32nd LIVESTOCK

RESEARCH ROUND-UP

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SECTION I

Progress Reports

of

Feeding, Breeding & Management Trials

at the

Dickinson Experiment Station

ESTRUS SYNCHRONIZATION AND CALVING EASE AMONG FIRST CALF HEIFERS

D.G. Landblom and J.L. Nelson

Managing heifer replacements so they will calve as two year olds with a minimum of difficulty has been, and continues to be a problem for many cow calf producers. Over the years numerous sire breed types have been used for calving ease and range from the Angus breed which has been most common, to dairy types such as the Jersey, and most recently the Longhorn. Success, of course, has been as diverse as the breed types used. Calving at three years of age normally results in very little calving difficulty, but is barely worth mentioning since the economics of beef cattle production won't allow such a lengthy delay. Several management tools are at the producers disposal, which when combined may be useful in getting more heifers bred early in the breeding season to sires known for calving ease. The management tools being considered are:

1. Artificial insemination.
2. Selection of progeny tested sires that are known for calving ease and performance in 1st calf heifers.
3. Estrus synchronization with Lutalyse to reduce labor.
4. Clean-up breeding with the Longhorn breed.
5. Short 45 day breeding season.

Combining artificial insemination and estrus synchronization, sires with above average performance and known calving ease can be used artificially in an AI breeding program while using only 1/4 – 1/3 of the time previously needed. Synchronization of heat cycles is being done with a naturally occurring compound called prostaglandin, which was released for use in this country in 1980 and is sold by veterinarians under the trade name, Lutalyse. Breeding artificially almost never results in 100% conception and therefore necessitates the need for cleanup bulls. Studies at this station have shown the Longhorn breed to be a very easy calving type and is being used for clean-up purposes. Adhering to a short breeding season of 45 days produces heifers that are either bred early in the breeding season or are open and can be sold or fed as feeder cattle.

Considering the criteria just discussed, a breeding management study was designed with the following objectives: (1) to evaluate two methods of synchronization with Lutalyse; (2) to minimize calving difficulty by using AI and progeny tested sires followed by clean-up with the Longhorn breed; and (3) to evaluate the overall efficiency and effectiveness of the heifer management systems being suggested.

During the winter growing period following weaning, Hereford and crossbred Angus X Hereford heifer calves are sorted by weight and fed to gain sufficiently to weigh 650-700 pounds at the start of the breeding season.

In order for estrus synchronization to be successful beef females must be sexually mature and cycling properly. In 1979, KaMar heat detection devices and rectal palpation were used to identify those heifers that were cycling. This method was found to be totally unacceptable and a waste of time and money. In all other years of the study epididectomized sterile bulls with marking harnesses have been used to measure pre-breeding estrus activity. All animals that were wintered, with limited exceptions were used in the breeding studies and were not eliminated until identified as open after being pregnancy tested.

Two breeding groups are being used in this study to evaluate two different management methods for using the estrus synchronizing compound, Lutalyse. A single injection of Lutalyse is being compared with the recommended double injection.

Group One was synchronized using the single injection method. With this method, heifers are inseminated conventionally during the first five days of the breeding season. On the sixth day at 8:00 AM all heifers not inseminated during the first five days of breeding are given 25 mg Lutalyse. After the Lutalyse is administered, AI breeding is continued until 80 hours has elapsed. At that time all remaining undetected heifers were inseminated as a group. Following the group insemination and a five day waiting period, the heifers were exposed to a Longhorn clean-up bull equipped with a chin-ball marker. Group Two was synchronized with the double injection method. Using this method, two injections of Lutalyse separated by eleven days are used. None of the heifers were inseminated during the eleven day period between injections. Our abbreviated description of how each group was synchronized is shown in Table 1.

Table 1. Design for Estrus Synchronization

Single Injection Method:		
	Day of Breeding Season:	
	1	
	2	
Period I	3	Inseminate normally 1st five days of breeding season.
	4	
	5	
	6	8 A.M. administer 25 mg Lutalyse to all heifers not inseminated during Period I.
Period II	7	Continue breeding normally until 80 hrs. post injection time.
	8	
	9	At 4 P.M. (80 hrs. after the Lutalyse injection) all heifers not inseminated during Periods I and II were inseminated as a group without regard to standing heat.
Double Injection Method:		
	Day of Breeding Season:	
	11 days before start of breed-ing season	Administer 25 mg Lutalyse.
	1	The 2nd injection of Lutalyse is given at 8 A.M. on the 11th day, which is the start of the breeding season.
	2 3	Inseminate normally all heifers found in standing heat until 80 hours post injection time.
	4	At 4 P.M. (80 hours after the 2nd injection of Lutalyse) all heifers not inseminated during the 80 hr. period are inseminated as a group without regard to standing heat.

The heifers were placed with a Longhorn clean-up bull after a five day waiting period.

Semen from an Angus sire, Shoshone Monitor 17An50, was purchased from Minnesota Valley Breeders Assn. in 1979, and in 1980 and 1981 semen from an Angus bull, Kadence Shoshone 7An47, was purchased from Select Sires, Plain City, Ohio. These sires have both been recommended by the suppliers as being easy calvers and known to transmit growth performance to their offspring.

Accumulated breeding results, calving difficulty, birth weights, and adjusted weaning weights are given in Tables 2, 3, 4 and 5.

Summary:

1. Three years of synchronization and calving data, and two years of weaning data have been summarized in this progress report.

2. Success with synchronization has been variable; ranging from no response in 1979 to a 74% conception rate this past year.

   The combined three year average conception rate for the single injection group was 41% and 46% for the double injection group.

3. Combined three year average cost/cow conceiving for semen and Lutalyse was $26.50 for the single injection groups and $37.65 for the double injection groups.

4. There was a high correlation between the number of heifers cycling before the start of the breeding season and the number of heifers responding to estrus synchronization.

5. Calving difficulty has been extremely variable. In 1981, calving difficulty with the Kadence Shoshone Angus bull was zero, however, the next year 62% of the heifers required assistance. Since the heifers originate from several diverse sire lines it is our feeling that the semen used was improperly labeled.

6. Trial is being continued and will conclude and be finalized when the calves are weaned in the fall of 1983.

Table 2. Single Injection Method of Synchronization among First Calf Heifers

	Single Injection			
Breeding/Calving Year	**1979-1980**	**1980-1981**	**1981-1982**	**3-Year Average**
No. head	20	24	19	63
No. in heat before breeding started	3	21	19	43 (68%)
No. inseminated 1st 5 days of breeding	4	9	5	18 (28.5 %)
No. in heat and inseminated before 80 hours	0	9	10	19 (30.2%)
No. not showing heat but inseminated at 80 hours	16	6	4	26 (41%)
No. open	1	8	0	9 (14.3%)
Conception rate for management system	1 (5%)	11 (46%)	14 (74%)	26 (41%)
Economics:				
Breeding expense for semen and Lytalyse	$200	$267	$222	= $689
No. conceiving to synchronization	1	11	14	= 26
3-year average cost/heifer conceiving	$26.50			

Table 3. Double Injection Method of Synchronization among First Calf Heifers

	Double Injection			
Breeding/Calving Year	**1979-1980**	**1980-1981**	**1981-1982**	**3-Yr. Total**
No. head	21	24	18	63
No. in heat before breeding started	7	21	18	56 (73%)
No. in heat and inseminated before 80 hours	4	18	14	36 (57.1%)
No. not showing heat but inseminated at 80 hours	17	6	4	27(42.9%)
No. open	1	3	1	5(7.9%)
Conception rate for management system	4 (19%)	14 (58%)	11 (61%)	29 (46%)
Economics:				
Breeding expense for semen and Lutalyse	$336	$432	$324	= $1092
No. conceiving to synchronization	4	14	11	= 29
3-year average cost/heifer conceiving	$37.65			

Table 4. Calving Difficulty and Birth Weights among Synchronized First Calf Heifers

	Single Injection				Double Injection			
Management method	**1979-1980**	**1980-1981**	**1981-1982**	**3-yr. Total**	**1979-1980**	**1980-1981**	**1981-1982**	**3-Yr. Total**
No. calving	19	16	18[1/]	53	20	21	17	58
No. calving unassisted	18	16	10	44	17	21	9	47
Calving difficulty [2/]								
AI Angus								
Shoshone Monitor (17An50)	1/1	-----	-----	1	4/2	-----	-----	2
Kadence Shoshone (7An47)	-----	11/0	13/8	8	-----	14/0	11/7	7
Station Angus (A94)	2/0	-----	-----		5/1	-----	-----	1
Longhorn	16/0	5/0	5/0		11/0	7/0	6/1	1
% Difficulty	33% Angus 0% Longhorn				29% Angus 4% Longhorn			
Birth Weight Summary 3-Year Average	**Bulls**		**Heifers**		**Bulls**		**Heifers**	
AI Angus								
Shoshone Monitor (17AN50)	72		-----		85		72	
Kadence Shoshone (7AN47)	72		68.5		71.3		69.5	
Station Angus	73		-----		67		70	
Longhorn	63.6		57.6		63.6		58.5	

1/ One heifer died.

2/ First number indicates number of calves sired.
Second number indicates number calving with difficulty.

Table 5. Two Year Adjusted Weaning Weights among First Calf Heifers Bred to Angus Artificially and Clean-up with Longhorn

	Single Injection					Double Injection			
	1979		1980			1979		1980	
	Bulls	Hfrs.	Bulls	Hfrs.		Bulls	Hfrs.	Bulls	Hfrs.
AI Angus									
Shoshone Monitor (17AN50)						556(2)	589(2)		
Kadence Shoshone (7AN47)			519(5)	524(5)				399(7)	564(2)
Station Angus (A94)	520(2)					473(3)	544(2)		
Longhorn			404(3)	561(1)					
Longhorn						463(5)	362(6)		382(4)

A COMPARISON OF TWO ESTRUS SYNCHRONIZATION METHODS IN MATURE COWS

D.G. Landblom and J.L. Nelson

Lutalyse, a naturally occurring compound in animal systems, has been released by the Food and Drug Administration under the direction of veterinarians for synchronization of estrus in beef cattle. Previous research conducted at many universities in the U.S. and at this station clearly shows that estrus cycles can be successfully synchronized in cattle that are cycling normally. Each injection costs approximately $5.00 at today's prices, and requires handling the cows twice. While requirements for the FDA clearance were being satisfied, extensive data was collected with the double injection method. At the same time alternate methods using a single dose of Lutalyse were being proposed in an effort to obtain equally good results at a lower cost to the producer. This experiment, which compares single versus double injections of Lutalyse, is designed to evaluate overall effectiveness, management requirements and economics of the two methods under typical ranch conditions.

Hereford cows ranging in age from 5 to 10 years were randomly assigned according to their post calving interval to either the single or double injection group. Each of the methods has been outlined in detail in Table 1.

To reduce sire variability, five different AI bulls were used at random, and were as follows: Kadence Shoshone 520 (7An47), PS Sasquatch 904 (7An61), Emulous 494 GDAR (7An41), Black Dot Chaparral King 276 (7An52) and PS Franco 064157 (7An56). Average semen cost was $6.00 per straw. Hereford clean-up bulls were used to complete a 60 day breeding season. The cows were palpated in the fall and any identified as open were sold.

A detailed description of each synchronization method is shown in Table 1.

Two years breeding results have been accumulated and summarized in Table 2.

Summary:

1. Lutalyse (Prostaglandin F_2 Alpha) can be used several different ways to synchronize estrus cycles in beef cattle. This trial has been designed to evaluate two of those methods in an attempt to reduce labor, handling and costs while maintaining equal or better reproductive performance. A single injection of Lutalyse given once to all cows not detected and inseminated after five days of artificial breeding was compared with administering two injections separated by eleven days.

2. Labor requirements for injections and heat detection ranged from five days in the double injection group to eight days in the single injection group.

3. Conception rate favored the single injection group by 13% after two years of data collection.

4. Using the single injection method has resulted in a substantial reduction in the cost per cow conceiving, and ranged from $16.09 in the single group to $31.50 in the double injection group.

5. Following the first injection in the double injection group, 71% of the cows responded. Although those cows responding were not inseminated until after the second dose of Lutalyse, this is one of the other single injection methods that have been used. The major problem with using a single dose of Lutalyse is that if any group of cows are not cycling sufficiently Lutalyse will not work and money and time are wasted. Therefore, when selecting methods to research, we placed our emphasis on the five day pre-breeding method before the single injection so we could evaluate estrus activity while breeding conventionally.

6. Synchronization of estrus was successfully completed using Lutalyse in this study. Using five day pre-breeding followed by a single dose of Lutalyse resulted in the highest conception rate of 70% and the lowest cost per cow conceiving.

Table 1. Design for Estrus Synchronization with Mature Cows

Single Injection Method:		
	Day of Breeding Season:	
	1	
	2	
Period I	3	Inseminate normally 1st five days of breeding season.
	4	
	5	
	6	8 AM administer 25 mg Lutalyse to all heifers not inseminated during Period I.
Period II	7	Continue breeding normally until 80 hours post injection time.
	8	
	9	At 4 PM (80 hours after the Lutalyse injection) all heifers not inseminated during Periods I and II were inseminated as a group without regard to standing heat.
Double Injection Method:		
	Day of Breeding Season:	
	11 days before start of breed-ing season	Administer 25 mg Lutalyse.
	1	The 2nd injection of Lutalyse is given at 8 AM on the 11th day, which is the start of the breeding season.
	2 3	Inseminate normally all heifers found in standing heat until 80 hours post injection time.
	4	At 4 PM (80 hours after the 2nd injection of Lutalyse) all heifers not inseminated during the 80 hour period are inseminated as a group without regard to standing heat.

Table 2. Single vs. Double Injection Method of Synchronization among Mature Cows

Management Method	Single Injection 1980-1981	Single Injection 1981-1982	Single Injection 2-Yr. Total	Single Injection %		Double Injection 1980-1981	Double Injection 1981-1982	Double Injection 2-Yr. Total	Double Injection %
No. head	22	25	47			25	24	49	
No. inseminated 1st 5 days	8	10	18	38		-----	-----	-----	-----
No. responding to 1st injection in the double injection group	-----	-----	-----	-----		19	16	35	71
No. in heat before 80 hours	9	6	15	32		19	13	32	65
No. that did not show heat but were inseminated at 80 hours	5	4	9	19		6	11	17	35
No. conceiving that cycled after 80 hours	5	1	6	66		2	0	2	12
No. open	2	5	7	15		3	0	3	6
Conception rate for management system	18	15	33	70.2		13	15	28	57
Days of labor			8					5	
Economics:									
Breeding costs for semen and Lutalyse	$256	$275 =	$531			$450	$432 =	$882	
No. head conceiving to synchronized estrus	18	15	15			13	15	28	
Semen and Lutalyse cost/cow conceiving to synchronization	$16.09					$31.50			

TIME OF FEEDING AND ITS EFFECTS ON TIME OF CALVING – A PRACTICAL APPROACH

D.G. Landblom and J.L. Nelson

Calving time is probably the most intense period in the livestock production year. Following its discovery by a Canadian cattleman, research conducted by Agriculture Canada at Brandon, Manitoba resulted in a significant increase in daytime calvings when cows were fed at either 11 A.M. or 9 P.M. Conversely, a negative response was obtained from 8 A.M. plus 3 P.M. feedings. Several factors were measured, however the only one having any significant effect on daytime calvings was the calves sire.

The inconsistency of a favorable response late morning and early evening necessitates the need for further investigation into this unique phenomena. To evaluate time of calving from a practical standpoint, feeding times of 8 A.M. and 5 P.M. were selected. The experiment was started during the winter of 1981-82, when 164 straightbred Herford and crossbred Angus X Herford cows ranging in age from 2-10 years were separated into two groups. Both were fed complete mixed balanced wintering rations as close to the predetermined feeding times of 8 A.M. and 5 P.M. as possible.

Ration composition in Group I (8 A.M.) consisted of sudan silage, alfalfa hay, wheat straw and minerals, whereas Group II received sudan silage, alfalfa hay, corn grain, and minerals.

Parameters being evaluated include age of cow, and size, sex and birth weight of calves.

Summary:

1. A total of 164 straightbred Hereford and crossbred Angus X Hereford cows were used to evaluate the effect of morning (8 A.M.) versus late afternoon (5 P.M.) feeding on time of calving.

2. Late afternoon feeding (5 P.M.) resulted in 17% more calvings between 6 A.M. and 8 P.M., with 67.5% of all calvings occurring during the most desirable daytime hours between 9 A.M. and 6 P.M.

3. Calvings among morning fed cows were distributed throughout the 24 hour period, however the greatest concentration occurred during the evening and early morning hours between 7 P.M. and 5 A.M.

4. No differences were measured when the effects of cow age, and sex, birth weight and sire of calf were analyzed.

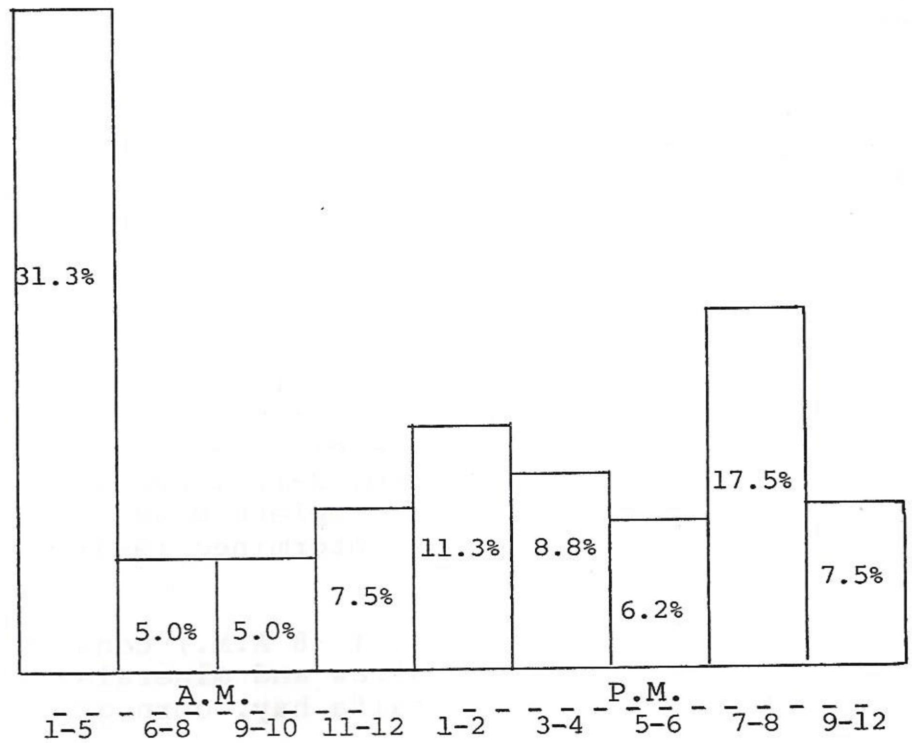
5. While preliminary, these initial results indicate that the number of daytime calvings can be increased with a late afternoon 5 P.M. feeding time.

Morning Fed

8 A.M.

6 A.M. - 8 P.M.
49 head; 61.3%

9 P.M. - 5 A.M.
38.8%

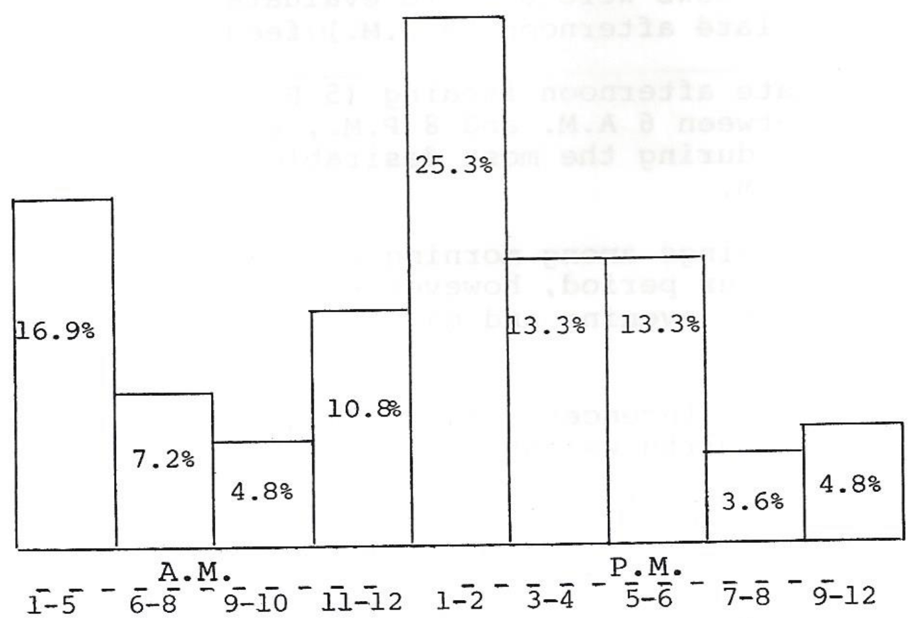


Afternoon Fed

5 P.M.

6 A.M. - 8 P.M.
65 head; 78.3%

9 P.M. - 5 A.M.
21.7%



USING AN ENZYME PRODUCT IN BACKGROUNDING RATIONS FOR STEER CALVES

J.L. Nelson and D.G. Landblom

The vitamin-mineral enzyme supplements used in this trial are being used and sold in this area with apparent success. Earlier research work reported by E.D. Holfield and D. L. Hixon in the 1975 Illinois Beef Cattle Day Report indicate an improvement in performance of 0.28 pounds per head per day. However, in the 53rd Roundup Report of Beef Cattle Feeding Investigations of the Fort Hayes Branch Station, little or no advantage was found for feeding the enzyme product. Because of questions being asked by producers and the divergence of opinion in the literature, the product is being evaluated under conditions in southwestern North Dakota.

"Vita Charge and Vita Ferm Cow Calf 5" are trade names of a commercial vitamin-mineral enzyme product containing an enzyme component Amafirm®, produced by the fermentation of sucrose by Aspergillus Flavus-oryzae (a fungus). These products were evaluated when fed to backgrounded steer valves for approximately 145 days.

In this trial, light weight steer valves, born in the spring were purchased at a local livestock market. Following an overnight shrink without feed or water, they were weighed, ear tagged and allotted into two uniform feeding groups with respect to weight, breed, and prior owner. The steers were handled and fed as recommended by the Vita-Ferm company representatives. These recommendations included an initial oral drench of approximately 1½ quarts of a solution made up of 4 oz. Vita Charge, 1 oz. C.R. (corn) oil and 1½ quarts warm water. The steers were drenched at the time of processing (branding, vaccination for blackleg and enterotoxemia, ear tagging, etc.). Immediately after processing they were started on a control feeding system or the control feeding system plus the Vita-Charge supplement as recommended by the Vita-Ferm company. The treatment calves were fed the control ration plus 4 oz./hd./day of Vita-Charge for the first fourteen days. They were then switched to the control ration plus 4 oz./hd./day of Vita-Ferm Cow Calf 5 for the duration of the trial. All feed was self-fed in straight sided self feeders. The calves started on a ration of 1/3 oats, 2/3 roughage for the first fourteen days and were then switched to a ration of approximately 50% oats, 50% roughage for the balance of the trial. Vita-Charge and Vita-Ferm Cow Calf 5 were added to the total mix so that each calf would consume a minimum of 4 oz. of supplement per day. Rations as fed are shown in Table 1.

Discussion:

During all three years this trial was conducted, calves in both groups made a rapid adjustment to rations and housing.

Neither group required any medication or treatment except one calf in the Vita-Ferm group in 1982. This calf made a rapid response to treatment and was not removed from trial.

In 1980, the first year of this trial, the calves fed Vita-Ferm were about ten pounds per head heavier than the control calves after 145 days on feed. They also had a $4.25 per head advantage when sold. However, because of higher feed cost per head, the actual dollar return over feed cost per head favored the control calves by $12.09 per head.

In 1981 (see Table 3) the Vita-Ferm calves were six pounds heavier after 139 days on feed (252 vs. 246) than the control calves. At the market they sold for $1.93 more per hundred weight. This amounted to $4.18 more gross dollars per head. Again, in 1981, feed cost for the Vita-Ferm fed calves was $6.64 higher than for the controls. Return over feed cost favored the control calves by $2.46.

In 1982 the Vita-Ferm calves averaged 12 pounds heavier after 146 days on feed, and returned $4.06 more per head than the control calves when sold. However, the control calves were slightly more efficient (8.95 vs. 9.09) and consumed less feed per lot (2278 pounds vs. 2418 pounds). Thus, the feed cost for the control calves was $17.43 less than the Vita-Ferm fed calves. Total returns (calf value – feed cost) favored the control calves by $13.37 in 1982.

When all three years are averaged together, the Vita-Ferm fed calves appeared to gain slightly faster and sold for more dollars per head.

However, they consumed more feed per head (2436 pounds vs. 2358 pounds) and incurred a higher feed bill per head ($140.26 vs. $126.70).

Thus, the slower gaining control calves returned $9.31 more per head than the Vita-Ferm fed calves.

<u>Summary:</u>

During a three year period from 1980 to 1982, calves fed according to the Vita-Ferm program tended to eat more feed and gain slightly faster, but returned less net dollars than control calves.

Table 5. Three Year Average Performance and Economic Summary

	Control	**Vita-Ferm**
Total head	10	10
Average:		
Initial wt., lbs.	367.7	367.3
Final wt., lbs.	630.7	639.3
Gain, lbs.	262.7	272.0
Days fed	143	143
Daily gain, lbs.	1.83	1.89
Wt. at market, lbs.	622.3	625.3
Value/hd., $	414.01	418.27
Value/cwt., $	66.46	66.89
Pounds of feed/hd.	2,357.7	2,436.0
Pounds of feed/day	16.4	17.0
Pounds of feed/lb. gain	8.98	8.96
Cost of feed + grinding/lot, $	1,234.23	1,363.67
Cost of feed + grinding/hd., $	126.70	140.26
Cost/cwt. gain, $	48.97	52.32
Return over feed/hd., $	287.32	278.01
Difference, $	+ 9.31	

Table 4. Performance and Economic Summary for Vita-Ferm Trial – 1982

	Control	Vita-Ferm
No. of head on trial	10	10
Initial wt. lbs. Nov. 13	3660	3665
Average per head, lbs.	366.0	366.5
Wt. off trial, lbs. April 8	6205	6325
Average per head, lbs.	620.5	632.5
Gain for 146 days, lbs.	2545	2660
Average gain/hd., lbs.	254.5	266.0
Average gain/day, lbs.	1.74	1.82
Weight at market, lbs.	6060	6170
Average/lot, lbs.	606.0	617.0
Total price, $	3942.25	3982.88
Value/hd., $	394.23	398.29
Value/lb., ¢	65.00	64.50
Pounds of feed/lot	22,775	24,185
Pounds of feed/hd.	2,277.5	2,418.5
Pounds of feed/day	15.6	16.6
Pounds of feed/lb. gain	8.95	9.09
Cost of feed + grinding/lot, $	1,259.16	1,433.53
Cost of feed + grinding/hd., $	125.92	143.35
Cost/cwt. gain, $	49.48	53.89
Return over feed/hd., $	268.31	254.94
Difference, $	+13.37	

Table 3. Performance and Economic Summary for Vita-Ferm Trial – 1981

	Control	Vita-Ferm
No. of head on trial	10	10
Initial wt. lbs. Dec. 3	3790	3780
Average per head, lbs.	379	378
Wt. off trial, lbs. April 21	6255	6300
Average per head, lbs.	625.5	630
Gain for 139 days, lbs.	2465	2520
Average gain/hd., lbs.	246	252
Average gain/day, lbs.	1.77	1.81
Wt. at market, lbs.	6140	6028
Average/lot, lbs.	614.0	602.8
Total price, $	4087.40	4129.18
Value/hd., $	408.74	412.92
Value/lb., ¢	66.57	68.50
Pounds feed/lot	22,380	22,415
Pounds of feed/hd.	2,238	2,241.5
Pounds of feed/day	16.1	16.1
Pounds of feed/lb. gain	9.1	8.9
Cost of feed + grinding/lot, $	1,560.73	1,627.10
Cost of feed + grinding/hd., $	156.07	162.71
Cost/lb. of gain, $	.63	.65
Return over feed/hd., $	252.67	250.21
Difference, $	2.46	

Table 1. Rations as Fed in the Vita-Ferm Trial 1980-1982

Ration I For First 14 Days:		
	Control	**Vita-Charge**
Oats	330.0	330.0
Chopped Tame Hay	657.5	636.5
Di cal	2.5	2.5
Vita Charge	-------	21.0
	1,000.0	1,000.0
Ration II – Day 15 to End of Trial:		
	Control	**Vita-Charge**
Oats	500.0	500.0
Chopped Tame Hay	487.5	469.5
Trace Mineral Salt	10.0	10.0
Di cal	2.5	2.5
Vita-Ferm Cow Calf 5	-------	18.0
	1,000.0	1,000.0

A record was kept of feed eaten, twenty-eight day weights, final weight and selling weight and price. The calves were sold in two groups representing each method of feeding. All performance and total economic records are shown in Tables 2, 3 and 4.

Table 2. Performance and Economic Summary for Vita-Ferm Trial – 1980

	Control	Vita-Ferm
No. of head on trial	9	9
Initial wt. lbs. Dec. 18	3225	3225
Average per head, lbs.	358	358
Wt. off trial, lbs. May 22	5815	5905
Average per head, lbs.	646	656
Gain for 145 days, lbs.	2590	2680
Average gain/hd., lbs.	288	298
Average gain/day, lbs.	1.98	2.05
Wt. at market, lbs.	5825	5900
Average/lot, lbs.	647	656
Total price, $	3951.59	3992.35
Value/hd., $	439.07	443.59
Value/lb., ¢	67.8	67.7
Pounds feed/lot	23,015	23,830
Pounds of feed/hd.	2,557.2	2,647.8
Pounds of feed/day	17.6	18.26
Pounds of feed/lb. gain	8.89	8.89
Cost of feed + grinding/lot, $	882.95	1030.37
Cost of feed + grinding/hd., $	98.10	114.71 (includes 23¢ for drench)
Cost/lb. of gain, $	0.34	0.38
Return over feed/hd., $	340.97	328.88
Difference, $	+12.09	

IMPROVING STRAW QUALITY WITH ANHYDROUS AMMONIA

J.L. Nelson and D.G. Landblom

According to the 1980 issue of North Dakota Agricultural Statistics, North Dakota farmers harvested more than twelve million acres of small grain. According to the same source there were approximately two million head of cattle on North Dakota farms on January 1980. Figuring a conservative yield of one third ton of straw per harvested acre, livestock producers have a potential feed source of approximately two tons per head. Cereal straws in their natural state have low protein levels and poor digestability which limits their use in rations for cattle to some percentage of ration, usually less than fifty percent. Straw digestability and intake by cattle can be improved by treatment with Sodium hydroxide (NaOH) or anhydrous ammonia (NH_3). Research by Hugh Nicholson at the University of Saskatchewan indicated an improvement of from 4% crude protein for untreated straw to 10-12% for straw treated with 3.5% anhydrous ammonia. He also reports 45 to 48% for treated straw. This level of crude protein and T.D.N. is about equal to most medium quality hays. This improvement in straw quality could be worth many dollars to North Dakota grain and livestock producers.

In the fall of 1979, a trial was designed to evaluate the treatment of wheat straw with 3.5% anhydrous ammonia. Steer calves fed a backgrounding ration were used to evaluate treatment effects. The trial has continued in 1980 and 1981, thus providing three years replicated results.

In all three years, large bales of wheat straw were hauled to the experiment station feedlot. A moisture sample was taken and bale weights were adjusted to a dry matter basis of approximately 675 to 700 pounds per bale. The bales were then lined up side by side on a sheet (28x100') of 4 ml black plastic, which was then wrapped over the bales and sealed to make an air tight package (16 bales). Used rubber tires were piled on top and along the sides of the stack to reduce wind damage. An anhydrous ammonia nurse tank from the local Farmers Union Oil Co. was flow calibrated under water prior to injection of the anhydrous ammonia. Injection of approximately 3.5% dry matter weight was made into the core of each bale using a four foot long perforated metal pipe (1" OD) that was sealed and brought to a point on one end. The other end of the pipe was fitted with an adaptor that allowed the injection pipe to be connected to the nurse tank delivery hose. Extreme care and safety precautions were exercised while handling the anhydrous ammonia.

In 1979, the 94% dry matter straw was treated on September 24th; and in 1980 the straw contained 88% dry matter and was treated on September 24th; in 1981 the straw contained 86% dry matter and was treated on October 5th. The straw remained covered from 55 to 60 days, after which the plastic was removed and bales were processed through a New Holland tub grinder. The cost of the plastic cover plus the 3.5% anhydrous treatment increased the cost of the straw to $15.50 per ton in 1979 and $20.04 per ton in 1980 and 1981. This does not include any cost for labor to handle and treat the straw.

In late November, 36 head of 450-550 pound steer calves were allotted to six uniform lots of six head per lot. Two lots were self fed a complete mixed ration of oats, mixed hay and minerals. Two lots were self fed a mixed ration that contained 30% anhydrous ammonia treated straw, while another two lots received a complete mixed ration containing 30% untreated wheat straw and served as the control. The rations were formulated with the aid of AGNET to promote gains of 1.5 to 2.0 pounds per head per day.

The steers on trial were weighed every twenty eight days and were sold at backgrounded weights of 750-800 pounds at a local auction market in treatment groups.

Table 1 shows the 1982 results of feeding the ammoniated straw.

Table 2 shows the 3 year results of feeding ammoniated straw.

Discussion:

The treatment of wheat straw with 3.5% NH_3 was not a difficult task, although care must be exercised whenever NH_3 is handled. We found a better response to the treatment as level of moisture in the straw increased. Calves fed the treated straw in 1982 consumed about one pound of straw more than calves fed untreated straw. They were the heaviest of all calves marketed and sold for the most gross dollars. However, because of high consumption they incurred a higher feed bill which lowered return per calf. Perhaps a more efficient and cost effective method of treating the large bales of straw would help reduce the cost of the feed. For example, a producer with adequate straw that could be fed for just the cost of baling and handling and with the ability to lower his cost of his plastic covering by using it more than one year, would be very competitive with the producer feeding hay.

Over the three years, the NH_3 treated straw ration promoted faster daily gains, heavier market weights and higher market values than the control rations with untreated straw. However, due to higher feed cost per head, returns per calf fed the treated straw was only slightly better than those realized when regular straw was used in the ration.

Summary:

Results from three years feeding show that wheat straw treated with 3.5% anhydrous ammonia (NH_3) increased intake, improved average daily gain and increased the market value of calves when compared to feeding untreated straw. However, the extra cost incurred due to treatment (NH_3 and plastic covering) reduced returns per calf to less than one dollar per calf over feeding regular straw. The best gains were made by calves fed a mixed hay grain ration.

Table 1. Results from the Feeding Trial with Ammoniated Straw – 1982

	30% Un-treated Straw			30% Ammoni-ated Straw			All Hay-Control	
	Lot 2	Lot 4		Lot 3	Lot 5		Lot 6	Lot 7
No. head	6	6		6	6		6	6
Final wt., lbs.	708	709		715	769		733	736
Initial wt., lbs.	504	505		506	506		506	499
Gain/lbs.	204	204		209	263		227	237
Days fed	127	127		127	127		127	127
ADG/lbs.	1.60	1.61		1.65	2.07		1.79	1.86
Actual market wt., lbs.	687	687		715	715		709	709
Avg. market value, $	444.89	444.89		465.02	465.02		460.96	460.96
Percent shrink	3.0	3.0		3.65	3.48		3.5	3.5
Feed/hd./day, lbs.								
Barley	2.1	2.1		2.3	2.4		1.1	1.0
Oats	5.1	4.9		5.4	5.9		6.3	6.1
Mixed hay	6.1	6.1		6.5	7.1		12.3	12.0
Straw	5.9	5.8		6.3	6.9		-----	-----
Di-cal	.12	.10		.12	.14		.16	.15
Limestone	.03	.04		.03	.04		.01	.01
Salt	.38	.37		.40	.44		.40	.39
Total lbs./hd./day	19.73	19.41		21.05	22.92		20.27	19.65
Feed cost/hd., $	120.20	117.74		136.33	148.37		132.09	127.88
Return/calf, $	324.69	327.15		328.69	316.65		328.87	333.08
Avg. feed/cwt gain, $	59.12	57.66		65.17	56.33		58.10	54.00

Table 2. Three Year Combined Results from the Feeding Trial with Ammonia Treated Straw

	30% Un-treated Straw	30% Ammoni-ated Straw	Control All Hay
No. head	36	36	36
Final wt., lbs.	753.7	779.2	809.7
Initial wt., lbs.	506.7	506.8	505.8
Gain/lbs.	247.0	272.3	303.8
Days fed	141	141	141
ADG/lbs.	1.75	1.92	2.13
Actual market wt., lbs.	735.3	750.8	779.8
Avg. market value, $	453.70	469.83	484.25
Percent shrink	2.45	3.60	3.70
Feed/hd./day, lbs.			
Barley	3.17	3.17	0.35
Oats	3.53	3.77	6.80
Alfalfa	2.98	2.90	3.41
Mixed hay	3.89	4.11	9.63
Straw	5.78	5.82	-----
Di-cal	.04	.06	.12
Limestone	.02	.02	.07
Salt	.20	.22	.41
Total lbs./hd./day	19.62	20.08	20.79
Feed cost/hd., $	106.91	117.21	123.17
Return/calf, $	346.79	347.62	361.08
Avg. feed/cwt gain, $	44.84	44.44	42.13

USE OF MONENSIN SODIUM IN RATIONS FED TO REPLACEMENT HEIFER CALVES DURING THE WINTERING PERIOD

J.L. Nelson and D.G. Landblom

The North Dakota Agricultural Statistics Bulletin number 48 for 1981 indicates there were 120,000 replacement beef heifers in the state. Management and feeding of these heifers so they will grow and mature into useful productive cows is of prime concern to North Dakota cattlemen. Since feed makes up a large percentage of the cost of raising replacement heifers, anything that will reduce the feed cost without reducing or impairing reproductive performance should be incorporated into the overall management system.

The feed additive, monensin sodium, has been shown to be effective in reducing feed intake by 6-10% without affecting gains under feedlot conditions. With a six month wintering period, and heifers consuming approximately 17 pounds of feed per day, an 8% saving in feed would amount to some 245 pounds. At four cents per pound of feed this would amount to $9.79 per heifer wintered, or approximately 1.2 million dollars in feed savings across the state.

Steer feeding trials reported in the 28th and 29th Annual Livestock Research Roundup indicate a feed savings and cost advantage when monensin was fed at levels of from 150-300 mg per head per day.

Numerous research reports from across the United States have shown both a feed savings and a cost advantage when monensin is fed. However, information on how monensin might affect reproductive performance in heifers is rather limited.

In December, 1981, a trial was started to determine the effects of incorporating 150-200 mg monensin per head per day in rations fed to replacement quality beef breeding heifers. The trial was designed to monitor feed intake and efficiency, economics, weight gain or loss, time of first estrus and overall reproductive efficiency.

Commercial quality Angus X Hereford heifer calves weighing approximately 520 pounds were allotted to either a control ration or a control ration plus monensin sodium. Both rations fed as complete mixed rations, self-fed in straight sided self feeders. Rations were formulated to promote 1.5 to 1.7 pounds of gain per day. Monensin was added to the ration so that the heifers received between 150 and 200 mg per head per day. Heifers were weighed every 28 days to monitor weight gain and feed intake.

On February 9th, sterilized detector bulls were added to each group to help determine estrus activity. On April 26th both lots of a treatment group were weighed and combined and moved to large holding lots where they continued on their respective rations until May 17 at which time, the heifers were weighed and turned out on pasture. Records were kept on time of first estrus and all heifers were inseminated in June. Fertile Milking Shorthorn bulls were used for cleanup following the A.I. program.

The initial ration formulation and results of this first years' trial are shown in the following tables.

Table 1. Ration.
Table 2. Results of winter feeding phase.
Table 3. Heat detection record.
Table 4. Pregnancy test data.

Discussion:

Heifers fed rations containing monensin sodium were able to gain weight faster (1.69 vs. 1.52 average daily gain) and on May 17th they were 26.9 pounds heavier after 154 days on trial. Heifers fed monensin also ate less feed per day (20.7 vs. 21.2 pounds) and were therefore more efficient. However, due to the cost of the supplement containing the monensin, actual feed cost savings per day were only one cent per head per day, for a cost savings of $1.54 per head.

It appeared that about 14% more heifers fed the monensin sodium reached puberty by the end of March. However, data based on pregnancy test show no differences as it relates to stage of pregnancy.

Summary:

The feeding of 150-200 mg per head per day of monensin sodium allowed crossbred Hereford – Angus heifers to gain 27 pounds more bodyweight during the 154 day feeding period in 1981-82. These heifers also ate less feed and were more efficient, although they only saved $1.54 in feed costs over control fed heifers. It appears that 14% more heifers reached puberty prior to the first of April, although this early puberty did not result in a better or earlier conception rate.

This trial will be continued for at least another two years.

Table 1. Initial Rations of Monensin Sodium Trial with Replacement Heifers

Trial Rations	Control	Monensin
Alfalfa-grass hay, %	56.5	56.5
Corn, %	41.0	39.75
SBOM, %	1.8	1.8
Beef Mix 600*	-----	1.25
Di cal, %	0.1	0.1
Limestone, %	0.1	0.1
Trace mineral salt, %	0.5	0.5
	100.0	100.0

*Beef Mix 600 will provide 7.5 mg of monensin per pound of complete feed consumed. At 20 pounds of intake heifers will get 150 mg of monensin.

Table 2. Combined Data for the Replacement Heifer Trial With and Without Rumensin from December 14 to May 17, 1982

	With Rumensin	Control
No. head	34	34
Days fed	154	154
May 17 wt./lot, lbs.	26,585	25,670
Avg. wt./hd., lbs.	781.91	755.0
Dec. 14 wt./lot, lbs.	17,745	17,700
Avg. wt./hd., lbs.	521.91	520.6
Total gain/lot, lbs.	8,840	7,970
Avg. gain/hd., lbs.	260.0	234.4
ADG, lbs.	1.69	1.52
Feed consumption/day, lbs.		
Corn	9.79	10.36
SBOM	0.31	0.32
Mixed hay	10.09	10.33
Di-cal	0.03	0.03
Limestone	0.02	0.02
Trace mineral salt	0.15	0.15
Beef Mix 600	0.27	-----
Total feed/hd./day	20.66	21.21
Feed cost/lot, $		
Corn	2,761.15	2,923.81
SBOM	192.20	200.32
Mixed hay	1,485.08	1,520.47
Di-cal	35.79	35.62
Limestone	5.32	5.55
Trace mineral salt	54.09	54.16
Beef Mix 600	187.90	-----
Grinding	1,382.88	1,420.13
Total cost/lot	6,104.41	6,160.06
Cost/hd./day, $	1.14	1.15
Cost/hd., $	175.56	177.10
Cost/cwt gain, $	67.52	75.55

Table 3. Replacement Heifers With or Without Rumensin Data Before Lots Were Combined on April 16, 1982

Lot Number	With Rumensin 19	With Rumensin 21	Without Rumensin 20	Without Rumensin 22
No. head	17	17	17	17
Days fed	133	133	133	133
April 26 wt./lot, lbs.	12,915	13,005	12,615	12,175
Avg. wt./hd., lbs.	759.7	765.0	742.1	716.2
Dec. 14 wt./lot, lbs.	8,855	8,890	8,840	8,860
Avg. wt./hd., lbs.	520.9	522.9	520.0	521.2
Total gain/lot, lbs.	4,060	4,115	3,775	3,315
Avg. gain/hd., lbs.	238.8	242.0	222.0	195.0
ADG, lbs.	1.80	1.82	1.67	1.47
Feed consumption/lot, lbs.				
Corn	22,432	22,369.9	23,948.1	23,775.1
SBOM	697.4	696.9	743.5	724.6
Mixed hay	23,464.6	23,381.7	24,100.1	24,117
Di-cal	83.4	82.9	81.1	84.4
Limestone	38.7	38.6	41.2	40.1
Trace mineral salt	372.5	370.2	366.1	378.5
Beef Mix 600	606.2	604.8	------	-----
Total Feed	47,695	47,545	49,280	49,120
Animal days	2,309	2,309	2,309	2,309
Feed consumption/day, lbs.				
Corn	9.72	9.69	10.37	10.30
SBOM	.30	.30	.32	.31
Mixed hay	10.16	10.13	10.44	10.44
Di-cal	.04	.04	.04	.04
Limestone	.02	.02	.02	.02
Trace mineral salt	.16	.16	.16	.16
Beef Mix 600	.26	.26	------	------
Total lbs./day	20.66	20.59	21.34	21.27
Feed cost/lot, $				
Corn	1,182.17	1,178.89	1,262.06	1,252.95
SBOM	80.20	80.14	85.50	83.33
Mixed hay	645.28	643.00	662.75	663.22
Di-cal	16.43	16.33	15.98	16.63
Limestone	2.22	2.22	2.37	2.30
Trace mineral salt	24.58	24.43	24.16	24.98
Beef Mix 600	77.59	77.41	-----	-----
Grinding	596.19	594.31	616.00	614.00
Total cost/lot, $	2,624.66	2,616.73	2,668.82	2,657.41
Cost/hd./day, $	1.14	1.13	1.16	1.15
Cost/hd., $	151.62	150.29	154.28	152.95
Cost/cwt gain, $	63.49	62.10	69.50	78.44

Table 4. Data on 21 Day Combined Feeding Period for the Replacement Heifer Trial With and Without Rumensin from April 26 to May 17, 1982

Lot Numbers	**19 & 21**	**20 & 22**
	With Rumensin	**Without Rumensin**
	(735 Animal days)	
No. head	34 + bull	34 + bull
Days fed	21	21
May 17 wt./lot, lbs.	26,585	25,670
Avg. wt./hd., lbs.	781.9	755.0
April 26 wt./lot, lbs.	25,920	24,790
Avg. wt./hd., lbs.	762.4	729.1
Total gain/lot, lbs.	665.0	880.0
Avg. gain/hd., lbs.	19.6	25.9
ADG, lbs.	0.93	1.23
Feed consumption/lot, lbs.		
Corn	7,591.8	7,757.1
SBOM	277.0	273.8
Tame hay	7,156.4	7,072.7
Di-cal	15.4	15.3
Limestone	15.4	15.3
Trace mineral salt	76.9	76.1
Beef Mix 600	257.0	-----
Total feed	15,390	15,210.3
Feed consumption/day, lbs.		
Corn	10.3	10.6
SBOM	0.38	0.37
Tame hay	9.74	9.62
Di-cal	0.02	0.02
Limestone	0.02	0.02
Trace mineral salt	0.10	0.10
Beef Mix 600	0.35	-----
Total lbs./day	20.91	20.73
Feed Cost/lot, $		
Corn	400.09	408.80
SBOM	31.86	31.49
Tame hay	196.80	194.50
Di-cal	3.03	3.01
Limestone	0.88	0.88
Trace mineral salt	5.08	5.02
Beef Mix 600	32.90	-----
Grinding	192.38	190.13
Total cost/lot	863.02	833.83
Cost/hd./day, $	1.17	1.13
Cost/hd., $	24.57	23.73
Cost/cwt gain, $	125.36	91.62

Table 5. Pregnancy Palpation Data Collected on September 13, 1982

	Rumensin			Control	
Estimated Days Pregnant	Number Head	%		Number Head	%
150+	12	35.3		12	35.3
120+	12	35.3		13	38.2
90+	3	8.8		3	8.8
Open	7	20.6		6	17.6
Total	34	100.0		34	100.0

Table 6. Time of First Estrus in Heifers Fed With or Without Monensin Sodium

	Rumensin			Control	
Time of detection	Number Head	%		Number Head	%
March	10	29		5	15
April	16	47		22	65
May	5	15		3	9
Not detected or prepuberal	3	9		4	11
Total	34	100		34	100

SECTION I-A

Special Report

Compudose, Ralgro & Synovex Implants
for
Yearling Steers

by

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Department of Animal Science
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Compudose, Ralgro and Synovex Implants for Yearling Finishing Steers

W.E. Dinusson, R.B. Danielson, L.J. Johnson and D.L. Feller

Implants have been used to increase gains and/or feed efficiency of beef cattle for over three decades. The first implant was Stilbestrol. Since the banning of Stilbestrol two other implants, Ralgro and Synovex, have been widely used. A new implant, Compudose, was shown to increase gains of yearling steers on pasture by 15 percent (Dinusson et al., 1980) over those nonimplanted controls. This research was conducted to evaluate Compudose in the feedlot and compare it to Ralgro and Ralgro-Synovex implants.

Procedure:

Ninety yearling steers were purchased from one herd for this experiment. All but eight were cross bred, sired by Simmental bulls. The steers had been vaccinated with a 7-way clostridia, IBR, PI_3 and BVD, as well as dewormed prior to purchase.

The steers were trucked to the Research Center at NDSU, allowed a 5 day rest and then were weighed on two consecutive days, allotted at random to 18 pens of five steers each. Five pens served as controls, five pens were implanted with Compudose and eight pens were implanted with Ralgro. Four of the Ralgro implanted pens were reimplanted with Synovex-s halfway through the trial period (at day 77). All steers were tagged with Ectrin tags on day 96 to minimize fly problems. The experiment was started March 5 and terminated August 10. All steers were sent to slaughter and carcass data recorded.

The same ration was fed to all lots. Chopped, mixed hay and a supplement were fed at a constant level with cracked corn fed to appetite. A salt-mineral mixture was provided free choice. The supplement was formulated utilizing sunflower seed oil meal fortified with Vitamins A, D, E, one percent limestone, Tylan and Rumensin. The Tylan was added to the supplement to provide 75 mg per head daily and the Rumensin to provide 300 mg per head daily. The steers were fed twice daily with the supplement top-dressed.

Weights were taken every 28 days with additional weights taken on days 70, 98, and 126 of the trial. Weights were taken on consecutive days at the termination of the experiment.

Results:

The pertinent summary is presented in Table 1. The data for each treatment were averaged together for this summary. Two steers were removed from the control treatment, one for a chronic bloat condition and the other because of partial blockage of the esophagus and are not included in this summary.

The steers gained very well for this 154 day trial. The Compudose and Ralgro-Synovex lots gained significantly faster ($P<.05$) than the control or Ralgro treatments. The Compudose, Ralgro and Ralgro-Synovex treated steers gained 9.5, 2 and 8.6% faster than the control and required 7.1, 1.3 and 7.1% less feed per pound of gain, respectively. It is interesting to note that on day 112, the Compudose treated steers had gained 11.4% faster, the Ralgro steers 5.4% and the Ralgro-Synovex steers 8.9% faster than the controls. Those steers which had received only one implant of Ralgro had lost over half the advantage in gains by day 154, showing that if steers are to be kept in the feedlot for much over 100 days, they should be re-implanted. However, they should not be re-implanted unless they can be kept for a minimum of 65 days prior to slaughter. Compudose is effective for 200 days with no withdrawal time required, so only one implant is needed.

The feed intake was very similar between treatments. However, because of faster gains, the Compudose and Ralgro-Synovex treatments required seven percent less feed per pound of gain.

The dressing percent, based on final off weight and hot carcass weights was 60.1%. Seventy-eight percent of the carcasses graded choice. Forty-one percent yield graded 3, 57% were 2 or better and only 2% had yield grade of 4. Ten percent of the livers were condemned due to abscesses, with no differences among treatments.

Summary:

Compudose implants improved gains by 9.5 percent, Ralgro implants by 2% and Ralgro-Synovex by 8.6% over a control with no implant in a 154 day feedlot experiment. Compudose and Ralgro-Synovex treatments required 7.1% less feed per pound of gain than the controls.

Table 1. Compudose, Ralgro and Synovex Implants for Steers

Treatment	**Control**	**Compudose**	**Ralgro**	**Ralgro + Synovex**
No. Steers	23[1]	25[1]	20[2]	20[2]
Initial wt., lb.	618.9	624.4	623.8	618.6
Final wt., lb.	1088.1	1136.4	1100	1126.6
Avg. daily gain, lb.[3,4]	3.04^a +/- .06	3.33^b +/- .07	3.10^a +/- .05	3.30^b +/- .09
% increase over control	-----	9.5%	2%	8.6%
Feed per day, total, lb.	21.28	21.54	21.38	21.35
mixed hay	4.29	4.30	4.30	4.30
corn	15.92	16.16	16.0	15.97
supplement	1.07	1.08	1.08	1.08
Feed per lb. gain, total, lb.	7.0	6.5	6.9	6.5
% less than control	-----	7.1%	1.3%	7.1%
mixed hay	1.41	1.30	1.39	1.31
corn	5.24	4.87	5.17	4.85
supplement	0.35	0.33	0.35	0.33
No. choice	23	17	17	12
No. good	0	8	3	8
Yield grade				
1	0	3	2	1
2	10	13	8	13
3	12	9	9	6
4	1	0	1	0
Livers condemned	3	2	2	2

1. averages of five lots.
2. averages of fours lots.
3. +/- 0.06, etc. is standard error of mean which shows variation of gains.
4. superscripts a significantly different ($P < .05$) from b.

SECTION II

Developing Replacement Heifers

by

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Using the O'Connor Management System to Improve Productivity

by

Dr. James Wiltbank
Mr. Roy Anderson

Animal Science Department
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DEVELOPING REPLACEMENT HEIFERS

Jim Wiltbank
Animal Science Department
Brigham Young University

Proper development of replacement heifers leads to

Higher pregnancy rate first breeding season

Less calving difficulty

Higher pregnancy rate 2^{nd} breeding season

Consequently, higher returns

The economic importance of developing heifers can be seen by comparing Brahman crossbred heifers fed to weigh either 600 lbs. or 700 lbs. at the start of the breeding season. Nineteen percent more calves were weaned the first year in the group fed to weigh 700 lbs. (TW2) than in the group fed to weigh 600 lbs. (TW1). The second breeding season 28% more cows became pregnant. This should lead to 28% more calves at weaning time the second year (Table 1). The first calves born to TW2 cows were 30 lbs. heavier at weaning than calves born to TW1 cows. A 16 lb. advantage for second calves was also estimated for TW2 cows. TW2 heifers weaned 21,512 lbs. more calf for the first two calves than TW1 heifers or 215 lbs. per heifer exposed. This difference in lbs. of calf weaned was obtained for approximately 500 lbs. of concentrate per heifer. This means each pound of concentrate fed produced 2.3 lbs. more calf. With calves selling for $0.65, each pound of concentrate was worth $1.50 for the first two calves. Other data would indicate this trend of early calving would continue throughout the lifetime of these cows.

More cows weaned calves in TW2 group because more cows became pregnant early in the breeding season in this group the first year and this trend was also apparent the second year (Table 2). This difference in pregnancy rate occurred because heifers were in heat and bred early in the breeding season both years.

It is apparent from these data that feeding the Brahman cross heifer to weigh 700 lbs. was advantageous. Seven hundred pounds is not the magic number for heifers of all breeds and crosses. Target weight differ by breed of heifer.

Information available indicates that the number of heifers showing heat and becoming pregnant early in the breeding season is dependent on age and weight of the heifer and the weight and age needed differs by breed of the heifer. This can be seen by looking at time of puberty in two breeds and the cross between them. The proportion of heifers which showed heat at different ages and weights is shown in Table 3. At 12 months of age, only 15% of the Hereford heifers weighing 600 lbs. had shown heat compared to 40% in the Angus heifers and crossbred heifers. The numbers of heifers weighing 600 lbs. which had shown heat by 14 months of age increased to 70% in Angus heifers, 82% in A x H heifers but was still only 30% in Hereford heifers. However, 90% of the Hereford heifers had shown heat at 14 to 15 months of age when they weighed 700 lbs. These data indicate age, weight and breed affect time of puberty. Most of the heifers in these two breeds will show heat by 14 to 15 months of age IF they have sufficient weight. The weight needed to reach puberty varies according to the breed of the heifer.

Puberty will be delayed in heifers until they attain sufficient weight. Table 4 shows the weight needed for heifers of different breeds to reach puberty at 14.15 months of age.

As an example, 50% of the Hereford heifers 14 to 15 months of age would be expected in heat at 600 lbs. This is the average weight at puberty. If you want 85-90% of Hereford heifers to show heat they should weigh 700 lbs. This doesn't mean that the group of heifers should average 700 lbs. It means each heifer should weigh 700 lbs. You can do this by sorting heifers and feeding the light heifers to make more gain and the heavy heifers to make less gain. Results presented are similar for heifers of other breeds.

A tool that must be used to achieve desired weight is a scale. "Eye balling" heifers for weight gain is not good enough. They must be weighed or heart girth measured monthly to make sure they are making the needed gain. If discrepancies are noted, rations should be adjusted so heifers will reach desired weights.

One other point about heifer weight at the start of breeding needs to be made. This can be done by looking at some data from Mr. Tom O'Connor's Ranch. Heifers were divided into three groups by heifer weight at the start of breeding (heifers weighing less than 550 lbs., 550-600 lbs. and over 600 lbs.). Only 65% of the heifers weighing less than 550 lbs. became pregnant in a 60 day breeding season, compared to 90% in heifers weighing over 600 Lbs. (Table 5).

Only 40% of the heifers weighing less than 550 lbs. weaned calves compared to 71% and 86% in the other two groups. Losses from pregnancy to weaning was 25% in light heifers compared to 6% and 4% in the other two groups. Thus calf losses were higher in the light group than in the other two groups. In the light heifers only 18% of the cows suckling calves became pregnant with 2nd calf compared to 69% in the heifers that weighed over 600 lbs. at the start of breeding.

Other data indicate that heifers fed on higher levels of feed have larger pelvic openings near calving. Data on the Brahman crossbreed heifers indicated a difference of 9 Cm in heifers fed to weigh 600 lbs. or 700 lbs. at the start of breeding and fed similar levels of feed thereafter (Table 6). Bellows reported in 1981 to this school a difference of 12 Cm in pelvic area in heifers fed on high or low levels of feed during the development period there was also a difference of 10% noted in calving difficulty in Bellow's study.

Many people underfeed their replacement heifers. Therefore, it would appear important to outline briefly a feeding program for heifers. First, the amount of weight they need to gain should be determined. This is done by choosing the target weight needed according to the breed of the heifer. Use Table 4 to make this decision. Each heifer should be individually weighed and the amount of gain needed to reach target weight calculated. Some ideas about this are shown in Table 7. For purposes of this discussion, 700 lbs. was chosen as the target weight. A heifer weighing only 300 lbs. must gain 400 lbs. and must gain 2 lbs. a day to reach target weight in 200 days. Contrast this to heifers weighing 400 lbs. who only have to gain 300 lbs. and can reach target weight by gaining 1.5 lbs. a day for 200 days. Reaching target weight is even easier in 500 lb. heifers. Doing this for each heifer will give you an idea about what it will take for each heifer to reach target weight.

The approximate amount of corn needed to make different weight gains is shown in Table 8. To make 2 lbs. a day gain, 6-8 lbs. grain per head per day is needed while 1.5 lbs. per day gain in a 400 lb. heifer could be achieved with 4 to 5 lbs. of corn and a full feed of hay. Thus, costs would be considerably greater in lighter animals.

Feed intake of light heifers is extremely limited. As an example, a 300 lb. heifer will only eat 9 lbs. of hay and grain. This must be considered as you try to force light animals to make large gains. If you are striving to reach a target weight of 700 lbs. with a heifer having an initial weight of 300 lbs., a gain of 2.5 lbs. will be difficult to achieve because a light heifer cannot eat the amount of grain necessary to achieve this gain. A person must be realistic about what he can achieve with heifers. They will only eat about 2.5 to 3.0% of their body weight. Remember, many heifers are light because they are young. Feeding them to target weight may cause them not to cycle if they are only 11 to 12 months of age.

The heart of a good reproductive program is a heifer replacement program. You must plan to consistently have heifers old enough and heavy enough to breed early in the breeding season.

Heifers which do not attain sufficient weight at the start of breeding have three problems: (1) pregnancy rate at first breeding is low; (2) losses are high at first calving; (3) cows suckling calves do not breed for the second calf. Feed heifers to achieve target weight and reproductive performance in the whole cow herd will improve and net income will increase.

Table 1. Value of Developing Brahman Cross Heifers to Two Weights

	600 (TW_1)	700 (TW_2)	Difference
No. of Hiefers	100	100	-----
Calves Weaned:			
1st Year	58	77	19
2nd Year[a]	40	68	28
Total	98	145	47
Weaning Weight:			
Average			
1st Year	356	386	30
2nd Year[b]	408	424	16
Total lbs.	37,020	58,532	21,512
Per Heifer Exposed			
1st Year	206	297	91
2nd Year	163	288	125
Total lbs.	370	585	215
Costs of Development Per Heifer:			
Hay (lbs.)	1978	1788	-190
Concentrate (lbs.)	924	1416	492
$ for feed	100	122	22
Pregnant Cows			
2nd Breeding Season	40	68	
a Estimate from cows pregnant			
b Estimate from time of conception 2nd breeding season			

Table 2. Reproductive Pattern in Heifers Developed to Two Weights

	600 (TW_1) 110	700 (TW_2) 111
No.		
1st Breeding Season		
% Showing Estrus by:		
20 Days	33	63
40 Days	56	80
60 Days	71	92
90 Days	97	100
Conceived 1st Service (%)	46	63
% Pregnant by:		
20 Days	9	39
40 Days	27	57
60 Days	47	74
93 Days	66	82
2nd Breeding Season		
No. of Cows Exposed	65	88
% Showing Estrus by:		
20 Days	12	24
40 Days	48	70
Conceived 1st Service (%)	69	81
% Pregnant by (%):		
20 Days	8	20
40 Days	33	57
60 Days	59	79
90 Days	68	85

Table 3. Proportion of Heifers in Heat at Various Weights and Ages

	Age in Months			
Weight (lbs.)	**12**	**13**	**14**	**15**
Hereford:				
500 (%)	0	0	0	0
600 (%)	15	20	30	37
700 (%)	---	65	90	90
Angus:				
500 (%)	0	33	57	77
600 (%)	40	65	70	80
700 (%)	---	80	100	100
A x H:				
500 (%)	27	36	73	91
600 (%)	40	75	82	96
700 (%)	---	78	96	100

Table 4. Weight at Which 14-15 Month Old Heifers Show 1st Heat

Proportion Desired	**Weight (lbs.) Needed By**						
In Heat	**Angus**	**Hereford**	**Charolais**	**AxH**	**SxE**	**LxE**	**BRxE**
50%	550	600	700	550	650	650	650
65-70%	600	650	725	600	700	700	700
85-90%	650	700	750	650	750	750	750
A = Angus L = Limousin							
E = English S = Simmental							
H = Hereford BR = Brahman							

Table 5. Reproductive Performance in Hereford Heifer as Influenced by Weight at Start of Breeding (Tom O'Connor)

	Less than 550 lbs.	**551 to 600 lbs.**	**Over 600 lbs.**
No. Heifers	40	166	45
Pregnant 60 days (%)	65	77	90
Calves weaned (%)	40	71	86
Losses pregnancy diagnosis to weaning (%)	25	6	4
Wet cows pregnant 2nd year (%)	18	57	69

Table 6. Effect of Heifer Development on Pelvic Opening Near Calving

	Target Weight at Breeding		
	600	**700**	**Difference**
No. Heifers	69	89	
Pelvic Area (Cm^2)[a]	249	258	9
	Feed Level During Winter After Weaning (Bellows, 1981)		
	Low		**High**
No	30		30
Precalving Pelvic Area (Cm^2)	240		252
Calving Difficulty	46		36
a 50 days prior to start of calving season			

Table 7. Weight Gain and Days to Reach Target Weight of 700 lbs.

Initial Weight	Total Gain	Days to Reach Target Weight When ADG is 1.0	2.0	2.5
300	400	400	200	160*
400	300	300	150	120
500	200	200	100	80
* This gain is difficult to achieve for this weight of heifer.				

Table 8. Corn (lb.) Needed to Make ADG from Initial Weight to Target Weight of 700 lbs.[a]

Initial	ADG		
Weight (lbs.)	1.0	2.0	2.5
300	2	8	12*
400	2	7	10
500	0	6	9
* All heifers assumed to have full feed alfalfa hay.			
* This gain is difficult to achieve because of grain consumption needed.			

Table 9. Amount of Hay and Grain* Heifers Will Eat Going from Initial Weight to Target Weight of 700 lbs.

Initial Weight (lbs.)	Initial Intake (lbs.)	Intake at Halfway (lbs.)	Intake at Target Weight (700 lbs.)
300	9	15 (500)	21
400	12	17 (580)	21
500	15	18 (600)	21
( ) Weight at halfway			
* Silage is about 40% dry matter so heifer will consume about 3 lbs. silage for each pound of dry feed.			

USING THE O'CONNOR MANAGEMENT SYSTEM TO IMPROVE PRODUCTIVITY

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The O'Connor Management System was devised to help increase the economic return in a beef cow herd. To produce calves economically, most cows must wean a heavy calf. Most beef herds contain many non-producers such as dry cows, replacement heifers and bulls and many cows wean light calves. As an example of non-producers, look at a beef herd containing 100 cows. In addition to the 100 cows, there would be 15 replacement heifers and 5 bulls. If 90 cows weaned a calf there would be 30 non-producing animals in this herd.

Non-Producers in a 100 Cow Herd

No. Calves Weaned	Dry Cows	Replacement Heifers	Bulls	Non-Producers No.	Non-Producers %	Cost per Calf[a]
90	10	15	5	30	25	$333
80	20	15	5	40	33	375
70	30	15	5	50	42	428

a $250 per animal carrying cost

These non-producers must be reduced to make production of calves economically feasible. The cost of keeping non-producers is as great or greater than the cost of keeping producers.

Calves which are light at weaning will not pay the costs of keeping the cow. As an example, consider calves weaning at different weights.

Weaning Weight and Net Return

Weaning Weight	Gross Return At 70¢	Cost of Keeping Cows	Net Return
500	350	250	100
450	315	250	65
400	280	250	30
350	245	250	-5
300	210	250	-40

It does not take a mathematician to calculate the value of the heavy calf.

Calves wean light because they are born late or do not grow or both. As an example, just look at the following table.

Weaning Weights as Influenced by Time of Birth and Average Daily Gain

	Average Age	Average Daily Gain Birth to Weaning		
Day of Calving	**Weaning**	**2.25**	**2.0**	**1.75**
0-20	220	565	510	455
21-41	200	520	470	420
41-60	180	475	430	385
61-80	160	430	390	350
81-100	140	385	350	315
101-120	120	340	310	280
121-140	100	295	270	245

Look at the differences in weaning weights in this herd. Calves varied from 565 lbs. to 245 lbs. The late calves were light even when they gained 2.25 lbs. a day. You can not just leave calves on the cow and wean later and expect calves to continue to gain. Calves stop growing when grass dries up and milk production stops in the cow. To wean heavy calves they must be born early and they must have the genetic ability to grow and the necessary nutrients to grow. A cow must wean at least 350 lbs. of calf to pay her own costs. When you consider paying cost of non-producers, each cow must wean a considerably heavier calf.

To get the complete picture, consider the concept of heavy calves and non-producers together.

Influence of Non-Producers and Weaning Weight on lbs. of Calf Weaned and Net Return in 100 Cow Herd

			Lbs. of Calf			Net Return		
Calves Weaned	**Total Animals**	**Non-**	**Weaned per Animal**			**Per Animal[b]**		
In 100 Cow Herd	**In Herd**	**Producers**	**500[a]**	**400**	**300**	**500[a]**	**400**	**300**
90	120	30	375	300	225	12	-40	-92
80	120	40	333	267	200	-17	-63	-110
70	120	50	292	233	175	-46	-87	-128

a Average weaning weight per calf

b Calves at 70¢ and $250 carrying cost

To make money, the number of non-producers must be kept low and the average weaning weight must be high. In cows weaning calves averaging 500 lbs; the pounds of calf weaned per animal in the herd varied from 375 lbs. to 292 lbs. The pounds of calf weaned must be averaged out over a lot of non-producers. Most of the figures on net return are negative. Only in those cows weaning 500 lbs. of calf and having only 30 non-producers are the results positive. Now look back to the last table and see how many calves weighed 500 lbs. or more. Only those calves born early and gaining 2 lbs. or more a day weighed over 500 lbs.

The O'Connor method was devised to cause most cows to calve early in the calving season and decrease the number of non-producers, thus optimizing pounds of calf weaned per animal in a cow herd and increasing the net return.

The O'Connor management system was first put into practice at Mr. Tom O'Connor's near Victoria, Texas. The reproductive performance in a small group of cows was noted to be exceptionally high.

Reproductive Performance in a Herd at O'Connors

% Pregnant After Breeding

21 days	42 days	63 days	84 days
80	87	87	93

A large proportion of the cows became pregnant in a short period because Mr. O'Connor;

1. Calved all cows in this group at least 30 days prior to the start of the breeding season.
2. Cows were in moderate or good body condition at calving time.
3. Cows were gaining weight for three weeks prior to the start of the breeding season and for the first three weeks of the breeding season.
4. Calves were removed from cows for 48 hours at the start of breeding season.
5. Cows were bred to fertile bulls.

The number of cows involved were small, therefore, an experiment was designed at Brigham Young University to further test the concepts of this management system and compare pounds of calf weaned with a control group. The work was done cooperatively on a ranch at Elberta, Utah. Mr. Dale Jolley was the manager. Two hundred thirty cows were checked for pregnancy in October. An attempt was made to divide the cows into groups by stage of pregnancy. The cows had been exposed to bulls for 5 months and some cows were only 35-40 days pregnant at the time of pregnancy examination. Cows selected to be in the O'Connor management group were all early calvers (calving 30 days before the start of the breeding season) while cows in the control group were expected to calve for the 150 day period. The controls contained the same percentage of early calving cows as was found in the original group. Cows were scored for body condition and were allotted so each group was similar. Most cows in both groups were in moderate or good body condition at calving time. Cows in the O'Connor group were full fed corn silage starting two weeks before breeding and were continued on this ration for the first three weeks of breeding. Calving started in the last of January and bulls were turned with cows on April 22nd. All bulls were evaluated for fertility four weeks before the start of the breeding season. All bulls turned with O'Connor group had testicles larger than 32 cm in circumference and had more than 70% normal sperm. Calves were removed from cows for 48 hours and the bulls were placed with the cows at the time of calf removal.

Thirty three of the 85 cows in the O'Connor management group showed heat within 48 hours after calf removal. Twenty one days after the start of the breeding season 93% had been bred. This increased to 97% after 42 days of breeding.

Reproductive Performance at Elberta Using O'Connor System

		Bred After		Conceived	Pregnant After[a]	
	No. Cows	21 days %	42 days %	1st Service %	21 days %	42 Days %
Control	83	53	69	50	27	52
O'Connor Management	85	93	97	81	75	93

a Estimate made from pregnancy exam giving number pregnant after 11 days of breeding.

Conception rate at first service was high in the O'Connor group (81%). Seventy five percent of the cows in the O'Connor group appear to be pregnant after 21 days of breeding. At the time of pregnancy exam, only cows bred in first 11 days of breeding season could be checked for pregnancy. Fifty four cows (64%) of the 85 cows were pregnant. It was estimated from heat dates and conception rate that 10 more cows would be pregnant in the first 21 days of breeding. Thus a 75% pregnancy rate was estimated after 21 days of breeding. Application of 5 principles resulted in large numbers of cows pregnant in a short period of time.

This can be used as a model to improve fertility in cow herds. The following programs must be developed to cause this to happen.

1. 60 day breeding season.
2. Nutrition program to insure all cows in at least moderate body condition at calving.
3. Nutrition program to make certain cows are gaining weight for 3 week period prior to breeding and 1st 3 weeks of breeding.
4. Develop a method of removing calves for a 48 hour period at the start of the breeding season.
5. Develop a program for evaluating bulls for potential fertility each year.

The importance of each of these will be mentioned and some methods for implementing them discussed.

The length of the breeding season is an important factor in determining pregnancy rate. Late calving cows have smaller calf crops than early calving cows. As an example, pregnancy was 88% in early calving cows compared to 60% in late calving cows in cows calving from Nov.15 to May 21.

Calving Time and Pregnancy

	Breeding Time		
Time of Calving	**Feb. 10 to April 11 60 Days**	**Feb. 10 to June 11 120 Days**	**Feb. 10 to August 9 180 Days**
Nov.15 to Feb.10 (%)	70	85	88
Feb. 11 to May 21 (%)	36	57	60

Similar results have been noted in an 80-day breeding season.

Pregnancy rate was decreased from 88% in early calving cows to 60% in late calving cows. Cows calving early have more time to show heat before start of breeding. Consequently, more will become pregnant.

The only reliable method for making sure cows calve early in the calving season is to have a short breeding season. Our results would indicate the breeding season should not last more than 60 days.

Shortening the breeding season from 150 days or even from 90 days to 60-day season may present a cash flow problem. The first year the breeding season is shortened there could be fewer calves for sale. Therefore, some suggestions of how this can be accomplished would appear important. The first step is to get an estimate of how many calves were dropped in the different weeks of the calving season. This should then be related to the breeding season to ascertain when cows are being bred. Next, an estimate of the amount and quality of forage available in different months of the year should be made. A chart which shows the nutrient requirements of cows should be obtained. A breeding season should be selected so that nutrient requirements of cows match as nearly as possible the available forage supply. The present calving pattern should be compared with the desired calving pattern. The changes that need to be made can then be made intelligently. Sometimes the breeding season can be shortened with only small losses in calf numbers the first year. Other times rather drastic changes must be made. There are two possible methods. First a plan is developed in which the breeding season is shortened two to four weeks per year. A heifer development program where heifers are bred only 45 days is an important part of this program and must be implemented or the plan will not work.

Second, a plan can be developed in which cows are bred in a fall and spring program. Forage supply must be carefully evaluated in this type of program. Calf numbers may actually be increased in this program.

An example of how the breeding season might be shortened from 150 days to 60 days follows. Thirty replacements per 100 cows are added each year for 3 years. To get these 30 replacement heifers calving in a 45 day period, 35 heifers are bred and open heifers culled. The cost per animal in the herd is increased from $250 to $270. The net return is changed from $-39 to $+45. This is assuming a 90% calf crop each year. Generally, when you have a long calving season, the calf crop is lower.

Changing Length of Calving Season

Expected Day of Calving	1st Year	2nd Year	3rd Year	4th Year	5th Year
1-20	10	30	50	70	75
21-40	10	20	20	25	20
41-60	10	10	20	5	5
61-80	20	20	10	-----	-----
81-100	20	20	-----	-----	-----
101-120	10	-----	-----	-----	-----
121-140	5	-----	-----	-----	-----
141-150	5	-----	-----	-----	-----
Total No. Pregnant	100	100	100	100	100
No. Replacements Saved	35	35	35	12	12
Pregnant Replace-ments Placed in Herd	10	30	30	30	10
Cost per Animal	250	270	270	270	250
Calf Crop Weaned	90	90	90	90	90
Animals per 100 Calves	127	135	135	135	127
Lbs. Calf Weaned per Animal	281	308	336	352	393
Net Return	-39	-39	-18	-6	+45

This particular method resulted in an increase in revenue but a place must be found to carry an extra 25 heifers each year for 3 years. Consequently, this may not be feasible to implement. This could be implemented by checking cows for pregnancy and culling open and late calving cows. Using this system, the number of cows replaced would be determined by the number of pregnant replacement heifers available to be placed in the herd.

Body condition is important in determining the proportion of cows showing heat and becoming pregnant. Many cows in thin body condition do not become pregnant. In one study the proportion open varied from 77% in very thin cows to 4% in cows in good body condition.

Relationship Between Body Condition and Pregnancy Rate in Florida

	Body Condition				
	Very Thin	**Thin**	**Slightly Thin**	**Moderate**	**Good**
No. of Cows	115	545	564	344	234
% open	77	49	27	14	5
Early Calvers (%)	5	15	19	40	56

Only 5% of the thin cows will calve early compared to 56% of the cows in good body condition.

The main reason thin cows do not become pregnant or calve late is that the proportion of cows showing heat is delayed in cows in thin body condition. Note in the next table how the proportion of cows which have shown heat by 60 days after calving differs in cows that are in good body condition (91%) compared to those in moderate (61%) or thin (46%).

Body Condition at Calving and Heat after Calving

	Days After Calving					
Body Condition at Calving	**No. Cows**	**40 %**	**60 %**	**80 %**	**100 %**	**120 %**
Thin	272	19	46	62	70	77
Moderate	364	21	61	88	100	100
Good	50	31	91	98	100	100

By 100 days after calving only 70% of the cows in thin body condition had shown heat.

There are two approaches to keeping cows in moderate body condition. First, cows should be carefully observed 1 or 2 months before calves are scheduled to be weaned. If cows are thin, then calves should be weaned right away. This will give cows a few months of good feed before the quality of the forage declines. Calves are probably growing at a slow rate because of low quality feed available.

The second approach which could be used is to sort cows by body condition at weaning time. Cows should be scored for body condition from 1 (thinnest) to 9 (fattest). A sheet describing method of scoring follows this paper. Decisions on feeding should then be made. The amount of weight gain needed to change body condition must be kept in mind. To help with this, the following table is included.

		Weight Gain				
Body Condition at Weaning	**Body Condition at Calving**	**Calf Fluids and Membrane**	**Fat or Muscle**	**Total**	**Days Weaning to Calving**	**ADG**
5 (Moderate)	5	100	0	100	130	0.77
3	5	100	160	260	130	2.00
3	5	100	160	260	200	1.30
3	5	100	160	260	100	2.60
2	5	100	240	340	130	2.60
7	5	100	-160	-60	130	-0.46

The body condition desired at calving is a 5. Note first that a cow that scores a 5 at weaning must gain 100 lbs. in order to calve with a body condition of 5. This 100 lbs. represents the weight of the calf, fluid, and membranes. Thus, even a cow with ideal body condition at weaning must gain nearly .8 lbs. a day to calve in ideal condition. A cow that scores only a 3 at weaning time must gain 2.0 lbs. a day when there is 130 days from weaning to calving. If calves are weaned earlier so there are 200 days between weaning and calving, she only has to gain 1.3 lbs. However, when calves are weaned late and there is only 100 days from weaning to calving, a cow scoring a 3 at weaning must gain 2.6 lbs. a day to score a 5 at calving time. To change a cow from one body condition to the next requires the cow to gain or lose approximately 80 lbs. of fat or muscle.

Each year is different. Cows are different. You must assess the body condition of your cows, the forage available and then put together a plan so cows will score a 5 or 6 at calving time. Don't ignore the problem and think it will go away. Thin cows will come back to haunt you next year. They will either be open or calve late.

<u>Flushing and 48 Hour Calf Removal</u> can be helpful in improving reproductive performance. Neither practice alone is beneficial as a combination of the two. A study conducted at Howell's in South Texas with first calf cows that were slightly thin (scored a 4) at calving time demonstrates this principle.

Pregnancy Rates Following Calf Removal and Flushing

	Control	**Fl[a]**	**Cr[b]**	**Fl + Cr**
No. Cows	18	21	21	21
Pregnant (%):				
21 days	28	14	38	57
24 days	56	52	62	72
63 days	72	76	62	86

a Flushed 10 lbs. corn for two weeks before breeding and first three weeks of breeding.
b Calf removal for 48 hours at start of breeding.

Pregnancy rate was only increased in the group where flushing and calf removal were both used. Flushing cows for 3 weeks before breeding did not increase pregnancy rate.

Feeding thin cows (3 or less) for short periods of time after calving to get them to show heat does not work. The principle is illustrated in the following table.

At Calving	**Body Condition Needed at Start of Breeding**	**Weight Gain Needed**	**Days Calving to Breeding**	**ADG**
3	5	160 lbs.	80	2.0
3	5	160 lbs.	60	2.7

A minimum of 2 lbs. a day must be gained by the cow scoring a 3 at calving if we want her to have enough body condition to show heat early in the breeding season. If in addition to scoring 3 she only has 60 days from calving to breeding she must gain 2.7 lbs. per day. This is an almost impossible task. As soon as you increase her food level she will increase her milk production. Therefore, only a small amount of the nutrients fed go to weight gain. It is difficult if not impossible to get her to gain 2 lbs. a day while nursing a calf. This means that we need to put the condition on the cow before calving.

Cows which score a 4 or greater will respond beautifully to a little extra feed for 3 weeks or so prior to breeding <u>if</u> the calves are removed for 48 hours when the bulls are placed in the breeding pasture. Note what happened again at Howells with flushing alone compared with flushing and calf removal.

How do you get cows to gain a little weight just prior to breeding? Grain is one way. A good pasture with some dry matter is another. However, you can not expect a cow to gain weight on little short green grass. That kind of grass is 90% water. Get good hay, grain or a pasture that has some good growth or you will be disappointed.

Removing calves for 48 hours can be a problem in some situations. The best way to accomplish it without extra labor being involved is to remove calves for 24 hours. Work the calves and then turn them back to their mothers at end of the 48 hour period. Calves must not nurse for 48 hours to get maximum results.

Fertile Bulls must (1) produce adequate amounts of sperm, (2) a large proportion of the sperm produced must be normal, (3) the bull must have the desire and ability to deposit the sperm in the cow. A good measure of semen production is scrotal circumference. It can be measured quickly and easily with a tape. Available data indicates that bulls with a scrotal circumference of less than 30 cm have reduced fertility. Ten to 15% of the bulls in most breeds have little or no desire to breed. Simple reliable tests for determining these bulls in all herds are yet to be developed, although tests for bulls who have been handled regularly have been developed and are reliable.

The effect of selecting bulls for semen quality was recently demonstrated at the King Ranch. Semen from 79 bulls was collected and evaluated. Twenty-seven of these bulls were selected and placed with 675 cows. These 27 bulls had 80% or more normal sperm. Another 26 bulls were placed with 655 cows. These bulls were selected as a representative sample of the original group of bulls. As an example, 52% of the original group had 80% or more normal sperm. In the control group of bulls, 14 or 54% had 80% or more normal sperm. In the original group, 16% had less than 40% normal sperm. The pregnancy rates after 120 days of breeding was 93% in the selected group and 87% in the controls. A study the second year showed a 5% at 6% improvement in pregnancy rates.

Bulls Selected for Semen Quality at King Ranch

Multiple Sire - 1980[a]			
	Control	**80% or Over**	
Number Exposed	572	656	
Pregnant (%)	87%	93%	
a Four bulls per 100 cows			
Multiple Sire - 1981			
	Control	**80% +**	**70% +**
Number Exposed	1,179	522	769
Pregnant (%)	85%	90%	91%

Bulls should be evaluated each year. Semen quality will improve in certain bulls from the first semen collection to the second. If a bull has poor semen, collect a second time immediately. Evaluate, and if semen is still poor, collect the bull three or four weeks later. Then make a decision. Don't compromise. Don't use a bull with poor semen.

SUMMARY

More calves can be produced in your herd by decreasing the non-producers. This means reducing the number of dry cows and replacement heifers. The number of dry cows can be reduced and more calves will calve early if you:

1. Have a 60 day breeding and calving season.

2. Have cows in good to moderate body condition at calving time.

3. Flush cows for 5 to 6 week period near breeding time.

4. Remove calves for 48 hours at the start of the breeding season.

5. Breed to fertile bulls.

This system requires application of all five principles. Use of one or two will leave you disappointed. It takes a plan to make it work for you.

SECTION III

Progress Report

Calf Enteritis Investigation

by

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CALF ENTERITIS INVESTIGATION

I.A. Schipper, D. Landblom, J. Pommer, T.J. Conlon

Detection of Rotavirus in Feces of Diarrheic and Non-diarrheic Calves.

Fecal samples of calves with clinical diarrhea and those not exhibiting clinical diarrhea were examined by three different laboratory methods to determine the presence or absence of the rotavirus. Rotavirus is considered one of the major causes of diarrhea in neonatal calves as well as other farm animals and humans.

The testing procedures utilized included culturing of the fecal specimens on cells (cell culture), and enzyme-peroxidase test (Rotazyme) and electron microscopic examination of feces (EM).

The fecal specimens were examined from 20 calves exhibiting clinical diarrhea and 29 calves exhibiting no clinical signs of diarrhea.

The results of this investigation indicated no correlation between the testing procedures and based on the testing procedures the rotavirus was not a factor in the cause of clinical diarrhea in these experimental animals. See Table 1.

Table 1

Clinical Cell			
Diarrhea	**Culture**	**Rotazyme**	**EM**
20+	-----	2+	-----
Calves			
29-	-----	3+	-----
Calves			

Solar Radiation in Relation to Calf Diarrhea.

Temperature, humidity, and solar radiation were recorded in the environment of 39 new born beef calves. No significant relationship of clinical enteritis was detected for humidity and temperature only.

Solar radiation (recorded as Kjoules/m^2 (K)) was 12,000 to 25,000 K through April and up to May 9. During this period 89.4% of the cows involved in this investigation had calved. On May 9, solar radiation decreased to 5,000 – 10,000 K and remained at this level until May 18 when it increased to 20,000 – 25,000 K. On May 16, six days following the initial decrease of solar radiation, 2.6% of the calves exhibited clinical diarrhea. Clinical enteritis was exhibited on May 17 (2.6%) and May 18 (13.0%), one day after the solar radiation increased (May 19), no clinical signs of enteritis were recorded.

Preliminary data obtained would indicate that solar radiation is a major contributing factor to the prevention of calf enteritis.

Vaccination with E. coli Bacterins

The cows involved in this investigation had been vaccinated one year previously thus only a booster or single vaccination was given in 1981-82 calving season. The results of this investigation are presented in Table II.

Table II

	Controls	**K99 Vaccine**	**Coligen Vaccine**
Total No.	34	29	27
Clinical Enteritis	4	5	7
Percent Clinical Enteritis	11.8%	17.2%	26.0%

Based on the results of this investigation, vaccination with E. coli bacterins had no demonstrable preventive activity to clinical enteritis in the neonatal calf.

SECTION IV

Progress Reports

of

Range & Pasture Management Research

at the

Dickinson Experiment Station

BROME VARIETY TRIAL

Dr. L.L. Manske and D.E. Williams

In the spring of 1979, eleven varieties of smooth bromegrass and one selection of meadow bromegrass were seeded in a plot study at the Dickinson Experiment Station. The main intent of this trial was to determine varietal suitability to western North Dakota and to compare production with Lincoln bromegrass (a standard variety used in this area). Dry weight production was determined for each year following the initial year of establishment.

Production for the 1982 season ranged from 1902 pounds per acre for Beacon smooth bromegrass to 3792 pounds per acre for Baylor smooth bromegrass. Two varieties of smooth bromegrass (Rebound and Baylor) and Meadow bromegrass produced over 3000 pounds per acre, with respective yields of 3792, 3239, and 3248 pounds per acre. When compared to 1981 yields, only three varieties (Rebound, Baylor, and Meadow) produced considerably more forage in 1982. In general the difference between 1982 and 1981 yields was small, some varieties increasing and some decreasing.

When considering the three year average yields, the two smooth bromegrass varieties Rebound and Baylor, and Meadow bromegrass tend to have the highest production potentials of the varieties tested.

Table 1. Bromegrass Production Trial*

Variety	1982 Yield	Rel.1/ %	3-Yr. Avg.	Rel. %
Rebound SB2/	3239	136	2194	117
Lincoln SB	2384	100	1867	100
Beacon SB	1902	78	1698	91
Blair SB	2224	93	1825	98
Baylor SB	3792	159	2381	127
Barton SB	2364	99	1822	97
Lyon SB	2342	98	1933	103
Lancaster SB	2751	115	2158	115
Fox SB	2575	108	1886	101
Manchar SB	1995	83	1681	90
Mandan 404 SB	2105	88	1596	85
Meadow Brome	3248	136	2023	108

* Dry weight production in lbs./acre.

1/ Relative % - in relation to Lincoln Smooth Bromegrass.

2/ SB – Smooth Bromegrass

ALFALFA VARIETY TRIAL

Dr. L.L. Manske and D.E. Williams

An alfalfa trial was seeded at the Dickinson Experiment Station in the spring of 1979, to evaluate the performance of pasture and dryland hay alfalfa varieties as compared with new and older "standby" varieties that are adapted to more mesic areas. A total of twenty-one varieties were evaluated on the basis of dry weight production with Vernal alfalfa used as the standard comparison.

Production for 1982 (1 cutting only) ranged from a high of 6139 pounds per acre in the variety Kane to a low of 3832 pounds per acre in the variety Agate. Four varieties (Kane, Spreador II, Norseman, and Travois) produced over 5000 pounds of forage per acre and all but two of the remaining varieties (D-111, and Agate) produced over 4000 pounds per acre. Forage production for the 1982 season was quite good when considering drought conditions from prior seasons.

The three year average yield (1980-1982) shows production for all years following the initial establishment year. The year following establishment (1980) showed extreme drought conditions, so the two year average (1981, 1982) more realistically shows the varietal production potential. The variety Kane, when considering both the two and three average production, was the highest producing variety (3898 and 2732 pounds per acre respectively). Eleven varieties produced over 3000 pounds per acre, when considering the two average production figures. Average production figures tend to indicate an advantage towards pasture and dryland hay alfalfa varieties when compared to the hay type alfalfa varieties that are adapted to more mesic areas. Varieties such as Kane, Spreador II, Norseman, Travois, and Rangelander are well adapted to this area and have good production potentials for use as hayland or pasture in semi-arid areas.

Table 1. Alfalfa Production Trial*

Variety	1982 Yield	Rel.[1/] %	3-Yr. Yield	Rel.[2/] %	2-yr.[2/] Yield	Rel.[1/] %
Kane	6139	139	2732	129	3898	131
Spreador II	5260	119	2312	109	3284	110
Norseman	5210	118	2405	114	3385	113
Travois	5077	115	2248	106	3186	107
Rangelander	4981	112	2341	111	3312	111
Ramsey	4804	108	2102	99	3000	100
Ladak	4796	108	2159	102	3078	103
Iroquois	4794	108	2205	104	3108	104
Ladak-65	4785	108	2173	103	3091	103
Polar I	4695	106	2153	102	3107	104
Anik	4562	103	2239	106	3273	110
Nugget	4558	103	2108	100	2974	100
Ranger	4455	101	2032	96	2847	95
Vernal	4425	100	2111	100	2981	100
Trek	4282	97	1993	94	2822	95
520	4274	96	1996	94	2903	97
Thor	4158	94	2005	95	2865	96
524	4121	93	1999	94	2828	95
Baker	4010	90	1968	93	2836	95
D-111	3944	89	1995	94	2846	95
Agate	3832	86	1848	87	2607	87

* Dry weight production in lbs./acre.
1/ Relative % in relation to Vernal.
2/ 2-Yr. yield – 1981, 1982 yields.

COMPLIMENTARY TAME GRASS GRAZING SYSTEM

Dr. L.L. Manske and D.E. Williams

The complimentary tame grass grazing system at the Dickinson Experiment Station consists of a crested wheatgrass pasture for spring grazing, a native range pasture for summer grazing and a Russian wildrye pasture for fall grazing. The study compares animal performance and herbage production between two treatments. One treatment has an annual spring broadcast application of 50 lbs. of nitrogen per acre in the form of ammonium nitrate and the other treatment has no fertilizer applied. Yearling steers were used in the study from 1972 through 1976. Cow/calf units have been used from 1977 through the present.

The animals were rotated to the different pastures based on nearly identical percentage of utilization of the herbage of the reciprocal treatments from 1972-1981. In 1982, the animals were rotated to the different pastures at the same time (Table 1) to acquire same season of use data. The animals were removed from the unfertilized Russian wildrye pasture seven days earlier than the fertilized pasture because of a shortage of forage in 1982.

The fertilized system has been superior to the unfertilized system. The mean above ground herbage production per acre (Table 2) and the mean gains per acre per day in pounds of beef (Table 3) showed a distinct advantage for the fertilized system during the ten years of data collection for the steers and cow/calf units.

The individual pastures of the fertilized system showed trends of increased production over the pastures of the unfertilized system. The mean above ground herbage production (Table 4) was greater in the fertilized treatments of all three pastures for the periods of grazing by steers and cow/calf units. The mean gain in pounds of beef per acre per day for the steers and calves (Table 5) was greater in the fertilized treatments of the crested wheatgrass and native range pastures. No data was available for steer gains on unfertilized Russian wildrye during the period of this trial. The gains for calves on the fertilized Russian wildrye were slightly lower than on the unfertilized for the period of 1978-1981 and for 1982. The mean gain in pounds of beef per acre per day for the cows (Table 5) was greater on the fertilized treatments of the crested wheatgrass and Russian wildrye pastures but lower on fertilized native range pasture in 1978-1981. The cow gains in pounds per acre per day were greater on the fertilized crested wheatgrass and native range pastures but lower on the fertilized Russian wildrye pasture in 1982.

The gain per acre of the calves in 1982 on the fertilized and unfertilized systems was 74.9 lbs. and 53.2 lbs. per acre respectively. The calf beef produced on the fertilized system was 21.7 lbs. per acre greater than on the unfertilized system. Assuming an average selling price of $0.72 per pound for the calves in the fall of 1982, the gross return would be $15.62 per acre greater for the fertilized system. The cost of the fertilizer in the spring of 1982 was $13.40 per acre. The net return would be $2.22 per acre greater on the fertilized system.

Table 1. **The Rotation Dates and Stocking Pressure Data for the Fertilized and Unfertilized Complimentary Grazing Systems at Dickinson Experiment Station – 1982**

Pasture Treatment	Pasture Size Acres	Period Grazed	Days in Period	No. of Head	No. of AUM	Stocking Rate AUM/Acre
Crested Wheatgrass:						
Fertilized	8	May 20 - Jun 21 May 20 - Jun 21	32 32	10 cow/calf 1 bull	11.5	1.4
Unfertilized	16	May 20 - Jun 21 May 20 - Jun 21	32 32	10 cow/calf 1 bull	11.5	0.7
Native Range:						
Fertilized	12	Jun 21 – Aug 20 Jun 21 - Aug 4	60 44	10 cow/calf 1 bull	21.1	1.8
Unfertilized	18	Jun 21 – Aug 20 Jun 21 - Aug 4	60 44	10 cow/calf 1 bull	21.1	1.2
Russian wildrye:						
Fertilized	16	Aug 20 - Oct 4	45	10 cow/calf	14.8	0.9
Unfertilized	16	Aug 20 – Sept 27	38	10 cow/calf	12.5	0.8

Table 2. **Mean Above Ground Herbage Production for the Unfertilized and Fertilized Complimentary Grazing Systems at Dickinson Experiment Station, Given in Lbs./Acre**

	Unfertilized System	Fertilized System
1972-1976 Steer	2296.0	3027.0
1978-1981 Cow/calf	1413.0	2405.0
1982 Cow/calf	1972.0	3844.0

Table 3. **Mean Gains of Beef for the Unfertilized and Fertilized Complimentary Grazing Systems at Dickinson Experiment Station, Given in Lbs./Acre/Day**

	Unfertilized System	Fertilized System
1972-1976		
Steer	1.21	1.66
1978-1981		
Calf	1.06	1.49
Cow	0.41	0.82
Cow/calf	1.47	2.30
1982		
Calf	2.08	2.76
Cow	1.21	1.65
Cow/calf	3.29	4.41

Table 4. **Mean Above Ground Herbage Production When the Animals Came Off For Each Pasture of the Complimentary Grazing System at Dickinson Experiment Station, Given in Lbs./Acre**

	Crested Wheatgrass		Native Range		Russian Wildrye	
	Unfertilized	Fertilized	Unfertilized	Fertilized	Unfertilized	Fertilized
1972-1976						
Steer	2136.0	2996.0	2677.0	4010.0	-----	2074.0
1978-1981						
Cow/Calf	1504.0	2772.0	1470.0	2404.0	1266.0	2038.0
1982						
Cow/Calf	2455.0	4779.0	1923.0	4047.0	1538.0	2706.0

Table 5 . **Mean Gains of Beef When the Animals Came Off For Each Pasture of the Complimentary Grazing System at Dickinson Experiment Station Given in Lbs./Acre/Day**

	Crested Wheatgrass		Native Range		Russian Wildrye	
	Unfertilized	**Fertilized**	**Unfertilized**	**Fertilized**	**Unfertilized**	**Fertilized**
1972-1976						
Steer	1.21	2.03	0.94	1.49	------	1.47
1978-1981						
Calf	1.07	2.34	0.94	1.05	1.16	1.08
Cow	0.53	1.52	0.31	0.04	0.39	0.90
Cow/Calf	1.60	3.85	1.25	1.09	1.55	1.97
1982						
Calf	1.23	2.70	2.19	3.25	2.80	2.41
Cow	2.09	4.88	0.76	1.02	0.82	0.50
Cow/Calf	3.32	7.58	2.95	4.27	3.62	2.91