# EFFECTS OF FEEDING HIGH ENERGY SUPPLEMENTS PRE AND POST BREEDING ON ESTRUS AND CONCEPTION OF SPRING CALVING HEIFERS

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EFFECTS OF FEEDING HIGH ENERGY SUPPLEMENTS

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# DEDICATION

I would like to dedicate this thesis to my grandparents, the late Ralph and Donna Coley, who without them, I would not be the person I am today. Through their guidance, I found my love of agriculture, farming, ranching, and animals. They also taught me that I could be anything I wanted to be if I worked hard enough. My grandfather taught me about farming, ranching, and livestock. He taught me that you have to work hard to achieve what you want in life. My grandmother taught me the importance of education and academics and nurtured my love of reading. She always encouraged me in whatever I chose to do in life and was never critical of my decisions.

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## ABSTRACT

The objectives of this study were to evaluate the feeding a high energy supplementation and its effects on estrus and conception rates in Angus heifers. Treatments were 1 a control group with water and wheat pasture *ad libitum* and 2 diet fed once daily containing 70% Sorghum Grain, 10% Cotton Seed Meal, 17% Alfalfa pellets and 3% Cane Molasses at 2.72 kg per head with water and sudan grass hay *ad libitum*. Treatment 1 consisted of 16 Angus heifers and Treatment 2 consisted of 15 Angus heifers randomly allocated. The 2-shot Lutalyse method was used to synchronize estrus and Heat Watch® sensors were attached. Treatment (2) received a high energy diet during entire breeding process, and two weeks post breeding. No significant differences between treatments were observed for estrus or conception rates ($P \leq 0.05$). Pre and post experiment body condition score (BCS) and body weight (BW) between the two treatments were similar. Therefore the feed treatment (Treatment 2) had no effect on reproductive performance in Angus heifers.

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## INTRODUCTION

The livestock industry and animal scientists have long recognized the importance of proper nutrition for cattle to achieve reproductive success (Hess et al., 2005). The goal of any producer is to avoid problems with infertility while maximizing profits at the same time. The most important factors affecting financial viability of a cow-calf enterprise are reproduction and nutrition (Hess et al., 2005). The use of flushing methods (increasing energy intake with addition of nutrients prior to estrus) on prepartum and postpartum cattle has helped with these production problems as well as the use of artificial insemination (AI) techniques. However, there is limited research using a flushing system prior to and post breeding in conjunction with artificial insemination especially with first year replacement heifers. Development of replacement heifers at optimal rates of growth that promote puberty before breeding is critical for beef cattle production (Roberts et al., 2009).

Detection of estrus (heat) plays an important role in determining the onset of puberty. Detection of heat is, however, the most effective way to determine the appropriate time to inseminate. Currently, there are many different methods used to detect heat; these include visual observation, chin ball markers used by gomer bulls, Kamar® patches and the Heat Watch® system. Each method is effective and is utilized by producers based on their preference and cost-effectiveness. Small operations usually utilize visual observation, chin ball markers and if financially feasible, the Kamar® patches. Larger facilities have veered away from these methods and tend to rely solely on Kamar® patches and the Heat Watch® system due to their cost-effectiveness and reduced labor requirements. The Heat Watch®

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system uses a pressure sensor and a battery operated radio transmitter that sends signals to a computer that records every time the cow/heifer has been mounted.

It has been noted in the past that first year heifers and second year cows have lower conception rates than their older herd mates. Producers require that heifers reach puberty and become pregnant immediately while they are still growing and maturing (13-16 months of age), thus it is difficult to achieve such results. The same can be said for second year cows, except their nutritional and physiological stress is greater since they are expected to lactate while rebreeding in addition to continued growth. While this is occurring, body condition seems to drop and when there is a drop in the animal's body condition, the pregnancy rate tends to decline. One important goal for beef cattle production systems, therefore, is to develop nutritional programs based on optimal diet formulation for maintaining or enhancing reproductive efficiency of the cowherd (Hess et al., 2005).

Low levels of nutrition can hinder and retard the onset of puberty in heifers. Flushing methods add nutrients to an animal prior to breeding and after breeding, thus increasing body condition score, body weight, and reproductive performance. By providing high energy nutrition to heifers and cows pre and post breeding producers could possibly influence conception rates and improve estrus onset, thus outweighing the costs of the increased nutrition by maintaining a more productive cattle herd.

## OBJECTIVES

The objectives of this study are to:

1.) Improve estrus onset and improve conception rates in first year heifers by feeding a high-energy supplemented feed.

2.) Maintain pregnancy and increase fertility by providing heifers with a higher body condition score and body weight.

# LITERATURE REVIEW

## Artificial Insemination History

Artificial Insemination is the process by which sperm is placed into the reproductive tract of a female for the purpose of impregnating the female by using means other than sexual intercourse or natural insemination. Semen which has been frozen is thawed and placed in the cervix of the animal with the outcome being fertilization of the egg and thus having a viable embryo (Foote, 2002). The first known artificial insemination was done on a dog in the 1780's by a scientist named Lazanno Spallanzani. Cattle artificial insemination did not occur until around 1899-1900 pioneered by Russian scientist E.I. Ivanoff. Use of AI did not become widespread until Cornell University began practicing on dairy cattle in the 1930's (Foote, 2002). Progressive cattlemen started using AI in the late 1930's after it was acknowledged in the US. The current method of using frozen semen in liquid nitrogen was developed in the 1950's, and by the late 1970's/early 1980's synchronization of estrus was developed. By this time AI practices were widely known and spread across many livestock species. Although great improvements have been made in the area of AI, scientists are continually looking at ways to improve herd conception rates. Use of AI in beef cattle is limited because of the difficulty in detecting the onset of estrus (White et al., 2002).

There are many benefits to utilizing a successful AI program. Producers are able to maintain a more consistent and uniform calf crop while also establishing a shorter calving season (Foote, 2002). They are also able to eliminate and/or reduce diseases that can be spread from male to female and female to male during natural insemination. By utilizing AI, producers can eliminate the need to maintain separate breeding pastures away from the herd, thus decreasing need for labor and field space (Foote, 2002). Artificial Insemination also allows for rapid improvement of genetic traits. By using AI, a producer can select from sires that have superior genetic merit thereby improving the quality of their herd (Foote, 2002; Larson et al., 2006).

To maintain and utilize a successful AI practice, a producer must first understand the estrous cycle of the female. The typical beef cow has an estrous cycle of 18-24 days. To know when to AI, the producer needs to watch for standing estrus in the female. Standing estrus is when the cow is the most receptive to being mounted, and she will allow other cattle to mount her for a few seconds at a time, numerous times throughout the day. The time of standing estrus varies from cow to cow, it can last a few hours up to 30 hours and once a cow is observed in standing heat, she should be inseminated approximately 12 hrs later (White et al., 2002). This time can vary a few hours, as long as she is inseminated within 10-16 hours of standing heat. The most common practice to follow is the AM/PM rule, which states that if a cow is in standing heat in the morning, she should be inseminated that evening and if she is in standing heat in the evening, she should be inseminated the following morning (Larson et al., 2009; Townson et al., 2002).

There are many different methods used to determine standing heat in cattle and each method works in its own way, some solely by themselves and some are better when used in conjunction with each other. Producers will utilize a method that is best for them and is most cost effective for their production. Smaller operations will tend to use either visual observation, chin-ball markers and Kamar® patches, while larger operations will use Kamar® patches and the Heat Watch® system (Foote, 1975; Senger, 1994; Stevenson et al., 1996). Visual observation requires the producer to visually watch for mounting activity in their females and determine when to AI based on their observations. This method is effective, but can be time consuming and labor intensive and is not an accurate indicator of exact time of onset (Stevenson and Britt, 1997). Chin-ball markers have been used for years and are a somewhat effective method. A gomer bull is used (a bull that has been altered so that he cannot inseminate a cow) and a harness is attached to his head with either ink or chalk in the ball. Every time he mounts the cow, a mark will be placed upon her back from the harness, thus a more effective way of observation. However, this method is also time consuming and a producer has to utilize a bull in the process (Foote, 1975). Also, the exact time of onset is not determined this way either. The Kamar® patch is a patch that is attached atop of the females' tail head with glue. The patch contains a reservoir that contains ink and when she is mounted, the reservoir bursts and red ink will be visible within the reservoir, indicating that she is in standing estrus. This method is a little more expensive; however it does not have as much room for error as the other, and still utilizes visual observation of the patch. Lastly the most effective method, yet the most expensive method is using the Heat Watch® system or any electronic monitoring system. The Heat Watch® system is composed of a pressure sensor and a battery operated radio transmitter that attaches in a patch to the rump of the cow to continuously monitor when a cow is mounted (White et al., 2002). Hair on the rump anterior to the tail head of a cow is trimmed, and the patch was attached with industrial strength glue (White et al., 2002). Use of radiotelemetric devices increased the efficiency of detecting estrus in estrus-synchronized heifers that had fewer standing events and (or) shorter duration of standing activity in which estrus was missed by visual observation at specific observation periods (Stevenson et al., 1996). This method uses a transmitter that contains a pressure switch, the transmitter is placed into a pouch with the button side up, and then the pouch is placed with extra strength glue on the tail head of the female.  Each transmitter is assigned a number as well as each cow will have a brand or ear tag with their identification number.  These are recorded and entered into a computer program.  Every time that the female is mounted, the transmitter sends a signal to the computer and the time and duration of the mount is recorded.  Standing heat (estrus onset) is noted by the computer program after a female has been mounted at least three times for duration of three or more seconds.  The computer should be checked at least twice daily, 12 hours apart, so that the AM/PM rule can be applied and the producer will know when to AI. A radiotelemetric system provides around-the-clock monitoring of standing activity and also might increase accuracy of detected estrus, depending on the skill of those making the visual observations (Stevenson et al., 1996).

**Estrus Synchronization**

Over the years, scientists have discovered and formulated new ways to alter the estrous cycle in order to obtain a shorter time frame of when the females are in estrus. Effective estrus synchronization programs shorten breeding seasons, increase weaning weights, and group cows and heifers so AI can be used more efficiently (Odde, 1990).  By shortening the time frame that females are in estrus, producers can cut down on their labor costs by effectively breeding the majority of the herd, as opposed to stretching it out over a longer period.  Synchronization of estrus implies the manipulation of the estrous cycle or induction of estrus to bring a large percentage of a group of females into estrus at a predetermined time (Odde, 1990).  Even if AI is not utilized, it will allow the producer to obtain a more unified calf crop that is similar in size and age.  Synchronization of estrus facilitates the use of genetically superior sires through artificial insemination (Odde, 1990).

There are many different synchronization protocols, supplements and hormones that can be administered to synchronize estrus and each vary in costs, labor, and time. The most common hormones used are prostaglandins ($PGF_{2\alpha}$) which occur naturally in the estrous cycle of the female. Prostaglandin $F_{2\alpha}$ is produced by the uterus when no implantation occurs during the follicular phase. It acts on the corpus luteum (CL) and causes luteolysis, forms a corpus albicans and stops the production of progesterone. Degradation of the corpus luteum will result in reduced levels of progesterone, which in turn promotes an increase in follicle-stimulating hormone (FSH); therefore, triggering the development of a new follicle on the ovary (Odde, 1990). When $PGF_{2\alpha}$ is released from the uterus, it triggers the female to return to estrus. Prostaglandin $F_{2\alpha}$ can be used in a varying degree of methods, usually a 1-shot, 2-shot, or in combination with other hormones, most commonly GnRH. Some restrictions can occur with using Prostaglandin $F_{2\alpha}$, such as it is not effective on females that have just concluded a heat cycle, post partum anestrous cows, and prepubertal heifers. Beef heifers frequently are maintained in a more confined environment than cows are and therefore may be more likely candidates for synchronization of estrus and artificial insemination (Odde, 1990).

**Nutritional Factors**

The livestock industry and animal scientists have long recognized the importance of proper nutrition for cattle to achieve reproductive success (Hess et al., 2005). Multiple studies have been conducted trying to improve reproductive success with increased nutrition while attempting to suppress financial costs. One of the major determinates of net income in a cow/calf enterprise is feed costs (Story et al., 2000). Beef cattle producers are continually challenged with the need to maintain sustainable production systems (Hess et al., 2005). It is essential for producers to develop diets that maintain or enhance the efficiency of their herd. Dietary fats, which contain the most energy-dense nutrient, stimulate follicular growth when fed to increase energy balance (Lucy et al., 1992). Energy nutrition has been shown to have a strong affect on pregnancy rates in beef cattle. Body weight and body condition score are great indicators of energy status of cows and heifers. It has also been observed in prior studies that underfeeding energy and/or protein tends to lower fertility in beef cattle. Also, previous studies indicate that low levels of nutrition tend to hinder the onset of puberty in heifers. Development of replacement heifers at optimal rates of growth that promote puberty before breeding is critical for beef cattle production (Roberts et al., 2009). To allow for normal growth and development of the fetus, it is critical that the energy requirements for pregnancy be known accurately (Ferrell et al., 1976).

The largest loss of the potential calf crop occurs because cows fail to become pregnant (Wiltbank et al., 1961). When cattle do not have proper nutrients for themselves, they cannot care for a calf and therefore tend to abort fetuses in times of poor nutrition. It is a cows priority to first maintain the life of the cow and then to reproduce. The approximate order of priority for partitioning of nutrients is as follows: 1) basal metabolism, 2) activity, 3) growth, 4) basic energy reserves, 5) pregnancy, 6) lactation, 7) additional energy reserves, 8) estrous cycles and initiation of pregnancy and 9) excess reserves (Short et al., 1990). Levels of nutrition and a cow's body condition score have been shown to have a substantial impact on anestrus and fertility. The ideal body condition score for breeding and gestation is 6, a score of 7 or higher is a waste of resources unless there will be nutritional deficiencies after calving, and a score lower than 5 tend to lower the occurrence of pregnancy (Short et al., 1990). Therefore, increasing a heifer or cows body condition score with a diet supplemented in high energy could potentially increase the conception rates and the profits would far outweigh the costs of feed.

## MATERIALS AND METHODS

This study consisted of 31 non-lactating first year Angus heifers randomly assigned to two groups, one control group and one treatment group. The heifers were divided randomly into the two groups, with one group consisting of 16 heifers and one group consisting of 15 heifers. Each heifer was weighed and assigned a body condition score prior to being allocated into their groups.

On Day 1, all heifers were removed from the wheat field and placed into a holding area. Then their identification numbers were recorded as they were brought through the chute. At this time, each heifer was weighed and assigned a body condition score (BCS), and then they were randomly placed into a group. The BCS was assigned by two individual evaluators and the recorded BCS of each Angus heifer was an average of the two evaluator scores. The control group was returned to the wheat field where they were allowed *ad libitum* access to water and wheat pasture. The treatment group was placed into a two acre pen with *ad libitum* access to water and sudan grass hay, but were also fed once daily a high energy feed which consisted of 70% Sorghum Grain, 10% Cotton Seed Meal, 17% Alfalfa pellets, and 3% Cane Molasses. A sample of Sudan grass hay from Angelo State University's Management Instruction and Research Center was collected and sent to Dairy One Forage Testing Laboratory in Ithaca, New York for analysis. Based on their findings, a diet was formulated to ensure a high energy composition was fed to Treatment 2. Table 1 and 2 illustrate the findings of the Sudan grass hay nutritional components, as well as the formulated diet to meet NRC (2000) requirements plus added energy for growth. The treatment group was fed a 1.81 kg per head ration of the high energy feed for approximately two days, and then they were fed 2.27 kg per head ration for two days, and lastly fed 2.72 kg

Table 1. Ingredient and nutrient composition of the supplement fed at 2.72kg/day to Angus heifers in Treatment 2 twenty-one days pre-breeding until 14 days post artificial insemination, as fed basis

| Ingredient | % |
| --- | --- |
| Sorghum grain | 70.0 |
| Cotton seed meal | 10.0 |
| Cane molasses | 3.0 |
| Alfalfa hay | 17.0 |

| Nutrients | % |
| --- | --- |
| Crude protein | 13.4 |
| Crude fiber | 7.3 |
| Total digestible nutrients | 69.3 |

Table 2. Nutrient composition of the Sudan Grass Hay provided *ad libitum* to Angus heifers in Treatment 2 twenty-one days pre-breeding until 14 days post artificial insemination, as fed basis

| Nutrients | % |
|---|---|
| Crude protein | 6.3 |
| Acid detergent fiber | 42.1 |
| Neutral detergent fiber | 59.0 |
| Total digestible nutrients | 48.0 |

per head for the remainder of the study. This was done to allow their rumen to adjust to change in diet.

After 11 days, each group was administered a 5 ml Lutalyse® ($PGF_{2\alpha}$) injection intramuscularly and then returned to their respective pens/groups, they were also given their yearly vaccines at this time. Eleven days after the initial shot, the heifers from each group were then given a $2^{nd}$ 5 ml Lutalyse® ($PGF_{2\alpha}$) injection intramuscularly. At this time Heat Watch® transmitters were placed on each heifer from both groups. As the heifers were brought through the chute, a transmitter number was assigned to each female and this number, along with the heifers' identification number were recorded. The transmitters were then placed into a pouch with the transmitter button on top. The pouches were sealed so that the transmitters would not fall out, and subsequently they were attached to the tail head of the female. Each heifer had glue placed on their tail head, a pouch was placed on the glue and then more glue was applied to ensure that the pouch did not become dislodged. It is important that the transmitter should run from her head to her tail and be centered on her tail head. Once the pouch was secured on the heifer, the female was released back into her respective pen/group.

Females were monitored via the Heat Watch® system for estrus and mounting activity. The Heat Watch® system is a radiotelemetric system that utilizes the use of a battery operated radio transmitter. There is a pressure-sensitive sensor on each transmitter, that when activated by the weight of a mounting female, sends a signal to a computer that is within the vicinity of the wheat field and holding pen. The signal transmitted the transmitter number, date, time and duration of each mount, which were then recorded for each heifer. The Heat Watch® system was monitored at least twice daily in 12 hour increments for the first week.  Once the female had been deemed in standing heat by the Heat Watch® system, she was artificially inseminated approximately 10-16 hours later.

As the females were deemed in standing heat, they were penned and placed in the chute.  The AI technician removed the assigned frozen semen straw from the semen tank and placed it into the hot water (35-37°C) bath.  Once the semen straw was warmed for 30-45 seconds, it was placed into the AI gun and the tip was cut from the straw.  A plastic sheath was then placed over the tip to prepare for insertion into the vagina and reproductive tract. The technician prepared the female by cleaning her vulva and anal area and placed the semen gun directly into her reproductive tract using the AI gun.  Once the rod had been inserted through the cervix of the female, the semen was released from the straw.  The gun was then removed from the female and the sheath and straw were disposed of.  After insemination, the transmitter was removed and each heifer was then placed back into her respective pen/group.

Heifers were monitored for 10 days for standing heat, and any females that did not show signs of estrus were penned and given a 3$^{rd}$ 5 ml injection of Lutalyse® ($PGF_{2\alpha}$) intramuscularly.  This was done in an attempt to bring any remaining females into standing heat, so that all females could be bred.  Estrus was monitored in the remaining females for five days.  Any females that remained un-bred after this time were placed with a bull for a last chance of being bred.

During the study, estrus onset (date and time) was recorded, along with number of mounts each heifer received.  The treatment group received the high energy diet during the entire time of the study and continued to receive the diet for two weeks after the first heifer in the group was bred.  On the last day of feeding, each heifer from each group was penned and placed into the chute, any remaining transmitters were removed and each heifer was once again weighed and assigned a body condition score. These were recorded and compared with the original weights and body condition scores from the beginning of the study.

Approximately 82 days after the last breeding, all heifers in the study were penned and ultrasounds were performed to determine pregnancy and fetal age. Any heifers that were deemed open were culled and sold; remaining pregnant heifers were released back into the field. Approximately 136 days after the last breeding, (52 days after ultrasounds) all remaining pregnant heifers were penned and palpations/pregnancy checks were performed to determine if any heifers lost fetuses and to ensure that all heifers were still pregnant.

Any discrepancies or errors in using the Heat Watch® system, transmitters lost, Kamar® patches being used, or misplacement of transmitters were also recorded. All procedures and animals used were approved by the Animal Care and Use Committee of Angelo State University prior to start of the study.

## STATISTICAL ANALYSIS

Heifers were randomly assigned to each treatment (n = 16 for treatment (1) and n=15 for treatment (2)). Heifer initial body weights (BW) and initial body condition score (BCS) were taken prior to start of study and were analyzed using the GLM procedure of SAS. Heifer final body weights (BW) and final body condition score (BCS) were taken after the final feeding and were analyzed using the GLM procedure of SAS. The change between the initial BW and the final BW were analyzed using the GLM procedure of SAS, as well as the change between the initial BCS and the final BCS. Heifer number of mounts and heifer estrous cycle were also analyzed using the GLM procedure of SAS. Treatment differences were considered significant at $P \leq 0.05$.

# RESULTS

## Weight gain and Body Condition Score

Heifer weights were similar and changed little throughout the study (Table 3). Heifers from both treatments had a slight increase in body weight from the beginning of the study to the end of the study, which was to be expected. The final body weights between both treatments were not different (P=0.43). The mean change in body weight of Treatment 1 was an increase of 21.2 kg, and the mean change in body weight of Treatment 2 was an increase of 16.6 kg. Heifer body condition scores were also similar throughout the study (Table 3). Heifers from both treatments had a slight increase in body condition scores from the beginning of the study to the end of the study. The final body condition scores between both treatments were similar (P=0.90). The mean change in body condition score of Treatment 1 was 0.31, and the mean change in body condition score of Treatment 2 was 0.30. These results show that the heifers showed no significant change in body weight (P=0.38) and body condition score (P=0.95) between the two treatments throughout the study.

## Estrus Behavior, Conception Rates and Parturition Dates

The number of mounts was monitored for each treatment and a mean was taken (Table 4). Treatment 1 and Treatment 2 had the same number of mounts, so the difference was not significant (P=0.46). Treatment 1 had a mean of 24.3 and Treatment 2 had a mean of 30.5 with a P-value of 0.46. Treatment 2 had 6.2 more mounts than Treatment 1, but spread over 31 heifers, it is not significant.

Parturition dates were calculated based on date of AI, where 283 days were added to date of AI. Parturition dates were also estimated based on the date of ultrasound. Fetal age was measured on day of ultrasound. Ultrasound date was taken, plus 283 days, minus the age

Table 3. Body weight and body condition scores of Angus heifers used in the experiment receiving Treatments[a] 1 and 2

| | Treatment | | | |
|---|---|---|---|---|
| | 1 | 2 | SEM[b] | P-value |
| n= | 16 | 15 | | |
| Initial body weight, kg | 433.5 | 425.0 | 12.16 | 0.62 |
| Final body weight | 454.7 | 441.6 | 11.66 | 0.43 |
| Body weight change[c] | 21.2 | 16.6 | 3.70 | 0.38 |
| Initial body condition score[d] | 5.75 | 5.80 | 0.23 | 0.88 |
| Final body condition score | 6.06 | 6.10 | 0.21 | 0.90 |
| Body condition score change[e] | 0.31 | 0.30 | 0.15 | 0.95 |

[a]Treatment 1 consisted of 16 Angus heifers with water and wheat pasture *ad libitum* and Treatment 2 consisted of 15 Angus heifers fed a high energy diet once daily containing 70% Sorghum Grain, 10% Cotton Seed Meal, and 3% Cane Molasses at 2.72 kg per head with water and sudan grass hay *ad libitum*
[b]SEM=most conservative standard error of the least squares means
[c]Difference in weight from the end of the experiment to the beginning of experiment (final body weight-initial body weight)
[d]Body condition score on a scale of 1-9, with 1 being emaciated and 9 being extremely fat
[e]Difference in body condition score from the end of the experiment to the beginning of the experiment (final body condition score-initial body condition score)

Table 4. Estrus activity, cycle conceived and conception rates of Angus heifers used in the experiment receiving Treatments[a] 1 and 2

| | Treatment | | | |
|---|---|---|---|---|
| | 1 | 2 | SEM[b] | P-value |
| n= | 16 | 15 | | |
| Mounts[c] | 24.3 | 30.5 | 5.89 | 0.46 |
| Cycle[d] | 1.4 | 1.6 | 0.17 | 0.41 |
| Conception rate | 81% | 80% | | |

[a]Treatment 1 consisted of 16 Angus heifers with water and wheat pasture *ad libitum* and Treatment 2 consisted of 15 Angus heifers fed a high energy diet once daily containing 70% Sorghum Grain, 10% Cotton Seed Meal, and 3% Cane Molasses at 2.72 kg per head with water and sudan grass hay *ad libitum*
[b]SEM=most conservative standard error of the least squares means
[c]Mounts=number of times the heifers were mounted during the 12 hours prior to artificial insemination. Mounts were recorded using the Heat Watch® system
[d]Cycle=the estrus cycle following estrus synchronization that the heifers conceived based on parturition date determined using ultrasonography

of the fetus to estimate the parturition date. From this data, each heifer was assigned a cycle to determine which estrous cycle they were bred. If the ultrasound date of parturition was within 21 days of the AI calculated parturition date, then the heifer was assigned cycle 1 (i.e. they conceived during the first estrous cycle of breeding). If the ultrasound date of parturition was greater than 21 days from estimated parturition date, then the heifer was assigned cycle 2 (they conceived during the second estrous cycle of breeding). Based on this data, a mean was analyzed for both treatment groups (Table 4) and found that there was no difference (p=0.41) between treatment groups for breeding cycle. Treatment 1 had a mean of 1.4, while Treatment 2 had a mean of 1.6.

Conception rates for both treatments were the same and showed no difference between heifers that were fed high energy diet and those that were not (Table 4). Treatment 1 had a conception rate of 81% and Treatment 2 had a conception rate of 80%. Each group had three heifers that were non-bred; therefore the treatment groups had the same end result.

## DISCUSSION AND IMPLICATIONS

Based on the results of this study, there is not a difference between the two treatments. Final body weights of both treatments were identical as were the final body condition scores as shown by their means. Each treatment group had relatively the same number of mounts and showed little variation as demonstrated by their p-values. Their cycles were also relatively the same, as the mean of Treatment 1 and Treatment 2 were 1.4 and 1.6, respectively. Conception rate had little to no change either, with only a 1% variance between the two treatments.

Heifers in this study started out at the same body condition scores and body weights. Because they were the same and neither treatment groups were under conditioned, at this time there is no benefit to supplement with feed. The cost is not beneficial to the gain, since field heifers fared the same as the energy supplement fed heifers. Heifers experienced greater than average growth and nutrients prior to the study due to a larger than normal amount of rain the previous year. This rain affected the forage in the area and therefore made it more nutritious than normal. Each group had three heifers that were non-bred and were therefore excluded from further analysis.

It can be concluded that further studies should be conducted to determine if utilizing thinner/under conditioned heifers would reap any benefits from the energy supplemented diet. In studies previously conducted utilizing sheep, flushing was beneficial and is a common practice in sheep operations. Flushing has shown to be especially beneficial for thin ewes that have not recovered from previous parturitions and lactation stress (Salisbury, et al., 2000). There appears to be no response to flushing in ewes that are already healthy or in above average conditions.  Perhaps utilizing cattle that did not start off as healthy or utilizing commercial cattle would improve the study and show greater results.  In this study, the cattle were healthier than normal and started off with above average body condition scores and body weights.  By trying to supplement heifers that are already in a healthy body condition, their metabolism is not being increased and thus the flushing is futile.  Heifers should be in a somewhat poor body condition for the flushing to work.  In conclusion, it is suggested that the study be repeated after a drought, when forage conditions are poor and utilize heifers in poorer body conditions.  It is also suggested that two-year old cows be used, since they are in the most stressful body conditions that they will experience.  If this study was repeated in a year when forage quality and quantity was limiting and the heifers are in less than optimal body condition, the results may be different.

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