36th
Livestock Research
Roundup

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Dickinson Experiment Station
Dickinson, North Dakota

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About the Cover Photo

The cover photo, taken by pioneer photographer A. J. Osborn in 1904 shows cattle from the last roundup of the 777 ranch being held at Ash Coulee Creek for loading at the Eland Stock Yards located 4 miles west of Dickinson. The 777 outfit trailed up from Texas in the early 1880's and lost 90% of their cattle in a December 19, 1884 snowstorm and blizzard.

Photo furnished by Lawton E. Osborn, Sr.

SECTION 1

PROGRESS REPORTS
OF
LIVESTOCK RESEARCH
AT THE
DICKINSON BRANCH EXPERIMENT STATION

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A COMPARISON OF BARLEY DISTILLERS DRIED GRAIN, SUNFLOWER MEAL AND SOYBEAN OIL MEAL AS PROTEIN SUPPLEMENTS IN BACKGROUNDING RATIONS

BY
D. G. Landblom, J. L. Nelson and LaDon Johnson

Introduction:

Agricultural statistics for North Dakota, (1984), show that North Dakota farmers planted approximately 2.9 million acres of barley, 2.6 million acres of sunflowers and 750,000 acres of soybeans. Sunflowers and soybeans are principally grown for their oil but the meal by-product is very valuable as a protein supplement for livestock feed. Soybean oil meal (SBOM) contains approximately 44% crude protein and sunflower oil meal (SFOM), depending upon the amount of hull that has been removed before oil extraction can contain anywhere from 28-44% crude protein, with the most common level being 34%.

The newest protein by-product, barley distillers dried grain with solubles (BDDG), comes from the distillation of ethanol from barley. Laboratory analysis of the BDDG has resulted in a crude protein value of approximately 26%.

The purpose of the investigation is to compare the capabilities of sunflower meal and barley distillers dried grain to replace soybean oil meal in backgrounding rations for calves. The economics of feeding these supplements will be documented as well.

There is no previous work with the distillers dried grain being produced in North Dakota. However, some limited work has been conducted by animal scientists at Montana State University. Moss and co-workers, (1983), used dry pelleted barley stillage in dairy cow rations and found pelleted BDDG to be equivalent to SBOM as a protein source if it replaced SBOM based on pounds of protein. When replaced on a volume or weight basis performance was lowered. Moss and Kezar, (1982), evaluated wet barley stillage in a digestion trial using sheep and when compared to an all alfalfa diet, rations containing 80% wet barley stillage had a lower TDN value and slightly higher protein digestion, which suggest that barley distillers grains may have some ruminal by-pass characteristics. These digestion trial results also suggest that the energy value of wet stillage was considerably higher than that of the alfalfa hay being used. Moss and Kezar concluded that wet stillage could be considered as a good intermediate source of both energy and protein for ruminants.

Dickinson Branch Station Research:

In the fall of 1985, weanling crossbred Charolais X (Angus X Hereford) heifer calves that ranged in weight from 480 to 560 pounds were used to compare the feeding value and economics of these supplements when fed on an equal protein basis. To better partition animal response to the supplementation the heifers were divided into lightweight, middleweight and heavyweight classes, with the weight classes serving as replicates. The supplements were fed for a period of 112 days.

To minimize variability, the starting and final weights were determined using the average of two consecutive daily weighings with interim weights taken at 28 day intervals.

Diets designed to compare the three protein supplements were formulated on a pound of protein basis to contain 12.5% crude protein and are shown in table 1.

Results of the feeding study have been summarized for each supplement type and are shown in tables 2, 3 and 4.

Summary:

When compared to SBOM daily gains for heifer calves supplemented with sunflower meal were the same. Daily gains for calves supplemented with barley distillers dried grain averaged .15 pounds more per day.

Average feed cost per hundredweight gain favored the heifers supplemented with sunflower meal and barley distillers dried grain resulting in $2.86 and $3.19 less feed cost per hundred pounds of gain respectively.

In the formulation of rations used in this study, barley distillers dried grain supplied the additional protein needed to meet the desired level of 12.5% crude protein, and replaced 7.5% of the barley grain. Since those calves receiving barley distillers dried grain posted the most rapid gains and required 1.4 pounds less feed, on an as fed basis, per pound of gain we concur with the findings of Moss and co-workers, (1982), that barley distillers dried grain provides not only protein but energy for body weight gains as well.

Net returns for each weight class of cattle for each supplement were calculated. Calves fed the BDDG product either broke even or made small net dollar returns. Calves fed sunflower meal were also profitable with the exception of the heavyweight group which had a net loss of $17.89. Calves fed SBOM posted net losses in the middle and heavyweight groups but had a net gain of $6.66 in the lightweight group, which was the most profitable weight class among all treatments.,

These are limited data, but indications are that BDDG and SFOM are excellent substitutes for SBOM as protein supplements for beef cattle when fed on a pound of protein basis.

Table 1. Rations formulated to contain 12.5% crude protein.

	Ration % (100% Dry)		
Ingredient	**SBOM**	**BDDG**	**SFOM**
Soybean Oil meal (44% CP)	7.3	-0-	-0-
Sunflower Oil meal (34% CP)	-0-	-0-	10.9
Barley distillers dried grain (26% CP)	-0-	18.2	-0-
Barley	44.0	36.5	40.4
Ground wheat straw	14.5	14.6	14.5
Corn silage (32% DM)	32.8	29.3	32.8
Limestone	1.4	1.4	1.4

Table 2. Weights, gains and economics of heifers supplemented with barley distillers dried grain (BDDG)

	Lot 4 Lt. Wt.	**Lot 9 Md. Wt.**	**Lot 3 Hvy. Wt.**
No. Head	5	5	5
Days Fed	112	112	112
Initial wt., lbs.	499	536	562
Final wt., lbs.	769	803	860
Gain, lbs.	270	267	298
ADG, lbs.	2.42	2.39	2.66
Feeding Economics:			
Feed/hd., lbs. (As Fed)	3455	3514	3758
Feed/day, lbs. (As Fed)	30.9	31.4	33.6
Feed/lb. of gain, lbs.	12.7	13.8	12.6
Feed cost/hd., $	118.77	121.46	129.64
Feed cost/cwt. gain, $	43.82	45.49	43.50
Feeder calf cost/hd., $	279.22	299.94	314.94
Feed cost/hd., $	118.77	121.46	129.64
Gross return/hd., $	405.17	425.54	445.21
Net gain or loss, $	+ 7.18	+ 4.14	+ .63

Table 3. Weights, gains and economics of heifers supplemented with soybean oil meal. (SBOM)

	Lot 6 Lt. Wt.	Lot 8 Md. Wt.	Lot 5 Hvy. Wt.
No. Head	5	5	5
Days Fed	112	112	112
Initial wt., lbs.	488	535	563
Final wt., lbs.	755	787	827
Gain, lbs.	267	252	264
ADG, lbs.	2.38	2.25	2.36
Feeding Economics:			
Feed/hd., lbs. (As Fed)	3519	3827	3757
Feed/day, lbs. (As Fed)	31.4	34.1	33.5
Feed/lb. of gain, lbs.	13.2	15.2	14.2
Feed cost/hd., $	117.65	127.99	125.49
Feed cost/cwt. gain, $	44.06	50.79	47.53
Feeder calf cost/hd., $	273.06	299.60	315.39
Feed cost/hd., $	117.65	127.99	125.49
Gross return/hd., $	397.37	417.27	428.18
Net gain or loss, $	+ 6.66	- 10.32	- 12.70

Table 4. Weights, gains and economics of heifers supplemented with sunflower oil meal. (SFOM)

	Lot 7 Lt. Wt.	Lot 2 Md. Wt.	Lot 10 Hvy. Wt.
No. Head	5	5	4 1/
Days Fed	112	112	112
Initial wt., lbs.	500	535	562
Final wt., lbs.	777	791	817
Gain, lbs.	277	256	255
ADG, lbs.	2.47	2.29	2.27
Feeding Economics:			
Feed/hd., lbs. (As Fed)	3661	3495	4014
Feed/day, lbs. (As Fed)	32.7	31.2	35.8
Feed/lb. of gain, lbs.	13.2	13.6	15.7
Feed cost/hd., $	115.31	110.14	125.76
Feed cost/cwt. gain, $	41.63	42.85	49.32
Feeder calf cost/hd., $	279.89	299.60	314.86
Feed cost/hd., $	115.31	110.14	125.76
Gross return/hd., $	409.06	419.60	422.73
Net gain or loss, $	+ 13.56	+ 9.86	- 17.89
1/ One heifer removed with broken leg.			

COW-CALF PERFORMANCE ON IMPROVED AND NATIVE GRASS PASTURES FOLLOWING WORMING

BY
D. G. Landblom, J. L. Nelson, G. Myers and M. F. Andrews

North Dakota cattle producers have been encouraged through commercial advertising and other means, to worm their cattle as a good routine management practice. This advertizing has also suggested that cattle harbor heavy numbers of worms and that their removal will result in increased economic returns.

Our concern relative to worming has been threefold. First, we want to identify how much intestinal parastism exists in cows and calves grazing the semi-arid ranges common to southwestern North Dakota. Second, we want to evaluate the efficacy of the various wormers on the market. Third, and probably of most importance, is our concern with the economics and labor needed to administer a worming program, and what financial returns could be expected if cattle are wormed.

In other worming studies conducted at this station we have found little or no improvement in performance or economic advantage for routine worming. Although we have been unable to measure significant differences in favor of worming we have observed some interesting things about the growth patterns of worms and levels of parasitism from fecal analysis. Analysis of intestinal worms based on fecal egg shedding has shown that egg shedding among cows drops naturally from the time cows are turned out on spring pasture in May to a fairly stable low in the early part of July. Calves nursing these same cows, however, become infested, have lower resistance, and egg shedding among them increases to a peak in mid-July to early August. Based on this information, the present study was developed to evaluate the effect that worming cows just before spring turnout and delaying calf worming until mid-July has on performance and subsequent economic return.

Young livestock has repeatedly been shown to be less resistant to parasitism, so crossbred first calf cows nursing three and four way crossbred calves were used for this trial. In each year of the study, cows and calves grazed crested wheatgrass pastures from spring turnout time in early May to the middle of July, at which time they were moved to native range pastures. Only the cows were wormed at spring turnout time and worming of the calves was delayed until mid-July when the level of parasitism was predicted to be the highest, based on our previous work.

A new anthelmentic, Safe-Guard, manufactured by the American Hoechst Corporation was used to worm cows and calves in this study. Safe-Guard, the trade name for fenbendazole, was administered to cows at the rate of 2.3 ml./100 lbs. body weight. Cows received 22 ml. and calves 7.5 ml. of a 10% suspension. Dr. Gil Myers, parasitologist representing the American Hoechst Corporation, cooperated by providing Safe-Guard wormer and technical assistance for analysis of fecal samples.

Animals used were allotted by weight, breed, sex of calf, and sire of calf. Cows and calves in each treatment were weighed and fecal sampled at selected intervals throughout the grazing season. In the first year of the study fecal samples were analyzed by Dr. Myron Andrews, NDSU parasitologist, using the Wisconsin Double Centrifugation Sugar Floatation technique. During the second year, due to Dr. Andrew's retirement, the fecal samples were analyzed by AEF Research, a private laboratory in Waunakee, Wisconsin.

Gain data for cows and calves have been summarized and are shown in table 1.

Cow and calf gains, as well as the profiles of fecal egg shedding at selected intervals during the growing season have been charted and are shown in figures 1, 2, 3 and 4.

Summary:

Worming of cows at spring turnout time in early May and delayed worming of calves until mid-July did not improve cow or calf performance. Cow gains varied somewhat during the growing season. However, the net seasonal growth performance of .65 lb. per day did not differ between treatments. The calves were quite similar in their yearly growth patterns. Calves that were wormed grew slightly slower than the control calves during the first year of the study and were no different in the second year.

Economically, worming under the conditions pf this study resulted in a net loss. Since wormed calves grew at a slower rate and wormed cows possessed similar body condition going into the wintering period there was no return to management for the investment of $3.53 per cow/calf pair.

Table 1. Two year summary of weights, gains and partial economics for worming with Safe-Guard (fenbendzole) in southwestern North Dakota.

Treatment	**Safe-Guard**		**Control**	
	Cows	**Calves**	**Cows**	**Calves**
No. head	66	66	70	70
Days on pasture	172	172	172	172
Gains:				
Initial weight, lbs.	938	159	938	161
Final weight, lbs.	1051	501	1051	517
Average gain/head lbs.	112	342	112	356
ADG lbs.	.65	1.99	.65	2.06
Economics:				
Wormer cost/cow, $ (22 ml. of 10% suspension)	2.64			
Wormer cost/calf, $ (7.5 ml. of 10% suspension)		.89		
Total worming investment per cow/calf pair, $	3.53			

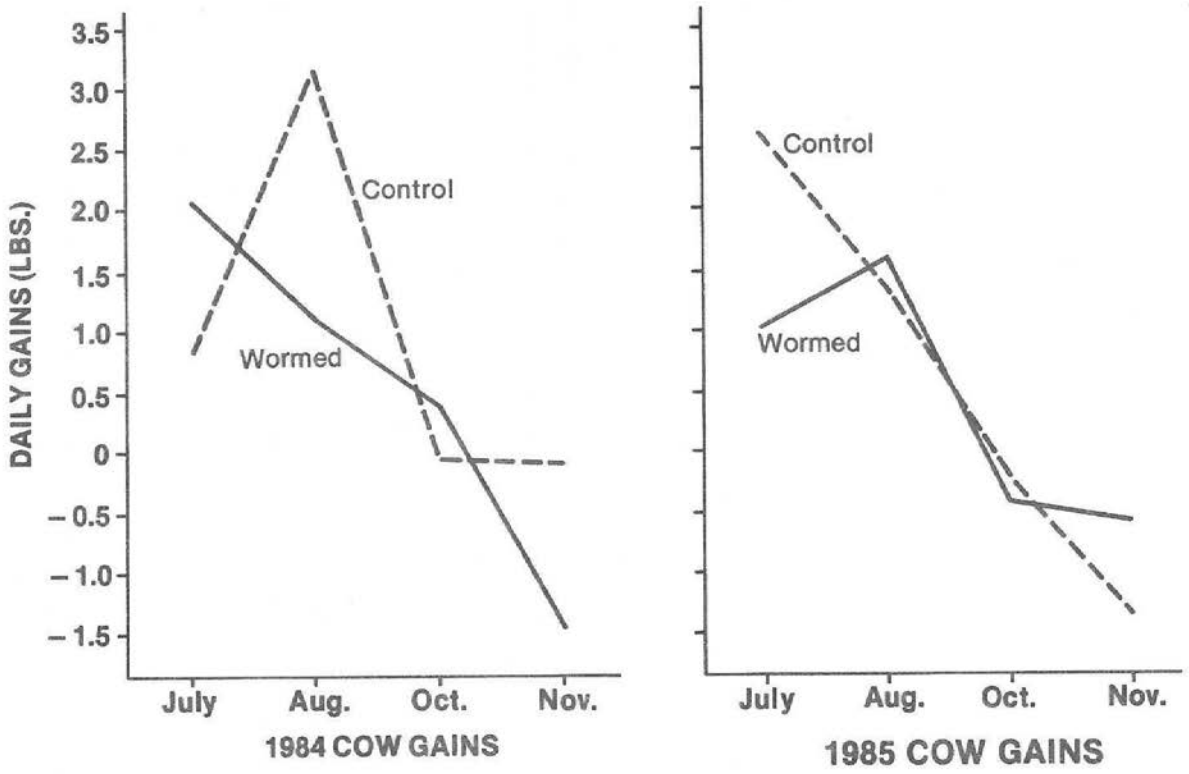

Figure 1. Cow gains during 1984 & 1985 grazing seasons.

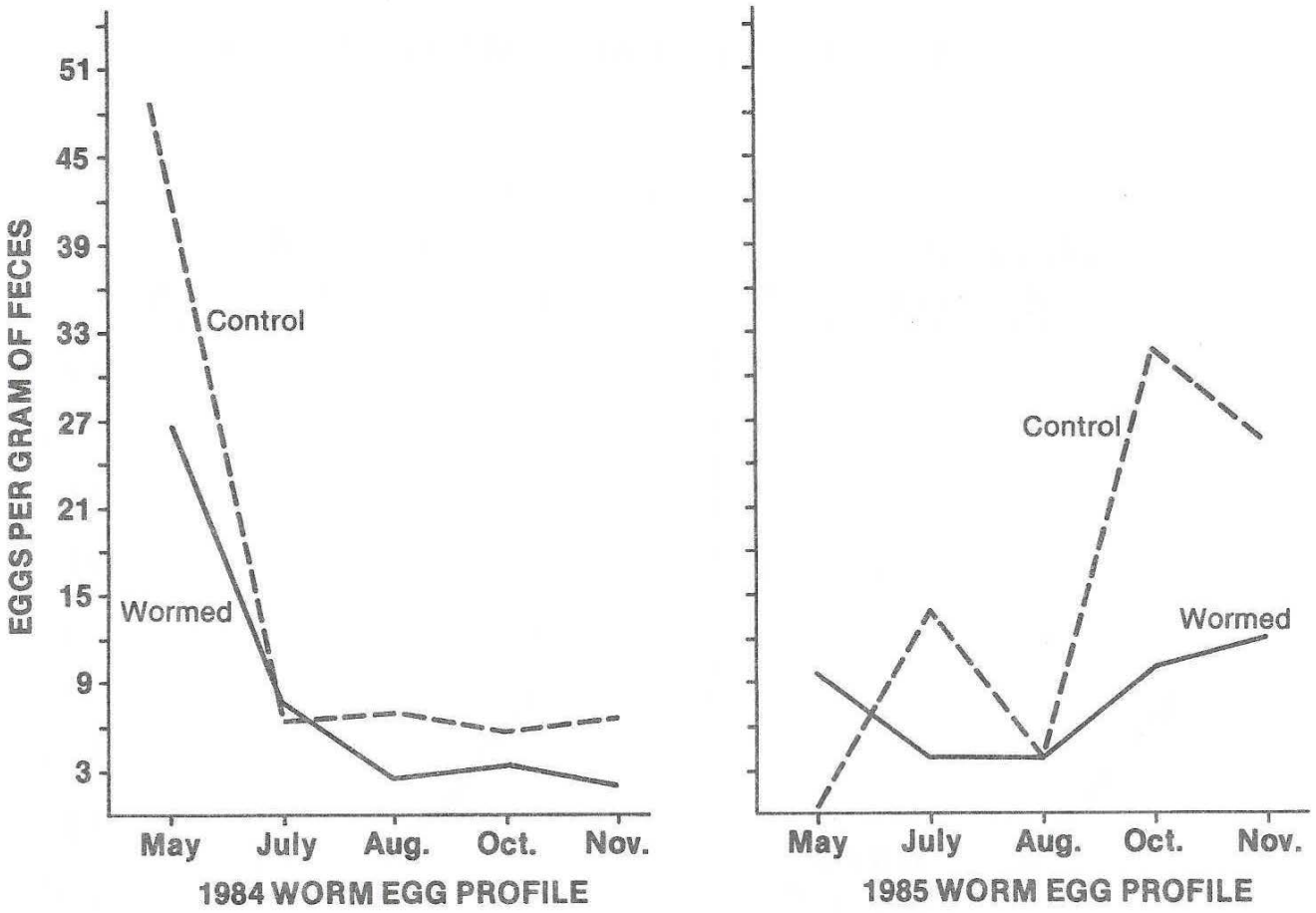

Figure 2. Profiles of fecal egg numbers being shed by cows at selected dates after worming during the 1984 & 1985 grazing seasons.

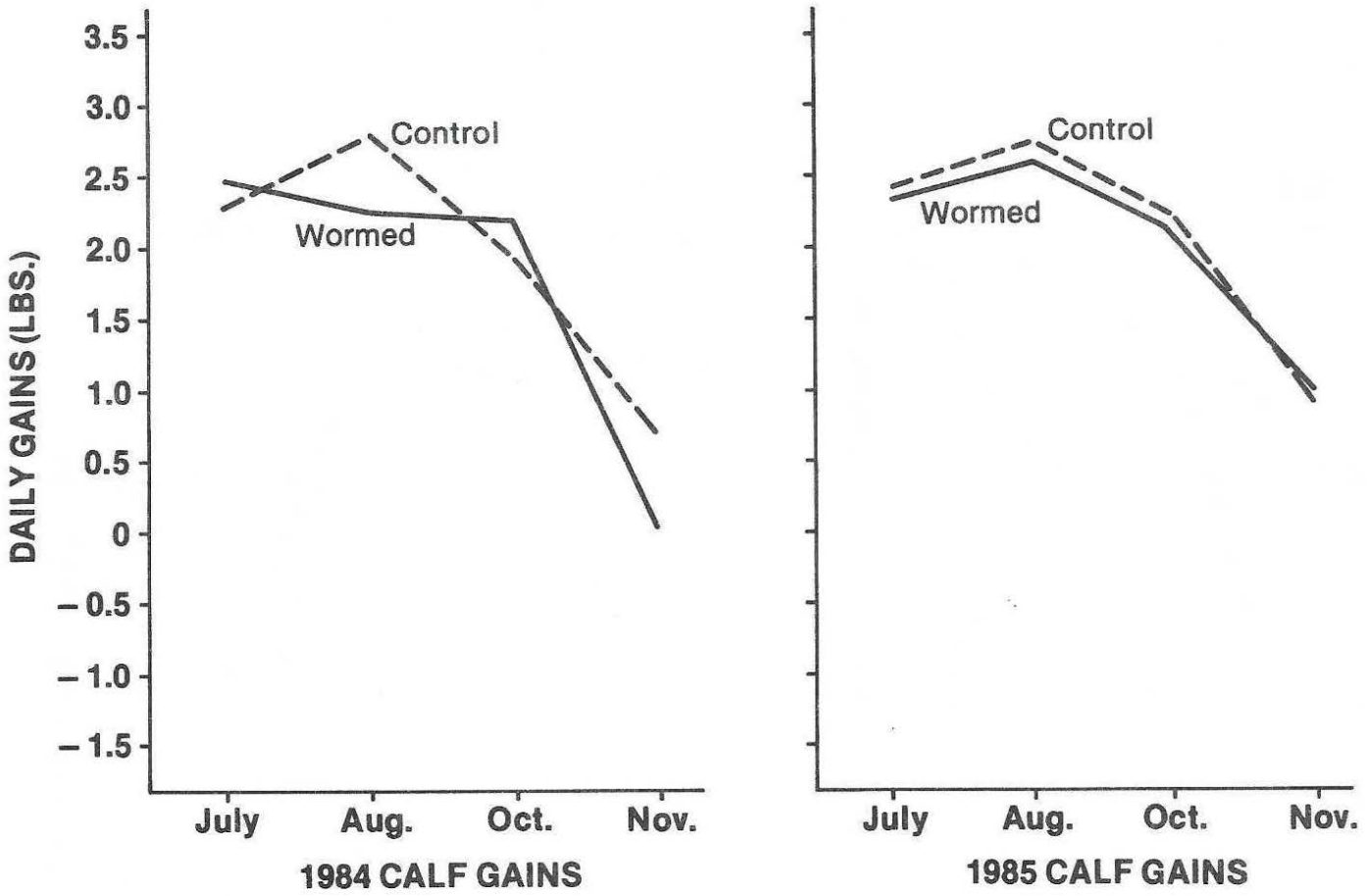

Figure 3. Calf gains during 1984 & 1985 grazing seasons.

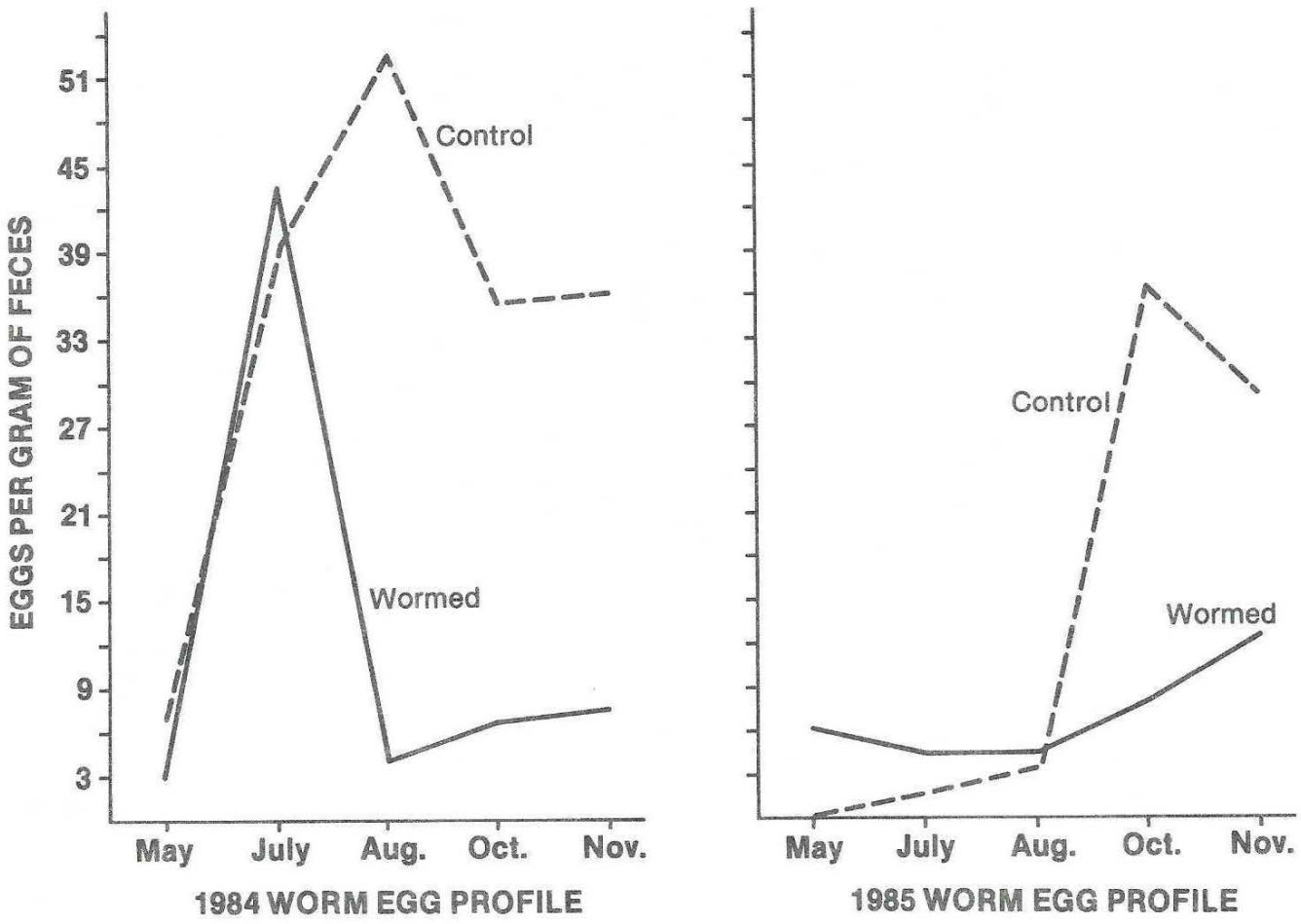

Figure 4. Profiles of fecal egg numbers being shed by calves at selected dates before and after worming in July during the 1984 & 1985 grazing seasons.

MEDICATED SALT-MINERAL MIXTURE FOR COW-CALF PAIRS GRAZING NATIVE RANGE PASTURES

BY
D. G. Landblom and J. L. Nelson

Medicated feeds have been used by livestock producers for many years in all classes of livestock. One such compound that has been used under feedlot conditions is chlortetracycline. This compound is a broad spectrum antibiotic sold by American Cyanamid Company under the registered trade name Aureomycin. American Cyanamid has been doing field grazing studies in conjunction with universities to ascertain the effectiveness of medicating salt-mineral-vitamin mixtures for about 10 years. Research under grazing conditions done with ranchers under the direction of Kansas State University has shown a positive cost effective response favoring increased weight gains and a lower incidence of pinkeye and footrot. In Kentucky, where the medication was used with cow-calf pairs over a two year period on fescue-clover pastures, calves were 31 pounds heavier, and pregnancy rates in the treatment groups were 10-13% higher. Since the geographical region where these studies were conducted is quite different from southwestern North Dakota it is important to investigate the usefulness of this antibiotic under our condtions.

Two years of data have been collected comparing medicated and unmedicated range mineral mixtures. The first grazing season crossbred Angus X Hereford first calf heifers and their Milking Shorthorn crossbred calves were used to evaluate the use of medication. In the second year Hereford and crossbred Angus X Hereford cows with Hereford, Charolais and Simmental crossbred calves at side were used. Medication was added to the mineral mixture at the rate of 312.5 mg./ounce of complete mineral mix during the first year of the study. Discussions with Ms. Cheryl Krogh, Minneapolis Sales Representative for American Cyanamid Company, indicated that the level of antibiotic should be lowered. Therefore, during the second year of the study the antibiotic level was lowered to 120 mg./ounce of complete mineral.

The trial starting date varied by twenty-three days between the two years. In the first year of the study cows and calves were started on the medicated mineral supplement on June 1st, and in the second year the study was started on May 9th. The calves were weaned on October 30th of each year and moved to drylot.

The mineral supplement was fed in covered “weather vane” type mineral feeders. To insure that the mineral and medication were kept fresh small amounts were added frequently when the cattle were routinely checked.

Weight gain performance of cows and calves and economics of using chlortetracycline in range mineral supplements are summarized in table 1 for 1984 and table 2 for 1985.

Summary:

Using chlortetracycline as a medication in self-fed mineral mixtures under range conditions resulted in better weight gains among both cows and calves. Lowering the level of antibiotic from 312.5 mg. to 120 mg. per ounce of complete mineral mix did not alter animal performance but did make including the antibiotic in range mineral supplements cost effective. Calves consuming medicated mineral were 18 pounds heavier than control calves. Using a market value of 67 cents per pound of beef, the additional 18 pounds of beef have a value of $12.06. Medicated mineral, prepared at the ranch, cost $4.92 per cow-calf pair leaving a net return of $7.14. Cow weights averaged 21.5 pounds more providing additional cow condition going into the wintering period.

Data relative to the effects that chlortetracycline had on the length of time required between calving and rebreeding (post-partum interval) is incomplete at this time.

Table 1. Gain performance and economics of using chlortetracycline as a medication in self-fed range mineral supplements.

	Control		Medicated	
1984	**Cows**	**Calves**	**Cows**	**Calves**
No. Cow/calf pairs	15	15	15	15
Days Grazing	151	151	151	151
Starting Weight, lbs.	950	199	954	192
Final Weight, lbs.	1020	486	1039	497
Gain, lbs.	70	287	85	305
ADG, lbs.	.46	1.89	.56	2.01
Economics:				
Total lbs. salt/ mineral mix consumed	450		700	
Total mineral cost, $	43.65		212.10	
Salt mineral mix cost/ pound, cents	10		31.1	
Avg. daily consumption/ pair, ounces, 1/	3.10		4.82	
Mineral Cost/pair, $	2.91		14.14	

1 Herd bull included in average daily consumption.

Table 2. Gain performance and economics of using chlortetracycline as a medication in self-fed range mineral supplements.

	Control		Medicated	
1985	**Cows**	**Calves**	**Cows**	**Calves**
No. Cow/calf pairs	15	15	15	15
Days Grazing	174	174	174	174
Starting Weight, lbs.	1059	135	1062	137
Final Weight, lbs.	1180	487	1211	507
Gain, lbs.	121	352	149	370
ADG, lbs.	.70	2.02	186	2.12
Economics:				
Total lbs. salt/ mineral mix consumed	259		424	
Total mineral cost, $	28.89		73.82	
Salt mineral mix cost/ pound, cents	11.1		17.4	
Avg. daily consumption/ pair, ounces, 1/	1.58		2.60	
Mineral Cost/pair, $	2.91		14.14	

1/ Herd bull included in average daily consumption.

ESTRUMATE, LUTALYSE AND SYNCHROMATE-B COMPARED FOR SYNCHRONIZING HEAT CYCLES IN BEEF HEIFERS

BY
D. G. Landblom and J. L. Nelson

Artificial insemination affords the stockman a tremendous potential for genetic advancement if he wants to commit himself and capital to the task. Committment to an artificial breeding program comes in many ways: study, capital investment, facilities and adherence to detail. Using synchronization compounds to group heat cycles together has proven to save time and labor but doesn't replace management; on the contrary, it intensifies management.

University and industry scientists, using the advanced technology of reproduction, now have four compounds available for commercial use to synchronize reproductive cycles in beef and dairy heifers. Three of the compounds, Estrumate, Bovilene and Lutalyse are prostaglandins which, when given to heifers and cows with functional corpus luteums (C.L.) cause the animals reproductive cycle to start over again bringing them into heat 2-5 days later. The fourth product, Synchromate-B, has a totally different mode of action by hormonally restraining a cow from coming into heat until the desired time. It is a progestogen/estrogen combination that research has shown takes a nine day holding period. Upon removal, heat cycles have been shown to be tightly grouped.

In previous research at this station a single 25 mg injection of Lutalyse has proven to be the most economical, and highest conception rates have been obtained when inseminations were done according to estrus instead of on a timed basis. In a study by former NDSU reproductive physiologist Dr. Gary Williams, it was found that estrus synchronization and conception rates were unaffected when the recommended level of Lutalyse used was reduced from 25 mg to 15 mg per heifer. Reducing the dosage of Lutalyse lowered the costs of synchronization substantially.

Synchromate-B was released for use in beef and dairy heifers in the spring of 1983. One of the advantages for Synchromate-B is that is produces a very tight synchronization and is reported to be a compound that will truly allow cattlemen to artifically inseminate cattle without detecting heat.

The purpose of this investigation is to compare two of the prostaglandin compounds Lutalyse (natural origin) and Estrumate (synthetic formulation) with the Synchromate-B system, and to further evaluate use of reduced dosages of Lutalyse under field conditions.

Three years of data have been accumulated with these products. Heifers used were Hereford, Angus x Hereford, Milking Shorthorn x Angus x Hereford and Simmental x Hereford. Onset of puberty was recorded for all heifers using epididectomized marker bulls during the wintering period in drylot. The heifers were randomly allotted to one of the three treatments based on age, weight, breed, and number of heat cycles each had before the start of the breeding season.

On the day that detection and breeding began in the Estrumate and Lutalyse groups, heifers in the Synchromate-B treatment were implanted. The Synchromate-B system consists of an ear implant impregnated with a potent progestogen compound, norgestomet, and a 2 ml injection containing a solution of norgestomet and an estrogen, estradiol valerate. Implants and injection were made with strict adherence to the manufacturers instructions. Asepsis is very important and therefore, the ear was clipped with an animal clipper, scrubbed with a detergent and nolvasan solution and further disinfected with alcohol before the implant was placed on the backside of the middle one-third of the ear. The implant remained in place for nine days and was removed the same time of day that it was installed. Removal was done by breaking through the scab and scar tissue with a forceps. Using the forceps to grasp and a thumbnail to apply pressure on the implant, it was slid out through the hole of entry.

The implanter needle was immersed in alcohol between implantings. The 2 cc. injection of norgestament and estradiol valerate were given using a 1½ inch x 16 guage needle and 2 cc hypodermic syringes.

The heifers were mass inseminated, beginning 48 hours after the last implant was removed, and placed with clean-up bulls after all heifers were out of heat.

The data have been summarized by year in tables 1, 2 an 3. The combined results are shown in table. 4.

Summary:

Comparing systems, Synchromate-B was easier to use since no heat detection was needed. Estrumate and Lutalyse required heat detection and additional labor.

Conception rates varied between years for all compounds. However, data for combined years shows that results from Estrumate and Lutalyse differed very little. The overall conception rates were 59.5% for Estrumate, 60.2% for Lutalyse and 44.6% for the Synchromate-B system. Conception rates obtained using Synchromate-B were the most variable ranging from a low of 23.5% to a high of 54.2%.

Using a reduced 15 mg dosage of Lutalyse was very effective. Conception rates were unaffected by the dosage reduction and the cost of synchronization was reduced proportionately.

For combined years, the synchronization cost per heifer conceiving using a conventional dosage of Estrumate was $3.74 and the reduced dosage cost per heifer conceiving using Lutalyse was $1.81. The cost for synchronization per heifer conceiving in the Synchromate-B group was $13.45.

Based on these data, the Synchromate-B program used cannot be recommended. While the program is easy to use and heat detection is not necessary, breeding success with the program has not been adequate making the cost per heifer conceiving very expensive. When compared to Synchromate-B, the prostaglandins Estrumate and Lutalyse, which do require nine days of heat detection, have been more consistent synchronizers and are very economical to use.

Table 1. Estrumate, Lutalyse, and Synchromate-B compared for estrus synchronization in beef heifers, 1984.

Treatment	Estrumate	Lutalyse	Synchromate-B
No. Head	23	23	23
No. insem. during 1st 5 days of breeding	6	6	--
No. given synchron. drug	17	17	23
No. not detected and not inseminated	4	3	-- 1/
No. having synchron. AI sired calves	11	13	12
No. having calves sired by clean-up bull	9	5	9
No. open heifers	3	5	2
Conception rate	47.8%	56.5%	52.2%
Amount of drug used	**500mg/2cc**	**15mg/3cc**	**Implant & 2cc injection**
Cost/heifer treated, $	3.50	2.10	6.00
Total cost/group, $	59.50	35.70	138.00
Cost/heifer conceiving to synchronized estrus, $	5.40	2.75	11.50

1/ All heifers inseminated by appointment.

Table 2. Estrumate, Lutalyse, and Synchromate-B compared for estrus synchronization in beef heifers, 1985.

Treatment	Estrumate	Lutalyse	Synchromate-B
No. Head	33	33	24
No. insem. during 1st 5 days of breeding	14	19	--
No. given synchron. drug	19	14	24
No. not detected and not inseminated	1	3	-- 1/
No. having synchron. AI sired calves	21	19	13
No. having calves sired by clean-up bull	10	13	9
No. open heifers	2	1	3
Conception rate	63.6%	57.8%	54.2%
Amount of drug used	**500mg/2cc**	**15mg/3cc**	**Implant & 2cc injection**
Cost/heifer treated, $	3.50	2.10	6.00
Total cost/group, $	66.50	29.40	144.00
Cost/heifer conceiving to synchronized estrus, $	3.16	1.55	11.08

1/ All heifers inseminated by appointment.

Table 3. Estrumate, Lutalyse, and Synchromate-B compared for estrus synchronization in beef heifers, 1986.

Treatment	Estrumate	Lutalyse	Synchromate-B
No. Head	18	17	18
No. insem. during 1st 5 days of breeding	6	10	--
No. given synchron. drug	11	7	18
No. not detected and not inseminated	1	1	-- 1/
No. having synchron. AI sired calves	12	12	4
No. having calves sired by clean-up bull	6	4	11
No. open heifers	0	1	2
Conception rate	66.6%	70.5%	23.5%
Amount of drug used	**500mg/2cc**	**15mg/3cc**	**Implant & 2cc injection**
Cost/heifer treated, $	3.50	2.10	6.00
Total cost/group, $	38.50	14.70	108.00
Cost/heifer conceiving to synchronized estrus, $	3.21	1.23	27.00

1/ All heifers inseminated by appointment.

Table 4. Combined synchronization results for, Estrumate, Lutalyse, and Synchromate-B compared for estrus synchronization in beef heifers, 1984, 1985 and 1986.

Treatment	Estrumate	Lutalyse	Synchromate-B
No. Head	74	73	65
No. insem. during 1st 5 days of breeding	26	35	--
No. given synchron. drug	47	38	65
No. not detected and not inseminated	6	7	-- 1/
No. having synchron. AI sired calves	44	44	29
No. having calves sired by clean-up bull	25	22	29
No. open heifers	5	7	7
Conception rate	59.5%	60.2%	44.6%
Amount of drug used	**500mg/2cc**	**15mg/3cc**	**Implant & 2cc injection**
Cost/heifer treated, $	3.50	2.10	6.00
Total cost/group, $	164.00	79.80	390.00
Cost/heifer conceiving to synchronized estrus, $	3.74	1.81	13.45

1/ All heifers inseminated by appointment.

A COMPARISON OF HEAT SYNCHRONIZATION METHODS IN MATURE COWS

BY
D. M. Landblom and J. L. Nelson

Since the late seventies, the evaluation of estrus synchronization products and their management has been an important part of the beef cattle research program at this station.

There are several estrus synchronization products on the market with Lutalyse Estrumate, and Synchromate-B, the most common. This station first tested Lutalyse in 1976. In 1983, Synchromate-B became available commercially for use in beef and dairy heifers. These products all offer a synchronization program allowing insemination by appointment. However, there is considerable variation in cost per cow treated.

To reduce the out of pocket costs, producers using Lutalyse and Estrumate can eliminate one injection by using conventional heat detection and insemination for a five day period. The remaining cows then receive a single injection and these cows can then be inseminated by appointment at 80 hours post injection, or the owner may continue to detect and breed for an additional four to five days.

Another experimental method of synchronizing estrus incorporates the feeding of melengestrol acetate (MGA) prior to the administration of a prostaglandin product (Lutalyse).

Prior research has shown MGA to be effective in preventing expression of estrus in breeding animals, but a temporary infertility occurs in the first estrus following removal of MGA. If MGA is fed for less than nine days, synchronization of estrus is not adequate or satisfactory. Theoretically, a combination of MGA feeding, a rest period and a single injection of Lutalyse would allow a maximum number of cows to be synchronized and inseminated at a minimal cost per cow treated.

The primary objective of this investigation is to evaluate the three methods and identify the method which produces the best synchrony at the lowest cost per cow conceiving.

A description of each synchronization method follows:

Synchromate-B: Synchronization with this product consists of placing a 6 mg. norgestomet implant on the back of the middle portion of the ear for nine days and giving a 2 cc. intramuscular injection containing 3 mg. norgestomet and 6 mg. estradiol valerate at the time of implantation. The ear was clipped, scrubbed with a detergent and nolvasan solution and bathed with alcohol from a squeeze bottle before the implant was placed in the ear. Upon implant removal, all calves were separated from their mothers, confined next to their mothers in pens equipped with a calf shelter and water trough and fed a commercial calf ration for 48 hours. Inseminations were conducted by appointment (no heat detection) between 48 and 52 hours after implant removal. Following insemination all cows and calves were rejoined.

Lutalyse (single injection method): Cows in this group were observed for heat during a five day conventional breeding period. On the morning of the sixth day (8AM), all cows not previously detected in heat were injected with 25 mg. (5 ml.) of Lutalyse deep in the muscle using a 1-1/2 inch x 16 gauge needle. Inseminations were conducted 12 – 14 hours after detection in standing heat.

Melengestrol Acetate (MGA)/Lutalyse Combination: This treatment was added in the second year of the study. Cows in this group were fed .5 mg MGA feed additive in one pound of a barley pellet containing 1% phosphorous. MGA feeding began five weeks before the start of the normal breeding season and was bunk fed for a period of fourteen days. Following a three week holding period after MGA had been removed from the cows diet a single injection Lutalyse program began as described above.

Assignment of cows to treatments was based on cow age, post-partum interval and cow breed. A minimum interval between calving and the start of the A I breading season was 60 days.

A brief summary of synchronization results and economics for 1984, 1985 and 1986 are shown in tables 1, 2 and 3. A summary for combined years is shown in table 4.

Summary:

Breeding artifically in mature cows following synchronization with Lutalyse, Synchromate-B or an MGA/Lutalyse combination has generated some very useful information.

Although Synchromate-B requires each cow to be handled twice for installation and removal of the implants, the program requires less labor since heat detection is not necessary. The cost for Synchromate-B continues to come down but the luxury cost for not detecting heat, even for a short period, is quite high. The overall conception rate per cow conceiving was 65.7% at a cost of $9.13.

Using the MGA/Lutalyse program requires more planning, daily feeding of a grain supplement containing .5 mg. of MGA for fourteen days beginning five weeks before the start of the breeding season and a total of nine days for heat detection. The conception rate per cow conceiving with this program was 65.3%. This rate is equal to the breeding success experienced with Synchromate-B, however, the cost per cow conceiving was substantially less, costing $3.78.

The single injection Lutalyse program also requires a total of nine days for heat detection. The overall conception rate per cow conceiving using Lutalyse was 72.9% and resulted in the lowest cost per cow conceiving of $3.50.

Table 1. Summary of Synchronization Methods, 1984.

Treatment	Single Injection Lutalyse	Synchromate-B
No. Head	27	25
No. cows conceiving at synchronized estrus	21	19
No. cows in heat 1st five days of breeding (%)	6 (22.2%)	0
No. cows open and sold	0	1
No. cows not having synchronized calves	6	5
Conception rate	77.7%	76.0%
Economics:		
No. cows treated: Lutalyse Synchromate-B	21	25
Cost/cow treated, $	4.00	7.50
Total cost for syn. in each treatment $	84.00	187.50
Syn. cost/cow conceiving, $	4.00	9.87

Table 2. Summary of Synchronization Methods, 1985.

Treatment	Single Injection Lutalyse	MGA/ Single Injection Lutalyse	Synchromate-B
No. head	23	25	21
No. cows conceiving at synchronized estrus	19	15	13
No. cows in heat 1st 5 days of breeding	5(21.7%)	17(68%)	0
No. cows open and sold	1	2	3
No. cows not having syn. calves	3	8	5
Conception rate	82.6%	60.0%	61.9%
Economics:			
No. cows treated: Lutalyse MGA Synchromate-B	18	9 25	21
Cost/cow treated: Lutalyse, $ MGA, $ Synchromate-B, $	4.00	4.00 1.33	7.50
Total cost for syn. in each system, $	72.00	69.25	157.50
Syn. cost/cow conceiving, $	3.79	4.61	12.11

Table 3. Summary of Synchronization Methods, 1986.

Treatment	**Single Injection Lutalyse**	**MGA/ Single Injection Lutalyse**	**Synchromate-B**
No. head	24	24	24
No. cows conceiving at synchronized estrus	14	17	14
No. cows in heat 1st 5 days of breeding %	9(37.5%)	17(70.8%)	0
No. cows open and sold	3	2	1
No. cows not having syn. calves	7	5	9
Conception rate	58.3%	70.8%	58.3%
Economics:			
No. cows treated: Lutalyse MGA Synchromate-B	15	7 24	24
Cost/cow treated: Lutalyse, $ MGA, $ Synchromate-B, $	3.50	3.50 1.33	6.00
Total cost for syn. in each system, $	52.50	56.42	144.00
Syn. cost/cow conceiving, $	3.75	3.31	10.28

Table 4. Combined results of Synchronization Methods, 1984 thru 1986

Treatment	**Single Injection Lutalyse**	**MGA/ Single Injection Lutalyse 1/**	**Synchromate-B**
No. head	74	49	70
No. cows conceiving at synchronized estrus	54	32	46
No. cows in heat 1st 5 days of breeding %	20(27%)	34(69.4%)	0
No. cows open and sold	4	4	5
No. cows not having syn. calves	16	13	19
Conception rate	72.9%	65.3%	65.7%
Economics:			
No. cows treated: Lutalyse MGA Synchromate-B	54	16 49	70
Cost/cow treated: Lutalyse, $ MGA, $ Synchromate-B, $	3.50	3.50 1.33	6.00
Total cost for syn. in each system, $	189.00	121.17	420.00
Syn. cost/cow conceiving, $	3.50	3.78	9.13

1/ Only two years data.

LUPROSTIOL AND LUTALYSE® COMPARED FOR HEAT SYNCHRONIZATION

BY
D. G. Landblom, J. L. Nelson and T. J. Newby

Scientists at Norden Laboratories are researching a new, and highly effective luteolytic analog of the prostaglandin F2 alpha, called Luprostiol, which has been marketed to European veterinarians for several years. To apply for marketing clearance for the new compound under the FDA's new drug clearance guidelines, Norden must conduct experiments with the product under field conditions. Dr. T. J. Newby, clinical scientist and research monitor for Norden Laboratories requested participation of the Dickinson Branch Experiment Station in a grant study comparing heat synchronization and artificial breeding with Luprostiol.

Luprostiol, a synthetic analog of the prostaglandin F2 alpha, has been formulated as an injectable solution. Information from pharmacokinetic studies with radiolabelled Luprostiol have shown that the experimental compound is rapidly eliminated from the animal in a manner similar to other prostaglandin analogs.

Dosage and safety studies have shown Luprostiol to be highly effective for estrous cycle control and abortion. Doses above the recommended level have been tolerated with only transient side effects.

The objective of this comparative study is to confirm the luteolytic, or estrus synchronization, effect of Luprostiol with a commonly used compound such as Lutalyse® when administered at recommended dosages to normal cycling females.

To complete the outlined objective, 131 cows and heifers were observed for standing heat and inseminated 12 -14 hours after detection during a five day pre-synchronization period to insure that an adequate number of females would be in the correct stage of their estrous cycle to respond to each of the synchronization compounds.

On the sixth day all cows and heifers that had not been previously inseminated were randomly allotted to either Luprostiol or Lutalyse® treatments according to age, breed and calving interval of cows. Then, beginning at 1 pm on the sixth day the remaining cows were injected with either 2 ml of Luprostiol or 5 ml of Lutalyse. As each cow or heifer was being injected, which was considered to be time zero, a 10 ml blood sample was taken, clotted, and a serum sample extracted. Serum samples were collected at 0, 48, and 96 hours after each drug was administered and analyzed for circulating progesterone levels by NDSU reproductive physiologist, Dr. Dale Redmer.

Following the injections, the females were inseminated according to estrus 12 – 14 hours after being detected in standing heat. Heat detection was done visually with the assistance of epididectomized sterile bulls equipped with chin ball marking harnesses.

Pregnancy was determined using a sophisticated ultra sound device and by conventional rectal palpation. Twenty-six days following the average date of insemination, Dr. Pat Hemming, DVM, representing the Bion Corporation, conducted pregnancy determinations using an ultra sound device developed and marketed by Bion. To check for potential early embryonic death that could occur after the ultra sound test, the females were rectally palpated by a local veterinarian fifty-six days after the average date of insemination.

Data accumulated in this investigation have been summarized in tables 1, 2 and 3.

Mean values for circulating progesterone were determined by radioimmunoassay and are expressed in picograms per milliliter in table 1. Conception rate as determined by ultra sound and by rectal palpation is summarized in table 2. Means for body condition score and the hours to standing heat following synchronization with each compound are shown in table 3.

Summary:

The new drug Lutprostiol manufactured by Norden Laboratories and Lutalyse® were evaluated in a comparative investigation and were found to be potent and equally efficient luteolytic agents.

The effect of these compounds on the anestrous female was not one of the prescribed objectives. However, anestrous females existed in each treatment, but were not affected by either synchronization substance.

Circulating progesterone was measured at 0, 48 and 96 hours after the administration of each substance. Progesterone levels in females that possessed functional corpus luteums were reduced rapidly by 48 hours and were reduced to stable low levels by 96 hours. Females that demonstrated normal standing heat but did not conceive to artificial breeding are considered in some instances to have been anovulatory. Those females that never cycled during the synchronized breeding period possessed very low circulation progesterone levels throughout the 96 hour sampling period.

First service conception rates as measured by ultra sound (26 days) or rectal palpation (56 days) were similar for both compounds. The percentage of animals pregnant as determined first by ultra sound and subsequently by palpation was 66.7% for Luprostiol and 68.4% and 65.8%, respectively, for Lutalyse®.

Table 1. Mean values for circulating progesterone measured in picograms/m1 of serum among pregnant, non-pregnant and females that never cycled following synchronization with either Lutalyse or Luprostiol.

	(No.)	0 Hours	48 Hours	96 Hours
LUPROSTIOL				
Total animals	36			
Pregnant 1/	24	3352.3	810.9	173.4
Cycled, but open	8	1576.6	1387.5	269.8
Never cycled	4	134.4	646.9	149.9
LUTALYSE				
Total animals	38			
Pregnant 1/	26	3676	387	165.1
Cycled, but open	3	2810	364.6	149.9
Never cycled	9	803.5	304.8	256.5

1/ Determined by ultra sound.

Table 2. Estimated conception rate as determined by ultra sound and conventional pregnancy testing proceedures.

	26 Day Ultra Sound		56 Day Conventional Pregnancy Test	
	Luprostiol	**Lutalyse**	**Luprostiol**	**Lutalyse**
No. Head	36	38	36	38
No. Pregnant 1/	24	26	24	25
No. cycled, but open	8	3	8	4
No. that never cycled, and open	4	9	4	9
Conception rate	66.7%	68.4%	66.7%	65.7%

1/ Determined by ultra sound.

Table 3. Body condition score and time lapse between injections at zero hours and the onset of standing heat.

	Luprostiol	Lutalyse
Pregnant: 1/		
Total hours	1666.0	1857.5
Mean hours	64.0	71.4
Mean range, hours	19 - 139	31 - 129
Body Condition Score	6.5	7.4
Not pregnant, but cycled		
Total hours	556.0	165.0
Mean hours	69.5	55.0
Mean range, hours	19 - 129	44 -57
Body Condition Score	7.4	7.6

1/ Determined by ultra sound.

FEEDLOT BREED COMPARISON OF FIRST GENERATION STEERS

BY
J. L. Nelson and D. G. Landblom

A majority of North Dakota cattle producers are attempting to increase profits in their cattle operation by crossbreeding. The decision on which breeds to combine is not easy and is often made based upon what type and breed combination is selling well at the time. Since the generation interval in cattle is long and the margin between profit and loss is often small, producers may be trapped into producing a "terminal" cross calf before they develop a highly productive brood cow.

Research on beef cow efficiency is just starting to filter out of Research Stations in the U.S. and Canada. The Dickinson Experiment Station has started to evaluate several different crossbred cow types and sizes in order to provide stockmen with data that have been collected under typical western North Dakota conditions. In this breeding study, crossbred brood cow types are being developed that should maximize heterosis when bred back to unrelated terminal sires. The development of these various brood cow types results in the production of steer calves that may have good or poor feedlot or carcass traits.

This phase of the trial compares the feedlot performance and carcass information from steers produced during the first generation of breeding. In 1984, the steers on trial represented four breed types: Hereford; Angus X Hereford; Milking Shorthorn X (A X H); and, Simmental X Hereford. Because of producer interest, three additional pens of steers were included in the 1985-86 trials. These were Charolais X Hereford; Gelbvieh X Hereford; and, Salers X Hereford crossbreds.

All steers were implanted with Compudose®, treated for lice, and vaccinated with a 7-way Clostridium vaccine prior to the start of the feeding period. Average starting weight for all pens was approximately 600 pounds in early December. The steers were bunk line fed a complete mixed ration of dry rolled barley, alfalfa and mixed hay (chopped), corn silage, dicalcium phosphate and trace mineralized salt. The barley portion of the ration started at 30% and was increased by 5% increments until it made up 75% of the total ration. Feed consumption during the trial is summarized in Table 2. The steers were fed on a grade constant basis, meaning that each group was fed until it was felt that 60% of the animals would grade USDA Choice when slaughtered. At this point, the steers were trucked to Held Beef Industries in West Fargo, North Dakota and sold. Dr. Paul Berg, Department of Animal and Range Sciences at NDSU was in charge of slaughter arrangements and collection of all carcass data. Table 1, shows the feedlot gain, economics and carcass data for 1986.

Discussion:

About half of the steers used in this study were purchased locally in order to get uniform starting weights and certain breed types, namely the Gelbvieh crossbreds and the Salers crossbreds. During the early weeks of the trial, several steers exhibited typical "shipping fever" respiratory problems and high fever that required careful observation and early medication. In mid-February, one of the AXH steers died from acute "bloat" and in early April, a Simmental cross steer was removed from trial due to a serious rumen infection. The rest of the steers finished the feeding period with no other health related problems, reaching an estimated 50-60 percent choice in mid June after 190 days on feed.
For some reason, the steers in this trial seemed to have a quieter disposition and were easier to handle during routine weighing than those fed in 1985.

Summary:

Steers fed in 1986 gained from 2.63 lbs./day (Gelbvieh cross) to 3.01 lbs./day (Simmental cross) during the 190 day feeding period. Daily feed consumption averaged 28.6 pounds as fed, and ranged from a low of 25.9 lbs. by the Gelbvieh cross to 31.0 lbs. for the Simmental crossbreds. The Charolais cross steers were the most efficient at 9.45 lbs. feed/lb.gain, while the Milking Shorthorn cross steers required 10.9 lbs. of feed per lb. of gain. Feed costs per hundred weight gain varied from $34.57 for the Charolais cross steers to $39.10 for the Milking Shorthorn cross steers. While none of the breed groups returned profitable margins over feed costs, the Charolais cross and the Salers cross steers returned the most while the Milking Shorthorn cross and the Gelbvieh crossbreds returned the least.

Carcass information revealed 55% of the steers graded USDA Choice with Herefords leading with 83%. Loin eye size favored the Simmental X, Gelbvieh X, and Charolais X steers with measurements of over 13 sq. inch, almost two inches larger than AXH, MS (AXH), and Herefords. The Gelbvieh X and the MSX (AXH) had the lightest carcass weights at 619.7 and 645.5 lbs. respectively, while the Salers X steers had the heaviest at 709.2 lbs. Based on $82.00 Choice and $70.00 Good, the actual carcass value varied from a low of $459.19 for the Gelbvieh X to $540.52 for the Simmental X.

Two years combined data in Table 3, show average daily gains ranging from 2.83 lbs. for the Herefords to 3.23 lbs. for the Simmental crossbreds. As might be expected, the Simmental X and the Salers X steers had the heaviest carcass weights. Gelbvieh X steers cut out rib eyes that measured over 13 sq. inches but they lacked some in marbling and thus had the lowest percentage of Choice carcasses. With a rather large spread between Choice and Good prices, this had a very negative effect on their overall carcass value. Average cost per hundred weight gain ranged from a low of $33.17 for the Charolais X to a high of $36.46 for the Herefords.

The three year combined summary for the original four breeds shows ADG ranging from 2.66 lbs./day for the Herefords to 2.93 lbs./day for the Simmental crossbreds. The best overall feed efficiency was shown by the Angus X Hereford cross steers. They also had the lowest cost of gain at $34.53 per hundred weight. All four groups graded about as expected averaging 55% Choice. Carcass value ranged from $548 for the Hereford steers to $595 for the Simmental crossbreds. Overall returns over feed varied from $376 for the Herefords to $404 for the Angus X Hereford crosses.

While this data was gathered from a relatively small sample size, the results do point out some of the strengths and weaknesses of the different breed types. It is important that producers utilize this type of information when they plan their long-range beef production goals.

Table 1. Feedlot gains, economics and carcass data for 1986

	Angus X Hereford	Gelbvieh X Hereford	Simmental X Hereford	Salers X Hereford	M. Shorthorn X (AXH)	Charolais X Hereford	Hereford
No. of steers	5 1/	6	5 2/	6	6	6	6
Final Weight, lbs.	1130.6	1058.5	1184.4	1201.7	1117.7	1186.5	1136.7
Initial Weight, lbs.	589.0	558.3	613.2	649.7	612.5	621.3	616.5
Average Gain, lbs.	541.6	500.2	571.2	552.0	505.2	565.2	520.2
Days Fed	190	190	190	190	190	190	190
ADG, lbs.	2.85	2.63	3.01	2.90	2.66	2.97	2.74
Hot Carcass Weight, lbs.	665.6	619.7	677.0	709.2	645.5	687.3	650.0
Dressing %	62	59	60	60	59	60	59
Loin Eye Size	11.50	13.13	13.74	12.68	11.50	13.05	11.32
Carcass Yield Grade	2.95	1.62	1.84	2.44	2.63	2.12	2.54
USDA Quality Grade							
U.S. Choice @82.00/cwt	4	2	4	3	4	4	5
U.S. Good @$70.00/cwt	1	4	1	3	2	2	1
Carcass Value $	530.02	459.19	540.41	538.52	503.57	536.27	533.93

1/ One steer died due to bloat

2/ One steer removed due to rumen infection

Least significant difference at 5% = 52.6 lbs.

Table 2. Feed consumption for 1986.

	Angus X Hereford	Gelbvieh X Hereford	Simmental X Hereford	Salers X Hereford	M. Shorthorn X (AXH)	Charolais X Hereford	Hereford
Daily Feed Consumption lbs.							
Barley	14.61	13.26	15.98	14.62	14.21	14.59	14.56
Corn Silage	7.15	6.46	7.72	7.41	7.65	6.98	7.30
Mixed Hay	5.04	4.52	5.34	4.96	5.22	4.73	4.96
Alfalfa	1.58	1.44	1.72	1.63	1.67	1.61	1.59
TM Salt	0.11	0.10	0.12	0.11	0.11	0.11	0.11
Di Calcium Phos.	0.11	0.10	0.12	0.11	0.11	0.11	0.11
Total lbs./days	28.60	25.88	31.00	28.84	29.12	28.12	28.62
Feed/lb. gain	10.03	9.84	10.31	9.93	10.90	9.45	10.46
Feed Cost/Steer	204.74	185.52	222.33	198.72	197.96	195.37	197.49
Feed Cost/cwt Gain $	37.80	37.09	38.92	36.00	39.19	34.57	37.97
Return Over Feed $	325.28	273.66	318.20	339.79	305.60	340.90	336.43

Feed Prices Used in This Trial

Alfalfa	$50/ton
Mixed Hay	$45/ton
Corn Silage	$15/ton
Barley	$1.60/bushel
TM Salt	$6.40/cwt
Dical Phosphate	$19/cwt
Grinding & Mixing	$25/ton

Table 3. Two Year Average Feedlot Gains, Economimcs and Carcass Data – Feedlot Comparison Trial.

	Angus X Hereford	Gelbvieh X Hereford	Simmental X Hereford	Salers X Hereford	M. Shorthorn X (AXH)	Charolais X Hereford	Hereford
No. of steers	12	13	12	12	13	13	13
Final Weight, lbs.	1109.6	1094.2	1224.2	1172.3	1132.2	1159.8	1103.2
Initial Weight, lbs.	608.5	601.2	660.0	648.9	657.7	625.6	630.4
Average Gain, lbs.	500.8	493.0	564.2	523.4	474.4	534.2	472.8
Days Fed	168	168	176	176	168	175	168
ADG, lbs.	3.00	2.96	3.23	2.99	2.85	3.07	2.83
Hot Carcass Weight, lbs.	653.8	632.7	709.3	695.3	655.3	671.8	637.8
Dressing %	60.5	58.1	59.4	59.8	58.5	59.0	58.75
Loin Eye Size	11.5	13.02	12.5	12.44	11.35	12.6	11.6
Fat Thickness	.52	.28	.36	.34	.41	.32	.52
USDA Choice Grade	9	2	8	7	8	5	7
U.S. Good	3	11	4	6	5	8	6
Actual Carcass Value $	550.50	510.09	597.48	556.01	545.37	534.77	539.52
Return Over Feed $	379.36	342.04	395.57	387.84	372.08	374.86	366.45
Feed/Head/Day, lbs.	29.6	28.94	33.85	30.78	31.22	30.22	28.8
Feed/lb. Gain, lbs	9.88	9.72	10.50	10.26	10.93	10.02	10.2
Feed Cost/Head, $	171.14	164.42	201.92	181.36	173.29	178.33	173.06
Cost/cwt Gain, $	33.85	33.26	35.74	34.44	36.34	33.17	36.46

Table 4. Three Year Average Feedlot Gains, Economics and Carcass Data. Feedlot Comparison Trial.

	Hereford	Angus X Hereford	M. Shorthorn X (AXH)	Simmental X Hereford
Gains:				
No. Head	20	19	20	19
Days Fed	177	170	170	182.3
Final Weight, lbs.	1089.6	1108.2	1138.6	1202.4
Initial Weight, lbs.	619.9	623.6	655.9	670.6
Gain, lbs.	469.7	484.5	482.7	531.8
ADG, lbs.	2.66	2.88	2.86	2.93
Economics:				
Feed/Head, lbs	25.99	27.4	29.3	30.6
Feed/lb. Gain, lbs.	9.63	9.42	10.2	10.3
Feed Cost/Head, $	171.44	170.08	177.55	201.08
Cost/cwt Gain, $	36.21	34.53	36.57	37.74
Carcass Data:				
USDA – Grade - Choice	9	12	12	10
Good	11	7	8	9
Hot Weight, lbs.	628.6	651.5	653.6	627.5
Carcass Value, $	547.89	578.45	575.90	595.92
Return Over Feed, $	375.78	403.74	394.91	400.22

WINTER GROWTH AND BREED PRODUCTION COMPARISON OF FIRST GENERATION HEIFERS

BY
D. G. Landblom and J. L. Nelson

One of the major segments of the Dickinson Experiment Station's beef cow efficiency study is to evaluate the winter growth and production efficiency of several experimental crossbreds. The overall study has been undertaken to provide cattlemen with information relative to beef cow efficiency conducted in southwestern North Dakota. This station does not have the animals or the land base to evaluate a large number of biologically different breeds, but does have the capability to evaluate a small number of crossbred cow types representative of many of the combinations possible in North America.

As stated in the previous discussion, "Feedlot Breed Comparison of First Generation Steers", the breeding model is designed to develop crossbred brood cow types that should maximize heterosis when bred back to unrelated terminal sires. The first generation breeding plan is shown in Table 1.

Winter growth performance, age and weight at puberty, first service conception rate and weaning weight of calves from these calves as first calf heifers are being evaluated in this phase of the overall cow efficiency investigation.

For the purpose of this progress report, information available includes winter growth performance, age and weight at puberty, pregnancy status and actual calving data.

Replacement heifers representative of four breed types have been fed during the winter growing periods of 1984, 1985 and 1986. In 1984, the heifers were self fed a mixture of dry rolled barley, chopped mixed hay, salt and dicalcium phosphate. Barley made up 30% of the ration initially and was increased to 55% and fed at that level for the duration of the study. The second year, corn silage was substituted for part of the chopped hay portion, with rolled barley making up approximately 38% of the ration. In 1986, the level of barley averaged 28% of the ration, with corn silage and chopped hay making up the rest of the ration.

Heifers on trial were given a seven-way Clostridium booster vaccination at the start of the trial. They were also vaccinated for Brucellosis, leptospirosis and vibriosis prior to breeding. Individual weights were taken on 28 day intervals with estrus determined with the aid of sterile epididectomized bulls equipped with Chin-Ball® marking halters. Weight at first estrus (Table 4) was estimated by interpolation based on days between two monthly weigh periods.

In early June, the heifers were assigned to an estrus synchronization artificial breeding study. This year, the heifers were kept isolated from fertile bulls for one month following breeding. They were checked for early pregnancy by Dr. Patrick Hemming using an Equiscan III ultrasonic scanner. Dr. Hemming is the owner of Animal Reproductive Technologies, North Glenn, Colorado. The Equiscan III ultrasound scanner was provided by the Bion Corporation of Westminister, Colorado. At breeding, blood samples were collected and sent to Dr. Dale Redmer, Department of Animal and Range Sciences, NDSU for progesterone assay, as part of the synchronization study. In July, the heifers were manually palpated for pregnancy by a local veterinarian. They were also re-checked in early October after having been exposed to cleanup bulls.

Discussion:

Heifers fed in 1986 gained from 1.94 to 2.15 pounds per head per day (Table 1). By the end of the wintering period, May 15th, average heifer weight varied from 797 pounds for the Milking Shorthorn crossbreds to 880 pounds for the Simmental X Hereford crossbreds. The heifers consumed 28-29 pounds of mixed feed per day with only minor differences between breed groups. Feed costs per heifer ranged from a low of $85.43 for the straightbred Hereford to $88.05 for the Milking Shorthorn (AXH) crossbreds. The Milking Shorthorn crossbred heifers exhibited their first estrus at 723 pounds of body weight while the Simmental crossbreds weighed 837 pounds at first estrus. The average date of first estrus ranged from April 5th to April 15th with no major differences between groups.

Actual calving records from the first two years of the study show a large percent of the Simmental crossbred heifers conceived early in the breeding season since 77.3% of these heifers calved in March. This compares with 48% in March for the Herefords; 50% for the Angus X Herefords; and 41% for the Milking Shorthorn X (AXH) crossbreds. (Table 7)

Summary:

During the three years this trial has been in progress, average daily gains have ranged from 2.02 pounds per day for the Angus X Hereford crossbred to 2.25 pounds per day for the Herefords. Feed intake has varied from 26.9 and 27.3 pounds per day for the Herefords and Angus X Herefords crossbred to 28.4 and 29.3 pounds per day for the Simmental X Hereford crossbreds and the Milking Shorthorn X (AXH) crossbreds. This seems to indicate a higher feed requirement or lower feed efficiency especially for the Milking Shorthorn X crossbreds. Because of differences in feed consumption, the actual wintering feed costs ranged from a low of $83.71 for the Hereford heifers to $91.67 for the Milking Shorthorn X (AXH) crossbreds, a difference of $7.96 per heifer wintered. No definite conclusions are possible regarding the ability of the different breed types to cycle and conceive due to the limited number of heifers used in the trial to date.

Table 1. Gains and wintering economics of heifers to be used in the cow efficiency study in 1986.

	Hereford Lot 16	Angus X Hereford Lot 15	M. Shorthorn X (AXH) Lot 14	Simmental X Hereford Lot 17
Gains:				
No. of Head	10	10	9	10
Initial Wt.Total/Lot	5327	5023	4328	5942
Average Weight	532.7	502.3	480.9	594.2
Final Wt. Total/Lot	8429	8085	7173	8804
Average Weight	842.9	808.5	797	880.4
Total Gain/Lot	3102	3062	2845	2862
Average Gain/Head #	310.2	306.2	316.1	286.2
Days fed	147	147	147	147
Animal days	1470	1470	1312	1470
Average Daily Gain	2.11	2.08	2.15	1.94
Feed and Economics:				
Total Feed/Head #	4221	4266	4342	4321
Feed/Head/Day	28.71	29.03	29.52	29.40
Feed/Lb/Gain #	13.61	13.93	13.74	15.1
Feed Cost/Head/Day $	.58	.58	.60	.59
Total Feed Cost/Head $	85.43	86.51	88.05	87.36
Cost/cwt, Gain $	27.54	28.25	27.86	30.52

Table 2. Average ration consumed by breed comparison heifers fed in 1986.

	Hereford	Angus X Hereford	M. Shorthorn X (AXH)	Simmental X Hereford
Chopped Mixed Hay	9.10	9.22	9.50	9.30
Corn Silage	11.56	11.63	11.65	11.86
Dry Rolled Barley	7.86	7.98	8.17	8.04
Trace Mineral Salt	0.10	0.10	0.10	0.10
Dicalcium Phosphate	0.10	0.10	0.10	0.10
	28.71	29.03	29.52	29.40

Table 3. Three year (1984-1986) average gain and feed efficiency for heifers to be used in cow efficiency study.

	Hereford	Angus X Hereford	M. Shorthorn X (AXH)	Simmental X Hereford
Gains:				
No. of Head	31	42	31	32
Average Days Fed	119	119	119	119
Initial Weight	543	571	586	611
Final Weight	811	811	843	873
Gain	268	240	257	262
ADG	2.25	2.02	2.16	2.20
Feed and Economics:				
Total Feed/Head #	3200	3244	3484	3384
Feed/Head Daily #	26.9	27.3	29.3	28.4
Feed/lb. Gain #	11.9	13.5	13.54	12.91
Feed Cost/Day $	.72	.72	.79	.76
Total Feed Cost/Hd. $	83.71	84.40	91.66	88.31
Cost/cwt Gain $	31.48	34.62	35.64	33.75

Table 4. 1986 average puberty distribution, age and weight.

	Hereford	Angus X Hereford	M. Shorthorn X (AXH)	Simmental X Hereford
Puberty Distribution:				
% Showing Estrus				
February		0	0	
March	30%	40%	33.3%	30%
April	60%	60%	44.4%	40%
May			22.2%	30%
Not Detected	10%	0	0	0
Average Cycle Date	96	95	100	105
Calendar Date	Apr. 6	Apr. 5	Apr. 10	Apr. 15
Average Calculated Weight at 1st Estrus, Lbs.	781	729	723	837

Table 5. Pregancy status of heifers artifically inseminated in June, 1986

	Hereford	Angus X Hereford	M. Shorthorn X (AXH)	Simmental X Hereford
Percent Pregnant:				
July	40%	40%	55%	50%
October	55%	70%	87%	70%

Table 6. Actual calving date of heifers bred in 1985 and calving 1986.

	Hereford	Angus X Hereford	M. Shorthorn X (AXH)	Simmental X Hereford
Calving In:				
March	50%	50%	42%	92%
April	50%	42%	42%	8%
Open or Aborted	0	8%	16%	0

Table 7. Two year combined calving date of heifers

	Hereford	Angus X Hereford	M. Shorthorn X (AXH)	Simmental X Hereford
Calving In:				
March	48%	50%	40.9%	77.3%
April	38%	34.4%	45.4%	22.7%
May	9.4%	3.1%	4.5%	0
Open or Aborted	4.6%	12.5%	9.2%	0

INCOMPLETE RESEARCH
BROOD COW EFFICIENCY STUDY

The brood cow efficiency study being conducted at this station is a long term investigation designed to evaluate biologically diverse cow types. Our primary objective is to identify the brood cow type, or types, among those being tested, that will yield the highest return on investment. To answer this question requires a number of different measurements. The first phase of measurements occurs during the wintering period before and after calving. During this phase winter maintenance and TDN levels that will promote high reproductive efficiency are being identified. The second phase of measurements occurs on pasture where pasture stocking rates, estimated milk production, pregnancy rates and pounds of beef produced per acre are being identified for each breed.

Breed combinations being used represent a cross section of the diversity that exists among cattle breeds. Several criteria were used when selecting breeds to include in the investigation. In the beginning it is important to note that every breed didn't need to be included because brood cows, regardless of color, can be categorized into trait groups. For the purpose of this investigation we categorized cows into groups according to their expected mature body weight and mature lactation potential. Breeds being investigated at other branch experiment stations in North Dakota were not considered to avoid unnecessary duplication.

Hereford cows nursing straightbred Hereford calves are serving as our control breed as well as the foundation breed in all of the other crossbred cow types being evaluated. Brood cow breed combinations, sire breeds being used for terminal crossing, and breed composition of the calves is shown in the following chart:

Breed Combination of Cow	**Sire Breed**	**Breed Combination of Calf**
Hereford (Control)	Hereford	Hereford
Hereford	Charolais	Charolais X Hereford
Angus X Hereford	Charolais	Charolais X (Angus X Hereford)
Milking Shorthorn X (Angus X Hereford)	Charolais	Charolais X Milking Shorthorn X (Angus X Hereford)
Simmental X Hereford	Charolais	Charolais X Simmental X Hereford

At this time, measurements during the first wintering and calving phase have been collected, but those being taken during the pasture phase are incomplete, therefore none of the data have been summarized for inclusion in this progress report. While data from the brood cow portion of this study is incomplete, replacement heifer wintering information for each cow breed type and feedlot finishing of their steer counterparts is completed and summarized on pages 34-44.

SECTION II

EVALUATION OF
LIVESTOCK WATERERS
FOR THE
NORTHERN PLAINS

BY

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LIVESTOCK WATER FOUNTAINS, TWO NEW UNITS EVALUATED

BY
V. L. Anderson

Energy efficiency of livestock water fountains becomes more critical as margins narrow and profits become harder to generate. This past winter, two new models of livestock waterers were made available to producers in the northern plains states. The Challenger II from Ritchie Industries and the Jug from Nolan Mfg. were installed at the Carrington Irrigation Station for evaluation prior to the past winter. Experience suggests some variation occurs in energy use from year to year. The data presented here is for one year for two units and multiple years for the other units. Table 1 gives basic data for all waterers evaluated thus far.

The Challenger II is a traditionally designed metal fountain with some major feature changes making it much more energy efficient. It is constructed of stainless steel, insulated on the sides, top and bottom with 2 inch of rigid foam. The metal cover on top has two holes, centered one near each end approximately 12 inches in diameter. A vertical stainless steel cylinder is fitted into these holes slotted on the bottom to allow water to enter from the reservoir. A plastic thermal cap resembling two frisbees glued together floats on the surface of the water inside the cylinder. No air can flow through from one hole to the other and very little surface is exposed to cool winds with this design. The heater is immersed in the reservoir unlike the older models of Ritchie waterers with the element attached to the underside of the metal pan. The thermostat is pre-set at 42 degrees F for optimum energy savings. Normally ground water is warmer than this so water entering the unit from cows drinking would not turn on the heating element. Water coming through the system at the Carrington Irrigation Station is 39 to 40 degrees F resulting in turning on the heating element and use of more energy than anticipated. Reducing the thermostat to 37 to 38 degrees resulted in freeze-up of the unit during severe weather. Warmer ground water temperatures would mean considerable savings in energy from an already quite efficient unit. An indicator light on the outside comes on when the heating element is on.

The Jug is a very unique design in livestock waterers. It is extremely energy efficient using less than one KWH per day. It has a completely enclosed 4 gallon reservoir from which animals drink through the use of a mouth cup. This yellow fiberglass cup has a small hole in it with a copper tube attached that acts much like a soda straw during the drinking action. Animals learned to drink from this new unit quite easily. A handy water level adjustment screw is located on the outside to raise the water level slightly for easier adaptation. The body of the waterer is made of high impact, very durable plastic. A small heat cable (48 watts) is provided with the unit and recommended to be installed near the riser pipe and valve assembly.

Another new waterer will be installed this fall. The Mirafount ball float closure model #3350 will be evaluated for watering young stock during the fall and winter. This unit is similar in design to the float closure model #3320 used for several years at this station for watering cows except round balls floating on the water surface seal the openings rather than the relatively flat floats. This unit does not require any electricity.

Table 1. Energy Use Of Livestock Water Fountains

Brand	Model	Retail Price	KWH Per Day	Cost [1] Per Day	Cost [2] Per Winter
Pride of the Farm	WE50	300.00	9.32	.75	104.38
Super insulated Pride of the Farm	WE4	300.00 +insulation	7.65	.61	85.40
Ritchie	No. 5	302.00	8.70	.70	97.44
Bohlman	75	339.00	6.31	.50	70.67
Johnson Artificial Spring	---	460.00	5.40	.43	60.48
Mirafount	3320	739.00	-0-	-0-	-0-
New Units					
Ritchie	Challenger II	459.00	3.27	.26	39.24
Jug	---	325.00	.90	.07	10.80

1. Based on $.08 per KWH
2. Average winter of 150 days from mid-November to mid-April

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Watering Livestock During Northern Plains Winters

V.L. Anderson and Dexter Johnson

Watering livestock in the winter in the northern plains can be frustrating. Over the years, new techniques have been developed and new waterers invented to help with this chore. None are perfect. As a reliable waterer, the free-flowing spring offers many advantages except it is often in a less than desirable location and not available to many producers. Increased genetic potential of cattle necessitates better care, including frequent watering. This article gives a brief review of the development of watering systems for cattle and compares some of the current commercial water fountains.

Water is an essential feed for cattle. Canadian research suggests cows will eat snow after a short adaptation period (not watered for several days). However, for health and feed efficiency, it is recommended to provide ice free water to cattle daily. National Research Council Nutrient Requirements for Beef Cattle (1984) water requirements are given in table 1.

Table 1. Water Requirements for Beef Cattle[a] (Gallons/Day).

		Temperature[b]	
Type Animal	**Wt. (Lb)**	**40°F**	**70°F**
Growing Calves	400	4.0	5.8
	600	5.3	7.8
	800	6.3	9.2
Finishing Cattle	800	7.3	10.7
	1000	8.7	12.6
Wintering Cows	900	6.7	9.7
	1100	6.0	8.7
Lactating Cows[c]	900	11.4	16.9
Bulls	1600	8.7	12.6

a) NRC Nutrient Requirements for Beef Cattle, 1984
b) Water intake up to 40°F is relatively constant
c) Varies with milk production

Anderson is associate animal scientist, Carrington Irrigation Station, and Johnson is agricultural engineer, Cooperative Extension Service.

Prior to the availability of electricity, small numbers of cattle were usually watered by hand operated pump jack on the farmstead. Large water tanks were partially covered and insulated with straw and soil to reduce heat loss. Several of these units are still in use in combination with wind or electric pumps. Some cattlemen use tank heaters fueled by wood, coal, fuel oil, propane or other combustible material to keep the water thawed. In remote areas larger tanks may be used to retain latent heat of water coming from the ground.

Electric water pumps and pressure water systems increased the number of animals that could be watered and reduced the labor required. Early automatic water fountains were designed to operate in moderate climates but often were not dependable in severe weather. Energy efficiency was not as critical a factor in the early years of automatic water fountains.

In recent years, energy consumption has become more critical. New designs and new materials have made possible several new water fountain designs that have potential for reducing maintenance time and energy consumption for watering livestock in the winter. Three years ago, a field trial was started at the Carrington Irrigation Station Livestock Unit to evaluate the energy consumption and operation of different water fountain designs.

Five different commercial water fountain treatments were installed prior to the winter of 1982-83. The standard automatic metal fountain (Treatment 1) has an electrically heated reservoir that provides ice free water to livestock.

A float valve is centrally located under a protective cover for easy maintenance. Two widely used waterers were used to represent this design, a Ritchie No. 5, rated at 500 watts (photo 1), and a Pride of the Farm Model WE-4 (photo 2), rated at 600 watts. Treatment 2 was a home-insulated version of the standard metal fountain. A Pride of the Farm was super insulated with 4 inches of styrofoam (photo 3) around the outside of the waterer protected by a custom made plywood cover. Diagram 1 gives an expended perspective of one method of super insulating a fountain. Treatment 3 was a Bohlman concrete fountain Model 75, rated at 298 watts (photo 4). This fountain is the same basic design but uses a poured reinforced concrete frame insulated inside with 2 inches of rigid board insulation. The fourth design was a recirculating waterer (photo 5) that required no supplemental heat. The Johnson Artificial Spring (Treatment 4) has a submerged 120 volt, 2 amp pump that runs continually to recirculate water through a 3/4-inch diameter pipe from a fiberglass reservoir 10-feet in the ground to the surface bowl. An adjustable overflow pipe allows water not consumed by livestock to fall back into the buried reservoir. The constant motion of the water in the surface bowl and the ground heat surrounding the buried reservoir prevent freezing. A float valve on the buried reservoir opens when cattle consume water in the surface bowl and the level in the buried reservoir drops (see diagram 2). Treatment 5 was an energy free waterer. The Mirafount (photo 6) is a super insulated waterer that utilizes residual heat of the water coming through the buried lines and periodic replacement of the water in the 40 gallon reservoir to keep from freezing. A heat well 15 inches in diameter installed to a depth of 10-feet provides a place for the 3/4-inch diameter insulated feeder line to come up to the waterer from the buried water line. Drinker floats block out the cold winter wind and reduce heat loss from the surface of the water. Cattle must push the float down in order to drink (see diagram 3).

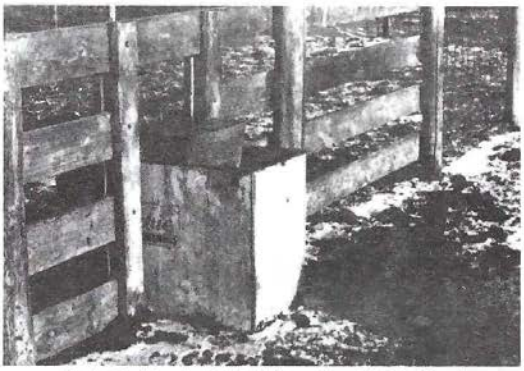

Photo 1. Standard Metal Fountain, Ritchie No. 5.

Photo 2. Pride of the Farm, Model WE-4.

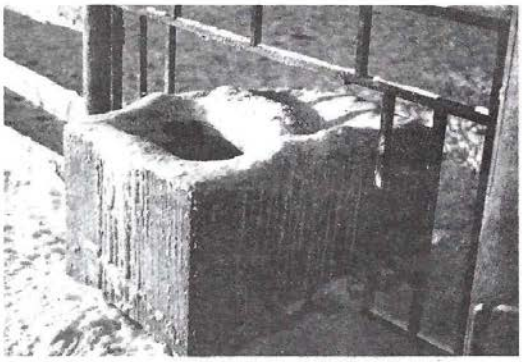

Photo 3. Home insulated water fountain.

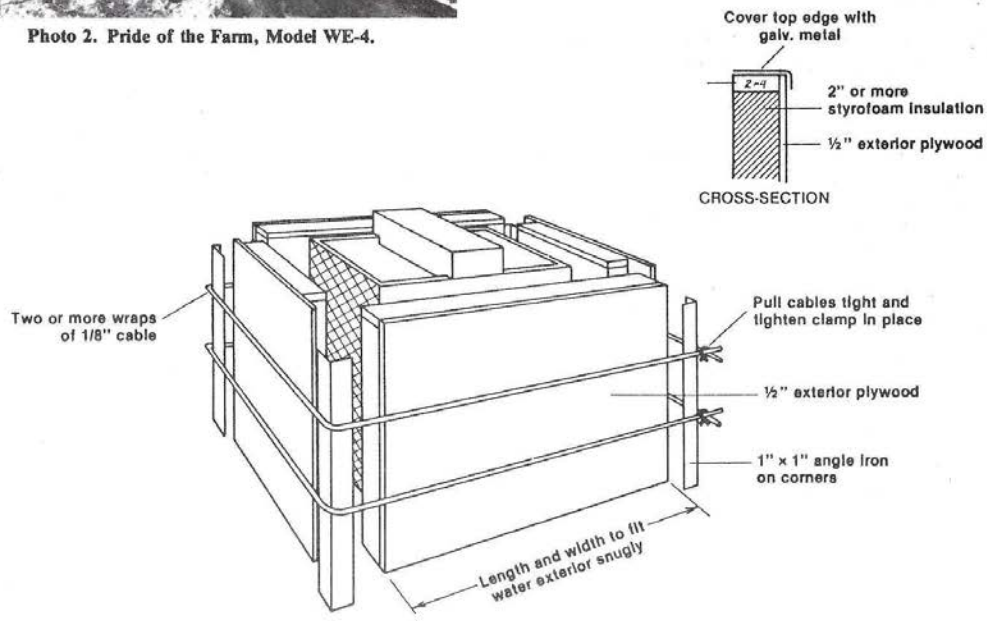

Diagram 1. Superinsulated Livestock Water Fountain

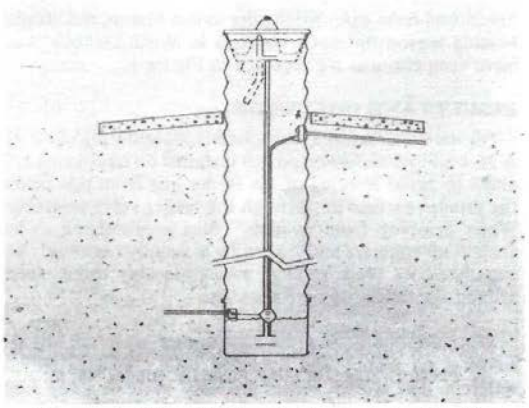

Diagram 2. Schematic diagram of recirculating fountain.

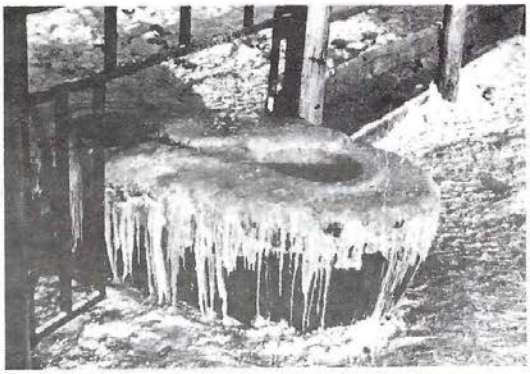

Photo 6. Mirafount energy free waterer.

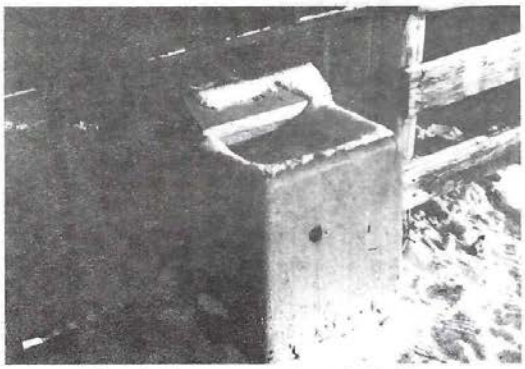

Photo 4. Concrete water fountain, Bohlman.

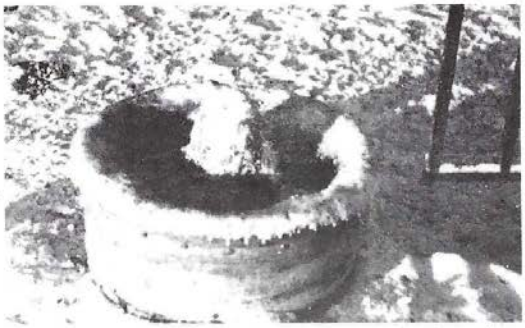

Photo 5. Johnson Artificial Spring recirculating fountain.

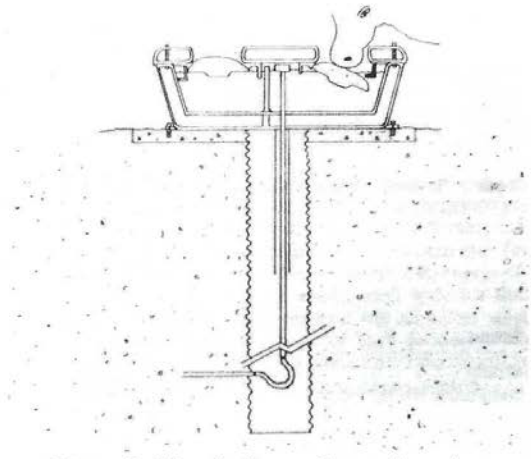

Diagram 3. Schematic diagram of energy free waterer.

Waterers in treatments 1, 2 and 3 were installed over a 12-inch plastic pipe heat well that extended 8 feet into the ground. Water lines are buried at approximately 8 feet. All waterers were installed in fenceline installations with 20 to 30 head of cattle on each side. Wateres were installed approximately 50 feet from any buildings with wind protection from trees and wind fences no closer than 50 feet. Water temperatures were checked periodically in the electrically heated fountains and maintained at 40 to 50 degrees. Each waterer was connected on a separate circuit to a kilowatt hour meter. Energy consumption was monitored from early November to late March, the normal heating season for stock waterers in North Dakota. Ambient temperatures are reported in Figure 1.

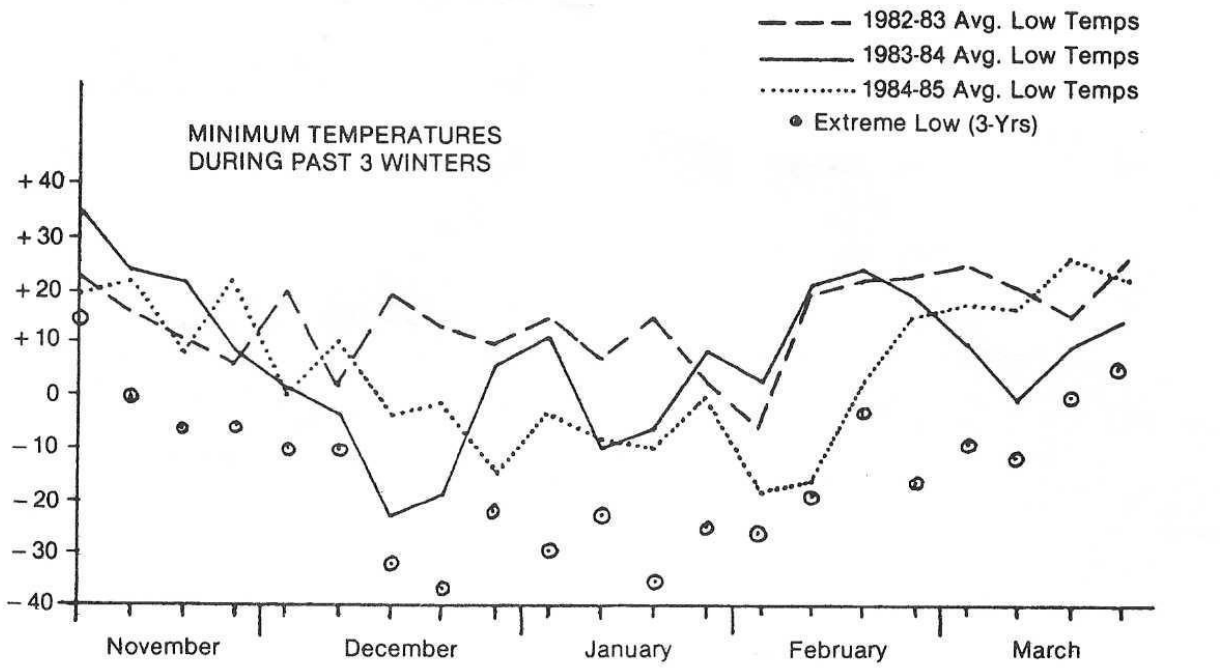

Figure 1.

RESULTS AND DISCUSSION

All waterers required some maintenance during the trial. A 36-watt electric heat tape was installed on treatments 1, 2 and 3 to avoid freezing of the feeder line from just below the ground surface up through the feeder valve assembly. Water dripping from animals' chins accumulated as ice around all waterers and had to be manually removed. Accumulated ice from spillage was noticeably more severe around the unheated type waterers.

Temperatures during the first winter were the second warmest on record and provided little challenge to the waterers. The second winter provided more of a test with several weeks of near record setting cold. The third winter was more typical with intermittent periods of mild weather and extreme cold. Extreme cold (ambient temperatures of -20°F or wind chills of -50°F and colder made occasional thawing of the standard fountains necessary. It was necessary to periodically remove the surface ice from the bowl of the Johnson Artificial Spring when wind chills approached -100°F and below. In every case, a pail of hot water was sufficient to thaw frozen areas and render the waterers serviceable.

Electrical usage is reported in table 2. Electricity was turned on for an average of 140 dys. Occasional checking of water temperatures in the standard fountains is recommended as the thermostats may drift. Average daily electrical cost for each of the waterers at $.08/KWH is given in table 2. Initial costs for each waterer are also given. Electricity costs for waterers in treatments 1, 2 and 3 were proportionally the same during each of the three years in the trial. Operating the Johnson Artificial Spring on a timer could substantially reduce the energy costs. Depending on the number of cattle serviced, the unit could run for an hour in the morning and an hour in the evening for 1/12 the cost of constant operation. A self-draining feature prevents freezing of the water in the bowl when the pump is not running. The Mirafount's manufacturer recommends a minimum of four head to keep the waterer operational. However, in periods of subzero cold and cold winds, the authors recommend no fewer than 10 to 15 animals drinking out of this unit. A few animals found it difficult to learn to depress the drinker float to the water in the Mirafount. Manufacturer redesign on later models has reduced this problem. Specific installation instructions and supplies are provided with all waterers and should be followed closely, especially with energy free waterers. Close observation is needed to see that all cattle drink.

Increasing the energy efficiency of currently installed waterers is possible. Extra insulation on the outside can save several dollars in electrical costs each year. Likewise, extra inside insulation and sealing of air leaks can reduce energy loss. Some producers have rotated the waterers 90 degrees to recommended fenceline installation and covered one side to reduce heat loss from air movement under the valve cover. Pride of the Farm offers a thermal blanket, a 1/4-inch thick sheet of closed cell foam cut to fit over the water surface to reduce heat loss from surface exposure. Cattle drink by pressing this thermal blanket down. Manually covering fountains with fitted covers or tarps during periods of extreme cold or at night is another energy saving technique.

Several new models of waterers have been introduced recently that are not represented in this trial. Energy saving is the main emphasis of these new designs. New materials and technology offer cattlemen more choices than ever for handling the winter watering chores. Initial cost, energy efficiency, parts availability, presently used waterers and number and kind of animals serviced will all effect what type or brand of waterer is best for each producer. No system is foolproof. All require some attention to insure proper function in the frigid northern plains winters.

This field trial will continue to evaluate new designs in livestock waterers for energy efficiency and reliability under the extreme winter conditions experienced in North Dakota.

Table 2. Livestock Water Fountain Electrical Usage 1982-1985.

	Standard Metal Fountains			Super Insulated Std. Fountain	Concrete Fountain	Recirculating Fountain	Energy Free
Brand	**Pride of the Farm**	**Pride of the Farm**	**Ritchie**	**Pride of the Farm**	**Bohlman**	**Johnson Artificial Spring**	**Mirafount**
Model	WE-4	WE-50	No. 5	WE-4	Model 75	----	2 Hole
Suggested Retail Price	281.75	300.00	304.99	281.75 + insul.	338.95	460.00	695.00
Avg. Electrical Use/Day (KWH)	9.99	9.32	8.70	7.65	6.31	5.40	0
Cost/Day @ $.08/KWH	.80	.75	.70	.61	.50	.43	0
Cost/Winter, Avg. 140 Days	111.89	104.38	97.44	95.40	70.67	60.48	0

SECTION III

PROGRESS REPORTS
OF
RANGE AND FORAGE RESEARCH
AT THE
DICKINSON BRANCH EXPERIMENT STATION

By

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SHORT DURATION GRAZING IN THE MIXED GRASS PRAIRIE OF SOUTHWESTERN NORTH DAKOTA

By
D. R. Kirby and T. J. Conlon

The mixed grass prairie comprising approximately 30% of the land area of the state is dominated by cool- and warm-season mid-grasses, short-grasses and sedges. The principle effects of previous unrestricted, heavy grazing in the mixed grass prairie is a marked decrease of tall and mid-grasses and an increased coverage of short-grasses and sedges, with a subsequent decrease in total forage yield. Considered to be below their potential for forage hence livestock production, North Dakota's rangelands warrant research into more efficient management systems such as short duration grazing.

Short duration grazing is a rotation system using multiple pastures and generally one herd. Stocking rate increases appear necessary and combined with a large number of smaller sized pastures results in a high stock density (animals/area). The grazing period of a pasture is short, usually seven days or less, to eliminate grazing of new plant regrowth. The rest period, generally 30 to 90 days, allows plants to recover from grazing and is short enough to allow animals to graze plant regrowth before it matures. Graze and rest period lengths should vary according to the growth rate of the vegetation.

A trial comparing short duration (SD) to repeated season long (SL) grazing was initiated June 25, 1981 on typical mixed grass prairie at the Dickinson Experiment Station. Section 16 of the Ranch Headquarters was divided into one 320 acre pasture grazed season long and eight 40 acre pastures grazed rapidly in rotation. Twenty and 35 cow/calf pairs were allocated to SL and SD treatments, respectively, in June 1981, 1982 and 1983. Since 1984 an additional five cow/calf pairs have been added to the SL treatment. Cattle were rotated every five days on the SD trial and pastures rested 35 days throughout the grazing season. Grazing seasons totalled 70, 112, 131, 131 and 126 days between 1981 and 1985. Average annual precipitation for the study area is 16 inches. Precipitation recorded for 1981 through 1985 was 8.5, 25, 15.5, 14, and 14 inches respectively. Forage production and disappearance was determined utilizing portable cages and the paired-plat technique. Fifty paired, caged and uncaged quadrats (18.6 inches) were clipped at the beginning of trials and approximately every 40 days thereafter until termination of trials. Caged plots were used to estimate growth and total annual production while comparison of paired, caged and uncaged quadrats allowed estimation of forage disappearance (use). Livestock were weighed on and off grazing trials and every 28 days thoughout the trials.

Annual production on grazing treatments has ranged from 678 to 1766 lbs/ac (table 1). Although forage availability has been consistently greater on the SL treatment, year-to-year variation in forage production within treatments has been much greater, exceeding 100%. Forage disappearance estimates between treatments have been very similar each year. Disappearance differences have not exceeded five percentage points any year of the study despite 40 to 75% more cow/calf pairs annually grazing the SD treatment.

Livestock performance is summarized in Table 1. From 1981 to 1983 cows grazing the SL treatment maintained more weight than those grazing the SD treatment. However, no differences in average cow gains were found the last two years of the study. Calf average daily gains exceeded two lbs/day on both treatments each year with the exception of 1984. Differences in calf daily gains between annual grazing treatments were insignificant. Calf production per acre was consistently higher on the SD treatment which is a reflection of the greater stocking rate on this treatment.

Summary:

Short duration (SD) and repeated season long (SL) grazing trials were initiated on the Dickinson Experiment Station in 1981. Forage production has generally been greater on the SL treatment when compared to the SD treatment, yet forage disappearance has been similar despite greater stocking rates on the SD treatment. Cows have maintained seasonal weight gains better on the SL treatment, while calf average daily gains have been similar between treatments. Increased calf gains/acre on the SD treatment is a reflection of greater stocking rates on this grazing treatment.

Table 1. Forage production and disappearance and livestock performance on short duration (SD) and season long (SL) grazing treatments, Dickinson Experiment Station

		Forage		Livestock			
				Cows		Calves	
Year	System	Production (lbs/ac)	Disappearance %	ADG (lbs)	Ag/ac (lbs)	ADG (lbs)	AG/ac (lbs)
1981	SD	678	55	0.4	3	2.2	16
	SL	679	51	0.7	3	2.3	10
1982	SD	1645	41	0.3	4	2.1	25
	SL	1766	36	0.5	4	2.1	15
1983	SD	1057	46	0.3	5	2.1	30
	SL	1720	43	0.5	5	2.2	18
1984	SD	919	60	0.0	0	1.9	26
	SL	1371	60	0.0	0	1.9	19
1985	SD	702	61	0.1	2	2.1	28
	SL	865	61	0.1	1	2.2	21

ALFALFA VARIETY PERFORMANCE TRIAL

L. Manske and T. J. Conlon

Alfalfa variety testing has been conducted at the Dickinson Experiment Station to assist western North Dakota producers in making discriminate selections of varieties to plant. Twenty varieties were seeded in May 1979 in a randomized block design with four replications. The data for four additional varieties seeded in a second set of plots in May 1981 are included in this report. Seventeen of the varieties are hay type with tap roots and seven are pasture type with branched or creeping roots (table 1). This trial was designed to evaluate the performance of these varieties on the basis of oven dry weight herbage production compared to a standard variety under a one cut system taken in late June or early July. Vernal was used as the standard because of its long, high production record across northern United States.

The annual above ground dry weight herbage production for each variety is shown in table 2. Most of the varieties in this trial were very similar in performance. All but Agate had five year mean herbage production above 3000 pounds per acre. There was very little actual significant difference between the performance of any of the varieties. One variety (Kane in 1982) has been the only variety with an annual herbage production of significant difference from the standard variety. All but three varieties (Anik, Thor and 532) have Vernal, Ladak and/or Rambler as sources of parental germplasm. This may be a major reason for similar production performance.

The comparison of each variety to the standard variety is shown as a percentage of herbage production in table 3. Four varieties had mean production equal to the standard. Fifteen varieties had mean production greater than the standard variety. All of the pasture type varieties had greater herbage production than Vernal under a one cut system. The pasture type varieties generally have slower regrowth after cutting than the hay type varieties and may not be satisfactory for a two cut system.

Vernal and Ladak have good, long performance records in western North Dakota for hay production and are dependable varieties to seed. Selection of any other variety should be based on tested performance of greater herbage production than Vernal or Ladak.

Table 1. Alfalfa variety, developing agency and year available for varieties included in this report.

Variety	Developing Agency	Year Available
Agate	USDA and Minnesota AES	1972
Anik*	Agriculture Canada	1975
Baker	Nebraska AES and USDA	1976
Drylander*	Agriculture Canada	1971
Iroquois	Cornell University	1966
Kane*	Agriculture Canada	1971
Ladak	Introduced from India	1910
Ladak 65	Montana AES	1964
Norseman	Brazen of Minneapolis	1964
Nugget	North American Plant Breeders	1974
Polar I	Northrup, King and Co.	1974
Polar II	Northrup, King and Co.	1980
Prowler*	Northrup, King and Co.	1980
Ramsey	Minnesota AES and USDA	1972
Rangelander*	Agriculture Canada	1978
Ranger	USDA and Nebraska AES	1942
Spredor II*	Northrup, King and Co.	1980
Thor	Northrup, King and Co.	1970
Travois*	South Dakota AES	1963
Trek	Agriculture Canada	1975
Vernal	Wisconsin AES and USDA	1953
520	Arnold-Thomas Seed Service	1968
524	Pioneer Hi-Bred Intl. Inc.	1977
532	Pioneer Hi-Bred Intl. Inc.	1979

*Pasture type

Table 2. Herbage production in pounds per acre.

	Years						1981-1985
Variety	**1980**	**1981**	**1982**	**1983**	**1984**	**1985**	**Mean**
Agate	329	1401	3832	3912	3705	1578	2886
Anik*	171	1978	4563	4459	3892	1606	3300
Baker	233	1662	4011	5865	3966	1779	3457
Drylander*			4604	5528	4267		4800
Iroquois	401	1422	4794	3744	4489	1803	3250
Kane*	402	1655	6139	6135	4428	1929	4057
Ladak	320	1351	4796	4414	4546	1740	3369
Ladak 65	337	1407	4785	5433	4884	1958	3693
Norseman	445	1556	5210	4495	4899	1628	3558
Nugget	374	1391	4558	4338	4549	1360	3239
Polar I	244	1519	4695	5277	4607	1606	3541
Polar II			4016	4036	3493		3848
Prowler*			5244	5212	3178		4545
Ramsey	307	1195	4804	5187	4094	1768	3410
Rangelander*	400	1642	4981	5010	4755	1585	3595
Ranger	403	1239	4455	5243	4540	1666	3429
Spredor II*	369	1289	5260	4575	4289	1728	3428
Thor	284	1554	4158	4662	4554	1916	3369
Travois*	372	1277	5077	4659	4097	1788	3380
Trek	335	1362	4282	5124	3561	1904	3247
520	180	1485	4274	6342	4086	2059	3649
524	339	1518	4121	5896	3820	1684	3408
532			3832	4165	3095		3697
Vernal	372	1572	4425	4838	4353	1512	3340

*Pasture type

Table 3. Percentage of herbage production compared to Vernal.

	Years						1981-1985
Variety	**1980**	**1981**	**1982**	**1983**	**1984**	**1985**	**Mean**
Agate	88	89	86	81	85	104	89
Nugget	101	88	103	90	105	90	95
532			102	101	86		96
Iroquois	108	90	108	77	103	119	99
Polar II			107	98	97		100
Ramsey	83	76	108	107	94	117	100
Ranger	108	79	101	108	104	110	100
Trek	90	87	97	106	82	130	100
Vernal	100	100	100	100	100	100	100
Ladak	86	86	108	91	104	115	101
Travois*	100	81	115	96	94	118	101
Spredor II*	99	82	119	95	99	114	102
524	91	97	93	122	88	111	102
Anik*	46	126	103	92	89	106	103
Thor	76	99	94	96	105	127	104
Baker	63	106	91	121	91	118	105
Polar I	66	97	106	109	106	106	105
Norseman	120	99	118	93	113	108	106
Rangelander*	108	104	112	104	109	105	107
Ladak 65	91	90	108	112	112	130	110
520	48	94	96	131	94	136	110
Prowler*			139	126	88		118
Kane*	108	105	139	126	102	121	119
Drylander*			122	134	118		125

*Pasture type

SECTION IV

SPECIAL REPORT
"FACTORS INFLUENCING PROFITABILITY IN THE BEEF CATTLE INDUSTRY"

By

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FACTORS INFLUENCING PROFITABILITY IN THE BEEF CATTLE INDUSTRY

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Dealing with tough cattle markets, dry weather, declining land prices and consumer resistance have unfortunately become a way of life for the American beef cattle producer. Coping with these things has started to create some very drastic changes in the structure of the beef cattle industry.

The dramatic decline in cattle numbers has resulted in a declining population of producers in many areas. All of this has lead many cow-calf producers to ask an extremely pointed and concerning question, "Will the beef cattle industry survive and can I survive within it?".

In spite of the turbulent times that our industry has been through, I don't think there is any question that there will be a beef cattle industry in the United States and I don't think there is any question that there will be profit potential within the beef cattle industry.

Then how does a producer position himself to take advantage of the profit potential that is going to exist. There are certain things a producer assumes will happen that really are uncontrolable such as:

1. Adverse Environmental Conditions

Seldom does a year go by in the United States when parts of the country and the cattle industry are not dramatically affected by harsh environmental conditions. In 1986, it was a spring and summer drought in the Southeast. In 1985, dry weather was prevalent in Montana and the Dakotas.

Harsh winter weather or cold adverse spring weather invariably has an impact on cattle producers. Yet producers accept weather problems as a part of managing cattle and work their way through these environmental hazards.

2. Violent Fluctuations in the Cattle Market

As we look at price fluctuations in the cattle market, we see dramatic changes literally from week to week that become extremely frustrating to the cow-calf producer. Yet, it is hard to anticipate with our agricultural markets being influenced by not only factors within the United States, but factors internationally that volatile price fluctuations are not a part of agriculture that will continue. They are never easy to explain or easy to accept, however, a producer has to attempt to utilize every type of risk management to protect against these volatile fluctuations.

It is also interesting to study other trends occurring in the cattle industry.

1. **The type of beef demanded by the consuming public is changing.**

   The American consumer has become more quality conscious, cost conscious, health conscious and desires a quick to prepare food that is going to fit into the fast paced American life style. In the past the beef cattle industry has produced what we considered to be a quality product and assumed the consuming public would eat it as we currently produced it. As we look to the future, that assumption may be dangerous.

   On the positive side of consumption, much has been written about declining consumer demand for beef. Yet, it is important to keep in mind that the consuming public has a strong desire to eat beef. Some statistics, clearly point out that the American people love to eat beef. We eat three times more beef today than in 1950 and it is interesting to note that we also live 25 years longer, so beef can't be all bad.

2. **We are in an era of specification beef production.**

   Because of the changing consumer demands, the way beef is currently being marketed is changing. Programs focusing on brand name beef marketing are abound everywhere in the United States. Unfortunately, many of these programs like many new business endeavors are not going to survive, but some will. It is hard at this stage to get a specific handle on what type of cattle will fit most of these brand name beef programs. But, the general trend seems to be:

   A. Live weights of 1150 to 1175 pounds for steers and 1025 to 1050 pounds for heifers.

   B. Carcasses that are predominately yield grade 2.

   C. Carcasses that are predominately choice quality grade.

   D. Beef that is lean, but very uniform in quality.

3. **The structure of the American cattle industry seems to be changing.**

   In the late 50's and early 60's, the commercial cattle feeding industry developed to where 75 to 85% of all fat cattle today are finished in commercial feedlots. This lead to literally the demise of the cattle feeding industry in the mid-West and a shifting of the industry to the High Plains. It is interesting to note, however, that on a smaller scale, we may see some shift back into Nebraska, South Dakota, and Iowa as custom feeding develops in smaller scale operations in that area. It is my own personal feeling that these will not be predominately finishing yards, but become custom growing yards. The other structural change occurring in the cattle industry is development of larger cow-calf operations.

Up to now we have speculated on what the structure of the cattle industry will be like. But, how does a producer position himself to enhance profitability in his operation? First you must evaluate the factors influencing profitability. There really are four factors which are:

A. Percent of Cows Weaning Calves
B. Weaning Weight of those Calves
C. The Price The Calves Sell For
D. The Annual Cost of Maintaining the Cow

To insure profitability, a producer has got to have a handle on his annual production costs, and then determine the level of productivity and the price needed to show the profit considered acceptable. Let's evaluate each of these factors more closely and start by looking at the interrelationship of these four factors.

As can be noted in the following table, as weaning weight goes up and a higher percent of the cows wean calves, the average pounds of calf produced per cow increases. Table 2 puts all of the factors together and by knowing the annual cow costs, level of productivity and selling price needed to show a profit can be determined.

TABLE 1. LBS OF CALF WEANED PER COW IN THE HERD

	% Weaning Calves			
Weaning Weight	**100%**	**90%**	**80%**	**70%**
400	400	360	320	280
450	450	405	360	315
500	500	450	400	350
550	550	495	440	385

TABLE 2. INFLUENCE OF WEANING WEIGHT, PERCENT CALF CROP AND SALE PRICE ON DOLLARS PRODUCED/COW

Weaning Weight of Calves	**% Cows Weaning Calves**	**Sale Price/LB**	
		$1.00/lb	**.70/lb**
400	90	$360	$252
	70	$280	$196
450	90	$405	$283.50
	70	$315	$220.50
500	90	$450	$315
	70	$350	$245
Annual Cow Costs = ?			

MANAGEMENT PRACTICES WHICH INCREASE PERCENT CALF CROP

A. Crossbreeding

One of the easiest ways to increase the calf crop is to crossbreed taking full advantage of heterosis. Heterosis is one of the few free things available in agriculture. Crossbred cows are more fertile producing calves that are more vigorous at birth than straight breds. Yet, too many cattlemen because of resistance to change or prejudice, do not take full advantage of crossbreeding in their operation.

A common question asked by producers is what is the most economically efficient size of cow and what breeds should be used? Unfortunately, there is not a simple answer. The ideal cow size in most operations will probably be 1050 to 1150 pound cow. However, some producers make cows work in their operation on either side of this guideline. The most important factor is that a producer has cows that will reproduce under their nutritional, management and environmental conditions. The breed combination used will probably be dictated by his personal preference, level of productivity desired and reproductive efficiency desired in the production system followed.

B. Placing Emphasis on Reproductive Efficiency

In order to achieve a high percentage of the cows weaning calves, emphasis on reproduction efficiency is a must. Reproductive efficiency means weaning a calf every year, calving early in the calving season and calving unassisted. To achieve that it is going to take a good nutrition program, particularly during the later part of pregnancy and during the early post-partum period.

One of the reasons weaning percentage are often reduced is problems with first calf heifers. This is often associated with a high percentage of the heifers having calving problems. Today the producer has the opportunity to use genetic information (E.P.D.'s for birth weight) that will help in identifying those sires causing too large birthweights. Some of the genetic information available (breeding values for heifer calving ease) in certain breeds, can predict the degree of calving difficulty in first calf heifers.

C. Utilizing a Sound Health Program

It goes without saying that to achieve a high percentage of the cows weaning a calf, a sound vaccination program must be followed with the cows, replacement heifers and the calves at weaning time. Not only that, but placing emphasis on a health program that will minimize scours at calving time can be extremely important. The North Dakota program that has focused on this, I am sure, has been of considerable help to many producers.

MANAGEMENT PRACTICES THAT INCREASE WEANING WEIGHT

A. Use of Genetic Information in Sire Selection

One of the exciting developments in the cattle industry is the genetic information now available on bulls. Through elaborate use of the computing capabilities now available, most of the breed associations provide purebred producers with this information on all bulls registered. Any commercial cow-calf producer who buys sires without using genetic information like expected progeny differences is really not taking advantage of one of the best genetic tools available. Use of this genetic information is one of the fastest ways to not only improve the growth rate of calves, but also achieve the type of replacement heifers desired through consideration of maternal values.

B. Crossbreeding

Again like in percent calf crop, crossbreeding is one of the fastest ways of improving the weaning weight of calves. Breed choice here is one of the most important decisions, yet having a high producing female in the herd is also going to impact weaning weights.

C. Maintaining a Short Calving Interval and Emphasizing Calves Being Born Early in the Calving Season

As shown in the following table, the time the calf is born relative to the start of calving season, has a major impact on the weaning weight.

TABLE 3. EFFECT OF CALVING TIME ON POUNDS OF CALF WEANED

Calving Time (Days Into Calving Season)	Average Weaning Weight (lbs)	Pounds Lost Per Calf
1st 20 Days	460	
2nd 20 Days	445	15
3rd 20 Days	393	52

Kansas State University data survey

Work in South Dakota has shown that calves born in February and early March will have the highest growth rate from the time of birth until weaning in the fall. For every area of the country there is an ideal time to get that calf on the ground and you want as high a percentage of those cows calving in as short a period as possible.

D. Utilizing Proven Management Practices Like Implanting

Unfortunately, in recent months considerable concern has been expressed about implants because of improper implant location and the trend by some beef marketing groups promoting natural beef, in which implants and other feed additives are not utilized. Yet, implants have clearly been shown to be safe, practical, economical products that can greatly help the cow-calf producer improve weaning weights. Developing a sound implant program is one key way of economically improving weaning weights and maintaining a high level of production efficiency.

MANAGEMENT PRACTICES THAT INCREASE THE VALUE PER POUND OF CALF OR THE GROSS RETURN FOR CALVES

A. Optimizing the Price of Calves

In every area of the country, certain calves bring a premium. Usually, these are crossbred calves with growth potential. However, in the future, they may also be calves that are going to fit the specification era of beef production we are in. Certain breeds will become considerably more popular and a cow-calf producer needs to keep a close eye on these trends.

There are also other factors that greatly influence the sale value of calves. Things such as horns, castration, calves being pre-conditioned, amount of fill, condition on the calves, etc. are management practices that a cow-calf producer can control that may well affect the value of his calves. Anything a producer can do to establish the image of his calves being reputation cattle capable of doing well in a growing or feedlot program will enhance the sale value of calves.

B. Taking Advantage of Short Term or Even Long Term Retained Ownership

One of the real trends in the cow-calf industry has been increased use of retained ownership from birth to slaughter. Admittedly, under North Dakota conditions, this is not as easily done because of the limited feedlot industry in your area. Yet, in many cattle operations, use of home-grown forages and grain allows short-term feeding (as short as two to three months) in which an extra 60, 80 or 100 pounds of gain are put on the calves prior to selling. With the current costs of gain in a growing program, this can often make the difference between profit or loss in a commercial cow-calf program.

Some northern cow-calf producers are placing calves in commercial feedlots and retaining ownership of the calves all the way to slaughter. One of the ideal ways of taking full advantage of the genetic potential of your cattle and the genetic potential of the cows in your cow herd is to retain ownership all the way. The following table illustrates the cost of gain one Kansas producer with genetically superior cattle is achieving compared to the run of the mill cattle being fed in the industry. It is interesting to note that his average costs of gain is consistently in the range of $5-$10/cwt lower which increases the profitability of a set of calves by $25 to $50.

TABLE 4. FEEDLOT DATA FROM PROGENT TEST STEERS (1981-83)

	No. Steers		Average Daily Gain		Cost of Gain	
Year	**Perf.***	**Typical****	**Perf.**	**Typical**	**Perf.**	**Typical**
1984	63	14,396	3.6 LBS	3.18 LBS	$47.00	$57.11
1983	70	13,700	3.28 LBS	3.10 LBS	$51.12	$58.34
1982	56	12,331	3.21 LBS	3.21 LBS	$43.74	$48.96
1981	75	11,347	3.24 LBS	3.11 LBS	$43.75	$52.26

* Perf. = Steers from performance tested herd

** Typical = Average steers in Kansas feedlots slaughtered at the same time

MANAGEMENT PRACTICES WHICH POSSIBLY REDUCE COW MAINTENANCE COSTS

A. Know Your Cost of Production

Unfortunately, in the cattle industry, less than 5-10% of commercial cow-calf producers truly have a handle on the annual cow cost. It is absolutely impossible to put together a profitable cow-calf program without knowing the costs of production. No industry can survive and no producer can survive without having a handle on production costs. The cow-calf industry is no different. Those producers who want to position themselves in a place of profitability in the industry have absolutely got to get a handle on production costs. Some excellent computer programs are now available to achieve this and simple worksheets are also available to achieve the same thing.

Recent work summarized by Ag Economists at North Dakota State University is extremely interesting. The North Dakota Farm record summary clearly illustrates that there are dramatic differences in annual feed costs ($224 vs $156). One of the things we have seen in the cattle industry the past year with declining land value, declining interest rates and declining feed costs, has been a reduction in the annual cow costs. This is greatly helping some producers put their cow-calf herd in a considerably more profitable situation than has been the case in past years.

B. Incorporate Those Management Practices That Allow You To Keep Your Production Costs to a Minimum

There are many ways a cow-calf producer can keep his annual production costs to a minimum. Things such as:

A. Formulating Your Own Protein and Mineral Supplements or Utilizing Home Grown Forages

Often times one of the cheapest sources of protein is simply feeding alfalfa hay or even high quality grass hay. Another is to take a little time, push a pencil and see if

the protein and energy requirements of the cow herd are being met through the use of home raised forages.

Many times when protein supplements are being purchased doing your own formulating can greatly reduce the cost. The same holds true in putting together simple mineral mixes.

B. Take Full Advantage of Range Management and Forage Management Practices That Enhance the Carrying Capacity of the Operation

Often one of the most over-looked aspects of a cow-calf program is effective utilization of high quality forages as a source of winter feed or even considering their summer grazing potential in a complimentary forage program. Any range management program that enhances the carrying capacity or the quality of grass available for the cows may be economically advantageous to a producer.

SUMMARY

Survival in the cow-calf industry has been tough. It appears their are three types of producers. A certain percentage of producers have already been operating in a profitable situation for the last two to three years and any improvement in cattle prices will really improve the profit potential of this group.

The second group of producers are those operating on a fine margin. Any upward swing in calf prices or reduced cost of production can move this producer to a profitable position.

The third group are the ones really in trouble. Because of production practices being used or poor financial position, they are in an unprofitable situation and in many cases it may be really tough to turn the operation into a profitable one.

Yet, it is important to keep in mind that the industry is changing. The industry will have profit potential but for some producers that will require some drastic changes.