	$21	$20	$23	$20
Maintenance and repairs-cow herd share	$27	$19	$29	$21
Rent expense	$32	$14	$14	$32
Semen and AI supplies	$26	$22	$20	$27
Taxes-cow herd share	$24	$13	$8	$21
Trucking and feed processing	$8	$5	$10	$6
Utilities-cow herd share	$16	$7	$8	$15
Veterinary and medical supplies	$42	$42	$43	$41
Dues, subscriptions and misc.	$58	$30	$27	$53
Total	**$268**	**$231**	**$220**	**$268**

Operating cost differences by region were very similar in most categories, but again slightly higher prices in those general categories are likely attributed to fewer enterprises to allocate general expense against, therefore most general operating expenses were charged to the cow enterprise.

Indirect Costs

Cost of Asset Ownership

There are many ways to calculate fixed or indirect ownership costs. Accuracy of asset valuation, purchased versus raised breeding stock, and fast depreciation schedules for tax purposes all are issues in determining a cost for assets. For the operations in this project, depreciable assets like buildings and equipment were valued at a current market value. For newer buildings and equipment this value would be similar to a purchase cost. For machinery or equipment that is used for other purposes in addition to the cow herd, the value allocated to the cow herd was calculated by taking the value multiplied by an estimated percent use in the cow herd. Machinery and equipment used for feed harvest was not included with the assumption that machinery was reflected in the cost of the home raised feedstuffs.

Photo by Dan Loy.

The annual ownership cost, which would represent depreciation and an opportunity cost on the value of the asset, was calculated by taking the value times a percentage. No salvage value for the asset was used in the calculation. For machinery and equipment a 10 percent factor was used and for buildings a seven percent factor was used.

For breeding stock, either the value the cooperators reported for breeding stock or an assigned value from published Ag Decision Maker Closing Inventory Prices was used and multiplied by 10 percent to calculate an annual cost representing depreciation and opportunity costs on the breeding stock investment.

Table 3.6. Asset value and ownership costs per cow.

	Average All Records	Limited Grazing	Traditional Grazing	Extensive Grazing	Records <200 cows	Records >200 cows
Average breeding female value	$1,758	$2,113	$1,615	$1,496	$1,863	$1,593
Machinery value/cow	$691	1,243	$398	$431	$773	$562
Building value/cow	$583	$1,531	$126	$37	$727	$356
Cow herd depreciation (10%) (based on producers valuation)	$176	$211	$161	$150	$186	$158
Machinery depreciation	$69	$124	$40	$43	$77	$56
Building depreciation	$41	$107	$9	$3	$51	$25

Often, machinery and building ownership costs are important at the time of purchase and initial tax depreciation, but are then forgotten or overlooked in terms of annual costs. Fast track depreciation likely further complicates this issue. The wide variation in cattle prices is also at play here, since many producers make major investments in years with high feeder calf prices, and tighten their belts in years with low feeder prices. However, annual costs of ownership should be considered in total costs of production. While this category is titled depreciation, it is really a broader component of total ownership costs which would include components of tax depreciation, interest, annual repairs, and value depreciation.

Table 3.6 shows the asset valuation and annual costs per cow overall and by system type and size of operation. On average limited grazing systems had higher machinery and building values and annual costs which would reflect newer buildings and more equipment for feeding and manure handling. But again, a huge variation was seen depending on the amount and age of “iron”, and other enterprises that share the machinery costs. Relative to breeding stock value and annual cost it should be noted that some operations had much higher breeding stock value than others. Those were typically seedstock operations or other value-added operations, many of which were in the limited grazing category. Herd size also had a significant impact on machinery, equipment, and building ownership costs, nearly doubling that expense in small herds. A minimum amount of tractor power, manure spreader, and feeding equipment is required regardless of herd size, making a much larger impact on smaller operations.

Labor

Most operations in this project relied on family labor for the cow herd, although some operations had paid labor. Family labor hours were estimated. Some cooperators recorded hours for short periods throughout the year that were extrapolated for an annual labor amount. Family labor hours were charged at $14 per hour. Those operations with hired labor reported the cost of labor as a cash operating expense as included in the direct costs. Table 3.7 shows labor hours overall, by system, and by herd size.

The Ag Decision Maker Livestock Enterprise Budgets use an estimate of eight hours of labor per cow. For this project, the overall average of 10 hours of total labor per cow per year did not vary greatly by system. However, there was a large range from 2-22 hours reported per cow, which probably reflects the difficulty in tracking and allocating labor used across enterprises.

Table 3.7. Labor hours per female by system (paid and unpaid).

	Average of All	Limited Grazing	Traditional Grazing	Extensive Grazing	Records <200 cows	Records >200 cows
Labor hours/female	10	9	11	10	12	8

Benchmarks

Benchmarking to compare operations is important, and several other published beef cow records are compared in Table 3.8. Each summary is calculated slightly differently, so use caution in making direct comparisons. In general, direct cow costs are likely based on cash costs similar to this project, and usually include all feed, pasture, veterinary, supplies, fuel, repairs, hired labor, and utilities. Indirect costs are likely based on very different assumptions and calculations, and in many cases may be based on a set percentage of the total farm machinery value, not specifically those items used by the cow herd.

A 13-year summary of 966 records in the ISU Beef Cow Business Record in 1997 showed that feed and pasture cost represented 48 percent of total cost of production, similar to this project. Total feed and pasture costs across all systems ranged from a low of $383 in Minnesota and the upper Midwest states to a high of $538 in Kansas; however, it is unclear if these other systems use cost of feed production or a current market value.

Table 3.8. Cost of production comparison.

	ISU Cow Systems Project 2015-17	ISU SPA 2012-17	2016 Illinois Farm Business	2016 FINBIN (Upper Midwest)	2016 ND Farm Business	2012-16 Kansas Farm Mgt Assn	2012-16 SW SPA
Number of farms	**62**	4	150	256	64	61	24
Ave # cows/herd	**196**	188	65	129	177	155	601
Feed cost/cow	**$306**	$392		$253	$349	$364	$270
Pasture cost/cow	**$117**	$106		$130	$174	$174	$130
Total feed and pasture/cow	**$423**	$498	$531	$383	$489	$538	$400
Direct cost/cow	**$684**	$601		$567	$514	$794	

Best Management Practices for Low-Cost Producers

The key to profitability is not necessarily knowing an average cost of a group of producers, but understanding what makes them low-cost and establishing targets for individual operations. Many production record datasets separate the top and bottom third of operations to make some comparisons. Table 3.9 shows the cost comparison of all operations in this dataset, the 21 records with the lowest direct cost per cow per year, and the 21 records with the highest direct costs. Records from all three production systems were included in both the low-cost and high-costs groups, indicating that management is more strongly associated with cost than is system type.

Table 3.9. Average costs for low cost operations.

	Average All Records	Average of 21 low-cost records	Average of low-cost using Standardized Feed Value	Average of 21 high-cost records	Average of high cost using Standardized Feed Value
Stored feed cost	$306	$159	$170	$507	$469
Pasture cost	$117	$123	$138	$106	$46
Residue cost	$6	$6		$5	
Total feed cost	$430	$288		$618	
Non-feed operating cost	$254	$200		$323	
Depreciation	$295	$214		$417	
Unpaid family labor	$116	$106		$126	
Total cost/female	$1,095	$808		$1,484	

Remember these observations are based on the limited operations included in this project, and thus may not be reflective of all operations. There was a large range in costs regardless of herd size which is consistent with the 1997 ISU Beef Cow Business Record summary.

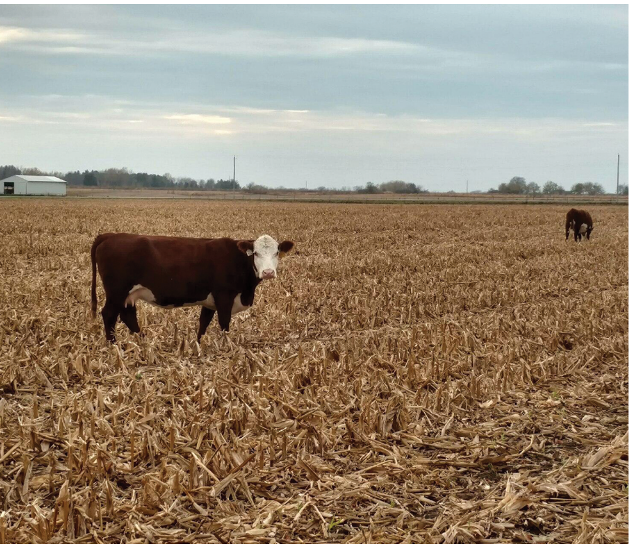

Photo by Patrick Wall.

Feed cost is the biggest factor affecting production costs. The low-cost group averaged $159 per female per year for stored feed and $123 for pasture for a total feed cost of $288 per female per year based on the feed cost they provided. When using standardized prices, feed cost per female per year was $170 and pasture costs was $138 per female per year. All low-cost herds used some form of hay as the base for their feeding program, although several used more haylage or baleage rather than dry hay as the foundation. All low-cost herds also utilized additional feedstuffs to keep the ration cost effective, with many using corn silage (78 percent), small grain silage (39 percent), and corn coproducts (61 percent). Surprisingly, only two utilized corn stover in the ration. All low-cost herds provided a mineral supplement, averaging $32 per female in salt and mineral. Only eight of the 21 records (38 percent) provided creep feed, at a cost of $14 per female. Low cost producers provided an average of 3,676 pounds of stored feed per female per year on a dry matter basis, ranging from 951 to 7,196 pounds. This is considerably lower than the overall average of 6,626 pounds of stored feed on a dry matter basis. This stored feed savings could be attributed to several management practices including extending the grazing season, limit feeding more nutrient dense rations, or reducing feed waste. Most of these low-cost operations also utilized pasture grazing to a large extent, with an average of 2.3 acres per female and a pasture cost of $123 per female per year. Seventy percent of low-cost operations utilized crop residue grazing to help control costs. Many of the low-cost operations also have multiple cattle enterprises such as feedyards or calf backgrounding, allowing them to take advantage of large quantities of inexpensive feeds, and to share the use of a feed wagon and tractor, spreader, and other equipment.

These low-cost operations also had lower non-feed operating costs which are shown in Table 3.10. The majority of the savings came from lower hired labor costs, supplies, and miscellaneous expenses. These savings may be a result of economies of scale, or from diversification of the operation.

Table 3.10. Non-feed operating costs of all records versus low-cost records.

Non-feed Operating Costs	Average All Records	21 Low-cost Records	21 High-cost Records
Bedding	$21	$22	$27
Hired and contract labor	$104	$63	$112
Pasture fence, fertilizer, seed	$39	$31	$95
Cattle supplies and cow share of general supplies	$28	$14	$51
Fuel, oil, and gas-cow herd share	$20	$16	$26
Insurance-cow herd share	$21	$21	$20
Maintenance and repairs-cow herd share	$24	$14	$41
Rent expense	$29	$0	$54
Semen and AI supplies	$24	$22	$28
Taxes-cow herd share	$19	$20	$22
Trucking and feed processing	$7	$5	$8
Utilities-cow herd share	$12	$10	$11
Veterinary and medical supplies	$42	$37	$43
Dues, subscriptions, and misc.	$48	$21	$65
Total	**$254**	**$201**	**$323**

While the low-cost records were identified based on direct costs, these same operations also had lower than average indirect costs, particularly machinery and building assets (Table 3.11). With lower asset valuation in the low-cost group, these operations may have older facilities and older or less equipment. The annual cost difference between the low-cost group and overall is about $100 per cow, emphasizing the importance of controlling investments and fixed costs.

Table 3.11. Comparison of indirect costs of all records versus low-cost records.

	Average All Records	21 Low-cost Records	21 High-cost Records
Average breeding female value	$1,758	$1,454	$2,185
Machinery value/cow	$691	$346	$1,055
Building value/cow	$583	$85	$1,328
Cow herd depreciation (10%) (based on producers valuation)	$176	$145	$218
Machinery depreciation	$69	$35	$106
Building depreciation	$41	$6	$93
Unpaid family labor	$126	$112	$126

The average herd size for the low-cost group was 263 cows and 188 cows for the high-cost group. There were more herds under 100 cows in the high-cost group.

This project focused on cost of production parameters and did not collect reproduction data, but no doubt conception and weaning rates are also key factors in controlling production costs per female since all costs are based on the average number of females in the herd.

Summary

Photo by Denise Schawb.

This project was designed to evaluate cow herd cost of production based on three different systems. Outcomes from this project were consistent with prior production cost projects and include:

- Extreme variation in production costs among all beef herds, regardless of system type.
- Producers need to monitor and analyze their own costs.
- Feed cost represents roughly half of the direct (cash) production costs.
- The indirect cost of ownership of cattle, equipment, and facilities is the second largest cost, but is often overlooked by producers since it is a non-cash cost.
- All three systems have the potential to be low-cost operations provided managers pay attention to feed and ownership costs.
- There are potential economies of scale benefits to all three system types.

Remember that even with 62 records, this is still a limited dataset and simply represents 24 operations over the three years of the project. Probably the most important outcome of this project is the opportunity for producers to compare their own actual production costs against the benchmarks mentioned in this manual, and set goals for cost control for future production.

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Chapter 4: Feed Resources

Photo by Dan Loy.

Iowa has a competitive advantage in livestock production thanks to the low cost of the state's available feed resources. Beef cow operations need to use that competitive advantage through both grazing and harvested feeds to compete. Determining the nutrient quality of available feedstuffs and how to best utilize the feed in meeting the cow's requirements at different production stages is the key to managing feed cost.

Feed costs have a major bearing on total cost of beef cow production, and the various systems include a diverse mix of feedstuffs and pasture resources. One objective of this project was to analyze the nutrient value of common Iowa feedstuffs and pastures utilized (Table 4.1). Throughout the project, stored forage and pasture samples were collected from the cooperators and a feed analysis was completed at Dairyland Laboratories in Arcadia, Wisconsin, using NIR-NDF 48 hour digestibility (Near Infrared Testing plus Neutral Detergent Fiber digestion). This test provided a more thorough analysis compared to the basic NIR test. The Ohio Agricultural Research and Development Center (OARDC) energy calculations used in this analysis are similar to those developed in 2001 by the Nutrient Research Council (NRC) for dairy cattle. Both calculations use a summative approach by assigning digestibility and energy values to adjusted crude protein (CP), neutral detergent fiber (NDF), fat, and ash. Both the OARDC and NRC utilize the relationship between lignin and NDF to determine NDF digestibility. The sample number and analysis are shown in Table 4.1. This variation in nutrient content of forages supports the importance of feed testing for proper ration development.

Table 4.1. Nutrient analysis of feedstuffs and pasture.

Feed Class (N)	Dry Matter, %	Adjusted CP, % DM	TDN	NE m, Mcal/cwt	NE g, Mcal/cwt	NDF, % DM	ADF, % DM	NFC, %	Lignin, % DM	Soluble Protein, %
Hay (84)	84.5	12.1	54.7	52.2	27.1	58.7	41.4	22.1	7.4	27.8
Corn Silage (13)	40.6	6.2	69.9	72.1	44.8	38.9	26	48.2	4	50.9
Small Grain Silage (9)	33.1	9.2	50.1	45.5	23.6	60.8	42.1	21	6.2	51.7
Baleage (12)	46.1	12.6	56.1	55.1	29.4	54.4	38.6	24.8	6.6	47.5
Haylage (9)	42.5	12.5	54.5	53.1	27.6	57.6	41.1	21.7	7.5	34.9
Stockpile (33)	38.9	14.5	60.6	62.4	36	55.1	35.4	24.2	5.9	35.6
Summer Pasture (49)	28	17.7	61.9	65.4	32.8	51.4	34.7	22.6	5.8	31.2

For more information on understanding forage test results and terminology refer to Interpreting Your Forage Test Report, IBC51, http://www.iowabeefcenter.org/information/IBC51.pdf

Hay

Photo by Erika Lundy.

The hay samples collected reflect the considerable range in quality previously observed in Iowa beef cow feeds based on the experience of Iowa State University Extension and Outreach beef specialists through routine ration analysis and evaluation. The variation is also similar to prior hay testing projects conducted by the Iowa Beef Center in 1994-95 and 2010-11, and reported in the Iowa State University Animal Industry Reports.

The range in quality of Iowa cool season grass and grass-legume hay is due primarily to the type and percentage of forages in the mix and maturity at harvest. Conservation Reserve Program (CRP) acres are often harvested for emergency hay in drought years or as part of routine CRP haying. These acres are harvested after the nesting season in late summer and are much more mature than hay harvested earlier in the summer. Waterway hay is also quite variable depending on the stage of maturity when harvested. Many cool season grass hayfields also are harvested late resulting in reduced quality.

The 84 hay samples were grouped into a high quality third and a low quality third based on nutrient values. Figure 4.1 compares the average along with the high and low third values. While these protein levels would be adequate for mature gestating beef cows in the last trimester, additional protein supplementation would likely be required in the lower quality third and some samples within the middle third for lactating cows. Likewise, developing heifers would require additional protein supplementation for the bottom half of the hay sampled in this project.

The energy levels as expressed as Total Digestible Nutrients (TDN) as calculated in the forage analysis, demonstrated an even larger variation. The average TDN level for hay samples was 54.7 percent, with the lower quality hays averaging 47.7 percent and the higher quality samples averaging 60.8 percent. The higher quality hays would be adequate for beef cow requirements in all stages of production, while the lower quality hays would not meet the requirements for mature pregnant or lactating cows. The average energy level would be marginally adequate for pregnant cows in good condition, but would not meet requirements for higher milk or thinner cows, and would be inadequate for lactating cows.

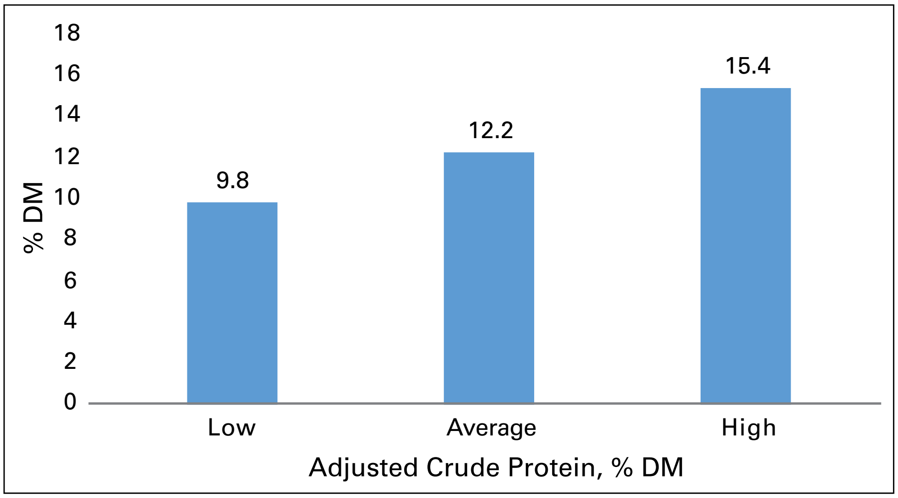


Figure 4.1. Average, low third, and high third values for adjusted crude protein from 84 hay samples.

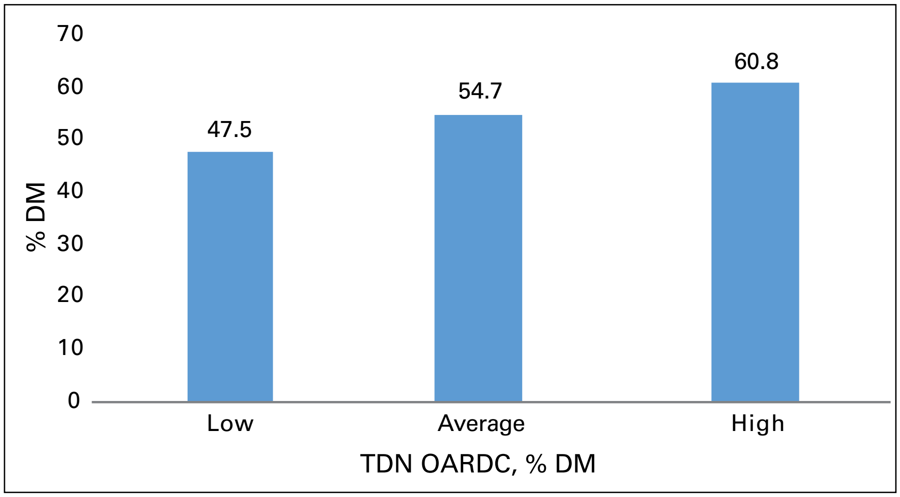


Figure 4.2. Average, low third, and high third values for total digestible nutrients from 84 hay samples.

The variability in forage test results emphasize the need to balance rations to determine appropriate supplementation needed to meet cow requirements at the various stages of production. Cooperators in this project frequently used corn or soybean coproducts, corn silage, or corn grain to balance rations. Each supplement has benefits and challenges.

Corn Coproducts

Grain coproducts are typically high in protein and provide a nice balance between ruminally degradable and bypass protein. They have had starch and oil removed, making their energy source compatible with fiber digestion in the rumen. Fortunately for beef producers in the state, Iowa produces approximately 25 percent of the United States' ethanol supply, leaving an abundant supply of corn coproducts that are readily available to the livestock industry. These corn coproducts are an excellent source of both protein and energy and have become a staple in the rations of beef producers in Iowa and the Midwest. Because corn coproducts are often a cost-competitive source of protein, inclusion in beef cow and developing heifer diets coupled with low quality forages such as corn stalks or CRP hay offer an opportunity for producers to provide high-quality diets often at a lower cost. Many producers, including some in this project, have found that this feedstuff combination is an opportunity to reduce feed costs and waste by limit-feeding a nutrient dense total mixed ration (TMR).

Photo by Dan Loy.

When used in rations for cows during the winter or year-round for limited grazing operations, the protein and energy supplementation from corn coproducts with low quality forages increases fiber digestibility, increasing the feed value from low quality forages. Because the starch has been removed during the ethanol process, there is less concern that coproducts will shift rumen microbe populations and impact fiber digestibility the way high levels of corn might, although corn grain can be included at moderate levels with little or no impact on forage digestion. Supplementing either corn or coproducts stretches short feed supplies by providing additional energy and protein while limiting forage intake.

Although corn coproducts are an economically viable addition into beef cow diets, spoilage and waste concerns do exist, especially for beef cow operations that may only utilize a few pounds per head per day. In circumstances where producers are in close proximity to a corn ethanol plant, concerns with spoilage may be minimized if producers can obtain small quantities more frequently. For the majority of producers though, it may be more advantageous to purchase corn coproducts in bulk and place them into long-term storage. Research from Iowa State University and the University of Nebraska-Lincoln have demonstrated that corn coproducts can be successfully stored in a silo bag or bunker system.

The high moisture content of some corn coproducts such as wet corn gluten feed or wet or modified distillers grains often results in these bags not having much structure, so research has also been done demonstrating that the addition of forage to corn coproducts is also an effective storage method. For more information on incorporating coproducts into cow rations see Iowa Beef Center publications Ethanol Coproducts for Beef Cattle: Distillers Grains for Beef Cows (IBCR 200D) (https://store.extension.iastate.edu/Product/14207) or Ethanol Coproducts for Beef Cattle: Handling and Storage Considerations (IBCR 200E) (https://store.extension.iastate.edu/Product/14208).

Corn Grain

Corn grain provides high energy and is often the cheapest source of energy available, but is low in protein and high in starch. High levels of starch in a supplement can reduce the fiber digestibility in the rumen. The University of North Dakota suggests limiting corn in the cow diet to about 0.4 percent of body weight dry matter (DM) to optimize fiber digestion. For a 1,400 pound cow, that would be about 5.6 pounds of corn. However, research from Ohio shows that in years with very short forage supplies, 11 pounds of corn and 2.5 pounds of protein supplement can be fed with only two pounds of hay to maintain body condition. Table 4.2 shows examples of supplementation needed for various hay qualities, and the feed cost per day based on feed quality, supplementation needs, and feed costs typical at the time of sampling.

Photo by Samantha Jamison.

Traditional Grazing Operations – Balancing Feed Resources

Dave Petty and Dan Cook have cow-calf operations in southern Hardin County in central Iowa. Both rely on pasture and crop residue grazing for a majority of the year and aim to minimize the amount of harvested feed that is fed. However, they manage winter feeding and supplementation differently.

Cook harvests a small amount of hay or cornstalks and silage but buys hay, cornstalks, and distillers grains for winter feeding. He has a vertical mixer wagon to deliver this mix to cows in the winter as well as bulls he is developing. The ration can be fine tuned to meet requirements and costs less per day than a typical hay corn ration using the standardized prices, and would likely have lower levels of waste. Equipment costs to deliver the mix are more than feeding large round bales and corn supplementation, but those costs are spread across a significant number of cows plus the bulls.

Petty harvests hay for winter feeding from pasture and hay ground and uses shell corn as an energy supplement when needed. Cows have access to cornstalks and grass from waterways and field boundaries and are only supplemented with hay or corn when needed. Large round bales or corn are typically fed in the field with limited equipment expense. Feeding locations are moved. With more access to cornstalks and grass, Petty provides less supplemental feed than average.

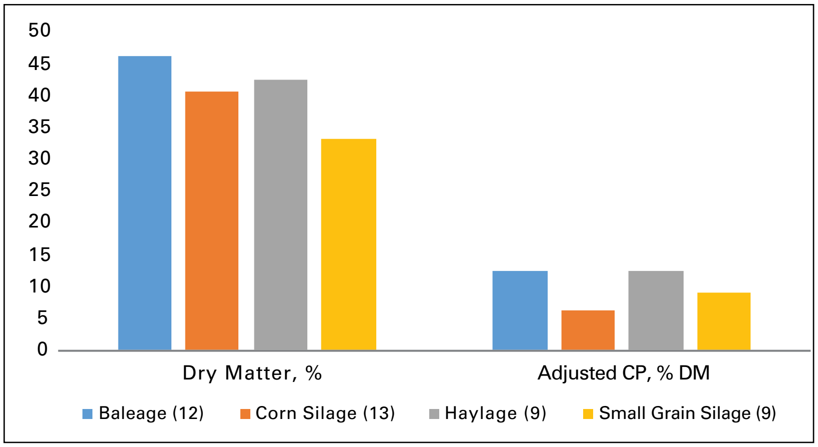
Both operations have stored feed costs that are in the lower third of traditional grazing operations. They are two distinctly different approaches but both alternatives meet cow requirements and manage costs.

Silage

Photo by Erika Lundy.

Different types of silage are important ingredients in beef cow diets. Forty-three silage samples were collected from project cooperators and included baleage, corn silage, small grain silage, and haylage. Dry matter, adjusted crude protein, and energy expressed as total digestible nutrients (TDN) are presented in Table 4.1 and Figure 4.3.

The energy and protein values in the corn silage samples were lower than standard reference values. Adjusted crude protein of corn silage samples averaged 6.2 percent, with TDN at 69.9 percent. The DM average of corn silage samples was 40.6 percent, which is a sound level for proper fermentation.



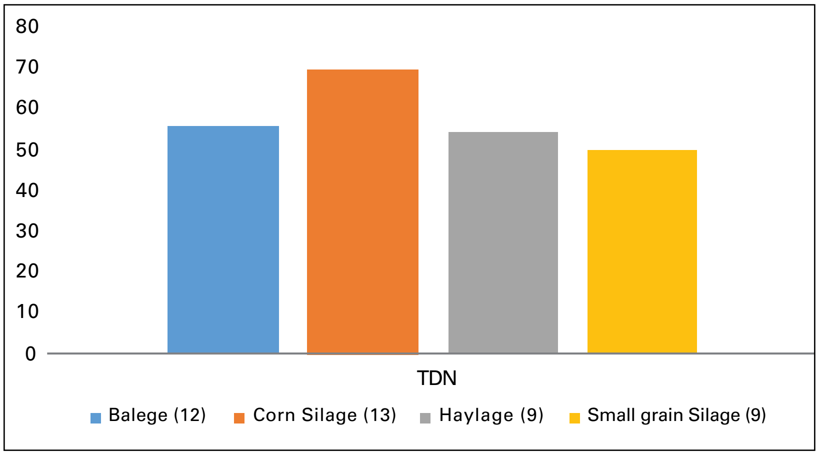


Figure 4.3. Silage test results. Number of samples indicated in parenthesis.

Net energy values were summarized to allow for comparison to other Iowa data. Cooperator corn silage nutrient analysis are quite similar to data collected in a statewide corn silage survey completed in 2016 and 2017 by ISU Extension and Outreach beef specialists, which also demonstrated the wide range in dry matter percentage and nutrient values. The study showed averages of 43.26 percent dry matter, 6.72 percent adjusted crude protein, and 71.55 percent TDN.

This variation in nutrient content of corn silage and hay samples supports the importance of feed testing for proper ration development.

Cornstalks

One of the largest quantities of available forage in Iowa is cornstalks. Beef cow operations can utilize cornstalks by grazing or harvesting the stalks and using them as part of a delivered ration. Although they are lower in energy and protein than most feedstuffs, they can be an economical feed source.

Grazing Cornstalks

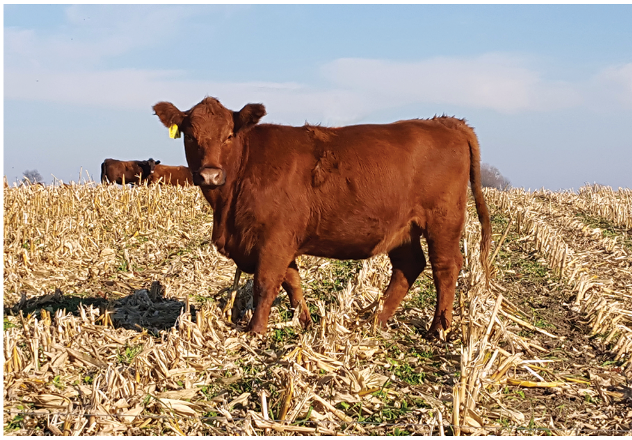


Photo by Denise Schwab.

Past data from the Iowa State Beef Cow Business Records showed that producers who utilize crop residue for fall and winter grazing reduced costs dramatically compared to those without this resource. Fifty-eight percent of the participants utilized some form of residue grazing, including 82 percent of participants who utilized traditional grazing systems, 43 percent of the limited grazing systems, and only 31 percent of the extensive grazing systems. Records from all cooperators showed that of those who grazed at least some crop residue averaged 56 days of grazing per female at an average cost of $11 per female. Seventy-eight percent of the cornbelt region cooperators grazed crop residue for an average of 53 days at a cost of $6 per female. Most of the extensive grazing system operations had no access to corn residue for grazing and depended fully on stockpiled grass for much of the winter feed supply with supplementation while on grass.

Obviously grazing cornstalks is available only after grain harvest in mid- to late October in Iowa. For cows calving in May, that period matches the cows' lowest nutrient demands. Also, the cows' ability to selectively graze higher quality material allows the spring calving cows to meet energy and protein requirements for a short period after grain harvest. A common recommendation is approximately one-half acre of cornstalks per cow per month of grazing. As weathering decreases the nutrient content of the stalks and cows requirements increase, supplementation may be needed. Cow body condition scores need to be monitored during the grazing period. If a fall seeded cover crop has enough growth in a harvested corn field, the cover crop can increase the quantity and quality of forage available for grazing for a longer period of time.

Harvested Corn Stalks


Photo by Dan Loy.

In many operations, the acres of cornstalks available would be greater than what could be grazed in the period available for grazing. Harvesting cornstalks for use later in the year is one way to take advantage of the available forage. With adequate supplementation, harvested cornstalks can be used economically in cow-calf rations. Corn coproducts being high in energy and protein make a good supplement to use in a ration with corn stalks. Other high energy feeds like corn silage or corn grain can also be used. Hay and corn stalk mixtures also work if energy is not a major need in the ration, based on cow production stage. Like other feeds the cost of nutrients provided by cornstalks in a ration need to be compared to other feeds.

The high fiber in cornstalks would limit the intake by cows in a ration and increase potential waste. Processing or grinding cornstalks will help improve intake and limit waste if combined in a total mixed ration. In most situations, 20 pounds per head per day of corn stalks in the ration would be considered maximum intake. Producers need to consider the processing costs in determining cost of the ration.

Using Feeds in Rations

Photo by Erika Lundy.

The range of available feeds makes many ration combinations effective. The variability in forage test results emphasize the need to balance rations to determine appropriate supplementation needed to meet cow requirements at the various stages of production. The cost of transportation, storage loss, feeding waste, and feed delivery needs to be considered. Below are some example rations for cows or heifers in different stages of production using the feed analysis of different quality of hays analyzed with corn or distillers supplements. There are many software programs available to help calculate appropriate rations.

Another management practice that producers can utilize to control feed costs in all systems is the addition of Rumensin® (monensin sodium). This ionophore influences rumen microbial populations to produce more proprionate, a more energy-efficient fuel source for cattle. As a result, cows maintain body condition on 5-10 percent less feed while also helping to increase digestibility of low quality forages. The maximum labeled rate of Rumensin® in a cow diet is 200 milligrams (mg) per head per day.

Table 4.2. Example rations using various hay quality.

Third trimester pregnancy, moderate crossbred cows, February		Cost per female per day
Low quality (CRP) hay	30 lbs. CRP hay 2 lbs. shelled corn 8 lbs. MDGS	$1.46
Average quality grass hay	36 lbs. grass hay 2 lbs. MDGS	$1.59
High quality grass legume hay	35 lbs. high quality hay	$1.84
Free choice high quality hay	40 lbs. full feed hay	$2.10
Third trimester pregnancy, first calf heifers, February		
Low quality (CRP) hay	25 lbs. CRP hay 5 lbs. shelled corn 7 lbs. MDGS	$1.41
Average quality grass hay	31 lbs. grass hay 2 lbs. shelled corn 3 lbs. MDGS	$1.58
High quality grass legume hay	31 lbs. high quality hay 1 lb. shelled corn	$1.80
Assuming 10% hay waste 5% concentrate waste	CRP hay - $65 per ton Average grass hay - $80 per ton Good quality hay - $100 per ton Corn - $3.50 per bushel Corn Modified DGS - $75 per ton	

Managing Winter Feed Risk

Photo by Denise Schwab.

Each management system requires flexibility and the need for alternative feeding strategies. Having a plan in mind for drought years, managing mud in feeding areas, extreme winter weather, or conditions that limit forage harvest is needed.

- Grazing corn crop residue requires timely crop harvest and proper soil conditions (no muddy conditions or frozen ground) to allow grazing.
- Rations based on corn crop residue will require fall conditions to allow harvest of corn stalks and proper storage.
- Fall and winter grazing of cover crops will also vary based on weather conditions and the amount of forage growth.
- Adequate moisture for late summer and fall grass growth is needed for winter conditions to allow grazing of stockpiled pastures. Too much ice or snow or extreme cold may require more winter feeding. The amount of protection from the wind (hillsides, trees, etc.) also affects the opportunity to graze in the winter.
- Hay based diets require timely harvest of quality hay, good storage methods, and reduction of feeding waste. Reliance on purchased hay may be more expensive than in the past based on reduced hay acres in Iowa and periodic droughts.

All these potential risks will require evaluation of different feeding options, including harvest and feeding of corn silage, and stretching existing forage with supplementation of grain and grain coproducts.

Photo by Samantha Jamison.

Type and Amounts of Feeds Fed by System

In an effort to track stored feed usage and costs, feeding records were collected from producers across all three systems. Not surprisingly, there was a wide variety of feeds utilized by cooperators. Producers reported feed delivery on an as fed basis and the amount of dry matter fed was calculated (Table 4.3).

Table 4.3. Stored, harvested, or purchased feed fed.

	Average All Records		Limited Grazing		Traditional Grazing		Extensive Grazing	
	As Fed	DM*	As Fed	DM*	As Fed	DM*	As Fed	DM*
Hay	2,968	2,523	4,039	3,433	3,146	2,674	989	841
Corn silage	5,009	3,256	6,954	4,520	3,761	2,445	1,736	1,128
Small grain silage	1,581	1,028	1,350	877	2,482	1,613	1,191	774
Cornstalks	2,911	2,474	3,384	2,876	901	765	0	0
Corn	671	570	1,476	1,255	250	213	52	44
Corn coproducts	1,666	750	2,590	1,165	1,151	518	261	118
Other	518	441	514	438	408	346	380	323
Salt	31	29	53	51	20	19	17	16
Mineral	76	72	76	73	72	68	82	78
Calves - creep	553	470	562	478	544	462	0	0
Total pounds/female	9,193	6,626	16,737	11,961	6,697	4,890	2,380	1,748

*As fed amounts recorded were converted to a dry matter (DM) basis with the following assumptions: Hay 85 percent DM, corn silage 65 percent DM , small grain silage or haylage 65 percent DM, corn stover 85 percent DM, corn 85 percent DM, and coproducts 45 percent DM. All remaining feedstuffs 85 percent DM, salt and mineral 95 percent DM.

An old rule of thumb is 2-2.5 tons of feed per cow per year, and the traditional grazing records in this project fit right into that benchmark. Using that basis, the extensive grazing operations were basically meeting half of a herd's "normal" stored feed needs by adding more grazing days. Assuming traditional grazing cooperators graze approximately half to two-thirds of the year and provide stored feed for about half to a third of the year, one could predict that the feed needed for the full year would be about 5-6 tons, which is about where the limited grazing operations averaged. Limited grazing operations were as low as 3.6 tons of feed DM fed per cow per year to as high as nearly 8.5 tons. A few of the limited grazing cooperators grazed small amounts of pasture, and almost half of them grazed crop residue for at least a few weeks per year. The average total dry matter of 11,961 pounds feed to limit grazed herds calculates to 32.7 pounds per day over 365 days, which suggests they are not limit feeding.

> Feed costs for the high-cost group was twice those of the low-cost group, $623 per cow per year versus $292 per cow per year.

Of the 62 total records in the analysis, 89 percent fed dry hay sometime during the year, 71 percent fed corn silage, 34 percent fed haylage, baleage, or a small grain silage, and 34 percent fed harvested cornstalks. Over half the records fed a corn coproduct in the diet. Only 90 percent reported feeding a salt or mineral supplement; however, some may have provided this as part of the TMR supplement and not reported it under the mineral source category. However, some herds apparently did not provide any source of salt or minerals. While high quality Iowa forages may have adequate macronutrients, forages may not meet the requirements for key nutrients such as salt and key micronutrients such as copper, cobalt, manganese, and selenium. Likewise, it is unknown exactly what proportion of minerals found in forages is available for utilization by the cow.

Photo by Erika Lundy.

Mineral costs varied widely with an average cost of $920 per ton, with a range from $383-$1,400 per ton. Average mineral plus salt cost was $35 per female per year with a range from $0-72 per female per year. Limited grazing herd records averaged $39 per female per year, traditional grazing averaged $27, and extensive grazing averaged $46 per female per year. Records with fewer than 200 cows had a mineral plus salt cost of $36 per female per year, while records from herds over 200 cows had mineral plus salt cost of $33 per female per year.

Just under half (43 percent) of the limited grazing herd records fed creep feed with a range in the cost of creep feed from $5-229 per female. One-third (32 percent) of the traditional grazing records fed creep feed with a cost of $6-26 per female. None of the extensive grazing records fed creep feed. Weaning weights were not collected in this project so weights cannot be compared against the cost of creep feed, but at a feeder calf price of $1.60 per pound, a cow weaning an additional 40 pounds of calf would cover the average cost of the creep feed ($63).

Extending Grazing in a Traditional System

Bruce River's cow operation is a lot like many others in Jackson County; cows graze pastures in the summer and are supplemented stored feed in the winter. Thanks to his feedlot operation he has ready access to corn silage and wet gluten, corn residue from his crop operation, and the ability to mix a relatively inexpensive ration. But he also has a cheaper option to stretch the feed bill – cover crop and residue grazing.

River started seeding cover crops several years ago by aerial spreading a mixture of cereal rye, crimson clover, and radish. He saw limited success the first year due to dry conditions and an early fall or winter, but persisted in trying to utilize cover crops to extend the grazing season. Now, 70 of the 100 acres of crop ground around the winter feeding site are aerial seeded, mostly with cereal rye and occasionally with radish. Locating the cover crops close to the wintering farm with an existing cement yard and bunk system also provides easy access to a water source during the winter, the stored feed supply, and pens if needed for calving assistance. The location also provides easy monitoring during calving season.

Cows start grazing crop residue fields closest to the pastures first, working their way home during the fall grazing season. They arrive back at the winter farm in early November, where they start grazing the residue and cover crop field. On average they can graze about 100 dry cows for 30 days in the late fall. While also grazing corn residue or in the bunks when muddy, cows are supplemented with a TMR of silage, wet gluten, and chopped hay on frozen ground throughout the winter. Sometime in March or early April all late calving cows move on to the rye cover crop to calve. River estimates he gets 30-45 days of spring grazing for 35-40 cows on the 70 acres of rye.

Residue and cover crop grazing costs are a third to half the cost of his daily winter feed ration costs. River can use the cows to pay for the cover crop seeding cost and still take advantage of its reduced erosion and soil benefits.

Stockpiled Grass

Many producers with extended grazing and traditional systems utilize fall saved or stockpiled pastures. Thirty-four fresh stockpiled grass samples were tested for forage quality. The nutrient values of average, low third, and high third grass samples are shown in Figures 4.4 and 4.7. As shown in Iowa extended grazing research, stockpiled grass quality is adequate in crude protein for pregnant beef cows. Energy can be limiting in late pregnancy so supplementation may be needed.

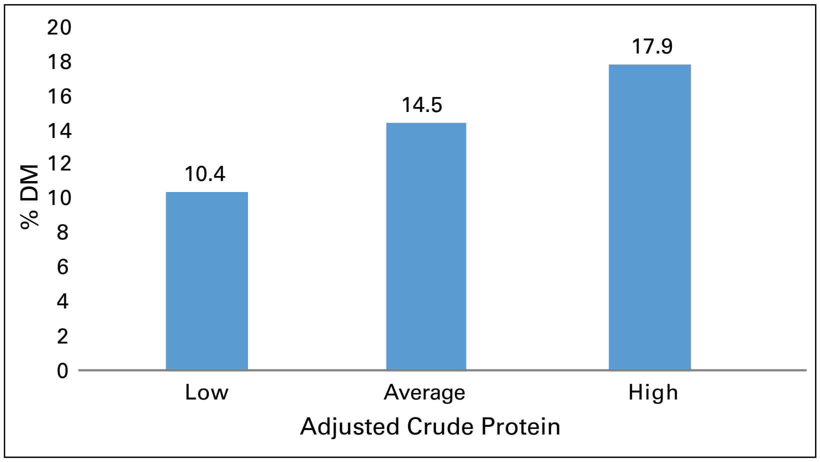


Figure 4.4. Crude protein of stockpile forage samples.

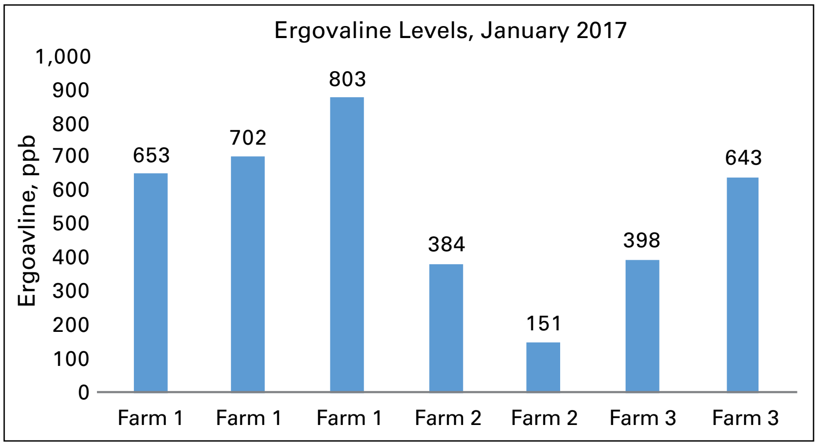


Figure 4.5. Ergovaline levels in stockpiled forage samples.

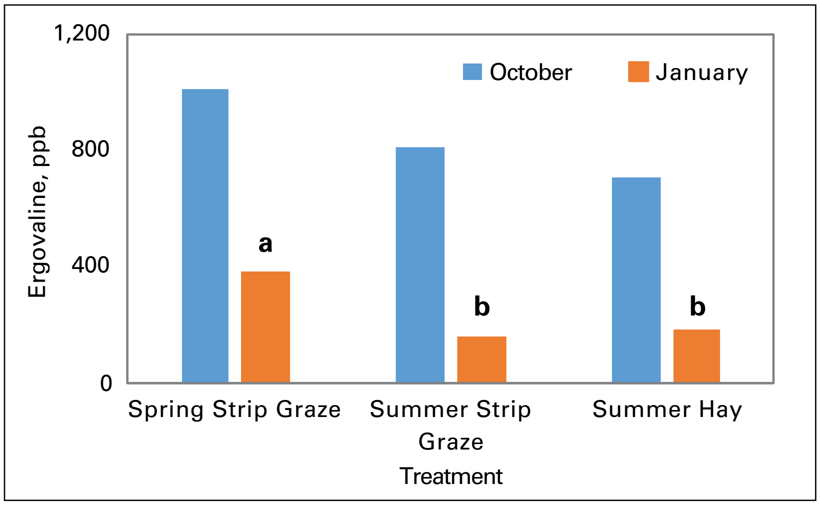


Figure 4.6. Ergovaline levels in October vs January, Iowa State University McNay Memorial Research Farm.

Most of the southern Iowa extended grazers were grazing endophyte infected fescue based pastures, which could have high enough ergovaline levels to affect the cattle. Alkaloid levels were detected in stockpiled pastures on three cooperator farms sampled in this project in 2017. Levels ranged from 151-883 parts per billion (ppb) ergovaline, which were high for winter stockpiled grass. This variation was due in part to the maturity of the stockpiled grass. These herds have little trouble grazing stockpiled fescue with adapted pregnant cows with little supplementation, but have adopted different management with more feed substitution for cows with calves at their side, and for pregnant first and second calf cows.

Stockpiling recommendations for quality suggest fall growth of 75-100 days to get optimum quality and adequate forage volume. Work at the Iowa State University McNay Memorial Research and Demonstration Farm in 2016-17 found that grass stockpiled from spring had lower digestible dry matter, more mature swards, and resulting higher levels of ergovaline as compared to stockpile growth following summer grazing or hay harvest. This data demonstrated lower ergovaline levels in January compared to October, as would be expected.

Fall calving pairs and young pregnant cows will require supplementation to mitigate the effects of fescue toxicity and to add protein and energy to low quality forages later in the winter. Other management changes may also include early weaning.

Some producers have fall calving herds as well as spring herds, so rations for wintering may be quite different. Pregnant cows are likely to graze stockpiled grass only, while fall calving cows with higher requirements will require supplementation of both protein and energy, often supplied by corn coproducts, hay, or corn silage.

The feed quality of stockpiled grass often is superior to the low to average quality grass hay harvested in Iowa – making extended grazing a good practice in many operations. The quality of stockpiled grass does decrease with weathering, and supplementation will be beneficial in late winter or early spring.

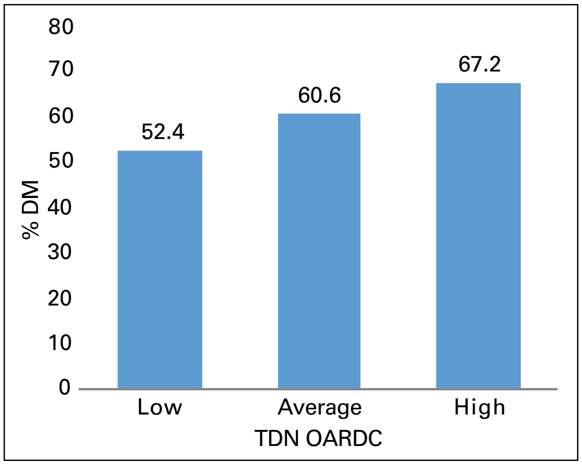


Figure 4.7. TDN levels of stockpile forage samples.

Fall Calving on the Rise in Southern Iowa

Photo by Erika Lundy.

Sellers Brothers started a fall calving herd out of necessity and have found it to be a sound enterprise. Twenty years ago, the Sellers' bought 56 pregnant, spring-calving, Angus-based heifers to upgrade their genetics. Unfortunately over 50 percent of these heifers failed to rebreed on the fescue pastures on their Lucas County farm. Tom Sellers decided to let the heifers develop and breed them for late August-October calves. Over 90 percent bred for fall calves and were successfully maintained in that herd.

Since then, the Sellers' have supplemented younger lactating cows and yearling heifers grazing fescue in the summer and have less trouble getting them bred. They hand feed 3-5 pounds of a dry gluten pellet, distiller's grain, and corn mix to targeted groups in late summer, usually every other day. They do still allow young cows to move from the spring to fall calving herds, but do not allow them to go back to the spring group once they've left. About 35-40 percent of their cows on the home farm calve in the fall.

Werner Family Angus manages their cows with the goal of having the mature cows harvest their own feed year round. Jim Werner has practiced winter grazing on stockpiled grass and rotational grazing in the summer for many years. They have a spring herd and a fall herd which complement each other in grass utilization. Fall pregnant cows can graze the summer fescue and maintain condition, while the pregnant spring calving cows can graze stockpiled winter pastures with little supplementation.

Both young and lactating cows are supplemented in the winter with home-raised silage, hay, and some coproducts. This helps dilute the alkaloids in the fescue and provide the higher energy and protein needed by the younger and lactating females.

Having both spring and fall calves allows the Werner's to use facilities and land more effectively, spread out the use of their feed efficiency and bull development barns, and provide more options for customers. The fall herd allows the family to develop bulls that are 18 months of age when sold to some of their larger spring calving customers.

Carney Family Farms have also expanded calving into the fall, in part due to the availability of fescue. Carney has developed a direct-to-consumer market in central Iowa, including an expanding grass-fed product line. The fall calves allow Bruce Carney to spread out marketing dates and income. The split herds also allows use of herd bulls on more cows.

Carney tries to graze the other species of grass and legume in the summer pastures, not forcing the cows to eat fescue in the heat. If cows are forced to eat the fescue, there is a greater risk for overgrazing the other species which encourages weeds and brush. Tall fescue is stockpiled for winter grazing when possible. He also will clip pastures when needed in late summer to stockpile higher quality forage. The decision to mow or not would not be for fescue alone unless it was the dominant species in the pasture, but usually would be for weed and brush or tree management as well as preparing quality stockpile.

Summer Pasture

With fewer available pasture acres, many producers have utilized management intensive grazing or other rotational grazing methods to improve forage quality, increase stocking rates, and extend the grazing season. Forage analysis on 48 fresh pasture samples found high quality feed in many pastures (Figures 4.8 and 4.9). As expected the quality decreases as grass matures later in the season, but in many cases grazing management kept the grass vegetative.

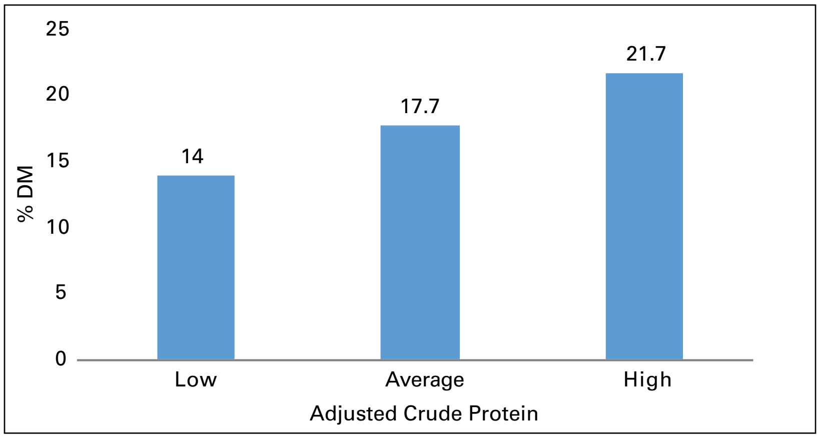


Figure 4.8. Crude protein of summer pasture forage samples.

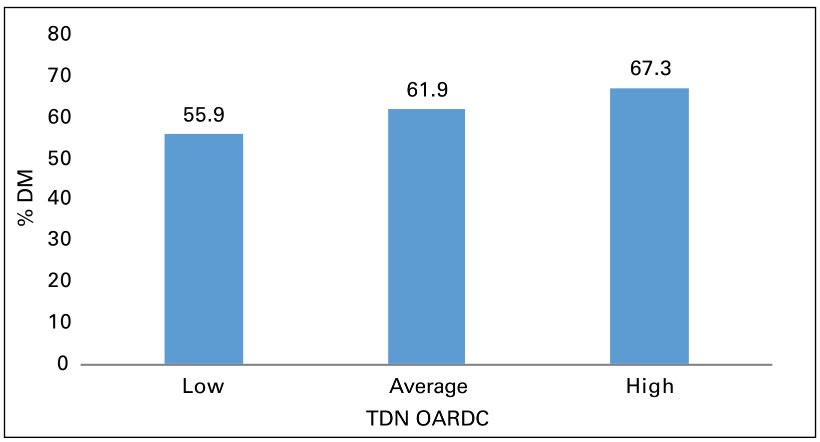


Figure 4.9. TDN levels of summer pasture forage samples.

Protein was adequate for most classes of cattle, but energy was marginal in the lower quality cool season grass pastures. Results are similar to a summary of 495 samples collected for Iowa State projects between 1994 and 2002, which found that research pastures with adequate forage supplied sufficient protein (113-220 percent of requirements) and sufficient energy in most months (87-118 percent) to maintain a 1,400 pound beef cow during lactation. While sampling pasture gives us a snapshot of what is available for the cattle, grazing selectivity often results in cattle consuming higher quality feed than predicted. Research has shown that cattle tend to select forages that are 18-30 percent greater in crude protein and three percent greater in digestible dry matter than pasture clippings would indicate. With this grazing selectivity, even the low quality pastures should support the nutrient requirements of a lactating cow.

Photo by Denise Schwab.

Supplementing Grazing Cows

Often times pasture or crop residue grazing needs supplementation due to insufficient availability or poor quality. Managing a cow's body condition score is key in determining effective supplementation. Supplementing a pound of dry matter doesn't typically offset grazing intake by the same amount, so trying to save forage for grazing isn't always economical. Making sure cows are getting the needed energy and protein intake is key. Feeding other forages like hay or corn silage can supplement grazing cows. Corn coproducts have benefits to feeding the cow herd beyond use in a total mixed ration. Supplementing distillers grains can help stretch pastures in dry years. An Iowa State study showed that supplementing distillers grains to growing heifers at 1.5 percent of body weight will reduce forage intake by 26.8 percent. Limited amounts of corn could also be supplemented as an energy source.

Impact of Pasture Costs

Photo by Chris Clark.

One of the arguments for increased limited grazing is the high price and availability of land access to expand the cow herd. Comparing limited grazing to other systems isn't a simple comparison for many reasons, including the fact that pasture provides roughly 1/2 to 3/4 of feed resources and is not simply a place to "house" the cows; land appreciates in value while facilities depreciate, and pasture or land suitable for pasture are not always available within reasonable proximity to the operation. This project attempted to examine this in more depth by evaluating records based on Iowa crop reporting districts and current rental rates for pasture and value of low quality land. All records were allocated based on their crop reporting district, then grouped based on the major aspects of each district in an attempt to get sizable groups for comparisons.

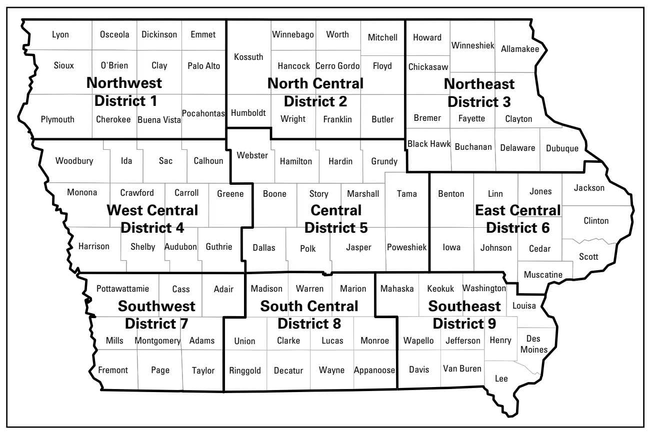


Figure 4.10 . Iowa crop reporting districts.

Crop Districts 2, 5, and 6 were grouped into a cornbelt region and Districts 7, 8, and 9 were grouped into a grassland region. No cooperators on this project were located in districts 1, 3, or 4. Twenty three records were in the cornbelt region and 39 were in the grassland region. Thirty two of the grassland region records and nine of the cornbelt region records grazed pastures and were included in all the data. Twenty one of the records did not graze a significant amount of pasture so those were excluded from the pasture cost calculations.

In order to look specifically at the effects of pasture value on cost of production, pasture costs were calculated based on the acres of pasture, females in the herd, and the average cash rent for improved pasture for the crop reporting district based on ISU Extension and Outreach publication Cash Rental Rates for Iowa 2018 Survey (FM 1851) (https://store.extension.iastate.edu/product/1841). As seen in Table 4.4, pasture cost using the crop reporting district rental rate and the actual acres grazed resulted in a cost of $130 per female for the cornbelt region and $206 per female in the grassland region. Actual grazing days were not collected from cooperators, so grazing days from the 2017 Iowa Beef Center Pasture Rent Survey were used (167 days in the north half of the state, 208 days in the southern half). Using those grazing day estimates, the cost per day would calculate at $0.77 per grazing day in the cornbelt region and $0.99 per grazing day in the grassland region.

Photo by Erika Lundy.

In comparison to the actual cooperator records, an average pasture cost of $122 per female for the cornbelt region and $179 for the grassland region would equate to $74 per acre in the cornbelt and $65 per acre in the grassland region, demonstrating actual pasture costs are very similar to survey rental rates. Using the same grazing day estimates, the cost per day using the cooperators' reported costs would calculate at $0.73 per grazing day in the cornbelt region and $0.86 per grazing day in the grassland region. Regardless of using cooperator pasture costs or regional pasture rent survey data, pasture grazing costs are significantly less than delivered feed at current feed prices.

Table 4.4. Pasture rent and value by crop reporting district.

Crop District	Average 2018 Improved Pasture Rental Rate	Average 2017 Land Value for Low-Grade Farmland	Rent Rate as % of Farmland Value	Average March 2018 Value, Non-tillable Pasture	Rent Rate as % of Pasture Land Value
2 (NC)	$67	$5,265	1.27%	$2,334	2.87%
5 (C)	$74	$4,993	1.48%	$2,853	2.59%
6 (EC)	$82	$5,305	1.55%	$2,800	2.93%
7 (SW)	$87	$3,935	2.21%	$3,294	2.64%
8 (SC)	$67	$2,824	2.37%	$2,630	2.55%
9 (SE)	$66	$3,768	1.75%	$2,744	2.41%
	From Cash Rental Rates for Iowa, 2018 Survey, https://store.extension.iastate.edu/product/1841	From 2017 Farmland Value Survey, ISU Ag Decision Maker, File C2-70	Based on 2017 Low-Grade Farmland Value	From 2018 Farmland Value Survey, Realtors Land Institute, C2-75	Based on 2018 non-tillable pasture value


Photo by Erika Lundy.

One way of comparing rents to actual land value is to calculate the rental rate as a percent of the land value. The rental rate percent of value is also calculated in Table 4.4 for both the low grade farmland and non-tillable pasture land by district. The ISU Extension and Outreach publication Iowa Farmland Rental Rates (FM 1728) (https://store.extension.iastate.edu/product/1795) tracks average rental rates and land value for cropland and pastureland in Iowa on a yearly basis. For higher value cropland at $8,100 per acre the rental rates have been 2.9 percent of the value in recent years. For pastureland at an average value of $3,100 the rental rates have been 1.7 percent of value in recent years. Table 4.4 suggests higher rents as a percent of value for the non-tillable pasture and similar rents as a percent of value for low grade farmland used as pasture.

Availability of pastureland may be more limiting than actual land value in the major grassland areas. High grain prices have pulled some traditional forage acres into row crop production. Additionally, increased CRP payments were attractive to older or retiring farmers who may have been considering selling their cow herd due to the operator's labor or health challenges. Increased interest in hunting and recreational use of land has also captured some of the traditional pasture acreage.

Summary

Production systems have many options to meet a cow's nutritional needs. Harvested hay and other forages, stockpiled pasture, and summer pastures were sampled and tested to determine nutritional content. While the average forage test results were adequate for beef cow needs, all classes of forages had a wide range in both crude protein and digestibility, supporting the need for forage analysis in ration development.

The costs of feeding cows also was variable. Reducing hay feeding waste and limit feeding of high quality hay helps control costs. Utilizing lower cost forages with coproducts is a strategy used by cooperators in the various systems. Improved grazing management can increase stocking rates or extend the grazing season to reduce supplemental feed costs. While pastureland may be limited in some areas of the state, pasture is still a very economical feed source based on both cooperator costs and typical rental rates.

Iowa's Economical Grazing Cost

The Iowa Realtor Land Institute Survey demonstrates lower values for non-tillable pasture, and that may be a good regional comparison on land values since this land is available in southern Iowa and is comparable to other grazing regions. The 2018 Farmland Value Survey estimated the value of pastureland in Iowa to range from $1,878 to $3,012 per acre. In comparison, similar reports in Kansas (Kansas Land Values Book) and Nebraska (2018 Trends in Nebraska Farmland Values and Rental Rates) found the value of pastureland in those states to be significantly less (Figure 4.11).

These other regions have competition for recreational and hunting uses, but not as much direct competition for row crop production.

Due to the increased productivity of Iowa pastures, when calculating the land value per cow an acre can support, Iowa pastureland actually is economical compared to central Kansas or north-central Nebraska. Very conservative levels of stocking rates – three acres per pair in southern Iowa; six acres per pair in the Flint Hills; and 12 acres per pair in the Sand Hills – were used in this discussion. Data would suggest Iowa rates might be lower (Guide for Year Round Forage Supply), the Flint Hills may be closer in nine acres per pair (Bluestem Pasture Release 2017), and the Sandhills may be over 15 acres per pair (Grazing Systems for Nebraska Sandhills Rangeland).

When the estimated stocking rates and the land values are combined, the southern Iowa pastures look favorable on a land investment per cow basis, as demonstrated in Figure 4.13. Grazing land is expensive everywhere and land investments involve more than year-to-year cash flow decisions, they are a long term investment in an appreciating asset.

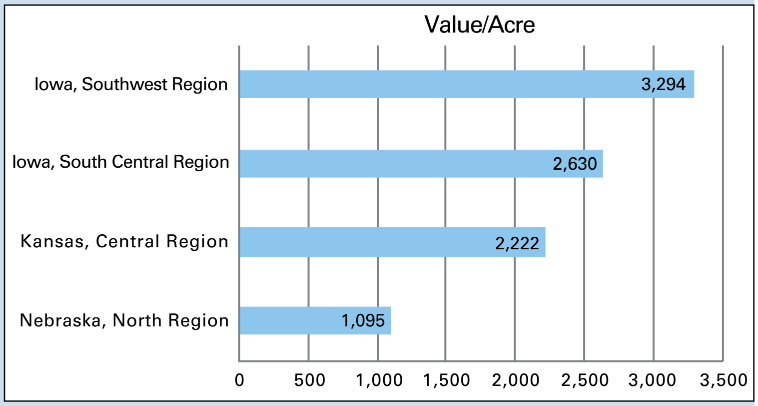


Figure 4.11. Pastureland value in Iowa, Kansas, and Nebraska.

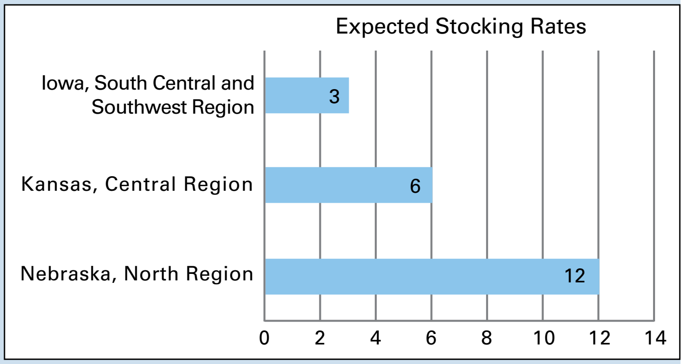


Figure 4.12. Typical stocking rate for pastures in Iowa, Kansas, and Nebraska.

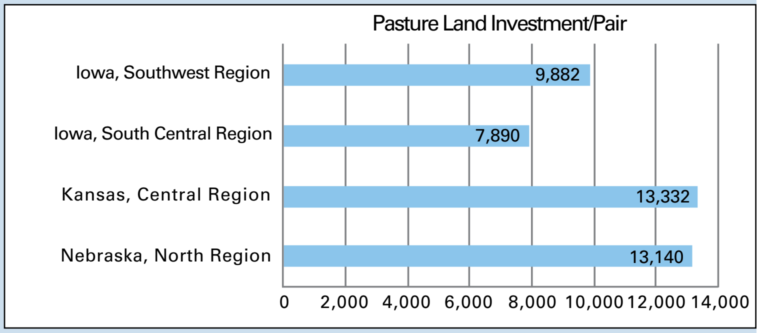


Figure 4.13. Pastureland investment per cow-calf pair in Iowa, Kansas, and Nebraska.

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Chapter 5: Animal Health Management

Photo by Denise Schwab.

The principles of animal health management are consistent across production systems. Vaccination, biosecurity, adequate nutrition, early identification of sick animals, appropriate medical intervention, and management of calving are cornerstones of any animal health program. Each production system, however, will present unique challenges and opportunities. Producers should think carefully about each system's advantages and disadvantages and how they relate to their operation's resources, skills, interests, and management styles.

Risk Analysis

Animal health programs must be tailored to meet the specific needs of individual cattle operations. Even though maintaining a truly closed herd can be extremely difficult, closed herds will have reduced risk for exposure to new pathogens compared to operations that purchase bulls and cows from outside sources. Environmental exposure can vary depending on wildlife, water sources, and neighboring operations. Extensive grazing systems often have different risk levels compared to limited grazing systems, with traditional grazing systems falling somewhere in between. Once a disease risk is identified, strategies to modify immune or pathogen levels through biosecurity, vaccination, nutrition, or management can be implemented to reduce disease risk.

A greater concentration of animals can facilitate the spread of disease through more animal contact and greater pathogen load. Limited grazing systems often utilize a relatively small area of space per animal, limiting the ability of animals to spread out and access cleaner, drier ground. Grazing systems often utilize a relatively large area of land or rotate cattle occasionally to fresh paddocks, minimizing pathogen build-up and promoting a cleaner environment. Of course, even in grazing systems, cattle sometimes congregate in close quarters, especially during inclement weather. Under certain conditions, areas such as those used for winter-feeding, sheltered areas, and shaded areas can become concentrated with cattle.

There are advantages and disadvantages to any beef production system. Grazing systems may allow greater area per animal, a cleaner environment, less intimate animal interaction, and more fresh air and sunshine. However, it may be difficult to check, catch, and treat animals in pastureland settings in a timely manner, especially when the pasture is a great distance from home. While confining cows allows for ease of attention to cattle, the long-term housing of cattle in greater concentration would be a potential disadvantage of limited grazing systems. Whether in drylot or in a building, contagious diseases can spread readily in these environments.

Vaccination

Vaccination is a common strategy to modulate immune function and protect against infectious diseases in livestock operations. Producers should work closely with their veterinarians to develop vaccination programs that work for their individual operations. As disease risk increases, vaccination programs may need to be enhanced to provide adequate immunity. The timing of a vaccination program should be evaluated to ensure an animal's immune response matches disease risk. Improvement of neo-natal calf immunity may require implementation of pregnant cow vaccinations to improve colostral immunity. Regardless of cow system, it is important to realize that vaccination alone will not solve all animal health concerns. Implementation of biosecurity measures and management programs are critical to assuring success of any vaccination program.

Weaning Management

A drought in the 1980's and short pastures encouraged Werner Family Angus to early wean a group of old cows when the calves were about 100 days old, and they've been weaning at about 120 days of age ever since. Initially, they weaned in dry lots but dust from the cows and calves walking fences posed a real concern. Thanks to a presentation by Denny Maxwell, former farm manager at Iowa State University's McNay Memorial Research and Demonstration Farm, they started weaning on grass and really liked the results.

Early weaning benefits both the cows and the calves. Since Werner Family Angus cows graze year round, weaning allows the cows to put body condition on while still grazing, reducing the need for supplemental winter energy. It also allows the calves to continue grazing initially and transer to dry feed earlier, which helps them develop bulls and heifers without expensive creep feed.

According to Jim Werner, cows are harder to hold than the calves, so they are sure to have a stout fence or a good electric wire between the cows and calves. Calves stay on pasture and graze just like they did with their mothers, and after a couple days of grazing they are introduced to feed bunks with a ration of oatlage, gluten, and corn topped with good alfalfa hay to draw them to it.

As for calf health, they give a first round of viral vaccinations in May prior to breeding season and test all calves for bovine viral diarrhea (BVD-PI), then booster calves at weaning. They would prefer to booster a couple weeks prior to weaning, but because of their pasture arrangements they comingle several groups of pairs to wean at the building site.

"While we realize early weaning is not for everyone, it has worked well in our operation," Werner said. "The biggest challenge to weaning calves on grass is getting them started eating out of the bunk. To combat that, we start them on a smaller paddock of grass that they can have grazed down in a week or two, which helps them start looking for food."

Biosecurity

The term biosecurity refers to management practices that help to minimize the risk of disease transmission. Producers should utilize biosecurity practices to prevent the introduction of new diseases into a herd. Should disease develop within a herd or on an operation, the same principles and practices can also be used to reduce disease transmission within a population of animals. Sound biosecurity practices can also be utilized to mitigate the negative impact of existing diseases within the herd such as BVD, Johne's Disease, and others. Specific biosecurity practices will differ from one operation to another depending on disease

Photo by Bonnie Larson.

risk, management style, facilities, and other factors, but the general principles should be comparable across operations and systems. Examples of biosecurity practices include quarantine of new animals, requirements that visitors check-in with the operator, use of virgin bulls or bulls that have tested negative for Tritrichomonas foetus, maintenance of effective fences, and control of insects, rodents, and other potential vectors.

The basic principles and goals will be consistent across systems but disease pressure and management differences are worth mentioning. Although it may be easier to implement biosecurity practices in a limited grazing system, this type of system may be less forgiving to breeches of biosecurity, as disease can spread readily in these settings. Alternatively, more traditional, pasture-based systems probably allow less producer control over biosecurity, but may be more forgiving to breeches of biosecurity simply because the concentration of animals is less.

Identification and Treatment of Animal Health Issues

Gastrointestinal diseases of neonates, respiratory and clostridial diseases of growing calves, and reproductive diseases of cows are the primary health concerns of most cow-calf producers. Outside these categories, numerous other diseases can also affect beef cattle including coccidiosis, Johne's Disease, footrot, pinkeye, and more. Primary disease concerns are similar across production systems; however, there may be differences in risk level, exposure, and disease transmission among different systems.

Grazing cattle can cover a large territory, interact with wildlife, and may have at least fence-line contact with other herds, thus increasing the risk of contracting some diseases. Grazing cattle will often share water sources with wildlife, increasing their risk of exposure to diseases like Leptospirosis. It can be difficult to maintain large amounts of fence, especially around rough terrain or water gaps. Therefore, grazing cattle sometimes escape or receive visits from neighboring cattle, thus increasing the likelihood of disease transmission between herds. BVD, Trichomoniasis, and pinkeye are examples of contagious diseases that may spread to and from neighboring herds.

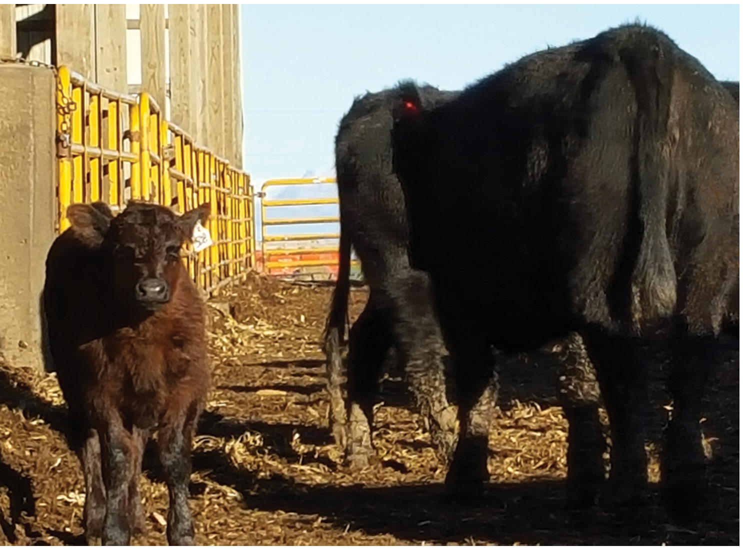

Photo by Denise Schwab.

Limited grazing systems probably allow more control over biosecurity and the environment, thus decreasing the risk of contracting some diseases. Cows in limited grazing systems are confined to a small area, often with a buffer of cropland, farmsteads, or barnyards between them and other cows. They likely drink from waterers supplied by wells or by rural water systems. However, disease will spread more easily and rapidly within a confined herd simply because of the greater contact and interaction between members of the herd. A greater concentration of pathogens within a smaller space creates greater disease pressure compared to traditional pasture systems. Scours, respiratory disease, and pinkeye are examples of contagious diseases that may spread readily in limited grazing systems.

Lameness

Long-term confinement in a drylot or under a roof has the potential to cause or exacerbate feet and leg issues. A commercial cow-calf herd managed in confinement at Illinois State University demonstrated that in confinement, cow culling rate (as a percent of total cows) increases, in large part due to feet and leg soundness problems. Cows and calves in limited grazing systems should be monitored regularly for footrot, hairy heel warts, and other causes of lameness. To minimize the spread of disease, infected cows must be identified and treated promptly, and perhaps isolated from the herd until the condition is resolved. Cows in long-term confinement may require regular hoof trimming so they should be monitored regularly for hoof overgrowth and associated lameness. When pairs are confined in close quarters, young calves may be prone to traumatic injuries such as broken legs, therefore, refuge or creep areas are critical for the protection of calves.

Calving

Management of parturition is critical to the success of a cow-calf operation. According to cow-calf survey data compiled by the United States Department of Agriculture (USDA) National Animal Health Monitoring System (NAHMS), 6.4 percent of calves born during 2007 were born dead, died, or were lost to other causes before weaning. Of those calves that were born alive but died prior to three weeks of age, 25.7 percent died from calving-related problems and 25.6 percent died from weather-related causes. Previous studies suggest that as much as 45-50 percent of pre-weaning death loss is directly related to dystocia. It has also been well documented that calves that experience dystocia are more likely to die from other causes such as infectious diseases, and that cows that experience dystocia have delayed return to estrus. Because antibodies do not readily cross the bovine placenta, colostrum is also critical for the health of newborn calves. Calves must ingest colostrum in order to receive passive immunity from the dam.

Photo by Patrick Wall.

Calving in confinement, whether as part of a limited grazing system or part of a traditional system, offers greater opportunity to monitor, catch, and assist cows during parturition. The ability to monitor closely and offer timely assistance can be a great advantage of calving in a confined setting. Additionally, shelter and bedding can help significantly to mitigate inclement weather.

There is evidence, however, that calving in confinement is not without problems and may require more producer intervention. A 2001 study reported better mothering and colostrum consumption calving on pasture compared to calving pens and cubicles. In a survey conducted by the USDA and Kansas State University in 2000, results suggested that calving in confinement was associated with an increased risk of calf sickness. Additionally,

Photo by Samantha Jamison.

a comparison of dairy cows calving on pasture versus in confinement showed that cows in confinement had 1.8 times more clinical mastitis and eight times the rate of culling for mastitis than did cows on pasture.

Perhaps the greatest health concern for limited grazing systems is the potential for neonatal diarrhea or scours outbreaks. Cleanliness of calving environment and maintenance of dry bedding are critical to the prevention and control of calf scours. The Sandhills Calving System works on the premise that by moving pregnant cows to clean paddocks on a weekly basis, calves are born into relatively clean environments thus reducing their risk for neonatal diseases, including scours. In order to prevent transmission of pathogens from older to younger calves, segregation by age is maintained until calves are at least one month of age. In a limited grazing system, this scheme becomes more challenging, but it may be possible to implement some type of modified Sandhills Calving System that works to protect calf health. Perhaps pregnant females could be grouped based on fetal age indicated by ultrasound and segregated into calving groups based on expected calving dates. Certainly, pen maintenance, bedding management, and excellent hygiene are paramount to the success of a confined calving facility.

The importance of bedding in limited grazing systems is evident in data from this project. Across systems, operators used an average of 1,143 pounds of bedding per female per year. Traditional grazing systems used an average of 583 pounds of bedding per female per year and extensive grazing systems used an average of 435 pounds per female per year. Several of these systems did not bed at all or only bedded first-calf heifers, calving mature cows on pastures, and stalk fields. The bedding used for limited grazing systems ranged from 298 pounds to 6,429 pounds per female with an average of 2,328 pounds of bedding per female per year. It is important to note that several of the limited grazing systems used some type of outside yard, or drylot, and bedded only seasonally. Eleven of the 21 limited grazing records utilized newer buildings designed to be bedded well throughout the year. These 11 records used an average of 3,924 pounds of bedding per cow per year.

Veterinary Medical Costs

There are costs associated with many components of an animal health program. There may also be costs associated with diseases that occur due to an inadequate animal health program. Animal health programs varied tremendously within this project, ranging from thorough preventive medicine programs to programs that did not include routine vaccination or deworming. The average veterinary medical cost ranged from $5-119 per female per year, with an average of $42. The average for the limited grazing system was $49 per female, traditional grazing was $32 per female, and extended grazing was $54 per female. There was no difference in veterinary medical cost based on herd size. It is worth mentioning that there may have been some inconsistencies in how veterinary medical costs were reported. For instance, some operators may have reported costs under "medical supplies" while others may have reported similar costs under "cattle supplies." This complication of how to classify some costs makes it difficult to compare veterinary medical costs.

Summary

The principles of animal health practices are similar regardless of production system, but there may be differences in disease risk based on system and associated management practices. Producers must think carefully about how disease risk may affect day-to-day activities and ultimately the success of the operation.

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Chapter 6: Soil and Water Resources

Impact of Cow-calf Systems on Soil Conservation and Water Quality

Integrating livestock production into cropping systems and land use is an important strategy in Iowa production systems. Long term tillage of Iowa soils has resulted in soil erosion and reduced soil health. Improved forage management, use of manure, no-till farming, and cover crops can help maintain and improve soil characteristics such as organic matter, water infiltration, and soil biology. Potential water quality impacts can be alleviated by improved grazing management and the recycling of nutrients produced by the herds. This project evaluated the impacts of various management choices on soil erosion potential, soil fertility, and the production and nutrient profile of manure produced in cow-calf facilities, as explained in this chapter.

Managing Land for Sustainable Productivity

Cow-calf operations can utilize feed from pasture, hay, or row crops produced on different soil types. Sustainable management of land used to produce feed for cow-calf beef production systems is essential to maintaining soil productivity by limiting erosion. A well-managed pasture can effectively limit soil erosion on steep slopes. Soil erosion will be reduced if there are more acres in Iowa seeded to forage utilized for grazing or hay production, however pastures still need to be managed well to keep soil loss at a minimum. The use of rotational grazing practices can improve forage utilization efficiency and thus allowing for larger stocking rates. However, overgrazing from continuous grazing or overstocking for too long a period can lead to bare soils which can become compacted over time. Compaction results in reduced water infiltration and can cause an increase in surface runoff. Less infiltration and subsequently lower moisture availability can lead to reduced or poor productivity of forages, and thus increased soil erosion.

Row crops can be produced on many soil types with variable topographies with good management to limit soil erosion. The row crops can provide corn silage, corn stalks, and cover crops for feed in many cow-calf beef operations. Cover crops, tillage methods, contouring, and other practices like terracing, strip cropping, and waterways can further help to limit soil loss with row crop production.

Land Use Comparisons and Soil Erosion for Cow-calf Production Systems

To show the effect of different land uses on potential erosion, cooperator fields were used to compare different crop rotations and tillage practices to estimate soil loss using the Revised Universal Soil Loss Equation 2 (RUSLE2). RUSLE2 combines long-term climate, soil characteristics, topography, residue, and canopy estimates to predict the long-term average annual soil erosion.

Variations in topography, soil types, crop productivity, and tillage can all make a difference in how much soil erosion occurs on a soil map unit (SMU). The effect of different crop rotations on soil erosion using RUSLE2 estimates were compared for three different slope classes. To make comparisons meaningful, SMUs for different cooperator locations by county were categorized together into B, C, and D slope classes. These slope classes refer to 2-5 percent, 5-9 percent, and 9-14 percent slopes, respectively. Slope class and SMUs were further categorized by northern and southern counties in Iowa to see if differences existed in soil erosion due to different crop productivities.

Soil Erosion Estimates Using RUSLE2

RUSLE2 utilizes several inputs to develop the erosion estimate for the conservation plan for a given SMU under consideration. Rotationally and continuously grazed pasture were compared with continuous corn or corn-soybean rotation, under no-till and conservation tillage practices, as every field operation can affect the residue, crop canopy, or vegetative cover over the soil. The corn or corn-soybean rotations with grain harvest only were compared with a corn silage harvest, as well as a corn stalk grazing rotation. A good stand of cereal rye and application of ten tons of solid manure was included following the corn silage harvest. In cases of continuous grazing of pastures, proper use was assumed but the yield was low due to the nature of grazing practices. In rotational grazing the stocking density on the paddocks was assumed to be 50 percent greater than the continuously grazed pastures.


Photo by Bonnie Larson.

For D slopes, the RUSLE2 calculations considered row crops being planted on an absolute row grade of two percent to reflect the contouring practices being followed to help reduce soil erosion. RUSLE2 soil loss estimates presented in this chapter assumed that the land is of uniform slope and was neither convex nor concave nor a complex slope. RUSLE2 can be used by individual producers to compare potential soil erosion in their own operations. Alternate software for erosion prediction with water, such as Water Erosion Prediction Project (WEPP), may also be used to develop such comparisons.

Soil Erosion Comparisons for Northern Counties

As shown in Figure 6.1, both continuously and rotationally grazed pastures showed lower levels of soil loss within each slope class and across soil types in comparison to row crop rotations under conservation tillage or no-till. Forages improve soil structure and rainfall infiltration, reduce raindrop impacts on soil surface with the canopy cover, and help trap sediment that may have eroded on the slope. When compared within the two grazing styles, rotational grazing of the pastures was lower in soil loss than continuous grazing, as higher productivity is achieved due to the pasture rest periods in rotational grazing. Overall, land management practices that include forage production minimize transport of sediment, nutrients, and pathogens to pasture streams when compared to row crop production.

When row crop rotations were compared, soil erosion was calculated to be higher for each conservation tillage rotation when compared with the same rotation using no-till. Soil loss estimates for respective row crop rotations showed some variability for the different SMUs within the B slope class. These differences exist due to the differences in soil slope, slope length, productivity erosivity, and erodibility. As such, it should not be assumed that all B slope class SMUs will behave the same when subjected to similar land management practices. The average soil loss for each rotation increased with increase in slope from B to D slope. These slope classes also showed an increase in variability across the different SMUs within the slope class. Water moving over steeper slopes has more energy and is able to erode more soil in comparison to flatter slopes.

The order of the average soil loss for row crops, from the highest to the lowest, was corn-soybean + grazing; corn-soybean; corn-soybean + silage + manure + cover crop; continuous corn + silage + manure + cover crop; and continuous corn rotation. This order was the same for conservation tillage as well as for the no-till rotations within each slope class, when averaged across SMUs for each respective rotation. This order of the reduction in soil loss, with change in land management, was mainly due to the amount of residue cover available on the soil at different times of the year.

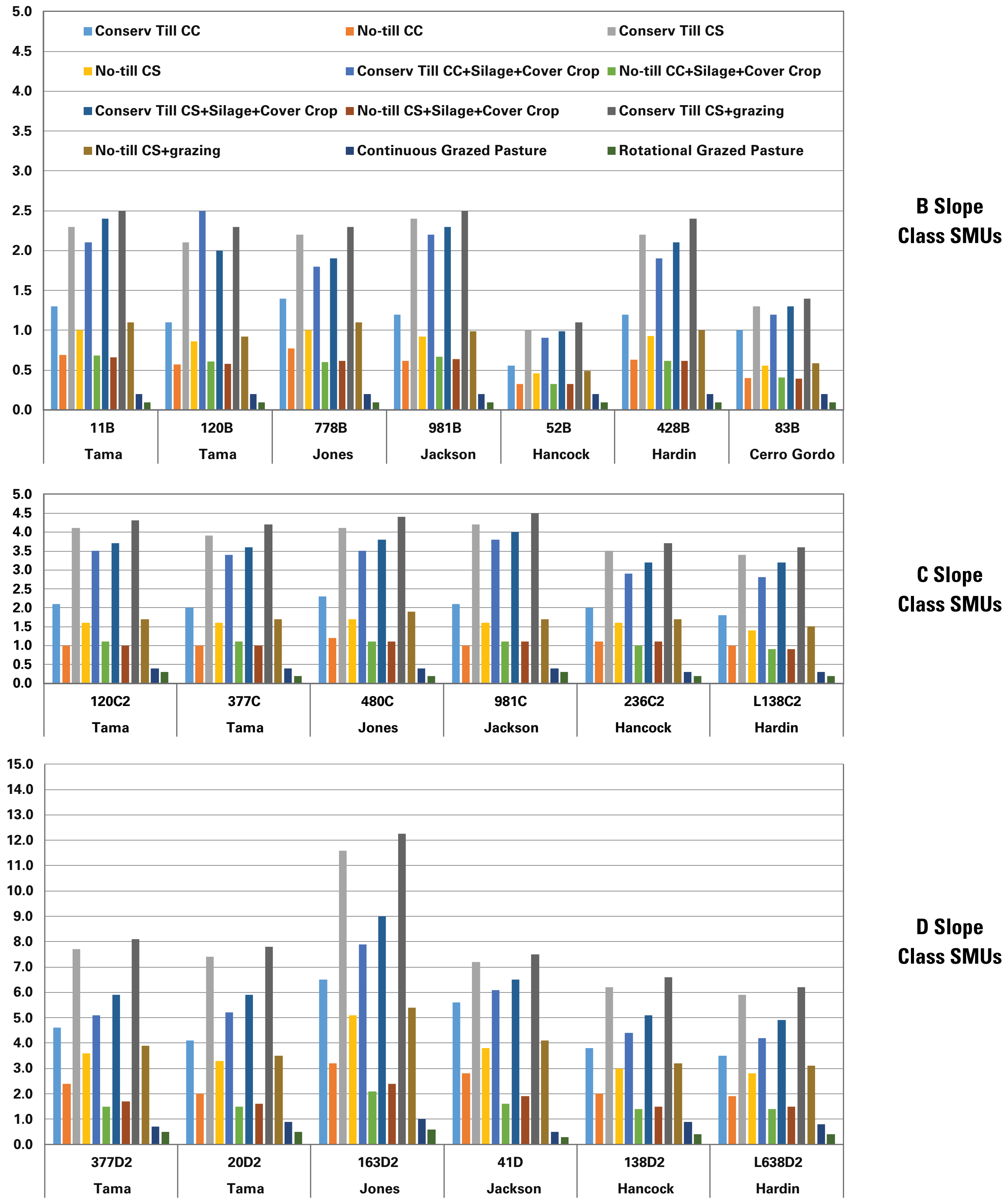

Figure 6.1. Soil loss estimates (tons per acre per year, y-axis) developed using RUSLE2 for different land uses for different soils and slope classes in northern Iowa counties. Note the change in y-axis scale for D slope class SMUs. Erosion factors and crop productivity numbers used in RUSLE2 calculations for the respective SMUs were obtained from the USDA's Electronic Field Operations Technical Guide. Soil map units within the field boundaries were determined using the USDA's Web Soil Survey.

Soil Erosion Estimates for Southern Counties

For southern counties, utilizing the marginal SMUs as pastures produced a lower soil loss RUSLE2 estimate under both continuous and managed intensive grazing conditions when compared to row crops using either tillage method. Rotational grazing of pastures showed a lower soil loss estimate than continuous grazing, although both estimates were less than one ton per acre per year. Maintaining marginal soils (C or higher slopes) in pastures, thus, can provide sustainability in conserving the soil as a resource. Stocking rates on these marginal soils will still need to be managed to balance productivity with grazing to ensure appropriate soil cover. If fields contain SMUs classified as highly erodible land (HEL), it is essential to work with the local United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) office to develop and implement a soil conservation plan.

Photo by Erika Lundy.

Tillage operations played a critical role on C slope class SMUs as soil erosion was calculated to be several times the tolerance limits. RUSLE2 calculations for C slopes under conservation tillage, as shown in Figure 6.2, provide evidence to how sustainability may be impacted for these slopes. As the slope increased, the erosion rate was predicted to be even higher for each respective rotation. On these marginal soils (C and D slopes), it may be helpful to minimize soil disturbance operations to keep soil erosion under control.

Implemeting no-till practices reduced soil loss over conservation tillage but the soil loss estimates were still higher than the tolerance limits for certin SMUs in Iowa's southern counties. Under no-till practices, some soil disturbance still occurs with anhydrous injection and during planting. As any tillage causes disturbance on the soil surface, runoff water moving on the steeper slope is able to carry disturbed sediment, resulting in overall higher soil loss from these SMUs. As such, implemeting no-till practices and growing row crops may still cause higher amounts of soil erosion.

The soil loss for each row crop rotation averaged across the SUMs for southern counties, from highest to lowest, was in the same order as for the northern counties. This order was also the same for conservation tillage as well as for the no-till rotations within each slope class when compared between southern and northern counties, although the southern counties averaged higher soil loss for each respective rotation. This was mainly due to soil types with low productivity and higher erodibility.

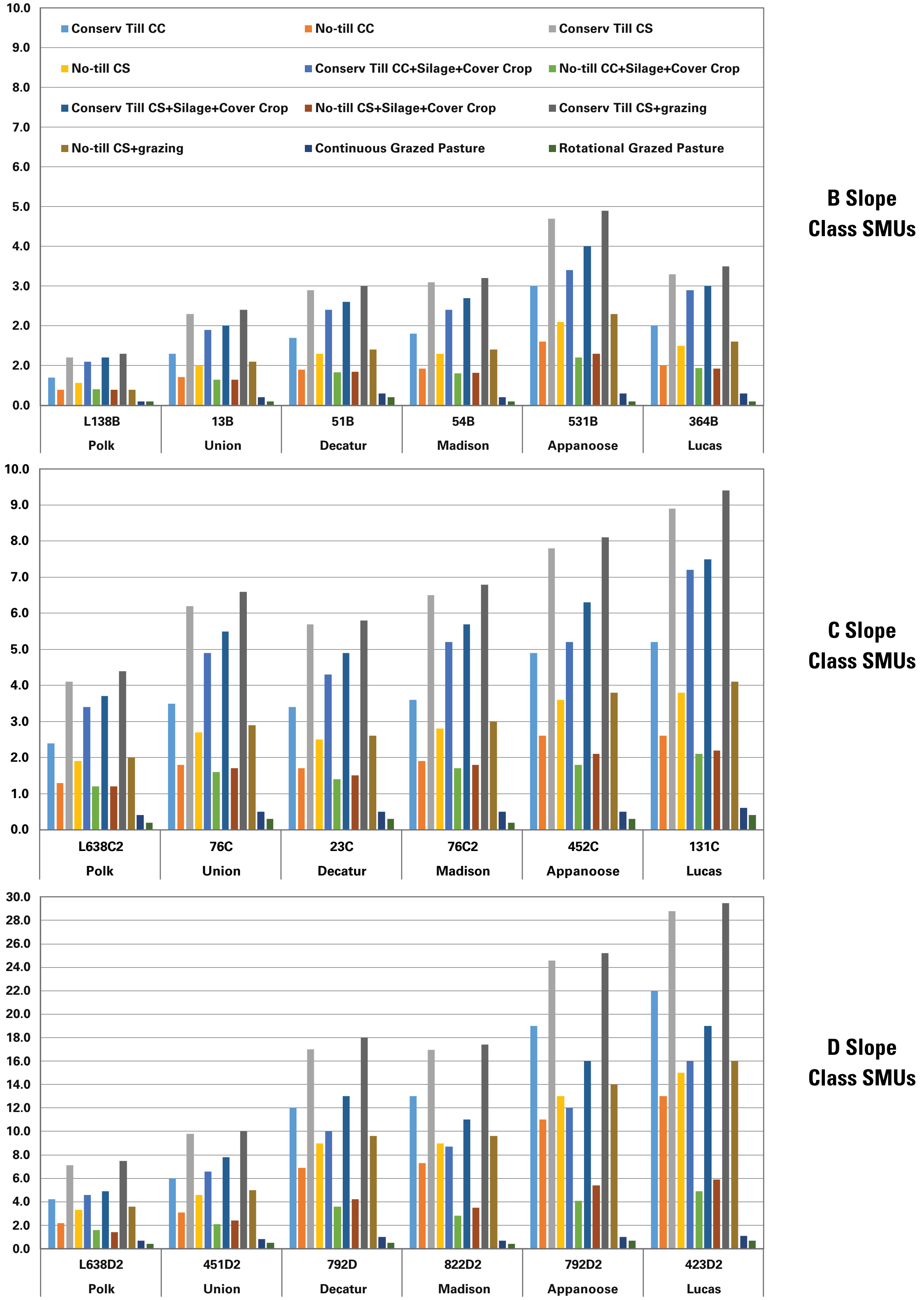

Figure 6.2. Soil loss estimates (tons per acre per year, y-axis) developed using RUSLE2 for different land uses for different soils and slope classes in southern Iowa counties. Erosion factors and crop productivity numbers used in RUSLE2 calculations for the respective SMUs were obtained from the the USDA's Electronic Field Operations Technical Guide. Soil maps units within the field boundaries were determined using the USDA's Web Soil Survey.

Summary of Land Management

Photo by Denise Schwab.

Sustainable management of land used in cow-calf beef production systems is essential to maintain the productivity of the soils by limiting erosion. Cow-calf producers have choices in production systems on how the land is utilized. RUSLE2 soil loss estimates were developed and compared for twelve different land use options for different SMUs in the B, C, and D slope class categories for northern and southern Iowa counties.

In both parts of the state an increase in slope showed an increase in the calculated soil erosion, with greater variability within each slope class in the southern counties. Reduced tillage in the row crop rotations in southern counties on marginal slopes (C and D slope class) did reduce soil erosion, but for certain SMUs it still exceeded soil loss tolerance limits.

Use of a cover crop in the rotation, such as cereal rye, provides cover during sensitive times of the year, both after silage harvest in fall or in spring the following year, which helps to reduce erosion.

In the analysis performed, the cover crop was terminated at the end of March or April to start preparing fields for corn or soybean planting, but could also be grazed or harvested if not terminated. Use of no-till practices in a continuous corn or corn-soybean rotation with use of a rye cover crop after corn silage harvest, showed less than half the RUSLE2 soil loss estimates in comparison to the respective rotations using conservation tillage practices. Calculations also showed that a lack of appropriate soil cover after silage harvest (i.e., not planting a cover crop) can increase soil erosion by nearly 50 percent in cases of no-till or more than double the soil erosion in cases of conservation tillage for the continuious corn and corn-soybean row crop rotations.

Structural practices such as terraces, drop structures, and waterways will not reduce erosion rates but can help to trap the eroded sediment on the slope, thus reducing soil loss. Use of structural practices was also not included in this discussion as it is site specific and each field needs to be considered separately.

Pastures, under either continuous or rotational grazing, should be properly managed to not allow for compacted or bare areas to develop due to overgrazing or overstocking. Water infiltration is reduced due to compaction which can result in higher surface runoff, thus promoting gully development on pastures.

For both northern and southern counties' soils considered in this analysis, using SMUs for pastures produced lower soil loss estimates than the different row crop rotations considered as options for land use in each slope class. Managed rotational grazing showed lower soil loss levels than continuous grazing mainly due to its establishment of better soil cover. Thus, land management practices that include forage production can potentially help to conserve soil on the slope, minimize the transport of sediment, and subsequently the transport of sediment-bound nutrients and pathogens to pasture streams.

Soil Test Results and Nutrient Levels

Pasture and hay fields of the cooperators were sampled for soil tests over the course of the project, resulting in 92 samples from 20 farms with the goal of looking at current nutrient levels on fields and fertility recommendations. There are diverse management histories of the tracts sampled, ranging from long-time permanent pasture to fields more recently rotated to pasture or hay.

Photo by Erika Lundy.

The soil test methods used in this publication are the Mehlich-3 (M3P), Mehlich-3 tests for K (M3K); a 1:1 water-soil slurry test for soil pH; and the Shoemaker-McLean-Pratt (SMP) or Sikora buffer pH method (BpH) for lime requirement. Soil sample handling procedures in the laboratory include testing of dried samples (at 95-105°F) and slurry for pH.

While the average test results were favorable, there was a tremendous range in all measurements. Some of the low levels of phosphorus (P) and potassium (K) may be limiting productivity, while some of the very high levels suggest no economic returns from additional manure or fertilizer applications.

Table 6.1. Test results, 92 samples from 20 farms.

	M3P	M3K	pH	BpH	OM
Minimum	3	60	4.95	6.15	2.5
Average	57	292	6.23	7.00	5.5
Maximum	341	1140	7.65	7.40	9.5

Phosphorous Levels

Recommendations from Iowa State University Extension and Outreach publication "A General Guide for Crop Nutrient and Limestone Recommendation in Iowa" (PM 1688) (https://store.extension.iastate.edu/Product/5232), would describe very low P levels as under 8 ppm, indicating that 20 percent of samples from this database were very low. These lower results were not unexpected due to the very low subsoil P levels of many of the southern Iowa soils. Therefore, many of these pastures could benefit from supplemental phosphate.

Sixty-three percent of samples tested were at optimum or higher levels for P (16 ppm or above) while 17 percent of the samples were over 100 ppm, suggesting high applications of manure. For more economical returns, many of these locations should consider applying manure only at nutrient removal rates or rotate manure application to other fields.

Potassium Levels

Potassium fertility levels were at higher levels relative to phosphorus. Twelve percent of the test results were very low (under 120 ppm), while 80 percent were considered optimum or higher. These tests did find some pastures that could benefit from additional potash to improve forage productivity.

Buffer pH

When looking at buffer pH (BpH) for the fields sampled, only 20 percent were lower than 6.8 percent, indicating most fields would need little or no lime to modify soil acidity. Actual pH levels in 23 percent of the fields were low enough to make alfalfa production difficult, but other legumes such as clovers or trefoil should be able to maintain competition in well managed grass pastures.

Organic Matter

Farmers recognize the relationship between soil organic matter management and the processes that maintain and improve soil structure. It is well known that soils with good structure (aggregate stability) have better infiltration and water holding capacity, are less easily compacted, allow unrestricted root growth, and are more resistant to erosion. Farmers in Wisconsin were polled on what factors they believed contributed most to soil quality on their farms. They were given a list of 40 soil quality indicators from the University of Wisconsin Center for Integrated Agricultural Systems in their Wisconsin Soil Health Scorecard, and listed soil organic matter as the number one factor.

Soils in the southern third of Iowa are loess-derived with greater agronomic limitations compared to the till-derived, organic matter-rich soils in the central and northern portions of the state. Topography of the southern third of the state is rolling, with shallow bedrock and limited level upland, whereas central and northern portions of Iowa are relatively level and undissected. These regions have differences in dominant environmental characteristics, as well as unique combinations of climatic, edaphic, and topographic factors. The typical range of organic matter in Iowa row cropland is 2.5-5.0 percent, though many soil scientists would agree that the general trend is for decreasing levels of organic matter. In general organic matter on low yielding crop acres in southern Iowa is lower (under four percent) while it is 4-7 percent in the Des Moines lobe.

An Iowa study modeled soil organic carbon changes in Iowa row crop acres from 1972-2007. Corn yield increased 108 percent, soybean yield increased 36 percent, and biomass removal increased 65 percent. This resulted in a 10 percent reduction in soil organic carbon.

Iowa can be described as having two broad environmental provinces; one in the south characterized by relatively high amounts of precipitation and higher variability of precipitation, soils with relatively high agronomic limitations, and substantial portions of the land surface with relatively steep slopes. The other environmental province can be characterized as having lesser precipitation but relatively high constancy of precipitation, agronomically superior soils, and fewer areas of slope-limited suitability.

Figure 6.3 demonstrates southern Iowa soils under crop production had much lower organic matter levels than northern Iowa. Results from this project demonstrate that well managed pasture and hay acres can build organic matter in the southern Iowa soils to levels similar to the Des Moines lobe.

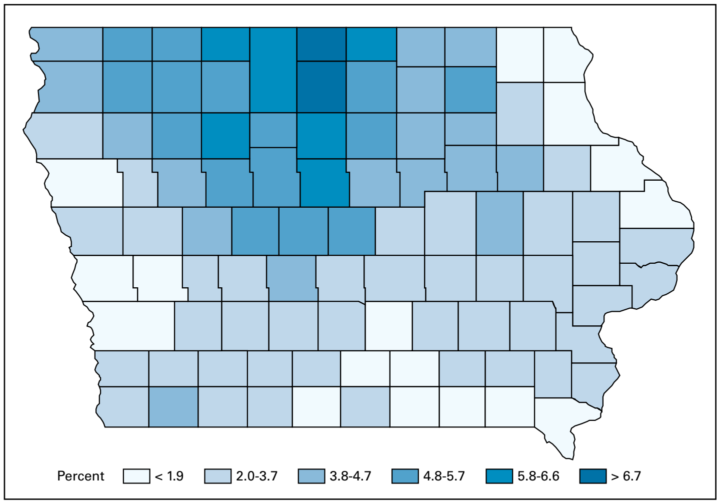

Figure 6.3. Percent organic matter, tilled cropland.

Many of the fields with long-term managed grazing had very high organic matter levels compared to typical Iowa row crop acres. Sixteen percent of the fields were over seven percent organic matter, 29 percent of the fields had organic matter above six percent, while 27 percent were lower than 4.5 percent. The cropping and tillage history on the lower organic matter fields contributed to their current levels of organic matter. Manure application history and grazing management were keys for higher organic matter.

Practices that build organic matter include the addition of organic residues such as manure and other by-products, leaving crop residues in the field, reducing tillage intensity, and diversifying rotations to include forages or cereal crops – many of these were utilized by project cooperators. Grasslands can help rebuild those organic matter levels, as can no-till farming combined with cover crops. Well managed pastures can increase and maintain organic matter levels.

Farm Averages by Region

Breakdowns by farm in each region are seen in Tables 6.2 and 6.3. Looking at the composite of samples taken for each farm, there is a difference between the southern Iowa and northern Iowa samples from project cooperators.

Organic matter is higher in the grasslands region, mainly due to very long term grazing management. Phosphorous levels are lower in grasslands areas, in part explained by intermittent hay harvest of pasture without replacement of nutrients removed and the low subsoil P levels. Commercial fertilization manure application or feeding in targeted pasture sites could improve production.

Soils in northern Iowa were less acidic as expressed either as BpH and pH compared to farms in southern Iowa. The addition of lime might help maintain more diverse pastures in some southern Iowa locations.

Table 6.2. Farms in northern Iowa, average test results.

Producer	M3P	M3K	Ph	BpH	OM
1	19.8	143.3	6.5	7.2	4.0
2	12.5	165.0	6.2	7.2	4.4
3	125.4	241.4	7.0	7.2	4.5
4	71.3	417.0	6.3	7.0	4.8
5	19.0	111.7	6.0	7.1	4.0
6	11.8	279.5	6.0	7.0	5.1
7	3.0	98.0	6.3	7.1	3.7
8	93.0	239.7	5.9	6.8	5.4
9	75.5	292.5	6.4	7.0	6.8
10	164.9	399.4	7.0	7.2	4.8
Averages	**77.0**	**263.4**	**6.4**	**7.1**	**4.8**

Table 6.3. Farms in southern Iowa, average test results.

Producer	M3P	M3K	Ph	BpH	OM
1	15.3	303.5	5.6	6.9	5.3
2	39.8	188.5	5.8	7.0	4.5
3	33.5	411.5	5.9	6.8	6.7
4	24.0	335.0	6.3	7.0	6.0
5	4.0	203.3	5.3	6.5	5.5
6	84.0	496.8	6.2	7.1	6.1
7	53.1	304.2	6.0	7.0	6.4
8	10.3	233.8	6.0	7.0	6.5
9	62.7	330.7	6.8	7.2	6.4
10	6.0	156.0	6.3	6.9	5.8
Averages	**42.8**	**318.9**	**6.1**	**7.0**	**6.1**

Managing Manure in Cow-calf Operations and Environmental Stewardship

Traditional cow-calf operations use pasture grazing to recycle nutrients not utilized by the grazing animals through the distribution of manure on the pasture. Although there is some loss of nutrients that are distributed in the manure, with good pasture and grazing management there would be limited manure run off. Many pastures have adequate phosphorus and potassium levels and with these two nutrients being recycled in manure, additional P_2O_5 and K_2O is seldom needed. Nitrogen (N) can be lost through volatilization so there is more N loss from manure distribution on the pasture and most grass pastures require supplemental nitrogen. Even in traditional grazing systems, there is often time when animals are not grazing and are delivered feed, which generates a small amount of manure, bedding, and wasted feed that can be applied from the operation to row crop, pasture, or hay ground. Limited grazing systems provide an opportunity to capture more of the manure nutrients and apply them to row crop acres. With increased cost of commercial fertilizer, capturing those nutrients and using them in row crop production has increased value, which producers need to consider when making choices in cow systems.

Manure nutrients start with the ration being fed and efficiency of the animal consuming the ration. Cows that are fed a delivered ration would typically be fed a diet to match their maintenance needs. At most times of the year, the ration would have less protein, P, and K than a feedlot diet. Mature cows, on average, would likely have a higher dry matter intake and more manure excretion than feedlot cattle. Table 6.4 compares manure and nutrient excretion by a cow and feedlot animal. Although there is a similar amount of nutrient excretion, it is less concentrated in the raw manure.

Photo by Samantha Jamison.

Table 6.4. Excreted manure and nutrients pounds per head per day as per MWPS 18 Section 1.

	Pounds of raw manure	N	P_2O_5	K_2O
Beef Cow (1,000 lb.)	92 at 88% moisture	.35	.18	.29
Beef Feedlot (1,100 lb.)	54 at 92% moisture	.40	.12	.25

How much of those manure nutrients are captured depends on the facility type, management of the facility, and handling of the manure following excretion. Other factors influence the actual plant available nutrients following animal excretion, including manure storage and application methods and environmental interaction with the manure.

Types of Facilities and Manure Management for Limited Grazing Operations

Limited grazing operations use open lots or bedded confined buildings for a majority of the year. Open feedlots typically have lower manure handling cost than bedded confinement, but also lower nutrient content and higher variability. Manure spread out in an open lot is subject to more environmental interaction, which typically results in more ammonia volatilization, dilution and loss with rainwater runoff, and less manure actually being captured. More frequent scraping of open lots captures more nutrients by reducing environmental interaction, but if land is not available for application, the manure needs to be stored. Manure nutrient concentration and moisture content from open feedlots is more variable, making it more difficult to apply to meet precise crop nutrient needs. The quantity of manure is also more variable in an open feedlot and can vary by season. More manure nutrient value can be retained from open lots by capturing and using the effluent (liquid) runoff from the pens. Because effluent nutrient concentration is typically low, high application rates per acre usually require pumping versus hauling. No estimates of quantity of manure or manure nutrients captured are available for cow-calf production in open lots. For feedlot finishing in open lots, estimates of manure quantities and manure nutrients are three tons of manure and 45 pounds N, 24 pounds P_2O_5, and 33 pounds K_2O per head per year, according to the "Beef Feedlot Systems Manual" (PM 1867) (https://store.extension.iastate.edu/product/5442) from ISU Extension and Outreach.

Bedded confinement buildings capture more manure nutrients than open lots because there is less surface area for environmental interaction. In addition, the majority of the manure and urine and the nutrients they contain are captured by the bedding. Some nitrogen is lost through volatilization of the ammonia in manure as the bedding dries.

The concentration of nutrients can vary with size of animal, rations being fed, and the density of the animals in the facility. Tables 6.5 and 6.6 show averages and standard deviations of nutrient concentrations in manure samples from bedded confined cow operations and bedded confined finishing beef operations.

Table 6.5. Bedded cow-calf confinement manure from eight project cooperator samples.

	% moisture	N lbs./ ton	P_2O_5 lbs./ton	K_2O lbs./ton
Average	69	10.0	7.0	16.0
Standard deviation	8	1.8	2.5	6.3

Table 6.6 Bedded finishing confinement manure from 82 samples included in the Animal Industry Report publication "A Survey of Manure Characteristics from Bedded Confinement Buildings for Feedlot Beef Production."

	% moisture	N lbs./ ton	P_2O_5 lbs./ton	K_2O lbs./ton
Average	69.00	18.00	11.00	14.00
Standard deviation	4.70	4.75	4.06	3.95


Photo by Denise Schwab.

The samples show less nutrient concentration in the bedded cow-calf facilities and slightly more variation than in finishing facilities. To be able to better manage manure nutrients, operations should take manure samples for analysis and use the analysis to inform their decisions.

There is likely large variation in quantity of manure from bedded cow-calf facilities, and more research is needed to determine quantities of manure and nutrients. An estimate of 13 tons of manure and bedding per cow per year will be used in further calculations. The 13 ton estimate is based on 13 pounds of bedding and 92 pounds of raw manure added per head per day and adjusted to 70 percent final moisture. This quantity will vary with the amount of bedding added, the amount of bedding consumed by cows, amount of manure drying, and ration being fed. Estimates of manure quantities for bedded confined beef finishing facilities are five ton per head per year, according to the Beef Feedlot Systems Manual. Additional quantity of manure for a cow-calf facility is due to more bedding and more manure per head than a finishing facility.

Bedded confinement facilities typically involve increased labor to clean out a facility and land apply manure as compared to an open lot or pasture grazing. Sometimes the manure is handled twice if it is stockpiled after removal from the building and before land application.

Land Application and Crop Utilization of Beef Manure

It is important to understand that typically not 100 percent of nutrients in beef manure are available for crop production in the first year of application when determining application rates and the value of the manure. ISU Extension and Outreach publication PMR 1003, "Using Manure Nutrients for Crop Production" (https://store.extension.iastate.edu/Product/12874) explains the availability and potential losses in more detail. The availability of the nutrients suggested in the publication is shown in Table 6.7.

Table 6.7. First year nutrient availability of beef cattle manure.

Nitrogen	Phosphorus	Potassium
30-40%	60-100%	90-100%

Nitrogen availability estimates do not account for potential volatile N losses during and after land application. Second year availability of N is 10 percent and third year is five percent.

Ranges in P and K availability account for variation in sampling and analysis and the need for P and K additions with different soil test levels. A small portion of P from manure may not be available immediately after application, but all P is potentially available over time.

To capture the full nutrient value of manure, it must be applied to land where the crop grown needs that nutrient. In other words, if the manure application does not replace purchased commercial fertilizer, then the value is not captured. Typically if manure is applied to land for corn production at a rate to meet the N need, the amount of P and K applied will exceed the P and K needed in one year. Applying beef manure to meet N demand every year will tend to build P and K levels and reduce the captured value of the manure P and K. Applying to a field every two or three years, or applying only to fields that have demand for all three nutrients, may increase nutrient returns by reducing the need for purchased nutrients.

Each operation needs to determine how to maximize value of the manure nutrients by determining which crops and fields will best utilize all the nutrients being applied.

Manure Nutrient Value

Using the nutrient concentration and quantity of manure produced and adjusting for nitrogen availability, it is possible to calculate the value of manure nutrients per head per year from a bedded confined cow facility. Manure application costs can vary widely, but need to be considered. Using estimated costs of application of $6-7 per ton, which would include labor, equipment ownership, and operation, Table 6.8 shows values using the assumptions mentioned previously.

Photo by Angie Rieck-Hinz.

Table 6.8. Estimated manure nutrient value per head per year from bedded cow-calf facility.

Per head per year	N value	P_2O_5 value	K_2O value	Total value
Applied manure	$21	$41	$94	$156.00
Application cost	13 ton @ $6.50/ton			-$84.50
After application				$71.50

Nitrogen availability 40%, P and K availability 100%. N price $.40/lb. P_2O_5 and K_2O $.45/lb. 13 ton of manure per head per year.

As a comparison, bedded confinements for finishing cattle would have an estimated manure nutrient value of $74.25 per head per year at five tons of manure per head per year. Subtracting the application cost of $32.50 leaves a net of $41.75.

Environmental Considerations and Regulations

Photo by Denise Schwab.

All animal operations need to manage their operations so that water quality is not impacted. Runoff from feedlots and feeding areas carry manure nutrients and pathogens that need to be managed. An area used for cows without vegetation for a total of 45 days in a year may be classified as an open beef feedlot and regulated as such. All sizes of cow-calf operations that use lots in the winter or feeding areas need to manage runoff from those areas to minimize water quality impacts. Systems that can manage and contain runoff from an open beef feedlot can be implemented for cow feeding areas. Of course, they add to the cost of an open feedlot. Although uncommon for cow-calf operations, an operation of 1,000 head or more using open lots would require additional environmental regulation and a National Pollutant Discharge Eliminiation System (NPDES) permit.

Confinement facilities are being considered by many producers to eliminate manure runoff from the facility. In Iowa, totally roofed confinement facilities are not allowed to discharge manure or process wastewater from the facility. Manure storage for bedded operations that are not under roof, as well as feed storage areas, could create a runoff issue if not managed correctly. Confinement operations have other regulations that are based on size of the operation that include separation distances and manure management plans (500 head or over). Manure application from these operations needs to protect water quality in all cases and follow prescribed plans and certification requirements if larger than 500 head.

Operations that have other livestock or other facilities in addition to a cow-calf operation need to check to see how combined animal number or facility types affect regulations they may need to follow. Sites that are classified as a large CAFO (concentrated animal feeding operation) for any species must follow permit requirement for all animals at that same site.

More information on beef feedlot operation environmental regulations and implemeting environmental stewardship practices for all types and sizes of operations are available from several sources, such as the Iowa Manure Management Action Group, (www.agronext.iastate.edu/immag), Iowa Department of Natural Resources (www.iowadnr.gov/Environmental-Protection), and the Coalition to Support Iowa Farmers (www.supportfarmers.com).

Summary of Land Use Choices

Land use choices and nutrient management have significant impacts on soil erosion and water quality protection. As noted in this publication, much of the tillable (cropland) pasture in Iowa was converted to row crop production between 1997 and 2012. Analysis of cooperator farms demonstrates that maintaining steeper and erosive soils in forage production can greatly reduce soil erosion and delivery of sediment to surface waters.

Soil nutrient analysis of cooperator pastures and rotational forage acres found higher organic matter levels than typical Iowa soils in row crop production. Most cooperator soil tests showed optimum or higher levels of phosphorous and potassium, but some could benefit from additional fertilizer. Manure analysis from the project found added value using these nutrients on cooperator farms.

The optimum production system should look at both economic and environmental impacts of practices applied. For regions in Iowa with more fragile soils, some land should remain in pasture and hay production used in traditional or extended grazing systems, while other parts of Iowa are well suited to row crop production and are more adapted to limited grazing systems.

Grazing Management May Be Used to Minimize Pollution of Pasture Streams

By James Russell, professor emeritus in animal science at Iowa State University

Photo by James Russell.

Because forages improve soil structure, increase microporosity and rainfall infiltration, reduce raindrop impacts on soil surfaces, and filter surface runoff; land management practices that include forage production may minimize transport of sediment, nutrients, and pathogens to pasture streams. In spite of the benefits of forage production on water quality, continuous grazing of forages at high stocking densities may promote transport of these pollutants because of excessive forage removal, soil compaction, and concentration of manure nutrients. However, the effects of grazing on water pollution is not a zero-sum game.

Research at Iowa State University has shown that precipitation runoff and transport of sediment and phosphorus during rainfall simulations did not differ between pastures that were not grazed or were grazed by rotationally stocked cattle to a minimum forage height of four inches. However, precipitation runoff and phosphorus loading for pasture that were not grazed or grazed by rotational stocking to a minimum forage height of four inches were 57 and 78 percent lower, respectively, than pastures grazed by continuous stocking to a forage height of two inches. Sediment losses from pastures that were not grazed or grazed by rotational stocking to a minimum forage height of four inches were also 78 percent lower than pastures grazed by continuous stocking to a forage height of two inches, but the large variation in sediment losses made this value statistically nonsignificant. Thus, maintaining a minimum forage height of four inches through rotational stocking may allow forage utilization while minimizing loading of precipitation runoff with sediment, nutrients, or pathogens from upland areas.

However, while precipitation runoff and loading in overland flow from upland areas are contributors to nonpoint source pollution of surface water resources and may be compared to loss values from cropland through models such as RUSLE2, total sediment and phosphorus losses from streambank erosion can be 2-4 times greater than those in overland flow. Although sediment and nutrient loading from streambank erosion may partially result from natural processes like stream flow or freeze-thaw activity, improper management of grazing animals accelerates this damage. While total exclusion of grazing animals from pasture streams may seem to be the most effective method to improve stream water quality, the winding nature of Midwestern streams, the need for water sources for grazing livestock, the effects of frequent flooding events on buffer fences and water gaps, and the effects of shade cover from developing trees and brush on ground cover often makes complete exclusion impractical. Similar to pasture uplands, limiting access to riparian paddocks in a rotational stocking system to maintain a minimum forage height of four inches and grazing for no longer than four days per rotation results in less bare ground and, thus, less sediment and phosphorus transport than in riparian areas of pastures grazed by continuous stocking.

In pastures with adequate size, providing off-stream shade may reduce damage to pasture streams by motivating grazing cattle to spend more time away from streams. Offstream water or nutrient supplementation, while effective in altering the distribution of grazing cattle to reduce damage to streams in Western rangelands, has seen less consistent results in the pastures of the Midwest.

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Chapter 7: Adding Value to the Cow Enterprise

Photo by Patrick Wall.

Previous chapters in this publication have outlined the significant variations in cow-calf operations across the state. Many of the participating herds within this project found unique avenues to add value to their production system. In many cases, the key is to match the available resources and system to the unique value added aspect.

Some options are more obvious than others, like marketing grass-fed beef from an extended grazing system. Two of the participating operations capitalize on extended grazing and forage-based operations to feed and market grass-fed beef direct to consumers. These operations tend to be smaller because of the need for increased pasture acres to support the longer grazing season, as well as cattle that range in age from calf to market-ready. They tend to use more labor for fencing, intensive grazing rotations, and direct marketing, and most of their labor was family labor. The growing and finishing enterprises were not included in the production cost component of the project, but made the division of feed, pasture, operating costs, and labor more challenging to separate for this project.

Purebred seedstock operations had higher investment costs whether in pastureland or confined buildings. They also had higher labor for additional record keeping, and higher feed costs both to maintain a higher body condition on cows and creep feed to wean heavier calves. While income was not recorded with this project, most reported higher sale values to offset these increased costs. Limited grazing operations have some unique aspects that work well with other value added enterprises. Confined systems often place cows in close proximity to the cattle handling facility, allowing technologies like artificial insemination (A.I.) and embryo transfer to be more easily implemented. Confined systems provide opportunities to easily use a nutrient-dense creep ration to maximize the genetic potential for growth in higher value cattle such as club calves or embryo transfer calves. Likewise, the constant presence of a feed bunk can ease the weaning transition for commercial calves and offers a lower-stress opportunity for retained ownership through the feedlot phase.

Fourteen producers provided records that showed involvement in some type of value added production system including seedstock sales, grass-fed direct marketing, club calf sales, or embryo transfer. Six of these records were from limit grazing operations and eight were traditional operations utilizing pasture grazing. While this project did not collect sales values, one would expect these operations to significantly increase both the market value of the females and the potential sale value of the calves or bred females from the system. These value-added operations did indicate higher value of their breeding females at $2,523 per female, whereas commercial producers valued their females at $1,593.

As might be expected, when examining production costs of value added operations, all cost categories were higher than the average of all records. On average these value added operations needed at least $350 in additional calf sales to offset the additional costs. Value added operations fed 8,132 pounds of dry matter feed per female, where the average of all 62 records fed 6,626 pounds of dry matter feed, explaining some of the difference in stored feed costs. Interestingly, there was no difference in labor use reported.

	Average All Records	Value Added Records
Stored feed cost	$306	$405
Pasture cost	$117	$137
Residue cost	$6	$2
Total feed cost	$430	$543
Non-feed operating cost	$254	$318
Direct cost	$684	$861
Ownership cost	$295	$469
Unpaid family labor	$116	$127
Indirect cost	$411	$596
Total cost per female	$1095	$1457

As expected, higher machinery ownership value and building values were seen for the value added records; totaling $1,061 machinery value per female and $1,607 in building value per female. Using 10 percent depreciation or ownership cost, this resulted in a machinery and equipment ownership cost of $106 per female and building ownership cost of $112 per female. But again, the value added operations tended to land on opposite ends of the spectrum; either with new facilities and totally confined animals, or featuring heavily pastured and forage based management.

Photo by Chris Clark.

This demonstrates the need for each value added operation to calculate their own production costs to determine the additional revenue and conception rate needed to offset the additional expenses.

John and Matt Schneider – Adding Value Through Embryo Transfer

John Schneider wanted his boys to get involved in agriculture. He had 480 acres of crops, which was not enough for John and his two boys, who both have good paying careers in town. Five years ago, John made the decision to devote a few acres of his cropland to raising cows, and to do it indoors.

Photo by Erika Lundy.

The Schneider's cow herd is not the typical cow herd. Their main objective is the embryo transfer work they contract out to others, housing the recipient cows at their facility, and the online club calf sale they hold each year. They believe it would be hard to cover their costs running a traditional cow-calf or feedlot operation, so they cater to a niche market.

The Schneiders put up a 50 foot x 240 foot hoop barn that holds up to 120 head of cow-calf pairs and a few bulls. They also have a drylot creep pen so the calves can get additional exercise. To ensure the health of the high-value calves, they calve in a separate barn with cameras installed.

Having the cows inside year-round leads to a lot of feed and bedding being used. The ration is primarily hay and corn silage, with the hay being completely bought and the corn silage being home raised. It takes about 275 corn stalk bales a year to bed the facility. In order to keep costs down last fall when hay prices were high, the cows grazed corn fields after harvest.

While John did admit it is nice to see cows out on pasture, he believes that confined cow systems work. "Ninety-nine percent of the time it's a one-man operation," John said.

John does all the daily cattle chores, and the boys come out to help during breeding, performing embryo transfer work, calving, and working the cows. He believes there is a future in confined cows, especially when they add value through special markets such as their embryo program.

Dave Schmidt – Grass Finishing and Direct Marketing

Like many other young producers, Dave Schmidt is attempting to capitalize on his labor to add value to his operation. Schmidt is utilizing grass not only for the cow herd, but also to finish his steer calves. He grazes the cow herd, the prior year's calves, and lambs together to take advantage of higher stocking density. One of his biggest challenges is to get the yearling steers to gain enough weight to be market ready before their second winter, which allows him to save on total feed and overhead costs. But one thing he credits for helping him through longer winters is the ability to graze cover crops and other crop residues.

Schmidt credits rotational grazing with the reemergence of different species of forages and for assistance in his constant war on weeds. He also markets his meat direct to consumers, adding value through his labor availability. The health of his animals has also been a challenge as he attempts to limit use of medical products to be able to sell a "natural" product.

Adjusting Calving Dates

The three different classifications in this project showed that operations in Iowa can calve in virtually any of the 12 months of the year, with economic justification for doing so in a given management scenario. Traditional and extended grazing operations are more likely to consider calving in late spring. This takes advantage of the growth of grass matching the increased nutrient needs of early lactating cows. These operations are also learning ways to calve on spring cover crops to reduce the impact of mud at calving. The downside of calving at this time is these calves miss the traditional peaks in feeder calf prices or the fed market rallies that happen during grilling season in the United States. Additional downsides are the effects of heat stress and the effects of fescue during breeding.

Photo by Chris Clark.

Iowa's more traditional spring-calving, fall-weaning system may be changing over time as producers find ways to avoid herd health risks like mud and extreme weather. Confined systems are more likely to calve from December to February. One advantage to this calving system may be to ensure that calves are on the ground before the demands of a producer's row crop enterprise. Calving cows inside a building protects newborns from the elements and allows producers to implement technology like surveillance cameras to keep a watchful eye on high-value calves. Operations specializing in embryo transfer may target to calve in December and January so cows that do not accept the embryo pregnancy can be recycled again or bull bred for a traditional spring calf. Close proximity to a chute and camera technology makes calving heifers in confinement a logical option.

Some producers add a fall calving operation to an existing spring herd, often to use their investment in bulls, facilities, and pastures more effectively. Fall calving avoids the challenges of spring mud and calf scours, and producers claim fall calving herds require less labor during calving season. Another advantage to fall calving is the ability to market weaned calves early in the spring, when backgrounders are seeking young calves to go onto grass or when feedyards are looking to refill after marketing spring born calves. But this approach is not without its own set of challenges: cow lactation requirements peak during the cold weather months when on expensive stored feed, calves are young going into the challenges of winter weather in Iowa, and the severity of winter weather can hurt this approach's economic feasibility. However, fall born calves have a built-in creep feed since many learn to eat stored feed next to their mothers.

Some operations have altered or have been forced to alter their calving dates to better align with the challenges of tall fescue pastures. Endophyte infected tall fescue is present in a higher percentage of Iowa pastures across the state. In some cases, endophyte infected tall fescue was incorporated in the conversion to improve pastures while wildlife spread fescue into many other permanent pastures. An intense focus on tall fescue identification and management has resulted in significant management changes in southern Iowa, yet many producers in northern Iowa may be unaware it exists in their pastures. As the grass matures, ergovaline and other alkaloids present in the plant restrict blood flow and elevate body temperature. This elevated temperature and other alkaloid effects reduce pregnancy rates and performance. In some cases, producers "rolled" their young open cows to fall calving to avoid significant herd liquidation. In other cases producers choose to move to fall calving as a system choice. The result is that cows are bred in cooler conditions and are not forced to lactate and rebreed in summer heat while consuming a grass that makes performance and reproduction more challenging. Gestating cows gain condition during the grazing season and better handle the effects of endophyte infected fescue. As Iowa producers have gained experience managing fescue, many have found that fescue works better in a hay-then-graze rotation to eliminate seed head production, or by stockpiling the grass beginning in late summer for winter grazing of fall pairs. Extensive research of toxic tall fescue is ongoing as the grass enters new pastures every year.

Custom Care and Share Arrangements


Photo by Bonnie Larson.

One of the objectives of this project was to identify opportunities where Iowa beef producers could capitalize on existing resources. Many young or beginning producers in Iowa want to start or expand beef operations, but they struggle to gain access to pasture or the capital necessary to raise cattle. In some cases, cows have been a way to diversify the farming enterprise and potentially allow a new producer to enter the farming operation. For example, the hoop buildings that scatter the Iowa countryside were originally a cost-effective alternative to raise hogs. With small modifications, those facilities also work as shelter for cow-calf operations. The number one resource of a young producer is labor, and the growing number of retiring cattlemen makes for a unique opportunity to set up a transition plan between the two parties. Unfortunately, no two arrangements are the same, so a blanket document or spreadsheet is difficult to put together. However, these arrangements can help young or beginning farmers gain access to cows, equipment, or pasture without writing a check or taking out a high-risk loan. Conversely, retiring producers can exit the business at a slower pace, and train the next generation in the process. Information on completing a cow-share agreement can be found through Iowa State University Extension and Outreach's Ag Decision Maker (www.extension.iastate.edu/agdm/wholefarm/html/c2-36.html) or from the Beginning Farmer Center (www.extension.iastate.edu/bfc). Remember, every situation is unique. Contact an ISU Extension and Outreach beef specialist (https://www.extension.iastate.edu/ag/beef) if additional assistance is warranted.

Using Custom Care and Cow Share to Add Value

Two producers in the project, the Mendenhall and Hostetler families in Decatur County, use cow share and custom care arrangements to add value to their pastureland, facilities, and labor. They have long-term arrangements with clients that keep cows on their farms part or all of the year.

Iowa producers and advisors have been evaluating alternative cow ownership and management strategies for several years. An Iowa survey on custom grazing in 2006 found that 75 percent of both cow-calf and stocker custom grazing operations saw custom grazing as part of their long-term farm strategy, enjoying the regular cash flow and diversity that custom grazing brings to their total farm operation. Other producers indicated they were using custom grazing as a stop-gap measure because of a lack of capital, they were waiting out the current cattle cycle, or they were just trying it for a short time with a long term goal of cow ownership.

Justin Mendenhall has a cow-calf share agreement with another producer who wants to maintain more beef cows than the producer has available pasture. In the past, this agreement had involved wintering cows, with the cows returning home before calving. Three years ago, as Justin was graduating from Iowa State University and set to return home, the stage was set to expand the share agreement. Justin and his dad, Sam, not only extended the cow agreement, but also offered to background or finish these partnership cattle on a custom feeding basis. Not only has the Mendenhall family continued to build cow share and custom agreements with other producers, but have built a large family-owned cow herd simultaneously.

Dan, Patty, and Hayden Hostetler are some of the best grazing managers in southern Iowa. Over the years they have grazed stockers, grass-finished beef, and fall or spring cow-calf pairs. The operation has emphasized extended grazing and limited winter feeding with the beef cow operation. The Hostetlers have also built their own cow herd while continuing to care for others' cattle. The Hostetlers receive a daily rate per animal per day to graze, feed, and manage these other cow herds. Their agreement includes different rates for pregnant and lactating cows, a care fee, feed cost for wintering, and additional fees for services such as animal treatment, artificial insemination, and fly control.

Their agreements are based on producing a feeder calf through weaning, with additional charges for backgrounding calves. The cow-calf share agreements share risks and rewards; so when the market is strong and feed is economical it is an advantage to the care taker. The cost care agreement is less risky to the cattle care taker, but also secures market advances to the cow owner.

Summary

While the focus of this project was to examine production costs, several cooperators shared their experiences of attempting to increase income above traditional feeder calf sales. Capitalizing on their unique resources, whether that be adequate pastureland, labor, marketing, or seedstock management, cooperators increased income to offset any increases in production costs.

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Chapter 8: Systems Best Management Practices, Advantages, and Concerns

There are several alternatives for beef cow production systems in Iowa and the Midwest that have been highlighted in this manual. The project, working with the producer cooperators, demonstrates the three systems outlined can be economically feasible if managed properly. Identification and efficient utilization of individual resources and data management for decision making are the keys to success, not the type of production system. Many operations include components of one or more of these systems. This overview summarizes the unique opportunities and challenges of each system and considerations for individual operators when considering implementing or making changes to their beef cow system.

Photo by Erika Lundy.

Some keys to success are critical in all systems, such as optimum reproduction, meeting nutrient requirements, managing feed cost, risk management, use of good genetics, adoption of appropriate technology, and optimum marketing of calves and cows. Financial management, debt management, and access to capital are also keys to business sustainability across all systems.

Keys to success in all cow systems
Control feed costs • Reduce feed waste • Utilize least-cost feedstuffs • Test feedstuffs to determine nutrient content • Balance ration to meet needs • Extend whatever grazing season is available • Utilize crop residue when available • Consider using Rumensin® to improve feed utilization
Optimize conception and weaning rates
Optimize value of calves using genetic selection, reproductive technologies, and marketing
Manage non-feed operating costs
Review health protocols with veterinarian at least annually • Manage diseases and parasites
Monitor body condition score
Market cows at acceptable body condition score and seasonal highs
Select and develop heifers appropriately
Capitalize on economy of scale and diversification
Control fixed asset costs
Keep enterprise records to know costs, and how and when they shift

Limited grazing systems	Traditional grazing systems	Extended grazing systems
Control feed cost • Feeding a TMR in a bunk may reduce feed waste from 25 percent to five percent or less • Adjust ration regularly based on nutrient requirements • Ensure calves have access to feed and water sources through appropriate throat height and adequate space, especially access to water without cow pressure on hot days • Ensure bunks are deep enough for the fiber based cow diet, or feed multiple times per day to reduce feed waste • Group cows based on age, stage of gestation, and feed to meet nutrient requirements • Provide adequate bunk space Provide creep pen for safety of calves Consider individual pairing pens for heifers to ensure adequate pairing and nursing Provide adequate bedding Segregate newborn calves by age Take advantage of higher manure value from bedding pack Encourage early weaning to reduce the nutrient demands on the cow and moving calves into finishing operation sooner Monitor cows regularly for health issues, and feet and leg concerns	Control feed costs • Improve pasture management and utilization • Supplement to meet cow needs without over feeding • Control feed waste • Optimize carrying capacity and stocking rate (approximately two acres per cow needed, depending on forage production ability of the land) Utilize crop residue and cover crop grazing Provide adequate lot area and relatively dry, well drained surface during winter feeding and calving season Move pregnant cows to manage calving pasture and limit disease spread Feed strategically in areas where soil nutrients are needed Match peak nutritional requirements to forage availability Manage environmental impact of feeding areas by keeping away from water sources Manage excess grass growth by harvesting hay from a portion of the pasture	Control feed cost • Utilize stockpiled pasture, crop residue, and cover crop grazing if possible • Optimize carrying capacity and stocking rate (approximately 3-4 acres per cow needed, depending on forage production ability of the land) Manage risk of weather impacts on grazing Utilize Sandhills calving system Match peak nutritional requirements to forage availability Manage excess grass growth by harvesting hay from a portion of the pasture Manage quality of stockpile forage by limiting growth to 100 days, fertilizing, and rotational or strip grazing

Limited grazing confinement building	
Opportunities	**Challenges**
Ability to add or expand cow-calf operation when pasture costs are high or unavailable.	Increased fixed cost in building and equipment per cow. Investment is made in a building that will depreciate in value over time.
Reduce severe weather impacts on cattle.	Annual feed cost is higher than current pasture rental rates per cow. Feed cost could be more variable between years.
Meet nutrient requirements of cattle more precisely, with more flexibility in feed resources.	Unknown impacts of long-term confinement on cow longevity, feet and leg structure, and lameness.
Potential to adjust calving seasons or adapt production to take advantage of seasonal markets or value added opportunities.	Bedding cost, availability, management, and time requirement for a bedded building.
Potentially reduce environmental impacts in sensitive locations.	Managing calving and breeding issues in a limited space with high cattle density.
Capture more manure nutrients that can be land applied for more value on row crop acres.	Increased manure handling cost and time.
Ability to observe, manage, and handle cattle due to convenient location and facilities.	Adequate feed and bedding storage on site.
One location, one water source, and less fence to maintain.	Biosecurity and disease risk due to increased animal density.

Limited grazing drylot	
Opportunities	**Challenges**
Ability to add or expand cow-calf operation when pasture costs are high or unavailable.	Annual feed cost is higher than current pasture rental rates per cow. Feed cost could be more variable between years.
Utilize existing facilities at lower fixed cost per cow.	Existing facilities may not be in good location, correct size, or designed properly for cattle or environmental impact.
Meet nutrient requirements of cattle more precisely, more flexibililty in feed resources.	Building new dry lot facilities with adequate square footage would add to fixed cost.
Ability to observe, manage, and handle cattle due to convenient location and facilities.	Unknown impacts of long-term confinement on cow longevity, feet and leg structure, and lameness.
Limited pasture could be used in conjunction with existing drylot facilities to expand cow numbers.	Managing calving and breeding issues in a limited space with high cattle density.
	Bedding required for winter and calving season, added bedding cost, management, and manure hauling.
	Adequate feed and bedding storage on site.
	Biosecurity and disease risk due to increased animal density.

Traditional grazing system	
Opportunities	**Challenges**
Proper grazing management can utilize fragile or highly erodible land in an environmentally sustainable manner.	Land availability, competition from other uses, or high cost for pasture can limit ability to expand.
Grazing cost is typically lower than delivered feed.	More cattle exposure to severe or extreme weather – shelter and windbreaks need to be provided.
More likely to be able to utilize corn stalk grazing to lower feed costs.	Feed and pasture resource fit better with April-May calving period, less flexibility in calving season choice, and timing may not fit with row crop labor demands.
Flexibility of feed sources for winter feed.	More susceptible to weather impacts, drought, snow or ice storms, extreme heat events, or water availability.
Can limit fixed cost investment in buildings and machinery.	Depending on pasture location, access and observation of cows can take more time.
	Need to have adequate location, and facilities for winter feeding that are potentially not used in summer.
	Fence and water source maintenance.

Extended grazing system	
Opportunities	**Challenges**
Proper grazing management can utilize fragile or erodible land in an environmentally sustainable manner and maximize ability of cow to harvest her own feed.	Increased pasture acres required to allow stockpiling for winter grazing.
Lower feed costs for grazing and ability to use cornstalk grazing if available.	Need a feed resource and flexible plan to supplement grazing in severe weather conditions that prevent grazing (drought, ice, or heavy snow).
Minimize fixed cost for building and facilities.	Drought effects on pasture feed and water availability can affect cattle numbers.
Can better utilize fescue pasture through stockpiling.	More cattle exposure to severe or extreme weather – need to have shelter and windbreaks in specific locations.
Investment in land can appreciate in value over time.	If pasture is in a distant location or spread out, access and observation of cows can take more time.
	Fence and water source maintenance.

Appendix A. Economic Comparison Results

Summary	Summary of All 62 Herd Years			Summary of 21 Limit Grazed Records			Summary of 28 Traditional Records			Summary of 13 Extensive Grazed Records			Summary of 23 Cornbelt Records	Summary of 39 Grassland Records	Summary of 38 Records <200 Cows	Summary of 24 Records >200 Cows
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Average	Average	Average
Average # Breeding Females	196	19	671	216	51	671	178	19	390	200	32	640	238	171	93	358
Direct Cost of Production per Female																
Stored Feed	$306	$45	$955	$543	$318	$955	$217	$59	$375	$118	$45	$196	$363	$273	$330	$269
Pasture Cost	$117	$0	$482	$22	$0	$108	$149	$42	$482	$203	$93	$324	$62	$150	$123	$108
Residue Grazing Cost	$6	$0	$82	$1	$0	$11	$12	$0	$82	$2	$0	$7	$4	$8	$8	$3
Total Feed Cost	$430			$566			$378			$323			$429	$431	$461	$381
Non-Feed Operating	$253	$118	$744	$248	$133	$400	$274	$118	$744	$216	$133	$306	$230	$267	$267	$231
Total Direct Cost per Female	**$683**	**$351**	**$1,397**	**$814**	**$455**	**$1,157**	**$652**	**$351**	**$1,397**	**$538**	**$470**	**$701**	**$659**	**$698**	**$728**	**$611**
Indirect Cost of Production per Female																
Depreciation/ Ownership Cost	$286	$140	$1,059	$443	$195	$1,059	$210	$142	$333	$195	$140	$245	$281	$289	$314	$240
Unpaid/Family Labor	$126	$0	$313	$97	$0	$218	$144	$22	$313	$135	$92	$221	$81	$152	$158	$76
Total Cost per Female	**$1,095**	**$615**	**$2,340**	**$1,353**	**$909**	**$2,340**	**$1,006**	**$615**	**$1,978**	**$869**	**$746**	**$1,017**	**$1,021**	**$1,139**	**$1,201**	**$927**
Stored, Harvested, or Purchased Feed Cost per Female																
Hay	$120	$5	$401	$183	$32	$401	$112	$5	$365	$42	$5	$153	$126	$117	$144	$71
Corn Silage	$94	$6	$286	$134	$13	$286	$67	$17	$119	$33	$6	$71	$115	$74	$106	$83
Rye Silage	$42	$3	$110	$35	$3	$87	$69	$8	$110	$29	$6	$68	$51	$33	$58	$32
Cornstalks	$54	$1	$176	$62	$21	$176	$16	$1	$29		$0	$0	$34	$94	$51	$56
Corn	$41	$0	$199	$91	$1	$199	$16	$0	$58	$3	$3	$4	$57	$30	$52	$29
DGS/Gluten	$54	$1	$128	$79	$13	$128	$41	$1	$108	$11	$6	$19	$68	$41	$56	$52
Other Feeds	$27	$7	$82	$37	$10	$82	$16	$7	$34	$22	$22	$22	$10	$44	$15	$45
Other Feeds	$14	$1	$46	$16	$1	$46	$6	$3	$13		$0	$0	$20	$4	$7	$30
Mineral + Salt	$33	$0	$72	$32	$0	$72	$26	$0	$48	$46	$40	$55	$25	$37	$35	$29
Calves – Creep	$63	$5	$229	$112	$5	$229	$13	$6	$26		$0	$0	$23	$125	$86	$17
Total Stored Feed Cost per Female	**$306**	**$45**	**$955**	**$543**	**$318**	**$955**	**$217**	**$59**	**$375**	**$118**	**$45**	**$196**	**$363**	**$273**	**$330**	**$269**
Pasture Cost/ Female	$117	$0	$482	$22	$0	$108	$149	$42	$482	$203	$93	$324	$62	$150	$123	$108
Pasture Acre/ Female	1.7	0.0	5.8	0.2	0.0	0.9	1.8	0.5	2.9	4.0	3.0	5.8	0.7	2.3	1.8	1.6
Total Feed + Actual Pasture Costs	$424	$162	$955	$564	$322	$955	$366	$162	$857	$321	$192	$520	$425	$423	$453	$377
Residue Grazing Cost/Female	$9	$0	$82	$2	$0	$11	$13	$0	$82	$4	$0	$7	$5	$12	$12	$4
Total Feed + Pasture + Residue Costs	$430	$167	$955	$566	$322	$955	$378	$167	$857	$323	$192	$520	$429	$431	$461	$381

Summary	Summary of All 62 Herd Years			Summary of 21 Limit Grazed Records			Summary of 28 Traditional Records			Summary of 13 Extensive Grazed Records			Summary of 23 Cornbelt Records	Summary of 39 Grassland Records	Summary of 38 Records <200 Cows	Summary of 24 Records >200 Cows
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Average	Average	Average
Other Direct Operating Costs per Female																
Bedding	$22	$1	$74	$25	$1	$74	$19	$2	$71	$17	$2	$38	$12	$29	$21	$22
Custom Hire and Contract Labor	$24	$2	$69	$38	$6	$65	$20	$2	$69	$16	$2	$55	$35	$19	$32	$13
Cattle Supplies	$16	$1	$195	$13	$2	$71	$24	$1	$195	$6	$2	$10	$13	$18	$22	$4
Dues and Subscriptions Cow Herd Share	$4	$0	$51	$2	$1	$5	$4	$0	$51	$4	$0	$8	$6	$2	$3	$4
Fence Repairs	$18	$1	$81	$12	$1	$33	$23	$7	$81	$10	$2	$29	$16	$18	$20	$15
Fertilizer, Lime, and Seed	$21	$3	$153		$0	$0	$24	$3	$153	$15	$3	$41	$15	$23	$24	$16
Fuel, Oil, and Gas Cow Herd Share	$20	$1	$75	$23	$1	$75	$18	$3	$53	$22	$9	$40	$21	$20	$20	$22
General Supplies Cow Herd Share	$12	$0	$40	$8	$2	$17	$15	$0	$40	$10	$2	$24	$8	$13	$15	$5
Hired Labor and Benefits – Cow Herd Share	$84	$2	$170	$102	$2	$170	$80	$4	$128	$5	$5	$5	$105	$55	$79	$88
Insurance – Cow Herd Share	$21	$1	$54	$21	$3	$54	$21	$1	$51	$20	$10	$30	$23	$20	$21	$20
Maintenance and Repairs – Cow Herd Share	$24	$2	$208	$29	$3	$208	$23	$2	$98	$17	$3	$42	$29	$21	$27	$19
Miscellaneous Expenses	$24	$0	$102	$32	$0	$102	$20	$2	$64	$4	$2	$8	$15	$29	$32	$12
Rent Expense (Other Than Pasture Rent)	$29	$0	$108		$0	$0	$34	$0	$108	$22	$21	$24	$14	$32	$32	$14
Semen and AI Supplies	$24	$3	$56	$22	$8	$41	$24	$13	$48	$27	$3	$56	$20	$27	$26	$22
Taxes Cow Herd Share	$19	$1	$109	$5	$1	$8	$22	$2	$109	$34	$21	$50	$8	$21	$24	$13
Trucking and Feed Processing	$7	$2	$23	$9	$2	$23	$6	$2	$11	$6	$4	$9	$10	$6	$8	$5
Utilities Cow Herd Share	$11	$0	$56	$8	$2	$29	$11	$0	$42	$20	$5	$56	$8	$13	$14	$7
Veterinary and Medical Supplies	$43	$5	$119	$49	$11	$119	$32	$5	$85	$55	$24	$115	$43	$42	$43	$42
Other	$18	$0	$53	$2	$2	$2	$21	$0	$53	$11	$6	$17	$6	$20	$20	$14
Total	**$253**	**$118**	**$744**	**$248**	**$133**	**$400**	**$274**	**$118**	**$744**	**$216**	**$133**	**$306**	**$230**	**$267**	**$267**	**$231**
Average Value/ Breeding Female	$1,758	$1,005	$4,100	$2,113	$1,210	$4,100	$1,615	$1,131	$2,511	$1,496	$1,005	$1,831	$1,776	$1,748	$1,863	$1,593
Average Weight/ Breeding Female	1,319	682	1,714	1,342	1,090	1,533	1,317	682	1,714	1,288	1,188	1,400	1,316	1,321	1,336	1,292
Average Weight/ Mature Cow	1,385	1,100	1,800	1,394	1,200	1,630	1,398	1,100	1,800	1,342	1,250	1,400	1,369	1,394	1,384	1,386
Cow Herd Depreciation/ Ownership Cost (10%)	$176	$101	$410	$211	$121	$410	$161	$113	$251	$150	$101	$183	$178	$175	$186	$159

Summary	Summary of All 62 Herd Years			Summary of 21 Limit Grazed Records			Summary of 28 Traditional Records			Summary of 13 Extensive Grazed Records			Summary of 23 Cornbelt Records	Summary of 39 Grassland Records	Summary of 38 Records <200 Cows	Summary of 24 Records >200 Cows
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Average	Average	Average
Fixed Expense – Machinery or Facilities																
Machinery Total	$691	$0	$2,619	$1,243	$447	$2,619	$398	$33	$917	$431	$0	$618	$670	$704	$773	$562
Building Total	$583	$0	$5,524	$1,531	$0	$5,524	$126	$0	$632	$37	$0	$163	$516	$623	$727	$356
Equipment Depreciation (10%)	$69	$0	$262	$124	$45	$262	$40	$3	$92	$43	$0	$62	$67	$70	$77	$56
Building Depreciation (7%)	$41	$0	$387	$107	$0	$387	$9	$0	$44	$3	$0	$11	$36	$44	$51	$25
Bedding Use/ Breeding Female	1,143	0	6,429	2,328	298	6,429	583	0	4,708	435	0	1,805	923	1,273	1,184	1,079
Total Labor/Cow	10	4	22	9	4	16	11	5	22	10	7	16	9	11	12	8
As Fed # Stored, Harvested, or Purchased Feed Fed																
Hay	2,968	125	7,294	4,039	645	7,285	3,146	231	7,294	989	125	2,897	3,393	2,777	3,394	2,091
Corn Silage	5,009	327	14,458	6,954	891	14,458	3,761	1,127	7,439	1,736	327	3,750	5,992	4,025	5,481	4,536
Rye Silage	1,581	199	3,619	1,350	199	2,981	2,482	211	3,619	1,191	242	2,754	1,761	1,418	1,815	1,437
Cornstalks	2,911	109	6,785	3,384	909	6,785	901	109	1,653		0	0	2,054	4,625	2,779	3,031
Corn	671	6	3,179	1,476	17	3,179	250	6	870	52	41	63	935	479	846	476
DGS/Gluten	1,666	47	4,272	2,590	223	4,272	1,151	47	2,927	261	180	422	2,385	987	1,523	1,786
Other Feeds	330	54	1,234	289	106	586	370	54	1,234	380	380	380	92	568	150	601
Other Feeds	188	3	1,321	225	3	1,321	38	3	58		0	0	129	307	80	404
Salt	31	0	189	53	4	189	20	0	81	17	16	19	18	44	9	95
Mineral	76	2	121	76	13	113	72	2	121	82	63	95	74	77	78	72
Calves – Creep	553	18	1,859	562	18	1,143	544	25	1,859		0	0	521	598	472	692
Total as Fed Pounds per Female	9,193	208	22,634	16,737	10,372	22,634	6,697	1,793	12,133	2,380	208	4,781	12,737	7,102	8,719	9,942
DM # Stored, Harvested, or Purchased Feed Fed																
Hay	2,523	106	6,200	3,433	548	6,192	2,674	196	6,200	841	106	2,462	2,884	2,361	2,885	1,777
Corn Silage	2,254	147	6,506	3,129	401	6,506	1,692	507	3,347	781	147	1,688	2,697	1,811	2,466	2,041
Rye Silage	712	89	1,629	607	89	1,341	1,117	95	1,629	536	109	1,239	792	638	817	647
Cornstalks	2,474	93	5,767	2,876	772	5,767	765	93	1,405		0	0	1,746	3,932	2,362	2,576
Corn	570	5	2,703	1,255	14	2,703	213	5	739	44	35	53	794	407	719	405
DGS/Gluten	750	21	1,922	1,165	100	1,922	518	21	1,317	118	81	190	1,073	444	685	804
Other Feeds	281	46	1,049	246	90	498	314	46	1,049	323	323	323	78	483	127	511
Other Feeds	160	2	1,123	192	3	1,123	32	2	50		0	0	109	261	68	344
Salt	29	0	180	51	3	180	19	0	77	16	15	18	17	41	9	91
Mineral	72	2	115	73	12	108	68	2	115	78	60	90	70	73	74	68
Calves – Creep	470	15	1,580	478	15	971	462	21	1,580		0	0	443	509	401	588
Total Feed DM Pounds per Female	5,808	185	14,660	10,429	6,286	14,660	4,345	969	6,564	1,496	185	2,581	7,529	4,793	5,740	5,917
Standardized Feed Cost																
Hay ($100/ton)	$148	$6	$365	$202	$32	$364	$157	$12	$365	$49	$6	$145	$170	$139	$170	$105
Corn Silage ($35/ton)	$88	$6	$253	$122	$16	$253	$66	$20	$130	$30	$6	$66	$105	$70	$96	$79
Rye/Oat ($40/ton)	$32	$4	$72	$27	$4	$60	$50	$4	$72	$24	$5	$55	$35	$28	$36	$29
Cornstalks ($55/ton)	$80	$3	$187	$93	$25	$187	$25	$3	$45		$0	$0	$56	$127	$76	$83
Corn ($3.50/bushel)	$42	$0	$199	$92	$1	$199	$16	$0	$54	$3	$3	$4	$58	$30	$53	$30
Total Standardized Feed Cost per Female	$314	$38	$663	$519	$367	$663	$251	$38	$429	$121	$47	$188	$382	$274	$325	$298
Pasture Cost per Female Standardized at $60/acre	$103	$0	$347	$12	$0	$54	$107	$32	$175	$242	$177	$347	$43	$34	$109	$94

Summary	Summary of All 62 Herd Years			Summary of 21 Limit Grazed Records			Summary of 28 Traditional Records			Summary of 13 Extensive Grazed Records			Summary of 23 Cornbelt Records	Summary of 39 Grassland Records	Summary of 38 Records <200 Cows	Summary of 24 Records >200 Cows
	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average	Average	Average	Average
Cost of Production Based on Standardized Feed and Pasture Costs																
Direct Cost	$695	$369	$1,113	$829	$503	$1,087	$648	$369	$1,113	$581	$510	$679	$670	$762	$736	$630
Total Direct and Indirect Cost per Female	$1,092	$656	$2,021	$1,318	$944	$2,021	$1,001	$656	$1,624	$923	$798	$1,067	$1,015	$1,114	$1,183	$948
Pasture Cost Based on Crop District																
Pasture Cost per Female at District Rent	$175	$47	$387		$0	$0	$131	$47	$211	$270	$198	$387	$130	$188	$184	$159
Total Direct Cost per Female	$713	$410	$1,158	$833	$504	$1,094	$672	$410	$1,158	$609	$536	$719	$683	$731	$754	$648
Total Direct and Indirect Cost per Female	$1,110	$696	$2,021	$1,322	$948	$2,021	$1,025	$696	$1,670	$951	$825	$1,094	$1,028	$1,158	$1,201	$966

Appendix B. Standardized Prices

Iowa State University Extension and Outreach's Ag Decision Maker (https://www.extension.iastate.edu/agdm) annually publishes a suggested closing inventory price. The 2015-17 sheets were averaged and adjusted based on the regions where most herds were located to determine an average price to use for feed inputs, cow values, and pasture values.

Ag Decision Maker					
Suggested Closing Inventory Prices					
Item	**2015**	**2016**	**2017**	**3-year Average**	**Standardized Prices Used in Calculations**
Corn	$3.40	$3.20	$3.05	$3.22	$3.50
Corn Silage	$31	$29	$27	$29.00	$35
Oat Silage	$42	$39	$37	$39.33	$40
Hay					
Grass Legume	$135	$133	$137	$135.00	$100
Cornstalks (ton)	$44	$50	$67	$53.67	$55
Beef Cows	$2,100	$1,400	$1,200	$1,566.67	$1,600
Bred Heifers	$2,000	$1,600	$1,400	$1,666.67	$1,700
Improved Pasture (acre)	$81	$80	$71	$77.33	$60

Appendix C. Budgeting for Cow-calf Systems

Prior to expanding an existing cow-calf operation or starting from scratch, producers should carefully budget costs and potential profitability to compare alternative systems. Averages and ranges from records can be used in budget preparation but the fact that there are large variations in costs from one producer to another suggests producers need to carefully analyze their own situation and potential costs. If producers are considering implementing different types of systems, comparing a budget for each system could be helpful.

An Excel spreadsheet is available for download from the Iowa Beef Center (www.iowabeefcenter.org/calculators.html) that will help producers assess costs and returns of each cow system. The spreadsheet is set up to help determine differences in three main areas: feed costs; equipment and operating costs; and facility, land, equipment, and livestock ownership costs. The spreadsheet allow users to fine-tune differences in those costs by system.

Budgeting a Cow System – Traditional, Confined, and Extended

Income

This project, as explained in the cost section, did not collect data on reproductive efficiency or cattle sales. Previous studies have shown cost influences net income more than gross income, but just like cost information, the number sold, weights, and prices received can vary greatly from one operation to another. Producers will want to estimate income when budgeting. The spreadsheet will allow you to input a calving rate, sale weights, and prices. Death loss percent, culling percent, and market cow price can also be added to calculate income.

Feed Costs

Feed costs in this budget are divided into stored and purchased feed, pasture, and residue grazing.

Figure 1 is an example of a worksheet used to fine-tune feed costs in the budget spreadsheet for the two systems. Pasture costs can be added on a per acre basis. Stored feed rations are based on dry matter intake and individual feed as a percentage of the ration. Four different rations can be used.

In the traditional system cows graze two acres of pasture per head for 180 days, corn residue for 65 days, and are delivered three different rations for the remaining 125 days.

In the confined system, cows are delivered four different rations over 300 days and graze cornstalks for 65 days. Less feed waste is included in these rations and lower dry matter intake is assumed as compared to the traditional system.

In the extended system 3.5 acres of pasture are grazed for 300 days, crop residue is grazed for 35 days, and a hay-corn ration is delivered for a 30 day period.

Pasture is valued at $75 per acre, corn residue grazing is $5 per acre. Although feeds used vary by system, the delivered feed is valued the same between the two systems - corn at $3.50 per bushel, corn silage at $35 per ton, hay at $80 per ton, corn stalks at $55 per ton, and modified distillers grains at $70 per ton.

Total feed and pasture cost per cow by system are as follows: traditional $359, confined $456, and extended $352.

Indirect or Fixed Costs

Possibly the most difficult cost to estimate or track are the fixed costs or ownership costs. The cost of cows, facilities, land, or equipment needs to be spread out over several years or annualized. Some costs may also need to be shared or allocated to different enterprises. In the case of allocating an item to do an enterprise budget, a percentage of use is typically estimated and that percent is taken and multiplied by the annual charge.

Usually the depreciation or the value decrease per year is used in the budget as the annual ownership cost. Tax depreciation should not be used, but a book depreciation that better reflects the actual life of the asset should be used. One other item to consider for an ownership cost is the opportunity cost of owning the item or the interest that could be earned from the money invested in the asset. In this spreadsheet, there is a simple worksheet included to calculate fixed costs for facilities, equipment, and more. Inputs include the value, years of life, salvage value, and percent allocated to the cowherd, which will allow the spreadsheet to calculate an annual charge per cow. Other items that are sometimes calculated as ownership costs include insurance, taxes, and opportunity costs that are also calculated in this spreadsheet.

Purchased or owned land is an asset but is typically assigned a rental value and in this budget is included in the feed cost. Land does not typically depreciate or have a useful life so assigning an annual depreciation cost as done with other assets is not appropriate. The rental value assigned would likely not cover an annual principal and interest payment on mortgaged land purchases. The purchase cost includes the value of potential or expected appreciation of the land in addition to the value of the land being able to produce forage for the cowherd. The principal and interest payments should be considered for cash flow purposes but the assigned rental rate of purchased or owned pasture should reflect market rental rates.

For this example budget, the largest fixed cost is for the confined system, with a large part of that representing the confinement building. That cost is estimated at $1,750 per cow, calculated at 90-100 square feet per cow. This can vary based on what is included in the cost estimate. The $1,750 would include building, bunks, concrete, gating in the building, and waterers. No working facilities are included in that cost. The annual cost of this building over 15 years is $111 per cow, which is similar to the confinement operations in this project.

The two grazing systems both include limited facilities for winter feeding and calving but the extended grazing system has roughly double the fence maintenance and repair cost due to more acres grazed per female.

Equipment cost can vary a great deal. In this example, the confined system has additional costs in feeding and manure handling equipment.

The fixed cost estimate per head using the assumptions given are: traditional system $364, confined $612, and extended $348.

Non-feed Operating Costs

The other costs typically budgeted are non-feed operating costs. There can be many categories of these types of cost and they are reasonably straightforward, but can be hard to allocate for the cow enterprise on a diversified farm. Costs such as fuel, utilities, repairs, general overhead, and maintenance should be allocated to the cowherd based on the percent of usage for the cow enterprise. If an operation is borrowing funds to pay for operating expenses, the interest cost on that principal should be estimated and allocated to the cow enterprise, including purchased feed for a portion of a year. In the total budget in Figure 1 non-feed costs such as veterinary expense, fuel, and repairs are included in the yellow cells for each system. Labor is estimated to be 10 hours per cow for the traditional system and 11 hours for the confined cow system, with an hourly value of $14 for each system. There is more bedding used in the confined system while the grazing systems have more expense for pasture fertilizer and weed control.

The total budget in Figure 1 from the spreadsheet uses the feed, non-feed operating, and fixed costs discussed above and can be compared side by side.

The budgeted costs are close to averages and within the ranges for the project cooperators' records. Those averages and ranges are reported in Appendix A.

The income estimates are also included in this overall budget. Income estimates are the same for each system and uses a 95 percent calf crop, 10 percent culling and replacement rate, and two percent rate of death loss on calves. A 600 pound heifer calf and 650 pount steer calf sold at $1.60 or $1.65 per pound, respectively, are the weights and sale prices used. Market cow income is based on a $0.70 per pound price for a 1,300 pound cow.

Investment and Financing Costs

The spreadsheet also has a worksheet included to estimate the total capital needed or total investment between systems on a per cow basis. The capital could come from operator equity or be financed by debt. The opportunity cost of a down payment or equity used in the investment is also calculated. The debt amount can be amortized to project loan and interest payments that would typically be used in a cash flow statement, which is used differently and uses different inputs than a long-term budget. Operations that are purchasing livestock, machinery, and facilities or land in the same time period will have significant cash flow needs that would likely not be met by income from cows and would need to be paid from other income or cash reserves.

	Price	Weight		Traditional	Confined	Extended
Income						
Heifer calves	$1.60	600	*lbs*	$301.43	$301.43	$301.43
Steer calves	$1.65	650	*lbs*	$ 499.25	$ 499.25	$ 499.25
Cull cows	$0.70	1300	*lbs*	$ 127.40	$ 127.40	$ 127.40
Gross Income				$928.07	$928.07	$928.07
Variable Costs						
Feed						
Pasture grazed				$ 150.00	$ -	$ 262.50
Delivered feed				$ 166.27	$ 414.38	$ 51.84
Residue grazing				$ 15.00	$ 15.00	$ 10.00
Mineral				$ 27.38	$ 27.38	$ 27.38
		Total feed		**$ 358.64**	**$ 456.76**	**$ 351.71**
Other variable per cow						
Veterinary & health				$ 40.00	$ 40.00	$ 40.00
Bedding				$ 20.00	$ 80.00	$ 10.00
Machinery, equipment, fuel & repairs				$ 10.00	$ 20.00	$ 10.00
Marketing & miscellaneous				$ 10.00	$ 10.00	$ 10.00
Other variable per herd						
Building Facility repair	$1,000			$ -	$ 10.00	
Other variable per acre	Cost per acre					
Pasture fertilizer	$ 20.00			$ 40.00	$ -	$ 70.00
Pasture weed control	$ 10.00			$ 20.00	$ -	$ 35.00
Fence repair	$ 5.00			$ 10.00	$ -	$ 17.50
				Hours/cow	Hours/cow	Hours/cow
Labor	$14/hour			10	11	10
				$ 140.00	$ 154.00	$ 140.00
Interest on stored feed and variable costs				$ 12.72	$ 15.42	$ 13.61
Total Variable Costs				**$ 671.36**	**$ 797.17**	**$ 707.82**
Total Fixed Costs				**$ 363.81**	**$ 612.23**	**$ 348.54**
Total All Costs				**$1,035.18**	**$1,409.41**	**$1,056.36**
Income over variable costs				$256.71	$130.90	$220.26
Income Over all Costs				$ (107.10)	($481.33)	$ (128.28)
Breakeven selling price for variable costs (per lb.)				$1.11	$1.36	$1.18
Breakeven selling price for all costs (per lb.)				$1.85	$2.61	$1.89

Figure 1. Example total budget for three cow calf systems.

Appendix D. Confinement Buildings for Beef Cows — Design, Layout, and Operation Considerations


Photo by Erika Lundy.

The main reasons to put cattle under a roof are to keep the cattle dry, provide an area free from mud, provide shade in the summer, and offer some wind protection. Various building types and layouts can achieve these goals. Many types of roof materials and shapes can work, including fabric arch, gable, or monoslope.

A main consideration when constructing a confinement building is ventilation. Most new buildings will have lots of air space and high sidewalls to allow for better ventilation. This helps remove humidity in both winter and summer, and helps reduce summer heat stress. While having a ridge vent or opening at the peak or top of the roof is recommended, most ventilation will likely come from cross ventilation.

Locating and orienting buildings so naturally occurring breezes are not diminished by the landscape or other nearby buildings is important. Buildings are typically oriented with the length of the building running east-west in regions with predominantly southerly summer breezes.

A longer, narrower building is more common to allow for appropriate bunk space along the side of the building while meeting the square footage requirement for the cows, with 45-60 foot wide buildings common. Usually the buildings have end walls that are equipped with doors or an opening for equipment and livestock access. If bunks are on one side, at least a six-foot tall opening at the top of the opposite wall is used for cross ventilation. Typically a curtain that can be closed if needed is used on that opening.

Doors and curtains are typically left open to provide good ventilation, but can be closed during wind-driven rain or snow events or high winds in cold weather.

The following are general recommendations for how a confinement building should be constructed. Additional resources for planning a building can be found through MidWest Plan Service publications "Hoop Barns for Beef Cattle" (https://www-mwps.sws.iastate.edu/catalog/livestock-categories/beef-operations/hoop-barns-beef-cattle-pdf); "Cattle Feeding in Monoslope and Gable Roof Buildings" (https://www-mwps.sws.iastate.edu/catalog/livestock-categories/beef-operations/cattle-feeding-monoslope-and-gable-roof-buildings-pdf); and "Beef Housing and Equipment Handbook" (https://www-mwps.sws.iastate.edu/catalog/livestock-categories/beef-operations/beef-housing-and-equipment-handbook).

Square footage: A minimum of 90 square feet per cow is needed, with an additional 30 square feet of space per pair at calving time is desired. This includes bunk apron and creep area. Future research may provide more precise advice on space allocation.

Bunk space: Minimum of two linear feet per cow. Be sure to allow for building supports or gates that would reduce bunk access. Size bunks to hold higher forage rations.

Bunk placement: Typically, in a 45-60 foot building, the bunk is placed on one long side of the building. Wider buildings could have bunks on both sides or in the middle. Some buildings have a covered feed alley along the bunk.

Bunk apron: An apron (typically 12-16 feet wide) along the bunk on the cattle side of a building that slopes slightly away from the bunk with a step by the bunk is common. The apron is not typically a bedded area. In some buildings a fence with gates is used to separate the bedded area from the apron feeding area. This allows cattle to be penned away from the apron for cleaning or used as a drovers alley for livestock.

Pens: Cross fencing is used to divide the barn into pens. Pens are used to group cows by age or by calving dates. Creep, escape, or rest areas for calves at calving time are on the side opposite the bunk. Gates need to be configured for equipment and livestock access to each pen.

Bedding: For bedded confinement buildings for beef cows, most operations add bedding once or twice a week or as needed to keep pens reasonably dry. The bedded pack is removed annually or periodically throughout the year. The apron by the bunk is cleaned more often, perhaps 2-4 times each month.

Bedding needs vary throughout the year based on weather, water intake of cattle, stage of production, and cattle stocking density. Different types of bedding absorb moisture differently, but corn stalk (stover) bales are the most common source in corn-producing areas. Plan on about 2.5 tons of bedding per cow per year for year-round housing. Harvesting and storing relatively dry bedding is important. Allocating time to make sure cornstalks can be harvested and stored is critical. Some managers use a bale processor to add bedding to the pen, while others put bales directly into the pen and break them with the handling equipment.

Cost considerations: Cost can vary for buildings depending on what is included, site preparation needed, water needs, and more. Getting bids from several contractors is important.

A common price range is $1,500-2,000 per cow space for buildings with 90-100 square feet per cow, two feet of bunk space per cow, and construction labor included.