FERTILITY ASSOCIATED ANTIGEN (FAA): ECONOMICS OF TESTING

By

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STATEMENT BY AUTHOR

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DEDICATION

I dedicate this thesis to the people that are no longer with me during this great accomplishment.

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ABSTRACT

Proteins in bull semen have been found that increase fertility, including the fertility-associated antigen (FAA). The uses of FAA-positive bulls have been found in previous studies to increase conception rates at least 16%. Increased fertility rates by FAA-positive bulls increased the number of pregnant cows early in the breeding season

Using historical data to compute an equation that can demonstrate buyers and producers in the Southwestern United States the benefits of using and testing for FAA-positive bulls over time. The cost for addition of a cassette to the BSE testing will be offset by an increase in conception rate, birthing rate, and increase calf weaning weights

This study focuses on the Southwestern United States, but eventually the information may be used nationwide. Fertility-associated antigen is a new science that is being studied to help the cattle industry increase production and profitability.

CHAPTER 1

LITERATURE REVIEW

Introduction

Over the past three years the United States has been in a state of economic turmoil. The stock market decline over the past years combined with destruction of Rangelands from natural disasters has hindered many industries, including cattle production. The price of grain and feed has increased whereas the price of beef has become a moving target. The question in place for producers is whether or not production can continue to bring in capital until this turmoil can be resolved.

The make-up of any ranch operation can be divided into sections that either generate or lose revenue. The herd bull(s) is frequently overlooked as an important source of profit or loss. Sprott et al. (1997) states that typically a bull-to-cow ratio of 1:25 is recommended, but can be wasteful. This is true whether a bull is used for clean-up after artificial insemination (A.I.) or as the main breeding source of a herd. The higher the fertility rates of a bull, then the fewer bulls are needed. Through impregnating more cows, a fertile bull can also exert a substantial effect on genetic merit in the next generation of the herd.

When considering herd bull replacements, bull fertility traits should be a priority consideration by both the buyers and the producers. Certain proteins in bull semen have been found to correspond to increased fertility, including the fertility-associated antigen (FAA). Bulls with FAA on their sperm are 16-18 percent more fertile than herdmates

lacking FAA over a 60-day breeding season (McGinley et al., 2005; Bellin et al., 1994, 1996, 1998). Also, Sprott et al. (2000) state that heifers inseminated once to bulls with sperm-associated FAA had a 16 percent higher pregnancy rate than herdmates inseminated to bulls without FAA on their sperm. Increased fertility rates produced by FAA-positive bulls increased the number of cows which conceived early in the breeding season. This allows for the production of calves with higher weaning weights because more calves are born early in the season. Increased weaning weights increase the pounds of calves sold and resulting sale price. A 16% increase in return, available to producers who incorporate FAA testing, is a large number to overlook in these economic times.

Ranch management cannot overlook a low cost noninvasive application that could increase returns for the herd. This study has been started for the Southwestern United States, but eventually may be used throughout the United States. Use of fertility-associated antigen as a marker of fertility is a science being studied to help the cattle industry increase production and profitability.

General Scenario

The majority of funds invested into research for cattle have been shifted to improved genetic make-up and production output of these herds. McCauley et al. (2004) stated that with a profit margin of $100 per calf, a 1% increase in birth rate would translate into an additional $38 million earned in 2004. Moreover, if each ranch weaned one additional calf, that would generate $80 million in added profit. Producers have changed their prospective on buying bulls: from considering only physical parameters to

focus on genetic testing. Producers have called for funding in reproductive programs to include synchronization trials, nutrition trials, and A.I. practices to increase production output, resulting in a smaller bull to cow ratio. Increase in the frequency of using A.I. techniques and synchronization programs, and use of a good clean-up bull and natural breeders are needed in all herds (Hawkins et. al. 1988a).

In 2007, at the Prescott Livestock Auction, the question asked of ranchers was how they chose a bull at auction to introduce into their herd. The answer should have been an increased sperm count, growth traits of the bull, or even previous pregnancy rate. However, none of those variables were listed as important determinants in their responses (Personal communication, Prescott, 2007). In the Southwestern United States, ranchers are mostly concerned whether a bull can live on their land and access cows distributed across pastures to mate. Most buyers look for bulls under two years of age from breeders that had previous progeny in the herd. Some ranchers were still under the illusion that physical traits that can be seen by the naked eye can determine the most reproductively fit bull including: how high a bull holds his head in the pen, whether the bull's rear is higher from the ground than its shoulders, and sometimes even which way the wind is blowing that day (Personal communication, Dr. Roy Ax, 2009).

Breeding Soundness Exam (BSE)

Producers searching for a cost efficient method to promote the success of a breeding program generally use breeding soundness examinations (BSEs), which have been found to be the most beneficial. Striegal et al. (2009) places the cost of this exam at

approximately $1.50 per cow. The BSE is a prognostication of a bull's ability to get cows pregnant and is typically performed on bulls that are used for natural service. Kastelic et al. (2008) and Hansen (2006) describe that the BSE consists of three major examination categories: 1) overall physical exam; 2) pre-breeding season exam – 30 to 60 days prior to start of breeding season; and 3) post-breeding season exam – if the owner suspects fertility problems. The importance of the bull in cattle-breeding programs is often underestimated. A cow is responsible for half the genetic material in only one calf each year, while the bull is responsible for half of the genetic material in 20 to 50 calves. The bull's ability to locate cows in estrus and breed them is clearly vital to a successful breeding program.

Semen Evaluation

Semen evaluation is a factor that has increased the worth of bulls. Semen is collected in one of three ways: 1) rectal massage – manual massage of the vesicular glands, ampullae, and pelvic urethra; 2) artificial vagina (AV) – collection device consisting of a hard tubular casing with a rubber inner liner filled with warm water to stimulate a bull's penis via temperature and pressure; and 3) electroejaculation – a rectal probe that contains ventral electrodes that stimulate the area near the pelvic-urethra by sending short bursts of electricity over a continuous but increasing pattern to stimulate muscle contractions that initiate the erection process, protrusion of the penis from the sheath, and eventual ejaculation (http://animal.ifas.ufl.edu/courses/ans3316L/, Hafez et al., 2000). Semen is then examined visually for motility, and morphology. The visual

examination notes volume (generally ranging from 1 to 6ml); the semen gross appearance should be creamy white, which is indicative of high sperm concentrations, and free from contaminants including blood, urine, dirt, or pus. Motility observation includes gross motility and individual sperm motility. Morphology relates to any physical abnormalities of the sperm seen by the examiner, including primary abnormalities such as underdeveloped, narrow heads, crater defect on head, abnormal head contour, abnormal midpiece, strongly folded or coiled tail, double forms, acrosome defects, pear-shaped heads, small and free abnormal heads, proximal droplet, and accessory tails and secondary abnormalities such as small normal heads, free normal heads, distal droplet, terminally coiled tail, detached, folded, loose acrosome membranes, giant and short broad heads, abaxial implantation, and simple bent tails (http://animal.ifas.ufl.edu/courses/ans3316L/). Concentration is estimated per ml, and when multiplied by ejaculate volume, total sperm count is computed (Kastelic et al. 2008; Hafez et al., 2000; Wenkoff, M.S., 1987). Sprott et al. (2000) found that pregnancy rates to first service at spontaneous and synchronized estrus are higher when using semen from bulls with detectable FAA on spermatozoal membranes when compared to sperm from bulls devoid of FAA on membrane.

Quality sperm, good health and vision and sound feet and legs are only part of the bull fertility picture. Sprott et al. (1997) suggested libido and serving capacity were important components of a successful breeding bull. High libido is conducive to high fertility, but desire is only a precursor to successful mating. Libido and serving capacity do not correlate well to BSE test results. Bulls may possess quality semen, but may be

unacceptable breeders because of lack of desire or mating ability. Observing bulls during the breeding season for their ability to mate is good management, but tests have been developed to assess serving capacity in bulls before being exposed to cows. Hawkins et al. (1988b) observed bulls during the breeding season for their ability to mate. This study developed tests to assess libido and serving capacity in beef bulls. Test developed for *Bos-indicus*-influenced breeds (Brahman-influenced bulls) are different from test for *Bos-taurus*-influenced breed (British and Continental bulls). The first, a "pen" test is recommended for *Bos-indicus*-influenced bulls, where estrus females are penned with bulls at a male-to-female ratio of 1:1.5 or 1:2. Bulls are observed for 30 minutes with mounts and completed services calculated. Bulls that achieve two or more services are considered high-serving-capacity bulls. Bulls completing one or no services during a 30-minute period are considered low-serving-capacity bulls. The second method of measuring serving capacity can be used on *Bos-taurus*-influenced bulls and involves stanchioned females placed in breeding crates, whether in estrus or not. Female-to-male ratio is 1:1. Bulls achieving more than three services in a 20- to 30-minute period are considered high serving capacity, while those achieving two or three are moderate. Bulls achieving one or no services are classed as low. The degree of serving capacity of each bull was proven to be important. Studies have shown that high-serving-capacity bulls increased pregnancy rates as well as earlier conception dates in comparison to low-serving-capacity bulls. This study found that this resulted in $53 more gross income in cows bred to high-serving-capacity bulls compared to low-serving-capacity bulls (Hawkins et al. 1988a; Sprott et al. 1997; Hansen 2006).

Foote (2003) evaluated past, current and future prospects for fertility estimation. He noted that fertility trials in the past were only estimated means and variations that establish probable differences in cattle. Estimates represent approximate numerical calculations at best, and sometimes they only reflect subjective values. There are certain endpoints in the full cycle of reproduction that can be clearly identified and studied. Researchers are interested in the causes of success or failure of reproduction at each stage, the mechanism involved, and possible treatment of deficiencies. The livestock producer is interested in ways to manage the animal and its environment to lead to a high probability of reproductive success, essential for efficient production. Fertility estimates can be based on a direct measure of fertility or on correlated variables.

Despite the limited role of the male in the many steps in the reproductive process, its potential impact on fertility and genetics is amplified because only a few selected males provide sperm for the production of hundreds of thousands of progeny through A.I. When genetic selection for correlated traits is combined with semen selection, A.I. could have a major favorable impact on fertility. The present procedures for genetic selection are inefficient and costly, but they will improve. Each estimate of fertility must be precisely defined both as to the specific endpoint in the reproductive cycle measured, and the conditions under which the estimate was made. With advances in molecular biology, reproductive technology and genomics, it is almost certain that estimation of genetic potential for high fertility will improve in reliability (Foote, 2003; Hill et al., 1999).

In the past 20 years, research has improved the reproductive output and changed the fertility classification process of beef cattle. Fertility problems have been broken

down to include attributions as 40% to male factors, 40% to female factors, and 20% to particular male/female combination (Hansen 2006). Bulls with equivalent semen evaluation often have dissimilar results in pregnancy percentage as demonstrated by significant differences in fertility rates among bulls which passed the BSE but differed in sperm-FAA content (Bellin et al., 1998). It is a fact that freshly ejaculated sperm cannot fertilize an egg. The mechanism of capacitation is an important contributor to the observed variation in fertility between bulls evaluated as equal in terms of physical parameters.

Capacitation

In mammals, freshly ejaculated sperm are incapable of fertilizing the egg. They gain this ability during their transit through the female reproductive trace. After ejaculation, bovine spermatozoa reside in the reproductive tract over a 6-8 hour time span, during which time they undergo a series of structural and functional modifications collectively known as capacitation. Capacitation is the final step in the maturation of spermatozoa and is required to render them competent to fertilize an oocyte. This step is a biochemical event; the sperm move and look normal prior to capacitation. Both Min Chueh Chang and C.A. Austin (1951) independently reported the discovery of this process. Many biochemical changes are required for capacitation. These include the removal of adsorbed components from the sperm surface, a change in membrane lipid composition, increased permeability to certain ions such as Ca^{2+}, a change in internal pH, and an increase in plasma membrane fluidity and in metabolism. There is also an

increased hyperactivity that is believed to result from the redistribution of membrane components during capacitation (Lane et al. 1999).

Capacitation involves the destablization of the sperm head membrane by the removal of sterols (cholesterol) and non-covalent bound epididymal/seminal glycoproteins. A heterotrimeric integral membrane protein, Na^+/K^+ATPase belongs to the family of P-type ATPases; is composed of two polypeptides, alpha (110kDa) and the glycosylated beta (55kDa); and is active in may cell types, including testis and spermatozoa. The alpha polypeptide is the catalytic unit of the enzyme, containing the binding sites for cations, cardiac glycosides, and ATP. The alpha 1 and testis-specific alpha 4 isoform of Na^+/K^+ATPase (ATP1aI and ATP1A4) have been isolated from the testis and are localized in spermatozoa. The inhibition of the activity of the ATP1A4 isoform has shown to eliminate sperm motility. The beta polypeptide is involved in the maturation of the enzyme, localization to the plasma membrane, and stabilization of the K+-occluded intermediate form of the protein. Studies have shown that spermatozoa intracellular Ca^{2+} is regulated by the Ca^{2+} –ATPase pump which acts as a Ca^{2+} extrusion pump. The result is a more fluid membrane with increase permeability to $Ca^{2+.}$ An influx of Ca^{2+} produces increased intracellular cAMP levels and thus, an increase in motility. Hyperactivity is also a part of capacitation and is the result of the increased Ca^{2+} concentrations. By secreting sterol-binding albumin, lipoproteins, proteolytic and glucosidasic enzymes, the uterus aids in the steps of capacitation. Sperm then have acquired the capacity to fertilize (Baldi et. al. 1996; Lamirande et al. 1997; Thundathil et al. 2006; Fraser and McDermott, 1992).

Seminal Proteins

Families of specific large molecular weight glycoconjugates called proteoglycans are components of the extracellular matrix, which are involved in influencing the behavior of many cells. Proteoglycans contain a core protein with glycosaminoglycan (GAG) side-chains. The most common GAG is heparin. Heparin is composed of repeating disaccharide units, which are variably sulfated. Heparin has been found to bind to numerous proteins including: collagens, IGF's, IGFBP's, hyaluronidase, IL-3, interferon, TGF-β, and numerous seminal proteins. The heparin-like GAGs are present in many tissues, including the male and female reproductive tracts of cattle, humans and sheep. At ejaculation, sperm are coated with heparin-binding proteins (HBP) secreted from the seminal vesicles, prostate, and Cowper's glands. Sperm leaving the epididymis are devoid of those HBP, which potentiate heparin-induced capacitation (Miller, 1989; Yanagimachi, 1994; Baldi et. al., 1996).

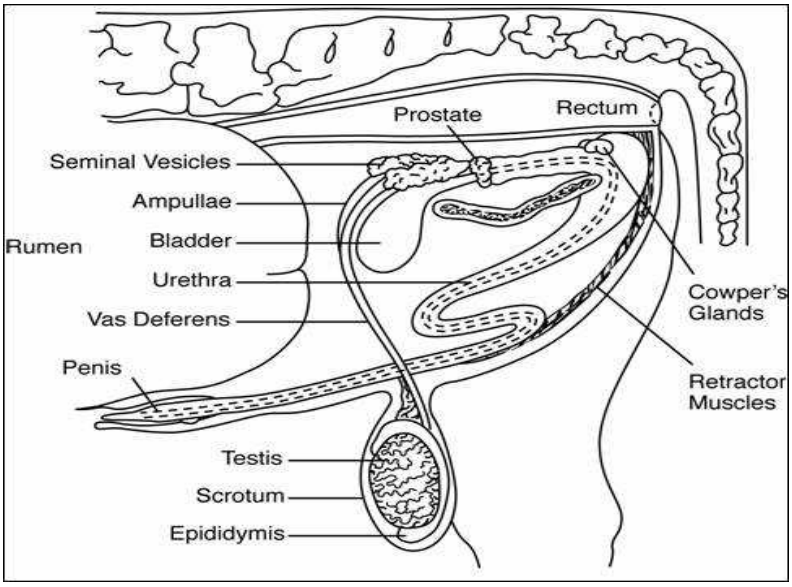


Illustration 1. The reproductive tract of the bull. This illustrates the various parts of the bull's reproductive tract. Sperm is produced continuously by the testes and stored in the epididymis. The prostate gland, seminal vesicles and cowper's glands secrete the fluid component of the semen. During mating, the penis is extruded from the sheath by the straightening of the S-shaped sigmoid figure; sperm are transported up the vas deferens to the urethra and exit via the penis (Lunstra 1978).

In all mammals, capacitation and the following acrosome reaction of spermatozoa are the essential steps prior to a successful fertilization and formation of a zygote. The process of acrosome reaction comprises the fusion and vesiculation of the sperm outer acrosomal membrane and the overlying plasma membrane. The release of an acrosomal content and exhibition of the inner acrosomal membrane occurs. When sperm bind the zona pellucida of the egg, the acrosome reaction commences. Acrosomal contents, including surface antigens and numerous enzymes are responsible for breaking through the egg's tough coating and allowing fertilization to occur (Jankovicova et al., 2006). Miller et al. (1989) showed that in epididymal sperm the acrosome reaction occurred approximately 22 hours after ejaculation, but sperm were unable to bind to the zona

pellucida. However if sperm were exposed to seminal plasma, the response to heparin occurred nine hours after exposure. Exposure to seminal plasma increased the number of binding sites for heparin, indicating proteins in seminal plasma conveyed the capacitating effects of heparin (Bellin et al., 1994, 1996, 1998).

The presence of heparin binding protein (HBP) on the sperm membrane corresponds to an increased fertility potential in range bulls. Bull semen samples with HBP on the membrane bind with higher affinity and undergo an increased frequency of acrosome reaction in response to GAG. Studies have found that the acrosome reaction predictive of nonreturn rate has a squared correlation coefficient (R^2) of 0.81 (Lamirande et al. 1997). Sperm from higher fertility bulls are more susceptible to capacitation effects of heparin in vitro and the binding affinity sperm display for heparin is higher in more fertile bulls (Ax et al., 1985; Lenz et al., 1983a).

Miller et al. (1990) first isolated heparin binding proteins by high performance liquid chromatography (HPLC). HPLC is a form of column chromatography used to separate components of a mixture by using a variety of chemical interactions between the substance being analyzed and the chromatography column. Two studies employed a monoclonal antibody and Western blots to visualize HBP patterns in detergent extracts of bovine sperm. Five protein families were identified and a monoclonal antibody was raised (Bellin et al., 1994) which recognized 31, 27, 24 kDa variants. Unique seminal proteins were identified (14-18 kDa, 24 kDa, and 31 kDa proteins) and studies began to understand their impact on bull fertility (Bellin et al., 1994, 1996, 1998).

The specific proteins found in bovine semen that reflect fertility potential include osteopontin (OPN), a lipoclin-type prostaglandin D (PGD) synthase, fertility associated antigen (FAA) and type-2 tissue inhibitor of metalloproteinases (TIMP-2) (McCauley et. al., 2001; Dawson et al., 2002; Erikson et al., 2007). Since a specific gene encodes for a particular protein, the potential exists to easily screen for these predictors of fertility. Single nucleotide polymorphisms (SNPs) in genes are becoming a valuable tool in both proteomics and genomics. Subtle mutations in the gene from one individual to another can be detected, suggesting that methods could be developed to predict fertility long before puberty.

The 24 and 31 kDa proteins from the Miller (1990) studies bound heparin with the highest affinity and facilitated heparin-induced capacitation. A monoclonal antibody for the 31-kDa protein designated M1 was subsequently developed. The 31-kDa protein was purified, characterized and named fertility associated antigen (FAA; McCauley et al., 1999). High fertility bull samples were found to show a presence of FAA in Western blot tests, and absence of FAA occurred in low fertility bulls (Bellin et al., 1994, 1996, 1998, Sprott et al., 2000).

Breeding Trials

From 1991 to 1998, controlled field trials were performed at King Ranch. Only bulls that had passed the BSE were included in those trials. Breeding seasons were set up on 60-day rotation patterns, and 1 bull was to service 25 cows in multiple-sire replicated pastures. Collectively, of more than 20,000 cows evaluated, bulls that were FAA positive

were found to have 79.9% pregnancy rate versus the FAA negative bulls with only a pregnancy rate of 63.6%. The mean pregnancy rate for all bulls in these studies 73.6%. Bulls with FAA achieved pregnancy rates that were 9 to 40 percentage points higher than herdmates producing sperm without the antibody epitope. It was later found that semen from bulls with FAA on sperm used during A.I. of mature cows and heifers, either at natural or synchronized estrus, resulted in greater conception rates than semen from bulls without FAA on sperm (Sprott et al. 2000). FAA positive bulls have been found to have a 17% higher fertility rate upon first service than FAA negative stock in both A.I. and natural mating trials. This led to an increase in the number of calves born earlier during the calving season. This in turn also significantly increased the weaning weights of the calves born to sires that were FAA positive (Bellin et. al., 1994; Bellin et. al., 1996). Bellin et al. (1998) showed the results from this study as follows:

	FAA in Sperm Membranes		
	Present	Absent	Total Numbers
No. Bulls	242	192	434
No. Cows Bred	5,317	4,497	9,198
No. Cows Pregnant	4,497	2,572	7,069
Pregnant (%)	85	66	77

Table 1: Fertility of cows bred to bulls with or without detectable FAA on sperm.

No. Females	No. Bulls	Bull FAA Status	No. preg. to 1st service (%)	Proj. No. Preg. by 3 Serv. (%)
386	7	Negative	192 (49.7)	283 (73.3)
764	18	Positive	501 (65.6)	673 (88.1)
Total 1150	25			

Table 2: Number of females pregnant to first A.I. service and projected number pregnant after 3 services to semen from FAA negative (-) or FAA positive (+) sperm.

Days of Calving Season	Prior to FAA testing – 1991 223 head		1995 262 head		1998 489 head	
	%	Wean Wt.	%	Wean Wt.	%	Avg. Wean Wt.
1-20	43.0	590	51.5	586	61.2	569
21-40	35.4	542	31.3	539	25.3	535
41-60	16.1	476	10.3	471	11.1	490
	94.5		93.1		97.6	

Table 3: Distribution of calving season in the nucleus herd at King Ranch. Cows were bred to FAA positive bulls, and their retained daughters have only been bred to FAA positive bulls.

These results are consistent with prior assumptions about the increased importance of FAA. In 1998, FAA positive bulls had a reproductive efficiency pregnancy rate of 85% versus FAA negative bulls that were only at 66%. Within 6 years, there are 20% more calves being born within the first 20 days of the calving season, leading to higher weaning weights for those earlier born calves. As a result, the higher numbers of heifers

fertilized in the first breeding of the season would increase calving numbers to 12,000 plus cows by the time of sale (Bellin et al., 1998).

Cassette to Simplify FAA Testing

Testing bulls for FAA using laboratory methods is costly and requires time. To incorporate these findings into the general practice of BSE's, a faster and less costly mechanism was needed. In January 2004, a patented lateral-flow cassette containing reagents to detect FAA entered the market (McCauley et al., 2004).

Midland BioProducts was established in 1987 with only 48 employees. This company began producing reagents for Human Clinical Chemistry kits including antibodies, calibrators, and controls. In 1994, the company ventured out into the field of bovine and equine reagents. The partial nucleotide sequence encoding FAA was used by Midland Bioproducts in order to synthesize an immunogen to create FAA antisera. One recombinant form that spanned amino acids 73-269 was found to be much less hydrophobic than the native FAA protein. This recombinant fragment was expressed in *E. coli* and used to generate rabbit polyclonal antisera. This recombinant FAA was also immunogenic, and the antisera were monospecific for FAA. In addition, immunolocalization performed with the antisera revealed specific binding of FAA to the acrosomal region on the head of bull sperm (McCauley et al., 2004). Midland BioProducts incorporated the antisera onto a lateral-flow cassette, which is marketed by ReproTec, Inc. (McCauley et al., 2004). The lateral flow cassette can now be used to test bull semen for the fertility-associated antigen. The advantage to this type of cassette is

that it is accurate, fast, does not easily expire, does not need to be refrigerated, and is easy to use on site.

When using the cassette a sample of dilute semen is exposed to the labeled anti-FAA antibody (McCauley et al. 2004). The sample and labeled antibody conjugate migrate along the membrane via capillary action and are exposed to immobilized anti-FAA antibody at a test position. The presence of FAA in the sample is evidenced by binding of the FAA and labeled antibody to the immobilized antibody, resulting in colorimetric visualization of the label at the test position. A control reagent, which serves as a substrate for unbound conjugate, is applied to the membrane at the control position. Visualization of the control band verifies that the cassette performed correctly, regardless of the presence or absence of FAA in the sample. The following is an illustration taken from this paper that shows pictorially how this works:

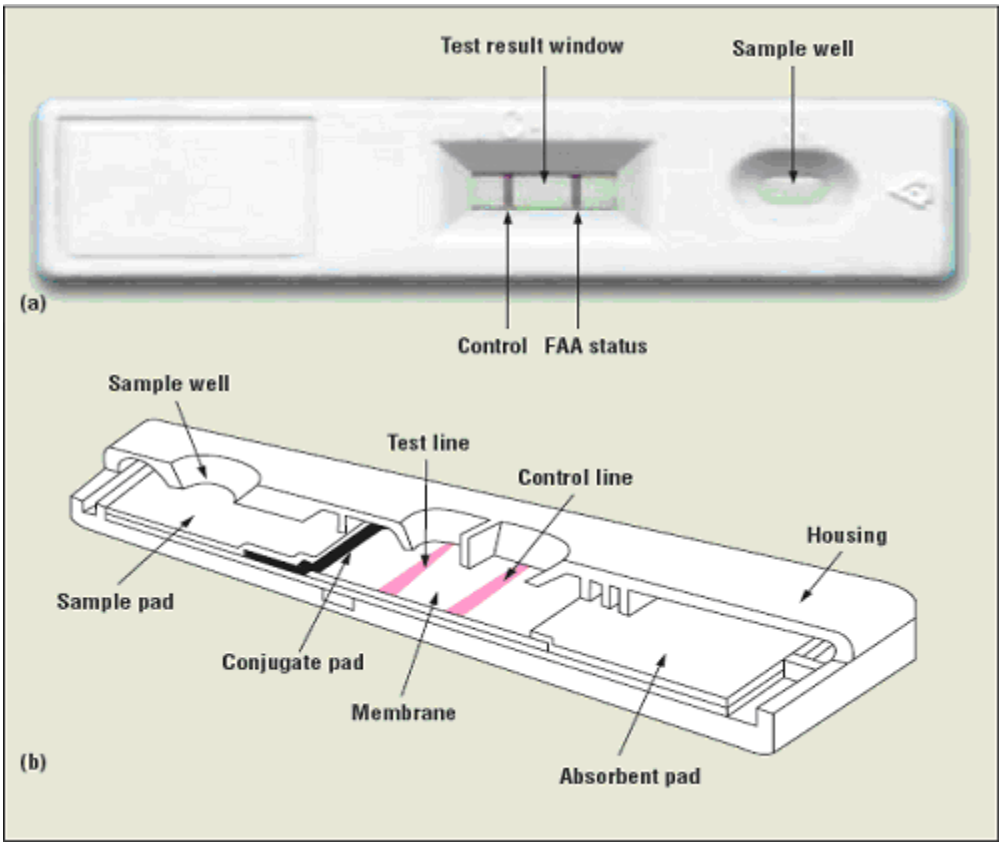


Figure 1. Lateral-flow cassette for detection of fertility-associated antigen (FAA) in bull semen developed by Midland BioProducts (Boone, IA). a) Picture of a lateral-flow cassette displaying the colorimetric development of control and test lines. b) Schematic showing the internal design present within the housing of the cassette. The sample migrates by capillary action over the conjugate pad before reaching the test and control lines, respectively McCauley et al. (2004).

At a cost of $45 for a single test kit, or $30 if more than 100 tests are ordered, a cost benefit analysis over time was needed to support introducing this additional cost to the budget for producers (http://www.reprotec.us).

McCauley et al. (2005) conducted the first cost benefit analysis of incorporating the cassette test into a herd breeding program. The following table illustrates the cost-benefit return of screening for FAA if a bull is used for four years and is exposed to 25

cows/heifers annually for breeding purposes. The table assumes that replacing a bull categorized as FAA negative with one that is FAA-positive will yield 15% more calves.

Item	Individual Sale ($)	Bulk Sale ($)
Cost per Bull for FAA test[a]	45	30
Cost per cow-yr 1[b]	1.8	1.2
Cost per cow-4 yrs[c]	.45	.30
Net value of add'tl calf	50	50
Add'tl calves; 15% per yr[d]	3.75	3.75
Value of add'tl calves per yr	187.5	187.5
4 yr return	750	750
Return/cow (4yrs)	7.5/.45=16.7-fold	7.5/.3=25-fold

[a] 2004 retail prices for purchase of a single test kit ($45) or volume discounted test kits ($30), respectively.
[b] One bull:25 cows each year.
[c] Based on 4 yr herd life per bull.
[d] Assumes 25% of bulls are FAA-negative.

Table 4. Cost benefit analysis of FAA testing of herd sires. Values are computed for two different cost scenarios: 1) Individual sale - $45 and 2) bulk sale - $30. The table assumes that replacing a bull categorized, as FAA negative with one that is FAA-positive will yield 15% more calves (McCauley et al., 2005).

Economics of FAA Testing

Ax et al. (2010) shows the impact of calving period on weaning weight and its economic benefit when shown for the return on investment.

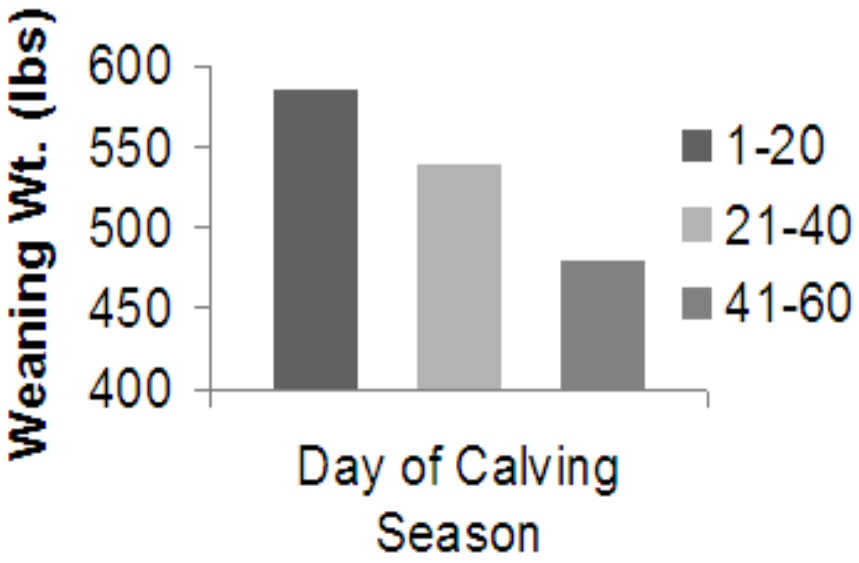


Figure 2. Shows the impact of early calving period on weaning weight. Increased fertility rates produced by FAA-positive bulls increased the number of cows bred early in the breeding season (Ax et. al. 2010).

With this information, one can calculate the cost per head of testing bulls and their return per extra lbs upon weaning weight. In 100 cows exposed at 11 lbs/head additional weaned beef: 1) $1.00/lb would equal $11.00 per exposed cow and $0.70/lb equals $7.70 per exposed cow. If you test 4 bulls at $45.00 per test it would cost $180 or at $30.00 per test at $120 (dependent on if bought in bulk or at the per cassette cost), the return would be as follow:

	Return on Investment	
Beef Price	$45.00/FAA Test	$30.00/FAA Test
$1.00/lb	1100/180=6.11	1100/120=9.16
$0.70/lb	770/180=4.27	770/120=6.41

Table 5. Return on investment of testing for FAA positive bulls by considering increase in calf weaning weights at time of sale (Ax et. al. 2010).

If 20% more claves are born from the first cycle, this would produce 100 lbs advantage in weaning weight along with if 10% more calves are born from the second cycle, this would produce 40 lbs advantage in weaning weight. If 15 more calves are born per 100 cows exposed: 9 during the first cycle at 100 lbs/calf would equal 900lbs when weaned, and 5 during the second cycle at 40 lbs/calf would equal 200 lbs weaned with a total of 1100 extra lbs.

Considering this information, this product needed to be able to be marketed to producers with a variety of different sized herds with different make-ups. Is this technology cost worthy to producers to incorporate into management practices during the current economic turmoil? The Objective of this study was to address that question and provide cattle producers with an objective, economic-based analysis of the overall value of testing for a biochemical marker, FAA, in their herd(s).

CHAPTER 2

EXPERIMENTAL OVERVIEW

Abstract

Fertility has many components and stages, which require that males and females be functionally capable of carrying out all critical stages if each generational reproductive cycle is to be completed. Fertility as a trait is 5 to 10 times more important to profitability than any other trait in a beef herd. Breeding soundness evaluations (BSE) can be performed to evaluate whether a bull can be classified as a potential satisfactory or unsatisfactory breeder. Bulls that qualify from BSE test cannot be ranked on fertility potential from that test.

FAA-positive bulls have been found in previous studies to increase conception rates resulting from the use almost 16%. Increased fertility rates by FAA-positive bulls increased the number of cows bred early in the breeding season, thus allowing for more calves with increased weaning weights. Increased weaning weights will, in turn, increase pounds of calves sold.

Three model herds (150 head, 500 head, and 1500 head) were produced and incorporated into three separate scenarios (No FAA testing, Partial FAA testing, and Complete FAA testing) to test the monetary value of testing for FAA in existing herds with a non-evasive chute test. Using previous fertility values, both partial testing and complete testing of herds were found to be highly beneficial to a producer’s bottom line.

Introduction

Fertility traits in bulls are more important to buyers and producers than most other traits in beef cattle herds. Certain proteins in bull semen have been found that are associated with increased fertility, including fertility-associated antigen (FAA) (McCauley et al., 1999). Previous studies have shown that FAA-positive bulls have 16% higher conception rates than their counterparts (Sprott et al., 2000). Higher fertility rates by FAA-positive bulls will increase the number of cows bred early in the breeding season, thus allowing for more calves with increased weaning weights. Increased weaning weights will, in turn, increase selling prices (Ax et al., 2010).

Working with the scientist who developed the testing devices for FAA (FAA-cassette), FAA-cassette vendors, and an agricultural economist, we used historical data to produce a model that can demonstrate to buyers and producers in the Southwestern United States the benefits of using and testing for FAA-positive bulls over time. Since semen is already collected for BSE on bulls offered for sale, we are attempting to show that the cost for addition of a cassette used in combination with BSE testing will increase that herd's conception rate, calving output, and increase calf weaning weights. This equation will in the end help show a multi-year fertility effect of how bringing in FAA-positive bulls can increase a producer's profitability depending on where its herd began utilizing FAA testing.

This study was started for the Southwestern United States, but eventually may be used nationwide or even worldwide. The Southwestern United States was chosen as the test case scenario for this study because this area has been found to have the most

depressed producers of cattle and the hardest terrain for breeding. Also, in conjunction with data previously collected from the King Ranch field trials, these numbers can be used to help validate the results from this economic model.

An economic model was developed to determine value to a rancher from testing bull semen for the presence of FAA. For the model, ranches of 150, 500, or 1500 head of cattle were contrasted. All inputs were from the Arizona Rancher's management guide published by the Department of Agricultural and Resource Economics. Feed costs were based on audited values. For example, annual hay costs were valued at $13.76 per head, salt and mineral was $7.22 per head, and average protein supplementation was $16.41 per head (Cooperative Extension, 2006).

To evaluate whether this cassette had economic value to producers, a multiyear investment plan was produced. This table incorporates all aspects of an individual farm dependent on size. The first aspect of this plan was the Ranch Investments needed to be included into the yearly cost analysis of each herd. The Ranch Investments included the number of buildings and improvements, the number of machinery and vehicles, and purchased livestock needed to run an establishment of each sized herd. Next, a Multiyear Budget was created to include both fixed and variable costs of running a herd yearly. Finally, the herd-planning sheet was created to be accountable for the variations in herd productive output dependent on fertility traits.

Materials and Methods

Ranch Descriptions

Three herd sizes with three different breeding practice models were produced and compared. The herd sizes were set as 150 head, 500 head, and 1500 head.

Herd Size	**150 Head**	**500 Head**	**1500 Head**
Livestock Inventory	Bred cows (114) Bred Heifers (21) Total weaned/ yearling heifers (15) Bulls (8) Horses (2)	Bred cows (440) Bred Heifers (40) Total weaned/ yearling heifers (40) Bulls (24) Horses (10)	Bred cows (1140) Bred Heifers (210) Total weaned/ yearling heifers (150) Bulls (76) Horses (25)

Table 6. Ranch descriptions broken down in a side-by-side comparison used for this study based on previous studies and conversations with Dr. Ax and University of Arizona economist Trent Teegerstrom.

Each herd was then placed under three different scenarios: 1) No FAA testing, 2) Partial FAA testing, and 3) Complete FAA testing. In the No FAA testing herds, the average normal fertility of a non-tested herd was used as a constant for this model. In the Partial FAA testing herds, in Year 1, half of the initial herds' bull population was tested for FAA and all replacement bulls purchased for the herd from then on were tested. This model includes the price for the cassette and the labor cost for testing each bull. In the Complete FAA testing herds, all bulls in the initial herd and all replacement bulls were tested using the FAA cassettes. This model, like the Partial FAA testing models included the price for the cassette and the labor cost for testing.

Test Case Scenario Set-Up

	No FAA Testing	**Partial FAA Testing**	**Complete FAA Testing**
150 Head	Test Case Scenario 1.1	Test Case Scenario 1.2	Test Case Scenario 1.3
500 Head	Test Case Scenario 2.1	Test Case Scenario 2.2	Test Case Scenario 2.3
1500 Head	Test Case Scenario 3.1	Test Case Scenario 3.2	Test Case Scenario 3.3

Table 7. Test Case Scenario Set-Up shows a description of the breakdown of each test case scenario based on herd size and testing procedure used.

Assumptions

The following assumptions refer to the following models and reflect the typical costs and returns associated with beef cattle production in the Southwestern United States. The practices described are based off of production practices and materials considered typical of a well-managed beef cattle operation in the region, as determined by previous cooperative extension studies run by agricultural economists. Cost, materials, and practices are not applicable to all operations, as production practices vary among ranchers within the region and across different regions. From the information found in past studies, the assumptions of the data output of this study were that all herds that incorporated testing would have a cost deficit for the cost of the cassette and labor associated with testing, but would make up for the cost exponentially over the following years. By starting each model off with no loans or investments initially, the numbers would be negative to begin with, but would eventually regain positive balances. It was also hypothesized that herds that utilized complete FAA-tested models would show a greater impact of cost-benefit versus the partially FAA tested models.

Multiyear Budget

Refer to NoFAAtesting150head.xls, PartialFAAtesting150head.xls, CompleteFAAtesing150head.xls, NoFAAtesting500head.xls, PartialFAAtesing500head.xls, CompleteFAAtesting500head.xls, NoFAAtesting1500head.xls, PartialFAAtesting1500head.xls, and CompleteFAAtesting1500head.xls for the exact figures used in this study.

Production Information, Operating Receipts, and Capital Receipt: These costs were introduced from calculations incorporating numbers from the herd-planning sheet. The equations were proven in previous studies preformed by the University of Arizona Economics division.

Variable Costs (All costs are estimated costs for the models to estimate real life rancher's needs.)

*FAA Test Costs***:** No cost was ensued in models that were run having no FAA testing within them. In the Intermediate and All FAA testing models, the cassette was added in as a cost of $45.00 per cassette used and labor was inferred at an additional $35.00 per bull tested.

Feed: The forage base for the ranch was based on the Arizona state Plateau region land ownership plan. The land ownership mix common to this region consists of approximately 45% grazing occurring on state land, 32% on private land, 12% on United States Forest Service (FS) land, and the remaining 11% on Bureau of Land Management (BLM) land. Additional hay cost was found to be at an average of $13.76 per head per year from multiple 2006 cooperative extension production costs and returns publishings.

From these same cooperative extensions (2006) the salt and mineral cost was found as an average of $7.22 per head per year and the average protein supplementation was $16.41 per head per year.

Veterinary/Medical: Cows and replacement heifers received a pregnancy check in November and were provided with an external insecticide, 7- or 8-Way vaccine, and an oral de-wormer. Weaned, replacement heifers are provided IBR, BVD, P13, BRSV, 7 or 8 Way, oral de-wormer, Naselgen, and Bangs vaccinations. Steer and heifer calves were branded, earmarked, de-horned in May, and vaccinated with 7 or 8 Way and Naselgen. Steers were also given implants and castrated in May. Total annual veterinary costs were computed at $20.00 per head.

Marketing/Checkoff: Calves were marketed through Video Marketing Sales in the winter with a November/December delivery. Cull animals were marketed through local auction markets. Annual marketing costs were calculated at 2% of total revenue. Check off fees were $1.00 per animal sold.

Horse Maintenance: Costs for shoeing horses, veterinary, and feed expenses were based on costs as reported by the producer panel, approximately $320.00 annually per head.

Labor: Labor included one hired employee, and one owner/manager. Hired labor costs included a monthly salary of $1,725.00 per hired labor unit per month (which is an average of multiple 2006 cooperative extension production costs and returns publishings). The owner/manager received 6% of the total variable costs. All employee benefits, payroll taxes, and worker’s compensation insurance were included in labor costs.

Overhead and Capital Recovery Costs

*Administrative Cost***:** Accounting and legal fees including office and travel costs were estimated at $5.00 per head per year. These expenses included office supplies, telephone services, Internet services, and travel expenses to educational seminars.

*Investment Repairs***:** Annual repairs were provided for all ranch investments or capital recovery items that required maintenance. Annual repairs were calculated at 2% of the purchase price for buildings and equipment and 7% of the purchase price for machinery and vehicles. This includes fuel and lube for all machinery and vehicles.

*Professional Fees and Insurance***:** Liability/insurance covers accidents on the farm at an annual cost of $3,000.00 per 500 head.

*Miscellaneous Costs***:** For additional costs and unforeseen complications on the farm, an annual cost of $20.00 per head was incorporated into the model.

Ranch Assets

Using the knowledge and educational background of Dr. Roy Ax and Dr. Trent Teegerstrom, ranch assets were constructed dependent on the number of head per herd. Refer to NoFAAtesting150head.xls, PartialFAAtesting150head.xls, CompleteFAAtesing150head.xls, NoFAAtesting500head.xls, PartialFAAtesing500head.xls, CompleteFAAtesting500head.xls, NoFAAtesting1500head.xls, PartialFAAtesting1500head.xls, and CompleteFAAtesting1500head.xls for usage of this information in these test case scenarios. The following is the breakdown of these findings:

Herd Size	150 Head	500 Head	1500 Head
Acres of private land	15 acres	40 acres	500 acres
Miles of pipeline	5 miles	10 miles	50 miles
Wells	2	2	14
Dirt tanks	3	10	74
Miles of fence	50 miles	100 miles	300 miles
Corral/working facility	1	1	5
Barn/shop	1	1	5
½ ton pick-up 4WD	0	1	2
¾ ton pick-up 4WD	1	1	4
Dozer/tractor	1	1	2
Gooseneck trailer	1	1	4
Horse tack	1	1	1
Stock truck	0	1	2
Water truck	0	1	1

Table 8. Ranch Assets dependent on herd size.

Results

150 Head

Test Cast Scenario 1.1 No FAA Testing – Ranch Description

The livestock inventory consists of 114-bred cows, 21 bred heifers, and 15 total weaned/yearling heifers, 8 bulls, and 2 horses. No bulls were tested for FAA in this model. Conception rate of purchased bred cows and cow/calf pairs was constant at 80% with a death loss of 2% and a cull rate at a constant 20%. Conception rate of the cows that survived at least one culling cycle was constant at 70% with death loss of 2%. The maximum cow to bull ratio was set at 15 with a bull cull rate of 20%. Only during the

first year of operation were any raised heifer calves retained to increase herd size the following year to not exceed Total Authorized Unit (AU) capacity.

Test Cast Scenario 1.2 Partial FAA testing – Ranch Description

The livestock inventory consists of 114-bred cows, 21 bred heifers, and 15 total weaned/yearling heifers, 8 bulls, and 2 horses. Half of the initial bull population was tested for FAA and all replacement bulls thereafter were tested. Conception rate of purchased bred cows and cow/calf pairs was at a variable increase that began with the standard in the first year at 80% and due to testing, slowly increased over the following 6 years to a conception rate of 95% with a death loss of 2% and a cull rate decreasing in tandem with the conception rate. Conception rate of the cows that survived at least one culling cycle was also affected with year 1 at the constant 70 % and slowly increasing over 5 years to 85% with death loss of 2%. The maximum cow to bull ratio was set at 15 but increased to 20 over time due to the FAA positive bulls having the ability to mate and impregnate at a higher rate than negative bulls, with a bull cull rate of 20%. Only during the first year of operation were any raised heifer calves retained to increase herd size the following year to not exceed Total AU capacity.

Test Cast Scenario 1.3 Complete FAA Testing – Ranch Description

The livestock inventory consists of 114-bred cows, 21 bred heifers, and 15 total weaned/yearling heifers, 8 bulls, and 2 horses. All bulls in the initial herd and all replacement bulls thereafter were tested. Conception rate of purchased bred cows and pairs was at a variable increase that began with the standard in the first year at 80% and was given a faster increase in productivity to increase to a conception rate of 95% within

4 years with a death loss of 2% and a cull rate decreasing in tandem with the conception rate. Conception rate of the cows that survived at least one culling cycle was also affected with year 1 at the constant 70 % and within 3 years increasing to 85% with death loss of 2%. The maximum cow to bull ratio was set at 15 but increased by year 2 to 20 due to the FAA positive bulls having the ability to mate and impregnate at a higher rate than negative bulls, with a bull cull rate of 20%. Only during the first year of operation were any raised heifer calves retained to increase herd size the following year to not exceed Total AU capacity.

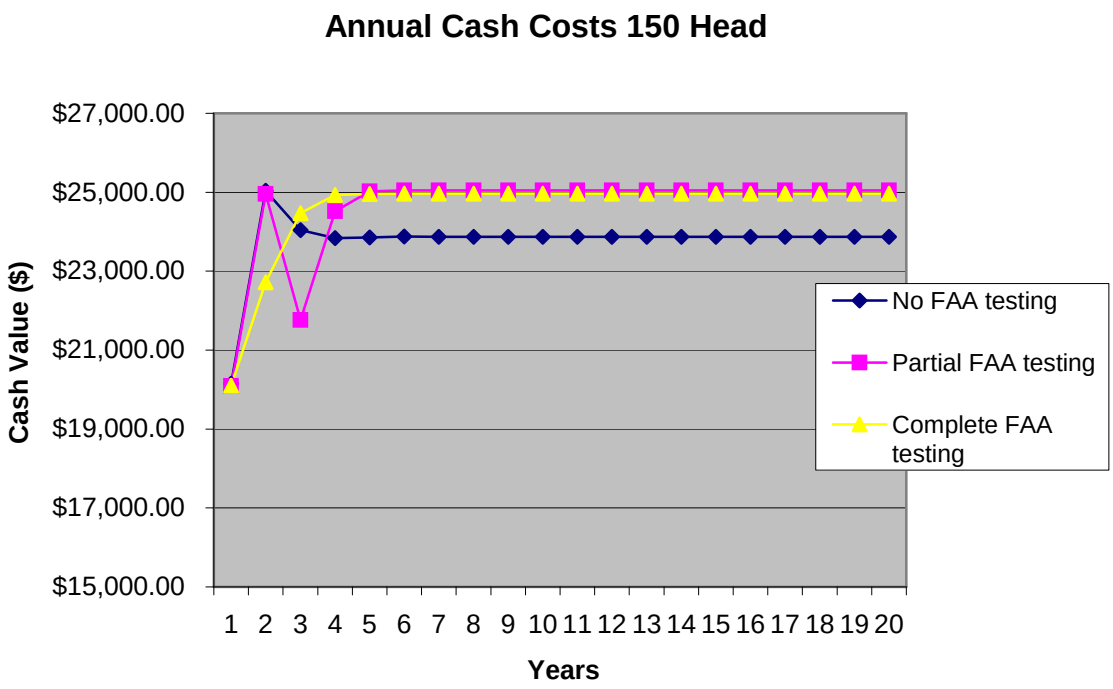


Figure 3. The annual cash cost is the cost of replacing stock on a 150 head herd using the parameters in this study over a 20-year time span.

Figure 3 illustrates the annual cash cost of replacing stock on a 150 head herd using the parameters in this study over a 20-year time span. This includes the cost of purchasing bulls, testing for FAA, purchasing bred cows, bred pairs, bred heifers (2+ years old), weaned/yearling heifers, feed costs, variable costs, interest on variable costs.

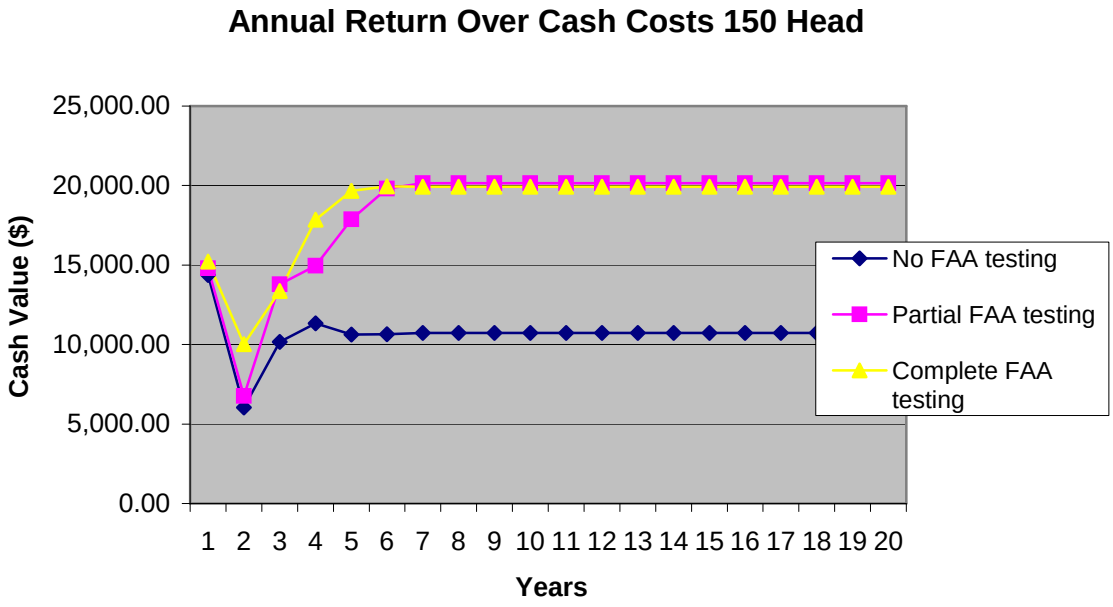


Figure 4. The annual return over cash cost consists of the cost of running a 150 head herd per year dependent on production variable costs and restocking costs.

Figure 4 illustrates the annual return over cash cost that consists of the cost of running a 150 head herd per year dependent on production variable costs and restocking costs. Due to lack of base funding for the initial year, the drop in profit by year 2 is appreciable.

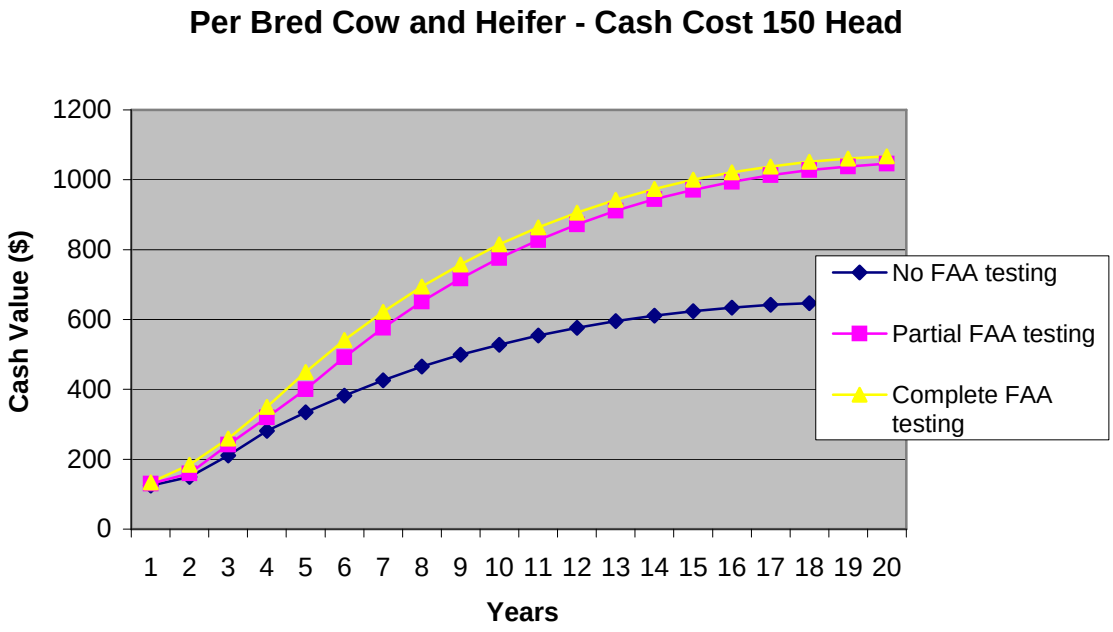


Figure 5. The annual cash cost of a cow and heifer unit consists of the cost of running a 150 head herd per year dependent on production variable costs and restocking costs

Figure 5 illustrates the annual cash cost of a cow and heifer unit, which consists of the cost of running a 150 head herd per year dependent on production variable costs and restocking, costs. This is the rancher return per cow& heifer unit.

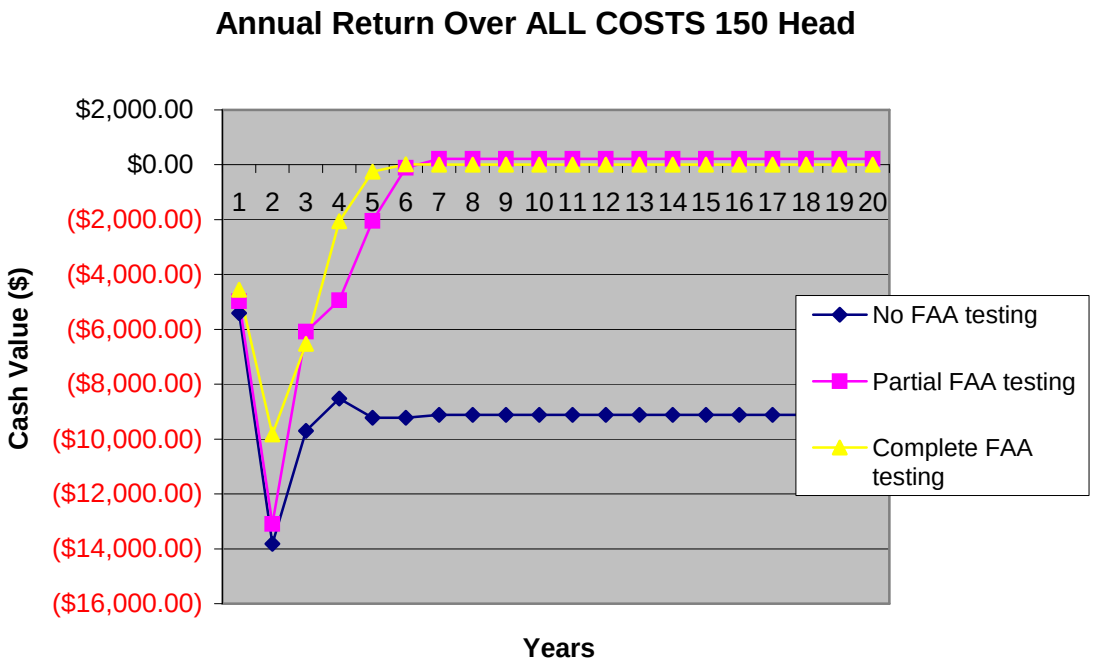


Figure 6. Annual return consists of the cash return of all cost above the ranch cost

Figure 6 illustrates the annual return, which consists of the cash return of all cost above the ranch cost. This includes the deduction of ownership costs and management/labor costs. Due to lack of base funding for the initial year, the drop in profit by year 2 is appreciable.

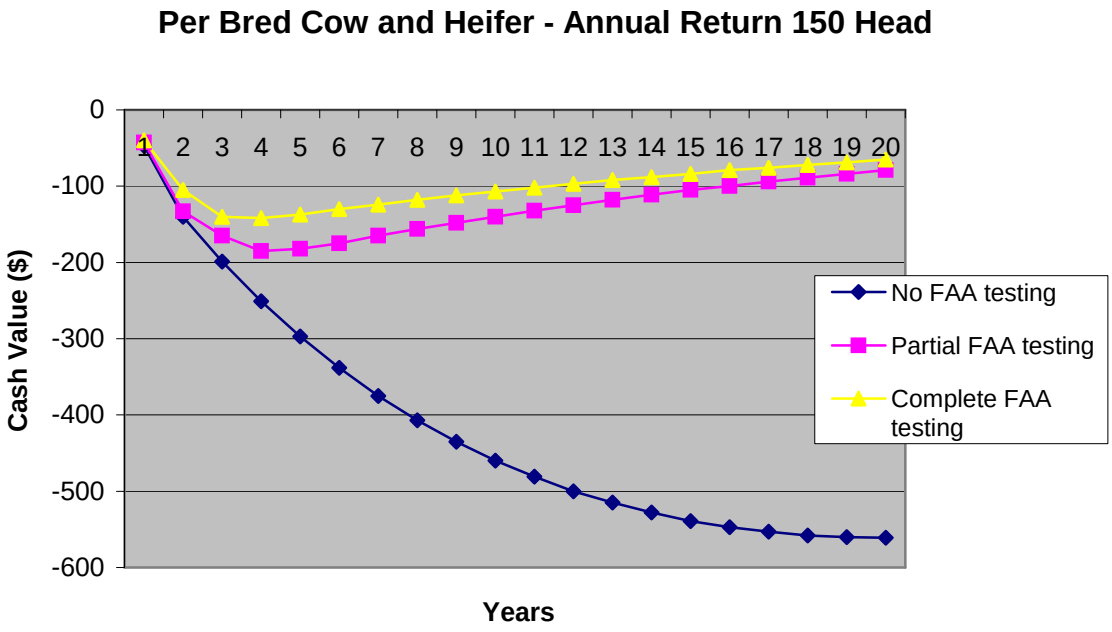


Figure 7. The annual cash return of a cow and heifer unit above the ranch costs per year in a 150 head herd.

Figure 7 illustrates the annual cash return of a cow and heifer unit above the ranch costs per year in a 150 head herd. In such a small herd size, the no FAA testing scenario shows a gradual decrease in bred cow and heifer annual return with no rebound.

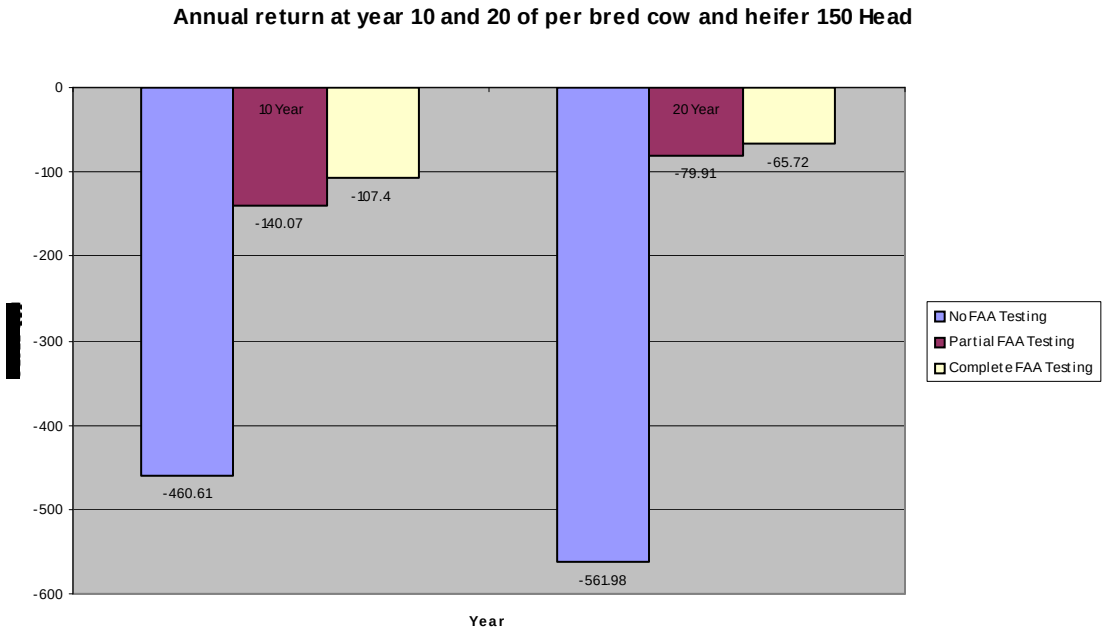


Figure 8. Comparative of the three scenarios of cow/calf return values at year 10 and year 20.

500 Head

Test Cast Scenario 2.1 No FAA Testing – Ranch Description

The livestock inventory consists of 440-bred cows, 40 bred heifers, and 40 total weaned/yearling heifers, 24 bulls, and 10 horses. No bulls were tested for FAA in this model. Conception rate of purchased bred cows and pairs was constant at 80% with a death loss of 2% and a cull rate at a constant 20%. Conception rate of the cows that survived at least one culling cycle was constant at 70% with death loss of 2%. The maximum cow to bull ratio was set at 15 with a bull cull rate of 20%. Only during the first year of operation were any raised heifer calves retained to increase herd size the following year to not exceed Total AU capacity.

Test Cast Scenario 2.2 Partial FAA testing – Ranch Description

The livestock inventory consists of 440-bred cows, 40 bred heifers, and 40 total weaned/yearling heifers, 24 bulls, and 10 horses. Half of the initial bull population was tested for FAA and all replacement bulls thereafter were tested. Conception rate of purchased bred cows and pairs was at a variable increase that began with the standard in the first year at 80% and due to testing slowly increased over the following 6 years to a conception rate of 95% with a death loss of 2% and a cull rate decreasing in tandem with the conception rate. Conception rate of the cows that survived at least one culling cycle was also affected with year 1 at the constant 70 % and slowly increasing over 5 years to 85% with death loss of 2%. The maximum cow to bull ratio was set at 15 but increasing to 20 over time due to the FAA positive bulls having the ability to mate and impregnate at a higher rate than negative bulls, with a bull cull rate of 20%. Only during the first year of operation were any raised heifer calves retained to increase herd size the following year to not exceed Total AU capacity.

Test Cast Scenario 2.3 Complete FAA Testing – Ranch Description

The livestock inventory consists of 440-bred cows, 40 bred heifers, and 40 total weaned/yearling heifers, 24 bulls, and 10 horses. All bulls in the initial herd and all replacement bulls thereafter were tested. Conception rate of purchased bred cows and pairs was at a variable increase that began with the standard in the first year at 80% and was given a faster increase in productivity to increase to a conception rate of 95% within 4 years with a death loss of 2% and a cull rate decreasing in tandem with the conception rate. Conception rate of the cows that survived at least one culling cycle was also affected

with year 1 at the constant 70 % and within 3 years increasing to 85% with death loss of 2%. The maximum cow to bull ratio was set at 15 but increasing by year 2 to 20 due to the FAA positive bulls having the ability to mate and impregnate at a higher rate than negative bulls, with a bull cull rate of 20%. Only during the first year of operation were any raised heifer calves retained to increase herd size the following year to not exceed Total AU capacity.

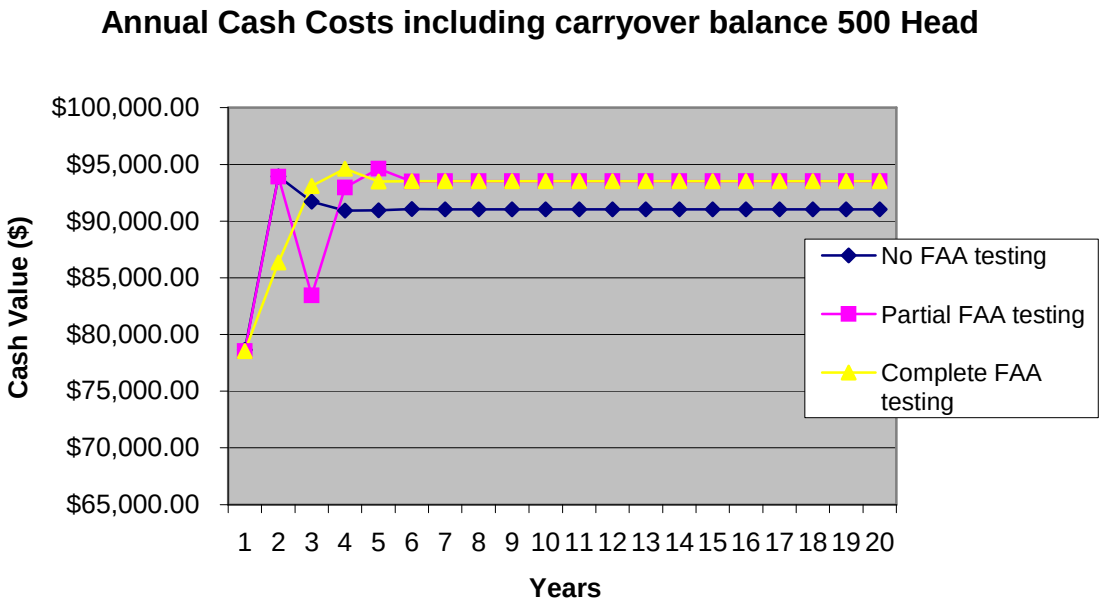


Figure 9. The annual cash cost is the cost of replacing stock on a 500 head herd using the parameters in this study over a 20-year time span

Figure 9 illustrates the annual cash cost of replacing stock on a 500 head herd using the parameters in this study over a 20-year time span. This includes the cost of purchasing bulls, testing for FAA, purchasing bred cows, bred pairs, bred heifers (2+ years old), weaned/yearling heifers, feed costs, variable costs, interest on variable costs.

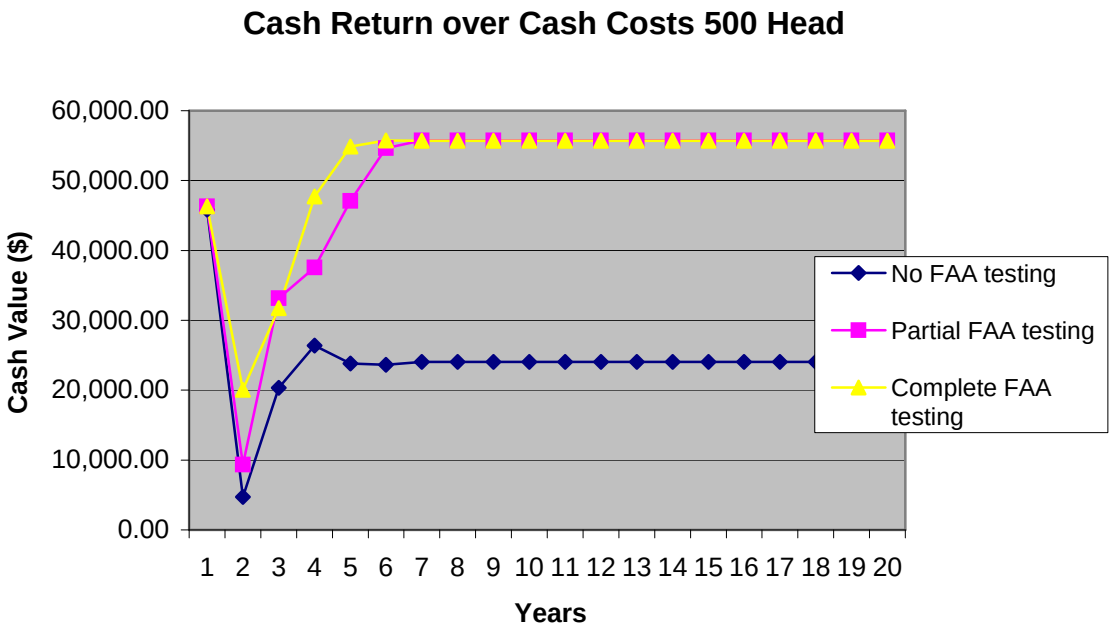


Figure 10. The annual return over cash cost consists of the cost of running a 500 head herd per year dependent on production variable costs and restocking costs.

Figure 10 illustrates the annual return over cash cost which consists of the cost of running a 500 head herd per year dependent on production variable costs and restocking costs. Due to lack of base funding for the initial year, the drop in profit by year 2 is appreciable.

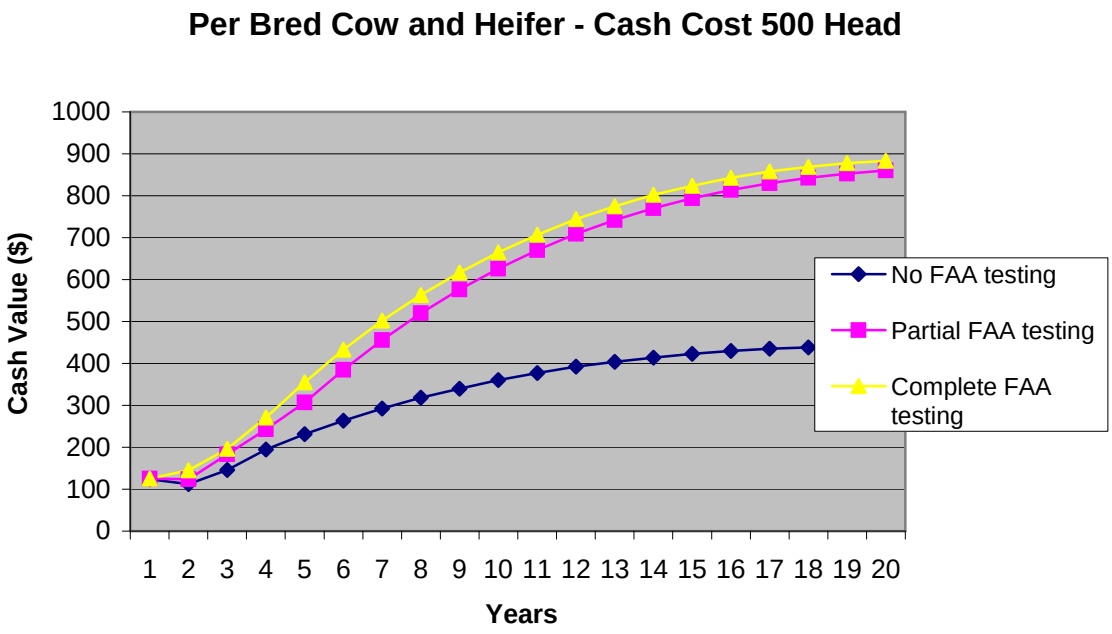


Figure 11. The annual cash cost of a cow and heifer unit consists of the cost of running a 500 head herd per year dependent on production variable costs and restocking costs.

Figure 11 illustrates the annual cash cost of a cow and heifer unit, which consists of the cost of running a 500 head herd per year dependent on production variable costs and restocking, costs. This is the rancher return per cow and heifer unit.

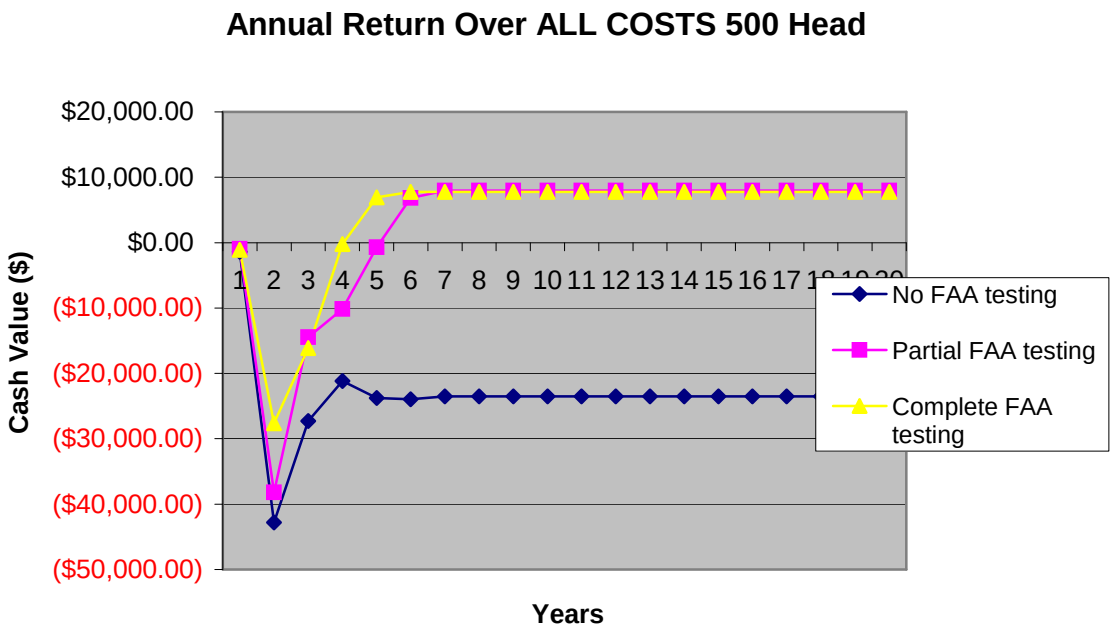


Figure 12. Annual return consists of the cash return of all cost above the ranch cost.

Figure 12 illustrates the annual return, which consists of the cash return of all cost above the ranch cost. This includes the deduction of ownership costs and management/labor costs. Due to lack of base funding for the initial year, the drop in profit by year 2 is appreciable.

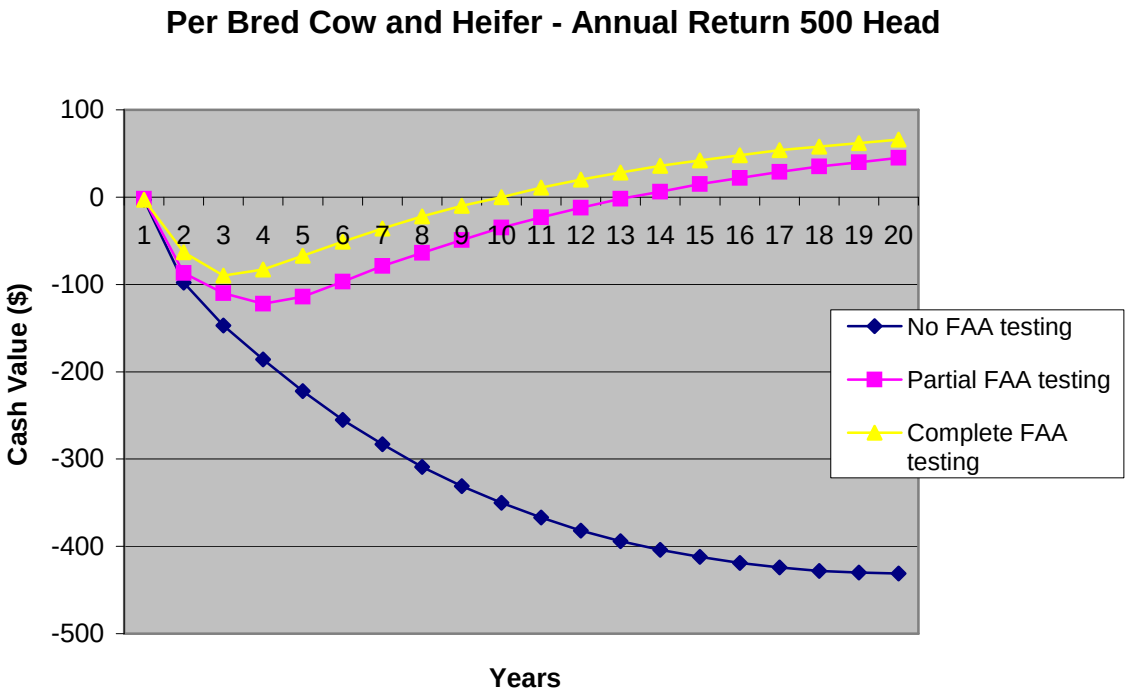


Figure 13. The annual cash return of a cow and heifer unit above the ranch costs per year in a 500 head herd.

Figure 13 illustrates the annual cash return of a cow and heifer unit above the ranch costs per year in a 500 head herd. In such a small herd size, the no FAA testing scenario shows a gradual decrease in bred cow & heifer annual return with no rebound.

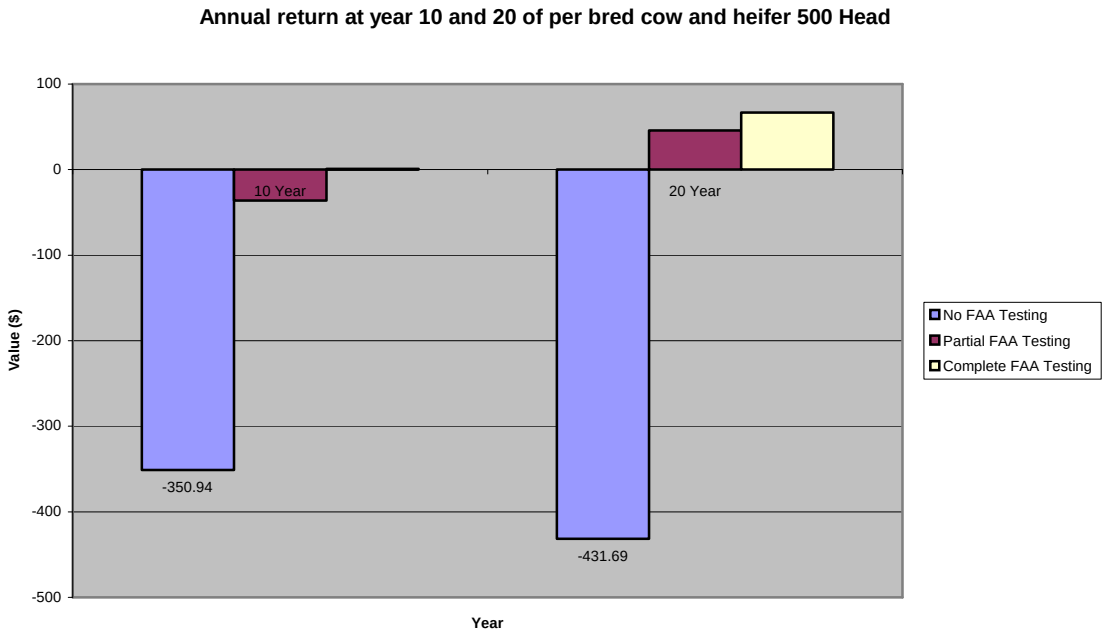


Figure 14. Comparative of the three scenarios of cow/calf return values at year 10 and year 20.

1500 Head

Test Cast Scenario 3.1 No FAA Testing – Ranch Description

The livestock inventory consists of 1140-bred cows, 210 bred heifers, and 150 total weaned/yearling heifers, 76 bulls, and 25 horses. No bulls were tested for FAA in this model. Conception rate of purchased bred cows and pairs was constant at 80% with a death loss of 2% and a cull rate at a constant 20%. Conception rate of the cows that survived at least one culling cycle was constant at 70% with death loss of 2%. The maximum cow to bull ratio was set at 15 with a bull cull rate of 20%. Only during the first year of operation were any raised heifer calves retained to increase herd size the following year to not exceed Total AU capacity.

Test Cast Scenario 3.2 Partial FAA testing – Ranch Description

The livestock inventory consists of 1140-bred cows, 210 bred heifers, and 150 total weaned/yearling heifers, 76 bulls, and 25 horses. Half of the initial bull population was tested for FAA and all replacement bulls thereafter were tested. Conception rate of purchased bred cows and pairs was at a variable increase that began with the standard in the first year at 80% and due to testing slowly increased over the following 6 years to a conception rate of 95% with a death loss of 2% and a cull rate decreasing in tandem with the conception rate. Conception rate of the cows that survived at least one culling cycle was also affected with year 1 at the constant 70 % and slowly increasing over 5 years to 85% with death loss of 2%. The maximum cow to bull ratio was set at 15 but increasing to 20 over time due to the FAA positive bulls having the ability to mate and impregnate at a higher rate than negative bulls, with a bull cull rate of 20%. Only during the first year of operation were any raised heifer calves retained to increase herd size the following year to not exceed Total AU capacity.

Test Cast Scenario 3.3 Complete FAA Testing – Ranch Description

The livestock inventory consists of 1140-bred cows, 210 bred heifers, and 150 total weaned/yearling heifers, 76 bulls, and 25 horses. All bulls in the initial herd and all replacement bulls thereafter were tested. Conception rate of purchased bred cows and pairs was at a variable increase that began with the standard in the first year at 80% and was given a faster increase in productivity to increase to a conception rate of 95% within 4 years with a death loss of 2% and a cull rate decreasing in tandem with the conception rate. Conception rate of the cows that survived at least one culling cycle was also affected

with year 1 at the constant 70 % and within 3 years increasing to 85% with death loss of 2%. The maximum cow to bull ratio was set at 15 but increasing by year 2 to 20 due to the FAA positive bulls having the ability to mate and impregnate at a higher rate than negative bulls, with a bull cull rate of 20%. Only during the first year of operation were any raised heifer calves retained to increase herd size the following year to not exceed Total AU capacity.

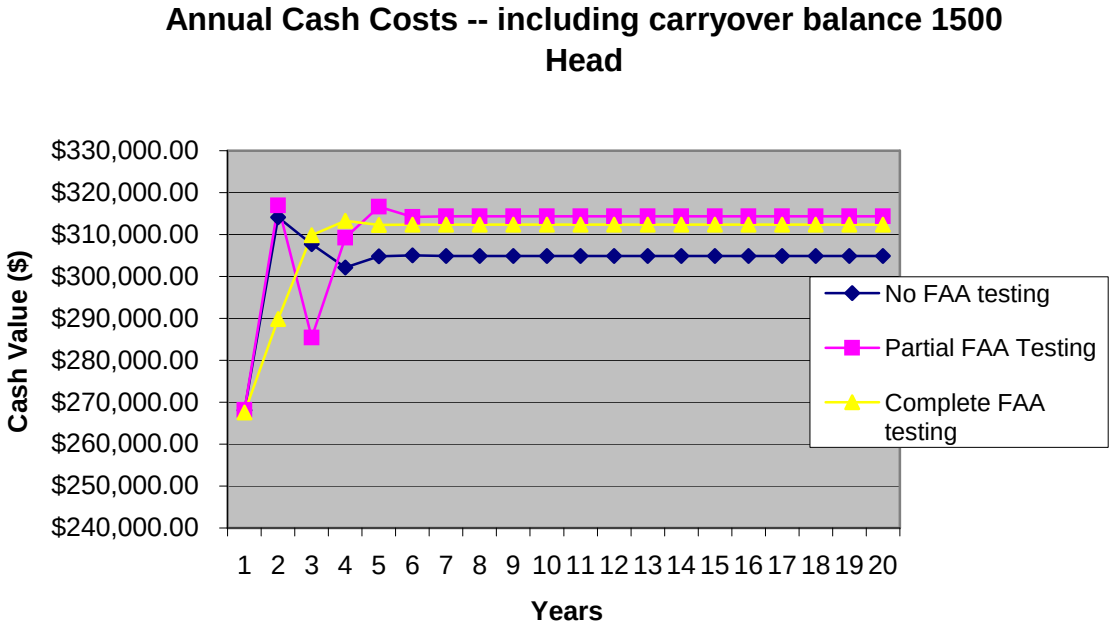


Figure 15. The annual cash cost is the cost of replacing stock on a 1500 head herd using the parameters in this study over a 20-year time span.

Figure 15 illustrates the annual cash cost of replacing stock on a 1500 head herd using the parameters in this study over a 20-year time span. This includes the cost of

purchasing bulls, testing for FAA, purchasing bred cows, bred pairs, bred heifers (2+ years old), weaned/yearling heifers, feed costs, variable costs, interest on variable costs.

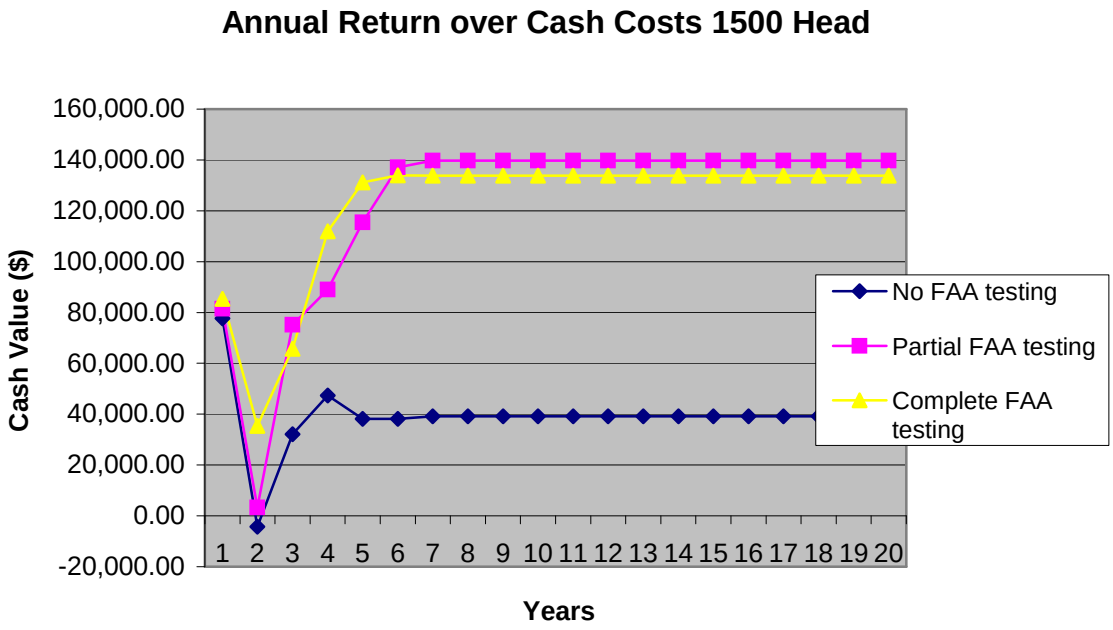


Figure 16. The annual return over cash cost consists of the cost of running a 1500 head herd per year dependent on production variable costs and restocking costs.

Figure 16 illustrates the annual return over cash cost which consists of the cost of running a 1500 head herd per year dependent on production variable costs and restocking costs. Due to lack of base funding for the initial year, the drop in profit by year 2 is appreciable.

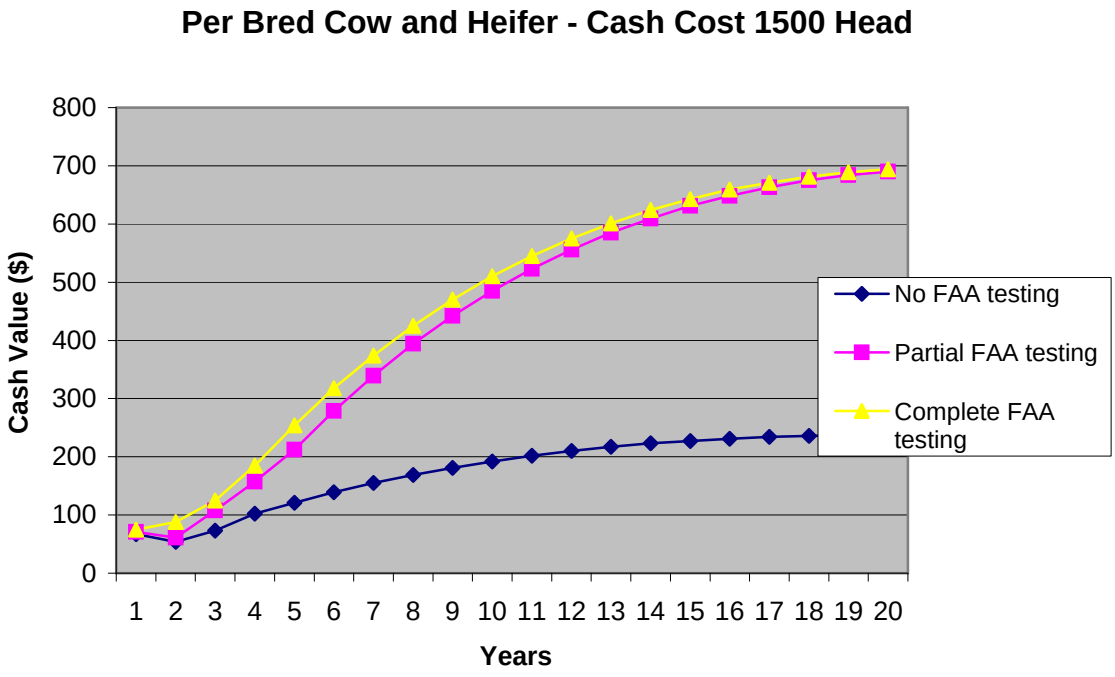


Figure 17. The annual cash cost of a cow and heifer unit consists of the cost of running a 1500 head herd per year dependent on production variable costs and restocking costs.

Figure 17 illustrates the annual cash cost of a cow and heifer unit, which consists of the cost of running a 1500 head herd per year dependent on production variable cost and restocking costs. This is the rancher return per cow and heifer unit.

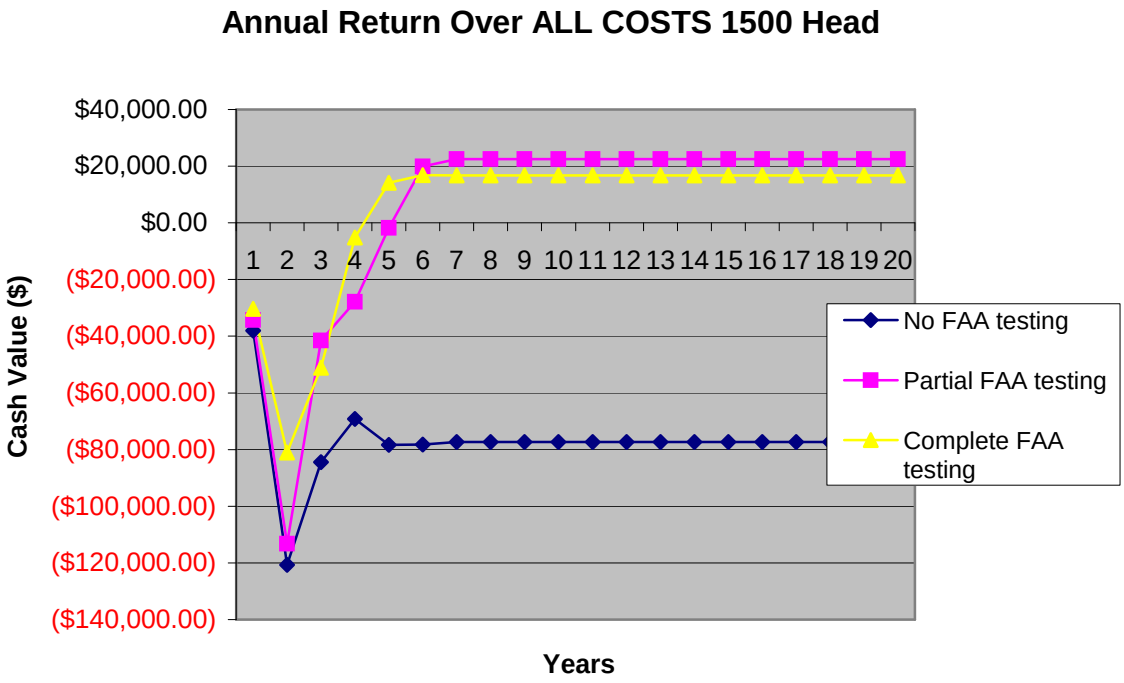


Figure 18. Annual return consists of the cash return of all cost above the ranch cost.

Figure 16 illustrates the annual return, which consists of the cash return of all cost above the ranch cost. This includes the deduction of ownership costs and management/labor costs. Due to lack of base funding for the initial year, the drop in profit by year 2 is appreciable.

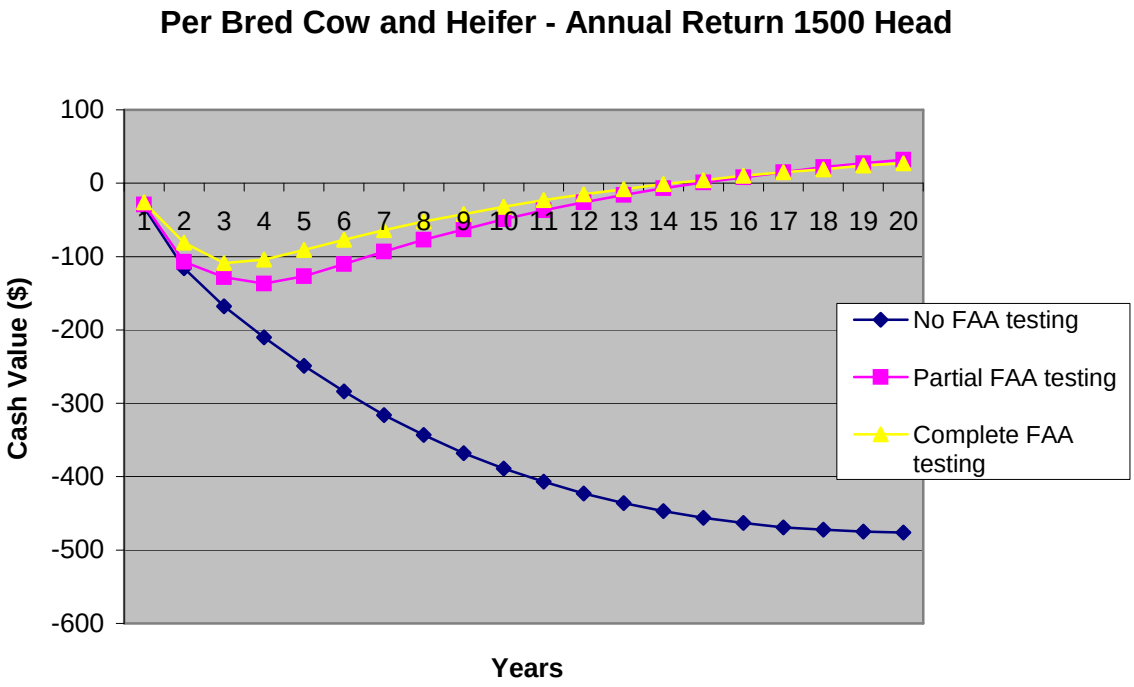


Figure 19. The annual cash return of a cow and heifer unit above the ranch costs per year in a 1500 head herd.

Figure 17 illustrates the annual cash return of a cow and heifer unit above the ranch costs per year in a 1500 head herd. In such a small herd size, the no FAA testing scenario shows a gradual decrease in bred cow and heifer annual return with no rebound.

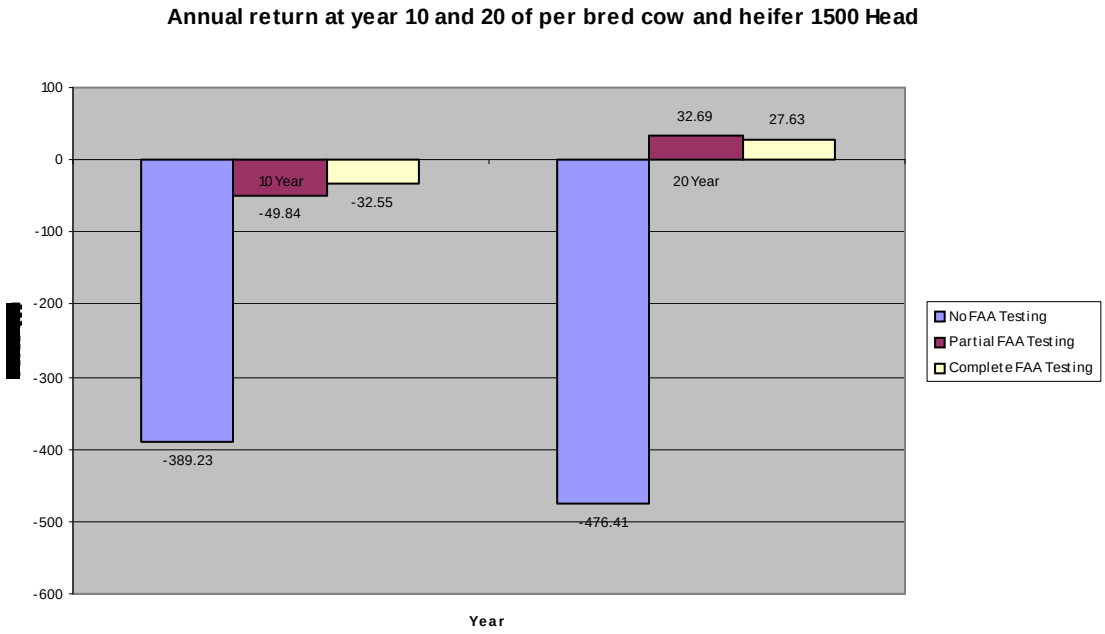


Figure 20. Comparative of the three scenarios of cow/calf return values at year 10 and year 20.

In all three-herd sizes, both the partial and complete testing scenarios show a high yielding return as compared to the no testing scenario over a 20-year projection. Profit margins have been shown to have a great impact when FAA testing is incorporated into the management of beef cattle production.

Discussion

Fertility, as a measurable trait, is 5 to 10 times more important to profitability of a livestock enterprise than any other trait we can measure. Males, who are subjected to a fertility exam, and pass, still vary dramatically in actual fertility. In mammalian males, objective biochemical markers which are indicators of a sperm's ability to successfully fertilize an ovum are needed (Foote et al,. 2003). From DNA parentage verification, 20%

of bulls in natural service breeding will sire 80% of the offspring. Poor bull fertility can cause substantial loss of a calf crop, especially in single sire herds.

Semen contains varying concentrations of a protein called fertility-associated antigen (FAA). The presence of FAA in semen samples has been linked to higher fertility among bulls. Each of the models began the herd at an 85% fertility rate based on previous studies that showed FAA-positive bulls to have a 16% higher conception rates than their counterparts (Sprott et al, 2000). Higher fertility rates by FAA-positive bulls will increase the number of cows bred early in the breeding season, thus allowing for more calves with increased weaning weights. Increased weaning weights will, in turn, increase selling prices (Ax et al. 2010). This is why an increase in these values was accounted for in the partial and complete models. Based on McCauley et al. (2004), which stated with a profit margin of $100 per calf, a 1% increase in birth rate would translate into an additional $38 million earned in 2004. Moreover, if each ranch weaned one additional calf, that would generate $80 million in added profit.

The maximum cow to bull ratio was set at 1:15 based on the Cooperative Extension input and Sprott et.al (1997) that states that typically a bull-to cow ratio of 1:25 is recommended, but can be wasteful. Since FAA positive bulls have been found to have higher first service conception rates, the ratio was decreased over time dependent on FAA testing to a maximum cow to bull ratio of 1:10. As FAA positive bulls were cycled into the herd, and FAA negative bulls were culled, conception rates of purchased bred cows and pairs were increased dependent on practice from 80% to 95%. This in turn increased weaning weights of calves at time of sale, causing a generation of profit.

In all three models, it is apparent that testing for FAA can and will increased ones profit margin. The question is should a producer concentrate funding to test all bulls in the herd at one time, or test when introducing new bulls into the herd as part of the BSE prior to purchase? Looking at figures 3-20, one can appreciate that both partial testing and complete testing are comparatively identical in all aspects except for the initial 3-5 years. This discrepancy is due to the cost of testing all bulls with veterinary and workman expenses versus testing over time. This outcome was contrary to the expected outcome when beginning this experiment. When discussion of this model began, the consensus was that complete testing would exponentially outweigh no testing and partial testing.

Herd size has been found to be a factor in the outcome of this model. This is an expected outcome considering that the larger the herd is, the more profit there is to be made. In the 150 head herd model, there are only eight bulls to be considered in the cost-benefit analysis of this experiment. As the herd size increases, so does the number of bulls needed to run the operation. Considering that these models are based on the changes that bulls have on production, one can expect that the more bulls in a herd, the more impact testing will be on the economic outcome.

Conclusion

Agriculturalists identify and breed genetically superior animals and plants. For years, this was done by examining the plant or animal and performing relatively simple tests. The prize bull's value would be determined, in part, by factors such as its size and weight. Technology has taken selective breeding to a higher plane. The same bull's

breeding soundness can be analyzed through genetic factors. Certain genes within DNA are linked to performance characteristics. The study for fertility in bulls is one of many that have direct application to other mammals.

A 31Kda heparin-binding protein named fertility-associated antigen (FAA) has been found to occur naturally in male mammals with higher fertility rates. Before this protein was isolated and analyzed, the male population was not seen as a profitable mechanism in which producers needed to consider. The mechanism by which FAA increases bovine fertility still remains unknown, but further experimentation will uncover its true mechanisms.

Further studies of this heparin binding protein have found potentials that affect the female reproductive success. Insemination results in the transmission of seminal factors that act, in the female reproductive tract, to promote sperm survival, to condition the female response to tolerate the conceptus, and to organize molecular and cellular changes in the endometrium to facilitate embryo development and implantation (Robertson, 2005). Postbreeding inflammation in the form of increased polymorphonuclear neutrophili granulocytes (PMN) into the uterine lumen is an important part of the uterine defense mechanism in pigs and horses (Rozeboom et al., 1998; Troedsson et al., 1998). Neutrophils ordinarily infiltrate the female reproductive tract subsequent to mating or artificial insemination, resulting in reduced fertility. Equine neutrophil extracellular traps (NETs) are formed as a result of activated neutrophils extruding their nuclear DNA and associated proteins to ensnare and kill foreign microbes (Brinkmann et al., 2004). NETs entangle sperm in these DNA-rich structures, interfering with thier normal transport

through the female reproductive tract. Seminal plasma (SP) or proteinaceous extracts from SP inhibited sperm-neutrophil binding and specifically degraded sperm-activated NETs, without suppressing bactericidal activity of neutrophils. Fertility associated antigen (FAA) has been shown to bind to sperm and potentiate heparin-induced capacitation Alghamdi & Foster, (2005). FAA shares 87% identity with Dnase I-like family members contains two internal DNase-I-like peptide motifs (Cropp, 2005), and demonstrates Dnase activity capable of inhibiting sperm-neutrophil binding.

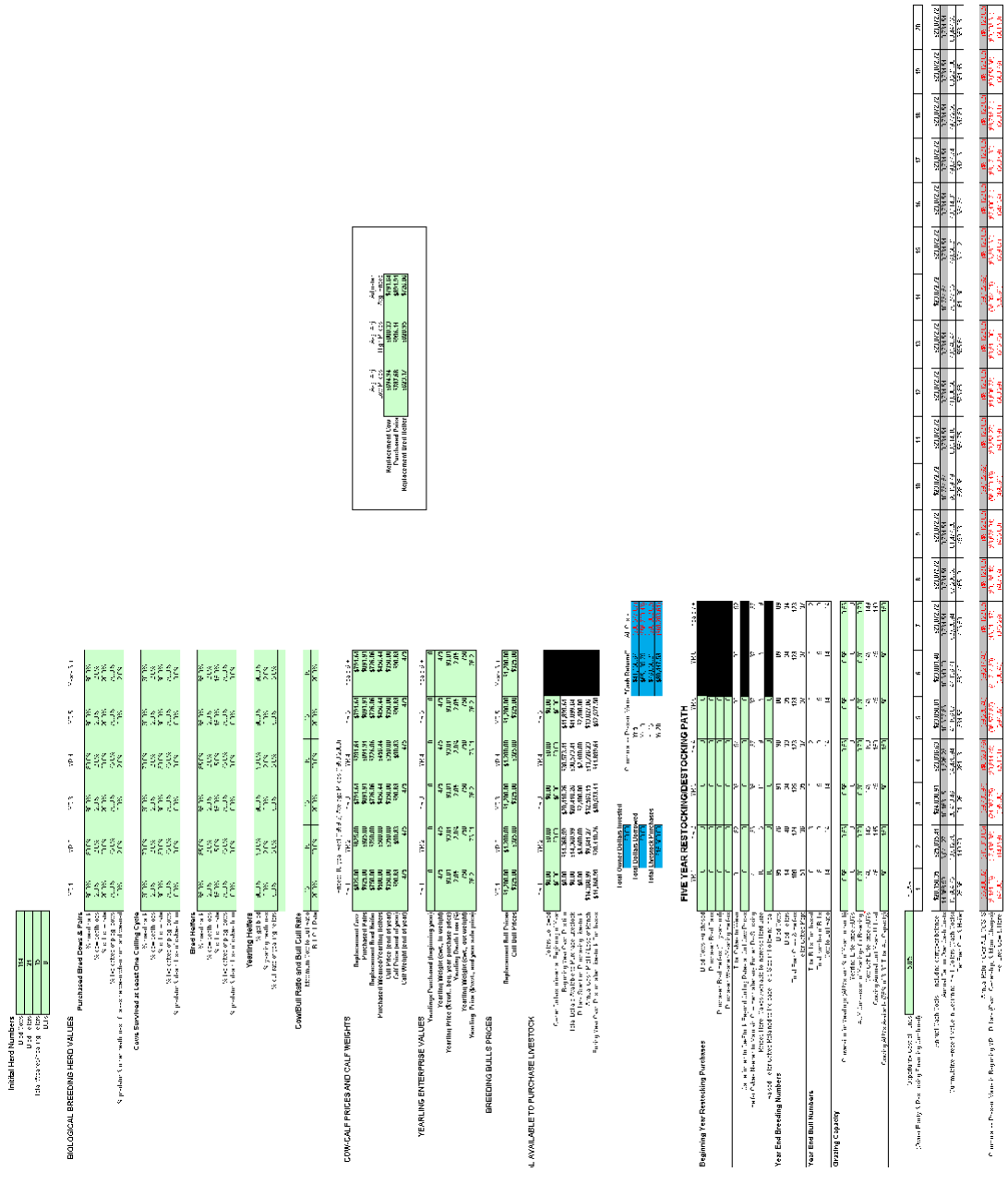
Collectively these results demonstrate that adding the FAA chute test to the Breeding Soundness Exam is both cost effective and non-invasive. Whether a producer decides to test all bulls in the herd prior to changing buying practices, or test all incoming bulls purchased for the herd, over time the culling of all FAA negative bulls combined with replacement of FAA positive bulls to the herd will increase the profit margin.

As for the future of this test, since mammalian genetics are very closely related, and FAA is highly homologous to cross a variety of mammalian species, a fertility test utilizing FAA could be developed to be used in both human and wildlife fertility testing in addition to economically important livestock. The chute test would be an excellent additive in reproductive trials being conducted in regions where cold storage is not always at ones disposal.

APPENDIX A

NO FAA TESTING 150 HEAD

Herd Planning



Multiyear Budget

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Years 7+
Production Information							
Yearlings Purchased (beginning year)							
Beginning Year Breeding Cows, Heifers, & Yearlings	160	160	160	160	160	160	160
Ending Year Herd Size	109	124	125	123	123	123	123
Weighted Avg. Cull Rate for Year	26%	21%	20%	21%	21%	21%	21%
Weighted Avg. % Weaned Calf	75%	75%	75%	75%	75%	75%	75%
% of Total Heifers Kept for Replacements	101%	89%	76%	80%	80%	80%	80%
Operating Receipts							
Calves Sold	[illegible]	$19,532.30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Yearlings Sold							
Capital Receipts							
Cull Cows	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cull Bulls	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other Livestock (Horses)							
Vehicle Sales							
Equipment Sales							
Land Sales							
Other Fixed Asset Sales							
Subtotal Capital Revenue	$12,882.60	$11,514.00	$9,280.99	$10,840.64	$10,762.24	$10,564.27	$10,624.70
Total Revenue	$34,519.34	$31,078.88	$34,202.08	$35,162.86	$34,488.87	$34,521.68	$34,807.28
Per Ending Yr Breeding Cow Revenues	$316.80	$251.20	$273.50	$286.77	$280.32	$280.08	$281.09
COSTS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Variable Costs							
FAA Test Costs							
Bulls Leased (From Herd Planning Sheet)							
Cartrages							
Labor etc.							
Feed Costs							
Hay	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Silage	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$1,009.79
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Private							
Salt & Mineral	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Protein Supplement	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$2,022.67	[illegible]
Grain							
Subtotal Feed Cost	$4,502.73	$5,204.16	$5,280.74	$5,158.01	$5,177.22	$5,166.86	$5,182.11
Other Variable Costs							
Yearling Purchases							
Admin Costs	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Auto/Vehicles (Fuel, Tires, Lube, Oil)	[illegible]	[illegible]	[illegible]	[illegible]	$3,500.00	[illegible]	$3,500.00
Equipment	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hired Labor							
Other Livestock & Marketing Costs	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Prof Fees & Insurance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Vet & Medicine	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Miscellaneous	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Horse Maintenance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other							
Subtotal Other Variable Cost	$14,427.04	$16,017.91	$16,153.32	$16,063.33	$16,066.94	$16,078.69	$16,076.17
Interest Rate on Variable Costs	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
Months	9	9	9	9	9	9	9
Simple Interest on Variable Costs	$1,140.69	$1,213.33	$1,224.84	$1,213.39	$1,214.66	$1,216.93	$1,216.44
Production Cash Variable Costs	$20,150.35	$21,435.41	$21,690.91	$21,438.69	$21,458.81	$21,461.48	$21,472.72
Per Ending Yr Breeding Cow Variable Costs	$185.04	$173.33	$173.10	$174.63	$174.42	$174.20	$174.37
Net Returns Above Variable Costs	$14,368.88	$9,641.27	$12,509.15	$13,726.23	$13,027.86	$13,040.20	$13,134.54
Ending Yr Breeding Cow Returns Above Var. Costs	$131.85	$77.86	$100.50	$111.85	$105.89	$105.80	$106.66
Ownership Cost							
Purchased Livestock (Bulls & Horses)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Housing & Improvements	$9,151.15	$9,151.15	$9,151.15	$9,151.15	[illegible]	$9,151.15	[illegible]
Machinery & Equipment	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Retained Livestock (Included in Herd Planning Sheet)							
Taxes & Insurance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Ownership Costs	$18,568.79	$18,568.79	$18,568.79	$18,568.79	$18,568.79	$18,568.79	$18,568.79
Per Ending Yr Breeding Cow Ownership Costs	$170.61	$150.16	$148.64	$151.44	$150.93	$150.66	$150.79
Annual Owner Management/Labor Cost	$1,209.02	$1,286.12	$1,298.33	$1,286.20	$1,287.63	$1,288.89	$1,288.36
TOTAL COSTS less Restocking Females	$39,928.17	$41,290.33	$41,508.03	$41,291.62	$41,315.13	$41,338.16	$41,329.87
Total Net Return less Restocking Females	($5,408.82)	($10,213.85)	($7,303.97)	($6,128.76)	($6,826.46)	($6,817.48)	($6,722.62)
er Ending Yr Breeding Cow -- Cash & Ownership Costs	($49.67)	($82.69)	($58.43)	($49.98)	($55.60)	($55.31)	($54.69)

RANCH ASSETS

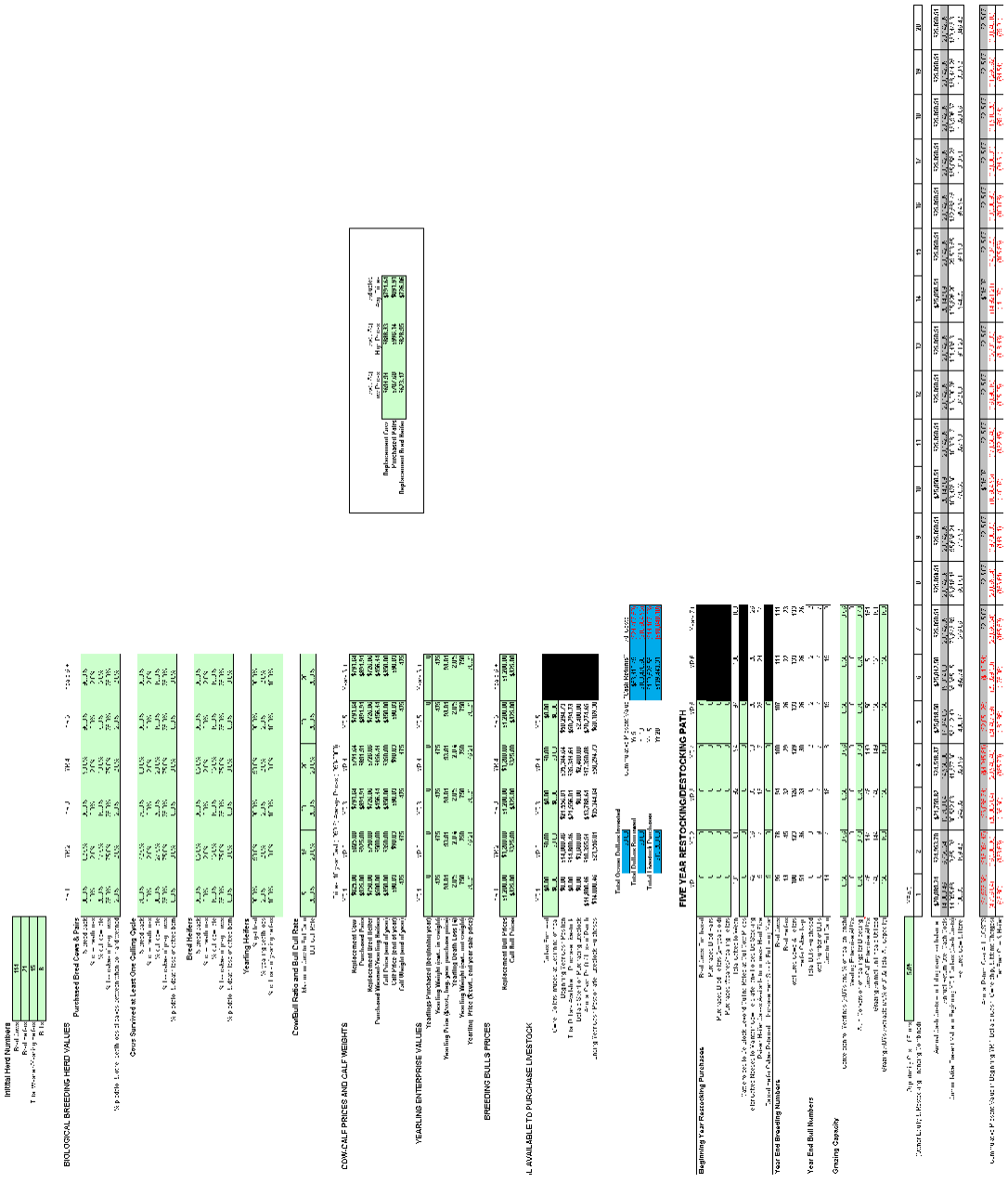
R & M = **2.0%**
Tax & Ins. = **0.9%**

Number	Buildings, Improvements	Price Per Unit	10 Yr Avg Rate of Return	Purchase Price	Salvage/Cull Value	Useful Life	Annual Taxes & Insurance	Annual Capital Recovery	Repair & Maintenance
15	Acres of private land	$800	3.5%	$12,000.00					
5	Miles of pipeline	$600	3.5%	$3,000.00	$300.00	25	$26.40	$188.63	60
2	Wells	$12,000	3.5%	$24,000.00	$2,400.00	25	$211.20	$1,509.07	480
0	Dirt Tanks	$900	3.5%	$0.00	$0.00	25	$0.00	$0.00	$0.00
50	Miles of Fence	$2,000	3.5%	$100,000.00	$10,000.00	25	$880.00	$6,287.80	$2,000.00
1	Corrals/Working Facilities	$10,000	3.5%	$10,000.00	$1,000.00	30	$88.00	$587.58	$200.00
1	Barns & Shop	$15,000	3.5%	$15,000.00	$1,500.00	30	$132.00	$881.37	$300.00
			Sub Totals	$164,000.00			$1,337.60	$9,454.45	$3,040.00
Number	**Machinery & Vehicles**	**Price Per Unit**	Interest Rate	Price	Salvage/Cull				
0	1/2 ton pickup 4WD	$15,000	6.5%	$0.00	$0.00	7	$0.00	$0.00	$0.00
1	3/4 ton pickup 4WD	$20,000	6.5%	$20,000.00	$2,000.00	7	$176.00	$3,483.98	$400.00
0	Stock truck	$25,000	6.5%	$0.00	$0.00	7	$0.00	$0.00	$0.00
1	Dozer/Tractor	$10,000	6.5%	$10,000.00	$1,000.00	7	$88.00	$1,741.99	$200.00
1	Gooseneck trailer	$7,000	6.5%	$7,000.00	$700.00	7	$61.60	$1,219.39	$140.00
0	Water truck	$10,000	6.5%	$0.00	$0.00	7	$0.00	$0.00	$0.00
1	Horse tack	$2,500	6.5%	$2,500.00	$250.00	10	$22.00	$343.49	$50.00
1	Misc. equipment	$2,500	6.5%	$2,500.00	$250.00	10	$22.00	$343.49	$50.00
			Sub Total	$42,000.00			$369.60	$7,132.35	$840.00
Head	**Purchased Livestock**	**Price Per Unit**	Interest Rate	Price	Salvage/Cull				
2	Horses	$1,000	6.5%	$2,000.00	$200.00	10	$17.60	$274.79	
			Sub Total	$2,000.00			$17.60	$274.79	
			Total	$206,000.00			$1,707.20	$16,586.80	

APPENDIX B

PARTIAL FAA TESTING 150 HEAD

Herd Planning



Multiyear Budget

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Years 7+
Production Information							
Yearlings Purchased (beginning year)							
Beginning Year Breeding Cows, Heifers, & Yearlings	160	169	169	169	169	169	169
Ending Year Herd Size	108	123	126	129	133	133	133
Weighted Avg. Cull Rate for Year	26%	22%	21%	23%	23%	24%	26%
Weighted Avg. % Weaned Calf	75%	75%	75%	75%	75%	75%	75%
% of Total Heifers Kept for Replacements	100%	90%	72%	64%	63%	61%	62%
Operating Receipts							
Calves Sold	[illegible]	$19,309.75	[illegible]	$27,792.09	[illegible]	$32,070.50	[illegible]
Yearlings Sold							
Capital Receipts							
Cull Cows	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cull Bulls	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other Livestock (Horses)							
Vehicle Sales							
Equipment Sales							
Land Sales							
Other Farm Asset Sales							
Subtotal Capital Revenue	$13,146.00	$12,399.60	$10,101.62	$11,676.66	$12,190.03	$12,778.77	$13,183.64
Total Revenue	$34,888.70	$31,708.25	$35,546.45	$39,468.45	$42,893.16	$44,857.30	$45,193.40
Per Ending Yr Breeding Cow Revenues	$322.80	$258.55	$282.13	$306.15	$321.38	$336.65	$339.14
COSTS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Variable Costs							
FAA Test Costs							
Bulls Tested (From Herd Planning Sheet)	4	3		2	2	2	2
Cartrages	[illegible]	[illegible]		[illegible]	$90.00	[illegible]	$90.00
Labor etc.	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Feed Costs							
Hay	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HRM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
State	[illegible]	[illegible]	[illegible]	[illegible]	$1,503.09	[illegible]	$1,500.95
USFS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Private							
Salt & Minerals	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Protein Supplement	[illegible]	[illegible]	[illegible]	[illegible]	$2,190.01	[illegible]	$2,193.73
Grain							
Subtotal Feed Cost	$4,551.17	$5,101.08	$5,302.28	$5,425.21	$5,616.85	$5,807.27	$5,807.75
Other Variable Costs							
Yearling Purchases							
Admin Costs	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Auto/Vehicles (Fuel, Tires, Maint.)	[illegible]	[illegible]	[illegible]	[illegible]	$3,500.00	[illegible]	$3,500.00
Equipment	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hired Labor							
Other Livestock & Marketing Costs	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Prof. Fees & Insurance	[illegible]	[illegible]	[illegible]	[illegible]	$900.00	[illegible]	$900.00
Vet & Medicine	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Miscellaneous	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$2,335.15
Horse Maintenance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other							
Subtotal Other Variable Cost	$14,400.94	$14,983.91	$15,226.87	$15,441.18	$16,721.36	$16,763.68	$16,760.66
Interest Rate on Variable Costs	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
Months	9	9	9	9	9	9	9
Simple Interest on Variable Costs	$1,137.13	$1,208.70	$1,231.69	$1,261.98	$1,280.29	$1,281.66	$1,282.10
Production Cash Variable Costs	$20,088.24	$21,353.70	$21,758.82	$22,118.37	$22,618.50	$22,842.50	$22,850.51
Per Ending Yr Breeding Cow Variable Costs	$185.75	$174.11	$172.70	$171.57	$169.46	$168.83	$169.98
Net Returns Above Variable Costs	$14,800.46	$10,355.54	$13,788.84	$17,350.08	$20,274.65	$22,214.80	$22,542.89
Ending Yr Breeding Cow Returns Above Var. Costs	$138.05	$84.44	$108.44	$134.50	$151.90	$166.72	$169.17
Ownership Cost							
Purchased Livestock (Bulls & Horses)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Housing & Improvements	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Machinery & Equipment	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Retained Livestock (Included in Herd Planning Sheet)							
Taxes & Insurance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Ownership Costs	$18,588.78	$18,588.78	$18,588.78	$18,588.78	$18,568.79	$18,588.78	$18,568.79
Per Ending Yr Breeding Cow Ownership Costs	$171.69	$151.40	$147.37	$144.03	$139.12	$139.36	$139.34
Annual Owner Management/Labor Cost	$1,206.36	$1,281.22	$1,306.69	$1,327.10	$1,357.11	$1,368.66	$1,369.03
TOTAL COSTS less Restocking Females	$39,883.38	$41,203.72	$41,634.20	$42,014.28	$42,544.41	$42,588.65	$42,578.33
Total Net Return less Restocking Females	($4,873.88)	($9,404.47)	($6,085.74)	($2,545.81)	$348.75	$2,267.48	$2,615.07
er Ending Yr Breeding Cow -- Cash & Ownership Costs	($45.99)	($77.42)	($48.30)	($19.76)	$2.61	$17.17	$19.62

RANCH ASSETS

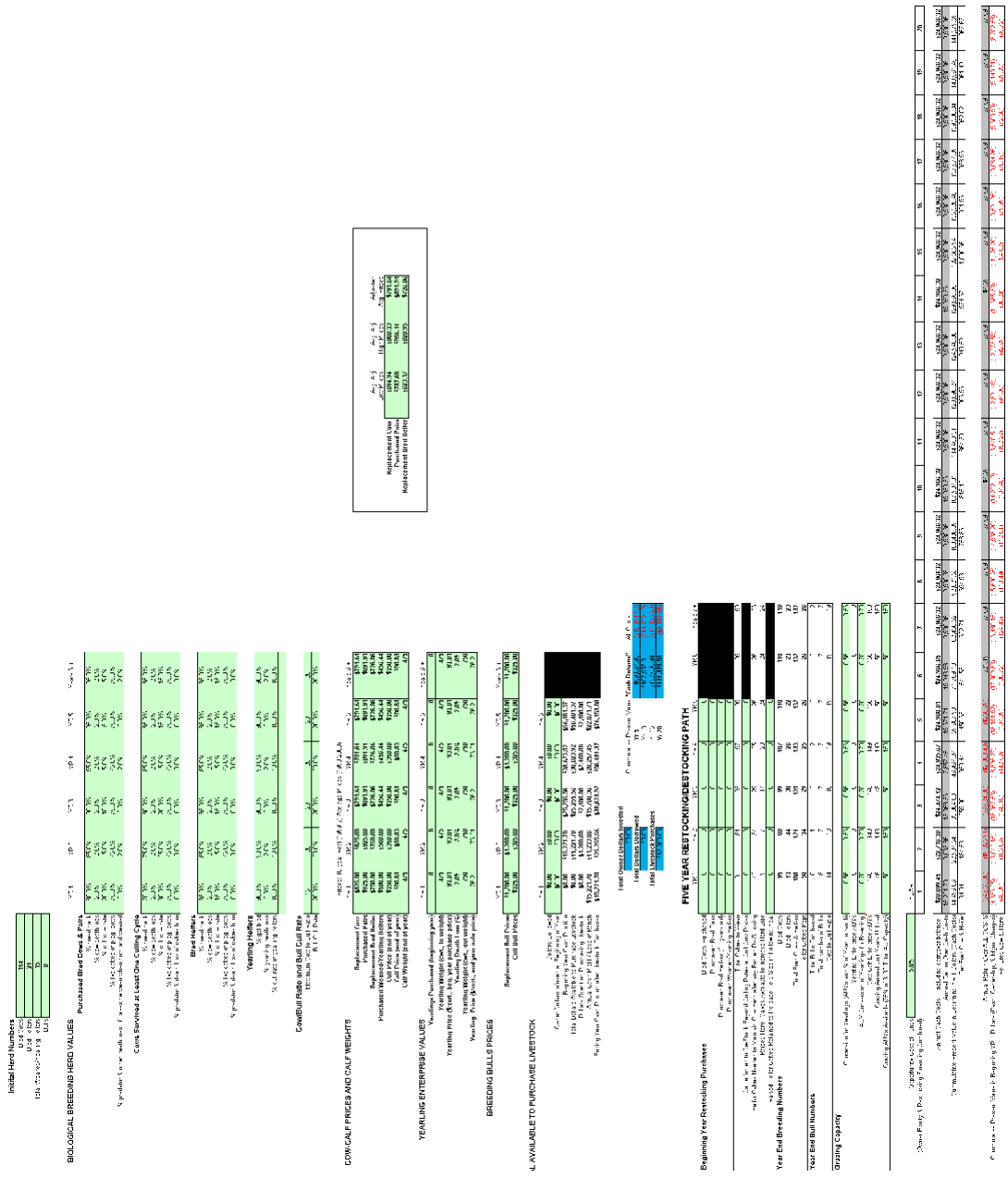
R & M = 2.0%
Tax & Ins. = **0.9%**

Number	Buildings, Improvements	Price Per Unit	10 Yr Avg Rate of Return	Purchase Price	Salvage/Cull Value	Useful Life	Annual Taxes & Insurance	Annual Capital Recovery	Repair & Maintenance
15	Acres of private land	$800	3.5%	$12,000.00					
5	Miles of pipeline	$600	3.5%	$3,000.00	$300.00	25	$26.40	$188.63	60
2	Wells	$12,000	3.5%	$24,000.00	$2,400.00	25	$211.20	$1,509.07	480
0	Dirt Tanks	$900	3.5%	$0.00	$0.00	25	$0.00	$0.00	$0.00
50	Miles of Fence	$2,000	3.5%	$100,000.00	$10,000.00	25	$880.00	$6,287.80	$2,000.00
1	Corrals/Working Facilities	$10,000	3.5%	$10,000.00	$1,000.00	30	$88.00	$587.58	$200.00
1	Barns & Shop	$15,000	3.5%	$15,000.00	$1,500.00	30	$132.00	$881.37	$300.00
			Sub Totals	$164,000.00			$1,337.60	$9,454.45	$3,040.00
Number	**Machinery & Vehicles**	**Price Per Unit**	Interest Rate	Price	Salvage/Cull				
0	1/2 ton pickup 4WD	$15,000	6.5%	$0.00	$0.00	7	$0.00	$0.00	$0.00
1	3/4 ton pickup 4WD	$20,000	6.5%	$20,000.00	$2,000.00	7	$176.00	$3,483.98	$400.00
0	Stock truck	$25,000	6.5%	$0.00	$0.00	7	$0.00	$0.00	$0.00
1	Dozer/Tractor	$10,000	6.5%	$10,000.00	$1,000.00	7	$88.00	$1,741.99	$200.00
1	Gooseneck trailer	$7,000	6.5%	$7,000.00	$700.00	7	$61.60	$1,219.39	$140.00
0	Water truck	$10,000	6.5%	$0.00	$0.00	7	$0.00	$0.00	$0.00
1	Horse tack	$2,500	6.5%	$2,500.00	$250.00	10	$22.00	$343.49	$50.00
1	Misc. equipment	$2,500	6.5%	$2,500.00	$250.00	10	$22.00	$343.49	$50.00
			Sub Total	$42,000.00			$369.60	$7,132.35	$840.00
Head	**Purchased Livestock**	**Price Per Unit**	Interest Rate	Price	Salvage/Cull				
2	Horses	$1,000	6.5%	$2,000.00	$200.00	10	$17.60	$274.79	
			Sub Total	$2,000.00			$17.60	$274.79	
			Total	$206,000.00			$1,707.20	$16,586.80	

APPENDIX C

COMPLETE FAA TESTING 150 HEAD

Herd Planning



Multiyear Budget

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Years 7 –
Production Information							
Yearlings Purchased (beginning year)							
Beginning Year Breeding Cows, Heifers, & Yearlings	160	168	168	168	168	168	168
Ending Year Herd Size	108	124	129	133	132	132	132
Weighted Avg. Cull Rate for Year	26%	22%	22%	27%	24%	26%	26%
Weighted Avg. % Weaned Calf	75%	75%	75%	75%	75%	75%	75%
% of Total Heifers Kept for Replacements	98%	83%	63%	63%	61%	62%	62%
Operating Receipts							
Calves Sold	$22,173.14	[illegible]	$27,579.00	[illegible]	[illegible]	[illegible]	[illegible]
Yearlings Sold							
Capital Receipts							
Cull Cows	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cull Bulls	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other Livestock (Horses)							
Vehicle Sales							
Equipment Sales							
Land Sales							
Other Fixed Asset Sales							
Subtotal Capital Revenue	$13,146.00	$12,364.60	$10,263.49	$12,068.48	$12,766.67	$13,101.66	$13,084.86
Total Revenue	$35,321.14	$32,750.18	$37,842.49	$42,789.12	$44,831.71	$44,910.63	$44,886.88
Per Ending Yr Breeding Cow Revenues	$326.58	$263.82	$293.70	$322.73	$337.07	$339.15	$338.05
COSTS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Variable Costs							
FAA Test Costs							
Bulls Tested (From Herd Planning Sheet)	8	1	2	2	2	2	2
Cartrages	[illegible]	$15.00		$90.00	$90.00	$90.00	$90.00
Labor etc.	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Feed Costs							
Hay	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Silage	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Private							
Salt & Minerals	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Protein Supplement	[illegible]	[illegible]	[illegible]	[illegible]	$2,172.05	[illegible]	$2,170.00
Grain							
Subtotal Feed Cost	$4,551.17	$5,223.85	$5,420.88	$5,500.03	$5,572.06	$5,572.48	$5,572.46
Other Variable Costs							
Yearling Purchases							
Admin Costs	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Auto/Vehicles (Fuel, Tires, Lube, etc.)	$3,500.00	$3,500.00	$3,500.00	$3,500.00	$3,500.00	$3,500.00	$3,500.00
Equipment	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hired Labor							
Other Livestock & Marketing Costs	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Prof Fees & Insurance	$900.00	$900.00	$900.00	$900.00	$900.00	$900.00	$900.00
Vet & Breeding	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Miscellaneous	[illegible]	$2,102.75	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Horse Maintenance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other							
Subtotal Other Variable Cost	$14,410.67	$16,074.44	$16,403.66	$16,680.08	$16,710.96	$16,716.82	$16,716.62
Interest Rate on Variable Costs	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
Months	9	9	9	9	9	9	9
Simple Interest on Variable Costs	$1,137.70	$1,217.90	$1,249.48	$1,276.60	$1,276.98	$1,277.36	$1,277.34
Production Cash Variable Costs	$20,099.45	$21,516.30	$22,074.12	$22,535.87	$22,560.01	$22,566.65	$22,566.32
Per Ending Yr Breeding Cow Variable Costs	$185.85	$173.33	$171.38	$169.85	$170.38	$170.42	$170.42
Net Returns Above Variable Costs	$15,221.70	$11,233.88	$15,768.38	$20,257.45	$22,071.71	$22,343.98	$22,330.36
Ending Yr Breeding Cow Returns Above Var. Costs	$140.75	$90.50	$122.41	$152.77	$166.69	$168.74	$168.63
Ownership Cost							
Purchased Livestock (Bulls & Horses)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Housing & Improvements	$9,151.15	$9,151.15	$9,151.15	$9,151.15	[illegible]	$9,151.15	[illegible]
Machinery & Equipment	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Retained Livestock (Included in Herd Planning Sheet)							
Taxes & Insurance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Ownership Costs	$18,568.79	$18,568.79	$18,568.79	$18,568.79	$18,568.79	$18,568.79	$18,568.79
Per Ending Yr Breeding Cow Ownership Costs	$171.69	$149.68	$144.16	$140.04	$140.24	$140.23	$140.23
Annual Owner Management/Labor Cost	$1,206.97	$1,290.98	$1,324.46	$1,352.14	$1,353.60	$1,354.00	$1,353.98
TOTAL COSTS less Restocking Females	$39,874.20	$41,376.07	$41,967.38	$42,456.80	$42,482.40	$42,489.44	$42,489.09
Total Net Return less Restocking Females	($4,553.06)	($8,625.91)	($4,124.98)	$338.52	$2,149.31	$2,421.19	$2,407.59
er Ending Yr Breeding Cow -- Cash & Ownership Costs	($42.10)	($69.49)	($32.02)	$2.54	$16.23	$18.28	$18.18

RANCH ASSETS

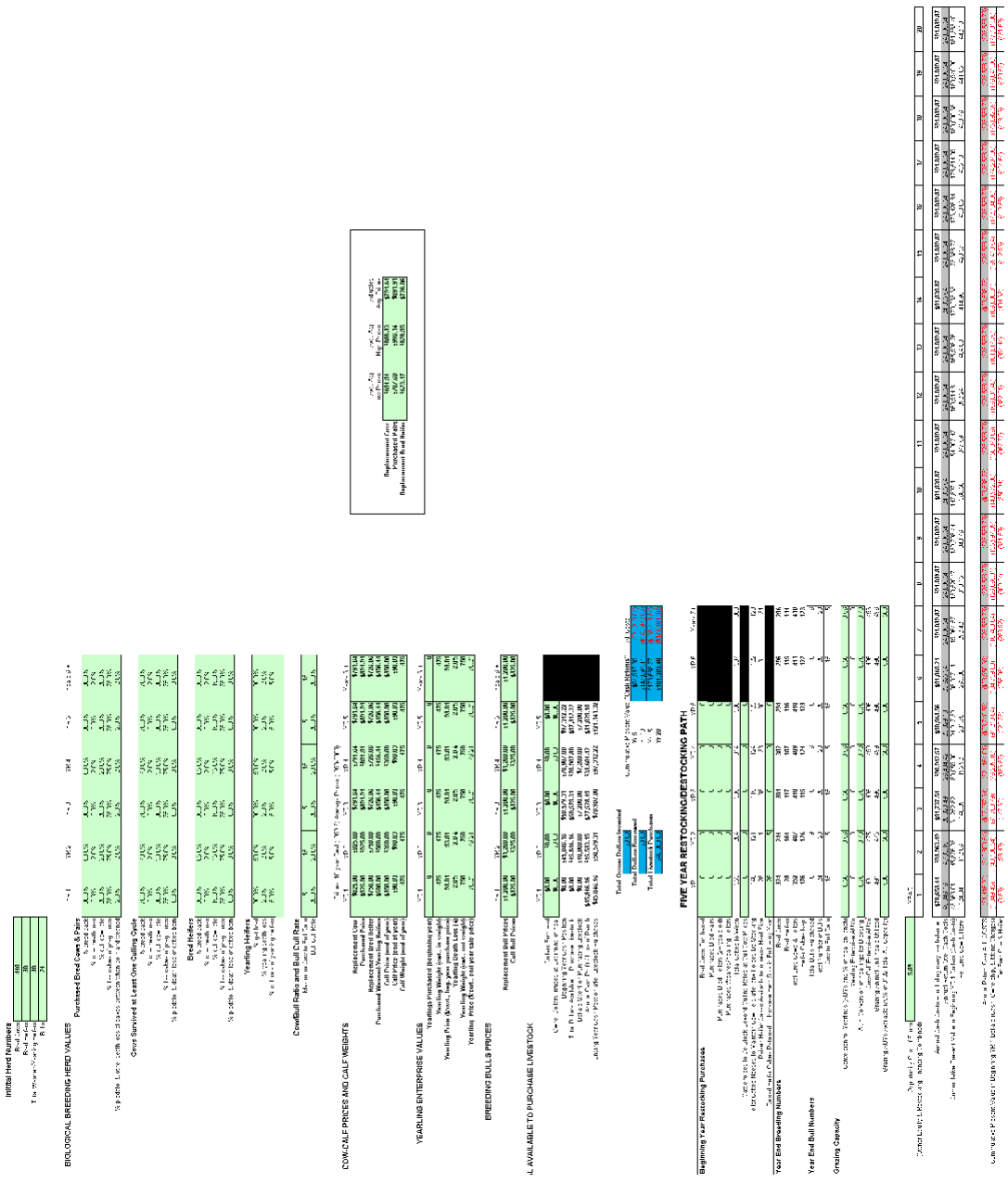
R & M = 2.0%
Tax & Ins. = **0.9%**

Number	Buildings, Improvements	Price Per Unit	10 Yr Avg Rate of Return	Purchase Price	Salvage/Cull Value	Useful Life	Annual Taxes & Insurance	Annual Capital Recovery	Repair & Maintenance
15	Acres of private land	$800	3.5%	$12,000.00					
5	Miles of pipeline	$600	3.5%	$3,000.00	$300.00	25	$26.40	$188.63	60
2	Wells	$12,000	3.5%	$24,000.00	$2,400.00	25	$211.20	$1,509.07	480
0	Dirt Tanks	$900	3.5%	$0.00	$0.00	25	$0.00	$0.00	$0.00
50	Miles of Fence	$2,000	3.5%	$100,000.00	$10,000.00	25	$880.00	$6,287.80	$2,000.00
1	Corrals/Working Facilities	$10,000	3.5%	$10,000.00	$1,000.00	30	$88.00	$587.58	$200.00
1	Barns & Shop	$15,000	3.5%	$15,000.00	$1,500.00	30	$132.00	$881.37	$300.00
			Sub Totals	$164,000.00			$1,337.60	$9,454.45	$3,040.00
Number	**Machinery & Vehicles**	**Price Per Unit**	Interest Rate	Price	Salvage/Cull				
0	1/2 ton pickup 4WD	$15,000	6.5%	$0.00	$0.00	7	$0.00	$0.00	$0.00
1	3/4 ton pickup 4WD	$20,000	6.5%	$20,000.00	$2,000.00	7	$176.00	$3,483.98	$400.00
0	Stock truck	$25,000	6.5%	$0.00	$0.00	7	$0.00	$0.00	$0.00
1	Dozer/Tractor	$10,000	6.5%	$10,000.00	$1,000.00	7	$88.00	$1,741.99	$200.00
1	Gooseneck trailer	$7,000	6.5%	$7,000.00	$700.00	7	$61.60	$1,219.39	$140.00
0	Water truck	$10,000	6.5%	$0.00	$0.00	7	$0.00	$0.00	$0.00
1	Horse tack	$2,500	6.5%	$2,500.00	$250.00	10	$22.00	$343.49	$50.00
1	Misc. equipment	$2,500	6.5%	$2,500.00	$250.00	10	$22.00	$343.49	$50.00
			Sub Total	$42,000.00			$369.60	$7,132.35	$840.00
Head	**Purchased Livestock**	**Price Per Unit**	Interest Rate	Price	Salvage/Cull				
2	Horses	$1,000	6.5%	$2,000.00	$200.00	10	$17.60	$274.79	
			Sub Total	$2,000.00			$17.60	$274.79	
			Total	$206,000.00			$1,707.20	$16,586.80	

APPENDIX D

NO FAA TESTING 500 HEAD

Herd Planning



Multiyear Budget

Production Information	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7+
Yearlings Purchased (beginning year)							
Beginning Year Breeding Cows, Heifers, & Yearlings	500	528	539	539	533	539	533
Ending Year Herd Size	362	407	418	409	410	411	410
Weighted Avg. Cull Rate for Year	28%	21%	19%	21%	21%	21%	21%
Weighted Avg. % Weaned Calf	76%	76%	76%	76%	76%	76%	76%
% of Total Heifers Kept for Replacements	100%	85%	75%	78%	81%	80%	80%
Operating Receipts							
Calves Sold	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Yearlings Sold							
Capital Receipts							
Cull Cows	$16,725.00	[illegible]	$27,770.28	[illegible]	$30,395.14	[illegible]	$30,202.03
Cull Bulls	[illegible]	[illegible]	[illegible]	[illegible]	$1,350.00	[illegible]	$1,350.00
Other Livestock (Horses)							
Vehicle Sales							
Equipment Sales							
Land Sales							
Other Fixed Asset Sales							
Subtotal Capital Revenue	$46,350.00	$38,060.50	$28,723.28	$35,608.70	$35,845.14	$34,865.01	$35,152.06
Total Revenue	$124,499.60	$98,696.64	$112,066.03	$117,246.98	$114,792.66	$114,694.66	$116,076.41
Per Ending Yr Breeding Cow Revenues	$353.89	$242.36	$267.82	$287.17	$280.31	$279.29	$280.60

COSTS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7+
Variable Costs							
FAA Test Costs							
Bulls Tested (From Herd Planning Sheet)							
Cartrages							
Labor etc.							
Feed Costs							
Hay	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	$327.23	$725.37	[illegible]	$720.17	$728.76	$701.00	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	$791.35	[illegible]	[illegible]	[illegible]	$790.00	$787.60
[illegible]							
Salt & Mineral	[illegible]	[illegible]	$3,021.11	$2,950.20	[illegible]	[illegible]	[illegible]
Protein Supplement	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Grain							
Subtotal Feed Cost	$14,812.86	$17,136.84	$17,608.61	$17,196.83	$17,233.21	$17,281.46	$17,264.18
Other Variable Costs							
Yearling Purchases							
[illegible]	$1,730.00	$2,003.10	$2,092.10	[illegible]	$2,017.50	$2,050.01	[illegible]
Auto/Vehicles (Reg., [illegible])	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Equipment	$3,302.00	$3,302.00	$3,302.00	$3,302.00	[illegible]	$3,302.00	[illegible]
Hired Labor	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other Livestock & Marketing Costs	[illegible]	$2,112.13	[illegible]	$2,503.09	[illegible]	[illegible]	[illegible]
[illegible] & Insurance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Vet & Medicine	[illegible]	[illegible]	$3,030.72	$3,172.50	[illegible]	$3,210.20	[illegible]
Miscellaneous	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Horse Maintenance	$3,200.00	$3,200.00	$3,200.00	$3,200.00	[illegible]	$3,200.00	[illegible]
Other							
Subtotal Other Variable Cost	$59,368.49	$61,319.28	$62,143.78	$61,806.59	$61,789.02	$61,840.45	$61,830.04
Interest Rate on Variable Costs	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
Months	9	9	9	9	9	9	9
Simple Interest on Variable Costs	$4,452.06	$4,707.37	$4,765.14	$4,740.15	$4,741.33	$4,747.31	$4,745.65
Production Cash Variable Costs	$78,653.44	$83,163.49	$84,537.64	$83,742.57	$83,763.56	$83,869.21	$83,839.87
Per Ending Yr Breeding Cow Variable Costs	$223.46	$204.22	$202.03	$204.94	$204.64	$204.23	$204.36
Net Returns Above Variable Costs	$45,846.16	$15,533.15	$27,528.49	$33,504.42	$31,029.10	$30,825.34	$31,236.54
Ending Yr Breeding Cow Returns Above Var. Costs	$130.24	$38.14	$65.79	$82.24	$75.77	$75.06	$76.14
Ownership Cost							
Purchased Livestock (Bulls & Horses)	$1,070.93	$1,070.93	$1,070.93	$1,070.93	[illegible]	$1,070.93	[illegible]
Housing & Improvements	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Machinery & Equipment	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Retained Livestock (Included In Herd Planning Sheet)							
Taxes & Insurance	$3,393.00	$3,393.00	$3,393.00	$3,393.00	[illegible]	$3,393.00	[illegible]
Total Ownership Costs	$42,543.88	$42,543.88	$42,543.88	$42,543.88	$42,543.88	$42,543.88	$42,543.88
Per Ending Yr Breeding Cow Ownership Costs	$120.86	$104.47	$101.67	$104.11	$103.89	$103.60	$103.70
Annual Owner Management/Labor Cost	$4,719.21	$4,989.81	$5,072.25	$5,024.55	$5,025.81	$5,032.15	$5,030.39
TOTAL COSTS less Restocking Females	$125,916.52	$130,697.18	$132,153.67	$131,311.00	$131,333.26	$131,445.24	$131,414.14
Total Net Return less Restocking Females	($1,416.92)	($32,000.54)	($20,087.64)	($13,964.01)	($16,540.59)	($16,750.59)	($15,338.73)
Per Ending Yr Breeding Cow – Cash & Ownership Costs	($4.03)	($78.58)	($48.01)	($34.17)	($40.38)	($40.79)	($38.63)

RANCH ASSETS

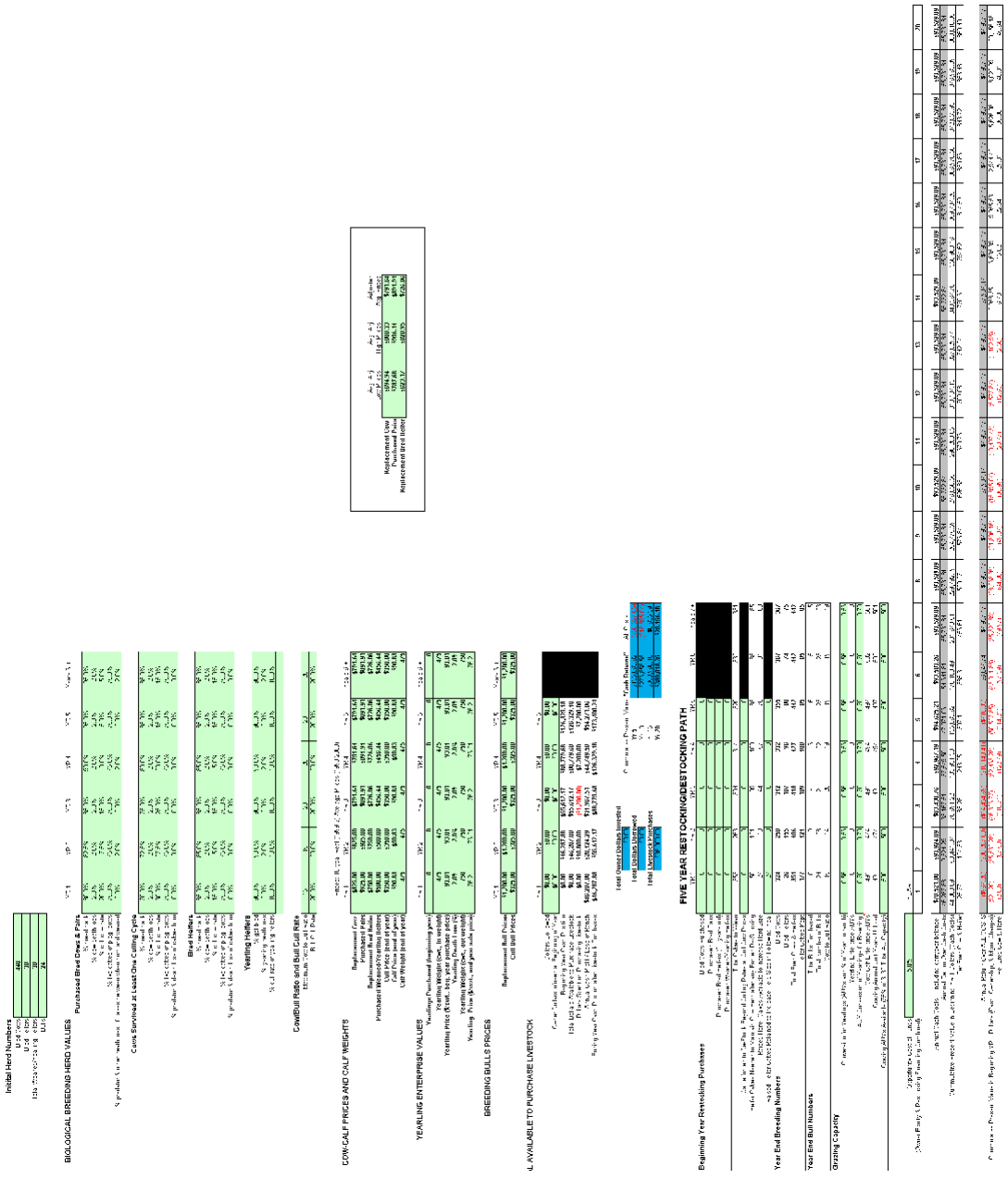
R & M = **2.0%**
Tax & Ins. = **0.9%**

Number	Buildings, Improvements	Price Per Unit	10 Yr Avg Rate of Return	Purchase Price	Salvage/Cull Value	Useful Life	Annual Taxes & Insurance	Annual Capital Recovery	Repair & Maintenance
40	Acres of private land	$800	3.5%	$32,000.00					
20	Miles of pipeline	$600	3.5%	$12,000.00	$1,200.00	25	$105.60	$754.54	240
5	Wells	$12,000	3.5%	$60,000.00	$6,000.00	25	$528.00	$3,772.68	1200
10	Dirt Tanks	$900	3.5%	$9,000.00	$900.00	25	$79.20	$565.90	$180.00
100	Miles of Fence	$2,000	3.5%	$200,000.00	$20,000.00	25	$1,760.00	$12,575.60	$4,000.00
2	Corrals/Working Facilities	$10,000	3.5%	$20,000.00	$2,000.00	30	$176.00	$1,175.16	$400.00
1	Barns & Shop	$15,000	3.5%	$15,000.00	$1,500.00	30	$132.00	$881.37	$300.00
			Sub Totals	$348,000.00			$2,780.80	$19,725.24	$6,320.00
Number	**Machinery & Vehicles**	**Price Per Unit**	Interest Rate	Price	Salvage/Cull				
1	1/2 ton pickup 4WD	$15,000	6.5%	$15,000.00	$1,500.00	7	$132.00	$2,612.99	$300.00
1	3/4 ton pickup 4WD	$20,000	6.5%	$20,000.00	$2,000.00	7	$176.00	$3,483.98	$400.00
1	Stock truck	$25,000	6.5%	$25,000.00	$2,500.00	7	$220.00	$4,354.98	$500.00
1	Dozer/Tractor	$10,000	6.5%	$10,000.00	$1,000.00	7	$88.00	$1,741.99	$200.00
2	Gooseneck trailer	$7,000	6.5%	$14,000.00	$1,400.00	7	$123.20	$2,438.79	$280.00
1	Water truck	$10,000	6.5%	$10,000.00	$1,000.00	7	$88.00	$1,741.99	$200.00
1	Horse tack	$5,000	6.5%	$5,000.00	$500.00	10	$44.00	$686.98	$100.00
1	Misc. equipment	$5,000	6.5%	$5,000.00	$500.00	10	$44.00	$686.98	$100.00
			Sub Total	$104,000.00			$915.20	$17,748.68	$2,080.00
Head	**Purchased Livestock**	**Price Per Unit**	Interest Rate	Price	Salvage/Cull				
10	Horses	$1,000	6.5%	$10,000.00	$1,000.00	10	$88.00	$1,373.96	
			Sub Total	$10,000.00			$88.00	$1,373.96	
			Total	$452,000.00			$3,696.00	$37,473.92	

APPENDIX E

PARTIAL FAA TESTING 500 HEAD

Herd Planning



Multiyear Budget

Production Information	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Yearlings Purchased (beginning year)							
Beginning Year Breeding Cows, Heifers, & Yearlings	500	527	527	527	527	527	527
Ending Year Herd Size	351	406	418	427	442	442	442
Weighted Avg. Cull Rate for Year	26%	23%	21%	23%	23%	24%	25%
Weighted Avg. % Weaned Calf	76%	76%	76%	76%	76%	76%	76%
% of Total Heifers Kept for Replacements	100%	92%	71%	64%	53%	51%	52%
Operating Receipts							
Calves Sold	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Yearlings Sold							
Capital Receipts							
Cull Cows	[illegible]	[illegible]	$30,503.90	$33,529.01	[illegible]	$30,193.10	[illegible]
Cull Bulls	$1,325.00	$1,950.00	$1,325.00	$1,325.00	[illegible]	$1,325.00	[illegible]
Other Livestock (Horses)							
Vehicle Sales							
Equipment Sales							
Land Sales							
Other Fixed Asset Sales							
Subtotal Capital Revenue	$48,875.00	$42,158.00	$32,161.98	$38,154.31	$38,848.17	$41,821.18	$43,187.53
Total Revenue	$124,808.88	$103,249.18	$116,606.27	$130,616.69	$141,696.27	$148,146.07	$149,262.73
Per Ending Yr Breeding Cow Revenues	$366.09	$254.48	$278.67	$306.48	$320.29	$335.44	$337.94
COSTS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Variable Costs							
BAA Test Costs							
Bulls Tested (From Herd Planning Sheet)	12	8		8	8	5	5
Cartages	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Labor etc.	[illegible]	[illegible]		[illegible]	$210.00	[illegible]	$175.00
Feed Costs							
Hay	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BLM	[illegible]	$720.00	[illegible]	[illegible]	$700.05	$707.00	$707.07
State	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
USFS	[illegible]	$700.72	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Private							
Salt & Minerals	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Protein Supplement	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Grain							
Subtotal Feed Cost	$14,749.74	$17,073.61	$17,608.62	$17,979.66	$18,616.97	$18,686.10	$18,686.69
Other Variable Costs							
Yearling Purchases							
Admin Costs	[illegible]	[illegible]	[illegible]	[illegible]	$2,211.99	[illegible]	[illegible]
Auto/Vehicles (...)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Equipment	[illegible]	[illegible]	[illegible]	[illegible]	$3,302.00	[illegible]	$3,302.00
Hired Labor	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other Livestock & Marketing Costs	[illegible]	[illegible]	[illegible]	[illegible]	$3,039.73	[illegible]	$3,201.13
Brand Fees & Insurance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Vet & Medicine	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$3,000.53
Miscellaneous	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Horse Maintenance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other							
Subtotal Other Variable Cost	$59,326.66	$61,346.09	$62,239.38	$62,932.79	$63,859.64	$63,965.15	$63,988.67
Interest Rate on Variable Costs	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
Months	8	9	9	9	8	9	8
Simple Interest on Variable Costs	$4,444.59	$4,705.18	$4,790.87	$4,854.75	$4,940.60	$4,953.01	$4,954.52
Production Cash Variable Costs	$78,521.00	$83,124.89	$84,638.76	$85,767.19	$87,425.21	$87,603.26	$87,629.89
Per Ending Yr Breeding Cow Variable Costs	$224.03	$204.88	$202.28	$200.74	$197.62	$198.13	$198.18
Net Returns Above Variable Costs	$46,287.88	$20,124.29	$31,967.61	$44,749.50	$54,271.06	$60,641.81	$61,732.84
Ending Yr Breeding Cow Returns Above Var. Costs	$132.06	$49.60	$76.40	$104.74	$122.67	$137.31	$139.77
Ownership Cost							
Purchased Livestock (Bulls & Horses)	[illegible]	[illegible]	[illegible]	[illegible]	$1,070.93	[illegible]	$1,070.93
Housing & Improvements	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Machinery & Equipment	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Retained Livestock (Included in Herd Planning Sheet)							
Taxes & Insurance	[illegible]	[illegible]	[illegible]	[illegible]	$3,393.00	[illegible]	$3,393.00
Total Ownership Costs	$42,643.88	$42,643.88	$42,643.88	$42,643.88	$42,643.88	$42,643.88	$42,643.88
Per Ending Yr Breeding Cow Ownership Costs	$121.36	$104.66	$101.67	$99.56	$96.17	$96.33	$96.32
Annual Owner Management/Labor Cost	$4,711.26	$4,867.49	$5,076.33	$5,146.03	$5,245.51	$5,250.20	$5,251.79
TOTAL COSTS less Restocking Females	$125,776.14	$130,656.26	$132,260.96	$133,467.10	$135,214.69	$135,297.33	$135,325.66
Total Net Return less Restocking Females	($967.26)	($27,407.08)	($15,654.69)	($2,940.41)	$6,481.57	$12,847.74	$13,937.17
Per Ending Yr Breeding Cow -- Cash & Ownership Costs	($2.76)	($67.55)	($37.41)	($6.88)	$14.65	$29.08	$31.56

RANCH ASSETS

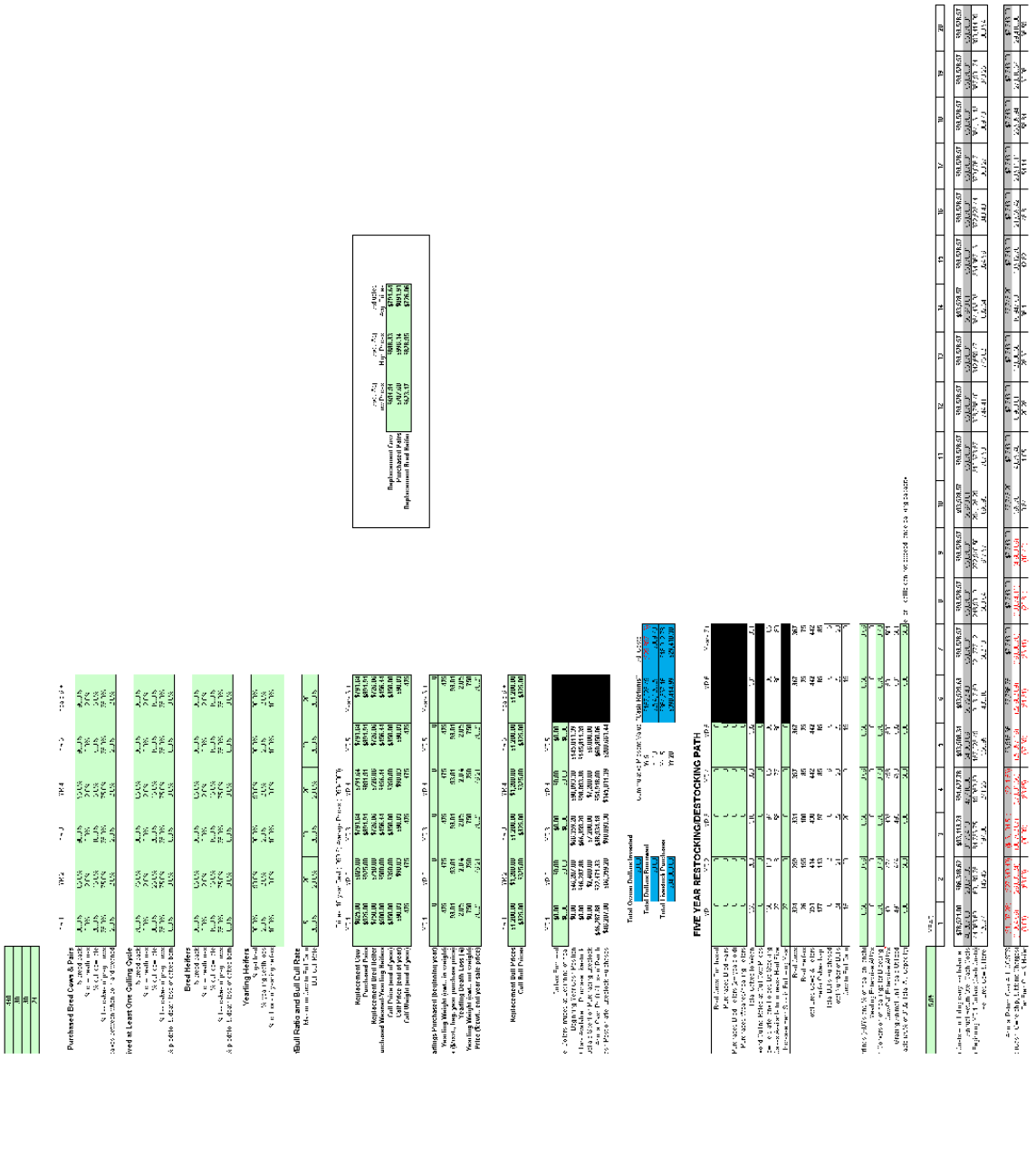
R & M = 2.0%
Tax & Ins. = **0.9%**

Number	Buildings, Improvements	Price Per Unit	10 Yr Avg Rate of Return	Purchase Price	Salvage/Cull Value	Useful Life	Annual Taxes & Insurance	Annual Capital Recovery	Repair & Maintenance
40	Acres of private land	$800	3.5%	$32,000.00					
20	Miles of pipeline	$600	3.5%	$12,000.00	$1,200.00	25	$105.60	$754.54	240
5	Wells	$12,000	3.5%	$60,000.00	$6,000.00	25	$528.00	$3,772.68	1200
10	Dirt Tanks	$900	3.5%	$9,000.00	$900.00	25	$79.20	$565.90	$180.00
100	Miles of Fence	$2,000	3.5%	$200,000.00	$20,000.00	25	$1,760.00	$12,575.60	$4,000.00
2	Corrals/Working Facilities	$10,000	3.5%	$20,000.00	$2,000.00	30	$176.00	$1,175.16	$400.00
1	Barns & Shop	$15,000	3.5%	$15,000.00	$1,500.00	30	$132.00	$881.37	$300.00
			Sub Totals	$348,000.00			$2,780.80	$19,725.24	$6,320.00
Number	**Machinery & Vehicles**	**Price Per Unit**	Interest Rate	Price	Salvage/Cull				
1	1/2 ton pickup 4WD	$15,000	6.5%	$15,000.00	$1,500.00	7	$132.00	$2,612.99	$300.00
1	3/4 ton pickup 4WD	$20,000	6.5%	$20,000.00	$2,000.00	7	$176.00	$3,483.98	$400.00
1	Stock truck	$25,000	6.5%	$25,000.00	$2,500.00	7	$220.00	$4,354.98	$500.00
1	Dozer/Tractor	$10,000	6.5%	$10,000.00	$1,000.00	7	$88.00	$1,741.99	$200.00
2	Gooseneck trailer	$7,000	6.5%	$14,000.00	$1,400.00	7	$123.20	$2,438.79	$280.00
1	Water truck	$10,000	6.5%	$10,000.00	$1,000.00	7	$88.00	$1,741.99	$200.00
1	Horse tack	$5,000	6.5%	$5,000.00	$500.00	10	$44.00	$686.98	$100.00
1	Misc. equipment	$5,000	6.5%	$5,000.00	$500.00	10	$44.00	$686.98	$100.00
			Sub Total	$104,000.00			$915.20	$17,748.68	$2,080.00
Head	**Purchased Livestock**	**Price Per Unit**	Interest Rate	Price	Salvage/Cull				
10	Horses	$1,000	6.5%	$10,000.00	$1,000.00	10	$88.00	$1,373.96	
			Sub Total	$10,000.00			$88.00	$1,373.96	
			Total	$452,000.00			$3,696.00	$37,473.92	

APPENDIX F

COMPLETE FAA TESTING 500 HEAD

Herd Planning



Multiyear Budget

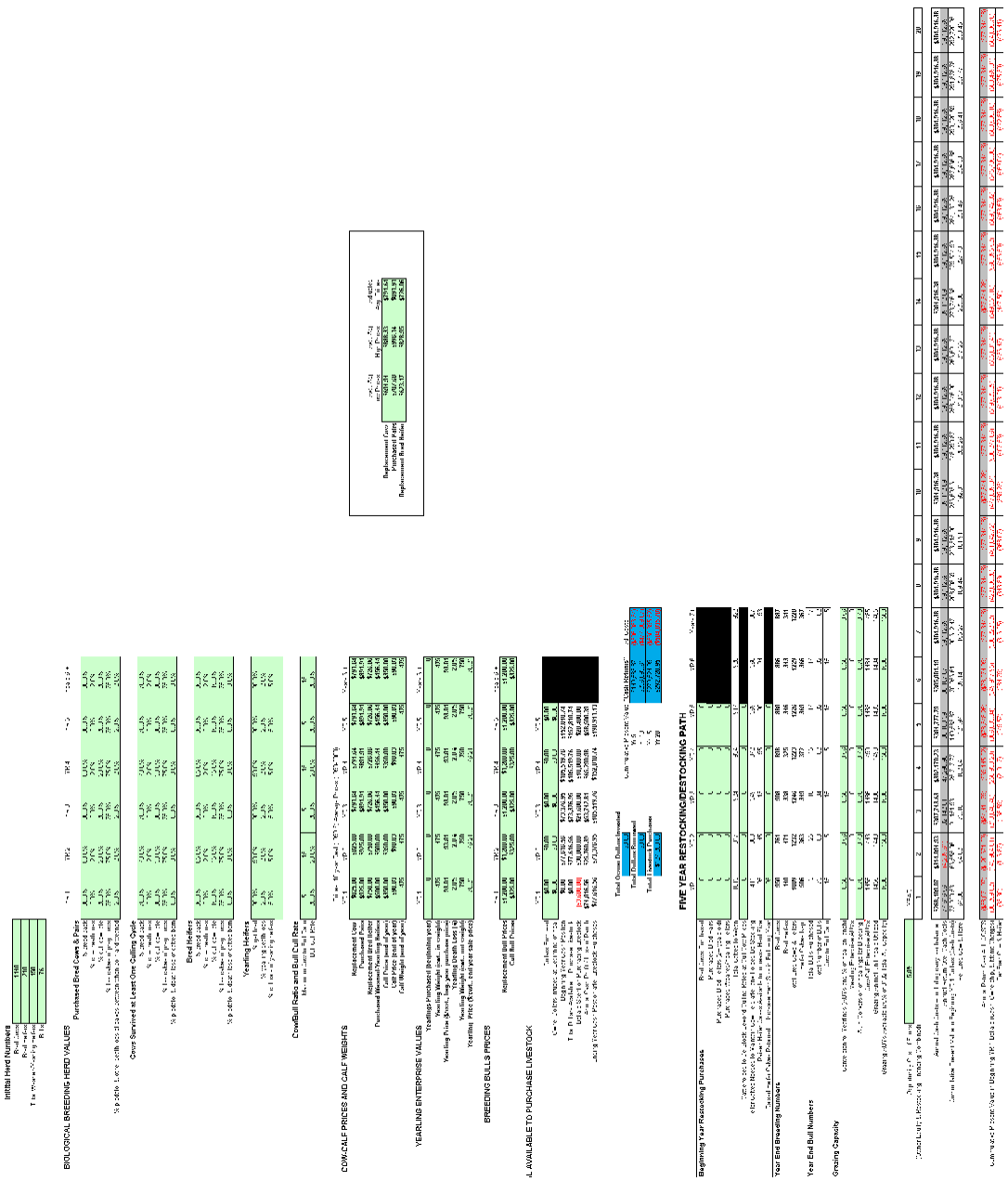
Production Information	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Yearlings Purchased (beginning year)							
Beginning Year Breeding Cows, Heifers, & Yearlings	500	527	527	527	527	527	527
Ending Year Herd Size	361	414	430	442	442	442	442
Weighted Avg. Cull Rate for Year	26%	23%	21%	23%	24%	25%	25%
Weighted Avg. % Weaned Calf	76%	76%	76%	76%	76%	76%	76%
% of Total Heifers Kept for Replacements	100%	86%	62%	53%	51%	52%	52%
Operating Receipts							
Calves Sold	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Yearlings Sold							
Capital Receipts							
Cull Cows	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cull Bulls	$1,325.00	$1,325.00	$1,325.00	$1,325.00	[illegible]	$1,325.00	[illegible]
Other Livestock (Horses)							
Vehicle Sales							
Equipment Sales							
Land Sales							
Other Fixed Asset Sales							
Subtotal Capital Revenue	$48,875.00	$41,833.00	$32,729.15	$39,722.68	$42,078.18	$43,154.68	$43,100.85
Total Revenue	$124,808.88	$106,419.94	$124,847.41	$142,346.78	$148,368.40	$149,252.06	$149,207.38
Per Ending Yr Breeding Cow Revenues	$366.09	$257.16	$290.26	$321.87	$335.92	$337.92	$337.82
COSTS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Variable Costs							
EPA Test Costs							
Bulls Tested (From Herd Planning Sheet)	24	2	6	6	5	5	5
Cartages	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Labor etc.	[illegible]	[illegible]		[illegible]	$175.00	[illegible]	$175.00
Feed Costs							
Hay	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BLM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
State	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
USFS	[illegible]	[illegible]	[illegible]	[illegible]	$350.53	[illegible]	$350.32
Private							
Salt & Minerals	[illegible]	[illegible]	[illegible]	[illegible]	$3,100.39	[illegible]	$3,100.30
Protein Supplement	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Grain							
Subtotal Feed Cost	$14,749.74	$17,414.68	$18,101.30	$18,610.88	$18,686.40	$18,686.68	$18,686.61
Other Variable Costs							
Yearling Purchases							
Admin Costs	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Auto/Vehicles [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Equipment	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hired Labor	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other Livestock & Marketing Costs	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] & Insurance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Vet & Medicine	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Miscellaneous	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Horse Maintenance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other							
Subtotal Other Variable Cost	$59,326.86	$61,782.22	$62,948.92	$63,868.15	$63,969.64	$63,988.45	$63,987.51
Interest Rate on Variable Costs	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
Months	8	9	9	9	8	9	8
Simple Interest on Variable Costs	$4,444.59	$4,751.81	$4,863.01	$4,948.74	$4,953.30	$4,954.51	$4,954.45
Production Cash Variable Costs	$78,521.00	$83,948.62	$85,913.23	$87,427.78	$87,608.34	$87,629.63	$87,628.57
Per Ending Yr Breeding Cow Variable Costs	$224.03	$202.86	$199.73	$197.69	$198.14	$198.18	$198.17
Net Returns Above Variable Costs	$46,287.88	$22,471.33	$38,934.18	$54,918.00	$60,860.06	$61,722.43	$61,678.81
Ending Yr Breeding Cow Returns Above Var. Costs	$132.06	$54.30	$90.51	$124.18	$137.78	$139.76	$139.65
Ownership Cost							
Purchased Livestock (Bulls & Horses)	[illegible]	[illegible]	[illegible]	[illegible]	$1,510.90	[illegible]	$1,510.90
Housing & Improvements	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Machinery & Equipment	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Retained Livestock (Included in Herd Planning Sheet)							
Taxes & Insurance	[illegible]	[illegible]	[illegible]	[illegible]	$3,393.00	[illegible]	$3,393.00
Total Ownership Costs	$42,683.90	$42,683.90	$42,683.90	$42,683.90	$42,683.90	$42,683.90	$42,683.90
Per Ending Yr Breeding Cow Ownership Costs	$121.78	$103.14	$99.29	$96.51	$96.65	$96.64	$96.64
Annual Owner Management/Labor Cost	$4,711.28	$5,036.92	$5,154.79	$5,245.67	$5,250.50	$5,251.78	$5,251.71
TOTAL COSTS less Restocking Females	$125,916.16	$131,669.43	$133,751.92	$135,357.34	$135,442.74	$135,465.31	$135,464.18
Total Net Return less Restocking Females	($1,107.28)	($25,249.49)	($8,904.51)	$6,988.44	$12,916.66	$13,786.75	$13,743.20
er Ending Yr Breeding Cow -- Cash & Ownership Costs	($3.16)	($61.01)	($20.70)	$15.80	$29.24	$31.21	$31.12

Number	Buildings, Improvements	Price Per Unit	10 Yr Avg Rate of Return	Purchase Price	Salvage/Cull Value	Useful Life	Annual Taxes & Insurance	Annual Capital Recovery	Repair & Maintenance
40	Acres of private land	$800	3.5%	$32,000.00					
20	Miles of pipeline	$600	3.5%	$12,000.00	$1,200.00	25	$105.60	$754.54	240
5	Wells	$12,000	3.5%	$60,000.00	$6,000.00	25	$528.00	$3,772.68	1200
10	Dirt Tanks	$900	3.5%	$9,000.00	$900.00	25	$79.20	$565.90	$180.00
100	Miles of Fence	$2,000	3.5%	$200,000.00	$20,000.00	25	$1,760.00	$12,575.60	$4,000.00
2	Corrals/Working Facilities	$10,000	3.5%	$20,000.00	$2,000.00	30	$176.00	$1,175.16	$400.00
1	Barns & Shop	$15,000	3.5%	$15,000.00	$1,500.00	30	$132.00	$881.37	$300.00
			Sub Totals	$348,000.00			$2,780.80	$19,725.24	$6,320.00
Number	**Machinery & Vehicles**	**Price Per Unit**	Interest Rate	Price	Salvage/Cull				
1	1/2 ton pickup 4WD	$15,000	6.5%	$15,000.00	$1,500.00	7	$132.00	$2,612.99	$300.00
1	3/4 ton pickup 4WD	$20,000	6.5%	$20,000.00	$2,000.00	7	$176.00	$3,483.98	$400.00
1	Stock truck	$25,000	6.5%	$25,000.00	$2,500.00	7	$220.00	$4,354.98	$500.00
1	Dozer/Tractor	$10,000	6.5%	$10,000.00	$1,000.00	7	$88.00	$1,741.99	$200.00
2	Gooseneck trailer	$7,000	6.5%	$14,000.00	$1,400.00	7	$123.20	$2,438.79	$280.00
1	Water truck	$10,000	6.5%	$10,000.00	$1,000.00	7	$88.00	$1,741.99	$200.00
1	Horse tack	$5,000	6.5%	$5,000.00	$500.00	10	$44.00	$686.98	$100.00
1	Misc. equipment	$5,000	6.5%	$5,000.00	$500.00	10	$44.00	$686.98	$100.00
			Sub Total	$104,000.00			$915.20	$17,748.68	$2,080.00
Head	**Purchased Livestock**	**Price Per Unit**	Interest Rate	Price	Salvage/Cull				
10	Horses	$1,000	8.0%	$10,000.00	$1,000.00	10	$88.00	$1,513.98	
			Sub Total	$10,000.00			$88.00	$1,513.98	
			Total	$452,000.00			$3,696.00	$37,473.92	

APPENDIX G

NO FAA TESTING 1500 HEAD

Herd Planning



Multiyear Budget

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Years 7 –
Production Information							
Yearlings Purchased (beginning year)							
Beginning Year Breeding Cows, Heifers, & Yearlings	1600	1696	1696	1696	1696	1696	1696
Ending Year Herd Size	1089	1232	1246	1223	1228	1229	1228
Weighted Avg. Cull Rate for Year	26%	21%	20%	21%	21%	21%	21%
Weighted Avg. % Weaned Calf	75%	75%	75%	75%	75%	75%	75%
% of Total Heifers Kept for Replacements	100%	89%	76%	80%	80%	80%	80%
Operating Receipts							
Calves Sold	$210,525.30	$195,777.02	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Yearlings Sold							
Capital Receipts							
Cull Cows	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cull Bulls	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other Livestock (Horses)							
Vehicle Sales							
Equipment Sales							
Land Sales							
Other Farm Asset Sales							
Subtotal Capital Revenue	$127,200.00	$114,077.60	$91,828.79	$107,011.93	$106,319.84	$104,374.82	$104,967.62
Total Revenue	$345,725.83	$309,855.32	$330,886.44	$340,461.21	$342,870.16	$343,188.25	$344,028.07
Per Ending Yr Breeding Cow Revenues	$317.47	$251.50	$272.60	$285.88	$279.50	$279.31	$280.25
COSTS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Variable Costs							
FAA Test Costs							
Bulls Leased (From Herd Planning Sheet)							
Cartrages							
Labor etc.							
Feed Costs							
Hay	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BLM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
State	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
USFS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Private							
Salt & Mineral	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Protein Supplement	[illegible]	[illegible]	[illegible]	[illegible]	$20,125.55	[illegible]	[illegible]
Grain							
Subtotal Feed Cost	$45,827.30	$51,848.06	$52,431.28	$51,445.34	$51,610.19	$51,708.51	$51,659.44
Other Variable Costs							
Yearling Purchases							
Admin Costs	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Auto/Vehicles (Rep, Tires, Fuel, etc.)	[illegible]	[illegible]	[illegible]	[illegible]	$20,100.00	[illegible]	$20,100.00
Equipment	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hired Labor	[illegible]	[illegible]	[illegible]	[illegible]	$32,100.00	[illegible]	$32,100.00
Other Livestock & Marketing Costs	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Prof Fees & Insurance	[illegible]	[illegible]	[illegible]	[illegible]	$9,000.00	[illegible]	$9,000.00
Vet & Medicine	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Miscellaneous	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Horse Maintenance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other							
Subtotal Other Variable Cost	$210,502.01	$216,168.01	$217,516.56	$216,639.78	$216,670.74	$216,786.17	$216,762.26
Interest Rate on Variable Costs	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
Months	9	9	9	9	9	9	9
Simple Interest on Variable Costs	$16,379.76	$16,080.84	$16,196.81	$16,085.11	$16,096.86	$16,109.60	$16,104.70
Production Cash Variable Costs	$271,709.07	$284,094.93	$286,143.83	$284,170.23	$284,377.79	$284,601.19	$284,516.38
Per Ending Yr Breeding Cow Variable Costs	$249.50	$230.58	$229.66	$232.45	$231.88	$231.63	$231.77
Net Returns Above Variable Costs	$74,016.58	$25,760.38	$53,742.61	$65,290.98	$58,500.39	$58,587.07	$59,512.69
Ending Yr Breeding Cow Returns Above Var. Costs	$67.97	$20.91	$43.13	$53.41	$47.70	$47.68	$48.48
Ownership Cost							
Purchased Livestock (Bulls & Horses)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Housing & Improvements	[illegible]	[illegible]	[illegible]	[illegible]	$52,990.90	[illegible]	$52,990.90
Machinery & Equipment	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Retained Livestock (Included in Herd Planning Sheet)							
Taxes & Insurance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Ownership Costs	$99,385.98	$99,385.98	$99,385.98	$99,385.98	$99,385.98	$99,385.98	$99,385.98
Per Ending Yr Breeding Cow Ownership Costs	$91.26	$80.67	$79.77	$81.30	$81.04	$80.89	$80.96
Annual Owner Management/Labor Cost	$16,302.54	$17,046.70	$17,168.62	$17,050.21	$17,062.67	$17,076.07	$17,070.98
TOTAL COSTS less Restocking Females	$387,397.60	$400,526.61	$402,698.23	$400,606.43	$400,826.44	$401,063.24	$400,973.35
Total Net Return less Restocking Females	($41,671.97)	($90,671.29)	($62,011.79)	($51,145.22)	($57,948.26)	($57,874.99)	($56,944.28)
er Ending Yr Breeding Cow -- Cash & Ownership Costs	($38.27)	($73.60)	($50.41)	($41.84)	($47.26)	($47.10)	($46.39)

RANCH ASSETS

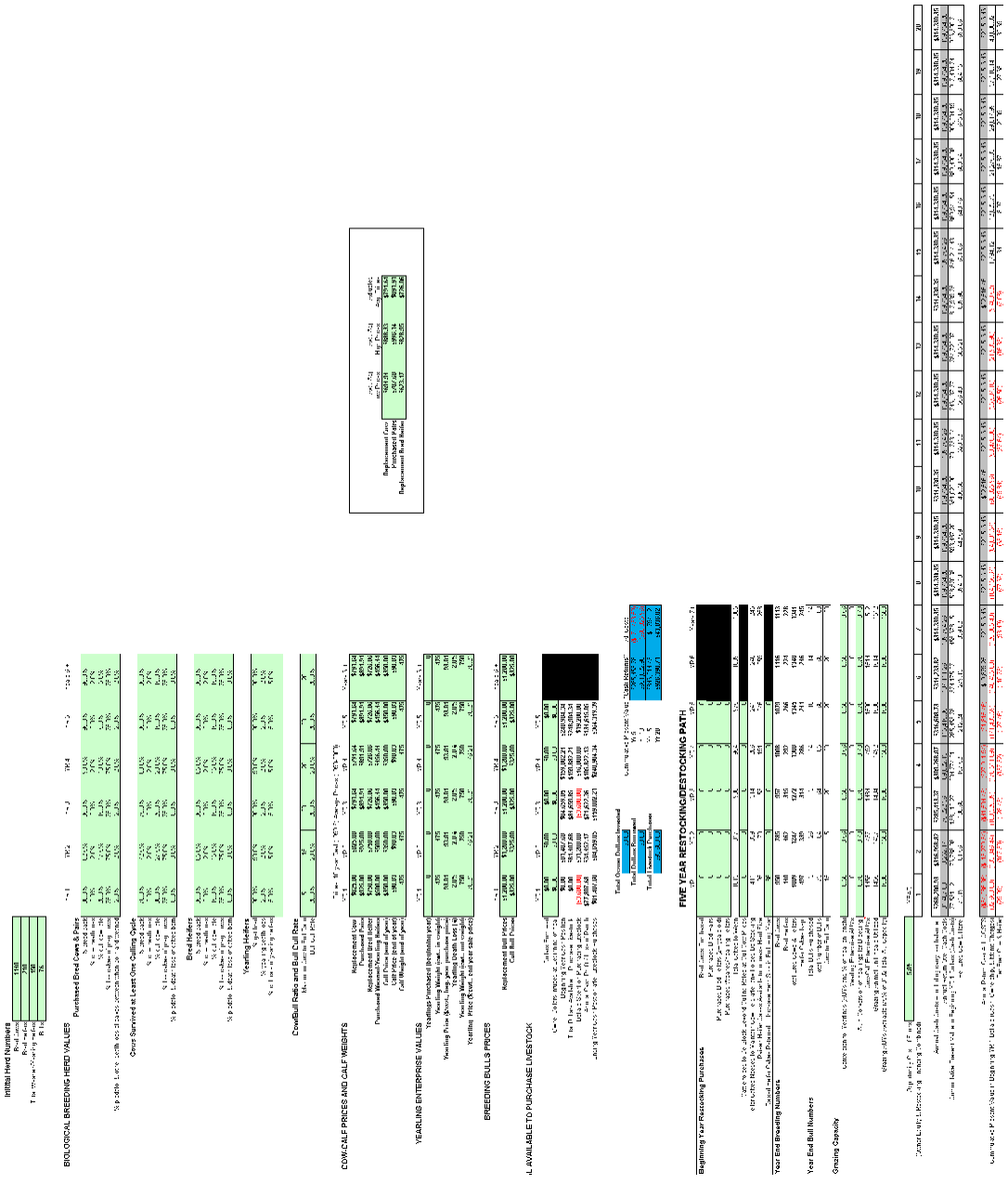
R & M = **2.0%**
Tax & Ins. = **0.9%**

Number	Buildings, Improvements	Price Per Unit	10 Yr Avg Rate of Return	Purchase Price	Salvage/Cull Value	Useful Life	Annual Taxes & Insurance	Annual Capital Recovery	Repair & Maintenance
250	Acres of private land	$800	3.5%	$200,000.00					
50	Miles of pipeline	$600	3.5%	$30,000.00	$3,000.00	25	$264.00	$1,886.34	600
10	Wells	$12,000	3.5%	$120,000.00	$12,000.00	25	$1,056.00	$7,545.36	2400
20	Dirt Tanks	$900	3.5%	$18,000.00	$1,800.00	25	$158.40	$1,131.80	$360.00
300	Miles of Fence	$2,000	3.5%	$600,000.00	$60,000.00	25	$5,280.00	$37,726.79	$12,000.00
5	Corrals/Working Facilities	$10,000	3.5%	$50,000.00	$5,000.00	30	$440.00	$2,937.90	$1,000.00
2	Barns & Shop	$15,000	3.5%	$30,000.00	$3,000.00	30	$264.00	$1,762.74	$600.00
			Sub Totals	$1,048,000.00			$7,462.40	$52,990.93	$16,960.00
Number	**Machinery & Vehicles**	**Price Per Unit**	Interest Rate	Price	Salvage/Cull				
2	1/2 ton pickup 4WD	$15,000	6.5%	$30,000.00	$3,000.00	7	$264.00	$5,225.97	$600.00
2	3/4 ton pickup 4WD	$20,000	6.5%	$40,000.00	$4,000.00	7	$352.00	$6,967.97	$800.00
2	Stock truck	$25,000	6.5%	$50,000.00	$5,000.00	7	$440.00	$8,709.96	$1,000.00
2	Dozer/Tractor	$10,000	6.5%	$20,000.00	$2,000.00	7	$176.00	$3,483.98	$400.00
4	Gooseneck trailer	$7,000	6.5%	$28,000.00	$2,800.00	7	$246.40	$4,877.58	$560.00
1	Water truck	$10,000	6.5%	$10,000.00	$1,000.00	7	$88.00	$1,741.99	$200.00
1	Horse tack	$10,000	6.5%	$10,000.00	$1,000.00	10	$88.00	$1,373.96	$200.00
1	Misc. equipment	$10,000	6.5%	$10,000.00	$1,000.00	10	$88.00	$1,373.96	$200.00
			Sub Total	$198,000.00			$1,742.40	$33,755.36	$3,960.00
Head	**Purchased Livestock**	**Price Per Unit**	Interest Rate	Price	Salvage/Cull				
25	Horses	$1,000	6.5%	$25,000.00	$2,500.00	10	$220.00	$3,434.89	
			Sub Total	$25,000.00			$220.00	$3,434.89	
			Total	$1,246,000.00			$9,204.80	$86,746.29	

APPENDIX H

PARTIAL FAA TESTING 1500 HEAD

Herd Planning



Multiyear Budget

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Production Information							
Yearlings Purchased (beginning year)							
Beginning Year Breeding Cows, Heifers, & Yearlings	1600	1686	1686	1686	1686	1686	1686
Ending Year Herd Size	1089	1247	1272	1300	1345	1340	1341
Weighted Avg. Cull Rate for Year	26%	21%	20%	22%	27%	24%	24%
Weighted Avg. % Weaned Calf	75%	75%	75%	75%	75%	75%	75%
% of Total Heifers Kept for Replacements	98%	83%	67%	60%	49%	49%	49%
Operating Receipts							
Calves Sold	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Yearlings Sold							
Capital Receipts							
Cull Cows	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cull Bulls	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other Livestock (Horses)							
Vehicle Sales							
Equipment Sales							
Land Sales							
Other Fixed Asset Sales							
Subtotal Capital Revenue	$127,200.00	$113,920.00	$92,694.79	$110,190.70	$116,362.90	$122,069.91	$126,061.87
Total Revenue	$349,800.81	$320,211.00	$360,835.73	$398,280.20	$432,023.76	$451,345.08	$454,084.82
Per Ending Yr Breeding Cow Revenues	$321.04	$256.70	$283.50	$306.36	$321.21	$336.70	$336.63
COSTS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Variable Costs							
FAA Test Costs							
Bulls Tested (From Herd Planning Sheet)	37	26		14	16	14	14
Cartrages	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Labor etc.	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Feed Costs							
Hay	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
FHM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
State	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$15,100.73
Lease	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Private							
Salt & Mineral	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Protein Supplement	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Grain							
Subtotal Feed Cost	$45,627.30	$52,402.77	$53,516.63	$54,705.21	$56,599.59	$56,410.15	$56,429.09
Other Variable Costs							
Yearling Purchases							
Admin Costs	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Auto/Vehicles (Repair, Tires, Fuel, etc.)	[illegible]	[illegible]	[illegible]	[illegible]	$20,100.00	[illegible]	$20,100.00
Equipment	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hired Labor	[illegible]	[illegible]	[illegible]	[illegible]	$32,100.00	[illegible]	$32,100.00
Other Livestock & Marketing Costs	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Prof Fees & Insurance	[illegible]	[illegible]	[illegible]	[illegible]	$9,000.00	[illegible]	$9,000.00
Vet & Breeding	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Miscellaneous	[illegible]	[illegible]	[illegible]	[illegible]	$23,399.37	[illegible]	[illegible]
Fence Maintenance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other							
Subtotal Other Variable Cost	$210,688.67	$217,091.02	$219,137.49	$221,208.07	$223,974.68	$224,187.80	$224,259.92
Interest Rate on Variable Costs	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
Months	9	9	9	9	9	9	9
Simple Interest on Variable Costs	$16,384.96	$16,176.03	$16,369.26	$16,564.80	$16,834.46	$16,835.88	$16,841.34
Production Cash Variable Costs	$271,000.93	$285,758.82	$289,013.37	$292,408.07	$297,408.73	$297,433.82	$297,530.35
Per Ending Yr Breeding Cow Variable Costs	$248.50	$229.06	$227.20	$224.98	$221.12	$221.90	$221.88
Net Returns Above Variable Costs	$77,807.88	$34,452.17	$71,822.36	$105,822.13	$134,615.05	$153,911.26	$156,554.26
Ending Yr Breeding Cow Returns Above Var. Costs	$71.45	$27.62	$56.32	$81.40	$100.09	$114.82	$116.75
Ownership Cost							
Purchased Livestock (Bulls & Horses)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Housing & Improvements	[illegible]	[illegible]	[illegible]	[illegible]	$52,990.00	[illegible]	$52,990.00
Machinery & Equipment	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Retained Livestock (Included in Herd Planning Sheet)							
Taxes & Insurance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Ownership Costs	$99,385.98	$99,385.98	$99,385.98	$99,385.98	$99,385.98	$99,385.98	$99,385.98
Per Ending Yr Breeding Cow Ownership Costs	$91.26	$79.67	$78.16	$76.46	$73.89	$74.14	$74.12
Annual Owner Management/Labor Cost	$16,308.06	$17,146.63	$17,340.80	$17,648.08	$17,844.62	$17,846.03	$17,851.82
TOTAL COSTS less Restocking Females	$387,494.97	$402,290.34	$405,740.15	$409,402.14	$414,639.24	$414,665.84	$414,768.16
Total Net Return less Restocking Females	($37,888.36)	($82,079.34)	($45,104.43)	($11,111.94)	$17,384.54	$36,679.25	$39,316.46
er Ending Yr Breeding Cow -- Cash & Ownership Costs	($34.79)	($65.80)	($36.47)	($8.55)	$12.93	$27.36	$29.32

RANCH ASSETS

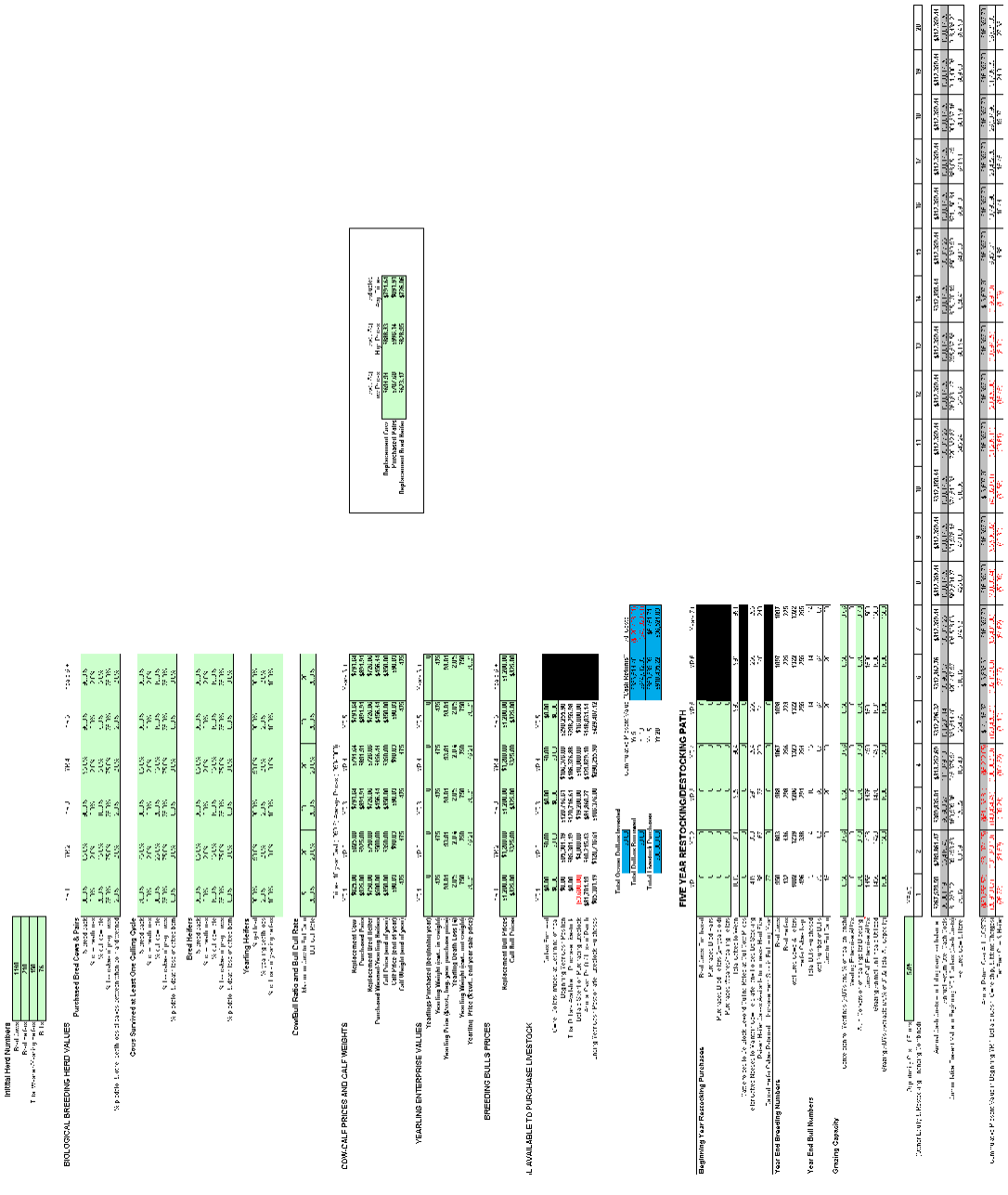
R & M = **2.0%**
Tax & Ins. = **0.9%**

Number	Buildings, Improvements	Price Per Unit	10 Yr Avg Rate of Return	Purchase Price	Salvage/Cull Value	Useful Life	Annual Taxes & Insurance	Annual Capital Recovery	Repair & Maintenance
250	Acres of private land	$800	3.5%	$200,000.00					
50	Miles of pipeline	$600	3.5%	$30,000.00	$3,000.00	25	$264.00	$1,886.34	600
10	Wells	$12,000	3.5%	$120,000.00	$12,000.00	25	$1,056.00	$7,545.36	2400
20	Dirt Tanks	$900	3.5%	$18,000.00	$1,800.00	25	$158.40	$1,131.80	$360.00
300	Miles of Fence	$2,000	3.5%	$600,000.00	$60,000.00	25	$5,280.00	$37,726.79	$12,000.00
5	Corrals/Working Facilities	$10,000	3.5%	$50,000.00	$5,000.00	30	$440.00	$2,937.90	$1,000.00
2	Barns & Shop	$15,000	3.5%	$30,000.00	$3,000.00	30	$264.00	$1,762.74	$600.00
			Sub Totals	$1,048,000.00			$7,462.40	$52,990.93	$16,960.00
Number	**Machinery & Vehicles**	**Price Per Unit**	Interest Rate	Price	Salvage/Cull				
2	1/2 ton pickup 4WD	$15,000	6.5%	$30,000.00	$3,000.00	7	$264.00	$5,225.97	$600.00
2	3/4 ton pickup 4WD	$20,000	6.5%	$40,000.00	$4,000.00	7	$352.00	$6,967.97	$800.00
2	Stock truck	$25,000	6.5%	$50,000.00	$5,000.00	7	$440.00	$8,709.96	$1,000.00
2	Dozer/Tractor	$10,000	6.5%	$20,000.00	$2,000.00	7	$176.00	$3,483.98	$400.00
4	Gooseneck trailer	$7,000	6.5%	$28,000.00	$2,800.00	7	$246.40	$4,877.58	$560.00
1	Water truck	$10,000	6.5%	$10,000.00	$1,000.00	7	$88.00	$1,741.99	$200.00
1	Horse tack	$10,000	6.5%	$10,000.00	$1,000.00	10	$88.00	$1,373.96	$200.00
1	Misc. equipment	$10,000	6.5%	$10,000.00	$1,000.00	10	$88.00	$1,373.96	$200.00
			Sub Total	$198,000.00			$1,742.40	$33,755.36	$3,960.00
Head	**Purchased Livestock**	**Price Per Unit**	Interest Rate	Price	Salvage/Cull				
25	Horses	$1,000	6.5%	$25,000.00	$2,500.00	10	$220.00	$3,434.89	
			Sub Total	$25,000.00			$220.00	$3,434.89	
			Total	$1,246,000.00			$9,204.80	$86,746.29	

APPENDIX I

COMPLETE FAA TESTING 1500 HEAD

Herd Planning



Multiyear Budget

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Years 7+
Production Information							
Yearlings Purchased (beginning year)							
Beginning Year Breeding Cows, Heifers, & Yearlings	1600	1677	1677	1677	1677	1677	1677
Ending Year Herd Size	1082	1239	1286	1323	1322	1322	1322
Weighted Avg. Cull Rate for Year	26%	22%	22%	23%	24%	26%	26%
Weighted Avg. % Weaned Calf	75%	75%	75%	75%	75%	75%	75%
% of Total Heifers Kept for Replacements	98%	83%	63%	63%	61%	62%	62%
Operating Receipts							
Calves Sold	$220,055.77	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Yearlings Sold							
Capital Receipts							
Cull Cows	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cull Bulls	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other Livestock (Horses)							
Vehicle Sales							
Equipment Sales							
Land Sales							
Other Fixed Asset Sales							
Subtotal Capital Revenue	$129,825.00	$121,265.00	$100,247.25	$118,487.61	$126,471.11	$128,830.38	$128,662.42
Total Revenue	$352,880.77	$325,276.80	$375,405.26	$425,131.70	$443,527.46	$446,316.12	$446,178.60
Per Ending Yr Breeding Cow Revenues	$326.20	$262.50	$292.06	$321.22	$335.60	$337.69	$337.50
COSTS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Variable Costs							
FAA Test Costs							
Bulls Tested (From Herd Planning Sheet)	76	4	16	16	14	14	14
Cartrages	[illegible]	[illegible]		$675.00	$300.00	$600.00	$300.00
Labor etc.	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Feed Costs							
Hay	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BLM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
State	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
USFS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Private							
Salt & Minerals	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Protein Supplement	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Grain							
Subtotal Feed Cost	$45,511.66	$52,126.45	$54,104.34	$55,604.50	$55,614.99	$55,616.67	$55,618.77
Other Variable Costs							
Yearling Purchases							
Admin Costs	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Auto/Vehicles (Rep., Tires, Fuel, Oil)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Equipment	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hired Labor	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other Livestock Marketing Costs	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Prof Fees & Insurance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Vet & Breeding	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Miscellaneous	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Horse Maintenance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other							
Subtotal Other Variable Cost	$210,318.12	$216,797.47	$220,079.63	$222,846.78	$223,166.12	$223,213.82	$223,210.89
Interest Rate on Variable Costs	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
Months	9	9	9	9	9	9	9
Simple Interest on Variable Costs	$16,349.79	$16,136.66	$16,461.04	$16,712.42	$16,726.21	$16,729.97	$16,729.78
Production Cash Variable Costs	$271,179.58	$285,061.47	$290,635.01	$295,252.60	$295,496.32	$295,562.70	$295,559.44
Per Ending Yr Breeding Cow Variable Costs	$250.74	$230.12	$226.05	$223.08	$223.59	$223.63	$223.62
Net Returns Above Variable Costs	$81,701.18	$40,215.43	$84,860.27	$129,878.10	$148,031.14	$150,753.37	$150,617.25
Ending Yr Breeding Cow Returns Above Var. Costs	$75.54	$32.46	$66.00	$98.19	$112.01	$114.06	$113.96
Ownership Cost							
Purchased Livestock (Bulls & Horses)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Housing & Improvements	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Machinery & Equipment	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Retained Livestock (Included in Herd Planning Sheet)							
Taxes & Insurance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Ownership Costs	$99,385.98	$99,385.98	$99,385.98	$99,385.98	$99,385.98	$99,385.98	$99,385.98
Per Ending Yr Breeding Cow Ownership Costs	$91.90	$80.23	$77.30	$75.09	$75.20	$75.20	$75.20
Annual Owner Management/Labor Cost	$16,270.78	$17,103.69	$17,438.10	$17,716.16	$17,729.78	$17,733.77	$17,733.67
TOTAL COSTS less Restocking Females	$386,836.35	$401,551.15	$407,459.09	$412,353.64	$412,612.08	$412,682.51	$412,678.99
Total Net Return less Restocking Females	($33,955.57)	($76,274.25)	($31,963.81)	$12,777.85	$30,915.37	$33,633.62	$33,497.70
Per Ending Yr Breeding Cow -- Cash & Ownership Costs	($31.40)	($61.57)	($24.86)	$9.66	$23.39	$25.46	$25.34

RANCH ASSETS

R & M = 2.0%
Tax & Ins. = **0.9%**

Number	Buildings, Improvements	Price Per Unit	10 Yr Avg Rate of Return	Purchase Price	Salvage/Cull Value	Useful Life	Annual Taxes & Insurance	Annual Capital Recovery	Repair & Maintenance
250	Acres of private land	$800	3.5%	$200,000.00					
50	Miles of pipeline	$600	3.5%	$30,000.00	$3,000.00	25	$264.00	$1,886.34	600
10	Wells	$12,000	3.5%	$120,000.00	$12,000.00	25	$1,056.00	$7,545.36	2400
20	Dirt Tanks	$900	3.5%	$18,000.00	$1,800.00	25	$158.40	$1,131.80	$360.00
300	Miles of Fence	$2,000	3.5%	$600,000.00	$60,000.00	25	$5,280.00	$37,726.79	$12,000.00
5	Corrals/Working Facilities	$10,000	3.5%	$50,000.00	$5,000.00	30	$440.00	$2,937.90	$1,000.00
2	Barns & Shop	$15,000	3.5%	$30,000.00	$3,000.00	30	$264.00	$1,762.74	$600.00
			Sub Totals	$1,048,000.00			$7,462.40	$52,990.93	$16,960.00
Number	**Machinery & Vehicles**	**Price Per Unit**	Interest Rate	Price	Salvage/Cull				
2	1/2 ton pickup 4WD	$15,000	6.5%	$30,000.00	$3,000.00	7	$264.00	$5,225.97	$600.00
2	3/4 ton pickup 4WD	$20,000	6.5%	$40,000.00	$4,000.00	7	$352.00	$6,967.97	$800.00
2	Stock truck	$25,000	6.5%	$50,000.00	$5,000.00	7	$440.00	$8,709.96	$1,000.00
2	Dozer/Tractor	$10,000	6.5%	$20,000.00	$2,000.00	7	$176.00	$3,483.98	$400.00
4	Gooseneck trailer	$7,000	6.5%	$28,000.00	$2,800.00	7	$246.40	$4,877.58	$560.00
1	Water truck	$10,000	6.5%	$10,000.00	$1,000.00	7	$88.00	$1,741.99	$200.00
1	Horse tack	$10,000	6.5%	$10,000.00	$1,000.00	10	$88.00	$1,373.96	$200.00
1	Misc. equipment	$10,000	6.5%	$10,000.00	$1,000.00	10	$88.00	$1,373.96	$200.00
			Sub Total	$198,000.00			$1,742.40	$33,755.36	$3,960.00
Head	**Purchased Livestock**	**Price Per Unit**	Interest Rate	Price	Salvage/Cull				
25	Horses	$1,000	6.5%	$25,000.00	$2,500.00	10	$220.00	$3,434.89	
			Sub Total	$25,000.00			$220.00	$3,434.89	
			Total	$1,246,000.00			$9,204.80	$86,746.29	

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May 23, 2009 at 10:30am. Meeting and conversation with Dr. Roy Ax.