SEMI-CONFINED COW/CALF SYSTEMS IN

THE TEXAS PANHANDLE

by

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ABSTRACT

Drought is common to Texas and the Great plains. This area experienced record drought during 2011-2012, prompting record cowherd liquidation. During extreme drought, forage is unavailable for grazing and hay is likewise unavailable or expensive. Cow/calf systems that minimize land and forage use are needed. Feed and labor costs in confinement cow/calf systems using concentrate diets are not well established. Cows were wintered in semi-confinement on diets differing in forage and grain composition for two consecutive winters. Costs and labor requirements for treatments differing in forage and grain composition were measured. Results indicate that high concentrate confinement systems diets may provide viable alternatives to forage-based cow/calf systems. In another experiment, Angus-cross cows (n = 48; initial BW=1,512 ± 159 lbs) were stratified by BW and randomly assigned to eight pens with six hd/pen, replicated four times. Treatments were limit-fed Sweet Bran and conventional free choice hay fed during the third trimester of gestation. Results showed no difference in birth weighs or weight of calves at branding. However, cows on the limit fed Sweet Bran diet did gain more weight during the feeding period and had a higher BCS. From the results of the experiments, a decision aid worksheet is presented to assist producers in choosing a semi-confinement system.

Key Words: Confinement cow-calf systems, cow costs, drought management, decision aid

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CHAPTER I

INTRODUCTION

On October 20, 1541, the Spanish explorer Francisco Vazquesz de Coronado wrote a letter to the king of Spain describing for the first time the vast Llano Estacado. Coronado described the plains as so vast that he could not find their limit anywhere. There was not a stone, nor a tree, nor a shrub; traveling there was like being swallowed up by a sea of grass (Historical, 2014). This same vast grassland developed from unfenced public grassland into a major part of an industrial economy. This grassland all the while providing forage for grazing animals that would become a major component of the area's industry in the 20th century. When these vast grasslands are unavailable for grazing, alternatives for cow/calf production will be needed.

Traditional cow/calf beef production operations utilize grazing lands as a primary forage source for their herds. However, several conditions and pressures have emerged in recent years that increasingly challenge producers to retain or secure viable grazing lands. Agricultural land available for cow/calf production is decreasing due to grazing land being lost to urbanization or cultivation that is rarely returned to cow/calf production. Urbanization has long been recognized as a strong competitor for agricultural lands. King (1925) observed the antagonism between population growth and grazing lands, as an increase in population resulted in the breaking up of the pastures and ranges that had always been associated with beef production. Agricultural land values are positively correlated with proximity to urban areas. The demand for land that can be developed for urban use is the most significant non-farm factor affecting farmland values in urbanized areas that are experiencing significant population growth (Livanis et al., 2006; Hardie et al., 2001). In addition, agricultural land values trend sharply upward both nationally and locally due to favorable commodity prices and when there are economic opportunities associated with cultivation (Anderson, 2007). Cow/calf producers are therefore increasingly forced to compete for grazing lands. Many new producers face challenges as they seek to develop or sustain cow/calf operations on an ever-shrinking land base.

The Texas Panhandle, along with the rest of Texas, experienced a historic drought in 2011-2012, as well as an unusually dry 2013-2014 winter. Likewise, the Great Plains region suffered severe drought in 2012. The severity and widespread nature of the drought produced both direct and indirect economic losses across all of agriculture in Texas and throughout the Great Plains states. Record economic losses in the agriculture sector placed strain on agriculturally dependent rural communities, especially those in the Texas Panhandle. Drought can also lead to wildfires which immediately destroy grazing resources. On a single day in March of 2017, over two million acres burned in Texas, Oklahoma, and Kansas (TAMU Forest Service, 2017).

During extreme drought, forage for grazing is greatly reduced or unavailable. In addition, producers recognize the need to preserve and sustain rangeland resources during drought, and therefore follow well-established range management principles that often require total destocking (Crider, 1948; National Drought Mitigation Center, 2011).

Rangelands in Texas need additional time, perhaps years, to recover from a drought as severe as that in 2011-2012. Many native pastures in Texas indicated permanent damage as a result. Restocking of regional rangelands to historical levels without adequate recovery risks further irreversible damage. Hay is likewise unavailable or prohibitively expensive during severe drought, forcing cow/calf producers to liquidate herds, move cows to another region, or provide feed.

The drought of 2010-2012 led to the largest single-year numerical drop in Texas' beef cow inventory in history, with more than twice as many beef cows leaving Texas in 2011 as in 2010 (TAHC, 2011). Over 600,000 cows were harvested or removed from Texas, resulting in a historically low breeding cow inventory (TAHC, 2011). Record liquidation of cows continued in 2012 throughout the Great Plains region, and contributed to a historically low Texas and U.S. breeding cow inventory. However, efforts to rebuild the cowherd were limited by several factors. Less land was available for cow-calf production due to competing interests and drought–related loss of rangelands. Many aging producers that liquidated herds during the drought would not have rebuilt their herds, and young producers seeking to enter cow-calf production became faced with financial barriers due to increasing land values as farm real estate remained the principal source of collateral for farm loans (FSA, 2010).

Following a drought as severe as the 2011-2012 drought, significant increase in cattle inventory is usually anticipated. Regionally and nationally this was concerning for its implications on long-term cattle supply, the regional stocker and fed cattle industries, food prices, and regional economies. Inadequate supplies of feeder cattle threatened long-established industry infrastructure, such as feedyards and beef processors in the

Texas Panhandle. Subsequently low cattle numbers in Texas and nationally resulted in a reduced beef supply and rising beef prices. Breeding cow herds also represent lifelong efforts at genetic improvement and a significant income source for many producers; therefore, great incentive exists for both individual producers and the industry to retain breeding herds if possible.

Traditional cow-feeding strategies during drought focus on hay-based feeding programs. Reflecting this, confinement cow/calf systems research has mostly relied heavily on forage-based diets (Wyatt, 1977). However, during conditions of enduring and geographically widespread drought like that of 2011 and 2012, hay becomes scarce and prices increase substantially, with some hay valued at a 75% markup in 2011 compared to 2010 (Texas Agrilife Extension, 2011). Traditional forage-based feeding systems may not be economically viable under such conditions creating a need for cow/calf production systems that remain productive and cost effective. Feed and labor costs for on-farm, semi-confinement cow/calf systems using concentrate diets are not well established. In addition, little research has been published related to optimum combinations of confinement and grazing cow/calf systems.

Objectives

The objective of this dissertation is to determine the economic and biological viability of semi-confinement cow/calf systems. Three semi-confinement experiments were conducted in three successive winters from 2011-2014. Two of the experiments had the objective of determining the added feed and labor costs associated with three differing semi-confinement systems. The research in the first two experiments seeks to determine cost information related to the mixed confinement-grazing systems with emphasis on identification of simple, manageable systems that could be easily implemented by producers in the Texas Panhandle. This information could potentially be used to develop optimization and decision aid models for evaluating semi-confined cow/calf systems. The third experiment compared the effectiveness of limit-fed Sweet Bran compared to a traditional high forage diet in semi-confined gestating cows.

CHAPTER II

LITERATURE REVIEW

Confined Cow Feeding Behavior

When cows are moved from a rangeland setting into a semi-confined setting there will be behavioral changes (Loerch, 1996). A clear understanding of cow behavior in a semi-confined setting is a valuable tool to increase productivity and reduce costs. Pritchard and Knutsen (1995) observed that feeding schedules may influence animal performance. Cattle typically come to the feed bunk when feed deliveries are made. However, peak eating periods by ad libitum-fed cattle are typically influenced by the juxtaposition of the total amount of feed delivered, compared to feed delivery time. Freetly et al. (2001) conducted an experiment where steers were fed either in the morning only, or in the evening, or both in the morning and evening. Steers fed only at evening time had higher ADG than the only morning or both morning and evening treatments. Although this work was done on steers, inferences can be made to cows in confinement. Freetly's (2001) work suggests that cows in confinement increase intake when fed in the evening. However, traditionally, agricultural labor is available in the mornings, so evening feedings might be prohibitive from a practical standpoint (Lancaster et al., 2011). Furthermore, when limit-feeding cattle, increasing intake becomes a debatable issue because of time and resources. Moreover, a basic circadian rhythm of the day causes more rumination during the early morning hours than at any other time (Gordon and

McAllister, 1970). Feeding behavior traits of eating rate and feeding events were positively correlated with residual feed intake demonstrating that biological processes can be modified by feeding times which can be responsible for variation in feed efficiency in beef cattle (Kelly et al., 2009). When considering a limit-feeding program for heifers, it may be different than that of cows, as limit-feeding heifers may decrease first-calf survival (Freetly, et. al., 2001).

A limit-fed study with a ration primarily composed of corn depicted no negative effects on cow performance; however, it was noted that cows began to consume the bark present on trees in the dry-lot (Loerch, 1996). Increasing the amount of hay would serve to make the cows more content but would also be an added cost.

According to Anderson and Boyles (2007) disadvantages of a semi-confined operation are facilities and equipment that depreciate more rapidly, in addition to a potential for crowding stress. Cactus Feeders (2016), in their Syracuse Kansas confined-cow facility, has observed that cows in confinement tend to play with their tongues more than non-confined cows. Cactus employees often report cows rolling their tongues at full extension in the air as well as continuously licking bunk rails. Furthermore, replacement cows born and raised in confinement on this operation seem more apt to play with their tongues than cows that were brought in from a range setting. Calves born into this confinement setting also chew each other's tags more frequently. It is common to have over 75% of a calf pen with completely or partially chewed tags (Jones, 2016)

The study of cows in confinement is not a new endeavor, as Schake and Riggs (1969) studied the activities of lactating beef cows in confinement. Forty-three range cows were confined and fed at three different levels of intake, and observations were made once each month for a 24-hr period. Walking was inversely related to the level of feed intake which suggests that cows fed a limit-fed ration will expend more energy as a result of the restlessness brought about by hunger. Even though cows fed at the lowest level of intake walked more, they still only walked about 10% of the distance recorded for ranch cows by Cory (1927), Dwyer (1961), and Wagnon (1963). Standing occurred 61% of the time and lying 29% of the time. There was a significant interaction with level of feed intake by portion of day. Cows that were fed at the lowest level of intake ate the majority of their feed during the day; whereas, cows on the highest level of intake were able to eat several meals both day and night. The dominant/subordinate ranking as described by Wagnon (1963) was not observed in the limit fed cows. All limit-fed cows in the Wagnon study were aggressive eaters and all animals ate at the same time. However, the cows fed the higher level were able to exert more dominant behavior and exerted physical force to control the feed remaining in the bunk. The cows fed the lowest level of intake were observed to idle nearly twice as much as the cows on the higher feed intake levels. Furthermore, the cows on the lowest feed intake levels were much more attentive to sounds of tractors, people and surroundings as evidenced by cows rising and approaching the bunk when signs of activity were present. Cows fed the lowest level of intake were also observed to lick a salt block more frequently.

Wagnon (1963) noted successful production under continuous confinement. In an experiment conducted in Spur, Texas, mature lactating cows were kept in confinement and fed at three differing intake levels. Behavior patterns differed markedly from those of range cows and varied significantly between differing levels of intake. Cows receiving the least amount of feed spent more time in non-productive activities such as aimless walking and scouring the pen floor for feed. Cows fed the most were observed to eat, stand, ruminate and defecate more. Cows fed the intermediate intake level combined behaviors of the high and low intake groups (Schake and Riggs, 1969). Confined cows also walked much less during the day--roughly one-tenth the distance recorded for range cows.

Cows in a dry lot had a shorter interval to estrus after a prostaglandin injection as compared with cows on pasture (Floyd et al. 2009). Confinement of cows increased the number of cows concurrently in estrus and thus increased the number of mounts each cow receives while in estrus. The greater display of estrus in confined cows could allow for fewer observations to detect cows in estrus and thus enhance the efficiency of artificial insemination.

Rumen Characteristics

Feeding events have an effect on rumen characteristics. Lower efficiency of energy utilization is a result of an increased rate of passage which inherently decreases rate of digestion (Soto-Navarro et al., 2000). Limit-fed steers showed high total tract digestibility of organic matter when feed was offered twice daily. Nitrogen and starch had the lowest total tract digestibility. There was a 10% fluctuation in intake beginning 9 hr after the morning feeding when feed was offered once versus twice daily. Total volatile fatty acid concentration also showed similar fluctuation. Increasing feeding frequency resulted in a more stable ruminal environment; however, twice-daily feeding might result in lower efficiency of energy utilization by limit fed steers. Feeding high concentrate diets in beef cows in confinement can be a cause of ruminal acidosis. Feeding frequency and times can be a management tool used to avoid acidosis but may result in decreased performance. However, some researchers have noticed that more rumination occurs during the early morning hours than at any other time (Gordon and McAllister, 1970). There is evidence that eating rate, daily feeding events, and non-feeding events change the rumen environment and affect residual feed intakes (Kelly et al., 2009).

There is a change in rumen profiles when cattle are fed either whole or processed grains (Sharp et al., 1982). Whole corn is a safer energy source when compared to processed corn when roughage sources are limited and adaptation diets are not properly implemented, as ingestion of excessive amounts of readily fermented carbohydrates can cause acidosis (Owens et. al., 1998). Supplementing hay-based diets with corn can reduce forage utilization and digestibility of total organic matter intake (Kartchner, 1980; Chase and Hibberd, 1987). When limit-feeding, a negative associative effect is avoided because so little forage is being fed.

Feeding a high corn diet can improve some digestibility parameters. Limit-feeding of a high corn diet to cows can result in a 15% improvement in dry matter digestibility as compared to feeding a high-forage diet. Limit feeding a concentrate diet can also improve organic matter digestibility (Driedger and Loerch, 1999; Murphey et al., 1983). This would be expected as corn has a greater digestibility than forages (NRC, 1989). Galyean (1979) suggested that limit feeding increases retention time in the gastrointestinal tract and thus increases digestibility.

One apparent disadvantage to feeding whole corn would be the kernels excreted in the feces which would indicate reduced digestibility of the feed. In studies comparing a high forage diet and a high corn diet there were no differences in corn kernel digestibility (Driedger and Loerch, 1999). Tjardes et al., (1998) reported that processing corn does increase dry matter digestibility in limit-fed diets and no measures of beef cow production were affected by the processing of the corn. Feeding a high corn diet as compared to a high forage diet can also reduce excreted nitrogen and increase digested nitrogen (Driedger and Loerch, 1999).

Diets containing greater concentrations of starch can have a negative associative effect on fiber digestibility; whereas, highly digestible feedstuffs such as dried distiller’s grains can have positive associative effects on fiber digestion (Firkins et al., 1984; Loy et al., 2007; Leupp et al., 2009).

Feedstuffs fed to Semi-Confinement Cows

A wide variety of feeds can be utilized by confined cows including crop residues, slough hay, barrow-ditch hay, or conservation reserve program hay as long as those lower quality feedstuffs are properly balanced in the diet (Anderson and Boyles, 2017). The use of non-protein nitrogen in the confinement setting can be a very attractive option for protein supplementation especially when the prices of natural protein supplements are high (Hart et al., 1938). A study by Holter and Kabuga (1974) showed no evidence that urea-nitrogen was used any less efficiently than soybean meal as a supplement to corn silage fed to heifers and dry cows.

Hay restricted diets can be economical during the winter feeding of cows as well as times when cows are at their peak of lactation (Anderson and Boyles, 2007). A minimum of 0.5 pounds of hay per 100 pounds of body weight is suggested (Loerch, 1996; Anderson and Boyles, 2017).

Substituting grain for hay is economical when forages are in short supply or when forages are expensive, since grains are often priced lower per unit of energy than roughage sources (Anderson and Boyles, 2007; Loerch 1996). Hay frequently costs 50-100% more than corn per unit of energy (Schoonmaker et al., 2003). Extending the grazing season into the winter also reduces the feed costs for maintaining cows during the gestation period (D'Souza et al., 1990; Adams et al., 1994; Hitz and Russell, 1998).

Hitz and Russell (1998) observed that feeding legume hay to confined cows can reduce the total pounds of hay fed while maintaining equal or greater body weights and condition scores. Radunz et al., (2010) conducted an experiment feeding gestating cows either hay, limit-fed corn, or limit-fed dried distiller's grains. Cows fed dried distiller's grains gained more body weight but there were no differences in body condition scores between the different treatments. Calf birth weights were higher for the cows fed the dried distiller's grain and corn diets.

By incorporating by-products of ethanol production such as dried distiller's grains the diet costs per cow were reduced by 24% as compared to a conventional hay diet (Randunz et al., 2010). However, an inclusion rate of dried distiller's grains over 30% is typically associated with reduced dry matter intake (Leupp et al., 2009; Vander Pol et al., 2009).

When comparing cracked corn vs. whole corn in limit-fed diets, cow and calf performance was not affected by intake level, as limit-feeding a corn-hay diet is an alternative to feeding ad libitum hay (Tjardes et. al., 1998). However, feeding cracked corn improved DM and OM digestion as compared with whole corn.

Advantages and Disadvantages to Semi-confinement

A semi-confined beef cow operation will have advantages and disadvantages. Anderson and Boyles (2007) list some advantages and disadvantages of a confined system. Advantages include:

- Increased marketability of crop residues, forages and other feedstuffs
- More control of the herd for health management
- Easier estrous synchronization and artificial insemination
- Increased number of cows per bull with natural service
- Flexibility of management (dry-lot during breeding or prior to weaning)
- Very low weaning stress for calves
- Easily integrated to back grounding calves—“bunk broke”
- More beef produced per acre due to efficient mechanical harvest vs. grazing
- Allows for pasture or rangeland restoration
- Market for frost-damaged, drought-stressed, sprouted or cheap feeds
- Extended production life of broken-mouth cows
- Maximum use of facilities
- Increased manure accumulation for fertilizing cropland
- Marketing flexibility
- Potential lower cost of production

Disadvantages include:

- Increased labor and equipment use for feeding
- More manure spreading required
- Higher level of management needed for ration balancing and herd health

- Possible increased crowding and associated stress
- Potential for more rapid spread of contagious diseases
- More challenging environment (dust, mud, flies, etc.) for cattle
- More harvested feed required for lactation and creep rations
- Increased odor from manure

A confinement operation can also become a viable option if the largest nutritional demand for one's cows occurs at a time when pasture quality is at its lowest (Schoonmaker et al., 2003). The decision to confine cows can be made based on the economics of feedstuffs available. Corn-based diets may also be used as emergency winter feed or as supplement when energy requirements are not being met by current feeds (Schoonmaker et al., 2003).

Semi-Confinement Systems

Options for semi-confinement differ in different regions of the country as readily available resources vary across the country. Many semi-confinement systems in the Midwestern and Northern Plains states center on the large number of corn fodder acres that are available (Warner, et al. 2016). In these areas of the country, total cow confinement systems are more expensive than extensive forage grazing systems. However, a semi-confinement approach can take advantage of seasonally available forages (Warner et al. 2016). Enhancing productivity per acre as a result of competition from alternative uses for grazing land can be achieved through a semi-confinement system. Utilizing partial confinement during strategic periods of the year increased calf gains and decreased total land area needed for beef production (McGee et al., 2017). Semi-confinement can also increase calf performance during the finishing phase. Bayliff et al. (2016) observed that improved winter nutrient status when cows were limit-fed and calves grazed wheat pasture, resulted in greater summer weaning weight followed by increased weight gain and feed conversion during the finishing phase.

Limited grazing land availability, modest feed prices, excess feedyard capacity and high cattle prices are among the factors that have stimulated interest in the expansion of semi-confinement and confinement systems for beef cattle production (Bayliff et al., 2016). Along with external factors that promote confinement options, Bayliff et al. (2016) concluded that additional energy supplied to cows resulted in linear increases in cow BW, BCS, milk yield, and calf BW.

Costs of Cow-Calf Systems

One of the major determinants of net income in a cow/calf production system is feed costs (Story et al., 2000). In an experiment conducted by Schoonmaker et al. (2003), cows were limit-fed a ration containing 5.8 kg whole corn, 1.1 kg of supplement, and 1.2 kg of hay. The prices of these feedstuffs and associated pasture leases of the control group of cows that were allowed ad libitum hay access were calculated based on current market prices. It was discovered that it cost almost twice as much to feed mid to late gestation cows a hay based diet when compared to the grain based limit-fed diet. Furthermore, there were no differences in calving dates, calf birth weight, or conception rates. The limit fed cows at the end of the trial had higher body condition scores and gained more weight during the feeding period. Schoonmaker et al (2003) determined that using stockpiled forage for mid to late-gestation and early lactation was a suitable alternative to feeding ad libitum hay.

Table 2.1 derived from data compiled by Steve Amosson, Texas A&M Agrilife Extension (2017), illustrates estimated costs and returns per animal unit from 2011 to 2017, based on typical production costs. However, during a time of drought when rangeland does not provide adequate forage, variable costs would increase sharply. Furthermore, the pasture value of $6.00 to $7.00 will be variable in different situations. TAMU Extension and Agriculture Economics (2018) provides specific performance analysis for cow-calf producers. Feed costs/cow from 2012-2016 averaged $123.75, whereas, from 1991-2009 costs/cow averaged $63.52. When making the decision to confine cows, a solid understanding of traditional cow-calf operations compared to confined costs is a valuable decision aid.

Confined cow costs can vary greatly depending on available forage and market conditions. Syracuse Feedyard, located in Syracuse Kansas, has been confining cows since 2010 and has developed a limit-fed ration that ranges in cost from $80-$95 per ton. Feed offerings to cows are adjusted according to stage of production and range from 28 lbs as fed per cow to 48 lbs as fed per cow, with the ration being approximately 56% dry matter. Cactus estimates a cost of $595.44 per calf for feed alone. When adding other variable and fixed costs, that amount increases to $869.19 per calf per year (Jones, 2016).

A semi-confinement system would potentially have costs lower than that of a complete confinement system. Semi-confined costs would vary greatly based on number of days confined along with prices and types of feedstuffs available.

Decision Aid Models

Many researchers perceive decision making as a multidimensional problem which involves more than one criterion and have sought methods of solving a category of problems (Eppler-Dixon, 1989). Decision-makers are faced with an array of problems on which decisions must be made in the process of formulating and implementing policies and programs based on agricultural marketing (Walker, 1997). Many agriculture producers also perceive their decision making as multidimensional in an uncertain world of agricultural marketing. In particular cow-calf operators have the option of several feed inputs for cows as well as different options in rearing conditions. Multiple criteria decision making became a topic of inquiry in the early 1970's and has since increased in journal article presence. The fundamental intent of all multiple criteria decision making is not to identify the optimal solution, but rather to identify a complete or representative set of non-dominated solutions (Eppler-Dixon, 1989). In considering a semi-confined cow operation, a producer would more likely see a set of options rather than be deduced to a single choice.

A decision aid model allows a producer to simulate outcomes based on known variables. Models enable man to think systematically and logically about reality. Therefore, the practice of building abstract models sharpens identification and analysis of problems. In themselves, such models aid in improving the logic of the decision-making process (Walker, 1997). It is not the aim of decision models to create an optimum scenario, but rather to allow the user to organize variables and thus organize thoughts.

A good example of a decision aid that has been developed and used would be the Cowculator v. 2.0 developed by Oklahoma State University. The Cowculator would be used by a producer to decide feedstuffs and amounts of feed to provide in order to maintain cows in production. Another decision aid, also developed by Oklahoma State, would be the Oklahoma Wheat Stocker Graze Out Decision Aid. The graze out decision aid helps a producer decide whether to graze out wheat or harvest for grain.

Table 2.1 Cow-Calf Budget Texas Agri-Life District 1—Texas High Plains

	2011	2012	2013	2014	2015	2016	2017
Revenue[1]	$446.36	$595.12	$650.28	$707.17	$1,091.26	$842.76	$476.34
Variable Costs	$208.75	$206.03	$207.98	$228.04	$212.88	$208.41	$215.33
Fixed Costs[2]	$196.09	$208.59	$240.77	$230.11	$231.18	$248.27	$237.18
Breakeven Price[3]	$110.66	$117.80	$105.41	$106.79	$82.97	$105.56	$114.57

[1] Revenue is based upon selling of cull cows, adjustment for heifer retention, 475 pound
weight for heifers and 525 pound weight for steers

[2] Fixed cost include pasture value at $6.00- $7.00 an acre with 25 acres allotted per animal unit

[3] Breakeven price on a CWT basis

CHAPTER III

EXPERIMENTS ONE AND TWO

Objective

The objective of this dissertation is to determine the economic and biological viability of semi-confinement cow/calf systems. Two semi-confinement experiments were conducted in two successive winters from 2011-2013. Experiment One had the objective of determining the added feed and labor costs associated with three semi-confinement systems. Experiment Two had the objective of determining the differences between feed and labor costs of four different treatments ranging from confined cows to range cows. The research in the first two experiments seeks to determine cost information related to the mixed confinement-grazing systems with emphasis on identification of simple, manageable systems that could be easily implemented by producers in the Texas Panhandle. Cost information can then be used to develop optimization and decision aid models for evaluating semi-confined cow/calf systems.

Experiment One

Experiment One Materials and Methods

Experiment One was performed during the cow production year of 2011-2012. The confined feeding portion of Experiment One began on January 10^{th}, 2012 and ended March 31, 2012. Pregnant Angus cross cows (n=36) were divided into three equal groups at the WTAMU Nance Ranch, located approximately seven miles east of Canyon, TX. The cows were weighed on three consecutive days prior to the beginning of the study and an average weight was obtained for each individual cow as well as each group. Cows were then stratified based on their BW into three feeding groups; conventional confinement (CC), conventional remote (CR), and high concentrate (HC). Cows were subsequently weighed individually at regular intervals one day apart, and at the end of the confinement feeding period. Scales were validated prior to weighing and all weights were taken at 1:00 PM of the same day for all groups of cows. All cows were provided with free choice mineral supplement.

Feeding Procedures

The CC group was confined to a four-acre trap at the ranch headquarters and provided with free choice, low quality grass hay, 3 lbs/hd/day of whole corn, and 2.5 lbs/hd/day of 38% CP range cubes. Range cubes were delivered on Mondays, Wednesdays and Fridays. All hay bales were weighed and delivered to CC cows using a tractor equipped with a bale spike. Hay was replenished when a visual inspection of the feeder showed that less than one d worth of hay remained in the ring type round bale feeder. The CR group was provided the same diet as CC cows but was located 1.85 mi from the headquarters and allowed access to 20 acres of rangeland in order to simulate a pasture situation where rangeland resources were exhausted and supplemental feed had to be provided to a pasture location. Forage in the 20-acre pasture was insufficient to meet the nutritional needs of the cows and provided very limited dry matter. Feed for CR cows was delivered and hay was replenished using the same procedures as for CC, except that all feed, including hay, was transported to the CR feeding site by truck. Cattle at the CR site were fed and observed once daily. The HC group was confined to a three-acre lot located at the ranch headquarters. The HC group went through a three-week adaptation period beginning with 3 lbs/hd/day of whole corn. Corn was increased gradually over this period until a target of 12 lbs/hd/day was achieved. The HC cows were also provided with 6 lbs/hd/day of hay and 2.5 lbs/hd/day of range cubes. The HC cows were fed in a concrete bunk and allowed 36"/cow. At the start of the feeding period, the HC cows received corn and hay at the same time. However, it was observed that some cows quickly consumed hay and other cows quickly consumed corn at the first opportunity. This situation resulted in some cows consuming more than their allotment of corn, while some cows consumed hardly any corn. The procedure was adjusted so that corn was fed first and time was allowed for corn consumption. After ample corn consumption, hay and range cubes were delivered. Corn purchase price was $7.56/CWT, range cubes were $385/ton, and hay was $205/ton.

Labor

Labor costs directly associated with each winter feeding scenario were calculated. The total time required to feed and check the cows was measured daily with a stopwatch and recorded. For each group, time measurement began as an employee entered the barn. Feed required for the day was prepared, weighed, loaded onto a truck, and driven to the respective feeding locations. The feed was placed into 15 ft metal feeders, and daily procedures were performed. Daily procedures included checking water and breaking ice as needed, careful observation of cows and calves, new calf processing, calf care, maintenance of feeders, waterers, and fences, and record keeping. The vehicle was then driven back to the barn and the time was stopped. Only one trip per d was made for CC and CR groups. The HC group required two separate trips from the barn as corn and hay were fed at an interval. When hay was needed for the CC lot, time was started when entering the tractor, the hay was delivered with a bale spike, and time was stopped when the tractor was returned to the barn. Time devoted to separate tasks was recorded so that labor costs could be assessed by category. Detailed notes were recorded each day to document weather-related difficulties or other atypical occurrences. A wage rate of $7.00/hr was used to calculate labor costs.

Calving Procedures

Calving began on February 29, 2012 and continued through May 16, 2012. All calves were tagged within two days of birth with a Z-tag (All-Flex USA) which contained a unique calf number along with the dam's number. Elastic castration bands were applied to all bull calves within two d of birth. Two calves were surgically castrated due to complications with banding. There was no dystocia experienced by any of the cows during the calving season. A small amount of labor was required periodically to sort escaped calves back into correct lots. All calf care time for tagging, banding, and sorting was recorded for each treatment group.

One winter storm occurred during the calving season that required placing extra bales in the lots for shelter. The dry lots at the headquarters stayed relatively dry during the calving season. The winter was generally mild and presented no major weather-related challenges.

Fuel Costs

Distance from the barn to each feeding site was measured and multiplied by the number of trips to each site for the duration of the winter feeding period. The CC and HC feeding sites were adjacent to each other and approximately 0.1 mi from the barn. The CR feeding site was 1.85 mi from the barn. A 2008 GMC pickup was used to deliver feed to each group. Fuel usage and mileage during ranch driving was recorded and an average fuel usage rate of 7.35 mi/gal was calculated for the truck. The same truck was used for each feeding. The miles traveled were multiplied by the average fuel use rate in order to calculate total fuel use. A fuel cost of $3.50/gal was multiplied by the gallons consumed to calculate fuel costs associated with each feeding site.

Grazing Season Procedures

The three feeding treatments were discontinued at the end of March 2012 and all cows were placed together and allowed to graze available rangeland. Estrous was synchronized and all cows were artificially inseminated on June 1st, 2012 and subsequently turned out with a bull for a 54-day breeding season. Pregnancy was diagnosed via ultrasound on July 24, 2012 to identify cows that conceived during the first 30 days of the breeding season. Cows not confirmed pregnant via ultrasound were subsequently rechecked via rectal palpation at the time of weaning in October. All calves were vaccinated on June 1 with a pentavalent respiratory vaccine (Bovi-Shield Gold 5, Zoetis, Kalmazoo, MI) and a 7-way clostridial vaccine (Vision 7, Merck Animal Health, Kenilworth, NJ). Appropriate boosters were given to all calves per label instructions. In addition, all steer calves received a growth implant containing 100 mg progesterone/10 mg estradiol benzoate (Synovex C, Zoetis, Kalamazoo, MI). All heifer calves were weaned early in keeping with the normal replacement heifer development program. Heifer calves were weaned on August 10th and were fed a receiving ration at the rate of 2.5% of body weight per day. All heifer calves were administered a metaphylactic with tulathromycin per label instructions (Draxxin, Zoetis, Kalamazoo, MI) during the weaning process. After weaning heifers were turned out onto pasture to graze. One heifer calf that was treated while nursing was deemed a chronic and was removed from the herd. The heifer removed from the herd was from the HC group. Steer calves were left with their dams and weaned on October 24th. Steer calves were fence-line weaned and grazed dormant native pasture while receiving supplementation of 1.5 lbs/hd/day of 38% CP cubes.

Weaning weights of steer and heifer calves were adjusted to a common age. Prices for the respective calves were determined from reported prices (USDA Market News) at the time of steer weaning and adjusted based on individual calf weights. Total returns for each calf were then calculated.

Experiment One Results

Cow Weight and Body Condition Score

Average cow weight gain from the beginning of the winter feeding period until February 24 was 90 lbs, 112 lbs, and 84 lbs for CC, CR, and HC groups, respectively. No cows calved until February 29, so this weight change provides the clearest indicator of group response to the feeding regimens during late gestation. Cow weights at the end of the winter feeding period were lower than at the start as expected, since most but not all cows calved during this period. Few, if any, inferences can be made regarding cow weight changes during the feeding period, since some cows had calved and some had not. No differences in average cow body condition score (BCS) were observed between the winter feeding groups, although individual variation did exist. Specifically, some individual cows in the HC group were observed to have lower BCS at the end of the winter feeding period. However, all groups had average BCS of 5 or greater at the time of A.I. on June 1, and were considered to be in typical and acceptable condition for breeding.

Calving Performance

No cows from any groups experienced dystocia. One cow from the CC group aborted on February 21, 2012 and was removed from the group. One cow from the CR group gave birth to a calf with contracted tendons in the front legs. The cow and calf were removed from the pasture and taken to the headquarters in order to provide proper care to the calf. One calf in the HC group showed symptoms of respiratory illness during the summer and was treated, recovered and left on study.

Breeding Performance

Cows responded to estrous synchronization as expected and were artificially inseminated (AI) without complication. Pregnancy rates determined on July 24 were 50%, 92%, and 83% for CC, CR and HC groups, respectively. These rates reflect the cows that conceived via A.I. or within the first 30 to 35 days of the breeding season. The rates are not unusual results for a 30-d breeding period that includes only one estrus for most cows. In addition, each cow represents a relatively large percentage since groups were small (n=12). All but one cow (CR group) was confirmed pregnant when rechecked in October. No conclusions can be made regarding differences between groups. However, confined winter feeding did not appear to have any adverse effect on breeding performance.

Calf Performance and Returns

Heifers at weaning weighed 642, 615, and 578 lbs for CC, CR, and HC groups, respectively. Steer calves at weaning weighed 688, 742, and 723 lbs for CC, CR, and HC groups, respectively. Weights were adjusted to a common age since heifers and steers were weaned on different dates. Market prices at time of weaning were obtained from USDA Market News and individual calf prices ($/CWT) based on weight and sex were derived using a sliding scale. Gross return for each calf was then calculated. Average gross returns per head were $910.92, $898.22, and $907.19 for CC, CR, and HC groups respectively. The number of steers and heifers in each group differed, contributing to differences in returns and making direct comparisons difficult.

Feed Cost

Feed costs for the 82-d winter feeding period are displayed in Table 3.1. The HC group had the lowest cost of winter feeding. This was not unexpected, as the greater energy density of corn lends a lower cost per unit of energy. In addition, the HC group consumed significantly less hay on the limit-fed diet. Hay consumption was 27.8, 18.7, and 4.9 lb per day for CC, CR, and HC groups, respectively. Cows in the CC group consumed 9.1 lb/hd/day more hay during the winter feeding period than CR cows. The difference in hay consumption and the resulting cost difference between CC and CR groups is not readily explained since the remote location was the primary difference in the feeding procedure between the two groups. The CR group did have access to 20 acres of dormant rangeland, while the CC cows were confined to a four-acre trap, suggesting that limited grazing had a substitution effect resulting in lower hay consumption by CR cows. However, the annual forage inventory in fall 2011 indicated that the CR pasture had less than 300 lb per acre of standing forage. Even if CR cows harvested all available forage in the 20-acre pasture, it could only provide about 6 lb/hd/day of forage, well short of the actual difference observed between the groups. The results suggest that winter feeding in pasture locations, even if forage appears inadequate, may reduce hay consumption compared to lot feeding. An alternate explanation is that the CC group location close to the headquarters facilitated observation and therefore the CC group was simply offered more hay. Visual observation of the CC feeding site indicated more noticeable scattering and wasting of hay than in the CR group's pasture.

Labor Cost

Labor costs for the winter feeding period are presented in Table 3.2. Average feeding times were 12.5, 25.4, and 21.2 min/d for CC, CR, and HC groups, respectively. All groups were very similar in terms of calf care time, as one group did not require considerably more time than another for calf care. Labor costs required for the winter feeding period were somewhat lower than might be expected. Workers were well trained and efficient, and the mild winter presented few if any weather-related challenges. Results suggest that labor requirements are not necessarily prohibitive for semi-confinement feeding and calving systems, even systems like HC that make use of high concentrate, limit-fed diets. Additional data is needed to assess labor requirements in years that have more severe weather challenges.

Fuel Cost

Fuel costs and total specified cost of the winter-feeding period, including feed, labor, and fuel required for feeding are presented in Table 3.2. Both the CC and HC groups were located at the headquarters while the CR group was in pasture 1.85 mi away (3.71 mi round trip). The feed truck traveled 36.2, 245.2, and 53.6 total mi delivering feed to CC, CR, and HC groups, respectively, during the winter feeding period. Fuel cost for HC cows was higher than for CC because two trips were used in order to allow HC cows to consume corn prior to feeding hay.

Experiment One Discussion

The least amount of time, mileage, and labor were realized from the CC treatment. It is possible that many producers choose this method of confinement for its ease especially when labor is limited. However, there are efficiencies that can be obtained from slightly more labor-intensive systems. It is interesting the feed costs for the CC treatment are much higher than that of the CR treatment. Both treatments were fed in the same manner yet the CC group was close to the headquarters and the bale feeder was in plain sight and seen several times a day as compared to the CR treatment bale feeder that was seen once per d. An empty bale feeder that is seen more often gets more hay delivered. It is doubtful that the cows in the CC group required more hay, however, more hay was delivered due to human behavior rather than cow behavior. There was a small amount of dormant forage available for the CR group but not enough to justify the increased amount of hay delivered to the CC group.

Only 283 more min were used for the CR group as compared to the HC group, but an additional 191.62 miles were traveled to care for the CR group as compared to the HC group. An advantage of this project was the close proximity of the CR group to the headquarters. In a setting where the remote group was located farther from headquarters, the time and mileage would rise quickly.

The HC treatment had the lowest total cost of all three treatments mainly due to the high price of roughage. A HC confined system has economic benefits when roughage costs are high. The HC treatment was the most labor intensive of all treatments as it was discovered early in the project that the whole corn needed to be delivered first with a second delivery of roughage after the cows were given ample time to consume the whole corn. Early in the project, whole corn and roughage were delivered together and some cows were observed eating the corn while others were observed eating the hay. Continuing to deliver the whole corn and hay together would have been dangerous as the cows consuming the corn would be over consuming corn and the cows that consumed hay first would only receive a few pounds of hay per day and would lose BCS quickly. When the whole corn was delivered first, all cows came to the bunk and consumed the corn quickly. Hay feeding only had to be delayed approximately 10-15 minutes. It should be noted that when confining cows ample bunk space should be provided so that all cows can have access to the bunk at the same time. Confinement costs were much higher than costs realized when rangeland was available for grazing. When compared to the costs seen in Table 2.1, confinement adds substantial cost.

Experiment Two

Experiment Two Materials and Methods

Experiment Two was conducted over the winter of 2012-2013. The experiment began on December 20th, 2012 and concluded April 8th, 2013. Pregnant Angus cross cows (n=44) were divided into four groups at the WTAMU Nance Ranch located approximately seven mi east of Canyon, TX. The cows were weighed on two consecutive d prior to the beginning of the study and an average weight was obtained for each individual cow as well as each group. Cows were then stratified based on their weight into four feeding groups; conventional confinement (CC), conventional remote (CR), high concentrate (HC), and conventional range (Range). Cows were weighed only at the beginning and end of the feeding period. Scales were validated before weighing and all weights were taken in the afternoon of the same day for all groups of cows. All cows were provided with free choice mineral supplement. To properly stock the available rangeland cows were not divided equally between treatments. Seven cows were allotted to the CC group, seven cows to the CR group, seven cows to the HC group, and 23 cows to the Range group.

Feeding Procedures

The CC group was confined to a 4-acre trap at the ranch headquarters and provided with free choice, low quality corn stalks, and 1.0 lbs/hd/day of 38% CP range cubes. Range cubes were delivered on Mondays, Wednesdays and Fridays. All hay bales were weighed and delivered to CC cows using a tractor equipped with a bale spike. Hay was replenished when a visual inspection of the feeder showed that less than one day's worth of hay remaining in the ring type round bale feeder. The CR group was provided the same diet as CC cows, but was located 1.85 mi from the headquarters and allowed access to 20 acres of rangeland in order to simulate a pasture situation where rangeland resources were exhausted and supplemental feed had to be provided to a pasture location. Forage in the 20-acre pasture was insufficient to meet the nutritional needs of the cows and provided very limited dry matter. Feed for CR cows was delivered and hay was replenished using the same procedures as for CC, except that all feed, including hay, was transported to the CR feeding site by truck. Cattle at the CR site were fed and observed once daily. The HC group was confined to a 3-acre lot located at the ranch headquarters. The HC group went through a 3-week adaptation period beginning with 3 lbs/hd/day of whole corn. Corn was increased gradually over this period until a target of 10 lbs/hd/day was achieved. The HC cows were also provided with 7 lbs/hd/day of hay and 1.0 pounds per head per day of range cubes. The HC cows were fed in a concrete bunk and allowed 36”/cow of bunk space. The corn was fed first and time was allowed for corn consumption. After ample corn consumption, hay and range cubes were delivered. The Range cows received 1.0 lbs/hd/day of 38% CP range cubes and free choice mineral. Corn purchase price was $9.20/CWT, range cubes were $398/ton, and hay was $95/ton.

Labor

Labor costs directly associated with each winter feeding scenario were calculated. The total time required to feed and check the cows was measured daily with a stopwatch and recorded. For each group, time measurement began as an employee entered the barn. Feed required for the day was prepared, weighed, loaded onto a truck, and driven to the respective feeding locations. The feed was placed into 15-ft metal feeders, and daily procedures were performed. Daily procedures included checking water and breaking ice as needed, careful observation of cows and calves, new calf processing, calf care, maintenance of feeders, waterers, and fences, and record keeping for all cow groups. The pickup was then driven back to the barn and the time was stopped. Only one trip per day was made for CC, CR, and Range groups. All trips were timed independently by cow group. The HC group required two separate trips from the barn as corn and hay were fed at an interval. When hay was needed for the CC lot, time was started when entering the tractor, the hay was delivered with a bale spike, and time was stopped when the tractor was returned to the barn. Time devoted to separate tasks was recorded so that labor costs could be assessed by category. Detailed notes were recorded each day to document weather-related difficulties or other atypical occurrences. A wage rate of $7.00/hr was used to calculate labor costs.

Calving Procedures

Calving began on March 2, 2013 and continued through May 20, 2013. All calves were tagged within two days of birth with a Z-tag (Allflex USA, Irving, TX) which contained a unique calf number along with their dam's number. Elastic castration bands were applied to all bull calves within two days of birth. There was no dystocia experienced by any of the cows during the calving season. A small amount of labor was required periodically to sort escaped calves back into correct lots. Calf care times were not recorded for this experiment.

On February 25th, 2013 blizzard conditions were experienced, including strong winds and 12 plus inches of snow resulting in drifts of over 15-ft. All treatment pens had windbreaks that accumulated and blocked the snow differently. During the storm, gates were opened, and the HC cows were moved to the CC pen for their safety. The range cows had a windbreak and were able to weather the storm. No cows were lost during this snowstorm.

Feed delivery was severely affected by the snowstorm and treatments were delayed. The HC cows were allowed to mix with the CC cows as hay could be delivered to the CC lot but not the HC lot. There was no corn delivered to the HC cows for four days and the HC cows were allowed free choice access to corn stalk hay. On February 28th, the HC cows were sorted back into their lot and were again transitioned back to corn until a 10 lb/hd/day amount was reached. Small square bales of Bermuda hay were delivered to the CR group. Small square bales of Bermuda along with large round bales of sorghum were delivered to the Range group.

Fuel Costs

Distance from the barn to each feeding site was measured and multiplied by the number of trips to each site for the duration of the winter feeding period. The CC and HC feeding sites were adjacent to each other and approximately 0.1 mi from the barn. The CR feeding site was 1.85 mi from the barn. A 2008 GMC pickup was used to deliver feed to each group. Fuel usage and mileage during ranch driving was recorded and an average fuel usage rate of 7.35 mi/gal was calculated for the truck. The same truck was used for each feeding. The miles traveled were multiplied by the average fuel use rate in order to calculate total fuel use. A fuel cost of $3.50/gal was multiplied by the gallons consumed to calculate fuel costs associated with each feeding site.

Grazing Season Procedures

The four feeding treatments were discontinued on April 8th, 2013 and all cows were placed together and allowed to graze available rangeland. Estrous was synchronized and all cows were artificially inseminated on June 4th, 2013 and subsequently turned out with a bull for a 50-d breeding season. Pregnancy was diagnosed via ultrasound on August 3rd, 2013 to identify cows that conceived during the first 30 days of the breeding season. Ultrasound determination of pregnancy is not reliable for cows that are pregnant for less than 30 days. Cows not confirmed pregnant via ultrasound were subsequently rechecked via rectal palpation at the time of weaning in October. All calves were vaccinated on June 4th with a pentavalent respiratory vaccine (Bovi-Shield Gold 5, Zoetis, Kalmazoo, MI) and a 7-way clostridial vaccine (Vision 7, Merck Animal Health, Kenilworth, NJ). Appropriate boosters were given to all calves per label instructions. In addition, all steer calves received a growth implant containing 100 mg progesterone/10 mg estradiol benzoate (Synovex C, Zoetis, Kalamazoo, MI). All heifer calves were weaned early in keeping with the normal replacement heifer development program. Heifer calves were weaned on August 15th and were fed a receiving ration at the rate of 2.5% of body weight per day. After weaning heifers were turned out onto pasture to graze. Steer calves were left with their dams and weaned on October 29th. Steer calves were fence-line weaned and grazed dormant native pasture while receiving supplementation of 1.5 lbs/hd/day of 38% CP cubes.

Weaning weights of steer and heifer calves were adjusted to a common age. Prices for the respective calves were determined from reported prices (USDA Market News) at the time of steer weaning and adjusted based on individual calf weights. Total returns for each calf were then calculated.

Experiment Two Results

Cow Weight and Body Condition Score (BCS)

Average cow weight loss from the beginning of the winter feeding period until April 8th was 189 lbs, 226 lbs, 165 lbs, and 66 lbs for CC, CR, HC, and Range groups, respectively. Cows began calving on February 25th. Cow weight at the end of the winter feeding period were lower than initial weight since most but not all cows calved during this period. Few if any inferences can be made regarding cow weight changes during the feeding period, since some cows had calved and some had not. No differences in average cow BCS were observed between the winter feeding groups, although individual variation did exist. Specifically, some individual cows in the HC and CR groups were observed to have lower BCS at the end of the winter feeding period. However, all groups had average BCS of 5 or greater at the time of A.I. on June 10th, and were considered to be in typical and acceptable condition for breeding.

Calving performance

No cows from any groups experienced dystocia. There was a significant winter storm on February 25th but no calves were lost in the storm. The HC group had one calf die. The Range group had two cows that were previously confirmed bred but never calved and one calf that aborted late in gestation.

Breeding performance

Cows were artificially inseminated on June 10th and clean up bulls were turned in after insemination. Individual conception rates were not obtained. The overall breed up of the cows was 94%. It appears that confined winter feeding did not have any adverse effect on breeding performance.

Calf Performance and Returns

Calves were weaned and weighed on August 12, 2013. Calf weaning weights averaged 461, 492, 479, and 446 lbs for CC, CR, HC, and Range groups, respectively. The number of steers and heifers in each group differed, contributing to differences in returns and making direct comparisons difficult. Calves sold at weaning averaged $2.01/lb for steers and heifers. Calves returned $926.61, $988.92, $962.79, and $896.46 for CC, CR, HC, and Range groups, respectively.

Feed Cost

Feed costs for the 102-d winter feeding period are given in Table 3.3. The Range group had the lowest cost of winter supplementation. This is not unexpected, as the majority of feed consumed was native rangeland. The feeds costs in Table 3.3 do not have costs of rangeland included. Just as in Experiment One, the CC cows did consume more hay than that CR cows. The CC cows consumed 32.05 lbs of hay/hd/day, whereas the CR cows consumed 26.59 lbs of hay/hd/day. The CR cows did have access to 20 acres of dormant winter forage. The results suggest that winter feeding in pasture locations, even if forage appears inadequate, may reduce hay consumption compared to lot feeding. An alternate explanation is that the CC group location close to the headquarters facilitated observation and therefore the CC group was simply offered more hay. Visual observation of the CC feeding site indicated more noticeable scattering and wasting of hay than in the CR group's pasture.

Labor Cost

Labor costs for the winter feeding period are presented in Table 3.4. Average feeding times were 11:43, 23:42, 15:58, and 23:17 min/d for CC, CR, HC, and Range groups, respectively. All groups were very similar in terms of calf care time as one group did not require considerably more time than another for calf care. Labor costs required for the winter feeding period were somewhat lower than might be expected. Workers were well-trained and efficient. Addition labor was required during the blizzard in February. All groups required additional labor and specific times for each group were not recorded during this weather event. Results suggest that labor requirements are not necessarily prohibitive for semi-confinement feeding and calving systems, even systems like HC that make use of high concentrate, limit-fed diets.

Fuel Cost

Fuel costs and total specified cost of the winter-feeding period, including feed, labor, and fuel required for feeding are presented in Table 3.4. Both the CC and HC groups were located at the headquarters while the CR group was in a pasture 1.85 mi away (3.71 mi round trip). The feed truck traveled 36.2, 245.2, 53.6, and 352 total mi delivering feed to CC, CR, HC, and Range groups, respectively during the winter feeding period. Fuel cost for HC cows was higher than for CC because two trips were used in order to allow HC cows to consume corn prior to feeding hay. The Range cows had the highest fuel costs as cows were usually scattered and extra miles were traveled to locate and deliver feed.

Experiment Two Discussion

It is easy to see that utilizing rangeland, when available, is much more cost effective than delivering feed to cows. Results were similar in terms of labor and time requirements as when compared to Experiment One. However, there were fewer cows per treatment in Experiment Two, therefore, inflating the cost per head. There were more miles traveled in the Range treatment in order to check calves and finding the cows in order to deliver them feed. Costs per head for the Range treatment are more reasonable than other treatments as the range was stocked with 23 hd while all other treatments had only seven head per treatment.

Table 3.1. Feed Costs and Composition for Cows During an 82-Day Feeding Period

	CC[a]	CR[b]	HC[c]
Corn			
Lbs/h/day	2.45	2.45	9.60
Cost/h	$27.13	$27.90	$106.25
Cost/h/day	$0.33	$0.34	$1.30
Range Cubes and Mineral			
Lbs/h/day	2.29	2.29	2.29
Cost/h	$36.47	$37.50	$36.47
Cost/h/day	$0.44	$0.46	$0.44
Grass Hay			
Lbs/h/day	27.78	18.71	4.90
Cost/h	$233.49	$161.70	$41.21
Cost/h/day	$2.85	$1.97	$0.50
Total Winter Feed			
Lbs/h/day	32.52	23.45	16.79
Cost/h	$296.71	$227.10	$183.54
Cost/h/day	$3.62	$2.77	$2.24

[a] Confined Conventional- hay based feeding system in small lot.

[b] Confined Remote- identical to CC system but located remotely.

[c] High Concentrate- limit fed diet with increased concentrate and low roughage feed.

Table 3.2. Combined Costs for Cows For 82-Day Feeding Period

	CC[a]	HC[c]	CR[b]
Feed Labor			
Labor, Min	819	1,686	1,403
Rate, $/hr	7.00	7.00	7.00
Total Cost	$95.62	$196.75	$163.70
Cost/h	$7.97	$16.40	$13.64
Cost/h/day	$0.10	$0.20	$0.17
Calf Labor			
Labor, Min	58.00	71	61
Rate, $/hr	7.00	7.00	7.00
Total Cost	$6.78	$8.36	$7.10
Cost/h	$0.57	$0.70	$0.59
Cost/h/day	$0.01	$0.01	$0.01
Fuel			
Miles Traveled	36.18	245.22	53.60
Efficiency, mpg	7.35	7.35	7.35
Fuel Cost	$3.50	$3.50	$3.50
Total Cost	$17.22	$116.76	$25.52
Cost/h	$1.44	$9.73	$2.13
Cost/h/day	$0.02	$0.12	$0.03
Totals			
Labor and Fuel Cost	$119.62	$321.87	$196.32
Labor and Fuel Cost/h	$9.97	$26.82	$16.82
Total Feed Cost/h	$296.71	$227.10	$183.54
Feed, Labor, and Fuel Cost/h	$306.68	$253.92	$200.36

[a] Confined Conventional- hay based feeding system in small lot.

[b] Confined Remote- identical to CC system but located remotely.

[c] High Concentrate- limit fed diet with increased concentrate and low roughage feed.

Table 3.3. Feed Costs for Cows For 102-Day Feeding Period

	CC[a]	CR[b]	HC[c]	Range[d]
Corn				
Lbs/h/day	0.0	0.0	10.0	0.0
Cost/h	0.0	0.0	$167.28	0.0
Cost/h/day	0.0	0.0	$1.64	0.0
Range Cubes				
Lbs/h/day	1.0	1.0	1.0	1.0
Cost/h	$24.00	$24.00	$24.00	$24.00
Cost/h/day	$0.20	$0.20	$0.20	$.20
Grass Hay				
Lbs/h/day	32.05	28.15	11.71	2.46
Cost/h	$155.04	$135.66	$57.12	$17.34
Cost/h/day	$1.52	$1.33	$0.56	$0.17
Total Winter Feed				
Lbs/h/day	33.05	29.15	22.71	3.46
Cost/h	$179.04	$159.66	$248.40	$41.34
Cost/h/day	$1.76	$1.57	$2.44	$0.41

[a] Confined Conventional- hay based feeding system in small lot.

[b] Confined Remote- identical to CC system but located remotely.

[c] High Concentrate- limit fed diet with increased concentrate and low roughage feed.

[d] Range- Cows allowed to graze native range—does not include pasture costs

Table 3.4. Combined Costs for Cows For 102-Day Feeding Period

	CC[a]	CR[b]	HC[c]	Range[d]
Feed Labor				
Labor, Min	1,196	2417	1,627	2,374
Rate, $/hr	7.00	7.00	7.00	7.00
Total Cost	$139.53	$281.98	189.82	$276.97
Cost/h	$19.93	$40.28	$27.12	$12.04
Cost/h/d	$0.20	$0.39	$0.27	$.12
Fuel				
Miles Traveled	45.9	310.0	66.3	484.5
Efficiency, mpg	7.35	7.35	7.35	7.35
Fuel Cost	$3.50	$3.50	$3.50	$3.50
Total Cost	$21.86	$147.61	$31.57	$230.71
Cost/h	$3.12	$21.09	$4.51	$10.03
Cost/h/d	$0.03	$0.21	$0.04	$0.10
Totals				
Labor and Fuel Cost	$161.39	$429.59	$221.39	$507.68
Labor and Fuel Cost/h	$23.06	$61.37	$31.63	$22.07
Total Feed Cost/h	$179.04	$159.66	$248.40	$41.34
Feed, Labor, and Fuel Cost/h	$202.10	$221.03	$280.03	$63.41
Feed, Labor, and Fuel Cost/h/d	$1.98	$2.17	$2.75	$0.62

[a] Confined Conventional- hay based feeding system in small lot.

[b] Confined Remote- identical to CC system but located remotely.

[c] High Concentrate- limit fed diet with increased concentrate and low roughage feed.

[d] Range- Cows allowed to graze native range—does not include pasture costs

CHAPTER IV

EXPERIMENT THREE

Objective

The objective of this dissertation is to determine the economic and biological viability of semi-confinement cow/calf systems. A semi-confinement experiment was conducted in the winter of 2012-2013. This research seeks to determine cost information related to the mixed confinement-grazing systems with emphasis on identification of simple, manageable systems that could be easily implemented by producers in the Texas Panhandle. Cost information can then be used to develop optimization and decision aid models for evaluating semi-confined cow/calf systems.

Materials and Methods

This study was conducted by West Texas A & M University and animal management was approved by the institution's Animal Care and Use Committee (approval number 02-12-13). Angus-cross cows (n = 48; initial BW=1,512 ± 159 lbs) were stratified by BW and randomly assigned to eight pens with six hd/pen. The two feeding treatments were replicated four times. Each pen was given free choice access to mineral, salt, and water. The cows were confined for 90 d from December 10th, 2012 to March 10th, 2013. All pens were of equal size giving approximately 300 sq. ft. per cow. Cows were fed in concrete bunks with cows having 3.3' of bunk space per cow.

Treatment one Cows were fed a diet composed of free choice sorghum-sudan hay (HAY) with 1.5 lbs/hd/day of 32% CP cubes supplemented to meet crude protein deficiency (NRC, 2000). Hay was fed in a Century round bale feeder with a skirt, which was chosen to minimize hay waste. Individual bales were weighed before feeding and weights recorded for each respective pen. Protein cubes for each pen were weighed prior to being fed in the morning. Hay feeders were replenished by visual determination throughout the feeding study. Hay waste was not quantified throughout the study.

Treatment two (Sweet Bran) cows were limit-fed a ration containing wet corn gluten feed (Sweet Bran) and sorghum-sudan hay. The ration was 60% Sweet Bran and 40% forage, with feed delivery limited to 1.5% of BW per day (DM basis). Sweet Bran and hay were weighed each morning prior to feeding and feeding occurred once per day in the morning. This diet was formulated to meet but not exceed cow nutrient requirements based on the NRC (2000). There were no feed refusals for the limit fed cows. Feed offered to both treatments along with costs are shown in Table 4.1. Nutrient analysis of feeds are shown in Table 4.2.

Cows were individually weighed through a chute at the beginning of the project, and BCS were assigned by three individuals with an average of the three scores being used as the initial BCS. Final weights and BCS were also obtained in the same manner. All cows were taken off feed the evening prior to weighing to account for gut fill, as well as cows being weighed on two consecutive days prior to the start of the trial and averaging the weights to determine initial weight.

The cows used for the project were all confirmed pregnant before initiation of the experiment. The feeding project ended approximately two weeks prior to calving and all cows were co-mingled and allowed to graze on rangeland. Calf birth weights were captured as well as weights at time of branding for calves (approximately 90 d of age). During the calf data collection process all cows were co-mingled and managed similarly.

Results and Discussion

Data was analyzed using the Mixed Procedure in SAS. There was no difference in initial body weights between treatments (P = 0.46); however, there was a trend (P = 0.07), for the Sweet Bran cows to have a greater initial BCS than the HAY cows. Final BCS were also greater (P < 0.01) for cows on the Sweet Bran treatment. A major concern of the study with the accelerated weight gain of the Sweet Bran cows was dystocia associated with high birth weights. There was no difference (P = 0.76) in birth weights between treatments as well as no observed differences in dystocia between treatments. There was also no difference (P = 0.58) in the weight of calves at branding. Cow and calf performance is shown in Table 4.3.

Considering commodity prices during the time of the study, it cost less per day to feed the Sweet Bran cows than it did the HAY cows. Hay at the time of the trial was valued at $150/tn, Sweet Bran was valued at $137/tn and protein cubes were valued at $400/tn. Feeding the Sweet Bran® cows on a per hd per d basis cost was $2.29; whereas, the hay treatment cost was $2.90. A visual inspection of the pens post study revealed more hay waste in each of the HAY pens. Cleaning of the pens after the study required more labor for the HAY pens due to the significant hay mat.

The largest labor requirement was the weighing of the hay each day for the Sweet Bran® treatment. In a commercial setting, where individual hay weights for each pen are not needed, this labor requirement would be alleviated. Previous studies by Jones et al.

(2013) revealed no difference in time required for feeding, and no additional labor requirements when limit-fed vs. free choice hay.

When confining cows during gestational periods, a limit-fed diet containing a majority of Sweet Bran is a viable option. In this study, cows gained a considerable amount of weight, and in retrospect a lower amount of Sweet Bran could have been fed to satisfy maintenance and gestational requirements. During times of drought, or times of high roughage prices, feeding Sweet Bran to confined cows is also a less expensive option than free choice hay. Even though body weights and condition scores of the cows did increase on the Sweet Bran diet, there were no adverse effects on birth weights of calves or dystocia; however, there was also no increase in performance of Sweet Bran calves at time of branding.

Table 4.1. Feed offered and cost summary of cows fed baled hay or limit-fed a diet based on Sweet Bran

	Hay [1]	Sweet Bran [2]
Commodity		
Sweet Bran lbs/hd/day	0.00	22.50
Sweet Bran cost/hd/day[3]	$0.00	$1.54
Hay lbs/hd/day[4]	34.0	10.00
Hay cost/hd/day[5]	$2.55	$0.75
Protein Cube lbs/hd/day	1.50	0.00
Protein Cube cost/hd/day[6]	$.34	$0.00

[1] Ration consisted of free choice sudan-hay and 1.5 lbs/hd/day of 32% protein cubes.

[2] Ration consisted of 60% WCGF and 40% sudan-hay on a DM basis and was offered to cows at 1.5% of BW/d.

[3]Sweet Bran was valued at $137 per ton

[4] Hay offered not adjusted for waste

[5] Hay was valued at $150 per ton

[6] Protein cubes were valued at $400 per ton

Table 4.2. Nutrient analysis of sorghum sudan hay and Sweet Bran

	Hay [1]	Sweet Bran [2]
Nutrient content on DM basis		
Crude Protein%	7.6	23.3
Acid Detergent Fiber%	46.0	12.2
Total Digestible Nutrients%	50.7	79.4
Net energy, Maint, Mcal/lb	0.45	0.87
Net energy, Gain, Mcal/lb	0.20	0.58
Net energy, Lact, Mcal/lbr	0.51	0.83
Digestible energy, Mcal/lb	1.02	1.59
Met. Energy, Beef, Mcal/lb	0.83	1.30

[1] 87.1% Dry Matter

[2] 62.0% Dry Matter

Table 4.3. Cow and Calf Performance when cows are offered *ad-libitum* access to baled hay or limit-fed[1] a diet based on Sweet Bran.

	Hay [1]	Sweet Bran[2]	SEM	*P*-value
Initial BW[3], lbs	1501	1524	29.8	0.46
Final BW[3], lbs	1593	1728	24.2	<0.01
Initial BCS	6.21	6.49	0.135	0.07
Final BCS	6.13	6.78	0.084	<0.01
Calf birth weight, lbs	89	90	4.6	0.76
Calf weight at branding, lbs[4]	295	303	13.7	0.58

[1] Ration consisted of 60% WCGF and 40% sudan-hay on a DM basis and was offered to cows at 1.5% of BW/d.

[2] Wet corn gluten feed—Cargill Animal Nutrition.

[3] Cows were held off feed for approximately 18 hours before weights were taken.

[4] Branding occurred when calves were approximately 90 days of age.

CHAPTER V

DECISION AID WORKSHEET

Introduction

Beef producers across the country are faced with several decisions in the management of their herd. Traditional beef production utilizes rangeland as the main forage source for cows. However, when drought or other factors cause rangeland to become unavailable a producer is faced with even more management decisions dealing with herd and rangeland management. When faced with grazing restraints induced by drought, a producer must decide between alternatives. Alternatives include, but are not limited to, liquidation, confinement, re-locating the cows, providing nutritional supplementation of forage, utilizing pen space at a feedyard, or partial liquidation by drastically culling cow numbers.

Management responses during times of forage unavailability may be related to the production cycle and the nutrient demand of the cow herd. In the Texas High Plains, most calving occurs in the spring as green grass starts to grow and as calves also start to appear and grow. Annual nutrient requirements of cows are the highest during peak lactation, which occurs approximately 60 days after calving. After calving, milk production increases as well as internal preparations for re-breeding to occur. Matching a cow's nutritive requirements with available high quality forage makes good sense. Calves nurse throughout the summer and are traditionally weaned in the fall. At weaning, producers then make the decision to sell the calf, or maintain ownership and precondition the calf.

There are stages in the cow/calf production cycle where semi-confinement is more conducive than other stages. Producers have a variety of weaning options—most commonly producers will wean for 45-60 days. After calves are weaned, if a producer has available forage or feed, ownership can be maintained and calves grown until they are ready for shipment to a feedyard. Some producers in the Texas High Plains choose to calve in the Fall as they take advantage of cultivated cool season grasses. No matter the calving season a producer chooses, there are times between weaning and calving when cows are only gestating. It is during this gestational time, without a nursing calf, in which semi-confinement would be easier than other times in the production cycle. If cows are confined while calves are at their side, the calves add considerable complexity. Calves in confinement have a higher risk of contracting disease such as respiratory disease and especially scours due to the concentration effects of confinement. Furthermore, calves in confinement tend to roam and find ways out of the pen—considerable attention to pen construction would be required to contain calves. Rations fed to cows in confinement may also have to be modified in terms of composition and amount as calves will likely consume the cow ration. No matter the chosen confinement period in the production cycle, the decision to confine is a difficult one with many variables. A decision aid is needed to assist producers with this unique production decision.

Previous research has culminated into the development of decision aids for cattle producers. Decision aids can be a valuable tool when a cow/calf producer is faced with a management decision. A good example of a cow/calf decision aid that has been developed and used would be the Cowculator v. 2.0 developed by Oklahoma State University. The Cowculator would be used by a producer to decide feedstuffs and amounts of feed to provide in order to maintain cows in production. Another decision aid, also developed by Oklahoma State, would be the Oklahoma Wheat Stocker Graze Out Decision Aid. The graze out decision aid helps a producer decide whether to graze out wheat or harvest for grain. These decision aids are helpful in terms of knowing what decision to make but give little insight into how to implement that decision.

We build on previous research and cow/calf tools with the development of the semi-confined cow/calf decision aid which will be presented in this chapter. The decision aid worksheet in this dissertation has the objective to assist a producer in deciding how to implement a semi-confined system. The decision aid worksheet assists by determining which scenario, chosen from the set of common semi-confinement scenarios, is likely to result in minimum feed-related costs for the gestational period while maintaining an acceptable body condition score. This decision aid worksheet also assists a producer in the decision to liquidate or semi-confine cows. In addition, it provides other options concerning the disposition of the cow herd. Although the goal is to help producers determine the cost of semi-confinement it is not intended to be a predictor of performance or actual costs, but rather a simulation of estimated costs in an effort to simulate a variety of different confinement and feedstuff options simultaneously.

Several key management benchmarks are commonly used by producers to gauge the profitability of their operation. Most producers are concerned with percentage of pregnancies, percentage of live calves weaned in relation to number of cows exposed, and calf weaning weight. All of these benchmarks are related to nutrients that are provided to the cow herd. If rangeland resources are limited, a producer will have to supplement cows in order to reach production benchmarks. Profits are a function of total revenue minus total costs for livestock producers. Previous research in semi-confinement cow/calf systems has revealed little impact on returns. Therefore, this decision aid is focused on costs. Feed costs are typically the largest cash cost category for cow/calf producers, and even more important during drought; therefore, this decision aid worksheet focuses on feed-related costs. The output generated provides producers side by side comparisons of costs associated with different semi-confinement systems. After costs of different production systems are simulated, producers can make more informed decisions about the management of their cow herd.

A Systems Approach

A system is defined broadly as a cohesive conglomeration of interrelated and interdependent parts (Beven, 2006). Systems can be relatively small or can be extremely complex. Cow/calf operations can be defined as a system which is part of a greater livestock industry system. Cow/calf systems are not simple stand-alone systems. Rather, cow/calf systems are extremely complex and interrelated to several other complex systems. It would be foolish to discuss a cow/calf system without incorporating complex and unpredictable systems that relate to the cow/calf system. A variety of these systems may influence the decision-making environment related to semi-confinement of the cow herd. Several examples of related systems and their potential influence on the semi-confinement decision will be discussed.

Systems related to the cow-calf production enterprise often add risk or complexity to decision-making, perhaps especially so during times of drought. Related systems often contribute to factors or situations that a producer has little or no control over. Examples of these types of systems include weather and markets, both which may add risk to a cow/calf operation, and which add risk to the decision to semi-confine. Other related systems may primarily influence the goals or objectives a producer has for the cow/calf operation. While the producer does control the operation's goals, related systems may exert powerful influence on these goals, ultimately influencing decisions. Only individual producers can know their specific resources and constraints and know their specific end goals. Examples of related systems that influence operation goals include career, family, and alternative land use. This decision aid worksheet can be modified by producers to aid in risk management and to accommodate their unique and differing goals.

Weather is a system that affects cow/calf production. Even with projection models and long-range forecasts, weather is still unpredictable, as is weather-dependent forage production. Some cow/calf producers have in place a drought/disaster plan before the drought/disaster occurs while many will not. If a drought/disaster plan is in place, a producer can have this decision aid worksheet as a tool in the drought/disaster plan. If a drought/disaster plan is not in place, a producer can still utilize this decision aid worksheet to mitigate the drought/disaster. A drought/disaster plan will also help in reducing headcount to confine. A drought or disaster can be an opportunity to cull deeper into the herd and only retain and confine those cows that are productive and desirable to the producer.

The market system also interacts with cow/calf production via its influence on product and input prices. It is common that in times of drought cattle prices may be lowered due to a large supply of cattle entering the market, and a lack of forage resources. At the same time, a scarcity of forage and feed may contribute to inflated feed prices. In addition, the prices may be especially volatile and variable during a time of drought. A decision aid is particularly valuable to producers in this situation. This decision aid allows producers to quickly evaluate the effect of feed prices in order to make informed management decisions.

A number of related systems may influence the goals of a producer, and therefore the perception and the use of the semi-confinement decision aid. Producers commonly have differing end-goals for cow/calf operations. A seedstock producer will look very differently at the decision to confine as compared to a producer managing a family's legacy ranch. The seedstock producer will most likely value the genetic progress made over time and will more likely be willing to confine cows, and pay a higher cost, to retain genetics. Genetic improvement in beef production occurs at a relatively slow rate as compared with other livestock species. Therefore, beef producers that have spent years building a genetic base in a herd may look for alternatives to liquidation when rangeland becomes unavailable, since the cow herd is their priority. Other producers may prioritize land use as their focus rather than the cow herd. A legacy ranch manager may be more willing to liquidate cows as rangeland preservation is more valued than genetic retention. In addition, producers often have ecological, wildlife, or other landscape goals that may encourage removal of cattle from the rangeland.

If a producer also has a farming system along with a cow/calf system, it may make more sense to confine based on what the farming operation can add to the confinement equation. A producer that raises crops may find that retaining ownership of the crop and feeding it to confined cows may make more economic sense than marketing the crop. The largest cost of confinement is feed cost and having access to lower priced feeds can greatly change the dynamics of cow confinement. Furthermore, a producer that also raises feed may have feed and/or hay stockpiled that could be used for cow confinement. Farmer-feeders in the northern plains commonly raise cattle due to the economic benefit of feeding a raised crop to their own livestock.

Another interrelated system that affects the cow/calf system would be the occupation of the producer. Many producers are full-time cow/calf producers while many others are employed with full-time day jobs. In the case of the full-time cow/calf producer, semi-confinement may be an option as it allows that producer to continue in cow/calf production and have a use for their time. However, many full-time cow/calf producers may decide that semi-confinement is not worth the hassle or the time and decide to liquidate. In the case of the cow/calf producer that has a full-time job other than cow/calf production, semi-confinement may be too much of a time commitment piled on top of an already busy schedule. On the other hand, confinement at a central location may actually free up time and allow the producer more time with the cows. Still another situation, the full-time job in town may be good enough that the producer needs more of a schedule F tax write off and semi-confinement would provide plenty of expenses.

Lifestyle, family, and community systems also commonly interact with cow/calf systems. There are cow/calf producers with external income sources that raise calves not for potential profits, but rather as a hobby and/or a use for land resources. A cow/calf producer may be in the cattle business as a lifestyle choice and enjoy raising calves so his/her children can be involved in the cattle industry. There could be a pet cow in the herd that eats cattle cubes out of your hand and it is for that reason that the family chooses to retain the herd and semi-confine. In these situations, there may not be a semi-confinement cost too large to liquidate the cow herd. If a cow/calf producer has a young family employed at the ranch, semi-confinement to keep that family on the ranch and employed may be more desirable than liquidating the cows and letting the family go during hard times. Similarly, other full-time cow/calf producers may look at their hired labor and make the decision to semi-confined based on the needs of the hired labor. The decision to confine or liquidate does not always come down to dollars and cents that can be displayed on a spreadsheet. However, it is useful to understand the costs associated with confinement even if cost is not the sole determinant of the decision.

No matter the reason for raising calves, these producers will also be interested in semi-confinement options when rangeland resources are limiting. There are surely examples of external systems that are not mentioned in this narrative that would be a part of a cow/calf producer's overall livelihood system. The decision to confine comes down to an individual producer. It is unlikely that individual producers will be faced with the same set of conditions year after year. External systems will change frequently and will have effects on cow/calf systems. If a decision to confine is made, the goal of the decision aid worksheet is to assist the producer in choosing which semi-confinement system is best suited for their operation and to provide cost information related to these systems.

Methods

When faced with grazing restraints induced by drought, a producer must decide between liquidation or confinement. Alternatives include re-locating the cows, providing nutritional supplementation of forage, utilizing pen space at a feedyard, or drastically culling cow numbers. This tool allows producers to have better insight into the costs of semi-confinement when faced with rangeland resource constraints.

Results from the three experiments previously discussed are utilized as input variables for the tool. By comparing the three different types of semi-confinement systems with the option of using two different high concentrate supplements across all three systems, cost figures are generated. Experiments One and Two provide the input for the three semi-confinement options. While all three experiments provide data on the concentrate feedstuff, we acknowledge the two concentrate feedstuffs used in the tool are not an exhaustive list. However, the two concentrate feedstuffs used are readily available in the Texas High Plains. Even though the three systems defined in the tool will not be an exact match to a producer's operations, one of the three systems will have elements that resemble semi-confinement options that many producers will have available. Producers will find components of the three systems defined in this tool that match their facilities and equipment. A producer can extrapolate results from this decision aid to match their semi-confinement conditions. The nutritional requirements of semi-confined cows in this worksheet are limited to gestating cows as this is the stage of production where semi-confinement is easiest, however, if semi-confinement continues into the calving season a producer will need to adjust the ration to meet the higher nutritional needs. This worksheet assumes there is no available rangeland for grazing.

As previously discussed, this tool incorporates two concentrate feedstuffs, whole corn and Sweet Bran. Both are readily available, and commonly used within the geographic region. Corn is considered a common grain while Sweet Bran is a common distilling by-product. Similar grains and by-products such as cracked milo, wheat, and distillers grains, would have very similar nutritive values respective to corn and Sweet Bran. The worksheet is flexible and allows modification of feedstuffs. If different feedstuffs are used, the producer has the ability to adjust quantity. The decision aid contains a link to the OSU Cowculator to help a producer wanting to use alternative feedstuffs. The output generated shows side by side comparisons of the three types of semi-confinement systems researched in this dissertation: a conventional confined system, a remote confined system, or a high concentrate limit fed system. Several input variables such as feedstuffs, costs, mileage, and as-fed amounts can be modified to better fit the resource constraints of the producer.

Procedures for Using the Worksheet

Included within the Excel spreadsheet are ten sections, with an instruction section also included. There are two background tabs where background calculations occur—these two background tabs will be hidden from the user of the worksheet. Tab one is the Sell or Retain section which helps a producer calculate a net present value of cows and provides insight on the decision to sell or retain. Tab two is the Producer Information section that gathers user information. Tab three is the Cost Input section and gathers costs, types of feedstuffs, pounds of feedstuffs, and other inputs required for confinement.

Tab four is the Ration Example section and provides four sample rations for limit-fed confinement and three sample rations for high forage confinement. Tab five is the Cost Summary section which shows the results of the worksheet where costs of the three semi-confinement systems are juxtaposed. There are three sensitivity analysis sections that all provide a matrix of cost/hd/day of the three different semi-confined feeding options. These sensitivity matrixes are located on tabs six, seven, and eight. The sensitivity matrixes are linked to the inputs provided in the Cost Input section and will automatically update as inputs in the Cost Input section are changed. Tab nine is the Other Options section which juxtaposes semi-confined costs with costs of other cow retainment options. Tab ten is the Feeding Instructions section which gives suggested feeding directions as cows move into different gestational trimesters. Each section is described in detail and followed by hypothetical examples.

Sell or Retain Section

The Sell or Retain section calculates a net present value of the cows and compares that value to the cost associated with buying cows back at a later date. Any cells highlighted in yellow require user input. This section asks for input on the current cow value if sold, a future cow replacement cost, percentage estimate of cow death loss, percentage estimate of culls, percentage estimate of marketable calves, estimate of steer weight, estimate of steer price on a cwt basis, estimate of heifer weight, estimate of heifer price on a cwt basis, estimate of weight of cows at culling, estimate of cull cow price on a cwt basis, estimate of feed and/or grazing costs on an annual basis, estimate of cow and calf care costs on an annual basis, estimate of principle and interest payment on an annual basis, number of cows, and the number of years anticipated between liquidation and cow buy back.

Net returns for keeping cows and net returns for selling cows with a future buy-back are calculated values in the worksheet. The calculations come from a background sheet. The net returns for keeping cows is defined as

(5.1)

$$net\ returns\ for\ keeping\ cows\ =\ calf\ income\ +\ cull\ income\ -\ cow\ cost$$

(5.2)

$$calf\ income\ =\ \left(rc \times mc\ \times\ .5\ \times \left(\frac{stwt}{100}\right) \times stp\right) + (rc\ \times mc\ \times\ .5\ \times \left(\frac{hfwt}{100}\right) \times hfp$$

Where rc is the remaining cows, mc is the marketable calf percentage, stwt is the steer weight, stp is the steer price in $/cwt, hfwt is the heifer weight, hfp is the heifer price in $/cwt.

(5.3)

$$cull\ income =\ \ rc\ \times cull\%\ \times \left(\frac{cullwt}{100}\right) \times cp$$

Where rc is the remaining cows, cull% is the culling percent of cows due to death or other culling decision, cullwt is the weight of culls, and cp is the cull price in $/cwt.

(5.4)

$$cow\ cost\ =\ fc\ + cc + pi$$

Where fc is the feed costs for the cows on an annual basis, cc is the care cost for cows and calves on an annual basis, and pi is the principle and interest costs on an annual basis.

The net returns for keeping cows are calculated over a nine-year simulation. If a producer chooses more than one year between liquidation of cow and future buy-back, net returns for the appropriate number of years are summed.

Net returns for selling cows with a future buy-back are calculated on a background sheet. The net returns for selling cows with a future buy-back is defined as (5.5)

$$net\ returns\ with\ future\ buyback = (ccp\ \times rc) - (fcp\ \times rc)$$

Where ccp is the current cow price, rc is the remaining cows, and fcp is the future cow price.

If the net returns for keeping cows are greater than the net returns for selling cows with a future buy-back, the decision worksheet returns a decision of “keep”. If the net returns for keeping cows are less than the net returns for selling cows with a future buy-back, the decision worksheet returns a decision of “sell”. However, this set of equations that calculate the net present value do not encompass all factors involved in the decision to keep or sell. There are several intangible hassle factors that a producer would need to consider. An example of the Sell or Retain section is shown in Figure 5.1. An example of the background calculations for the Sell or Retain section is shown in Figure 5.2.

Producer Information Section

In this area of the worksheet, input of general producer information is entered. Any cells highlighted in yellow require user input. A producer provides general information such as quantity confined and the desired confinement time period. From this information, the worksheet automatically calculates the number of days to confine and transfers this information to the Cost Summary section. The first and last days of the breeding season are required to calculate the gestation and calving season dates. The worksheet adjusts nutritional requirements of the semi-confined cows based on the stage of their production cycle. The time period of confinement along with the dates of the breeding season are used by the worksheet to calculate the cow's production cycle during confinement and thus determine approximate pounds of feed required. An estimation of cow weight is needed by the worksheet as feedstuff amounts are calculated based on a percent body weight. The worksheet asks the producer to enter either corn or Sweet Bran as a desired concentrate feedstuff. After the worksheet has calculated using one of the feedstuffs, a user can easily leave all other variables constant while going back to change the concentrate choice. An example of the Producer Information section is shown in Figure 5.3.

Cost Input Section

Contained within this section is information regarding price. Several variables in the worksheet require user input. The three yellow cells of feedstuff price require user entry (whole corn, hay, and protein supplement). Labor rate is needed in a $/hour unit, an estimated health cost is needed in a $/cow/day unit, a fuel cost is needed in a $/gallon unit, a fuel efficiency is needed in a miles/gal unit, and a mileage cost is needed in a $/mile unit. Blue cells are values which have been derived from research data generated in Experiments One, Two and Three. Blue cells are pounds of supplement supplied, health costs, and travel mileages realized in the experiments. Blue cells can be adjusted by the user according to unique situations. Producers are encouraged to alter these to more closely model their situation. For example, if a producer expects more health issues in the limit-fed system, they have the ability to increase the $/cow/day value.

Producers also have the ability to change the type of feedstuff along with the price and as-fed quantity. Users of the worksheet are also encouraged to change the types of feedstuffs used in the worksheet. Changing the name of the feedstuff along with a respective price and pounds as-fed feed per day are needed to compare different feedstuffs in the worksheet. Although Sweet Bran cost varies, worksheet iterations here will assume Sweet Bran cost at 93% of simulated corn costs. The cost of Sweet Bran is generated within the worksheet based on the user-entered corn price. Relative, region-specific prices are encouraged. Some users may or may not require all three of the semi-confinement situations, the worksheet will function even though all confinement types are not used. Most all cells that can be modified contain notes as a guide for worksheet users. An example of the Cost Input section is shown in Figure 5.4.

All cost entries, except Sweet Bran, are manually entered values in respective units. The cost of Sweet Bran is a function of corn cost and is calculated as

(5.6)

$$Sweet\ Bran\ Cost\ =\ (Corn\ Price\ per\ cwt\ \div 100) \times 0.93$$

For the HCC treatment the lbs/d of Sweet Bran is calculated as

(5.7)

$$Sweet\ Bran\ =\ (tri_1\ \times 0.013\ \times bw) + (tri_2\ \times 0.014\ \ bw) + (tri_3\ \times 0.015\ \times bw)$$

where tri_1 is the number of days the cows will be in trimester one of gestation, tri_2 is the number of days the cows will be in trimester two, tri_3 is the number of days the cows will be in trimester three, bw is the body weight of the cows entered in the Producer Information section, 0.013, 0.014, and 0.015 are coefficients expressing feed required as a percent of BW based on NRC nutrient requirements respectively for each trimester.

For the HCC treatment the lbs/d of corn is calculated as

(5.8)

$$corn = (tri_1 \times 0.007 \times bw) + (tri_2 \times 0.00735 \times bw) + (tri_3 \times .00781 \times bw)$$

where tri_1 is the number of days cows are in trimester one of gestation, tri_2 is the number of days cows are in trimester two of gestation, tri_3 is the number of days cows are in trimester three of gestation, bw is the body weight of the cows entered in Producer Information section, and 0.007, 0.00735, and 0.00781 are coefficients expressing feed required as a percent of BW based on NRC nutrient requirements respectively for each trimester.

For the HCC treatment the lbs/d of hay is calculated as

(5.9)

$$HCC\ hay = bw \times 0.0045$$

where bw is the body weight of cows entered in the Producer Information section, and 0.0045 is a coefficient expressing hay required as a percent of body weight based on Experiments One, Two, and Three in this dissertation.

For the CC treatment the lbs/d of hay is calculated as

(5.10)

$$CC\ hay = bw \times 0.025$$

where bw is the cow weight entered in Producer Information section and 0.025 is a coefficient expressing hay required as a percent of body weight based on Experiments One, Two, and Three in this dissertation.

For the CR treatment the lbs/d of hay is calculated as

(5.11)

$$CR\ hay = bw\ \times 0.025$$

where bw is the cow weight entered in Producer Information section and 0.025 is a coefficient expressing hay required as a percent of body weight based on Experiments One, Two, and Three in this dissertation.

The hours/day for the CR treatment is calculated as

(5.12)

$$CR\ hours = .12\ \times rtm$$

where .12 is a coefficient determined by research in this dissertation in Experiments One, Two and Three, and rtm is the round-trip miles.

Ration Example Section

The Ration Example section provides four example limit-fed confinement rations and three high-forage confinement rations. These seven examples are not meant to be an exhaustive list of rations as a producer can modify rations to use feedstuffs that best fit current availabilities and favorable prices. Each of the seven example rations are balanced using the OSU Cowculator and results from Experiments One, Two, and Three in this dissertation. Quantities of roughages in the high-roughage examples are increased above recommended values to account for waste. An example of this tab is shown on Figure 5.5.

Cost Summary Section

Within this section is a representation of the costs associated with the three systems. There are no cells which need to be modified or changed in this section, and the analyzed results of all inputs are displayed here. Costs are calculated as the sum of the following costs: concentrate, roughage, supplement, labor, fuel, and mileage. To determine the amount of concentrate used, the Stage of Production section calculates the number of days of each trimester the cow will be in during the confinement period. A different rate of feed based on the average cow weight entered by the producer will be applied to the number of days a cow is in a respective trimester. An example of the Cost Summary section is shown in Figure 5.6.

The objective of the worksheet is to calculate the confinement feed costs (CFC) associated with the confinement period from various semi-confined cow/calf production scenarios. CFC are calculated as

(5.13)

$$CFC = (cn + rc + sc + hc + lc + mc) \times n$$

where cn is concentrate cost, rc is roughage cost, sc is supplement cost, hc is health cost, lc is labor cost, mc is mileage cost and n is the number of cows confined.

Costs of concentrate feeds (cn) are calculated as

(5.14)

$$cn = p_c \times q_c$$

Where p is price of feed on a an as-fed basis and q_c is the lbs/hd/day of concentrate fed on an as-fed basis. Quantities of concentrates are calculated in formulas 5.7 and 5.8.

Roughage costs for all groups are calculated as

(5.15)

$$rc = p_r \times q_r$$

where p is price of hay on an as-fed basis and q_r is the quantity of roughage fed/hd/day on an as-fed basis. Quantity of roughage is calculated in formulas 5.9, 5.10, and 5.1. Supplement costs are calculated as

(5.16)

$$sc = p_s \times q_s$$

where p is the price of supplement on an as-fed per ton basis and q_s is the quantity of supplement fed on an as-fed basis. The quantity of supplement is entered by the user of the worksheet in the Cost Input section. Labor costs are calculated as

(5.17)

$$lc = lr \times q_l$$

where lr is the labor rate in $/hour and q_l is the quantity of labor in hours. The quantity of labor is entered by the user of the worksheet in the Cost Input section. Health costs are calculated as

(5.18)

$$hc = p_h \times n$$

where p_h is the price of health costs in a $/hd unit for both cows and calves and n is the number of cows confined. The health cost price is entered by the user of the worksheet in the Cost Input section. Fuel costs are calculated as

(5.19)

$$fc = \left(\frac{rtm}{mpg}\right) \times p_f$$

where rtm is the round-trip miles driven per day, mpg is the miles/gallon fuel efficiency of the vehicle being used and p_f is the fuel price in $/gallon. Mileage costs are calculated as

(5.20)

$$mc = rtm \times mr$$

where rtm is the round miles driven per day and mr is the mileage rate in $/mile.

Limit-Fed Sensitivity Section

The three sensitivity analysis sections allow the producer to learn the price points at which a different decision might result. Producers could look at the sensitivity matrix and set threshold levels that key certain decisions. For example, if hay prices reached above $170/ton, a producer would know that semi-confinement costs would be above a pre-determined cost threshold. These sensitivity analyses can be compared not only to each other but can also be compared to the other options for the cow herd such as transport, utilizing feedyard pen space, or liquidation.

This section is a matrix that shows the price/hd/day of confinement when feeding a limit-fed ration with changing corn price and hay price. Corn prices are located in the first column of the matrix and start at $5.00/cwt and go up to $15.00/cwt in $0.50/cwt increments. Hay prices are located in the first row of the matrix and start at $70.00/ton and go up to $220.00/ton in $10/ton increments. To use the matrix, find the current price of corn/cwt in the column and follow that row horizontally until it intersects with the current hay price. The point where the two prices interact will be an estimated price/hd/day for the limit-fed system. The price in the matrix does not only include feed costs, all other costs associated with the limit-fed confinement system are included. Furthermore, all values in the limit-fed sensitivity matrix are linked to the Cost Input section. As prices are changed in the Cost Input section, the matrix automatically updates with the current prices entered. However, the corn price and hay price are not linked to the sensitivity matrix as they are found in the column and row respectively. The values in the sensitivity matrix are calculated as

(5.21)

$$P_{sm} = \left(\frac{p_c}{100} \times lbs_c\right) + \left(\frac{p_h}{2000} \times lbs_h\right) + sc + lc + hc + fc + mc$$

where p_{sm} is the price/hd/day in the sensitivity matrix, p_c is the price of corn/cwt, lbs_c is the pounds of corn fed/hd/day, p_h is the price of hay in lbs/tn, lbs_h is the pounds of hay fed/hd/day, sc is the supplement cost, lc is the labor cost, hc is the health cost, fc is the fuel cost, and mc is the mileage cost. An example of the Limit-fed Sensitivity tab is shown in Figure 5.7.

High-Forage Sensitivity Section

This section is a matrix that shows the price/hd/day of confinement when feeding a high-forage ration with changing supplement price and hay price. Supplement prices are located in the first column of the matrix and start at $180/ton and go up to $400/ton in $10/ton increments. Hay prices are located in the first row of the matrix and start at $70.00/ton and go up to $220.00/ton in $10/ton increments. To use the matrix, find the current price of supplement/ton in the column and follow that row horizontally until it intersects with the current hay price. The point where the two prices interact will be an estimated price/hd/day for the high-forage system. The price in the matrix does not only include feed costs, all other costs associated with the high-forage confinement system are included. Furthermore, all values in the high-forage sensitivity matrix are linked to the Cost Input section. As prices are changed in the Cost Input section, the matrix automatically updates with the current prices entered. However, the supplement price and hay price are not linked to the sensitivity matrix as they are found in the column and row respectively. The values in the sensitivity matrix are calculated as

(5.22)

$$P_{sm} = \left(\frac{p_s}{2000} \times lbs_s\right) + \left(\frac{p_h}{2000} \times lbs_h\right) + lc + hc + fc + mc$$

where p_{sm} is the price/hd/day in the sensitivity matrix, p_s is the price of supplement/ton, lbs_s is the pounds of supplement fed/hd/day, p_h is the price of hay in lbs/ton, lbs_h is the pounds of hay fed/hd/day, lc is the labor cost, hc is the health cost, fc is the fuel cost, and mc is the mileage cost. An example of the High-Forage Sensitivity tab is shown in Figure 5.8.

High-Forage Remote Sensitivity Section

This section is a matrix that shows the price/hd/day of confinement when feeding a high-forage remote ration with changing round trip miles and hay price. Round-trip miles are located in the first column of the matrix and start at five miles and go up to 100 miles in five-mile increments. Hay prices are located in the first row of the matrix and start at $70.00/ton and go up to $220.00/ton in $10/ton increments. To use the matrix, find the round-trip miles in the column and follow that row horizontally until it intersects with the current hay price. The point where the two prices interact will be an estimated price/hd/day for the limit-fed system. The price in the matrix does not only include feed and mileage costs, all other costs associated with the high-forage remote system are included. Furthermore, all values in the high-forage remote sensitivity matrix are linked to the Cost Input section. As prices are changed in the Cost Input section, the matrix automatically updates with the current prices entered. However, the mileage, fuel, and hay prices are not linked to the sensitivity matrix as they are found in the column and row respectively. The values in the sensitivity matrix are calculated as

(5.22)

$$P_{sm} = \frac{\left(\frac{m}{mpg} \times p_f\right)}{n} + (m \times 0.12 \times lr) + \frac{m \times mr}{n} + \left(\frac{p_h}{2000} \times lbs_h\right) + sc + lc + hc$$

where p_{sm} is the price/hd/day in the sensitivity matrix, m is the round-trip miles, mpg is the fuel efficiency of the vehicle used for feeding, p_f is the fuel price in $/gal, n is the number of cows confined, lr is the labor rate in $/hr, mr is the mileage rate in $/mile, p_h is the price of hay in lbs/ton, lbs_h is the pounds of hay fed/hd/day, sc is the supplement cost, lc is the labor cost, hc is the health cost. An example of the High-Forage Remote Sensitivity tab is shown in Figure 5.9.

Other Options Section

Semi-confinement is not the only option when grazing resources are limited. This section juxtaposes two other options with the costs of all three semi-confinement systems. Yellow cells require user input. Costs of all three semi-confinement options come directly from the Cost Summary section and are shown as total costs/hd/day. Costs of moving the cows to a feedyard and costs of moving cows to another location to graze are shown in total costs/hd/day. An example of the Other Options tab is shown in Figure 5.10.

Feeding Instructions Section

The Feeding Instructions section shows feeding directions for the limit fed ration. Feeding instructions for the conventional confined and remote confined systems are omitted as it only requires feeding hay and protein supplement. Dates on the Feeding Instructions section are adjusted according to desired days to confine based on the first section that gathered Producer Information. An example of the Feeding Instructions Section is shown in Figure 5.11.

Stage of Production Section

The Stage of Production section takes the breeding dates of the cows and calculates the number of days the cows are in each trimester of gestation during the confined feeding period. This section contains a column with a date that is the average first day of breeding season and a corresponding column that shows the trimester of gestation. There are also columns that utilize lookup functions to calculate the number of days the cows are in each trimester during the confined feeding period. There are cells that receive the total number of days in each trimester for the cows and multiply them by a rate of feed for both corn and Sweet Bran. Feed amounts are increased as cows move into different trimesters of gestation. This section performs calculations using input values and links to other worksheet sections. This section would not be visible to users. An example of the State of Production section is show in Figure 5.12.

Results

This section contains results from five different scenarios. All five simulations will be based off the same hypothetical producer. The producer used in all scenarios will have 50 cows to semi-confine starting on October 1st and ending on March 1st. Breeding seasons will be constant through all scenarios as well as all other parameters of the cows.

Scenario One

Major conditions of Scenario One are high hay costs and low corn costs. Corn is valued at $6.25/CWT ($3.50/bushel), Sweet Bran is valued at $116.25/ton, hay is valued at $150/ton, and protein supplement is valued at $350/ton. The distance for the confined remote option is considered small at 15 miles round trip estimate. Scenario One includes two sets of results, one from a limit-fed corn diet (Figure 5.13) and the other from a limit-fed Sweet Bran diet (Figure 5.14). This scenario was chosen as these were the conditions experienced during Experiment One. During Experiment One the drought was in its second year and was greatly affecting hay prices. Hay prices were very high, but the price of corn was low. Conditions of this scenario could easily be seen again in the future.

The calculations of this scenario using corn as a concentrate show the limit fed option as the least expensive option with total cost of \$1.55/hd/day. The high forage remote option costs \$3.57/hd/day which is \$1.82/hd/day more expensive than the limit fed option. The high forage confined option cost is \$2.79/hd/day. This scenario shows a need for a limit fed option when it comes to confinement of cows. During seasons of high priced hay, this worksheet demonstrates the high costs of maintaining cow on a high forage ration.

The calculations of this scenario using Sweet Bran as a concentrate show the limit fed option as the least expensive option with total costs of \$1.93/hd/day. The high forage remote option costs \$3.37/hd/day which is \$1.44/hd/day more expensive than the limit fed option. The high forage confined and high forage remote options are unchanged in costs as when compared to feeding corn as a concentrate. Even though there is more cost in feeding Sweet Bran as a concentrate there may be some advantages to feeding Sweet Bran. Sweet Bran is a much safer feed in terms of ruminal acidosis and may lend itself to ease of delivery depending on a producer’s available equipment. Furthermore, the price of the protein supplement was not changed between the scenarios in Figure 5.13 and

Figure 5.14. As the price of protein supplement increases, the costs of feeding Sweet Bran as a concentrate decreases as compared to feeding corn as a concentrate.

Scenario Two

Major conditions of Scenario Two are moderate hay costs and low corn costs. Corn is valued at $6.25/CWT ($3.50/bushel), Sweet Bran is valued at $116.25/ton, hay is valued at $110/ton, and protein supplement is valued at $350/ton. The distance for the confined remote option is considered small at 15 miles round trip estimate. Scenario Two includes two sets of results, one from a limit-fed corn diet (Figure 5.15) and the other from a limit-fed Sweet Bran diet (Figure 5.16). This scenario was chosen as a scenario where hay was moderately priced and corn was low. In market conditions where hay is moderately priced and corn is low, a producer may choose to semi-confine to allow extra pasture rest or to increase headcount. This would be a scenario where a producer would choose to semi-confine instead of being forced to semi-confine.

The calculations of using corn as a concentrate under conditions of moderate hay costs and low corn costs again show that the limit fed option is the least expensive option at $1.42/hd/day. The high forage confined and high forage remote options are both less expensive as compared to Scenario One. The limit fed option is $1.32 less expensive than the high forage remote option in this scenario. This scenario shows that a limit fed option can be less expensive than a high forage-based ration in times of moderate commodity prices. Again, the calculation using Sweet Bran as a concentrate is more expensive than using corn under the conditions of this scenario.

Scenario Three

Major conditions of Scenario Three are low forage costs and high corn costs. Corn is valued at $10.71/CWT ($6.00/bushel), Sweet Bran is valued at $199.21/ton, hay is valued at $75/ton, and protein supplement is valued at $350/ton. The distance for the confined remote option is considered small at 15 miles round trip estimate. Scenario Three includes two sets of results, one from a limit-fed corn diet (Figure 5.17) and the other from a limit-fed Sweet Bran diet (Figure 5.18). This scenario was chosen as an opposite to Scenario One. Market conditions such as these will make a difference in the type of semi-confinement system. Semi-confined systems that utilize high forage also require less labor therefore a producer may choose to change systems during these market conditions.

Calculations from this scenario using high corn costs and low hay costs with corn as concentrate show that the high forage confined option is the least expensive at $1.62/hd/d. However, the limit-fed option is still less expensive than the high forage remote option as mileage becomes a factor. When Sweet Bran is used as a concentrate in this scenario, it is the highest of all three options. The cost of the concentrate, in conditions of low hay costs, becomes the major factor in determining the cost relativity of the limit-fed option.

Scenario Four

This scenario uses wet distillers grain instead of Sweet Bran and illustrates how a producer would modify the worksheet using a different feedstuff. Major conditions of Scenario Four are high hay costs and low corn costs. Corn is valued at $6.25/CWT ($3.50/bushel), wet distillers grain is valued at $53/ton, hay is valued at $150/ton, and protein supplement is valued at $350/ton. The distance for the confined remote option is considered small at 15 miles round trip estimate. This scenario was chosen as it is the most likely scenario during a drought. Cost summaries from this scenario are shown in Figure 5.19.

Calculations using wet distillers grain coupled with high hay costs show that the limit feeding option is much less expensive than the high forage options. The limit fed option is $1.26 less expensive per head per day than the high forage remote option. This worksheet will accommodate using different feedstuffs by changing just a few variables on the Cost Input section.

Scenario Five

This scenario uses cotton burrs instead of hay for a roughage source and wet distillers grains as a concentrate. Major conditions of Scenario Five are high hay costs and low corn costs. Corn is valued at $6.25/CWT ($3.50/bushel), wet distillers grain is valued at $53/ton, cotton burrs are valued at $36/ton, and protein supplement is valued at $350/ton. The distance for the confined remote option is considered small at 15 miles round trip estimate. This scenario was chosen as it is the most likely scenario during a bumper crop of cotton. During bumper crop years, cotton by-products would be very readily available and inexpensive. Cost summaries from this scenario are shown in Figure 5.20.

When wet distillers grain is used in conjunction with low cost cotton burrs, the limit fed option becomes much more comparable to the high forage options. The high forage confined option is the least expensive in this worksheet at $1.01/hd/day, whereas, the limit fed option cost is $1.40/hd/day. However, a producer using different feedstuffs must be aware that more protein and supplemental energy may need to be provided to adequately feed cows. This worksheet is designed to compare different semi-confinement systems—not to be a nutritional requirement balancer. When a producer changes feedstuffs in the worksheet, they should know the proper amounts of each feedstuff to balance the ration for the cows before entries are made.

Summary and Conclusions

Limit feeding shows to be an inexpensive method of semi-confinement across a variety of scenarios. The higher energy density of the concentrates used in a limit-fed ration lead to less pounds needed thus drives down the cost of limit feeding. Only conditions of very low-priced hay and high-priced concentrates would lead to high forage semi-confinement options being less expensive than limit-fed options.

Tab 1-- Sell or Retain

If you have already decided to retain ownership, move to Tab 2-- Producer Information. Yellow cells require user input.

Inputs:	
Current cow value if sold:	$1,250.00
Future Replacement cow value:	$1,200.00
Estimated cow death loss percentage:	1.0%
Estimated cow culling percentate:	15.0%
Estimated percentage of marketable calves:	90.0%
Estimated steer weight(lbs):	500
Estimated steer price ($/cwt):	$180.00
Estimated heifer weight(lbs):	450
Estimated heifer price ($/cwt):	$168.00
Estimated cow weight at culling (lbs):	1100
Estimated cull cow price ($/cwt):	$65.00
Estimated feed and/or grazing costs ($/hd/yr):	$450.00
Estimated cow and calf care costs ($/hd/yr):	$50.00
Estimated principle and interest payments ($/hd/yr):	$292.00
Number of cows:	50
Years between selling and buyback:	1
Results:	
Net returns from keeping cows:	$3,022.50
Net returns from selling cows with future buyback:	$2,500.00
Decision	Keep

Figure 5.1. Sell or Retain Section

Net Present Value Calculator										
Current Cow Value	$1,250.00		$62,500.00							
Number of Cows	50									
Future Cow Buyback	$1,200.00									
						Year				
		1	2	3	4	5	6	7	8	9
	Cow Death loss	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
	Cows Culled	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	50.0%
	Marketable Calves	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
	Steer Weight	500	500	500	500	500	500	500	500	500
	Steer Price	180	180	180	180	180	180	180	180	180
	Heifer Weight	450	450	450	450	450	450	450	450	450
	Heifer Price	168	168	168	168	168	168	168	168	168
	Cull Weight	1100	1100	1100	1100	1100	1100	1100	1100	1100
	Cull Price	65	65	65	65	65	65	65	65	65
	Cost/cow/year	792	792	792	792	792	792	792	792	792
	Cows Remaining	50	42	35	30	25	21	18	15	12
	Calf Income	$37,260.00	$31,298.40	$26,290.66	$22,084.15	$18,550.69	$15,582.58	$13,089.36	$10,995.07	$9,235.86
	Cull Income	$5,362.50	$4,504.50	$3,783.78	$3,178.38	$2,669.84	$2,242.66	$1,883.84	$1,582.42	$4,430.78
	Cow Cost	$39,600.00	$33,264.00	$27,941.76	$23,471.08	$19,715.71	$16,561.19	$13,911.40	$11,685.58	$9,815.89
	Net Returns	$3,022.50	$2,538.90	$2,132.68	$1,791.45	$1,504.82	$1,264.05	$1,061.80	$891.91	$3,850.75

Figure 5.2. Sell or Retain Background Calculation Section

Tab 2--Producer Information

Yellow cells require user entry

Producer:	
Date:	7/16/2018
Desired Starting Confine Date:	10/1/2018
Desired Ending Confine Date:	3/1/2019
Desired Days to Confine:	151
Number of Cows to Confine:	50
1st Day of Breeding Season:	5/5/2018
Last Day of Breeding Season:	7/4/2018
Days in Breeding Season:	60
Average Cow Weight:	1250
Enter "1" if using Corn and "2" if using Sweet Bran:	1

Figure 5.3. Producer Information Section

Costs:		Amounts Required As Fed		
		High Concentrate Confined	High Forage Confined	High Forage Remote
	price/ton	lbs/day	lbs/day	lbs/day
Sweet Bran	$49.29	0.00	0.00	0.00
	price/cwt	lbs/day	lbs/day	lbs/day
Whole Corn	$2.65	25.00	0.00	0.00
	price/ton	lbs/day	lbs/day	lbs/day
Hay	$36.00	15	31.25	31.25
	price/ton	lbs/day	lbs/day	lbs/day
Protein Supplement	$175.00	2.00	2.00	2.00
	$/hour	hrs/day	hrs/day	hrs/day
Labor	$10.00	0.30	0.18	1.80
	$/cow/day	$/cow/day	$/cow/day	$/cow/day
Health	$0.05	0.05	0.05	0.05
	$/gallon	miles/day	miles/day	miles/day
Fuel	$2.35	0.66	0.45	15.00
	MPG			
Fuel efficiency	7			
	$/mile			
Mileage	$0.55			
	lbs			
Average Cow Weight	1250			

Figure 5.4. Cost Input Section

Limit-Fed Ration Examples

High Forage Ration Examples

Rations based on a 1,250 lb cow. If the nutrient profile of your feedstuffs do not match the profiles given in these examples, or your cows weigh differently,a balancer is suggested. A link to the OSU Cowculator is provided below. As-fed amounts in these ration examples are balanced with the OSU Cowculator with adjustments made based on research performed by WTAMU. The as-fed amounts of roughage in the high forage ration suggestions are higher than OSU's suggested intake level to acount for waste.

OSU Cowculator

Limit-Fed Ration Examples

		Nutrient Profile of Feedstuffs		
Feedstuff	**Lbs As-Fed**	**Dry Matter**	**CP (DM basis)**	**TDN (DM Basis)**
Whole Corn	9.5	88	9.2	90
Prairie Hay	6.25	91	6.4	51
20% Protein Cube	2	89	22.5	77

		Nutrient Profile of Feedstuffs		
Feedstuff	**Lbs As-Fed**	**Dry Matter**	**CP (DM basis)**	**TDN (DM Basis)**
Sweet Bran	18	62	23.3	79.4
Prairie Hay	10	91	6.4	51
20% Protein Cube	0	89	22.5	77

		Nutrient Profile of Feedstuffs		
Feedstuff	**Lbs As-Fed**	**Dry Matter**	**CP (DM basis)**	**TDN (DM Basis)**
Wet Distillers Grair	25	35	32	83
Cotton Burrs	15	92	11	44
Whole Cottonseed	2	92	23.9	96

High Forage Ration Examples

		Nutrient Profile of Feedstuffs		
Feedstuff	**Lbs As-Fed**	**Dry Matter**	**CP (DM basis)**	**TDN (DM Basis)**
Prairie Hay	31	91	6.4	51
20% Protein Cube	4	89	22.5	77

		Nutrient Profile of Feedstuffs		
Feedstuff	**Lbs As-Fed**	**Dry Matter**	**CP (DM basis)**	**TDN (DM Basis)**
Prairie Hay	30	91	3.5	47
38% Protein Cube	4.5	89	42.7	78

		Nutrient Profile of Feedstuffs		
Feedstuff	**Lbs As-Fed**	**Dry Matter**	**CP (DM basis)**	**TDN (DM Basis)**
Alfalfa Hay (Poor)	29	91	14	52
Whole Cottonseed	3	92	23.9	96

Figure 5.5. Ration Examples Section

Tab 4-- Cost Summary

This tab compares costs of three confinement systems, no user input required.

	Types of Confinement Systems		
Inputs	**Limit Fed**	**High Forage Confined**	**High Forage Remote**
Sweet Bran	$0.00	$0.00	$0.00
Whole Corn	$33.13	$0.00	$0.00
Hay	$13.50	$28.13	$28.13
Supplement	$8.75	$8.75	$8.75
Labor	$3.00	$1.80	$18.00
Health	$2.50	$2.50	$2.50
Fuel	$0.22	$0.15	$5.04
Mileage	$0.36	$0.25	$8.25
Summary:			
Total costs/day	$61.46	$41.57	$70.66
Total costs/hd/day	$1.23	$0.83	$1.41
Total costs	$9,280.40	$6,277.61	$10,669.77

Figure 5.6. Cost Summary Section confining 50 head of cows for 151 days

Limit-Fed Sensitivity Analysis

The point where the price of corn intersects with the price of hay will yield the cost per head per day to feed the limit-fed ration. This sensitivity analysis is linked to tab three-- Cost Input. This sensitivity matrix will automatically modify when supplement, labor, fuel, health, fuel efficiency and mileage amounts are changed in tab three.

		Price of Hay $/ton															
		$70.00	$80.00	$90.00	$100.00	$110.00	$120.00	$130.00	$140.00	$150.00	$160.00	$170.00	$180.00	$190.00	$200.00	$210.00	$220.00
Price of Corn $/cwt	$5.00	$2.07	$2.15	$2.22	$2.30	$2.37	$2.45	$2.52	$2.60	$2.67	$2.75	$2.82	$2.90	$2.97	$3.05	$3.12	$3.20
	$5.50	$2.20	$2.27	$2.35	$2.42	$2.50	$2.57	$2.65	$2.72	$2.80	$2.87	$2.95	$3.02	$3.10	$3.17	$3.25	$3.32
	$6.00	$2.32	$2.40	$2.47	$2.55	$2.62	$2.70	$2.77	$2.85	$2.92	$3.00	$3.07	$3.15	$3.22	$3.30	$3.37	$3.45
	$6.50	$2.45	$2.52	$2.60	$2.67	$2.75	$2.82	$2.90	$2.97	$3.05	$3.12	$3.20	$3.27	$3.35	$3.42	$3.50	$3.57
	$7.00	$2.57	$2.65	$2.72	$2.80	$2.87	$2.95	$3.02	$3.10	$3.17	$3.25	$3.32	$3.40	$3.47	$3.55	$3.62	$3.70
	$7.50	$2.70	$2.77	$2.85	$2.92	$3.00	$3.07	$3.15	$3.22	$3.30	$3.37	$3.45	$3.52	$3.60	$3.67	$3.75	$3.82
	$8.00	$2.82	$2.90	$2.97	$3.05	$3.12	$3.20	$3.27	$3.35	$3.42	$3.50	$3.57	$3.65	$3.72	$3.80	$3.87	$3.95
	$8.50	$2.95	$3.02	$3.10	$3.17	$3.25	$3.32	$3.40	$3.47	$3.55	$3.62	$3.70	$3.77	$3.85	$3.92	$4.00	$4.07
	$9.00	$3.07	$3.15	$3.22	$3.30	$3.37	$3.45	$3.52	$3.60	$3.67	$3.75	$3.82	$3.90	$3.97	$4.05	$4.12	$4.20
	$9.50	$3.20	$3.27	$3.35	$3.42	$3.50	$3.57	$3.65	$3.72	$3.80	$3.87	$3.95	$4.02	$4.10	$4.17	$4.25	$4.32
	$10.00	$3.32	$3.40	$3.47	$3.55	$3.62	$3.70	$3.77	$3.85	$3.92	$4.00	$4.07	$4.15	$4.22	$4.30	$4.37	$4.45
	$10.50	$3.45	$3.52	$3.60	$3.67	$3.75	$3.82	$3.90	$3.97	$4.05	$4.12	$4.20	$4.27	$4.35	$4.42	$4.50	$4.57
	$11.00	$3.57	$3.65	$3.72	$3.80	$3.87	$3.95	$4.02	$4.10	$4.17	$4.25	$4.32	$4.40	$4.47	$4.55	$4.62	$4.70
	$11.50	$3.70	$3.77	$3.85	$3.92	$4.00	$4.07	$4.15	$4.22	$4.30	$4.37	$4.45	$4.52	$4.60	$4.67	$4.75	$4.82
	$12.00	$3.82	$3.90	$3.97	$4.05	$4.12	$4.20	$4.27	$4.35	$4.42	$4.50	$4.57	$4.65	$4.72	$4.80	$4.87	$4.95
	$12.50	$3.95	$4.02	$4.10	$4.17	$4.25	$4.32	$4.40	$4.47	$4.55	$4.62	$4.70	$4.77	$4.85	$4.92	$5.00	$5.07
	$13.00	$4.07	$4.15	$4.22	$4.30	$4.37	$4.45	$4.52	$4.60	$4.67	$4.75	$4.82	$4.90	$4.97	$5.05	$5.12	$5.20
	$13.50	$4.20	$4.27	$4.35	$4.42	$4.50	$4.57	$4.65	$4.72	$4.80	$4.87	$4.95	$5.02	$5.10	$5.17	$5.25	$5.32
	$14.00	$4.32	$4.40	$4.47	$4.55	$4.62	$4.70	$4.77	$4.85	$4.92	$5.00	$5.07	$5.15	$5.22	$5.30	$5.37	$5.45
	$14.50	$4.45	$4.52	$4.60	$4.67	$4.75	$4.82	$4.90	$4.97	$5.05	$5.12	$5.20	$5.27	$5.35	$5.42	$5.50	$5.57
	$15.00	$4.57	$4.65	$4.72	$4.80	$4.87	$4.95	$5.02	$5.10	$5.17	$5.25	$5.32	$5.40	$5.47	$5.55	$5.62	$5.70

Figure 5.7. Limit-Fed Sensitivity Analysis Section

High Forage Sensitivity Analysis

The point where the price of supplement intersects with the price of hay will yield the cost per head per day to feed the high forage ration. This sensitivity analysis is linked to tab three-- Cost Input. This sensitivity matrix will automatically modify when labor, fuel, health, fuel efficiency and mileage amounts are changed in tab three.

		Hay Price in $/ton															
		$70.00	$80.00	$90.00	$100.00	$110.00	$120.00	$130.00	$140.00	$150.00	$160.00	$170.00	$180.00	$190.00	$200.00	$210.00	$220.00
Supplement Price $/ton	180	$1.37	$1.52	$1.68	$1.84	$1.99	$2.15	$2.31	$2.46	$2.62	$2.77	$2.93	$3.09	$3.24	$3.40	$3.56	$3.71
	190	$1.38	$1.53	$1.69	$1.85	$2.00	$2.16	$2.32	$2.47	$2.63	$2.78	$2.94	$3.10	$3.25	$3.41	$3.57	$3.72
	200	$1.39	$1.54	$1.70	$1.86	$2.01	$2.17	$2.33	$2.48	$2.64	$2.79	$2.95	$3.11	$3.26	$3.42	$3.58	$3.73
	210	$1.40	$1.55	$1.71	$1.87	$2.02	$2.18	$2.34	$2.49	$2.65	$2.80	$2.96	$3.12	$3.27	$3.43	$3.59	$3.74
	220	$1.41	$1.56	$1.72	$1.88	$2.03	$2.19	$2.35	$2.50	$2.66	$2.81	$2.97	$3.13	$3.28	$3.44	$3.60	$3.75
	230	$1.42	$1.57	$1.73	$1.89	$2.04	$2.20	$2.36	$2.51	$2.67	$2.82	$2.98	$3.14	$3.29	$3.45	$3.61	$3.76
	240	$1.43	$1.58	$1.74	$1.90	$2.05	$2.21	$2.37	$2.52	$2.68	$2.83	$2.99	$3.15	$3.30	$3.46	$3.62	$3.77
	250	$1.44	$1.59	$1.75	$1.91	$2.06	$2.22	$2.38	$2.53	$2.69	$2.84	$3.00	$3.16	$3.31	$3.47	$3.63	$3.78
	260	$1.45	$1.60	$1.76	$1.92	$2.07	$2.23	$2.39	$2.54	$2.70	$2.85	$3.01	$3.17	$3.32	$3.48	$3.64	$3.79
	270	$1.46	$1.61	$1.77	$1.93	$2.08	$2.24	$2.40	$2.55	$2.71	$2.86	$3.02	$3.18	$3.33	$3.49	$3.65	$3.80
	280	$1.47	$1.62	$1.78	$1.94	$2.09	$2.25	$2.41	$2.56	$2.72	$2.87	$3.03	$3.19	$3.34	$3.50	$3.66	$3.81
	290	$1.48	$1.63	$1.79	$1.95	$2.10	$2.26	$2.42	$2.57	$2.73	$2.88	$3.04	$3.20	$3.35	$3.51	$3.67	$3.82
	300	$1.49	$1.64	$1.80	$1.96	$2.11	$2.27	$2.43	$2.58	$2.74	$2.89	$3.05	$3.21	$3.36	$3.52	$3.68	$3.83
	310	$1.50	$1.65	$1.81	$1.97	$2.12	$2.28	$2.44	$2.59	$2.75	$2.90	$3.06	$3.22	$3.37	$3.53	$3.69	$3.84
	320	$1.51	$1.66	$1.82	$1.98	$2.13	$2.29	$2.45	$2.60	$2.76	$2.91	$3.07	$3.23	$3.38	$3.54	$3.70	$3.85
	330	$1.52	$1.67	$1.83	$1.99	$2.14	$2.30	$2.46	$2.61	$2.77	$2.92	$3.08	$3.24	$3.39	$3.55	$3.71	$3.86
	340	$1.53	$1.68	$1.84	$2.00	$2.15	$2.31	$2.47	$2.62	$2.78	$2.93	$3.09	$3.25	$3.40	$3.56	$3.72	$3.87
	350	$1.54	$1.69	$1.85	$2.01	$2.16	$2.32	$2.48	$2.63	$2.79	$2.94	$3.10	$3.26	$3.41	$3.57	$3.73	$3.88
	360	$1.55	$1.70	$1.86	$2.02	$2.17	$2.33	$2.49	$2.64	$2.80	$2.95	$3.11	$3.27	$3.42	$3.58	$3.74	$3.89
	370	$1.56	$1.71	$1.87	$2.03	$2.18	$2.34	$2.50	$2.65	$2.81	$2.96	$3.12	$3.28	$3.43	$3.59	$3.75	$3.90
	380	$1.57	$1.72	$1.88	$2.04	$2.19	$2.35	$2.51	$2.66	$2.82	$2.97	$3.13	$3.29	$3.44	$3.60	$3.76	$3.91
	390	$1.58	$1.73	$1.89	$2.05	$2.20	$2.36	$2.52	$2.67	$2.83	$2.98	$3.14	$3.30	$3.45	$3.61	$3.77	$3.92
	400	$1.59	$1.74	$1.90	$2.06	$2.21	$2.37	$2.53	$2.68	$2.84	$2.99	$3.15	$3.31	$3.46	$3.62	$3.78	$3.93

Figure 5.8. High-Forage Sensitivity Analysis Section

High Forage Remote Sensitivity Analysis

The point where round trip miles from headquarters intersects with the price of hay will yield the cost per head per day to feed the limit-fed ration. This sensitivity analysis is linked to tab three-- Cost Input. This sensitivity matrix will automatically modify when supplement, labor, fuel, health, and fuel efficiency amounts are changed in tab three.

		Hay Price in $/ton															
		$70.00	$80.00	$90.00	$100.00	$110.00	$120.00	$130.00	$140.00	$150.00	$160.00	$170.00	$180.00	$190.00	$200.00	$210.00	$220.00
Round trip miles from headquarters	5	$1.53	$1.68	$1.84	$2.00	$2.15	$2.31	$2.46	$2.62	$2.78	$2.93	$3.09	$3.25	$3.40	$3.56	$3.71	$3.87
	10	$1.74	$1.89	$2.05	$2.20	$2.36	$2.52	$2.67	$2.83	$2.99	$3.14	$3.30	$3.45	$3.61	$3.77	$3.92	$4.08
	15	$1.94	$2.10	$2.26	$2.41	$2.57	$2.73	$2.88	$3.04	$3.19	$3.35	$3.51	$3.66	$3.82	$3.98	$4.13	$4.29
	20	$2.15	$2.31	$2.47	$2.62	$2.78	$2.93	$3.09	$3.25	$3.40	$3.56	$3.72	$3.87	$4.03	$4.18	$4.34	$4.50
	25	$2.36	$2.52	$2.67	$2.83	$2.99	$3.14	$3.30	$3.46	$3.61	$3.77	$3.92	$4.08	$4.24	$4.39	$4.55	$4.71
	30	$2.57	$2.73	$2.88	$3.04	$3.20	$3.35	$3.51	$3.66	$3.82	$3.98	$4.13	$4.29	$4.45	$4.60	$4.76	$4.91
	35	$2.78	$2.94	$3.09	$3.25	$3.40	$3.56	$3.72	$3.87	$4.03	$4.19	$4.34	$4.50	$4.65	$4.81	$4.97	$5.12
	40	$2.99	$3.14	$3.30	$3.46	$3.61	$3.77	$3.92	$4.08	$4.24	$4.39	$4.55	$4.71	$4.86	$5.02	$5.17	$5.33
	45	$3.20	$3.35	$3.51	$3.66	$3.82	$3.98	$4.13	$4.29	$4.45	$4.60	$4.76	$4.91	$5.07	$5.23	$5.38	$5.54
	50	$3.40	$3.56	$3.72	$3.87	$4.03	$4.19	$4.34	$4.50	$4.65	$4.81	$4.97	$5.12	$5.28	$5.44	$5.59	$5.75
	55	$3.61	$3.77	$3.93	$4.08	$4.24	$4.39	$4.55	$4.71	$4.86	$5.02	$5.18	$5.33	$5.49	$5.64	$5.80	$5.96
	60	$3.82	$3.98	$4.13	$4.29	$4.45	$4.60	$4.76	$4.92	$5.07	$5.23	$5.38	$5.54	$5.70	$5.85	$6.01	$6.17
	65	$4.03	$4.19	$4.34	$4.50	$4.66	$4.81	$4.97	$5.12	$5.28	$5.44	$5.59	$5.75	$5.91	$6.06	$6.22	$6.37
	70	$4.24	$4.40	$4.55	$4.71	$4.86	$5.02	$5.18	$5.33	$5.49	$5.65	$5.80	$5.96	$6.11	$6.27	$6.43	$6.58
	75	$4.45	$4.60	$4.76	$4.92	$5.07	$5.23	$5.38	$5.54	$5.70	$5.85	$6.01	$6.17	$6.32	$6.48	$6.63	$6.79
	80	$4.66	$4.81	$4.97	$5.12	$5.28	$5.44	$5.59	$5.75	$5.91	$6.06	$6.22	$6.37	$6.53	$6.69	$6.84	$7.00
	85	$4.86	$5.02	$5.18	$5.33	$5.49	$5.65	$5.80	$5.96	$6.11	$6.27	$6.43	$6.58	$6.74	$6.90	$7.05	$7.21
	90	$5.07	$5.23	$5.39	$5.54	$5.70	$5.85	$6.01	$6.17	$6.32	$6.48	$6.64	$6.79	$6.95	$7.10	$7.26	$7.42
	95	$5.28	$5.44	$5.59	$5.75	$5.91	$6.06	$6.22	$6.38	$6.53	$6.69	$6.84	$7.00	$7.16	$7.31	$7.47	$7.63
	100	$5.49	$5.65	$5.80	$5.96	$6.12	$6.27	$6.43	$6.58	$6.74	$6.90	$7.05	$7.21	$7.37	$7.52	$7.68	$7.83

Figure 5.9. High-Forage Remote Sensitivity Analysis Section

Semi-Confinement vs. Other Options

This tab provides a side-by-side comparison of semi-confined costs vs. other options.

		Types of Confinement Systems		
		Limit Fed	High Forage Confined	High Forage Remote
Cost/hd/day		$1.23	$0.83	$1.41
Feedyard option				
Feed cost/hd/day	$1.28			
Yardage cost/hd/day	$0.34			
Freight cost/hd/day	$0.40			
Total Feedyard Costs/hd/day	**$2.02**			
Movement to different location option				
Feed and/or grazing/hd/day	$0.70			
Care cost/hd/day	$0.25			
Freight cost/hd/day	$0.80			
Total movement cost/hd/day	**$1.75**			

Figure 5.10. Semi-Confinement vs. Other Options Section

Feeding Instructions

When limit feeding corn or Sweet Bran, feed corn or Sweet Bran on first pass and let cows clean then feed hay on second pass.

Corn Feeding Schedule

Lbs/hd/day				
0	from	6/4/2018	to	9/5/2018
9.19	from	9/6/2018	to	12/8/2018
9.76	from	12/9/2018	to	3/13/2019

Figure 5.11. Feeding Instructions Section

1st Breed Date	5/5/2018			1st confine Date	10/1/2018
End Breed Date	7/4/2018			Last confine Date	3/1/2019
Average Breed Date	6/4/2018				
				Days in 1st Trimester	0
Gestation time	283			Days in 2nd Trimeste	69
				Days in 3rd Trimeste	82
Average Calve Date	3/14/2019				151
Average Cow Weig	1250				
				Corn	Sweet Bran
1st Trimester	6/4/2018	to	9/5/2018	0	0
2nd Trimester	9/6/2018	to	12/8/2018	9.19	17.50
3rd Trimester	12/9/2018	to	3/13/2019	9.76	18.75

	Corn	SB
rate 1st	0.007	0.013
rate 2nd	0.00735	0.014
rate 3rd	0.00781	0.015

	Corn	SB		Corn	SB
lbs 1st	0	0		0	0
lbs 2nd	633.9375	1207.5		9.1875	17.5
lbs 3rd	800.525	1537.5		9.7625	18.75
Sum	1434.463	2745			
Av per da	9.50	18.18			

Trimester Date	Trimester Date	Confined Date	Actual confine	Trimester
6/4/2018	1	10/1/2018	10/1/2018	2
6/5/2018	1	10/2/2018	10/2/2018	2
6/6/2018	1	10/3/2018	10/3/2018	2
6/7/2018	1	10/4/2018	10/4/2018	2
6/8/2018	1	10/5/2018	10/5/2018	2
6/9/2018	1	10/6/2018	10/6/2018	2
6/10/2018	1	10/7/2018	10/7/2018	2
6/11/2018	1	10/8/2018	10/8/2018	2
6/12/2018	1	10/9/2018	10/9/2018	2
6/13/2018	1	10/10/2018	10/10/2018	2
6/14/2018	1	10/11/2018	10/11/2018	2
6/15/2018	1	10/12/2018	10/12/2018	2
6/16/2018	1	10/13/2018	10/13/2018	2
6/17/2018	1	10/14/2018	10/14/2018	2
6/18/2018	1	10/15/2018	10/15/2018	2
6/19/2018	1	10/16/2018	10/16/2018	2
6/20/2018	1	10/17/2018	10/17/2018	2
6/21/2018	1	10/18/2018	10/18/2018	2
6/22/2018	1	10/19/2018	10/19/2018	2
6/23/2018	1	10/20/2018	10/20/2018	2
6/24/2018	1	10/21/2018	10/21/2018	2
6/25/2018	1	10/22/2018	10/22/2018	2
6/26/2018	1	10/23/2018	10/23/2018	2
6/27/2018	1	10/24/2018	10/24/2018	2
6/28/2018	1	10/25/2018	10/25/2018	2
6/29/2018	1	10/26/2018	10/26/2018	2

Figure 5.12. Stage of Production background section

Tab 4-- Cost Summary

This tab compares costs of three confinement systems, no user input required.

Inputs	Types of Confinement Systems Limit Fed	High Forage Confined	High Forage Remote
Sweet Bran	$0.00	$0.00	$0.00
Whole Corn	$29.69	$0.00	$0.00
Hay	$24.38	$117.19	$117.19
Supplement	$17.50	$17.50	$17.50
Labor	$3.00	$1.80	$18.00
Health	$2.50	$2.50	$2.50
Fuel	$0.22	$0.15	$5.04
Mileage	$0.36	$0.25	$8.25
Summary:			
Total costs/day	$77.65	$139.39	$168.47
Total costs/hd/day	$1.55	$2.79	$3.37
Total costs	$11,724.59	$21,047.30	$25,439.46

Figure 5.13. Scenario One using corn as concentrate—high hay cost, low corn cost; 50 head of cows confined for 151 days

Tab 4-- Cost Summary

This tab compares costs of three confinement systems, no user input required.

	Types of Confinement Systems		
Inputs	Limit Fed	High Forage Confined	High Forage Remote
Sweet Bran	$52.83	$0.00	$0.00
Whole Corn	$0.00	$0.00	$0.00
Hay	$37.50	$117.19	$117.19
Supplement	$0.00	$17.50	$17.50
Labor	$3.00	$1.80	$18.00
Health	$2.50	$2.50	$2.50
Fuel	$0.22	$0.15	$5.04
Mileage	$0.36	$0.25	$8.25
Summary:			
Total costs/day	$96.42	$139.39	$168.47
Total costs/hd/day	$1.93	$2.79	$3.37
Total costs	$14,558.93	$21,047.30	$25,439.46

Figure 5.14. Scenario One using Sweet Bran as concentrate—high hay cost, low corn cost; 50 head of cows confined for 151 days

Tab 4-- Cost Summary

This tab compares costs of three confinement systems, no user input required.

	Types of Confinement Systems		
Inputs	Limit Fed	High Forage Confined	High Forage Remote
Sweet Bran	$0.00	$0.00	$0.00
Whole Corn	$29.69	$0.00	$0.00
Hay	$17.88	$85.94	$85.94
Supplement	$17.50	$17.50	$17.50
Labor	$3.00	$1.80	$18.00
Health	$2.50	$2.50	$2.50
Fuel	$0.22	$0.15	$5.04
Mileage	$0.36	$0.25	$8.25
Summary:			
Total costs/day	$71.15	$108.14	$137.22
Total costs/hd/day	$1.42	$2.16	$2.74
Total costs	$10,743.09	$16,328.55	$20,720.71

Figure 5.15. Scenario Two using corn as concentrate—moderate hay cost, low corn cost; 50 head of cows confined for 151 days

Tab 4-- Cost Summary

This tab compares costs of three confinement systems, no user input required.

	Types of Confinement Systems		
Inputs	Limit Fed	High Forage Confined	High Forage Remote
Sweet Bran	$52.83	$0.00	$0.00
Whole Corn	$0.00	$0.00	$0.00
Hay	$27.50	$85.94	$85.94
Supplement	$0.00	$17.50	$17.50
Labor	$3.00	$1.80	$18.00
Health	$2.50	$2.50	$2.50
Fuel	$0.22	$0.15	$5.04
Mileage	$0.36	$0.25	$8.25
Summary:			
Total costs/day	$86.42	$108.14	$137.22
Total costs/hd/day	$1.73	$2.16	$2.74
Total costs	$13,048.93	$16,328.55	$20,720.71

Figure 5.16. Scenario Two using Sweet Bran as concentrate—moderate hay cost, low corn cost; 50 head of cows confined for 151 days

Tab 4-- Cost Summary

This tab compares costs of three confinement systems, no user input required.

	Types of Confinement Systems		
Inputs	Limit Fed	High Forage Confined	High Forage Remote
Sweet Bran	$0.00	$0.00	$0.00
Whole Corn	$50.87	$0.00	$0.00
Hay	$12.19	$58.59	$58.59
Supplement	$17.50	$17.50	$17.50
Labor	$3.00	$1.80	$18.00
Health	$2.50	$2.50	$2.50
Fuel	$0.22	$0.15	$5.04
Mileage	$0.36	$0.25	$8.25
Summary:			
Total costs/day	$86.64	$80.79	$109.88
Total costs/hd/day	$1.73	$1.62	$2.20
Total costs	$13,083.13	$12,199.64	$16,591.80

Figure 5.17. Scenario Three using corn as concentrate—low hay cost, high corn cost; 50 head of cows confined for 151 days

Tab 4-- Cost Summary

This tab compares costs of three confinement systems, no user input required.

	Types of Confinement Systems		
Inputs	Limit Fed	High Forage Confined	High Forage Remote
Sweet Bran	$90.53	$0.00	$0.00
Whole Corn	$0.00	$0.00	$0.00
Hay	$18.75	$58.59	$58.59
Supplement	$0.00	$17.50	$17.50
Labor	$3.00	$1.80	$18.00
Health	$2.50	$2.50	$2.50
Fuel	$0.22	$0.15	$5.04
Mileage	$0.36	$0.25	$8.25
Summary:			
Total costs/day	$115.37	$80.79	$109.88
Total costs/hd/day	$2.31	$1.62	$2.20
Total costs	$17,420.53	$12,199.64	$16,591.80

Figure 5.18. Scenario Three using Sweet Bran as concentrate—low hay cost, high corn cost; 50 head of cows confined for 151 days

Tab 4-- Cost Summary

This tab compares costs of three confinement systems, no user input required.

	Types of Confinement Systems		
Inputs	Limit Fed	High Forage Confined	High Forage Remote
Sweet Bran	$33.13	$0.00	$0.00
Whole Corn	$0.00	$0.00	$0.00
Hay	$37.50	$117.19	$117.19
Supplement	$0.00	$17.50	$17.50
Labor	$3.00	$1.80	$18.00
Health	$2.50	$2.50	$2.50
Fuel	$0.22	$0.15	$5.04
Mileage	$0.36	$0.25	$8.25
Summary:			
Total costs/day	$76.71	$139.39	$168.47
Total costs/hd/day	$1.53	$2.79	$3.37
Total costs	$11,583.15	$21,047.30	$25,439.46

Figure 5.19. Scenario Four using wet distillers grain as concentrate; 50 head of cows confined for 151 days

Tab 4-- Cost Summary

This tab compares costs of three confinement systems, no user input required.

	Types of Confinement Systems		
Inputs	Limit Fed	High Forage Confined	High Forage Remote
Sweet Bran	$33.13	$0.00	$0.00
Whole Corn	$0.00	$0.00	$0.00
Hay	$13.50	$28.13	$28.13
Supplement	$17.50	$17.50	$17.50
Labor	$3.00	$1.80	$18.00
Health	$2.50	$2.50	$2.50
Fuel	$0.22	$0.15	$5.04
Mileage	$0.36	$0.25	$8.25
Summary:			
Total costs/day	$70.21	$50.32	$79.41
Total costs/hd/day	$1.40	$1.01	$1.59
Total costs	$10,601.65	$7,598.86	$11,991.02

Figure 5.20. Scenario Five using wet distillers grain as a concentrate and cotton burrs as a roughage; 50 head of cows confined for 151 days

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