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Analyzing the Management Practices of East Texas Beef Cattle Producers

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Abstract

A survey of East Texas beef cattle producers was designed to evaluate the management practices that were prevalent in the area. Demographic and cattle operation data from 103 respondents were analyzed using SPSS (Version 25; Chicago, IL). This electronic-based survey was distributed through Qualtrics. Respondents were located in Angelina, Nacogdoches, or Cherokee county. Most producers (38.8%) had a Bachelor's degree. A negative correlation was established between castration method and weaning weight (p = - 0.204). Calves were weaned 50 pounds heavier when band or surgically castrated. Females were less likely to castrate their calves or utilize a mineral program. Approximately, 49.5% of producers did not pregnancy check their cattle. Areas of future education should focus on castration and weaning methods, mineral distribution, and pregnancy detection methods.

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Chapter I

Background

Introduction

The cattle industry plays a major role in the United States economy. According to the 2017 Census of Agriculture, cattle and calves ranked as the top commodity and contributed $77.2 billion to agriculture sales (USDA-NASS, 2017). In 2018, cattle and calf production were valued at $49.8 billion and the retail value of U.S.-produced beef was $106.7 billion (USDA, 2019). In 2018, the top export markets for U.S. beef were Japan, South Korea, Mexico, and Canada; however, Japan had the highest value of $1.844 billion (USDA, 2019). The U.S. cattle industry received much of its sales and cattle numbers from Texas. Cattle, mostly beef, dominate the Texas economy. In Texas, the 2017 top commodity, cattle, was valued at $12.3 billion and accounted for 16% of the total U.S. cattle and calves commodity (TDA, 2019). Texas ranked number one in total number of farms and total number of cattle and calves with 13 million head, approximately (USDA-NASS, 2019c).

Beef cattle production is prominent in East Texas. Angelina, Nacogdoches, and Cherokee counties have a combined total of 110,600 head of cattle and calves (TDA, 2019). These counties were chosen to be featured in this study because they were more centrally-located within East Texas. The focus of

this study was to identify the management practices that East Texas beef cattle producers utilized. In this study, management practices were characterized into three categories: nutrition, reproduction, and herd health. Nutrition management practices, such as a mineral program, pasture and grazing management, and hay production, were a primary feature of this study. Reproductive management practices, such as pregnancy detection and breeding methods, were highlighted topics within this study. Also, herd health management practices, like a vaccination program and weaning and castration methods, were a key topic within this study. These management practices may be implemented by different types of beef cattle producers. For this reason, demographic-related questions, such as age, gender, and cattle operation type, played an important role in this study.

Since the cattle industry is vital to the Texas and U.S. economies, beef cattle management practices are important to the cattle industry and should be evaluated. Beef cattle producers must make conscientious decisions about nutrition, reproduction, and herd health management. Based on a producer's environment and production scheme, management practices can vary. By analyzing local cattle producers' management practices, other local cattle producers could implement the practices that would best fit their environment and production schemes.

Objectives

1) Describe demographic and background of East Texas beef cattle producers and their farms.
2) Identify nutrition management practices among East Texas beef cattle producers.
3) Identify herd health management practices among East Texas beef cattle producers.
4) Identify reproductive management practices among East Texas beef cattle producers.
5) Identify correlations between demographics and adoption of management practices, and correlations between individual management practices.
6) Identify sources of knowledge for East Texas beef cattle producers.

Significance

The beef cattle industry is a top contributor to Texas agriculture and its economy. With the rise of different beef preferences, such as grass-fed, and implementation of low-stress management practices, cattle producers need access to up-to-date material on management practices and production methods. Cattle producers must make informed management decisions that best fit their production scheme and environment. While there was ample research on management techniques in the U.S. and Texas, current research has not been

conducted for East Texas, more specifically, in Angelina, Nacogdoches, and Cherokee counties. This study identified the management practices that were prevalent to East Texas. Information, obtained from this study, will provide the necessary tools to implement educational opportunities for East Texas beef cattle producers. In order to thrive in this industry, beef cattle producers must monitor and adapt their nutrition, herd health, and reproductive management choices. Beef cattle producers should consider adopting current technology, such as artificial insemination and improved pasture/grazing techniques, to increase efficiency and remain sustainable (Vestal et al., 2006).

The importance of this study was to identify sources of knowledge, current management practices, and adoption of management practices of East Texas beef cattle producers. Through the survey questions, this study allowed beef cattle producers to reflect on their own management practices. This study can inform those who conduct educational opportunities for beef cattle producers in East Texas.

Chapter II

Literature Review

Overview of the Beef Cattle Industry

Cattle were introduced to America by the Europeans. Since more than eighty breeds, such as Brahman, Charolais, and Angus, entered the U.S., producers were able to utilize selection and domestication to create the modern U.S. beef cattle industry (Drouillard, 2018).

The beef cattle industry encompasses several areas: breeding, calving, weaning, finishing, processing, and marketing of retail products to consumers. Following breeding, cattle have a 9-month gestation time. The time from calving to weaning is 6 to 8 months. Finally, the time between weaning and harvesting is 5 to 18 months, approximately. Therefore, it may take 2 to 3 years before a consumer will have access to the beef retail product of one generation (Field, 2018).

There are eight major segments of the U.S. beef cattle industry: seedstock, commercial cow-calf, stocker, feedlot, packing, purveyor, retail, and consumer (Field, 2018). Seedstock, or purebred, producers provide the genetics for cow-calf producers and other breeders. Genetics are sold in the form of breeding-age bulls, heifers, and cows as well as embryos and semen. The

commercial cow-calf producer is responsible for their cowherd and producing calves to be marketed at weaning time. Depending on the size of the operation, calves serve as the primary source of revenue and replacement females for cow-calf producers (Field, 2018). The stocker segment adds weight to weaned calves before they enter the feedlot. Stockers utilize a forage supply, such as pasture, hay, or silage, to grow the weaned calves (Field, 2018). The feedlot segment is responsible for feeding finishing rations to cattle prior to harvest. Cattle will remain in the feedlot between 100 and 200 days (Field, 2018). Cattle are fed high-grain diets to produce “economically efficient gains” and improve palatability of the beef product (Field, 2018, pp. 10). The packing segment harvests and processes the finished cattle. Primarily, this segment produces boxed beef, and it is highly regulated. The purveyor segment consists of purveyors and distributors. While distributors sell beef to most retail markets, the purveyors sell to the food service industry, predominantly (Field, 2018). The retail segment markets retail beef cuts at supermarkets, mainly. Finally, the consumer segment depends on the buying and consumption of beef products by the consumer.

In the United States, the total cattle inventory numbers exhibited a rapid incline from 1900 to 1975; however, in 1975, cattle numbers peaked at 132 million head (Field, 2018). Total cattle numbers, as of July 1, 2019, have declined to 103 million head (USDA-NASS, 2019b). These inventories reflect beef and

dairy cattle as well as beef and dairy calves. Nevertheless, beef cow numbers, as of July 1, 2019, were 32.4 million head (USDA-NASS, 2019a).

As the U.S. beef cattle industry progresses, cattle producers are having to provide more pounds of product with less cattle numbers. There are 729,000 beef cattle operations in the U.S. (USDA-NASS, 2014). While there are less cattle numbers, small producers, or part-time farmers, own half of the farms in the U.S. Therefore, smaller herd sizes are to be expected. Approximately, 80% of beef cattle operations operate with less than 50-head of cattle (Field, 2018). Most of the cattle operations can be found on less than 50 acres of land (Field, 2018). Furthermore, while 55% of producers own greater than 100-head of cattle, only 10% of beef cattle enterprises fall into this size category (Field, 2018). To be considered an economic unit, a cattle producer must have a herd size greater than 300-head of cattle (Field, 2018). Cattle numbers and herd size fluctuate to meet the needs of supply and demand, to combat environmental effects, like drought, and other financial factors that arise.

Texas Demographics

According to the Texas Department of Agriculture (TDA), Texas leads the nation in total number of farms with 248,416 farms that cover 127 million acres (TDA, 2019). Texas contains 130,000 beef cow-calf operations (TDA, 2019). Between 2012 and 2017, the average farm size decreased from 423 acres to 410 acres (TDA, 2019). This can be attributed to the increased presence of urban

populations and conversion of rural lands for urban use. Young beef cattle producers are categorized as being 35 years old or less. While the average age of beef cattle producers, in Texas, is 59 years, the average age of young producers is 29 (TDA, 2019). Young producers account for 21,304 of the total farms (TDA, 2019). In Texas, cattle remained the top commodity and attained a market value of $12.3 billion in 2017 (TDA, 2019)

In Texas, beef cattle are distributed in the panhandle, central, and eastern parts of the state, primarily. Stocking densities, pasture management, and feedlot and packing plant locations determine where the majority of cattle are raised. As of 2018, the top counties, Gonzales and Lavaca, produced 68,000 and 67,000 head of beef cattle, respectively (USDA-NASS, 2018). These counties are located in the south-central region of Texas. For the eastern area of Texas, Leon and Houston counties produced 53,000 and 48,000 head of beef cattle, respectively (USDA-NASS, 2018).

Beef Cattle Production in East Texas

Due to its abundant annual rainfall of 46 inches and ideal stocking densities, East Texas provides optimal conditions to raise beef cattle (Redmon, 2002). In East Texas, the majority of beef cattle producers contribute to the commercial cow-calf segment of the beef industry. As mentioned before, the cow-calf producer maintains a herd of females to produce a yearly calf crop. In order to continue production, commercial cattle producers must replenish their

herd. This can be accomplished by retaining replacement heifers or purchasing females from seedstock or other local producers. In order to calve by 24 months of age, heifers are bred between 14 and 15 months of age. Commonly, stocker operations are found closer to the feedlots that are located in the panhandle and southern parts of Texas; however, some East Texas beef cattle producers may operate a cow-calf and stocker operation. Nevertheless, due to greater forage availability and better stocking densities, commercial cow-calf operations are abundant in East Texas (Asem-Hiablie et al., 2015).

Texas Department of Agriculture divides East Texas into District 5 North and District 5 South. Angelina, Nacogdoches, and Cherokee counties represent each part of District 5. These three counties are centrally-located within East Texas, and they are the counties of interest for this study.

Nutrition Management

Mineral Program. For a beef producer to thrive, cows should breed back within forty-five to sixty days, post-calving. Mineral deficiencies or toxicities, such as selenium, can decrease herd productivity. Trace minerals are vital for parturition, milk production, fertility, and performance in cattle (Brummer et al., 2014).

Selenium, one of the most important minerals, should play a major role in a producer's mineral program. Cattle must receive selenium in small quantities. Selenium, organic and inorganic forms, are regulated by the FDA at 0.3 ppm for

beef cattle diets (Brummer et al., 2014). For example, a ,1400-pound cow should have a minimum intake of 1 mg/kg of selenium per day; however, if a cow consumes more than 5 mg/kg of selenium per day, this is considered toxic. In cattle, selenium is known to interact with Vitamin E and other trace minerals to sustain reproductive and herd health (Brummer et al., 2014).

Geographically, selenium deficiencies are more of an issue than a selenium toxicity. When selenium intake exceeds 5 to 8 mg/kg per day, selenium toxicity can occur, and cattle may exhibit blind staggers (Mehdi and Dufrasne, 2016).

Selenium deficiencies occur when there is less than 0.05 mg/kg present in the diet (Mehdi and Dufrasne, 2016). Reproductive problems associated with a selenium deficiency include: retained placentas, stillborn calves, abortions, poor semen quality in bulls, and silent estrus (Balamurugan et al., 2017). A retained placenta can delay a cow's rebreeding time by nearly six months. In one study, a herd of twenty-six dairy cows were found to be selenium deficient; of the twenty-six cows, thirty-eight percent of the cows exhibited a retained placenta (Muegge et al., 2016). The cows were supplied with an increased selenium intake of 0.69 milligrams, daily. The percentage of retained fetal membranes decreased by thirty-eight percent. Although rare, late-term abortions can arise from a deficiency. Abortion can be a direct correlation to white muscle disease (Giadinis et al., 2016). Yet, calves will likely die within a few days of birth. White muscle

disease is associated with a selenium deficiency. Eventually, the calves are too weak to nurse and die from starvation or develop a weakened immune system. Overall, a decrease in growth rate, due to disease susceptibility from the weakened immune system, can be observed in calves (Giadinis et al., 2016). While cows and calves are a primary focus in the study of selenium deficiencies, one cannot forget about selenium's effect on bulls. Reduction in sperm motility is the main effect of a selenium deficiency (Mehdi and Dufrasne, 2016). This infertility comes from a low secretion of testosterone and spermatozoa synthesis. Also, selenium was found to impact the histological and gross anatomy of the testes in males. Bull infertility may lower conception rates and delay rebreeding times (Mehdi and Dufrasne, 2016).

Selenium deficiencies and toxicities lower conception rates. This can be attributed to bull or cow infertility or the amount of selenium that is present in the diet. Eighty percent of forages contain less than 0.05 ppm of selenium (Mehdi and Dufrasne, 2016). Through the rise of supplementation of selenium and other trace minerals, reproductive and growth performance have rapidly improved. Selenium can be supplemented in the following forms: trace mineral injections, salt-mineral mixes, selenium-fortified feeds, rumen boluses (only in California), and selenium fertilizer (only in Oregon) (Brummer et al., 2014). Trace mineral injections and salt-mineral mixes are the most common methods of supplementation. (Brummer et al., 2014).

For the trace mineral injection, Multimin90 (Multimin North America, Inc) is a current product that is utilized in the beef cattle industry. Multimin90 contains zinc, selenium, manganese, and copper. In beef cows, Multimin90 should be administered four weeks before breeding and before calving (Brasche, 2015). Recently, a series of studies were conducted at the University of Illinois. These studies observed the effects of Multimin90 on reproductive performance and reproductive tract development in heifers. The studies utilized 290 head of commercial Angus females. All heifers were artificially inseminated. Pregnancy and conception rates were analyzed between the heifers supplemented with Multimin90 and the control heifers that received no supplementation. Heifers, injected with Multimin90, had a 37% AI conception rate compared to the 30% AI conception rate observed in the control heifers (Stokes et al., 2018). However, a difference in pregnancy rates, the number of females that remained pregnant, was not observed between the control and supplemented heifers. When blood samples were evaluated, an increase in copper and selenium levels was noted for the heifers receiving Multimin90. In another study, Multimin90 was utilized in a similar way, but crossbred Angus females were evaluated. In this particular study, heifers, receiving Multimin90, had a pregnancy rate of 92.7% and control heifers had a pregnancy rate of 83.3% (Brasche, 2015). Therefore, one cannot definitively state that heifers will have a significantly higher conception and

pregnancy rate when supplemented with this product. However, conception rates are certainly improved when using Multimin90 (Brasche, 2015).

Recently, a free-choice mineral, containing selenium and other trace minerals, has appeared on the market. This product is called Concept-Aid (Vitaferm). As an added benefit, Concept-Aid contains Amaferm. Amaferm is a natural prebiotic that aids in digestibility, intake, and nutrient absorption (Glaubius, 2017). In 2017, the reproductive success of Concept-Aid was investigated among 4,934 head of cattle from 9 different states. In this study, conception rate, calving percentage, and weaning weight were the primary traits of interest. When compared to the Texas average conception rate of 88.8%, cows, receiving Concept-Aid, had a conception rate of 96.2% (Glaubius, 2017). Throughout the study, Concept-Aid exhibited an average conception rate of 94%. Calving percentage improved from the national beef cattle industry average (87.8%) to the Concept-Aid average of 93.6%. Weaning weight displayed an 11% increase above the national industry average. With Concept-Aid, the average weaning weight was 591 pounds. Therefore, Concept-Aid attained reproductive success by increasing conception rate, calving percentage, and weaning weight (Glaubius, 2017).

Pasture Management. Grazing management techniques can be utilized to increase grazing time and improve pasture. Rotational grazing is one of these techniques. By implementing this type of grazing, producers allow their cattle to

graze a pasture for a brief time. Then, the pasture receives a rest-period once the cattle are rotated to the next pasture. Depending on the intensive style of grazing, pastures can be sectioned off and grazed hourly or daily. Generally, the rest-period is 25 to 30 days, or until forage has reached a suitable grazing height (Kinder, 2015). By implementing rotational grazing, forages have shown to increase gains by 40% (Bertelsen et al., 1993). Rotational grazing is one of the more common grazing methods in East Texas. This management technique has the capability to extend grazing time and reduce the need for stored feed. Rotational grazing can reduce forage loss by 20 to 30% (Ball et al., 2008).

Continuous grazing means that cattle will graze a single pasture year-round. It is the simplest and least labor-intensive technique. In continuously grazed pastures, forages are under-utilized, stocking rates are decreased, and pastures do not receive a rest-period (Kinder, 2015). Also, continuous grazing leads to an increased use of stockpiled forage. In a Georgia study, hay fed per cow, on continuously grazed pasture, was 1,166 kilograms while hay fed per cow, on rotationally grazed pasture, was 793 kilograms (Ball et al., 2008). When compared to continuous grazing, rotational grazing produced a greater forage mass of 1,023 kilograms per hectare (Bertelsen et al., 1993).

Types of forages can determine what pasture, or grazing, management techniques are most appropriate. In East Texas, bahiagrass and various bermudagrasses are common. Bahiagrass is a warm season grass that can

withstand “close, continuous grazing” (Redmon, 2001, p. 1). Bahiagrass can withstand more soil types and stays greener than bermudagrass, in the fall. However, bermudagrass has a greater drought tolerance. Bermudagrass is better suited for hay production as it produces more pounds of dry matter (Redmon, 2001). Also, bahiagrass and bermudagrass should be overseeded with a cool season grass, such as ryegrass, to extend grazing time into cooler weather. ‘Coastal’ bermudagrass is the most common in Texas (Redmon, 2002). This grass can withstand intensively grazed pastures. ‘Common’ bermudagrass is favorable to East Texas because of its ability to be grown in any weather condition. According to the Natural Resource Conservation Service (NRCS), for rotational grazing, bahiagrass and ‘Common’ bermudagrass should be maintained at a minimum height of 3 inches during grazing and maintained at a height of 6 inches prior to grazing (NRCS, 2015).

Hay production is a form of stored forage. This stored forage will be consumed by cattle during the cooler months, or potential drought during the summer months. Due to its copious annual precipitation, East Texas excels in hay production. In order to benefit from hay production, producers must avoid hay losses. Through good management, hay losses can be minimized, by 42%, at the curing, harvesting, storage, and feeding stage (Ball et al., 2008).

Herd Health Management

Preventative Herd Health Program. A preventative herd health program is necessary for beef cattle production. A vaccination program should be established with the consultation of a licensed veterinarian. Vaccinations can be timed with breeding season as well as pre- and post-weaning time. Infectious Bovine Rhinotracheitis (IBR) and Bovine Respiratory Syncitial Virus (BRSV), common respiratory diseases, should be included in a vaccination program. According to North Dakota State University Extension Service (NDSU), intranasal vaccines or a 5-way injection is recommended for nursing calves; however, a second injection should be administered at preweaning or weaning time (Stokka and Dahlen, 2014). Blackleg is a clostridial disease that can affect younger calves. A 7- or 8-way vaccine, that covers clostridial species, is given as a bacterin or toxoid. This vaccine should be given at 3 months of age and repeated at preweaning or weaning time. For breeding heifers, less than 12 months old, a brucellosis vaccination, RB51, is recommended, or required in some states (Stokka and Dahlen, 2014). While Texas is a brucellosis-free state, a brucellosis vaccination serves as a precautionary measure to prevent this reproductive disease from entering a cowherd. Prior to breeding time, other reproductive diseases, such as vibriosis and leptospirosis, should be vaccinated against. Cows and heifers need to be vaccinated 30 to 60 days before breeding time. Bulls should be vaccinated 30 days before breeding. As part of the preventative

herd health program, it is recommended that bulls receive a breeding soundness exam, and incoming cattle should be quarantined for a minimum of 30 days (Stokka and Dahlen, 2014).

Calf Management. Growth and stress, in cattle, are important topics. In order to make a profit, many producers rely on the sale of their calves at, or shortly after, weaning time. A producer's management practices may affect their profit. Management practices, such as weaning and castration methods, can impact growth and stress in cattle. Calves, sold on a weight basis, may be directly affected by how they are weaned and/or castrated. Time, additional labor, additional materials required, animal welfare, and stress-added are a few factors that may impact calf growth.

Weaning Methods. Weaning time can be a stressful experience for any calf. To diminish this stressful period, a producer must select, from a wide array of weaning methods. Depending on the method, calves may benefit by maintaining their health and not sacrifice their weight in the process. According to a study conducted in Montana and Canada, calves bawled 98% less, paced the fence 78% less, spent 23% more time eating, and rested 24% more, due to the implementation of low-stress weaning techniques (Gill and Carpenter, n.d.).

Fence-line weaning is a common, low-stress method. As the name suggests, fence-line weaning requires the cow and calf to be separated by a fence. This method requires strong fences, like net-wire or multi-stranded. One

downside could be the cost of additional fencing if the current fences are not up to par. With this method, calves are able to hear and see their mothers. However, the calves and cows are not allotted physical contact (Gill and Carpenter, n.d.).

One study compared fence-line weaning to other traditional methods. The purpose of this experiment was to determine if fence-line weaning would reduce behavioral distresses, such as vocalization and pacing, and other issues associated with short-term weight loss (Price et al., 2003). For seven days, 100-head of crossbred calves were assigned to one of five treatments: fence-line, total separation on pasture, total separation in a drylot preconditioned to hay, total separation in a drylot not preconditioned, and non-weaned control (Price et al., 2003). The study was conducted over a ten-week period. Calves were weighed weekly. As predicted, fence-line weaned calves did not vocalize as much as the other groups, and they spent more time grazing. During the first two days of weaning, fence-line calves spent 60% of their time within a three-meter distance of the fence that was near their mothers (Price et al., 2003). When compared to the average calf of the total separation groups, fence-line calves gained 95% more weight within the first two weeks of the trial (Price et al., 2003). At the ten-week mark, fence-line calves gained 110.0 pounds while the total separation calves gained 84.0 pounds (Price et al., 2003). In this one study, fence-line calves did not exhibit much of the behavioral distresses that are normally experienced at weaning time. Also, fence-line calves were able to

minimize their weight loss. On the contrary, totally separated calves were still lighter and could not compensate for their behavioral distresses early on (Price et al., 2003).

In 2014, Penn State Extension compiled fence-line versus traditional weaning research from other extension services. According to one of the compiled studies, conducted in Oklahoma, fence-line calves started at a lower weight, but witnessed more weight gain when compared to the traditionally-weaned calves. Fence-line calves gained 34.9 pounds and the traditional calves gained 14.9 pounds (Comerford, 2014). Also, traditionally-weaned calves had a 3.3% morbidity and fence-line calves had 0% morbidity (Comerford, 2014). Therefore, fence-line weaning would be a method of choice.

Next, the two-stage weaning method is another low-stress option. This method utilizes anti-suckling devices and requires calves to be worked twice. An anti-suckling device is placed in the nostrils for five to seven days. This device keeps calves from nursing but maintains physical contact between cow and calf. If the device is left in for too long, nose sores will develop. After the allotted time, the devices are removed, and calves are totally separated from the cows. There is a small cost associated with the purchase of anti-suckling devices. Also, there is more labor associated with two-stage weaning than fence-line or traditional weaning (Smith, 2011).

According to an Ontario Veterinary College study, two-stage calves bawled 95% less, paced 60% less, and spent 30% more time eating than abruptly-weaned calves (Smith, 2011). A Virginia study compared two-stage to fence-line weaning. While fence-line and two-stage calves exhibited reduced stress behavior, fence-line calves proved to have superior weight gain within the first seven days (Smith, 2011). This was attributed to the discomfort created from the anti-suckling devices. With two-stage weaning, average daily gain was similar to abruptly-weaned calves. While two-stage weaning reduces stress indicators, such as bawling, this method does not have a profound effect on post-weaning growth (Smith, 2011).

Castration Methods. In conjunction with weaning time, castration is another stressful event in a calf's life. Calves should be castrated at a young age. Three months, or younger, is the preferred castration time. As calves get older, castration can become risky. Depending on the castration method, a producer could benefit from associated weight gain and stress reduction.

Surgical castration involves the immediate removal of the testes by using a scalpel blade or sharp knife. It is the most common method for beef cattle producers because it does not involve additional purchases. Surgical castration is best performed when calves are less than thirty-six hours old. Calves are easier to restrain at this age and bleeding is fairly limited. Therefore, at this age, limited stress should be associated with this method (Fisher et al., 2001).

According to a study, conducted at the University of Tennessee, “A correctly surgically castrated calf will have less depression of weight gains and a lower incidence of infections than calves castrated by other methods” (Hopkins et al., n.d., p. 9). In other words, a producer should witness more weight gain and lower infection susceptibility. In a two-way experiment, surgical and banding castration was compared on 14-month old and 9-month old bull calves. In the first few days following castration, surgically castrated bull calves displayed more behavioral stress than banded calves (Fisher et al., 2001). However, surgically castrated calves grew faster, in the first 56 days, compared to banded calves (Fisher et al., 2001).

Band castration utilizes a rubber ring, or latex band, to cut off blood supply to the testes. This process allows the testes to fall off in three to six weeks. Initially, band castration is relatively painless. In the weeks to follow, calves may exhibit behavioral stress, such as awkward stances or leg stamping. Unfortunately, this method creates more chronic pain than surgical castration. In the study mentioned earlier, banded, 14-month old cattle developed “persistent wounds” above the bands, but this did not occur among the 9-month old calves (Fisher et al., 2001, p. 1).

Reproductive Management

Breeding Practices. Artificial insemination (AI) and natural service are the two primary breeding practices employed by beef cattle producers. Advanced

breeding practices consist of embryo transfer and in-vitro fertilization (IVF). However, these advanced breeding practices are more common to seedstock producers. When focusing on commercial cow-calf producers, natural service is the prevalent choice (Bader et al., 2003).

Natural service means a bull is turned out to the cowherd during breeding season. However, a portion of producers will leave a bull with the cowherd, continuously. Commonly, one bull is needed to service 25 to 30 cows. Potentially, older bulls, older than 2 years old, may service more cows. Natural service depends on prolific bulls that can remain in the herd from 2 to 5 years. Three commercial ranches, based in northern California, served as the sample for a bull prolificacy study. Over a three-year period, 15 calf crops, consisting of a total of 5,052 calves, were used to evaluate 2- to 11-year-old bulls and to determine the number females that conceived. There was one bull per twenty-five cows. In a 60 to 120-day breeding season, the average number of calves, that were conceived, was 18.9 with a range of 0 to 64 (Van Eenennaam et al., 2014). Also, the peak number of calves conceived were sired by 5-year-old bulls. Since bull prolificacy decreases between 5 and 7 years old, this concurs with beef cattle producers choosing to sell their herd bulls that are older than 5 years old (Van Eenennaam et al., 2014).

Artificial insemination is utilized by approximately 5% of beef cattle producers, (Bader et al., 2003). Yet, AI is one of the best ways to use superior

genetics, improve selection traits, like birth weight, and decrease calving interval. AI, in conjunction with estrus synchronization protocols, can reduce a calving season to a 45- to 60-day window (Kinder, 2015). In one U.S. beef cow-calf study, only 8.5% of cow-calf operations utilized AI, and these operations own 14.5% of cows in the U.S. (Pruitt et al., 2012).

Pregnancy Detection Methods. Pregnancy detection is a crucial tool for cow-calf producers because it can identify open, or non-pregnant, cows and make culling and management decisions, accordingly. After a 120-day calving season, conception rates range from 80% to 94% (Troxel and Simon, n.d.). By implementing pregnancy detection methods, 6% to 20% of open cows can be identified; therefore, culling open cows can save a producer $250 per head (Troxel and Simon, n.d.). The three main pregnancy detection methods are rectal palpation, transrectal ultrasound, and blood tests (Filley and Cooke, 2011).

Rectal palpation is one of the cheapest, simplest, and most common detection methods. A veterinarian or trained technician will insert their gloved arm into the cow's rectum, and "palpate the reproductive tract through the rectal wall" (Filley and Cooke, 2011, p. 3). A trained technician may detect pregnancy as early as 40 days. The cost of rectal palpation is $2.50 to $15.00 per cow. However, beef cattle producers can receive the proper training to palpate their own cows. Therefore, the cost of utilizing a trained technician can be eliminated (Filley and Cooke, 2011).

Transrectal ultrasound utilizes a probe that is inserted into the cow's rectum. Then, an image displays the fetus, the uterus, and the ovaries. This detection method can detect pregnancy as early as 25 days (Filley and Cooke, 2011). Transrectal ultrasound can determine the viability of the fetus as early as 30 days and determine its sex between 50 and 60 days. Most veterinarians and trained technicians will perform this type of pregnancy exam for $3.00 to $10.00. However, larger beef cattle operations may consider purchasing an ultrasound machine for $7,000 to $14,000 (Troxel and Simon, n.d.).

Blood samples can be taken from under the cow's tail and examined for the pregnancy-associated glycoproteins (PAG). The blood sample should be taken, at least, 30 days post-breeding (Troxel and Simon, n.d.). Not including the cost of syringes, test tubes, and needles, blood samples cost between $2.00 and $4.00. On average, blood tests exhibit false-positives about 5% of the time (Troxel and Simon, n.d.).

Calving Season. For cow-calf producers, a defined calving season may occur in the spring or fall. A calving season can range from 45 to 120 days with an average of 75 days (Troxel and Simon, n.d.). In a national survey, 61.4% of cow-calf producers adopted a defined calving season, and these producers managed 71.4% of the cows in the U.S. (Pruitt et al., 2012). Small cow-calf producers can benefit from a shortened calving season. Some benefits include marketing a more uniform calf crop, decrease labor, and optimize forage and

supplemental feeding use. In Arkansas, when a calving season was shortened to 90 days, there was a 32% reduction in direct cost per animal unit and 38% decrease in herd break-even costs (Troxel and Simon, n.d.).

Survey Research

Texas. In 2015, a regionally-based survey was conducted to assess common management and production practices in Texas, Kansas, and Oklahoma. This region was selected because it accounts for 25% of beef cows and 37% of all beef produced in the U.S. (Asem-Hiablie et al., 2015). Cow-calf, stocker, and finishing operations were represented in this survey. Texas accounted for 291 of 356 survey responses. In the eastern areas of Texas, 64.9% of ranches operated with 100 cows or less, and 19.5% of ranches were only a cow-calf operation (Asem-Hiablie et al., 2015). Researchers reported that the largest ranch, in East Texas, maintained a herd size of 3,300. In Texas, the average herd size was 45 head of mature cows. The cow to bull ratio, in Texas, was 18:1. Stocking rates ranged from 0.74 acres/cow to 131 acres/cow (Asem-Hiablie et al., 2015). Due to 60% of Texas responses coming from central Texas, the stocking rates were vastly different from other states in the region. Smaller-sized cow-calf operations were prevalent; yet, in East Texas, producers, who operated a cow-calf with stockers operation, maintained 70.7% of the cows (Asem-Hiablie et al., 2015).

Missouri. Missouri State University conducted a survey to evaluate the management and production practices in Missouri's beef cattle industry. The survey was distributed by the Missouri Cattlemen's Association. The researchers were interested in grazing management techniques, leased versus owned pasture, and profitability within the beef cattle industry. Reported data was based on 112 survey respondents. It was reported that 76.6% of Missouri cattle producers operated a commercial cow-calf operation (Kinder, 2015). In regard to grazing management, 62**.**2% of producers would rotationally-graze their pasture during the growing season; however, only 9% of producers utilized continuous grazing (Kinder, 2015). For pasture improvement, the majority of producers added lime and fertilizer (81.9%), made fence improvements (87.6%), or mowed their pastures (85.7%). Researchers reported that there was a "positive correlation" between net profit and number of mature cattle as well as amount of rented land (Kinder, 2015, pp. 59).

Oklahoma. In 2006, Oklahoma State University distributed a producer survey to identify management practices for Oklahoma cow-calf operations. Also, the survey was intended to identify correlations between adoption of management practices, herd size, and dependence on the beef cattle operation. Responses were obtained from 335 producer surveys and divided into two groups. Group 1 consisted of small producers with a herd size of 1 to 99 head of

beef cattle. Group 2 consisted of larger producers with a herd size of 100 or greater head of beef cattle (Vestal et al., 2006).

In Group 2, when asked about forage testing, 25% utilized forage testing. However, in Group 1, 19% utilized forage testing. Larger producers were more likely to test their forage. Forage testing was common among producers that purchased harvested forage (Vestal et al., 2006).

Reproductive and herd health management practices, within the cowherd, were an intricate part of this study. According to this study, only 14%, of Group 1, and 33%, of Group 2, always performed a pregnancy exam (Vestal et al., 2006). These results indicate smaller producers, who are not as dependent on beef enterprise income, are less likely to perform pregnancy examinations. Furthermore, Group 1 producers (53%) utilize only one method of identification (ear tag, tattoo, electronic identification, or brand), while Group 2 producers (52%) utilize multiple identification methods (Vestal et al., 2006). Group 1 producers are less likely to incorporate and invest in management practices that can increase profit returns and diminish costs. With regards to herd health and calf management, Group 1 producers (41%) only give a single vaccination and 56% castrate their bull calves. Yet, Group 2 producers utilize multiple vaccinations (41%) and a majority (76%) castrate their bull calves. Overall, Oklahoma cow-calf producers, classified as larger producers, are more likely to implement management practices that increase efficiency and profitability.

Researchers determined that there was a correlation between herd size and dependency on cattle operation income. Larger producers are more dependent on their beef enterprise income (Vestal et al., 2006).

Chapter III

Methodology

Research Design

The East Texas Beef Cattle Management survey was developed based on a previous beef cattle management survey conducted by Missouri State University (Kinder, 2015). This survey contains more specific beef cattle management questions than previous studies; however, the East Texas Beef Cattle Management survey was adapted to fit the beef cattle production schemes of East Texas.

The survey was comprised of forty-one, quantitative (closed ended) questions. The East Texas Beef Cattle Management survey questions were sectioned by demographics, nutrition management, herd health management, reproductive management, and sources of knowledge. Survey questions were answered using a Likert scale (never, rarely, sometimes, often, always), fill in the blank, check-all-that-apply, or multiple-choice (see Appendix A).

Validity and Reliability

The updated survey was reviewed by a panel of experts consisting of three Stephen F. Austin State University agriculture professors and experienced beef cattle producers. These experts confirmed face and content validity. Cronboch's alpha was used to determine survey reliability *post hoc*. This

survey's alpha score is 0.883, which means this survey has a good reliability.

Population

Due to not being able to survey every beef cattle producer in East Texas, a snowball sample was used. Participants, in this sample, were identified through personal connections with the researcher or contacts with local feed stores, county extension agents, and county agriculture science teachers.

Survey Distribution

The survey links were distributed, via email, to the contacts within Angelina, Nacogdoches, and Cherokee counties. Texas Department of Agriculture divided East Texas into District 5 North and District 5 South. These selected counties represented each part of District 5. The contacts were asked to forward the email, with the anonymous survey link, to all known local beef cattle producers in their area. The electronic version of the survey was distributed through the electronic survey platform, Qualtrics. For participants, who did not have internet access or an email address, a hard-copy version was mailed to them. A pre-addressed, stamped return envelope was mailed with the hard-copy of the survey.

Data Collection

The survey was approved by the Stephen F. Austin State University Institutional Review Board on March 1, 2020 (see Appendix B). The project case number was AY2020-1161. The following timeline highlighted all participant

contact and data collection points that occurred between April 2, 2020 and May 26, 2020:

- **April 2nd**: Initial email was sent to county extension agents, agriculture science teachers, and known beef cattle producers in Angelina, Nacogdoches, and Cherokee counties. Within this email, a brief description of the study and the Qualtrics link was provided.
- **April 8th**: The anonymous, Qualtrics survey link was posted to the researcher's personal Facebook page.
- **April 14th – 17th**: Fifty to sixty known beef cattle producers were individually contacted, via phone, to request their participation and email addresses for the survey. Emails, with the anonymous link, were sent to the participants on the same day they were contacted.
- **April 20th**: Hard-copies of the survey were mailed to the participants that requested this version.
- **April 27th**: Participants, who did not answer the previous phone call, were contacted by phone again. Reminder emails were sent to all participants that did not state whether they completed the survey or not.
- **May 5th – 7th**: All hard-copy surveys were retrieved from the mail. The researcher entered the responses using the Qualtrics survey link.
- **May 13th**: The anonymous survey link was posted on the researcher's personal Facebook page for a second time.

- **May 20th**: The last anonymous survey link was posted on the Stephen F. Austin State University Agriculture Department Facebook page.
- **May 26th**: Survey response collection was concluded.

Data Analysis

The data was analyzed using Statistical Package for Social Sciences (Version 25; SPSS, Chicago, IL) to perform frequency counts, percentages, descriptive statistics, and bivariate correlations. Frequency counts indicated the most and least frequently occurring management practices that were implemented by the sampled beef cattle producers. A frequency count established a distribution shape of the obtained data (McMillan and Schumacher, 2006). Descriptive statistics, such as mean, identified the averages and ranges of responses to the demographic and farm characteristic questions. A few variables of interest, such as average age and farm size, were analyzed using descriptive statistics. A bivariate correlation established the relationship between two variables of interest (Field, 2009). Bivariate correlations were used to identify relationships between age, education level, gender, years of experience, herd size, and individual management practices.

Chapter IV

Results

Introduction

Initially, the survey received 112 responses; however, 9 responses were not completed, or respondents' beef operations did not reside in the surveyed counties. Therefore, these responses were deleted, and 103 responses were analyzed. Nearly all respondents did not provide a response to every question. Valid percentages were assessed without the missing responses. All correlation tests were completed with an established significance level of $p < 0.05$.

This chapter will highlight the results of the following research objectives:

1) Describe demographic and background of East Texas beef cattle producers and their farms.
2) Identify nutrition management practices among East Texas beef cattle producers.
3) Identify herd health management practices among East Texas beef cattle producers.
4) Identify reproductive management practices among East Texas beef cattle producers.
5) Identify correlations between demographics and adoption of management practices, and correlations between individual management practices.

6) Identify sources of knowledge for East Texas beef cattle producers.

Demographic Data

County Information. Of the three surveyed counties, Angelina had the highest number of responses (*f* = 49), which accounted for 47.6% of the total responses. Nacogdoches and Cherokee county accounted for 33.0% (*f* = 34) and 19.4% (*f* = 20) of the total responses, respectively. Table 1 displays the number of respondents in the three counties.

Table 1. Number of Survey Respondents in East Texas by County (n = 103)

County	Frequency (*f*)	Percent (%)
Angelina	49	47.6
Cherokee	20	19.4
Nacogdoches	34	33.0

Gender and Age. The majority of beef cattle producers (77.7%) were male (*f* = 80) and were an average age of 56.71 years. Females (*f* = 23) accounted for 22.3% of respondents and were an average age of 39.40. This indicates that beef operation owners are more likely to be older and male. The youngest beef cattle operation owner was 18 years of age and the oldest owner was 92 years of age. However, the average age of the surveyed cattle producers was 54.33 years.

Years of Cattle Experience. In this survey, beef cattle producers have been involved with cattle for an average of 31.46 years (n = 103). Responses

ranged from 1 to 80 years of experience. Female producers had fewer years of experience than the male producers. A majority (69.6%) of female producers responded with less than 30 years of experience with cattle.

Highest Level of Education. In response to their highest education level, 38.8% of the surveyed producers have a Bachelor's degree (*f* = 40). For one-fourth of the beef cattle producers (*f* = 27; 26.2%), their highest education level was a high school or GED education. The majority of producers (68.0%) completed a form of secondary education. The percentage of these producers, who obtained a vocational or technical diploma, an Associate's degree, or a Graduate degree, are 6.8%, 7.8%, and 14.6%, respectively (Table 2). Only 5.8% of producers completed an education that is less than high school.

Table 2. Highest Level of Education Completed by Beef Operation Owners in East Texas (n = 103)

Variable	Frequency (*f*)	Percent (%)
Less than High School	6	5.8
High School or GED	27	26.2
Vocational or Technical Diploma/Certificate	7	6.8
Associate's Degree	8	7.8
Bachelor's Degree	40	38.8
Graduate Degree	15	14.6

Reasons for Raising Cattle. Participants allotted their reasons for raising cattle in a "check all that apply" question. The options included source of income, personal consumption of meat/products, hobby, showing, tax deduction

purposes, and other. The majority (74.8%) of producers selected source of income was a reason for raising cattle (*f* = 77). Also, producers indicated the following reasons: tax deduction (46.6%), hobby (40.8%), personal consumption (24.3%), showing (23.3%), and other (4.9%). For participants that selected other, they were asked to specify that reason. Of the five responses, tradition and building assets were the prominent answers.

Herd Size and Characteristics. Surveyed producers provided the number of total head as well as the number of commercial and purebred or registered cattle within their herds. The average herd size consisted of 147.23 head of cattle. However, there were 3 participants that owned more than 1,200 head of cattle. For total number of head, the mode was 25 (Table 3). This indicated that more beef cattle operations operated with a smaller herd size. Fifty-five participants owned 5 or less head of purebred or registered cattle. The ownership of commercial cattle was more prevalent than purebred or registered cattle. Table 3 displays the herd size characteristics within the beef cattle operations.

Table 3. Number of Head for Specified Herd Size Characteristics of Beef Cattle Producers in East Texas

Variable	Mean	Median	Mode	Range
Total Head (n = 100)	147.23	55.50	25	2199
Commercial (n = 100)	124.98	38.00	0	2200
Purebred/Registered (n = 99)	19.32	3.00	0	290

Furthermore, respondents reported the number of head that were dedicated to the different types of cattle production methods (Table 4). The production methods were cow-calf, stocker, heifer development, bull production, bottle calves, finishers (grass-fed), and finishers (grain-fed). Most producers reported that the greatest number of head were dedicated to cow-calf production. Only one producer cited that the majority of their total head was dedicated grain-fed finishers. Also, this producer owned the largest number of cattle with 2,200 total head. Of those 2,200 head, 1,950 head of cattle were grain-fed finishers. Most producers operated with multiple types of cattle production methods.

Table 4. Cattle Production Methods Used by Beef Cattle Producers in East Texas

Variable	Mean	Median	Mode	Min.	Max.
Cow-calf (n = 103)	101.60	44.00	25	2	1365
Stocker (n = 54)	31.24	0.00	0	0	800
Heifer development (n = 72)	13.03	4.50	0	0	200
Bull production (n = 69)	3.94	1.00	0	0	40
Bottle calves (n = 53)	0.38	0.00	0	0	5
Finishers (grass-fed) (n = 56)	5.09	0.00	0	0	125
Finishers (grain-fed) (n = 56)	52.61	0.00	0	0	1950

Nutrition Management Practices and Correlations

Mineral Program. Respondents reported their utilization of a mineral program (salt, trace mineral, etc.) and the forms (injectable, free-choice, both,

and other) in which the minerals were distributed. If participants selected no, they provided their reasons for not having a mineral program. If participants selected yes, they provided the names of the supplemental mineral products.

Most producers (84.5%) implemented a mineral program. In a “check all that apply” question, producers attributed the cost of products (*f* = 10) and not being informed (*f* = 8) as the main reasons for not having a mineral program. Approximately, 62.1% of producers distributed the minerals through free-choice, whereas 17.5% of producers distributed the minerals using free-choice and injectable forms (Table 4). In a “fill-in-the-blank” question about supplemental mineral products, Vitaferm Concept-Aid Heat, Multimin90 (injectable), salt blocks, and Purina Texas 7 were the most frequent answers. Only 1.9% of surveyed producers distributed the minerals through a liquid form. However, this form is considered free-choice. Table 5 highlights the implementation of a mineral program and mineral distribution by producers.

Table 5. Frequency of Mineral Programs and Forms of Mineral Distribution by Beef Cattle Producers in East Texas

Variable	**Description**	**Frequency (*f*)**	**Percent (%)**
Mineral Program	Yes	87	84.5
(n = 103)	No	16	15.5
Forms	Injectable	3	2.9
(n = 87)	Free-choice	64	62.1
	Both	18	17.5
	Other	2	1.9

Farm Size. To establish farm size, producers indicated the number of acres that they owned and rented (Table 5). On average, surveyed cattle producers (n = 103) owned 223.08 acres and rented 237.11 acres (n = 101). There were five producers that owned or rented more than 1,000 acres. Producers stated the number of acres dedicated to grazing and hay production. An average of 357.43 acres was used for grazing and an average of 73.92 acres was used for hay production (Table 6).

Table 6. Farm Size and Land Use of Beef Cattle Producers in East Texas

Variable (acres)	Mean	Median	Mode	Range
Owned Land (n = 103)	223.08	105.00	80	2,000
Rented Land (n = 101)	237.11	40.00	0	3,600
Grazing (n = 103)	357.43	130.00	150	4,695
Hay Production (n = 102)	73.92	35.00	0	1,200

Pasture Management. Producers reported their pasture improvement practices made to owned or rented land. The categories included lime and fertilizer, fencing improvements, water source improvements, over-seeding or planting pastures, mowing, herbicide treatments, pesticide treatments, none, and other.

When compared to rented land, more than twice as many beef cattle producers made pasture improvements to owned land. The four pasture

improvements, that presented with the most utilization on owned and rented land, included fencing improvements, lime and fertilizer application, mowing, and herbicide treatments. The majority (91.3%) of producers made fencing improvements on owned land and 41.7% on rented land. Mowing was performed by 83.5% of producers on owned land and 57.3% on rented land. Lime and fertilizer were applied by 80.6% of producers on owned land and 44.7% on rented land. On owned land, 78.6% of producers applied herbicide. Less than half (45.6%) of the producers applied herbicide to rented land. The least percentage (15.5%) of producers made water source improvements to rented land. On rented land, only 11.7% of beef cattle producers did not make any pasture improvements (Table 7). Only one respondent did not perform any pasture improvements on owned land.

Table 7. Prevalence of Pasture Improvements on Owned and Rented Land by Beef Cattle Producers in East Texas (n = 103)

Variable	Description	Frequency (*f*)	Percent (%)
Lime and fertilizer	Owned Land	83	80.6
	Rented Land	46	44.7
Fencing improvements	Owned Land	94	91.3
	Rented Land	43	41.7
Water source improvements	Owned Land	54	52.4
	Rented Land	16	15.5
Over-seeding or planting pastures	Owned Land	62	60.2
	Rented Land	31	30.1
Mowing	Owned Land	86	83.5
	Rented Land	59	57.3
Herbicide treatments	Owned Land	81	78.6
	Rented Land	47	45.6
Pesticide treatments	Owned Land	57	55.3
	Rented Land	26	25.2
None	Owned Land	1	1.0
	Rented Land	12	11.7

Forage Management. Using a Likert scale, respondents indicated how often they tested produced stored forage (n = 103), purchased stored forage without a nutrient test (n = 103), and tested their soil (n = 101). Most producers (40.8%) never tested produced forage and 4.9% always did. The majority (26.2%) of the cattle producers did not purchase stored forages, 17.5% sometimes purchased stored forages, and 21.4% never purchased stored forages without a nutrient test. In this study, approximately one-third (32.0%) of producers sometimes tested their soil and 22.3% never soil tested. Only 3.9% of producers always tested their soil.

Table 8. Frequency of Soil and Stored Forage Testing by Beef Cattle Producers in East Texas

Variable	Description	Frequency (*f*)	Percent (%)
Test produced stored forage (n = 103)	Never	42	40.8
	Rarely	15	14.6
	Sometimes	26	25.2
	Often	15	14.6
	Always	5	4.9
Test purchased stored forage (n = 103)	Never	22	21.4
	Rarely	12	11.7
	Sometimes	18	17.5
	Often	14	13.6
	Always	10	9.7
	Do not purchase stored forage	27	26.2
Test soil (n = 101)	Never	23	22.3
	Rarely	22	21.4
	Sometimes	33	32.0
	Often	19	18.4
	Always	4	3.9

Grazing Management. The prevalence of rotational and continuous grazing was reported by the participants. With regards to rotational grazing, 24.3% of producers rotated every 3 to 4 weeks, 13.6% rotated every 1 to 2 weeks, and 2.9% rotated daily (Table 8). However, most producers (38.8%; *f* = 40) continuously grazed pastures. Producers, who utilized rotational grazing, provided the average number of days of rest that pastures received between grazing events. There was an average of 25.22 days of rest between grazing events. Days of rest ranged from 3 to 120 days.

Table 9. Prevalence of Rotational Grazing by Beef Cattle Producers in East Texas (n = 103)

Variable	Description	Frequency (*f*)	Percent (%)
Frequency of rotational grazing	Multiple times per day	2	1.9
	Daily	3	2.9
	2 to 3 times per week	3	2.9
	Every 1 to 2 weeks	14	13.6
	Every 3 to 4 weeks	25	24.3
	Every 1 to 2 months	10	9.7
	Every 3 to 4 months	6	5.8
	Never (continuously grazed pastures)	40	38.8

Correlations. Gender was moderately correlated with having a mineral program with a correlation coefficient of 0.349 (Davis, 1971). Females were less likely to utilize a mineral program than the male participants.

There was a significant relationship established between number of acres of owned and rented, forage production, and forage and soil tests. Number of grazed and rented acres were very strongly correlated with a correlation coefficient of 0.961 (Davis, 1971). However, there was no significant difference (p = 0.860) between rented acres and acres for hay production. This indicated that surveyed producers were likely utilizing more rented land for grazing instead of hay production. There was a significant relationship (p = 0.000) between number of acres dedicated to hay production and use of a produced stored forage test (Table 10). Also, hay production and soil evaluation were lowly correlated with a correlation coefficient of 0.297 (Table 10) (Davis, 1971). This indicated that participants, who dedicated land to hay production, were more likely to utilize a produced stored forage test and soil test. Table 10 exhibits the relationship

between forage and soil tests and the number of acres dedicated to forage production.

Table 10. Correlation Between Number of Acres for Grazing and Hay Production and Forage and Soil Evaluation for Beef Cattle Producers in East Texas

		Grazing	Hay Production	Produced Stored Forage Test	Soil Test
Grazing	Pearson Correlation	1	0.202*	0.049	0.164
	Sig. (2-tailed)		0.041	0.624	0.101
	N	103	102	103	101
Hay Production	Pearson Correlation		1	0.351**	0.297**
	Sig. (2-tailed)			0.000	0.003
	N		102	102	100
Produced Stored Forage Test	Pearson Correlation			1	0.702**
	Sig. (2-tailed)				0.000
	N			103	101
Soil Test	Pearson Correlation				1
	Sig. (2-tailed)				
	N				101

*** Correlation is significant at the 0.05 level (2-tailed)**

Herd Health Management Practices and Correlations

Preventative Herd Health Program. Producers answered several questions that pertained to particular herd health practices. The practices included deworming, vaccinations, visual identification methods, and breeding soundness exams (Table 11). A majority (61.2%) of producers dewormed their cattle twice per year, whereas 25.2% dewormed only once per year. For the producers that selected “other," those producers dewormed three times per year. Most beef producers (72.8%) vaccinated their cattle against reproductive

diseases, and 82.5% of participants vaccinated their calves against Blackleg. Prior to breeding, slightly more respondents indicated their bulls received a breeding soundness exam (*f* = 50) when compared to those that did not utilize a breeding soundness exam (*f* = 45) (Table 10). Only 8 producers did not own bulls. The respondents used the following visual identification methods: ear tags (80.6%), tattoos (20.4%), branding (55.3%), none (9.7%), and other (4.9%). For producers that selected other, electronic identification tags or ear notches were used for visual identification.

Table 11. Prevalence of Preventative Herd Health Management Practices by Beef Cattle Producers in East Texas (n = 103)

Variable	**Description**	**Frequency (*f*)**	**Percent (%)**
Deworming	Twice per year	63	61.2
	Once per year	26	25.2
	Do not deworm	3	2.9
	Other	11	10.7
Reproductive Diseases Vaccinations	Yes	75	72.8
	No	28	27.2
Blackleg Vaccination	Yes	85	82.5
	No	18	17.5
Breeding soundness exam	Yes	50	48.5
	No	45	43.2
	Do not own bulls	8	7.8
Visual Identification*	Ear tags	83	80.6
	Tattoos	21	20.4
	Branding	57	55.3
	None	10	9.7
	Other	5	4.9

*** Note that producers could have selected more than one visual identification method**

Castration Methods. Producers reported their primary castration method that was utilized within their beef cattle operation as herd health practices. The majority (47.6%) of producers surgically castrated their calves while 30.1% did not castrate their calves. Band castration was performed by 20.4% of surveyed producers (Table 12).

Table 12. Frequency of Castration and Weaning Methods by Beef Cattle Producers in East Texas (n = 103)

Variable	Description	Frequency (*f*)	Percent (%)
Castration Method	Surgical (knife or scalpel)	49	47.6
	Band (rubber ring or latex band)	21	20.4
	Other	2	1.9
	Do not castrate calves	31	30.1
Weaning Method	Abruptly Weaned	60	58.3
	Fence-line (separated by fences)	32	31.1
	Two-stage (anti-suckling device)	9	8.7
	Other	2	1.9

Weaning Methods. Participants provided answers regarding calf weaning age, weaning weight, primary weaning method, and factors that affected when calves were weaned. The majority (58.3%) of respondents abruptly wean their calves. The method of fence-line weaning was performed by 31.1% of surveyed producers (Table 12). Calves were weaned at an average of 6.70 months of age (n = 96). Calves had an average weaning weight of 540.49 pounds (n = 98) (Table 13).

Table 13. Weaning Age and Weaning Weight of Calves in East Texas

Variable	Mean	Median	Mode	Range
Weaning weight (lb) (n = 98)	540.49	532.50	450	550
Weaning age (months) (n = 96)	6.70	7.00	6	10

The factors that affected weaning time were ranked by producers. The choices included time availability, forage availability, weather, market price, and body condition of the cow. Producers ranked body condition of the cow (35.9%) as the most important factor that affected weaning time. Time availability closely followed with 32.0% as a secondary consideration for weaning time. The least important factors were weather (1.9%) and forage availability (5.8%). Producers ranked market price (17.5%) as a priority for weaning time.

Correlations. Gender was moderately correlated with utilization of a breeding soundness exam and lowly correlated with method of castration with correlation coefficients of 0.347 and 0.264, respectively (Davis, 1971). Female producers were less likely to castrate their calves or utilize a breeding soundness exam.

Age and weaning method were negatively correlated with a correlation coefficient of - 0.278. This indicated that older (greater than 60 years of age) beef cattle producers were less likely to utilize fence-line or two-stage weaning methods compared to an abrupt weaning method.

There was a significant relationship (p = 0.001) between the beef cattle producers that selected market price as a priority for weaning calves and their education level. These two variables were moderately correlated with a correlation coefficient of 0.328 (Davis, 1971). As producer education level increased, there was an increase in the likelihood that calves would be weaned based on market price.

Calves, who were not castrated, had a decreased weaning weight (p = 0.05) compared to castrated calves; therefore, weaning weight and castration method were negatively correlated with a correlation coefficient of -0.204. This was supported by intact (not castrated) calves exhibiting a mean weaning weight of 513.24 pounds. Yet, banded and surgically castrated calves exhibited an average weaning weight of 556.52 and 560.38 pounds, respectively.

Reproductive Management Practices and Correlations

Breeding Methods. Survey participants estimated the number of cattle that were bred using the following breeding methods: artificial insemination (AI), embryo transfer (ET), natural service, and in vitro fertilization (IVF). Artificial insemination, ET, and IVF are all considered advanced breeding methods. Many participants employed more than one breeding method; therefore, percentages did not equal 100%. The majority (85.4%) of respondents utilized natural service (f = 88). The average number of cattle, bred by natural service, was 91.09. Producers also utilized AI (27.1%), ET (14.5%), and IVF (7.8%). Ten of the

fifteen producers, who used ET, only bred ten or less head of cattle with this method. Eight producers, who used IVF, only bred five or less head of cattle with this method. Table 14 shows the frequency of breeding methods by survey participants.

Table 14. Frequency of Breeding Methods by Beef Cattle Producers in East Texas

Variable	Frequency (*f*)	Percent (%)
Artificial Insemination (AI)	28	27.1
Embryo Transfer (ET)	15	14.5
Natural Service	88	85.4
In Vitro Fertilization (IVF)	8	7.8

*** Note that respondents could have utilized more than one breeding method**

Pregnancy Detection Methods. In a "check all that apply" question, producers reported their use of different pregnancy detection methods: rectal palpation, transrectal ultrasound, blood sample, or none (Table 15). Most producers (49.5%) did not employ any pregnancy detection methods. The most prominent method was rectal palpation (46.6%). Transrectal ultrasound (5.8%) was used the least frequently as a pregnancy detection method.

Table 15. Prevalence of Pregnancy Detection Methods by Beef Cattle Producers in East Texas

Variable	Frequency (*f*)	Percent (%)
Rectal Palpation	48	46.6
Transrectal Ultrasound	6	5.8
Blood Sample	14	13.6
None	51	49.5

*** Note that respondents could have utilized more than one pregnancy detection method**

Calving Season. Approximately, 50.5% of survey participants do not have a defined calving season. Sixteen participants (15.5%) utilized a 90-day calving season. The average calving season was 95.22 days. In this sample, a calving season, ranged from 30 days to 210 days. For beef producers, with a defined calving season, fall and spring calving seasons were the most common. February had the greatest number of calves born with an average of 15.81 calves (Table 16).

Table 16. Calving Month Characteristics Used by Beef Cattle Producers in East Texas (n = 103)

Variable	Description	Mean	Median	Mode	Range
Calving month	January	13.47	4.00	0	250
	February	15.81	5.00	0	200
	March	14.60	5.00	0	200
	April	11.01	4.00	0	100
	May	5.67	1.00	0	80
	June	1.93	0.00	0	15
	July	1.07	0.00	0	10
	August	1.69	0.00	0	20
	September	6.58	0.00	0	50
	October	14.69	3.00	0	125
	November	12.09	4.00	0	100
	December	10.20	2.50	0	150

Correlations. There were significant correlations ($p < 0.05$) between breeding methods, county, and herd size characteristics (Table 17). Artificial insemination and embryo transfer were lowly correlated with county with correlation coefficients of 0.288 and 0.258, respectively (Davis, 1971).

Producers, in Nacogdoches county, were more likely to utilize advanced breeding methods. Also, beef cattle producers, who owned purebred or registered cattle, were more likely (p = 0.000) to utilize artificial insemination. Embryo transfer was significant (p = 0.041) with number of purebred or register cattle. There were no significant correlations between in vitro fertilization and herd size characteristics. The use of natural service was more prominent among those producers that operated with larger numbers of commercial cattle, which was indicated by a very strong correlation between natural service and number of commercial cattle with a correlation coefficient of 0.710 (Davis, 1971).

Table 17. Correlation between Breeding Methods, Herd Characteristics, and County in East Texas

		County	**Total Number of Cattle**	**Number of Commercial**	**Number of Purebred/ Registered**
Artificial Insemination	Pearson Correlation	0.288**	0.141	0.013	0.581**
	Sig. (2-tailed)	0.008	0.205	0.909	0.000
	N	85	83	83	82
Embryo Transfer	Pearson Correlation	0.258*	0.336**	0.297**	0.234*
	Sig. (2-tailed)	0.021	0.003	0.008	0.041
	N	80	78	78	77
Natural Service	Pearson Correlation	-0.111	0.707**	0.710**	0.024
	Sig. (2-tailed)	0.281	0.000	0.000	0.819
	N	96	93	93	94
In Vitro Fertilization	Pearson Correlation	0.077	-0.056	-0.094	0.174
	Sig. (2-tailed)	0.508	0.635	0.424	0.139
	N	76	74	74	73

*** Correlation is significant at the 0.05 level (2-tailed)**

Sources of Knowledge

Survey participants stated their sources of knowledge in a “check-all-that-apply” question (Table 17). The majority (75.7%) of participants received their knowledge from family members and friends (*f* = 78). The least number of producers (16.5%) received their knowledge from a pharmaceutical representative. Of the producers that selected “other,” the prominent answers were Texas Southwestern Cattle Raisers Association and previous cattle experience.

Table 18. Sources of Knowledge of Beef Cattle Producers in East Texas (n = 103)

Variable	**Frequency (*f*)**	**Percent (%)**
High School Ag Education classes	47	45.6
Undergraduate/Graduate classes	38	36.9
Extension workshops/bulletins	41	39.8
Beef Cattle Industry workshops	41	39.8
Newsletter/Magazine	57	55.3
Feed Store salesman	44	42.7
Pharmaceutical Representative	17	16.5
Veterinarian	53	51.5
Family Members/Friends	78	75.7
Other	8	7.8

*** Note that respondents could have selected more than one source of knowledge**

Chapter V

Discussion, Recommendations, and Limitations

Summary of Average Beef Cattle Producer in East Texas

For this study, the average beef cattle producer was male and 54 years of age. This was consistent with TDA information that average age of Texas producers is 59 years (TDA, 2019). The average producer has a Bachelor's degree and 31 years of cattle experience.

While the average producer, in this study, operated with 147 head of cattle, the most common herd size was 25 head. Commercial cow-calf production was prominent in East Texas. Herd size was consistent with 55% of beef cattle producers, in the U.S., owned more than 100 head of cattle (Field, 2018). Also, the common herd size (25) was consistent with information, reported by Field (2018), that 80% of producers operate with less than 50 head of cattle.

Results of this study indicated significant differences between the management practices that were implemented by male and female participants. Females had less years of cattle experience than the male producers. On average, females were 17 years younger than the males. Female producers were less likely to utilize a mineral program, castrate their calves, and utilize a breeding soundness exam within their beef cattle operation; however, female

beef producers were more likely to implement a low-stress weaning method such as fence-line or two-stage, when compared to the male producers. Also, participants, who were greater than 60 years of age, were more likely to use the abrupt weaning method.

The results of this study indicate the need for more education for female beef producers in nutrition and herd health management practices, mainly. For female producers, areas of education should focus on castration methods and their relation to weaning weight as well as the importance of mineral distribution. For males, areas of education should focus on the implementation of low-stress weaning methods. Since natural service was the prevalent breeding method, all beef cattle producers should be encouraged to implement breeding soundness exams and pregnancy detection methods.

Due to the survey instrument being posted on the researcher's and SFA Agriculture Department Facebook pages, there was a possibility that these posts reached more younger female respondents than previous studies. Therefore, the results, for demographic and gender, may have been slightly skewed. According to the National Cattlemen's Beef Association (NCBA), beef cattle operations are operated by 11% of women (2018). The 2017 Census of Agriculture reported that approximately 30% of female producers, primary owners or not, were involved in the beef cattle industry (NCBA, 2018). This survey was able to reach a greater percentage (22.3%) of female beef cattle owners than the 11% that was reported

by the NCBA. Results, for herd size, may have been skewed by the presence of outliers. There were three beef cattle producers that owned more than 1,000 head of cattle. This may have led to the higher average herd size of 147 head of cattle. The common herd size, of 25 head of cattle, may be a more accurate representation of beef cattle herd size in East Texas.

Calf Management Discussion

A key part of this study was to analyze how producers managed their calves. Castration methods, weaning methods, and their effect on weaning weight became a particular interest. A correlation was established between castration method and average weaning weight. This relationship was supported by the two-way experiment that surgically castrated calves grew faster than banded calves (Fisher et al., 2001). In this East Texas study, surgically castrated and banded calves were approximately 50 pounds heavier at weaning time than intact calves.

Calves were weaned at an average age of 6.70 months with an average weaning weight of 540.49 pounds. This was consistent with the information from the survey, conducted by Missouri State University, that calves were weaned at 530 pounds and 6.85 months of age (Kinder, 2015). A correlation was not established between weaning method and weaning weight. This may be attributed to the prevalence of abrupt weaning in this study, with 58.3% of participants utilizing this method. Low-stress weaning methods, such as fence-

line and two-stage, were less prevalent. The information, on weaning weight, was not obtained from experimental research. Since participants were asked to provide an estimate of weaning weight, it can be inferred that castration and weaning methods have an effect on weaning weight.

When calves were banded or surgically castrated, calves exhibited a higher weaning weight. By implementing one of these castration methods, producers were able to wean heavier calves. This was supported by intact calves that weighed an average of 513.24 pounds and castrated calves weighed 560 pounds. These results displayed a significant difference between castration method and weaning weight.

Since most producers reported abruptly weaning calves, the results did not indicate a strong correlation between weaning method and weaning weight. Areas of education should focus on castration and weaning methods and their relation to weaning weight.

Reproductive Management Discussion

In this study, producers, who used AI (27.1%), were more prominent than the national average (5%) that was reported by Bader et al. (2003). Furthermore, this study was not consistent with a national survey that reported that 8.5% of cow-calf operations utilize AI (Pruitt et al., 2012). However, natural service was the most prevalent breeding method that was used by 85.4% of the participants.

The pregnancy detection methods results were not consistent with the Oklahoma study that reported that 14% of smaller-sized operations performed a pregnancy exam (Vestal et al., 2006). While this study did not divide participants by herd size, it was noted that 49.5% of participants did not pregnancy check their cattle.

For this survey, the average calving season (95.22 days) was not consistent with average calving season (75 days) provided by Troxel and Simon (n.d.). However, a national survey reported that approximately 40% of producers did not utilize a calving season (Pruitt et al., 2012). Results, from this study, were similar (50.5%) to the national survey.

Results indicated significant differences between breeding methods, county, and herd size. Artificial insemination and ET, advanced breeding methods, were more likely to be utilized by cattle producers that owned purebred or registered cattle or were in Nacogdoches county. Natural service was prominently used among the beef cattle producers that operated with a larger herd size and number of commercial cattle. Furthermore, nearly 50% of participants did not utilize any form of pregnancy detection. Since natural service was the prevalent breeding method, producers should be encouraged to implement a breeding soundness exam, pregnancy detection methods, and a defined calving season.

The greater number of purebred or registered cattle in Nacogdoches county may have led to the prevalence of AI and ET within this area. Natural service may be a more prominent breeding method among larger cattle operations due to the time constraints and expenses associated with AI and ET. Producers, who selected hobby as one of their reasons for raising cattle, may be less likely to utilize advanced breeding methods and other practices that can improve reproductive efficiency. Hobby cattle producers are less likely to be dependent on the income that is generated from their beef cattle operation.

Nutrition Management Discussion

When the responses from producers, regarding the average owned and rented acres of land were added together, the average farm size, in this study, was 460.19 acres. Beef cattle operations, in this study, were 50 acres larger than the average farm size (410 acres) recorded by the 2017 Census in Texas (TDA, 2019). Rented land was used more for grazing than hay production. Participants, who dedicated land to hay production, were more likely to utilize a forage and a soil test.

Most participants (38.8%) did not employ rotational grazing on their beef cattle operation. This result was not consistent with the Missouri State University survey that reported only 9.3% of producers continuously grazed their pastures (Kinder, 2015). This was attributed to the presence of grazing school in Missouri. The grazing school taught producers about different grazing management

techniques, such as rotational versus continuous grazing. Furthermore, in this East Texas study, the average 25.22 days of rest between grazing events was not consistent the 41.4 days that was reported from the Missouri survey (Kinder, 2015). However, East Texas has an approximate average rainfall of 40 inches per year. The increased precipitation promotes forage growth and ideal conditions for grazing (Redmon, 2002).

Another important aspect of the study was to determine the presence of a mineral program and use of supplemental mineral products by East Texas cattle producers. The distribution of the supplemental products was dominated by free-choice. Multimin90 was the only injectable product mentioned in this study.

Sources of Knowledge

Since other Texas beef cattle management studies have not focused on sources of cattle knowledge, this objective became an integral part of this study. As previously mentioned, most participants (75.7%) stated that family members and friends were one of their sources of knowledge. Also, participants received much of their knowledge from newsletters or magazines, high school education classes, veterinarians, and feed store salesmen.

Recommendations

The nutrition, herd health, and reproductive management practices, identified in this study, represent the common beef cattle producers in East Texas. Calf and reproductive management practices represented the areas

where East Texas producers needed the most improvement. As opposed to abrupt weaning, fence-line and two-stage weaning should be utilized more often. Producers should castrate their calves. By utilizing either band or surgical castration, producers can wean significantly heavier calves. Producers may benefit from the implementation of a breeding soundness exam, pregnancy detection, and a defined calving season. These practices can improve reproductive efficiency, calving percentage, and develop a more uniform calf crop.

Extension personnel and university educators may be able to use the information from this study to establish curriculum and educational programs that instruct East Texas producers on profitable and efficient management practices. Curriculum should focus on the herd health and reproductive management practices that producers should utilize. Information should be made available to all producers that want to improve the sustainability of their beef operation. Areas of improvement, that were previously mentioned, should take priority in the development of educational programs. Also, more educational programs should target the female beef cattle producer. These programs should focus on castration methods and development of a mineral program.

Future research is needed to understand the specific needs within individual East Texas counties. Any future studies should address the correlations established in this study. For example, correlations between

individual management practices and their implementation based on gender, age, and years of experience of the East Texas producer. Future research and surveys should ask more specific questions, related to nutrition and reproductive management practices, to gauge the participants knowledge and perception of the beef cattle industry in their area.

Understanding the current practices and demographics of East Texas beef cattle producers is necessary for the development of educational opportunities. Extension personnel, industry professionals, and other educators may utilize this information to facilitate workshops that focus on efficiency and providing training for the current East Texas beef cattle producer. Since magazines and newsletters were significant sources of knowledge, East Texas producers may benefit from reading articles that contain research, relevant to management practices that are utilized in East Texas. These educational opportunities could encourage the producer to implement more profitable and sustainable management practices.

Limitations

The information obtained from this study should be used as a pilot for future studies. The biggest limitation was sample size. Since a snowball sample was used, a smaller number of participants were reached. Response rate relied on personal connections and primary distribution of the survey through email. Only three or four follow-up emails were sent due to producers not receiving the

first email. Furthermore, the study was limited to three counties. If other East Texas counties were included, an increased number of respondents would have been reached.

Another limitation was the reduced representation of female beef cattle producers. Only 23 female participants responded to the survey. This may have caused some of the results to be skewed. Also, several of the questions needed to be written more specifically. By limiting the amount of “check all that apply” and Likert scale questions, a more accurate representation of beef producers may be obtained. This was noted in the responses to the pregnancy detection method question.

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Appendices

Appendix A

East Texas Beef Cattle Survey Questions

Start of Block: Demographics

Q1 Does your beef operation utilize land in Angelina, Cherokee, or Nacogdoches county?

- Yes (1)
- No (2)

Q2 Which county does your beef operation primarily utilize property in?

- Angelina (1)
- Cherokee (2)
- Nacogdoches (3)

Q3 Which of the following best describes your status?

- Beef Operation Owner (1)
- Beef Operation Manager (not the owner) (2)
- Other (3)

Q4 What is the age of the primary owner of the beef operation?

- Years (1) _____

Q5 What is the gender of the primary owner of the beef operation?

- Male (1)
- Female (2)
- Other (3)

Q6 What is the highest level of education the owner of the beef operation has completed?

- Less than High School (1)
- High School or GED (2)
- Vocational or technical diploma/certificate (3)
- Associate Degree (4)
- Bachelor's Degree (5)
- Graduate Degree (6)

Q7 How many years has the owner of the beef operation owned cattle?

○ Years (1) _____

Q8 What is the owner's reason(s) for raising beef cattle? (Check all that apply)

- ☐ Source of Income (1)
- ☐ Personal consumption of meat/products (2)
- ☐ Hobby (3)
- ☐ Showing (4)
- ☐ Tax deduction purpose (5)
- ☐ Other (6) _____

Q9 What is the work status of each of the following people who may be associated with the beef operation?

	Only work is farm-related (1)	Work on the farm full-time (3)	Work on the farm part-time and have another non-farm related job (5)	Only work is non-farm-related (6)	Retired (7)	No one of this status (8)
Owner (1)	○	○	○	○	○	○
Owner's Spouse/Partner (2)	○	○	○	○	○	○
Owner's business partner (other than spouse) (3)	○	○	○	○	○	○
Manager (non-owner) (4)	○	○	○	○	○	○

Q10 How many head of cattle does the beef operation have?

○ Head of Cattle (1) _____

Q11 Please indicate the number of each of the following types of cattle. (Enter ‘0’ if none).

- Commercial (1) _____
- Purebred/Registered (2) _____

Q12 How many cattle fit into the following categories? (Enter ‘0’ if none).

- Cow-calf (1) _____
- Stocker (2) _____
- Heifer Development (3) _____
- Bull Production (4) _____
- Bottle Calves (5) _____
- Finishers (grass-fed) (6) _____
- Finishers (grain-fed) (7) _____

Q13 How many mature (3 years or older) cows and bulls does the operation have? (Enter ‘0’ if none).

- ○ Mature Cows (1) _____
- ○ Mature Bulls (2) _____

Q14 How many cattle, less than 3 years old, does the operation have? (Enter ‘0’ if none).

- ○ Less-than-3-year-old cattle (1) _____

End of Block: Demographics

Start of Block: Pasture and Forage Management

Q15 How many acres of owned and rented land does the beef operation include? (Enter ‘0’ if none).

- ○ Owned Land (1) _____
- ○ Rented Land (2) _____

Q16 How many acres of total land for grazing and/or hay production? (Enter ‘0’ if none)

- ○ Grazing (1) _____
- ○ Hay Production (2) _____

Q17 Regarding land use for cattle production, which of the following types of pasture improvements have been made to owned and/or rented land? (Check all that apply).

	Owned Land (1)	Rented Land (2)
Lime and fertilizer (1)	☐	☐
Fencing improvements (2)	☐	☐
Water source improvements (3)	☐	☐
Overseeding or planting pastures (4)	☐	☐
Mowing/brushhoging (5)	☐	☐
Herbicide treatments (6)	☐	☐
Pesticide treatments (7)	☐	☐
None (8)	☐	☐
Other (please specify) (9)	☐	☐

Q19 How often do you purchase stored forages without a nutrient test?

- Never (1)
- Rarely (2)
- Sometimes (3)
- Often (4)
- Always (5)
- Do not purchase stored forages (6)

End of Block: Pasture and Forage Management

Start of Block: Grazing Management

Q20 How often are cattle rotated to a “new” pasture during growing season?

- ○ Multiple times per day (1)
- ○ Daily (2)
- ○ 2-3 times per week (3)
- ○ Every 1-2 weeks (4)
- ○ Every 3-4 weeks (5)
- ○ Every 1-2 months (6)
- ○ Every 3-4 months (7)
- ○ Never (continuously grazed pastures) (8)

Q21 On average, how many days of rest does each pasture (whether temporary or permanent) receive between grazing events? (Enter ‘N/A’ if rotational grazing is not used).

- ○ Days of rest (1) _____

End of Block: Grazing Management

Start of Block: Mineral Program

Q22 Do you have a mineral program (Salt, trace mineral, etc.)?

- ○ Yes (1)
- ○ No (2)

Q23 What form do you distribute the minerals?

- ○ Injectable (1)
- ○ Free-choice (2)
- ○ Both (3)
- ○ Other (please specify) (4) _____

Q24 Please list the names of the supplemental mineral products that you use. (Enter 'N/A' if supplemental products are not used).

_____

Q25 What are your reasons for not having a mineral program? (Check all that apply).

- [ ] Not informed (1)
- [ ] Cost of products (2)
- [ ] Other (please specify) (3) _____

End of Block: Mineral Program

Start of Block: Herd Health

Q26 Do you have a Preventative Herd Health Program or a vaccination program?

- ○ Yes (1)
- ○ No (2)

Q27 How often do you deworm your cattle?

- ○ Twice per year (1)
- ○ Once per year (2)
- ○ I don't deworm (3)
- ○ Other (please specify) (4) _____

Q28 Do you vaccinate your cattle against reproductive diseases (Leptospirosis, Vibriosis, etc.)?

- Yes (1)
- No (2)

Q29 Prior to breeding, do your bull(s) receive a Breeding Soundness Exam?

- Yes (1)
- No (2)
- I don't own bulls (3)

Q30 Do you vaccinate your calves against Blackleg?

- Yes (1)
- No (2)

Q31 What types of visual identification do you currently use in your beef operation? (Check all that apply).

- [ ] Ear Tags (1)
- [ ] Tattoos (2)
- [ ] Branding (3)
- [ ] None (4)
- [ ] Other (please specify) (5) _____

End of Block: Herd Health

Start of Block: Calf Management

Q32 Which castration method do you primarily utilize in your beef operation?

- ○ Surgical (knife or scalpel) (1)
- ○ Band (rubber ring or latex band) (2)
- ○ Other (please specify) (3) _____
- ○ I don't castrate my calves (4)

Q33 Which weaning method do you utilize in your beef operation?

- ○ Abruptly weaned (1)
- ○ Fence-line (cows/calves are separated by fences) (2)
- ○ Two-stage (calves have an anti-suckling device placed in nostrils to prevent nursing) (3)
- ○ Other (please specify) (4)

Q34 At what age (in months) are calves weaned?

- ○ Age (1) _____

Q35 What is the average weaning weight (in pounds) of calves on the operation?

- ○ Weaning weight (1) _____

Q36 Please rank the following factors that effect the time calves are weaned. (1 being the most important reason and 5 being the least important).

_____ Time availability (1)
_____ Forage availability (2)
_____ Weather (3)
_____ Market price (6)
_____ Body condition of the cow (7)

End of Block: Calf Management

Start of Block: Reproductive Management

Q37 How many head of cattle are bred using the following breeding methods? (Enter an estimated number, or ‘0’ if none).

- Artificial Insemination (AI) (1) _____
- Embryo Transfer (ET) (2) _____
- Natural Service (3) _____
- In Vitro Fertilization (IVF) (4) _____

Q38 What pregnancy detection methods are used in the beef operation? (Check all that apply).

- Rectal Palpation (1)
- Transrectal Ultrasound (2)
- Blood Sample (3)
- None (4)

Q39 How many days does the calving season last on the beef operation? (Enter '0' if you don't have a defined calving season (year-round calving)).

- Days (1) _____

Q40 What is the estimated number of calves born during each month? (Enter ‘0’ if none).

- January (1) _____
- February (2) _____
- March (3) _____
- April (4) _____
- May (5) _____
- June (6) _____
- July (7) _____
- August (8) _____
- September (9) _____
- October (10) _____
- November (11) _____
- December (12) _____

End of Block: Reproductive Management

Start of Block: Sources of Knowledge

Q41 Which of the following methods have you gained knowledge that impacts your management decisions? (Check all that apply).

- ☐ High School Ag Education classes (1)
- ☐ Undergraduate/Graduate classes (2)
- ☐ Extension workshops/bulletins (3)
- ☐ Beef Cattle Industry workshops (4)
- ☐ Newsletter/Magazine (5)
- ☐ Feed Store salesman (6)
- ☐ Pharmaceutical Representative (7)
- ☐ Veterinarian (8)
- ☐ Family Members/Friends (9)
- ☐ Other (please specify) (10) _____

End of Block: Sources of Knowledge

Appendix B

IRB Approval

STEPHEN F. AUSTIN STATE UNIVERSITY

Institutional Review Board for the Protection of Human Subjects in Research
P.O. Box 13019, SFA Station • Nacogdoches, Texas 75962-3046
Phone (936) 468-1153 • Fax (936) 468-1573

Principal Investigator: Candis Carraway
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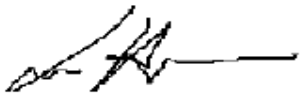
Co-investigators: Hiliary Swor (ts), Candis Carraway, Stephanie Jones, and John Mehaffey

RE: Project Title "Analyzing the Management Practices of East Texas Beef Cattle Producers" Case # AY2020-1161

TYPE OF RESEARCH: Thesis

FROM: Luis E. Aguerrevere, Chair, IRB-H



DATE: March 1, 2020

I would like to thank you for submitting your project entitled "Analyzing the Management Practices of East Texas Beef Cattle Producers" to the IRB for review. It has been reviewed and has been **Approved** based on the following criteria:

> ***45 CFR 46. 45 CFR 46.104 (d)(2): Research that only includes interaction involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior (including visual or auditory recording) if at least one of the following is met: (1) Information obtained is recorded by the investigator in such a manner that the identity of human subjects cannot be readily ascertained, directly or through identifiers linked to the subjects; or (2) Any disclosure of the human subjects' responses outside of the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation or; (3) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects can be readily ascertained, directly or through identifiers linked to the subjects, and an IRB conducts a limited IRB review to make the determination required by 45 CFR 46.111(a)(7). Children may only be included in research under this exemption when involving educational tests or observation of public behavior if the investigator(s) do not participate in the activities being observed and the information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot be readily ascertained directly, or through identifiers linked to the subjects.***

AY2020-1161 Exempt

104(d)(1): Research involving normal educational practices that are not likely to adversely impact students' opportunity to learn required educational content or the assessment of educators who provide instruction such as: (1) Most research on regular and special education instructional strategies; or (2) Research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management.

Your project has approval through **March 1, 2021** should you need additional time to complete the study you will need to apply for an extension prior to that date. The IRB should be notified of any planned changes in the procedures during the approval period, as additional review will be required by the IRB, prior to implementing any changes, except when changes are necessary to eliminate immediate hazards to the research participants. The researcher is also responsible for promptly notifying the IRB of any unanticipated or adverse events involving risk or harm to participants or others as a result of the research.

All future correspondence regarding this project should include the case number **AY2020-1161.**

Vita

After completing her work at Diboll High School, Diboll, Texas, in 2015, Hiliary Cheyenne Swor entered Stephen F. Austin State University at Nacogdoches, Texas. She received the degree of Bachelor of Science in Agriculture from Stephen F. Austin State University in December 2018. In January 2019, she entered the Graduate School of Stephen of Austin State University and received the degree of Master of Science in August of 2020.

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JAS Style Manual

This thesis was typed by: Hiliary Cheyenne Swor