35th
LIVESTOCK RESEARCH
ROUNDUP

DICKINSON EXPERIMENT STATION
Dickinson, North Dakota
OCTOBER 9, 1985

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of

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Weaning Management Study

by

D. G. Landblom and J. L. Nelson

Stress, trauma, weight loss, and an undesirable amount of sickness characterize the events experienced by a calf that has just been weaned. These events are stimulated by a multitude of changes that a freshly weaned calf must adjust to, the first and most traumatic being the calf's loss of association and protection provided by its mother. In addition, when the calf is weaned directly into a drylot, it must also adjust to changes in its environment, feed type and physical form, and in many cases dusty lots and water type.

The purpose of this investigation is to evaluate three different methods of weaning to determine whether weaning stress can be miminized while maintaining or increasing weight gains. A second objective is to identify the cost/benefit ratio when additional feed is used to minimize stress; and, third, to evaluate the long term effects of weaning type on backgrounding performance.

The following methods are being used in this comparison of weaning management systems:

1. Conventional drylot weaning (control).
2. Short term pre-wean creep feeding followed by drylot weaning with creep feed.
3. Short term pre-wean creep feeding followed by weaning on native range pasture with creep feed for 2 weeks before being moved to drylot with creep feed.

Group 1 cows and calves served as the control group and grazed native range during the thirty day period just before weaning. No grain supplement was given to this group. When weaned, the calves were transported by trailer to drylot pens where they were started on a complete mixed ration containing 25% dry rolled oats, 74% ground mixed hay, .5% TM salt, .5% dicalcium phosphate and 5,000 IU Vitamin A per pound of feed. Ingredient changes were made weekly in 10% increment increases until the calves were on a 45% dry rolled oats ration containing 54% mixed hay, .5% TM salt, .5% dicalcium phosphate and 5,000 IU Vitamin A per pound of feed. The thirty day period after weaning was monitored closely and fluctuations in weight gain recorded. Following the thirty day monitoring period the calves were carried on feed for an additional thirty-eight days to measure the effects of weaning stress on backgrounding performance.

Group 2 cows and calves grazed similar native range pastures, but calves had access to a self-fed creep ration thirty days before weaning that consisted of 62% dry rolled oats, 33% dry rolled barley, 5% molasses, 5,000 IU of Vitamin A and 500 IU of Vitamin D per pound of feed. Upon weaning, calves in group 2 were transported to drylot pens adjacent to the control group calves. The self-fed creep ration just described for use on pasture was continued as a self-fed creep ration in drylot. Good quality ground mixed hay was offered to the calves in bunkline feeders. Calves in this group were also weighed at selected intervals during the thirty day period after weaning. Upon completion of the thirty day monitoring period, calves in group 2 were switched to the same 45% dry rolled oats ration described for calves in group 1 and fed for an additional thirty-eight days to measure the effects of weaning stress on backgrounding.

Group 3 cows and calves were handled in exactly the same way as in group 2 during the creep-feeding phase thirty days before weaning. At weaning, however, the calves stayed on native range pastures that had been set aside especially for weaning and the cows were removed. While continuing on pasture the calves had access to the self-fed creep ration. The calves were kept on pasture an additional two weeks and were then moved to drylot with self-fed creep feed where they were handled in exactly the same manner, for the remainder of the study, as those calves in group 2.

Data have been collected for three consecutive years to measure yearly variations. Creep-feeding was begun the last week of September each year and the calves were consistently weaned on October 31st. The thirty day post weaning monitoring period started at weaning and ended on November 30th. During this period calves in all treatments were weighed one week after weaning, three weeks after weaning and at the end of the thirty day period. In order to measure the effects of weaning stress over a longer period the calves were continued on feed for an average thirty-eight day feeding period which ended the first week of January each year.

To develop the most immunity possible to Clostridium organisms that cause blackleg, malignant edema, hemorrahagic septisemia and overeating disease, the calves were vaccinated at the beginning of the trial in late September and again when weaned.

Composition of all rations fed and the sequence in which they were used is shown in Table 2.

Fluctuations in average daily gains which were monitored by weighing at selected intervals during the post weaning thirty day period are shown in Table 1.

Three year weight and gain data are shown in Table 3, and the three year summary of feed and economics of weaning is shown in Table 4.

Summary

Weaning methods in this investigation compared calves that have been conventionally weaned with those that were creep-fed one month before weaning and then either weaned directly into drylot with creep feed or weaned on pasture into set aside native range pastures with creep feed.

Complications, such as over eating on creep feed and keeping the calves in the pasture after weaning were important concerns. Four and five wire fences were strengthened with additional "stays". Cows were hauled far enough away from their calves so they could not hear each other bawling. Although some death loss from bloat and respiratory illness was encountered, the illness or dealth loss could not be attributed to any particular treatment. None of the calves weaned on pasture developed bloat or respiratory illness until after they were confined to drylot.

Short term creep feeding beginning thirty days before weaning is one of the major elements in this investigation, the other being the type of weaning method used. Substantial variation in total weight gained per calf was measured between years during the creep feeding period before weaning. Control calves that were not creep fed outgained the creep fed groups by 10.8 pounds during the first year. During the second and third years, creep fed calves outgained the control group by 6.7 and 14 pounds per head respectively. Three year combined weight and gain data show no large differences in total pounds gained between groups.

Calves were weighed at selected intervals after weaning to measure the effects that pre-weaning supplementation in the form of creep feeding and method of weaning would have on reducing stress and subsequent weight gain after weaning. This segment was characterized by a wide variation in weight gain or loss, as the calves adjusted to being weaned. Greatest yearly variation was measured one week after weaning in the conventionally weaned group and ranged from a 2.06 pound per day loss the first year to a gain of 5.12 pounds the last year. Calves creep fed on pasture and weaned directly into drylot or on pasture experienced weight gain fluctuations but they were not as dramatic as the conventionally weaned calves, resulting in earlier stabilization of their growth profile. It is apparent that most of the fluctuations measured during the thirty day period after weaning were due to variations in rumen fill and that most of the month after weaning was needed for the calves to become fully stabilized.

Type of pre-weaning and post-weaning treatment did have an effect on performance. Best overall performance was shown among calves creep fed on pasture and weaned directly into drylot with creep feed. By continuing to use creep feed in drylot, calves were weaned on a high energy ration consisting of 71% grain (2/3 oats and 1/2 barley) and 29% chopped mixed hay. Pre-conditioning with creep feed on pasture facilitated a less stressful weaning which resulted in faster gains that were more economical. Calves in this group were approximately twenty pounds heavier, gaining a total of 151 pounds at a cost of $31.15 per hundredweight gain. Conventionally weaned group gained 132 pounds at a cost of $31.15 per hundredweight and the group creep fed and weaned on pasture gained 128 pounds at a cost of $33.08 per hundredweight.

Table 1. Daily gain changes among calves weighed at selected intervals during the month following weaning.

	Selected Intervals			Average
1982 weaning	**Nov. 3**	**Nov. 16**	**Nov.26**	**30 day post weaning gain**
Days between each weighing	7	13	10	30
Treatment I:				
Conventional weaning (Control)	-2.06	3.36	.01	1.11
Treatment II:				
Pasture Creep-drylot wean with creep	-.15	2.75	-.01	1.15
Treatment III:				
Pasture creep/pasture wean with creep/drylot with creep	1 /	.77	1.61	.97

	Selected Intervals			Average
1983 weaning	**Nov. 7**	**Nov. 17**	**Nov. 28**	**30 day post weaning gain**
Days between each weighing	10	10	11	31
Treatment I:				
Conventional weaning (Control)	4.00	.38	2.11	2.16
Treatment II:				
Pasture creep-drylot wean with creep	2.45	.55	3.18	2.10
Treatment III:				
Pasture creep/pasture wean with creep/drylot with creep	2.15	.20 2 /	1.11	1.16

Table 1 (Continued):

1 / Weaned on pasture one week after groups II and III and moved to drylot November 16th.
2 / Moved from native pasture into drylot on November 17th.

	Selected Intervals			Average
1984 weaning	**Nov. 7**	**Nov. 21**	**Nov. 30**	**30 day post weaning gain**
Days between each weighing	7	14	9	30
Treatment I:				
Conventional weaning (Control)	5.12	1.97	.80	2.35
Treatment II:				
Pasture creep/drylot wean with creep	4.04	1.66	1.89	2.36
Treatment III:				
Pasture creep/pasture wean drylot with creep	2.87	1.98 1 /	.98	1.85

1 / Moved from native pasture into drylot on November 14th.

Table 2. Creep feed and complete mixed ration composition and ration changes used.

<u>Calves in creep fed treatments:</u>

Dry rolled creep feed mixture

Oats	62%
Barley	33%
Molasses	5%
Vitamin A, IU/lb.	5,000
Vitamin D, IU/lb.	500

Creep ration shown was self-fed in creep feeders on pasture and in drylot after weaning. After weaning chopped mixed hay was fed free choice in in the bunkline in addition to the self-fed creep feed.

<u>Conventionally Weaned Calves</u>

	Weaning Ration	**1st Change**	**2nd Change**
Chopped mixed hay, %	74	64	54
Dry rolled oats, %	25	35	45
TM Salt, %	.5	.5	.5
Dical, %	.5	.5	.5
Vitamin A, IU/lb.	5,000	5,000	5,000

Ration changes were made weekly

<u>Growing ration fed to all calves during short backgrounding phase</u>

Chopped mixed hay, %		54	
Dry rolled oats, %		45	
TM Salt, %		.5	
Dical, %		.5	
Vitamin A, IU/lb		5,000	

Table 3. Three year combined weight and gain data among calves comparing weaning management methods.

	Control	Pasture creep drylot wean	Pasture creep pasture wean
30 day pre-weaning period:			
No. head	60 1 /	61 2 /	62
Days fed	30	30	30
Initial weight, lbs.	409.9	410.2	411.1
Weaning weight, lbs.	443.3	444.4	447.5
30 day gain, lbs.	33.4	34.2	36.3
30 day ADG, lbs.	1.11	1.14	1.21
30 day period after weaning			
No. head	60	61	61 3 /
Days fed	30.3	30.3	30.3
Weaning weight, lbs.	443.3	444.4	446.3
30 day post weaning wt., lbs.	496.7	499.7	481.9
30 day post weaning gain, lbs.	53.4	55.3	35.6
30 day post weaning ADG, lbs.	1.76	1.82	1.18
38 day backgrounding period:			
No. head	60	61	59 4 /
Days fed	38.3	38.3	38.3
Initial weight, lbs.	496.7	499.7	484.6
38 day final weight, lbs.	542.2	560.9	540.8
38 day gain, lbs.	45.5	61.2	56.2
38 day ADG, lbs.	1.19	1.60	1.47
Gain – all phases:			
Days fed	98.6	98.6	98.6
Initial weight, lbs.	409.9	410.2	411.1
Final weight, lbs.	542.2	560.9	540.8
Gain, lbs.	132.3	150.7	129.7

1/ One heifer died of pneumonia; one steer died of bloat.

2/ One heifer died of pneumonia

3/ One steer strayed away from lot

4/ One steer chronic bloater-removed; one heifer died of pneumonia

Table 4. Three year summary of feed and economics comparing weaning management methods.

	Control drylot wean	Pasture creep drylot wean	Pasture creep pasture wean
<u>30 day pre-weaning period</u>			
No. head	60 1/	61 2/	62
Creep feed before weaning, lbs.	--	4862	5209
Creep feed/head, lbs.	--	79.7	84.0
Total creep cost, $	--	243.73	259.20
Creep cost/head, $	--	4.00	4.18
<u>Creep feed on pasture after weaning</u>			
No. head	--	--	61 3/
Creep feed consumed, lbs.	--	--	5454
Creep feed/head, lbs.	--	--	89.4
Total creep cost on pasture, $	--	--	273.73
Creep cost/head on pasture, $	--	--	4.42
Pasture charge/calf, $	--	--	3.20
<u>Drylot Phase</u>			
No. head	60	61	59 4/
Mixed hay, lbs.	--	7198	2934
Mixed hay cost/head, $	--	3.76	1.54
Creep feed, lbs.	--	17613	6808
Creep feed cost/head, $	--	13.95	5.52
Complete mixed ration, lbs.	62,577	37,091	33,813
Complete mixed ration cost/head, $	42.22	25.24	23.52
Total cost/head all phases, $	42.22	46.95	42.38
Gain/head, lbs.	132.2	150.7	128.1
Cost/cwt. gain, $	31.94	31.15	33.08

1/ One heifer died of pneumonia; one steer died of bloat.
2/ One heifer died of pneumonia.
3/ One steer strayed away from pasture lot.
4/ One chronic bloater removed; one heifer died of pneumonia.

System for Feeding Early Weaned Beef Calves

by

D. G. Landblom, J. L. Nelson and W. D. Slanger

Early weaning of dairy calves is a common practice, but early weaning of beef calves in the cattle producing areas of the United States is very uncommon, particularly in southwestern North Dakota where cows and their calves normally graze large tracts of improved native grass pastures from May until November. Although generally uncommon, there are circumstances where early weaning of beef calves has been shown to be beneficial. Such circumstances include fall calving, drylot cow/calf production and drought.

When considering early weaning, a producer must decide how calves are to be handled and what they will be fed. Under drought conditions early weaning generally becomes an emergency measure rather than customary practice. Drought conditions have prevailed in several southwestern and western North Dakota counties during the past four out of five grazing seasons. Drought of the magnitude experienced has caused producers to make liquidation decisions. Many have had to liquidate both cows and calves because pasture regrowth hasn't occurred and feed supplies were short or non existant. Others with some remaining feed supplies decided to keep their calves and sell only cows.

Before early weaning calves for drylot feeding producers have asked, "Is there any profitability in feeding the early weaned calf, how and what should they be fed and what special handling is necessary?"

A survey of the literature shows that most early weaned calf research has been done with dairy calves (Hallman, 1971) and that a limited amount of work has been done with beef calves pointing out the effects that early weaning has on the interval from calving to first estrus. Bellows et al., (1974) reported that weaning calves early at 3 to 10 days of age resulted in a shortening of the interval from calving to first estrus and that early weaned calf gains were normal and digestive problems minimal. Methods for handling early weaned calves were evaluated by comparing the performance of calves held in drylot with those housed on pastures with creep feed (Lusky et al., 1981). At seven months of age, early weaned calves weighed the same as calves weaned normally. Moving early weaned calves to pastures with creep feed reduced labor but gains were reduced by 20 kilograms (44 lbs.). McKee et al., (1977) compared performance of early weaned calves with nursing calves that did and did not have access to creep feed. Total gain was highest for the early weaned calves and lowest for the nursing calves that were not creep fed. It was determined from the limited amount of work conducted with beef calves and the differences in feeds used by these investigators when compared to those that are common to southwestern North Dakota, that a comparison of feeding systems for early weaned beef calves would be beneficial to drought stricken cattlemen. The purpose of this investigation is to compare calf rations that are suitable for an early weaned calf program that have been either commercially prepared or formulated from home grown ingredients.

Based on information gleaned from the literature and recommendations from Dr. Chung Park of the North Dakota State University dairy science department, it was determined that to be successful, adherence to the following would be necessary:

1. Calves should be at least 35 days of age if supplemental milk wasn't going to be used.

2. Calves should be supplied a highly palatable ration that is high in protein, available energy, vitamins and minerals.
3. Starter rations should be available to the calves during a 2-3 week adjustment period before calves are actually weaned.
4. Calf-hood vaccinations for blackleg, malignant edema, hemoglobulinurea, pasturellosis, enterotoxemia and Vitamins A and D should be administered at the beginning of the adjustment period.
5. Calves should be checked regularly for respiratory problems and flies must be controlled.

Procedure:

To answer the questions most often asked by producers planning to early wean calves under ranch conditions, 82 calves comprised of Hereford, Angus X Hereford and Longhorn X Hereford breeding from young or poorer producing cows were randomized by age, sex, breed, size and age of dams into four feeding treatments as follows:

1. Completely commercial pelleted starter and calf growing program.
2. Commercial pelleted starter and calf growing program during the critical first one-third of the growing phase followed by a home grown oat based preparation.
3. Home grown rations formulated around an oat base
4. Home grown ration formulated around a barley base.

The calves ranged in age from 38-89 days during the first year and from 64-105 day of age the second year.

At the start of the study, all calves were weighed and vaccinated with Electroid-7 and allowed to remain with their mothers in drylot for three weeks while they developed immunity and became accustomed to starter rations. The commercial and home grown starter rations were fed in low trough feeders inside a creep area that restricted the cows during adjustment. At weaning, the calves were started on complete mixed self-fed rations that were either commercially prepared or blended from home grown feeds. High quality crested wheatgrass/bromegrass hay was provided free choice throughout the feeding study.

Commercial rations used were pelleted and formulated for specific age and weight of calves and changes were made according to the manufactures recommendations. Aureomycin/Sulfomethozine (As-700) medication was included during the first twenty-eight days of feeding after weaning. In the treatment in which a commercial ration and a home grown blend were both used the commercial medicated formulation was fed for 28 days, then the medication was removed and feeding was continued for an additional 28 days. At the end of 56 days the commercial preparation was discontinued and an oat based home grown blend was provided during the remainder of the feeding study.

Home grown rations blended on the farm were formulated to be highly digestible. Nutrient digestability was maintained between 71% and 73%. Protein levels during the early part of the feeding study ranged between 15.5% and 16% and were lowered to 14% as the calves matured.

Calves were weighed at selected intervals during the course of the investigation beginning at the trials onset, when the calves were weaned from their mothers and at 28 day intervals thereafter. Final weights were taken following an overnight feed and water shrink.

Calves were fed for a total of 142 days which corresponded to an average weaning age of 205 days.

Calf performance under each system of feeding, feeding economics, and net returns over feed using a calf value of $78.50 per hundredweight have been summarized in table 2.

Results and Discussion:

Eighty-two beef calves of Hereford, Angus X Hereford and Longhorn X Hereford breeding were randomly allotted to one of four ration types in a feeding systems comparison for early weaned calves.

The study was conducted two consecutive years and weaning age ranged from 38 days to 89 days the first year and from 64 days to 105 days the second year. Calves were weaned after a twenty-one day adjustment period during which time they had access to starter rations. Starter ration consumption per calf averaged approximately twenty-five pounds and seasoned the calves to dry feed making the transition from nursing to a completely dry ration very smooth.

Diets evaluated in this feeding system comparison were as follows:

1. Completely commercial pelleted starter and calf growing program.
2. Commercial pelleted starter and calf growing program during the critical first one-third of the growing phase followed by a home grown oat based ration. Home grown rations were complete mixed preparations that were self-fed in straight sided feeders.

Growth rates among calves fed any one of the four ration types were satisfactory. Problems encountered with rations were small and easily rectified. Molasses was initially used to increase palatability and control dust but unfortunately it attracted an unbearable number of flies and was discontinued early in the study. When average daily gains of calves fed the commercial ration are compared to the commercial/home grown oat base and the straight home grown oat base rations there is some variation but the differences are not significant. Comparing the daily gains of calves fed the commercial/home grown rations scheme with those calves fed either the oat or barley based rations also shows slight differences but none of them were great enough to be statistically significant. Calf gains among calves fed the all commercial ration were significantly faster than those generated by calves receiving the barley based preparation.

When these four ration types are evaluated in terms of economic efficiency and resultant profitability the results take on an entirely different complexion. The all commercial ration which yielded the fastest daily gains generated the lowest net return over feed cost of $205.37. Calves receiving the all commercial preparation during the critical first one-third of the feeding period followed by a home grown oat based ration had the most efficient feed to gain ratio of 4.60 pounds and had the highest net return per head over feed cost of $256.48.

The completely mixed home grown oat and barley rations returned similar net dollars and were substantially higher than the all commercial ration returning $240.09 and $242.06 over feed costs. Feed costs per hundred weight gain had the greatest effect on net return in the comparison of these rations.

Flies and pinkeye are problems that can easily be encountered and must be controlled. Fly tags should be used on the calves to control those fly species that are susceptible to ectrin and permethrin type compounds. Residual barn sprays for buildings and facilities should also be considered.

Calves that are weaned early are more susceptible to disease and therefore need to be under close surveilance Respiratory problems are one of the major disease problems that might be encountered. When the first sign of a respiratory problem or other disease arises it should be treated immediately according to the recommendations of a veterinarian.

These data clearly indicate that livestock producers wanting to early wean beef calves have several feeding options at their disposal depending on individual circumstances, available feed supplies and processing and handling equipment. These data also indicate quite strongly that choice of feeding method can definitely have a strong influence on profitability.

Table 1. Percentage of ingredients and various ration changes in the home grown oat and barley based rations.

	Oat Base					Barley Base			
Changes	**Starter (1)**	**2**	**3**	**4**		**Starter (1)**	**2**	**3**	**4**
Ingredients:									
Alfalfa, %	34	39	39	39		36	41	41	41
Corn, %	20	20	20	20		20	20	20	20
Oats, %	27	27	33	34		--	--	--	--
Barley, %	--	--	--	--		27	27	31.5	32.5
Soybean Meal, %	12	12	6	5		10	10	5.5	4.5
Molasses, %	5.1	--	--	--		5.1	--	--	--
Minerals & Vit. 1 /									
Protein %, as fed	16	16.4	14.5	14.2		15.5	15.8	14.4	14.1
TDN, %	73.4	71.4	71.0	71.0		74.8	72.9	72.9	72.9

1 / Minerals and Vitamins: 1.0% dicalcium phosphate; 3% limestone; .6% T.M. salt; 2,000,000 IU vitamin A; 800,000 IU vitamin D.

Table 2. Summary of gains, feed, ration economics and net return among early weaned calves when comparing four different ration types.

Rations:	Commercial	Commercial/ home grown oat base	Home grown oat base	Home grown barley base
No. Head	21	21	20	20
Days fed	142	142	142	142
Gains:				
Initial Wt. #	155	158	152	156
Final Wt. #	490	459	434	421
Gain, lbs.	335	301	282	265
Actual/ADG, lbs.	2.34	2.12	1.97	1.85
ADG obtained by regression analysis 1 /	2.43_{a}	$2.12_{a,b}$	$2.10_{a,b}$	1.94_{b}
Feed:				
Feed/head, lbs.	1754.00	1384.00	1623.00	1409.00
Feed/hd/day, #	12.3	9.70	11.35	9.84
Feed/lb., gain, lbs.	5.27	4.60	5.77	5.39
Feeding Economics:				
Feed cost/hd/day, $	1.24	0.73	0.70	0.62
Feed cost/cwt gain, $	52.71	34.62	35.86	33.75
Feed cost/hd, $	176.83	103.83	100.60	88.42
Returns:				
Gross return/ hd @ $78.50/ cwt, $	382.20	360.31	340.69	330.48
Feed cost/hd $	176.83	103.83	100.60	88.42
Return/hd over feed, $	205.37	256.48	240.09	242.06

1 / Average daily gains subjected to regression analysis: statements of significance are based on Tukey's multiple range comparison with p=.05. ADG's with similar subscripts so not differ significantly.

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An Evaluation of Immune Response in Weanling Age Beef Calves Given Booster Vaccinations at Selected Intervals

by

I. A. Schipper, D. G. Landblom, J. L. Nelson and H. M. Smith

Objectives:

The primary objective when using vaccines is to prevent infectious disease. This objective is too frequently not obtained because of incorrect administration of the biological product. Investigations at this station to identify the method that would generate the most immune response revealed that very minimal, or no antibody production was produced following a single vaccination; and that regardless of the type of vaccine used (modified live or inactivated) two vaccinations were required to produce maximum blood serum levels of antibodies (Schipper et al, 1984). It was also found that when weaning and vaccination occurs simultaneously, antibody titer is decreased and that a more rapid decay of antibody titer occurs. When the previous work being discussed was done, an interval of three weeks was used between the initial and booster Vaccinations. The purpose of this present investigation is to identify the interval between the initial and booster vaccinations that will promote maximum antibody response among weanling age beef calves.

Procedure:

Calves weighing approximately 450-550 pounds of multiple breeds and of both sexes were utilized in this investigation. The biological agent used was an inactivated trivalent (Infectious Bovine Rhinotrachetis – IBR, Bovine Virus Diarrhea – BVD, and Para Influenza – 3-PI-3) vaccine administered according to the manufacturers recommendations. In the vaccination protocol 46 calves served as controls and were intermingled with the treated groups but received no vaccine. One group of 39 calves received a single administration (5 ml) of the trivalent vaccine when the experiment began. Three other treatment groups comprised of 38 to 40 calves each were given an initial vaccination of the trivalent vaccine and were then given booster vaccinations at either one, two or three week intervals.

All calves were bled on vaccination day, on the day that booster vaccinations were given and six weeks following the initial vaccination. Blood serum was obtained, frozen and forwarded to the Veterinary Diagnostic Laboratory, NDSU where it was titered for antibodies to IBR, BVD and PI-3 viruses present in the trivalent vaccine.

Results:

IBR

Over the six week period of this investigation, control calves did not exhibit major changes in blood serum antibody levels. All calves, regardless of the frequency or interval that a booster vaccination was administered exhibited a definite blood serum titer decay. The greatest antibody titer response was detected in those calves given a booster vaccination two weeks following the initial vaccination. (Figure 1)

BVD

Calves in the control group exhibited a slight increase in blood serum antibody titer between the three and six weeks period of the investigation. A similar slight increase occurred in varying degrees between the three and six week period for those calves given an initial vaccination only and those given booster vaccinations at one and two weeks after the initial challenge. A major increase in blood serum titer was observed for those calves given a booster vaccination three weeks following the initial vaccination. (Figure 2)

PI-3

The controls exhibited a steady increase in blood serum titer over the six week period investigated. Administering a booster vaccination two weeks following the initial challenge generated the greatest increase in blood serum titer to PI-3. With the exception of the control group of calves, all calf groups exhibited a similar increase in serum antibody titer following the three week period of the investigation. (Figure 3)

Comparison of Immune Response for IBR, BVD, and PI-3 Antigens.

Figure 4 provides a comparison of blood serum antibody response for each disease antigen in the trivalent viral vaccine when administered initially followed by a second administration at three weeks. The IBR vaccine provided the least antibody response and an antibody decay between the third and sixth week of the study. Greatest antibody response was detected by those calves receiving the PI-3 antigen following the three week booster vaccination.

Discussion:

IBR

Response among calves given the IBR (Herpes virus) antigen was substantially less than that observed among calves receiving either BVD or PI-3 vaccine. Also these data clearly indicate that IBR blood serum antibody decay occurs soon after maximum post-vaccination titers are observed.

The blood serum titer decay observed is characteristic for nearly all Herpes viruses and has lead to the suggestion that continuous multi-vaccinations must be utilized to maintain a maximum level of antibody for protection from Herpes virus diseases. While this would maintain maximum antibody levels, it is an impractical approach.

BVD

The results relating to the immune response among calves vaccinated with BVD virus indicates that there is little protection provided animals vaccinated only once, or receiving a second administration at one or two weeks following initial vaccination. When comparing BVD and IBR antibody titers, BVD exhibited a greater antigenic activity. It is apparent from these data that those animals receiving a second vaccination three weeks after the initial vaccination for BVD would have the greatest opportunity to develop maximum protection against BVD virus.

Blood serum titers to BVD were detected at the time initial vaccinations were made, indicating that calves in this investigation had experienced natural infections to BVD virus and had developed some immunity before the vaccination sequence began.

PI-3

A steady increase in blood serum titer to PI-3 virus was detected in the control animals indicating that PI-3 virus was present in the calves in advance of the vaccination program. It would also appear that the stress of handling and crowding resulted in a rapid and extensive spread of the PI-3 virus among all animals involved. This would result in a consistent titer increase among vaccinated and unvaccinated calves. Results obtained for PI-3 virus demonstrate that it is a virus that spreads rapidly throughout all calves brought together and that by the end of the six week study period all calf groups had developed strong antibody titers.

Summary:

To obtain maximum antibody levels to the three viral strains tested would require administering an initial vaccination to IBR and PI-3 followed by a booster vaccination two weeks later. And in the case of BVD virus, maximum antibody production would be obtained by giving an initial vaccination for BVD followed by a booster vaccination at three weeks. While this would provide the best protection it is impractical to handle cows and their calves so often. The best alternative is to use a trivalent vaccine (IBR, BVD and PI-3) giving an initial vaccination and following it with a booster vaccination two weeks later.

If one is to establish and maintain maximum blood antibody titers to IBR virus it will be necessary to follow one initial vaccination with IBR vaccine with routine booster vaccinations at six week intervals, which is impractical. The PI-3 virus is everywhere in the young calf and when they are subjected to the stress of vaccination, handling and crowding there is an extensive spread of this viral agent. The infection under stressful conditions results in the establishment of high blood serum antibody titers by six weeks following the initiation of the stressful period.

References:

I. A. Schipper, D. G. Landblom, J. L. Nelson, V. Anderson, R. Danielson and T. Stromberg. 1984 Optimum vaccination time for feeder calves. North Dakota Agriculture Experiment Station, Dickinson Branch, 34th Livestock Research Roundup, pp. 38.

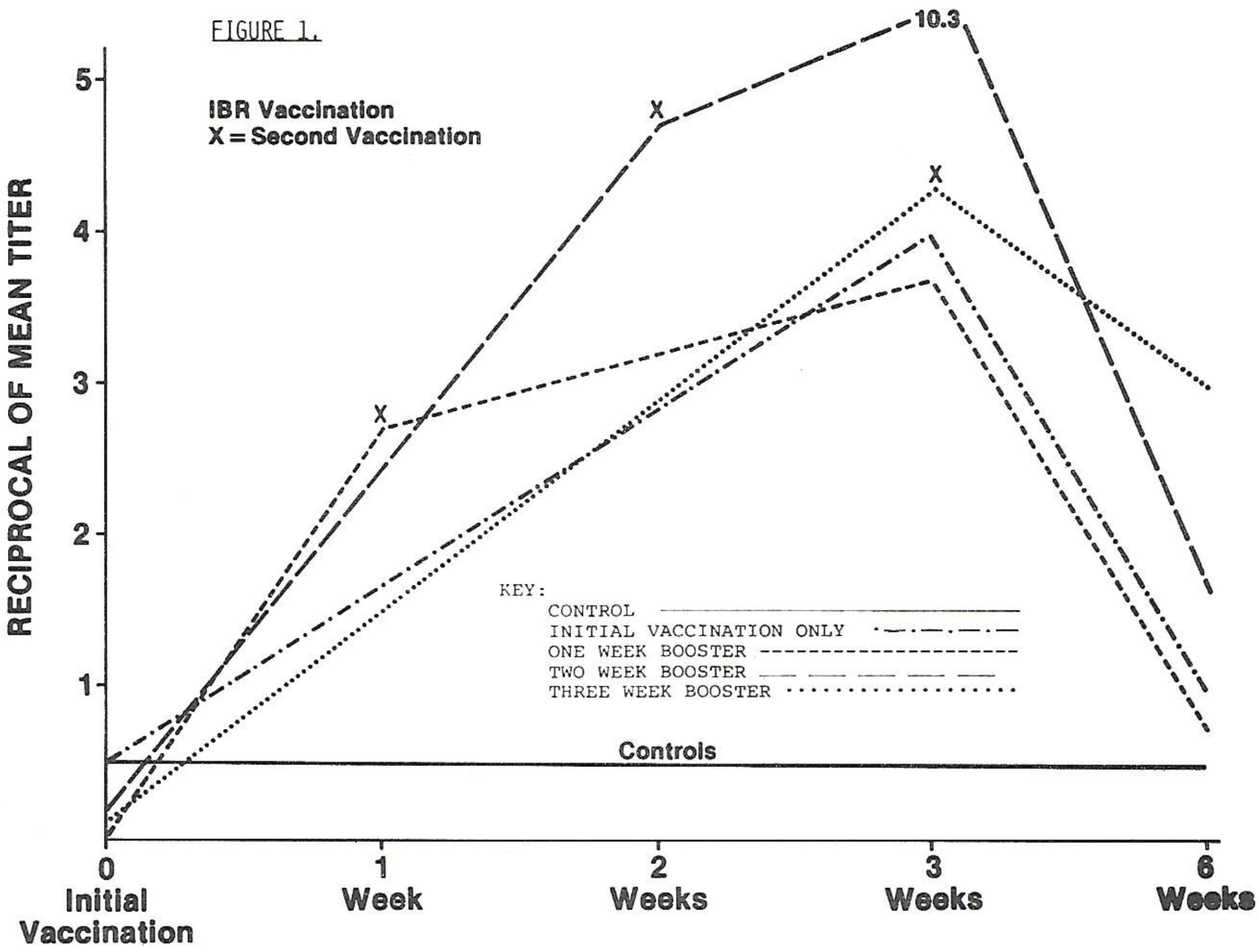


FIGURE 1.
IBR Vaccination
X = Second Vaccination
10.3
X
RECIPROCAL OF MEAN TITER
5
4
3
2
1
KEY:
CONTROL
INITIAL VACCINATION ONLY
ONE WEEK BOOSTER
TWO WEEK BOOSTER
THREE WEEK BOOSTER
Controls
0
Initial Vaccination
1
Week
2
Weeks
3
Weeks
6
Weeks

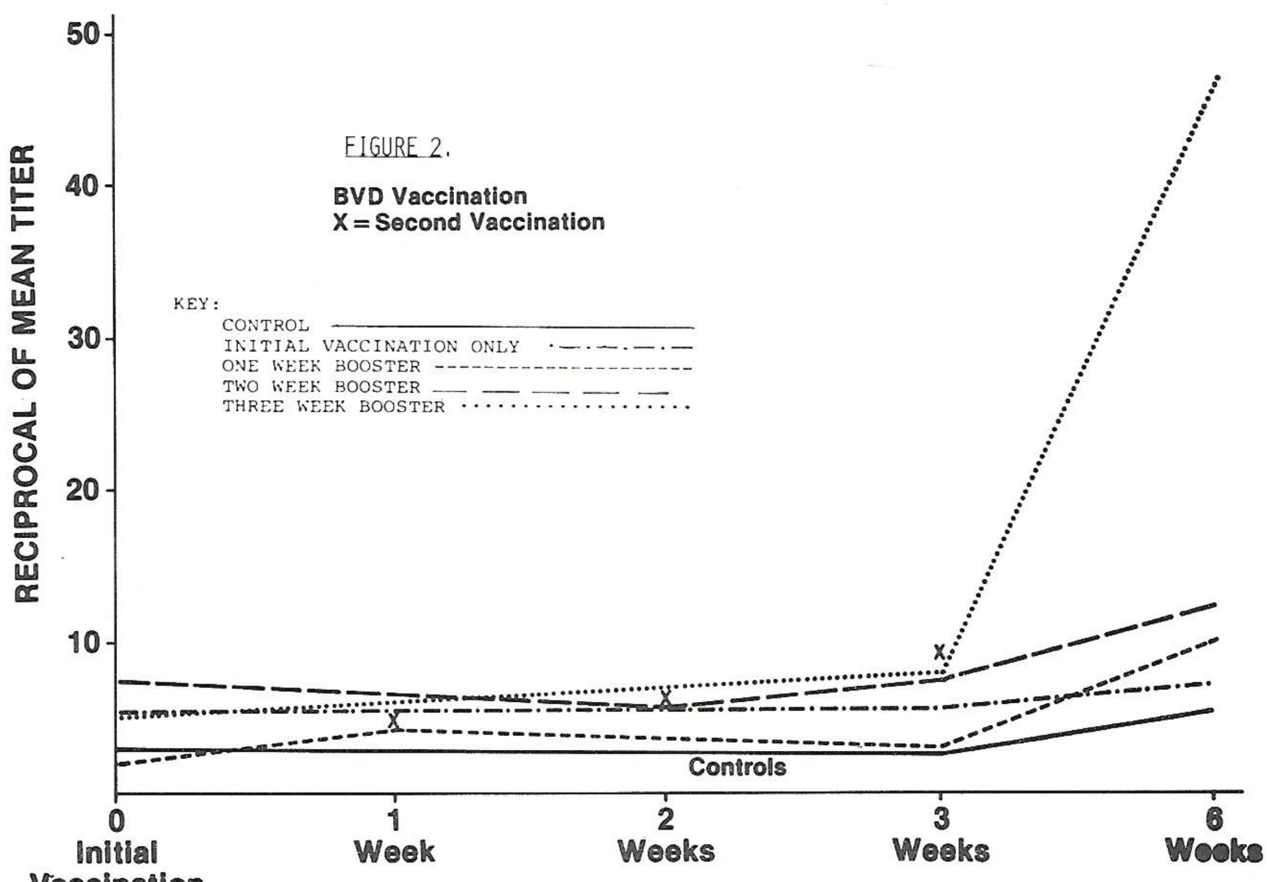


FIGURE 2.
BVD Vaccination
X = Second Vaccination
RECIPROCAL OF MEAN TITER
50
40
30
20
10
KEY:
CONTROL
INITIAL VACCINATION ONLY
ONE WEEK BOOSTER
TWO WEEK BOOSTER
THREE WEEK BOOSTER
X
Controls
0
Initial Vaccination
1
Week
2
Weeks
3
Weeks
6
Weeks

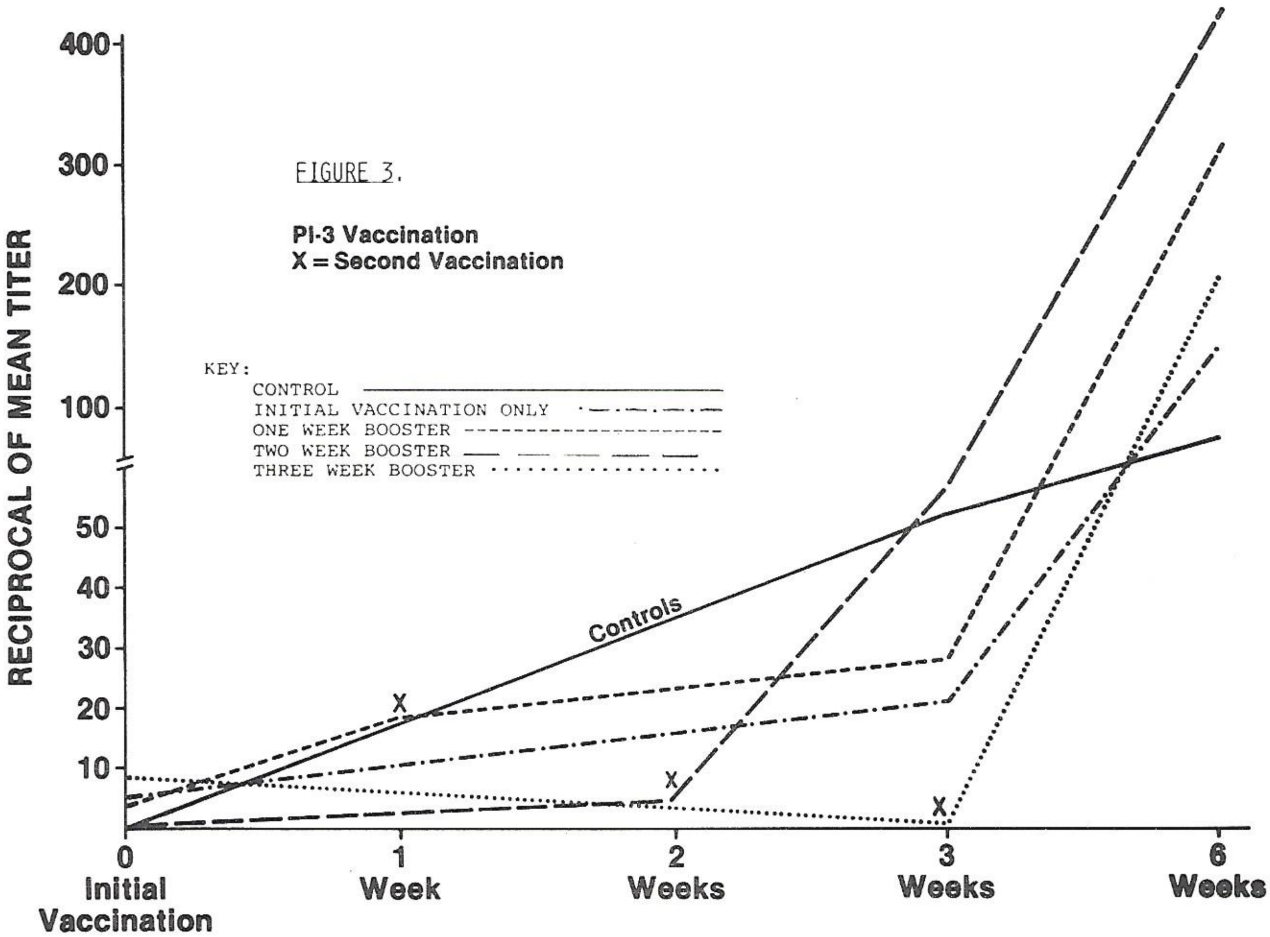


FIGURE 3.
PI-3 Vaccination
X = Second Vaccination
KEY:
CONTROL
INITIAL VACCINATION ONLY
ONE WEEK BOOSTER
TWO WEEK BOOSTER
THREE WEEK BOOSTER
Controls
X
RECIPROCAL OF MEAN TITER
400
300
200
100
50
40
30
20
10
0
Initial Vaccination
1
Week
2
Weeks
3
Weeks
6
Weeks

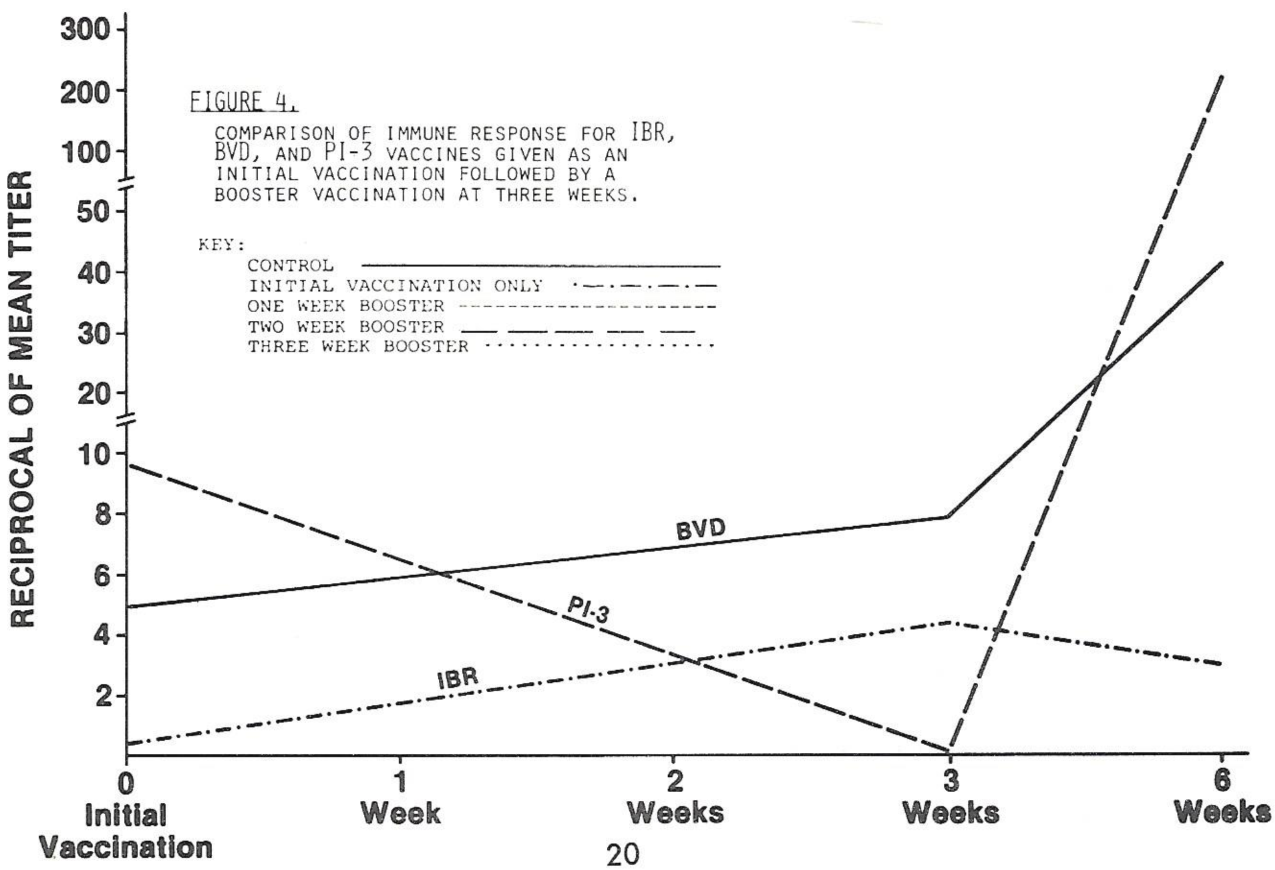


FIGURE 4.
COMPARISON OF IMMUNE RESPONSE FOR IBR, BVD, AND PI-3 VACCINES GIVEN AS AN INITIAL VACCINATION FOLLOWED BY A BOOSTER VACCINATION AT THREE WEEKS.
KEY:
CONTROL
INITIAL VACCINATION ONLY
ONE WEEK BOOSTER
TWO WEEK BOOSTER
THREE WEEK BOOSTER
BVD
PI-3
IBR
RECIPROCAL OF MEAN TITER
300
200
100
50
40
30
20
10
8
6
4
2
0
Initial Vaccination
1
Week
2
Weeks
3
Weeks
6
Weeks

Medicated Salt-Mineral Mixtures 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 tradename 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 pink eye and foot rot. 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 conditions.

Angus X Hereford first calf heifers and their Milking Shorthorn X Angus X Hereford calves were allotted to graze native range pastures and receive either a chlortetracycline medicated mineral mix or an unmedicated control mixture. Fed free choice in covered mineral feeders, the salt mineral mix contained two parts trace mineral salt and one part dicalcium phosphate. Chlortetracyline was added at the rate of 312.5 mg. per ounce of mineral mix.

The mineral blend was kept fresh by adding small amounts at frequent intervals. Results for the 1984 grazing season, which ran for 151 days from June 1st to October 30th are shown in Table 1.

Summary:

Chlortetracycline fed in the salt mineral mixtures resulted in 5.9% faster calf gains and cow weight gains were 17% better at the end of the 151 day grazing period. Although a gain advantage was shown for medication, the cost for the medicated mixture was $11.23 more per cow-calf pair than for the control. Using .70¢ per pound for value of the additional gain, the 18.1 pounds of calf obtained by using the medication would amount to $12.68. Any advantage for the medication in the form of weight gain would be eliminated by the cost of medication.

Table 1. Summary of cow-calf pairs supplemented with Chlortetracycline medicated and unmedicated salt mineral mixtures.

	Control			Medicated		
	Cows		**Calves**	**Cows**		**Calves**
No. cow/calf pairs	15		15	15		15
Starting weight June 1	950		199	954		192
Final weight, Oct. 30	1020		486	1039		497
Days grazing	151		151	151		151
Avg. daily gain	.46		1.89	.56		2.01
<u>Economics:</u>						
Total pounds salt/ mineral mix consumed		450			700	
Avg. consumption/pair 1/ daily, ounces		3.10			4.82	
Salt mineral mixture cost/pound, ¢		10			31.1	
Avg. mineral cost/pair daily		.0193			.0936	
Total cost/pair, $		2.91			14.14	

1/ Herd bull included in average daily consumption.

Cow-Calf Performance on Improved and Native Grass Pastures Following Worming

by

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

Worming continued to be an important segment of research at the Dickinson Experiment Station. Several experiments have been conducted recently to evaluate the effects of performance and economic returns where worming is incorporated as a management tool. To date, with one exception, under the conditions of these studies there has been little or no performance or economic advantage for routine worming. The conditions in which we were able to measure an advantage occurred when worming with Safe-Guard® and implanting with Compudose ® were combined in steer calves fed back-grounding rations.

Fecal analysis has been a part of each experiment dealing with worming. Analysis of intestinal worms based on fecal egg shedding has shown us 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.

Our objective in this investigation is to study the effect that worming cows just before spring turnout and delaying calf worming until mid July has on performance and subsequent economic return to management.

Young second calf 1/2 Angus X 1/2 Hereford crossbred cows nursing 3/4 Angus X 1/4 Hereford crossbed calves were used to evaluate the new worming product Safe-Guard®. The cows and calves grazed crested wheatgrass pastures from turnout time in May until July 24th when they were weighed, calves wormed and moved to native range patures where they remained until weaning on November 2, 1984.

The control and wormer treated groups were weighed and fecal sammpled at selected intervals throughout the grazing season.

Fecal samples were analyzed at the North Dakota State University Veterinary Diagnostic Lab by Dr. Myron Andrews using the Wisconsin Double Centrifugation Sugar Flotation technique.

The animals were allotted by weight, breed, sex, sire of calf and performance index of cow based on North Dakota Beef Cattle Improvement Association performance indexing.

Gains and partial economic results of this investigation have been summarized in Table. 1.

In figures 1 and 2, cow and calf gains have been charted. The gains shown are average daily gains between each weighing period. Weights shown are typical as range conditions deteriorate during late fall.

Figures 3 and 4 chart the results of fecal egg shedding obtained from fecal samples collected during each weighing period.

Summary:

Worming of cows with Safe-Guard ® resulted in slightly better daily gains for the entire grazing season. There was no advantage for mid July worming of calves even though the eggs per gram of feces being shed was reduced to very low levels as shown in Figure 4.

Based on these results there is no doubt that Safe-Guard ® is an effective, easy to use product, but the level of parasitism that prevailed under the conditions of this investigation was not great enough to depress animal performance. No economic advantage was realized.

Table 1. Weights, gains and worming costs for cows and calves wormed with Safe-Guard ®

	Wormed			**Control**		
	Cows		**Calves**	**Cows**		**Calves**
No. head	34		34	34		34
Days on pasture (May 24-Nov. 2, 1984)		162			162	
Gains:						
Initial wt., lbs.	969		160	950		163
Final wt., lbs.	1109		474	1062		492
Avg. gain/hd., lbs.	140		314	112		329
ADG, lbs.	.86		1.94	.69		2.03
Economics:						
Wormer cost/cow, $ (22ml of 10% Suspension)	2.64			-		
Wormer cost/calf, $ (7.5ml of 10% suspension)			.89			-
Total investment/cow-calf pair,, $		3.53				

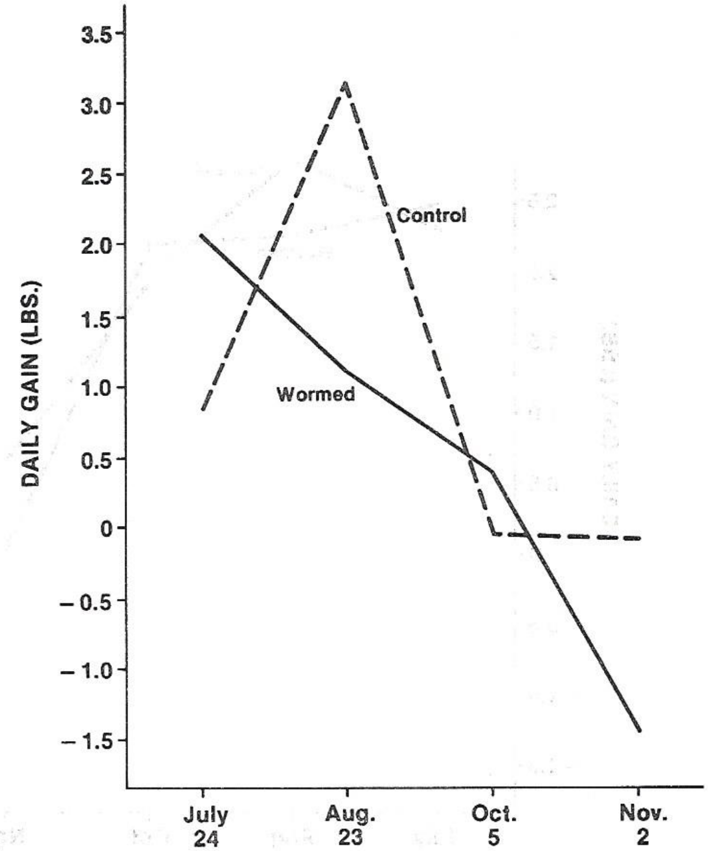


FIGURE 1. COW GAINS DURING 1984 GROWING SEASON.

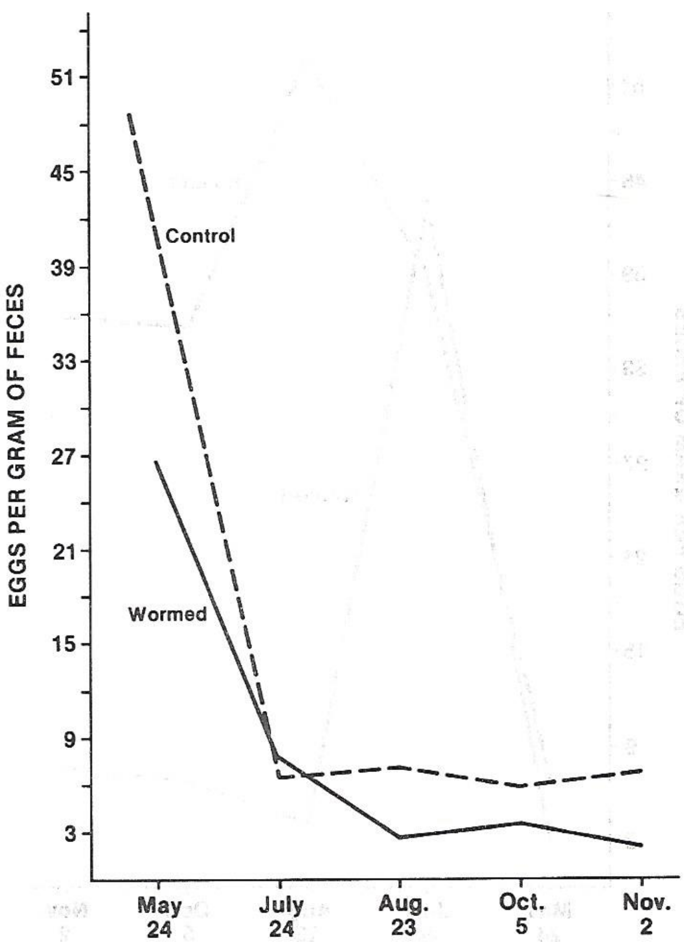


FIGURE 2. FECAL EGG NUMBERS BEING SHED BY COWS AT SELECTED DATES AFTER WORMING.

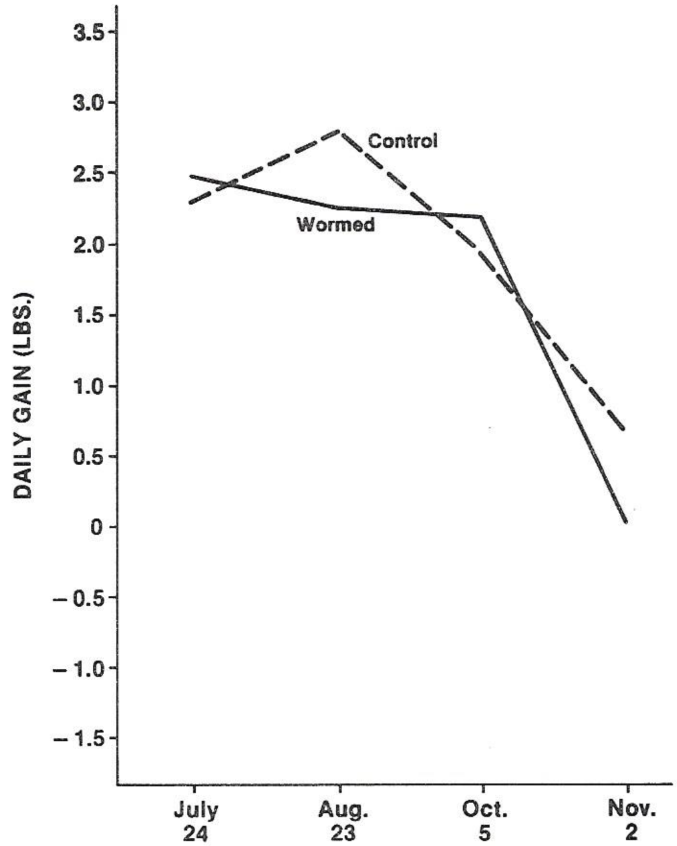


FIGURE 3. CALF GAINS DURING 1984 GROWING SEASON.

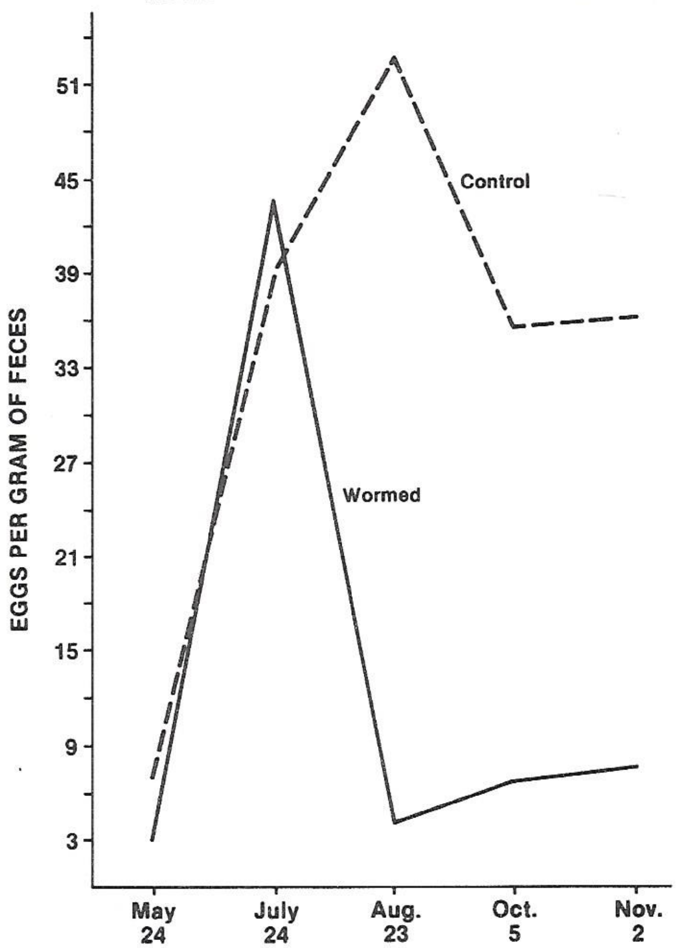


FIGURE 4. FECAL EGG NUMBERS BEING SHED BY CALVES AT SELECTED DATES AFTER WORMING.

Effects of Worming and Implanting Compared Among Backgrounded Steer Calves

by

D. G. Landblom and J. L. Nelson

Beef cattle producers are often faced with the decision of whether or not to deworm their livestock. Internal parasite research conducted specifically under the conditions of Western North Dakota is very limited. Consequently, a portion of the ongoing research effort at this station has focused on internal parasitism of beef cattle at various stages of production.

Investigations at this station have included studies with cows and calves wormed in the spring and calves wormed in mid-summer using conventional deworming methods and cooperative work with Pfizer and Company to test their Morantel® slow release bolus for calves.

The study reported here under backgrounding conditions is the next phase of production to be investigated. Backgrounding is a very important part of beef cattle production in North Dakota and therefore it is necessary to know the depth and magnitude of internal parasitism among calves being wintered in confinement. The objectives in all of our internal parasite investigations are generally much the same. The first major objective is to determine the extent of internal parasitism and to document the effects on production. The second objective is to document the effects of treatment on production, costs of treatment and dollars returned to management. In addition to these objectives, the current investigation is designed to evaluate the effects of deworming and implanting in backgrounded steer calves. No documented research is available at this time. However, the potential exists for an additive effect on production when deworming and implanting are used together.

No attempt has been made to compare deworming products. Thiabendazole®, Tramisol® (Levamisol Hydrochloride), Rumatel® (morantel tartrate), and Safe-Guard® (fenbendazole) have been used. Based on fecal examination and worm species culturing, all of these products have been efficient dewormers in these trials.

To evaluate parasitism in this region, under the conditions of backgrounding, straight bred Hereford steers weighing 530 to 570 pounds and crossbred Angus X Hereford steers weighing 600 to 630 pounds were randomly assigned to one of the four following treatments:

1. Control.

2. Wormed with Safe-Guard® (fenbendazole).

3. Implanted with Compudose®.

4. Wormed with Safe-Guard® and implanted with Compudose®.

Animals wormed with Safe-Guard® received 2.3 ml. of drug suspension per 100 lbs. of body weight. Lightweight Hereford steers were given from 12-13 ml. per head and heavier crossbreed steers received 13.8 to 14.5 ml. per head. The anthelmentic was administered using a "no waste" dosing gun. Safe-Guard® wormer is the trade name given to the compound fenbendazole which is manufactured by American Hoechst corporation. Dr. Gil Myers, parasitologist, representing American Hoechst Corporation has assisted in this investigation by providing financial support for fecal analysis and deworming product.

Those steers allotted to receive the estradiol based Compudose® growth implants were given a single 24 mg. implant, which was placed under the skin on the backside of the middle one-third of the ear.

Calves were weighed at 28 day intervals and one-half of the steers in each treatment were fecal sampled. Fecal samples were analyzed the first year of the study by Dr. Myron Andrews, DVM, and his technical staff at the Veterinary Diagnostic Laboratory, N.D.S.U., Fargo, North Dakota. During the second year of the study Dr. Myron Andrews retired and our fecal analysis was done by AEF Research, a private laboratory, located at Waunakee, Wisconsin.

Backgrounding rations used the first year were very simple and consisted of 42.5% chopped hay, 55% dry rolled barley, .5% dicalcium phosphate and 2% trace salt. In the second year of the study corn silage was used, and on a 90% dry matter basis the following rations was used: 42.2% dry rolled barley, 19.9% corn silage, .5% dicalcium phosphate, .5% trace mineral salt, 29.6% chopped hay, and 7.3% alfalfa.

Gains and economics have been summarized by breed of steer and by year in tables 1, 2, 3 and 4.

Summary:

In the first year of the study the worming product Safe-Guard® reduced worm egg shedding and cultured larvae to zero during the first half of the investigation. Shedding and numbers cultured began to increase during the last half of the study indicating that the arrested 4th stage larvae of Ostertagia ostertagi was not affected by the drug fenbendazole. Culturing revealed five species of worms: Brown stomach worm (Ostertagia ostertagi), small stomach worms (Cooperia punctata and C. oncophora), small stomach worm (Trichostrongylus axei), and the threadnecked intestinal worm (Nematoderies). Of these five species only the two species of small stomach worms and the brown stomach worm appeared in any numbers.

In 1985 egg shedding of Ostertagia ostertagi was substantially reduced when compared with the previous year. A possible explanation for this may be that the fourth stage larvae of this tomach worm had migrated to the intestinal mucosa by the time initial fecal samples were taken. Fecal analysis revealed that worms of the Cooperia genus were most common. The next most common was the large stomach worm (Haemonchus placei). Small numbers of the following were also identified; small stomach worm (Trichostrongylus axei), threadnecked intestinal worm (Nematodirus), tapeworm (Moniezia) and the whipworm (Trichuris).

Deworming only, among backgrounded feeder claves, did not improve average daily gains or feed efficiency, and when compared to the control steers those steers dewormed only returned less net dollars. When compared to the control steers the dewormed Hereford steers netted $1.85 less per head and the dewormed crossbred Angus X Hereford steers netted $5.23 less return over feed.

Implanting with the growth promoting implant Compudose® resulted in .35 pound per day faster gains and 2.4% better feed conversion than control steers. This increase in performance resulted in a substantial increase in net dollars returned over feed. When compared to the control steers, crossbred Angus X Hereford steers netted a return over feed of $7.29 more and the Hereford steers netted a return over feed of $16.07 more per head.

By contrast to deworming only, implanting and deworming combined did have an additive effect on steer performance. When compared to control steers, average daily gains for Hereford steers were .5 and for the crossbred steers .42 pounds per day faster. These rates of gain were not significantly better than rates of gain for steers implanted only. However, feed efficiency was significantly better where the combination was used when compared to all other treatments. When compared to the controls, Hereford steers administered the combination were 10.3% more efficient and the crossbred steers were 10.9% more efficient. Significant improvement in rate of gain and feed efficiency resulted in substantially higher returns over feed costs. Hereford steers netted $20.26 more, and crossbred steers netted $12.89 more than the control steers.

Table 1. Summary of Hereford steers backgrounded to compare worming with Safe-Guard®, implanting with Compudose® and the two products combined, 1985.

Hereford	Control	Safe-Guard®	Compudose®	Safe-Guard® Compudose®
No. Head	6	6	6	6
Days Fed	113	113	113	113
Initial Wt., lbs.	563	573	571	561
Final Wt., lbs.	850	872	908	911
Gain, lbs.	287	299	337	350
ADG. lbs.	2.54	2.65	2.98	3.09
Feed/Day, lbs. 1 /	20.91	21.80	21.77	22.11
Feed/lb. Gain, lbs. 1 /	8.23	8.23	7.31	7.15
% of Feed Efficiency Improvement	- -	-0-	11.2	13.1
Feed Cost/CWT. Gain, $	36.50	36.57	32.31	31.77
Avg. Selling Price, Cwt., $	56.29	56.29	56.29	56.29
Avg. Value/Head, $	478.47	491.02	511.11	512.80
Feed Cost/Steer, $	104.77	109.34	108.88	111.19
Implant Cost/Steer, $	- -	- -	2.00	2.00
Worming Cost/Steer, $	- -	1.30	- -	1.30
Return Over Expenses, $	373.77	380.38	400.23	398.31
Difference Compared to Control, $		+6.61	+26.46	+24.54

1 / Rations used contained corn silage; values shown for "Feed/Day" and "Feed/lb. Gain" have been adjusted to a 90% dry matter basis.

Table 2. Summary of Angus X Hereford steers backgrounded to compare worming with Safe-Guard®, implanting with Compudose® and the two products combined, 1985.

Angus X Hereford Steers	Control	Safe-Guard®	Compudose®	Safe-Guard® Compudose®
No. Head	6	6	6	6
Days Fed	113	113	113	113
Initial Wt., lbs.	632	625	636	626
Final Wt., lbs.	898	884	956	937
Gain, lbs.	266	259	320	311
ADG, lbs.	2.35	2.29	2.83	2.75
Feed/Day, lbs. 1 /	21.42	20.3	23.46	22.21
Feed/lb. Gain, lbs. 1 /	9.11	8.88	8.29	8.08
% Feed Efficiency Improvement	- -	2.5	9.0	11.3
Feed Cost/Cwt. Gain, $	40.19	39.20	36.66	35.84
Avg. Selling Price/ Cwt., $	56.29	56.29	56.29	56.29
Avg. Value/Head, $	505.48	497.60	538.13	527.44
Feed Cost/Steer, $	106.92	101.54	117.31	111.47
Implant Cost/Steer, $	- -	- -	2.00	2.00
Worming Cost/Steer, $	- -	1.30	- -	1.30
Return Over Expenses, $	398.56	394.76	418.82	412.67
Difference Compared to Control, $	- -	-3.80	+20.26	+14.11

1 / Rations used contained corn silage; values shown for "Feed/Day" and "Feed/lb. Gain" have been adjusted to a 90% dry matter basis.

Table 3. Two Year Average of Hereford Steers backgrounded to compare worming with Safe-Guard® (fenbendazole), implanting with Compudose® and the two products combined, 1985.

Hereford	Control	Safe-Guard®	Compudose®	Safe-Guard® Compudose®
No. Head	12	12	12	12
Days Fed	116	116	116	116
Initial, Wt., lbs.	553.5	552.5	547	551
Final Wt., lbs.	833.5	834	878	889.5
Gain, lbs.	280	281.5	331	338.5
ADG, lbs.	2.41	2.43	2.85	2.91
Feed/Day, lbs.	19.9	20.0	21.39	21.56
Feed/lb. Gain, lbs.	8.26	8.23	7.51	7.41
Feed Efficiency Improvement, %	- -	.36	9.1	10.3
Feed Cost/Cwt., gain, $	34.85	34.99	31.69	31.31
Average Selling Price, Cwt., $	57.11	57.11	57.11	57.11
Average Value/Head, $	476.01	476.29	501.42	507.99
Feed Cost/Steer, $	97.67	98.50	104.91	105.99
Implant Cost/Steer, $	- -	- -	2.10	2.10
Worming Cost/Steer, $	- -	1.30	- -	1.30
Return Over Expenses, $	378.34	376.49	394.41	398.60
Difference Compared to Control, $		-1.85	+16.07	+20.26

Table 4. Two Year Average of Crossbred Angus X Hereford steers backgrounded to compare worming with Safe-Guard® (fenbendazole), implanting with Compudose® and the two products combined, 1985.

Angus X Hereford	Control	Safe-Guard®	Compudose®	Safe-Guard® Compudose®
No. Head	12	12	12	11 1 /
Days Fed	116	116	116	116
Initial Wt., lbs.	619	614	618	609
Final Wt., lbs.	886	885	925	925
Gain, lbs.	267	271	307	316
ADG., lbs.	2.30	2.34	2.65	2.72
Feed/Day, lbs.	21.06	21.75	23.68	22.20
Feed/lbs., Gain, lbs.	9.16	9.29	8.94	8.16
Feed Efficiency Improvement, %	- -	+1.42	-2.40	-10.9
Feed Cost/Cwt., Gain, $	38.64	39.30	37.80	34.54
Average Selling Price/Cwt., $	505.99	505.42	528.27	528.27
Average Value/Head, $	57.11	57.11	57.11	57.11
Feed Cost/Steer, $	103.16	106.52	116.05	109.15
Implant Cost/Steer, $	- -	- -	2.10	2.10
Worm Cost/Steer, $	- -	1.30	- -	1.30
Return over Expenses, $	402.83	397.60	410.12	415.72
Difference Compared to Control, $	- -	-5.23	+7.29	+12.89

1 / Steer died of heart failure.

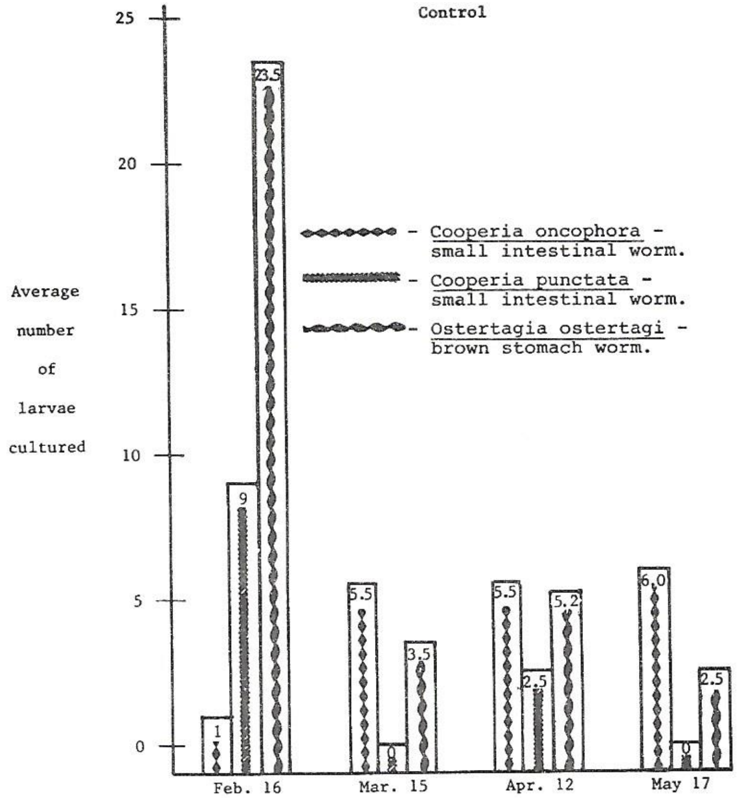


Figure 1. Summary of average number of worm larvae cultured from combined lots, 1984.

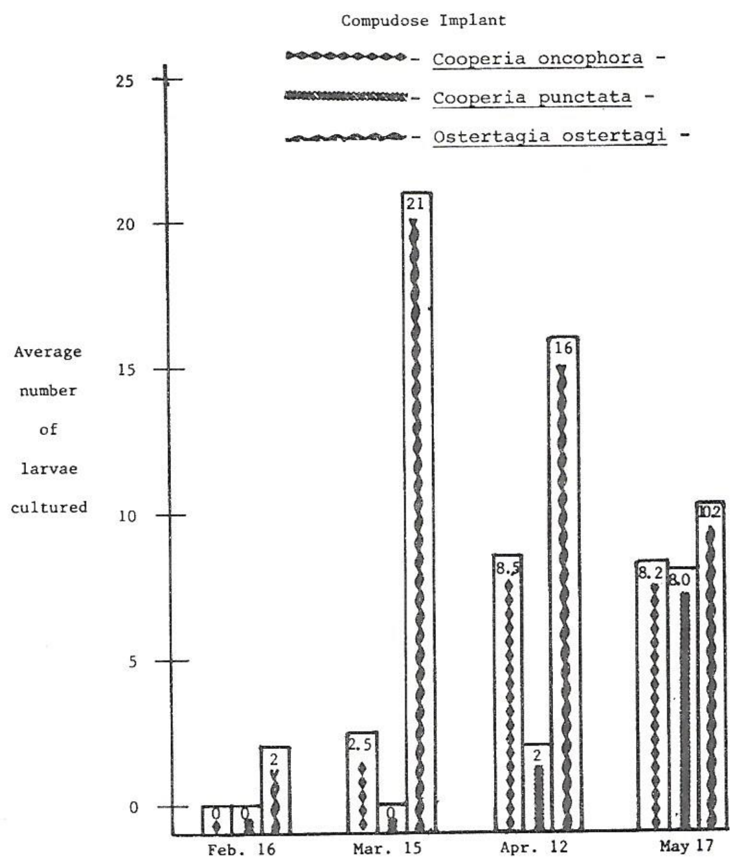


Figure 2. Summary of average number of worm larvae cultured from combined lots, 1984.

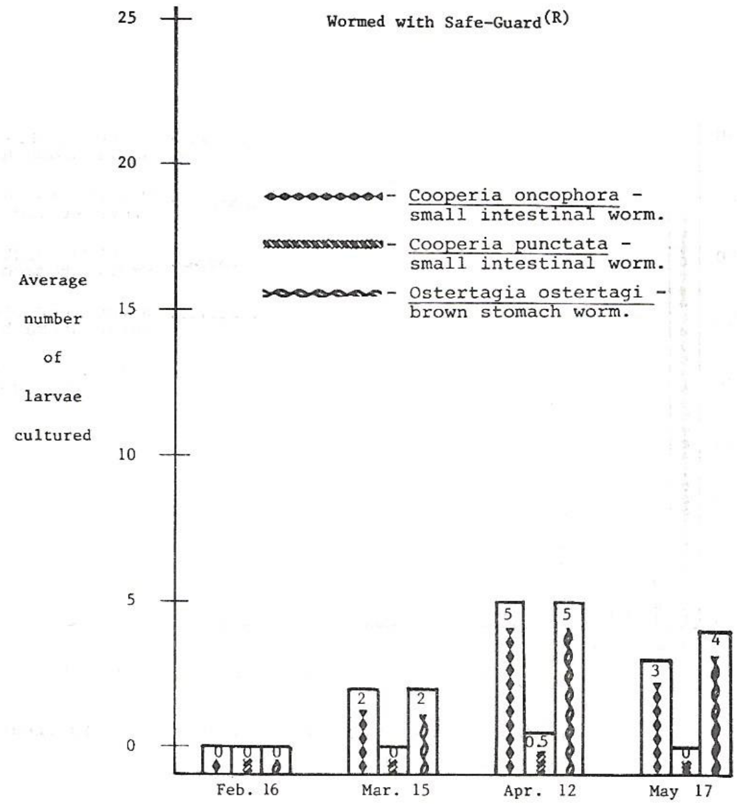


Figure 3. Summary of average number of worm larvae cultured from combined lots, 1984.

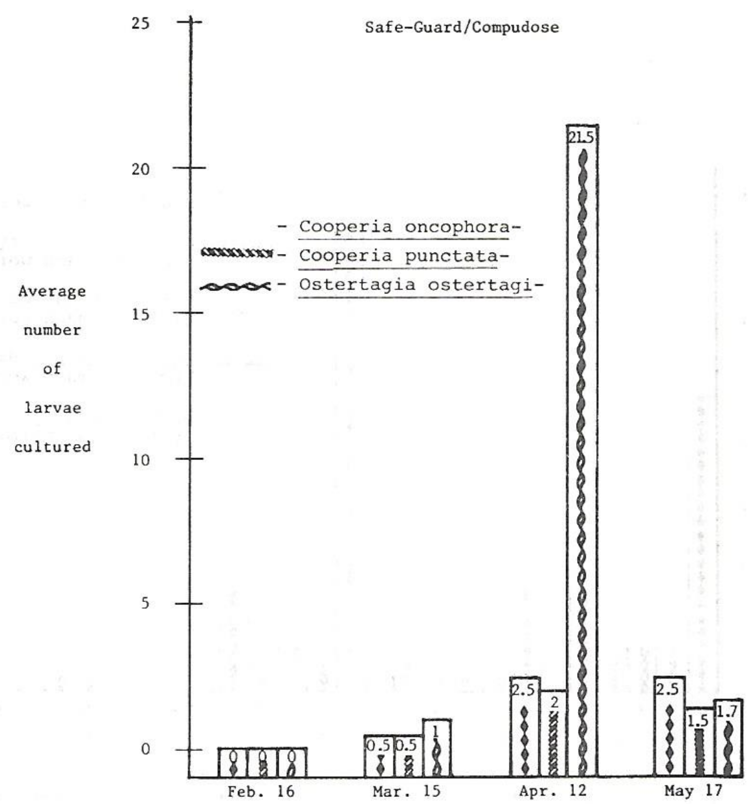


Figure 4. Summary of average number of worm larvae cultured from combined lots, 1984.

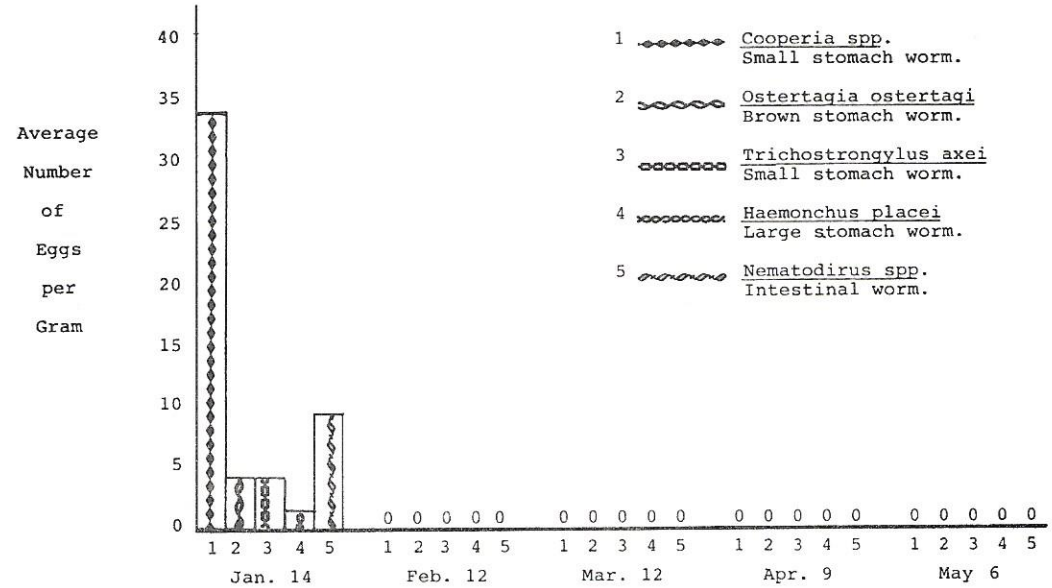


Figure 1. Summary of eggs/gram of feces from all lots treated with Safeguard - 1985.

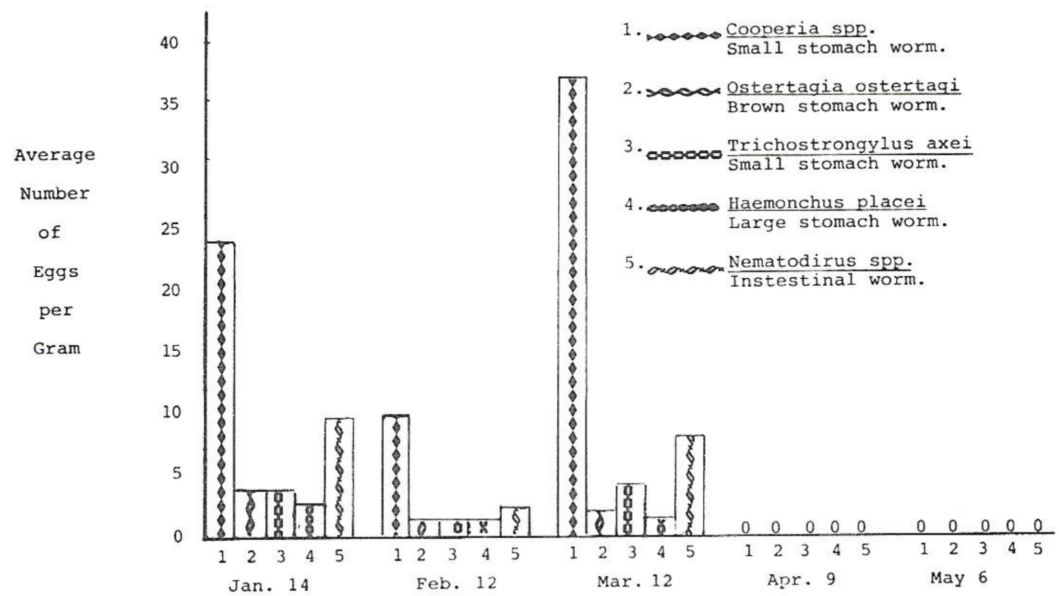


Figure 2. Summary of eggs/gram of feces from all lots treated with Compudose - 1985.

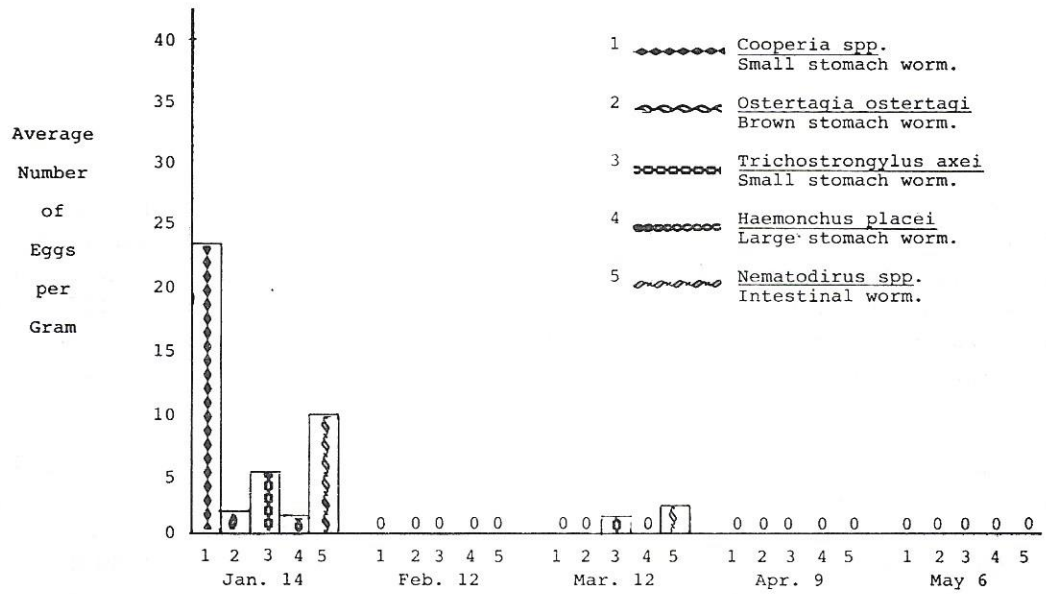


Figure 3. Summary of eggs/gram of feces from all lots treated with Safeguard and Compudose combined - 1985.

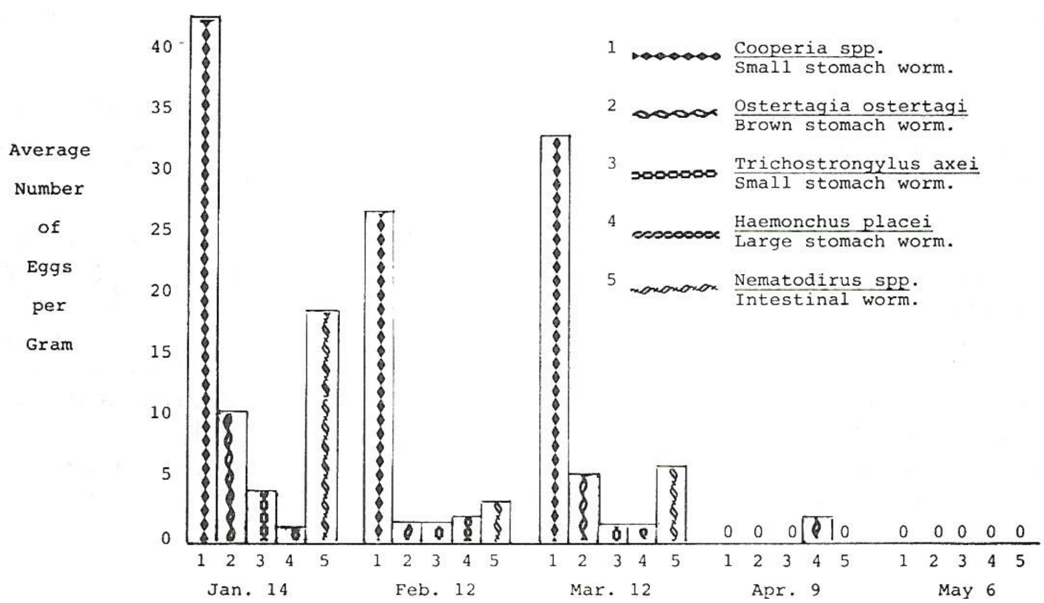


Figure 4. Summary of eggs/gram of feces from all untreated control lots - 1985.

Feedlot Breed Comparison of
First Generation Steers

by

J. L. Nelson and D. G. Landblom

A majority of North Dakota beef cattle producers are attempting to increase profits in their cattle operation by crossbreeding. Deciding which breed 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 Experiment 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 has 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 calf counterparts which 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 fed represented four breed types namely Hereford, Angus X Hereford, Milking Shorthorn X (Angus X Hereford) and Simmental X Hereford. Because of producer interest three additional pens of steers were included in the 1985 trial. These were: Charolais X Hereford; Gelbvieh X Hereford and Salers X Hereford crossbreds.

Before the feeding trial was begun all steers were implanted with Compudose®, treated for lice, and vaccinated with a 7-way Clostridium vaccine. Average starting weight for all pens ranged from 600 to 675 pounds.

All steers were bunk line fed a complete mixed ration of rolled barley, chopped mixed hay, corn silage and minerals. 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 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 choice when slaughtered. Following this determination, the steers were trucked to Held Beef in West Fargo, North Dakota for slaughter. Dr. Paul Berg, Animal Science Department at N.D.S.U., was in charge of slaughtering and collection of all carcass data.

Summary:

All steers performed better in 1985 than in 1984, with average daily gains ranging from 2.91 lbs. for Herefords to 3.44 lbs. for Simmental crossbreds. Feed consumption per day averaged 28.95 lbs. for the Herefords to 36.70 lbs. for the Simmental cross. The Gelbvieh crossbreds had the lowest feed cost per hundredweight gain at $29.43, followed by the Angus X Hereford at $29.90. The Hereford had the highest at $34.95. Based on actual selling price minus feed cost in 1985, the Milking Shorthorn X BWF Cross at

$413.47, the Angus X Hereford at $412.74, and the Simmental X Hereford at $409.38 showed the highest returns. All steers graded about as expected except for the Gelbvieh crossbreds which failed to make the choice grade. However, they had the largest loin eye size at 12.9 square inches.

This information shows a rather large yearly variation in rate of gain and feed efficiency. There also appears to be substantial differences between breed types in their ability to grade choice.

Feeding gains, economics, carcass data and returns over feed are shown in Table 1 for 1985.

Table 5 shows the 1984 and 1985 combined data.

The trial will be continued in the 1985-86 feeding season.

Summary:

All steers performed better in 1985 than in 1984, with average daily gains ranging from 2.91 lbs. for Herefords to 3.44 lbs. for Simmental crossbreds. Daily feed consumption averaged 28.95 lbs. for the Herefords to 36.70 lbs. for the Simmental crossbreds. The Gelbvieh crossbreds had the lowest feed cost per hundredweight gain at $29.43 followed by Angus X Hereford steers at $29.90. The Hereford steers had the highest feed cost per cwt. gain at $34.95. Based on actual carcass value minus feed costs in 1985, the Simmental crossbreds returned $440.97, the Milking Shorthorn X (Angus X Hereford) crossbreds $438.55, and the Angus X Hereford steers at $443.43 showed the best return. The Charolais crossbreds and the Gelbvieh crossbreds failed to grade as well as expected, with only one of the Charolais steers and none of the Gelbvieh steers grading choice. This reduced their carcass value considerably and therefore lowered their return over feed costs.

The two year combined results shown in Table 3, show some interesting patterns. All three crossbred groups Angus X Hereford, Milking Shorthorn X (Angus X Hereford) and Simmental X Hereford outgained the straight bred Herefords by 0.27 lbs/head/day. Both the Hereford and the Angus X Hereford steers were more feed efficient than the larger framed Milking Shorthorn X (Angus X Hereford) and Simmental X steers.

The Angus X Hereford and Milking Shorthorn X (Angus X Hereford) steers graded 57% choice, the Simmental X graded 54% choice and the straight Hereford only had 28.6% choice according to U.S.D.A. standards. Best overall return over feed costs was $442.98 for the Angust X Hereford, followed by the Milking Shorthorn X (Angus X Hereford) at $439.56.

Table 1. Feedlot gains, economics and carcass data for 1985.

	Hereford	Charolais X Hereford	Gelbvieh X Hereford	Angus X Hereford	Salers X Hereford	M. Shortnorn X BFW	Simmental X Hereford
No. of steers	7	7	7	7	7	7	7
Final Weight, lbs.	1069.6	1137.0	1124.9	1088.0	1147.1	1146.6	1264.1
Initial Weight, lbs.	644.3	629.3	638.0	628.0	648.3	702.9	706.9
Gain, lbs.	425.3	507.7	486.9	460.0	498.8	443.7	557.2
Days fed	146	160	146	146	162	146	162
ADG, lbs.	2.91	3.17	3.33	3.15	3.07	3.03	3.44
Hot Carcass wt., lbs.	625.6	658.4	643.8	642.0	683.4	665.1	741.6
Dressing %	58.5	57.9	57.2	59.0	59.6	58.0	58.7
Loin eye size	11.8	12.0	12.9	11.5	12.2	11.2	11.3
Fat Thickness	.47	.33	.30	.53	.29	.45	.39
U.S.D.A. Grade	2 choice	1 choice		5 choice	4 choice	4 choice	4 choice
	5 good 2 /	6 good 3 /	7 good 2 /	2 good 2 /	3 good 3 /	3 good 2 /	3 good 3 /
Actual Carcass Value $	545.11	533.48	553.72	570.99	571.00	587.17	622.47
Assumed Carcass Value $ 1 /	545.11	570.09	553.72	570.99	599.88	587.17	654.45

1 / Assumed value using $86/cwt for good
$90/cwt choice

2 / actual selling price
choice @ $90.00
Good @ $86.00

3 / Actual selling price
Choice @ $87.00
Good @ $80.00

Table 2. Feed consumption for 1985.

	Hereford	Charolais X Hereford	Gelbvieh X Hereford	Angus X Hereford	Salers X Hereford	M. Shorthorn X BWF	Simmental X Hereford
Feed Consumption/lbs							
Barley	15.4	17.6	17.0	16.3	17.6	17.6	19.5
Corn Silage	10.4	11.1	11.4	10.8	11.4	11.9	13.2
Mixed Hay	1.59	1.94	1.92	1.85	2.03	2.13	2.06
Alfalfa	1.37	1.44	1.46	1.42	1.43	1.42	1.62
TM Salt	.102	0.12	0.11	.11	0.12	0.12	.13
Di cal	.102	0.12	0.11	.11	0.12	0.12	.13
Total/Day/lbs	28.95	32.32	32.00	30.66	32.73	33.31	36.70
Feed/lb gain	9.94	10.58	9.61	9.73	10.6	10.96	10.70
Feed Cost/Steer	148.63	161.29	143.31	137.54	163.99	148.62	181.51
Feed Cost/cwt gain	34.95	31.77	29.43	29.90	32.87	33.49	32.57
Return over feed $	396.47	372.19	410.41	433.43	407.00	438.55	440.97
Assumed Value 2 / $	396.47	408.80	410.41	433.43	435.89	438.55	472.94

2 / Assumed value using $86/cwt for good
$90/cwt for choice

Table 3. Two year average feedlot gains, economics and carcass data – feedlot comparison trial.

	Hereford	Angus X Hereford	M. Shorthorn X Hereford	Simmental X Hereford
Gains:				
No. head	14	14	14	14
Days fed	170.5	160	160	178
Initial wt., lbs.	621.4	636	674.6	691.15
Final wt., lbs.	1069.4	1100	1147.6	1205.9
Gain, lbs.	448	464	473	517
ADG, lbs.	2.66	2.92	2.95	2.94
Economics:				
Feed/head, lbs.	24.70	26.78	29.33	30.47
Feed/lb. gain, lbs.	9.21	9.12	9.52	10.30
Feed cost/head, $	158.41	152.76	167.34	190.46
Cost/cwt gain, $	35.34	32.89	35.26	37.13
Carcass Data:				
USDA – Grade 1 /	4 ch 10 gd	8 ch 6 gd	8 ch 6 gd	6 ch 8 gd
Hot weight, lbs.	619.5	646.5	657.0	702.5
Carcass Value, $	553.87	595.74	607.12	615.70
Return over feed, $	395.44	442.98	439.56	425.44

1984 1 / Choice carcass value $101.00/cwt - good - $91.00/cwt.
Choice carcass value $ 96.00/cwt - good - $90.00/cwt.

1985 1 / Choice carcass value $ 90.00/cwt – good - $86.00/cwt.
Choice carcass value $ 87.00/cwt – good - $80.00/cwt.

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 each experimental breed. This overall study has been undertaken to provide cattlemen with information relative to beef cow efficiency that has been conducted in southwestern North Dakota. This station doesn't have the land base or animals to evaluate a large number of biologically different breeds, but does have the capability of evaluating a small number of crossbred cow types that will be representative in performance to many of the combinations possible in North America.

As stated in the previous discussion, "Feedlot Breed Comparison of First Generation Steers", the breeding model presented here is designed to develop crossbred brood cow types that are biologically diverse which will maximize heterosis when outcrossed to unrelated terminal sire breeds. The first generation breeding scheme 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 and age and weight at puberty.

Replacement heifer calves representative of each breed type were randomly selected at the conclusion of a weaning management study and fed during the wintering period. Rations used the first year were self-fed and consisted of dry rolled barley, chopped mixed hay (crested wheatgrass, bromegrass and alfalfa in approximately equal proportions) salt and dicalcium. Barley made up 30% of the ration at the start and increased to 55% where it was held 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.

The calves were booster vaccinated three weeks before weaning with a 7-way Clostridium vaccine, and were also vaccinated for brucellosis.

As a preventive measure, the heifers were vaccinated for leptospirosis and vibrosis one month before the start of the breeding season.

The heifers were weighed on 28 day intervals with estrus determined with the aid of sterile epididectomized bulls equipped with Chin-Ball® markers. Weight at first estrus was interpolated based on days between two weigh periods.

Starting June 1st, heifers were randomly assigned to an artificial breeding synchronization study. Following the A. I. breeding, heifers were exposed to fertile cleanup bulls.

Summary

Completion of two years of heifer wintering, and one calving season has shown some very distinct differences between the heifer breed types being compared.

All heifer groups made good gains during the wintering phase, ranging from 2.09 lbs/day for the Angus X Hereford crossbreds to 2.38 lbs/day for the Simmental X Hereford crossbreds. Over the two years, the Milking Shorthorn X (Angus X Hereford) heifers have consumed the most feed per day, (28.7 lbs.) and required the most feed per pound of winter gain. (13.1 lb./lb. of gain). These heifers have also had the highest total winter feed cost of $93.47. However, they also exhibited early estrus, with 52.5% cycling in February and 47.5% cycling in March. By contrast, only 8.3% of the Hereford heifers cycled in February, and only 75.3% had exhibited estrus by the end of March.

The Simmental X Hereford heifers were heaviest at first estrus weighing an average of 775 pounds. While based on rather small numbers, 60% of the Simmental X Hereford heifers calved in March and 40% in April, even though their apparent first estrus was scattered from February to May one year earlier.

This trial will be continued for several more years to better document winter growth and efficiency with overall reproduction performance as these heifers become cows.

Actual calving dates of heifers wintered in 1984 and calving in the spring of 1985.

	Hereford	**Angus X Hereford**	**M. Shorthorn X (Angus X Hereford)**	**Simmental X Hereford**
Calving in March	4/9 = 44.4%	10/20 = 50%	4/10 = 40%	6/10 = 60%
Calving in April	2/9 = 22.2%	6/20 = 30.3%	5/10 = 50%	4/10 = 40%
Calving in May	2/9 = 22.2%	1/20 = 5.0%	1/10 = 10%	--
Open	1/9 = 11.2%	3/20 = 15%	--	--

Table 1. Gains and Wintering economics of heifers to be used in the cow efficiency study in 1985.

	Hereford	Angus X Hereford	M Shorthorn X (Angus X Hereford)	Simmental X Hereford
Gains:				
No. of Head	12	12	12	12
Intial Wt. (1-17-85)	585	635	664	617
Final Wt. (5-7-85)	835	856	895	873
Average Gain	250	221	230	256
Days Fed	110	110	110	110
A.D.G.	2.27	3.01	2.09	2.33
Feed and Economics:				
Total Feed/head, lbs.	3388	3517	3826	3744
Feed/Head daily, lbs. (as fed)	30.8	32.0	34.8	34.0
Feed/lb. gain, lb. (as fed)	13.6	15.9	16.6	14.6
Feed cost/day, $	0.7869	0.8126	0.8754	0.8623
Total feed cost, $	86.56	89.39	96.29	94.85
Cost/Cwt. gain, $	34.66	40.41	41.82	37.04

Table 2. Average Ration consumed by breed comparison heifers fed in 1985.

Breed	Dry Rolled Barley	Corn Silage	Chopped Mixed Hay	Dicalcium Phosphate	T.M. Salt	Total lbs.
Hereford						
As fed	8.32	13.32	8.96	0.10	0.10	30.80
Dry	7.49	4.66	7.44	0.10	0.10	19.79
As fed %	27.01	43.26	29.09	0.32	0.32	100%
Angus X Hereford						
As fed	8.62	13.99	9.16	0.10	0.10	31.97
Dry	7.76	4.90	7.60	0.10	0.10	20.46
As fed %	26.96	43.76	28.64	0.31	0.31	100%
Milking Shorthorn X (Angus X. Hereford)						
As fed	9.39	15.29	9.88	0.11	0.11	34.78
Dry	8.45	5.35	8.20	0.11	0.11	22.22
As fed %	27.00	43.96	28.41	0.32	0.32	100%
Simmental X Hereford						
As fed	9.12	14.99	9.70	0.11	0.11	34.03
Dry	8.21	5.25	8.05	0.11	0.11	21.73
As fed %	26.80	44.06	28.50	0.32	0.32	100%

Table 3. Two year (1984 and 1985) average gain and feed efficiency for heifers to be used in cow efficiency study.

	Hereford	Angus X Hereford	M. Shorthorn X (Angus X Hereford)	Simmental X Hereford
Gains:				
No. of Head	31	32	22	22
Days fed	105.5	105.5	105.5	105.5
Initial Wt.	542	601	625	619
Final Wt.	790	820	859	869
Gain	248	219	234	250
A.D.G.	2.35	2.09	2.22	2.38
Feed and Economics:				
Total feed/head, lbs.	2690	2733	3056	2915
Feed/head daily, lbs.	25.3	25.6	28.7	27.3
Feed/lb. gain, lbs.	10.8	12.4	13.1	11.6
Feed cost/day $	.7852	.7890	.8865	.8407
Total feed cost/head $	82.84	83.35	93.47	88.78
Cost/cwt gain, $	33.50	37.94	40.08	35.40

Table 4. Two year (1984 and 1985) average puberty distribution, age & weight.

	Hereford	Angus X Hereford	M. Shorthorn X (Angus X Hereford)	Simmental X Hereford
Puberty Distribution:				
% showing estrus				
February	8.3	6.7	52.5	22.5
March	67.0	77.5	47.5	40.0
April	5.5	15.8	- -	18.4
May	5.5	- -	- -	5
June	8.3	- -	- -	14.2
Not detected	5.4	- -	- -	- -
Average cycle date	88	78	62	84
Calendar date	March 29	March 19	March 2	March 25
Age at 1st estrus				
Days	358	360	347	368
Months	11.8	11.9	11.4	12.2
Average calculated wt. at 1st estrus	698	729	718	775

Vaccination of Pregnant Heifers with an E. Coli Bacterin Vicogen® to Reduce the Incidence and Severity of Calf Scours

by

D. G. Landblom and J. L. Nelson

It is often said that an ounce of prevention is worth a pound of cure. If this is true, then a program of prevention by vaccination rather than treatment by medication would be desirable. Colostrum from hiefers is normally lower in antibody level than colostrum from older cows. Also, heifers tend to produce less milk and are usually poorer mothers than mature cows. Therefore, a pre-calving vaccination program to increase specific immunities in the heifer would seem to be a valid management decision. Recent research at Kansas State University indicates that poor energy input for heifers prior to calving may lower antibody count and in the process, affect the colostrum protection for the calf.

Currently, there appears to be some difference of opinion between U.S. and Canadian workers as to the value of vaccination as a preventive for calf scours.

Work reported by Schipper and Landblom indicated that vaccination of cows with E. Coli bacterins had no demonstrable preventive activity to clinical enteritis in the neonatal calf. Vaccines used in this trial were K99, and the Coligen vaccine.

In other studies by Dr. Schipper, (personal communication) conducted during two calving seasons, 14.6% of Vicogen® and 12.3% of Coligen vaccinated heifers had calves that demonstrated clinical enteritis. Only 5.4% of the control calves (heifers not vaccinated) developed clinical enteritis.

Canadian researchers Makarechian and Acres reported positive results in reducing the incidence of calf scours by vaccinating the heifers with the Vicogen® brand of E. Coli vaccine. In their work, vaccination of heifers with Vicogen® at 7 and 3 weeks prior to start of calving reduced the incidence of calf scours considerably. They concluded that every dollar invested in Vicogen® vaccination returned $5.96 at weaning. They also concluded that had the entire herd been vaccinated it would have increased returns by 12.2% at weaning.

The purpose of this investigation is to evaluate the effectiveness of the E. Coli bacterin, Vicogen® to develop passive immunity and prevent or lower the evidence and severity of enteritis infections.

By the end of the 1983, 1984 and 1985 calving seasons, a total of 259 first calf heifers have been used to evaluate the use of Vicogen®. Heifers used were Hereford and Angus X Hereford crossbreds that were randomly assigned to treatment by age of pregnancy and breed type. In January of each year the heifers were sorted into their assigned groups and vaccinated with Vicogen® bacterin or kept as controls. Three weeks later the heifers were given a 3 cc booster vaccination of vitamins A and D (500,000 I.U. vitamin A and 75,000 I.U. vitamin D per cc) and a 7-way Clostridum booster vaccination.

Both groups of heifers were housed in uniform but separate calving areas approximately 6 acres in size. These areas are equipped with a slotted board fence for wind protection and an automatic waterer. Both calving areas are adjacent to smaller corrals and a maternity barn. As the heifers calved, they were moved into the smaller corrals until they were mothered up and the calves were nursing well. Those heifers requiring assistance at calving were moved directly into the maternity barn. Following delivery the heifer and her calf were usually moved outside into the corrals within 24-48 hours. Groups of cows and calves 4-7 days old were then transferred to a clean ungrazed forty acre pasture.

All heifers were self-fed mixed alfalfa-crested hay using large round bales fed in 8 foot diameter steel hay feeders. Following calving the heifers were fed five pounds of grain (70% oats and 30% wheat mixed) bulked up with chopped hay daily. In addition they had access to mixed hay and limited grazing. Portable 8 X 8 foot plywood calf shelters provided weather protection for the calves.

All births were recorded showing birth weight, birth date, type of delivery, sire and time of calving. Heifers were checked and assisted when necessary on an every three hour schedule around the clock.

All calves were closely watched to see if they nursed and were accepted by their mothers. All calves were checked daily and those showing signs of diarrhea or scours were caught and treated with Sulkamycin S boluses at the rate of one bolus per fifty pounds body weight. Calves were retreated whenever it was deemed necessary. Cost of the Sulkamycin-S bolus was approximately 32¢ per bolus or 60¢ per treatment assuming the calf weighed about 100 pounds.

A summary for the three calving seasons in this investigation is shown in Table 1, and a brief summary of weather data is shown in Table 2.

Summary:

Under the calving conditions of this study during the years 1983-1985, problems with calf scours were minimal. No calves were lost due to scours and most calves requiring treatment responded to a single oral administration of Sulkamycin-S® medication. The low incidence of scours could well be attributed to the overall management and nutrition of the heifers during this trial. Under similar conditions it would be hard to justify the additional labor and expense required to double vaccinate pregnant heifers with the E. Coli bacterin Vicogen®.

Table 1. Three year (1983, 1984, 1985) average scours incidence, treatment and economics of heifers vaccinated with the E. coli bacterin Vicogen® and unvaccinated control heifers.

	Vicogen	**Control**
No. head	133	126
Percent born by month		
February	.6	0
March	64.2	52.5
April	30.6	44.5
May	4.6	2.2
June	--	0.8
No. of live calves	132.00	121.00
Calving percent	99.2	96.0
Calves treated for scours		
Heifers	10	9
Bulls	15	13
Total	25	22
Percent treated	18.9	18.2
Vaccination cost/heifer, $	1.80	--
Treatment cost/lot, $	6.48	16.05
Treatment/calf, $	.71	4.03
Avg. age in days of calf treated		
Heifers	13	11.4
(range in age)	(8-26)	(8-16)
Bulls	12.7	13.3
(range in age)	(6-27)	(1-27)

Table 1a. Summary of scours incidence, treatments, and economics among heifers vaccinated with the E. Coli Bacterin Vicogen® and unvaccinated control heifers. 1983, 1984 and 1985 calving seasons.

	Vaccinated with Vicogen®			Control		
	1983	**1984**	**1985**	**1983**	**1984**	**1985**
No. Head	59	31	43	55	28	43
Percent born by month						
February	1.7	0	0	0	0	0
March	67.8	61.3	63.4	60.0	46.4	51.2
April	27.1	35.5	29.3	38.2	53.6	41.8
May	3.4	3.2	7.3	1.8	0	4.7
June						2.3
No. live calves	58	31	43	54	26	41
Calving %	98.3	100	100	98.2	92.8	95.3
Calves treated for scours						
Heifers	5	2	3	7	1	1
Bulls	9	3	3	9	1	3
Total	16	5	6	16	3	4
% treated	24.1	16.1	14.0	29.6	10.7	9.3
No. treatments/calf	1.5	1.2	1.0	1.4	1.3	1.0
Range of treatments	(1-3)	(1-2)	(1)	(1-2)	(1-3)	(1)
Vaccination cost/heifer $	$ 1.80	$ 1.80	$ 1.80	---	---	---
Treatment cost/lot $	$12.60	$ 3.24	$ 3.60	$13.80	$31.94 2 /	$ 2.40
Treatment/calf, ¢	.90	.64	.60	.86	10.64	.60
Avg. age in days of calf treated						
Heifers	10.2	11	17.7	12.3	8	14
(range in age)	(8-16)	(11)	(9-26)	(10-16)	(8)	(14)
Bulls	13.6	9.6	15.0	12.3	5	22.7
(range in age)	(6-27)	(6-14)	(12-21)	(8-19)	(1-9)	(17-27)

2 / Veterinarian needed for one very sick calf; successful response

Table 2. 1983 and 1984 weather weather conditions during calving season.

1983	**Feb.**	**March**	**April**	**May**
Avg. Maximum temperature, °F.	37.6	36.4	50.4	62.1
Range, °F.	11-58	21-57	31-68	32-86
Avg. Minimum temperature °F.	16.6	20.3	24.4	34.4
Range, °F.	-4-28	3-30	10-44	21-48
Precipitation				
Snow on ground, inches	1	1.5	1.75	9
Rain & melted snow, inches	.05	.95	.32	1.15
Sky conditions				
Days cloudy	19	21	7	18
Days clear	9	10	23	13

1984	**Feb.**	**March**	**April**	**May**
Avg. Maximum temperature, °F.	43.4	36.4	54.5	65.7
Range, °F.	24-58	14-65	28-69	47-91
Avg, Minimum temperature °F.	16.6	14.8	27.1	35.3
Range °F.	-8-29	-12-31	14-38	17-54
Precipitation				
Snow on ground, inches	1	15.5	28.5	0
Rain & melted snow, inches	.11	1.0	2.9	.05
Sky conditions				
Days cloudy	11	21	16	15
Days clear	18	10	14	16

Table 2. Continued.

1985	**Feb.**	**March**	**April**	**May**
Avg. Maximum temperature °F.	27.0	43.1	60.1	72.5
Avg. Minimum temperature °F.	0.8	15.5	28.9	40.7
Precipitation				
Snow on ground, inches	0	13.5	7.0	0
Rain & melted snow, inches	.06	0.68	0.87	4.31
Sky conditions				
Cloudy days	11	12	20	17
Clear days	17	19	10	14

The Castration of Bull Calves with Chem-Cast®

by

James L. Nelson

Until Chem-Cast® became commercially available in early 1984, cattlemen mostly relied on a "jacknife" or other surgical procedure to castrate bull calves. The "rubber band" elastrator or the "pincher" burdizzo method has also been used. However, both of these "bloodless" methods are not without problems. Chem-Cast® is a sterile ready-to-use preparation for injection into the testes of bull calves to effect castration.

In May, 1984, a trial was designed to compare chemical and surgical castration of bull calves weighing approximately 90 to 200 pounds. On May 8, fifty-six bull calves of mixed breeding were weighed and randomly assigned to be castrated surgically or with the Chem-Cast® injection. The calves were restrained in a "calf cradle" where they were branded, vaccinated and castrated. Surgical castration was effected using an "All In One" castration tool. In this procedure, the scrotum of the calf was disinfected. The bottom one third of the scrotum was then cut off and the exposed testicles removed using the castration tool. No blood stop or other material was administered to the open wound. The castration tool was placed in a disinfectant solution between castrations. Efforts were made not to touch the exposed testicles with anything except the disinfected castration tool.

The calves assigned to the chemical castration group were also restrained in the "calf cradle". Two small syringes equipped with Lur-Loc tips and 1½ inch, 20 gauge needles were used to inject the Chem-Cast® solution into each testicle of the calf. Prior to injection, the scrotum was disinfected using 70% ethanol alcohol. The scrotum was squeezed to define the testicles. The needle was inserted into the center of the testicle from the top and the injection completed, with a noticeable increase in testicle size and turgor. Following castration, the calves and cows were placed on crested wheatgrass pasture and observed daily. Approximately two weeks later, the calves were reweighed and visually evaluated for abnormal swelling and infection. (see Table 1 and Table 2) At approximately 205 days of age the calves were again weighed and weaned.

<u>Discussion and Summary:</u>

In 1984 (see Table 1), the Chem-Cast® castrated calves gained 4.2 pounds while the control calves gained less than a pound during the sixteen day post-castration period. However, at weaning, the control steers were 28.3 pounds heavier than the Chem-Cast® steers based on actual weaning weights. This difference was only 11 pounds if we compare adjusted weaning weights.

In 1985, (see Table 2), the differences between each group are small and while weaning weights are not available at this writing, no large differences are expected between groups.

It appears that injection of Chem-Cast® into the testicles of 100-200 pound calves at the recommended rates will effect complete and total castration. Cost of the Chem-Cast® solution in this trial averaged approximately $2.00 per calf. Calves treated with Chem-Cast® did not appear to suffer any noticeable discomfort or pain although several calves had considerable swelling of the scrotum for four to five days following treatment.

This trial may be continued in 1986 depending upon 1985 results.

Table 1. Effects of Chemical Castration in Beef Calves in 1984.

	Chemical Castration	**Regular Castration**
No. of Steers	27	29
Average weight, day of castration	149.1	153.4
Average weight, 16 days post-castration	153.3	154.3
Gain or Loss/steer (lbs)	+4.2	+0.9
Actual Weaning wt. (lbs)	475.8	493.3
Gain/herd	326.7	355.0
Difference		+28.3
Average age at Weaning (days)	219.8	220.5
Adjusted Wean wt. (lbs)	497.4	508.4
Cost of Chem-Cast® per calf	$2.00	

Table 2. Effects of Chemical Castration in Beef Calves in 1985.

Group 1:	Chemical Castration	Regular Castration
Number of Steers	18	18
Weight, day of Castration (May 2, 1985)	156.9	146.4
13 day post-castration weight (May 15)	169.4	158.9
Post-Castration Gain	12.50	12.49
Average Calf weight on August 22, 1985	426.7	414.5
112 day gain	269.8	268.1
ADG =	2.41	2.39
Group 2:		
Number of Steers	7	7
Weight, day of Castration (May 9, 1985)	136.3	125.6
28 day post-castration weight (June 6)	199.4	180.7
Post-Castration Gain	63.14	55.14
Average daily gain	2.26	1.97
Average Weight August 8, 1985	363.57	316.57
91 day gain	227.3	191.0
ADG	2.50	2.10

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.

Scientists and the advancing technology of reproduction now have four compounds available for commercial use to synchronize reproductive cycles in beef 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 C. L. to regress and the animals reproductive cycle starts over again, returning to heat 2-5 days later. The fourth product, Synchromate-B, has a totally different mode of action by harmonally restraining a given group of animals 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.

For the purpose of this investigation only two of the prostaglandins, Estrumate and Lutalyse and the progestogen compound, Synchromate-B are being compared.

Previous research at this Station with the 25 mg prostaglandin compound Lutalyse has shown that a single 25 mg injection system is most economical and that highest conception rates are obtained when inseminations are done according to estrus instead of on a timed basis. Also, in a comparative study using reduced rates, Dr. Gary Williams, NDSU Reproductive Physiologist, found that synchronization results were the same when the dosage per heifer was reduced from 25 mg to 15 mg. This reduction reduced the cost 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 it produces a very tight synchronization and was clearly shown to be a compound formulation that would truly allow cattlemen to artificially inseminate cattle without detecting heat.

Comparing these products, while using reduced dosages of Lutalyse, under field conditions is the purpose of this investigation. The different parameters measured include: The result when reduced dosages of Lutalyse are used, ease of use, number of days labor required for heat detection and handling, labor requirements needed for placement and removal of ear implants, conception rate and overall economics of each method.

The study is now in its second year. The first year Hereford and Angus X Hereford heifers were used and the second year Hereford, Angus X Hereford, Milking Shorthorn X (Angus X Hereford), and Simmental X Hereford heifers wintered at the Dickinson Experiment Station were used.

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 three treatments based on age, weight, breed, and number of heat cycles each had before the start of the breeding season.

Heifers in the Estrumate and Lutalyse groups were detected for heat during the five day conventional pre-synchronization breeding period. On the morning of the 6th day all heifers not inseminated during the 5 day period were given either 2 cc Estrumate or 3 cc Lutalyse intramuscularly using a 1" x 16 gauge needle. After these two compounds were given the heifers were inseminated 12-14 hours after being detected in standing heat. Sterile marker bulls were used to simplify heat detection.

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, norgestamet, and a 2 ml injection containing a solution of norgestamet 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 is 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 norgestamet and estradiol valerate were given using a 1½" x 16 gauge needle and 2 cc hypodermic syringes.

The heifers were inseminated once and placed with clean-up bulls for a total breeding season of 50 days.

The data has been summarized by year in tables 1 and 2. The combined results are shown in table 3.

Summary

Comparing systems, Synchromate-B was much easier to use since no heat detection was required. Using the prostaglandins Estrumate and Lutalyse required heat detection but didn't require catching each heifer individually in a squeeze chute to install and remove implants. Each program has its strengths and weaknesses.

Conception rates changed very little for the Lutalyse and Synchromate-B groups between years. The first year these two products had conception rates of 56.5% and 52.2% respectively. In the second year Synchromate-B's rate increased 2% and Lutalyse conception increased 1.3%. Conception with Estrumate increased significantly between the first and second years from a low of 47.8% to 63.6%, a 15.8% increase.

Using reduced dosages for Lutalyse, under the conditions of this experiement, has not been detrimental to conception, but lowered the cost of synchronization substantially. Cost per heifer conceiving when the two years were combined was $2.33. Estrumate cost per heifer conceiving was $4.50. Synchromate-B's conception rate over the two year period, when compared to the prostaglandin products, is very much the same, however the convenience of not having to detect heat was very expensive costing $14.10 per heifer conceiving.

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

	Estrumate®	**Lutalyse®**	**Synchromate-B®**
No. Head/treatment	23	23	23
No. Head inseminated during 5 day pre-synchronization breeding period	6	6	--
No. head given synchronization drug	17	17	23
No. head not detected in heat and not inseminated	4	3	-- 1 /
No. head having AI sired calves	11	13	12
No. head having calves sired by clean-up bull	9	5	9
No. of open heifers	3	5	2
Conception rate, %	47.8%	56.5%	52.2%
Amount of drug used/head	**500 mg/2 cc**	**15 mg/3 cc**	**Implant and 2 cc injection**
Cost/heifer treated, $	4.00	2.40	7.50
Total cost/lot, $	68.00	40.80	172.50
Cost/heifer conceiving to synchronized estrus $ 2 /	6.18	3.13	14.38

1 / All heifers inseminated by appointment.
2 / Value shown is for synchronization only.

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

	Estrumate®	**Lutalyse®**	**Synchromate-B®**
No. Head/treatment	33	33	24
No. Head inseminated during 5 day pre-synchronization breeding period	14	19	--
No. head given synchronization drug	19	14	24
No. head not detected in heat and not inseminated	1	3	-- 1 /
No. head having AI sired calves	21	19	13
No. head having calves sired by clean-up bull	10	13	9
No. of open heifers	2	1	3
Conception rate, %	63.6%	57.8%	54.2%
Amount of drug used/head	**500 mg/2 cc**	**15 mg/3 cc**	**Implant and 2 cc injection**
Cost/heifer treated, $	4.00	2.40	7.50
Total cost/lot, $	76.00	33.60	180.00
Cost/heifer conceiving to synchronized estrus $ 2 /	3.62	1.77	13.85

1 / All heifers inseminated by appointment.
2 / Value shown is for synchronization only.

Table 3. Combined synchronization results for Estrumate®, Lutalyse®, and Synchromate-B® when used in beef heifers, 1984 and 1985.

	Estrumate®	**Lutalyse®**	**Synchromate-B®**
No. Head/treatment	56	56	47
No. Head inseminated during 5 day pre-synchronization breeding period	20	25	--
No. head given synchronization drug	36	31	47
No. head not detected in heat and not inseminated	5	6	-- 1 /
No. head having AI sired calves	32	32	25
No. head having calves sired by clean-up bull	19	18	18
No. of open heifers	5	6	5
Conception rate, %	57.1%	57.1%	53.2%
Amount of drug used/head	**500 mg/2 cc**	**15 mg/3 cc**	**Implant and 2 cc injection**
Cost/heifer treated, $	4.00	2.40	7.50
Total cost/lot, $	144.00	74.40	352.50
Cost/heifer conceiving to synchronized estrus, $ 2 /	4.50	2.33	14.10

1 / All heifers inseminated by appointment.
2 / Value shown is for synchronization only.

A Comparison of Heat Synchronization Methods in Mature Cows

By

D. G. Landblom and J. L. Nelson

The number of cattlemen that utilize artificial insemination in their breeding program make up a small percentage of the total number of producers breeding cattle. While the number is small, those using AI and synchronization have a definite need. This study is part of the ongoing beef breeding program at the Dickinson Experiment Station.

More than one method is commercially available to synchronize heat cycles. Lutalyse® has been available for several years and Synchromate-B® was released for use in beef and dairy heifers only in the spring of 1983. While Synchromate-B is a relatively easy program to use, since it requires no heat detection, it is a more costly product to use. Lutalyse, when used as a single injection following five days of conventional AI breeding has been shown in studies at this station and across the country to be an effective synchronizer at a lower cost per cow conceiving. In an attempt to further lower the cost of synchronization, the progestogen feed additive compound melengestrol acetate (MGA®) used as a pre-synchronizer in advance of Lutalyse poses a potential to further lower the cost of synchronization.

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 9 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 removed from their mothers, confined next to their mothers with a calf shelter and commercial calf ration for 48 hours. Inseminations were conducted by appointment (no heat detection) between 48 and 52 hours after implant removal.

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 (8 AM), all cows not previously detected in heat were injected with 25 mg. (5 ml) of Lutalyse deep in the rump muscle using a 1½" 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 .75 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 fed in wooden bunks 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.

The progestogen compound MGA has been studied extensively. Research pointed out that MGA could be used as a synchronizer but that a temporary infertility occurred when the compound was fed longer than 9 days. However when fed for 9 days or less adequate synchrony could not be obtained. Based on this information we elected to begin feeding MGA five weeks before the start of the breeding season to allow the cows to have one heat cycle in between MGA feeding and the start of the breeding season. We predicted that a three week holding period would alleviate the temporary infertility problem.

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 breeding season was 60 days.

Crested wheatgrass was grazed from turnout time in early May until after the artificial breeding season was complete. During this time five pounds of barley was fed per head daily as a flushing feed.

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

Summary

Breeding artificially in mature cows following synchronization with Lutalyse, Synchromate-B and an MGA / Lutalyse combination has generated some very useful information for the cattleman using artificial insemination in his breeding program.

Two years of data have been collected for Lutalyse and Synchromate-B. An MGA / Lutalyse combination treatment was added in the second year of the study and therefore, only one breeding seasons data is available.

Conception rates with Synchromate-B and Lutalyse have been variable between years and within years. In year one conception rates for the two products were 77.7% and 76.0% for Lutalyse and Synchromate-B respectively. In year two however, conception rate for Lutalyse increased 4.9% while Synchromate-B’s rate fell 14.1%. Technician fatigue is a possible explanation for the reduction, but is doubtful.

Conception rate with the MGA / Lutalyse combination after one breeding season was 60%. Our primary objective for using this combination was an attempt to improve upon the success previously obtained with Lutalyse while lowering the cost of synchronization.

Comparing using Lutalyse alone with the MGA / Lutalyse system revealed two important aspects. First, using MGA as a pre-synchronizer increased the number of cows in heat and inseminated during the first five days of the breeding season by 46%, and secondly, the conception rate with MGA was 20% lower. It would appear to us that the three week period between MGA feeding and when breeding began was not sufficient time to allow the temporary infertility associated with MGA to correct itself.

Economically, Lutalyse has been shown to be the most consistent synchronizer, being a very competitive and easy product to use. Cost per cow conceiving after two breeding seasons is $3.90. Synchromate-B under the conditions of this study has not been as consistent, requires placing cows in a squeeze chute twice before breeding, and is the most costly product per cow conceiving at $10.78. Although the conception rate with MGA / Lutalyse system was depressed, the cost per cow conceiving was more in line with the Lutalyse system costing $4.61.

This trial is being continued with one change. MGA level was lowered from .75 mg/head/day to .50 mg/head/day in the 1985 breeding season.

Table 1. Summary of Synchronization Methods, 1984.

	Single Injection Lutalyse	**Synchromate-B**
No. head	27	25
No. cows conceiving at synchronized estrus	21	19
No. cows in heat 1st 5 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
<u>Economics:</u>		
No. cows treated	21	25
Cost/cow treated, $	4.00	7.50
Total cost for synchronization in each treatment, $	84.00	187.50
Synchronization cost/ cow conceiving, $	4.00	9.87

Table 2. Summary of Synchronization Methods, 1985.

	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 synchronized calves	3	8	5
Conception Rate, %	82.6	60.0	61.9
<u>Economics:</u>			
No. cows treated	18	9	21
Cost 1 cow treated:			
Lutalyse, $	4.00	4.00	--
MGA, $	--	1.33	--
Synchromate-B, $	--	--	7.50
Total Cost for synchronization in each system, $	72.00	36.00 <u>+33.25</u> 69.25	157.50
Synchronization cost / cow conceiving, $	3.79	4.61	12.11

Table 3. Combined Results of Synchronization Methods, 1984 and 1985.

	Single Injection Lutalyse	MGA/ Single Injection Lutalyse 1 /	Synchromate-B
No. head	50	25	46
No. cows conceiving at synchronized estrus	40	15	32
No. cows in heat 1st 5 days of breeding (%)	11 (22%)	17 (68%)	0
No. cows open and sold	1	2	4
No. cows not having synchronized calves	9	8	10
Conception Rate, %	80.0	60.0	69.5
Economics:			
No. cows treated	39	9	46
Cost 1 cow treated:			
Lutalyse, $	4.00	4.00	--
MGA, $	--	1.33	--
Synchromate-B, $	--	--	7.50
Total cost for synchronization in each system	156.00	36.00 +33.25 69.25	345.00
Synchronization cost / cow conceiving, $	3.90	4.61	10.78

1 / Only one years data.

SECTION II

Progress Reports

of

Range and Pasture Management Research

at the

Dickinson Experiment Station

Short Term Grazing Systems
Dickinson Experiment Station
by
Don Kirby

Short duration grazing systems use: (1) multiple pastures, 3 to 60, (2) 1 to 15 day grazing periods, (3) 30 to 60 day rest periods, and (4) 1 herd stocked at a heavier rate when compared with recommended seasonlong stocking rates. It has been suggested that this system will maintain or improve range condition and increase carrying capacity over conventional rangeland management systems. This project was initiated to test this hypothesis.

The grazing trial began in June, 1981 by dividing section 16, Dickinson Experiment Station Ranch Headquarters, into a 320 acre seasonlong (SL) pasture and 8-40 acre short duration grazed (SDG) pastures. On June 25, 1981, June 22, 1982 and June 17, 1983, 20 cow-calf pairs and 1 bull were allocated to the SL pasture and 35 cow-calf pairs and 1 bull were allocated to the SDG system. June 27, 1984 25 cow-calf pairs were allocated to the SL pasture and 35 pairs allocated to the SDG system. Cattle were rotated every 5 days on the SDG system as pastures received 35 days rest between grazings. Drought, causing low forage production, forced removal of livestock from both systems on September 3 in 1981. In 1982, 1983, and 1984 cattle were removed October 12 and 26, and November 5 concluding 112, 131 and 131 day grazing seasons, respectively.

Forage production and utilization and livestock performance are summarized in Table 1. Forage produced and utilized was similar between grazing treatments in 1981 and 1982. In 1983 the range sites used for estimating forage production and utilization were changed to better represent the "true" sites according to the newly revised Dunn County Soil Survey. We feel the difference in forage production in 1983 on the two grazing treatments is a result of this site change and not an effect of the grazing treatment. Forage production was again greater on the SL treatment in 1984. Utilization of forage is quite similar between treatments from year to year despite the increased stocking rate on the SDG treatment. Livestock performance per head was similar but production of calf per acre was higher each year for the SDG system which reflects the increased stocking rate.

Livestock performance by year, season and 28 day weigh period are shown in Table 2. Data from 1981 was omitted due to the shortened grazing season. Cows gained and maintained more weight over the season on the SL treatment each year. Cows on both grazing treatments began losing weight usually in the 4th weigh period which ran from mid-September to mid-October. Cows on the SDG treatment in both 1983 and 1984 were able to maintain weight better in the latter weigh periods than SL cows. Calf seasonal and daily gains were not different for the SL and SDG treatment in all years. Calf gain also dropped off dramatically in weigh period 4. This suggests some management in fall might be needed to maintain condition of cows and/or weight gain of calves.

Research has shown that various species of grazing animals have different forage preferences. When animals don't compete for the same type of forage, an increase in stocking rate is possible without causing detrimental affects to the condition of the rangeland. Consequently, a study to determine dietary overlap of sheep and cattle on the two grazing treatments was initiated.

Botanical composition (%) of cow diets on the SDG system indicated cattle select more grasses throughout the grazing season (Table 3). Grass averaged over 80% of cattle diets each year and generally increased in diets from early summer through late fall. Forbs were an important part of diets in early summer but were selected less as seasons progressed. Except for 1981 a drought year, browse contributed little to cattle diets in any season.

Botanical composition of sheep diets on the same SDG system indicated that forb use was highest in early summer and summer (Table 3). The last half of the grazing season showed decreases in the amount of forbs selected in diets and increases in grass and browse selection. The decrease in forb use is due to the disappearance of forb species in the latter months of the grazing season and to the decrease in palatability of forbs when mature.

Comparing cattle and sheep diets, indicates that sheep have little dietary overlap with cattle for forbs. The only competitive overlap in diets appears to be for the short, warm-season grass, blue grama. This competitive overlap in diets would appear to increase in the latter part of the grazing season.

In 1985 the grazing trials began June 18. As in 1984, precipitation received was below normal in the early growing season resulting in low total forage production. Preliminary estimates of forage produced are 575 and 685 lbs. per acre for SD and SL grazing treatments, respectively. To date (55 days), cows are maintaining their early season gains while calves are gaining nearly 2.5 lbs. per day. A complete report of results obtained in 1985 will be available after completion of this year's grazing season.

Table 1. Forage production and utilization and livestock performance on short duration grazing and seasonlong systems on the Dickinson Experiment Station.

				Livestock			
		Forage		Cows		Calves	
Year	System	Production (lbs/ac)	Utilization %	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

Table 2. Cow and calf gains (lbs) by year, grazing treatment, weigh period and season on the Dickinson Experiment Station Ranch Headquarters.

		Weigh Period [1/]						
Animal	Treatment						Total	ADG
		I	II	III	IV	V		
				1982				
Cow	SL	50	22	5	-17	-	53	-
	SD	58	4	1	-33	-	30	-
Calf	SL	66	69	61	40	-	231	2.1
	SD	67	68	65	30	-	230	2.1
				1983				
Cow	SL	71	39	20	-2	6	135	-
	SD	74	-26	25	9	11	92	-
Calf	SL	64	69	61	69	22	285	2.2
	SD	69	61	63	62	22	277	2.1
				1984				
Cow	SL	77	23	-14	-48	-25	14	-
	SD	27	20	1	-32	-11	3	-
Calf	SL	70	71	58	29	15	243	1.9
	SD	66	66	61	25	27	239	1.9

[1/] Weights were recorded every 28 days throughout grazing seasons.

Table 3. Botanical composition (%) of cattle and sheep diets on a short duration grazing system, Dickinson Experiment Station Ranch Headquarters.

		Season				
Year	**Class**	**ES**	**S**	**F**	**LF**	**Mean**
		Cattle				
	Grass	87	92	85	-	88
1981	Forb	12	4	1	-	6
	Browse	1	4	14	-	6
	Grass	71	82	87	87	81
1982	Forb	25	14	9	9	15
	Browse	4	4	4	4	4
	Grass	86	88	93	95	91
1983	Forb	13	11	6	4	8
	Browse	1	1	1	1	1
		Sheep				
	Grass	43	45	75	72	59
1983	Forb	56	51	17	21	36
	Browse	1	4	8	7	5
	Grass	35	45	47	33	40
1984	Forb	64	40	16	4	31
	Browse	1	15	37	63	29

Complementary Rotation Grazing System – 1985
Dickinson Experiment Station

By

L. L. Manske and T. J. Conlon

Complementary grazing uses tame grass or annual crop pastures to add to or complement native range pastures. Research on tame grass and the use of tame grass pastures has been conducted at the Dickinson Experiment Station since 1907 (Waldron 1908). Crested wheatgrass has been included in the studies since 1920 (Moomaw 1922). Grazing studies on crested wheatgrass have been conducted since 1955 (Whitman, Langford, Douglas and Conlon 1963). Grazing research on complementary grazing systems has been conducted since 1972 using steers (Nyren, Whitman, Nelson and Conlon 1983) and since 1978 using cow-calf pairs (Manske, Nelson, Nyren, Landblom and Conlon 1984).

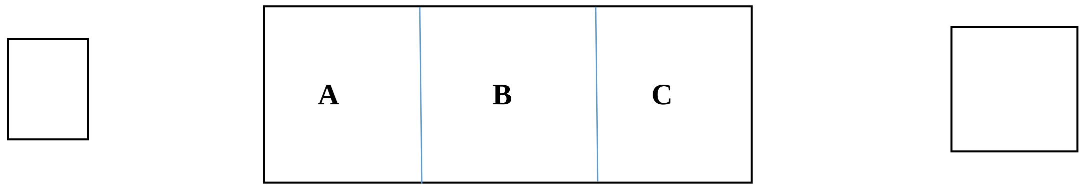
Management to maximize herbage and livestock production on native range in the Northern Great Plains should delay grazing until mid June (Campbell 1952, Whitman 1954, Rogler, Lorenz and Schaaf 1962, Dodds 1971, and Smoliak, Kilcher, Lodge and Johnston 1982). Grazing of native range in May has detrimental effects on the grass plants. Annual total herbage production is reduced by 40% to 60%. This lost herbage production is never available to the grazing animal and the carrying capacity of the pasture is greatly reduced. Grazing native range in May is extremely costly to the producer in lost production potential.

The livestock producer has a couple of other choices on what to feed his cattle in the spring besides grazing native range. One is to continue feeding hay and the second is to develop tame grass pastures. Crested wheatgrass is still the best spring pasture grass that has been developed for western North Dakota. Crested wheatgrass can be grazed from late April, in most years, until the native range is ready to graze in June. Native range grasses are generally very nutritious in early summer and good animal weight gains can be maintained. The nutritional quality generally decreases in late summer and calf weight gains are generally at the expense of the cow. Tame grass pastures of wildrye are of higher nutritional quality than native range in early fall. Cow and calf weight gains are improved on fall grazed tame grass pastures. Dry cows can graze on altai wildrye until early December without protein supplementation. With supplementation, the cows could graze until the weather dictated their removal.

The 1985 grazing season was the third year of the complementary rotation grazing system at ranch headquarters of the Dickinson Experiment Station. The complementary system consists of a crested wheatgrass pasture for spring grazing, a native range three pasture rotation with twice over on each pasture for summer grazing, and an altai wildrye pasture for fall and early winter grazing.

Complementary Rotation Grazing System

Crested Wheatgrass | **Native Range** | **Altai Wildrye**



Grazing Schedule

Crested Wheatgrass 1 Pasture	30 days	1-31 May
Native Range	137 days	1 June-15 Oct.

	1st Rotation	**2nd Rotation**
Pasture A	15 days 1 June – 15 June,	30 days 31 July – 31 Aug.
Pasture B	15 days 15 June – 1 July,	30 days 31 Aug. – 30 Sep.
Pasture C	30 days 1 July – 31 July,	15 days 30 Sep. – 15 Oct.

Altai Wildrye 1 Pasture	60+ days	15 Oct. – 15 Dec. or later

The purpose of this study is to attempt to: Maximize herbage and livestock production, Lengthen the grazing season in the spring and fall, Improve range condition of native range, and Reduce acreage required to carry a cow and calf.

The data that is collected is above ground herbage production from inside and outside exclosure cages, quantitative species composition and animal weight gains or losses.

Mean Herbage Production in lbs/acre

	1983	**1984**	**1985 (to 1 July)**
Crested Wheatgrass	1663	1661	1851
Native Range			
Clayey (18%)	1337	1142	1666
Sandy (26%)	1416	1231	1962
Shallow (28%)	1084	884	1259
Silty (18%)	1618	1413	1834
Altai Wildrye	2020	4058	3967

	Total % Basal Cover, 1982 & 1984		
	Live Vegetation	**Litter**	**Soil**
1982	30	54	16
1984	36	63	1

The condition of the pastures has improved since the beginning of this study. The plant species composition has improved and the herbage production has generally improved in relation to environmental conditions. The stocking rate has been increased annually as the condition of the pastures has improved.

	Stocking Rate				
	acres/AUM				
	S.C.S. recommended	**1983**	**1984**	**1985**	**1986 projected**
#Cow-calf pairs	13	16	19	24	26
Crested Wheatgrass		0.83	0.90	0.75	0.69
Native Range	4.07	3.33	2.75	2.18	2.00
Altai Wildrye		2.70	0.63	0.63	0.58

	Animal Weight Gain **Mean gain/day/head**		
	Crested Wheatgrass	**Native Range**	**Altai Wildrye**
1983			
Cow	2.65	0.82	0.51
Calf	1.76	2.21	1.52
1984			
Cow	3.11	0.25	0.02
Calf	2.14	1.96	1.16
1985 (to 30 Aug)			
Cow	2.20	1.37	
Calf	1.88	2.29	
Mean			
Cow	2.65	0.81	0.27
Calf	1.93	2.15	1.34

Animal gains have been good on the complementary rotation grazing system. The calf gains have been close to or above 2 pounds per day. Cow gains have been acceptable. Cows on season long native range grazing systems generally experience a weight loss in late July or early August through the removal date. The cows on this system have not experienced this customary weight loss until late September or early October.

The grazing season on the complementary rotation grazing system at the Dickinson Experiment Station has been 228 days (7.5 months) from 1 May to 15 December with the potential to expand to 255 days (8.4 months) from 20 April to 31 December. This is compared to the traditional grazing season of 183 days (6 months) from 15 May to 15 November.

The acreage required to feed a cow and a calf for the 7.5 months on the complementary grazing system in 1985 will be 11.82 acres. It would require 24.42 acres to feed the same cow and calf on a 6 month season long grazing system on native range alone in the same area.

If a livestock producer used a complementary grazing system similar to the one used at the Dickinson Experiment Station, he could: Lengthen the grazing season, Reduce the acreage required to feed a cow and calf, and Increase the amount of saleable beef from his unit.

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SECTION III

Special Report

Crossbreeding With A System

and

Electricity Used and Operation of Different Designs of Livestock Water Fountains

by

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Prepared for Dickinson Experiment Station Research Roundup, October 9, 1985

CROSSBREEDING WITH A SYSTEM

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INTRODUCTION

Tough economic times dictate the use of proven management practices virtually guaranteed of being cost effective. Many management techniques have come along from research and industry to benefit the cattlemen. Some are simple, inexpensive and easy to administer such as implants and fly tags. Some are more complex, take years to incorporate and are more difficult to manage such as grazing systems and crossbreeding.

A system is defined as "a group of units combined to form a whole operation in unison." In crossbreeding, the cattle in the system should meet the goals of the producer within the environment available. Combining breeds has too often been a fad oriented, haphazard decision making process.

This article describes an approach to crossbreeding and results to date for an integrated beef production system.

CROSSBREEDING PROGRESS REPORT AT THE CARRINGTON IRRIGATION STATION LIVESTOCK UNIT

Efficient beef production means rapid early growth with excellent conversion of forages and grains to marketable beef. Previous studies at this station used straightbred Herefords for comparing diets, management and other variables. The high quality forage produced under irrigation in the form of corn silage and alfalfa hay may lend itself to more efficient use in cattle with more genetic potential for milk production. Altering the amount of residue (straw or stover) in the ration will allow the producer to feed to the needs of the lactating female much as dairymen do. The next step was to design a breeding project in which we can compare cows of different milk production potential yet similar in mature size and other traits. The three way rotation crossbreeding system was selected. Females in the system will be up to 67% from one of the three breeds. A straightbred Hereford herd will be used as a control. The three breeds used in the rotation are Hereford, Red Angus and Tarentaise.

Herefords are known for their fertility, easy fleshing, hardiness, mothering ability and wide accurate selection of germ plasm available. Red Angus was chosen to compliment the Hereford. The cross produces the baldy cow which is an industry standard known throughout most of the northern plains. The red color, polled trait, fertile females, easy calving and increased carcass quality are major features of the breed. Tarentaise was selected for strong maternal ability, easy calving, increased milk production and lean growth in the feedlot. Relatively little information is available on the Tarentaise breed. Many other breeds could have been used successfully in this trial. The cow herd will be red to red white face, polled, strong maternally yet efficient and productive. The goal of this beef enterprise is to maintain an 1100 lb. cow herd, that produces 1100 lb. steers in 11 months.

The three breed rotation is the most productive breeding system that is self perpetuating according to computer modeling and preliminary work done at other stations. It allows for high heterosis values for maternal and individual performance traits. Certain criteria for selection of breeds should be followed when using the three way rotation crossbreeding system. Each breed should be similar in mature size, fairly strong in maternal traits and contribute some unique traits to the system. Extreme types or exceptional traits cause management problems and reduce the uniformity of the progeny. The three breed rotation requires three breeding pastures or pens or the use of artificial insemination. As the system is developed, each female is bred to the breed of sire she is least related to.

Breeding decisions have long term effects on a cattle enterprise, likewise data from a trial in breeding systems accumulates relatively slowly. This project was initiated in 1980. Up to now F_1 crosses developed as the intermediate step to the three way cross have been evaluated. The first set of 3-way cross heifers calved in 1985 with calves sired by Hereford bulls. The following reports cover different periods in the production cycle and serve to measure progress of this breeding project.

CROSSBRED CALVES FROM STRAIGHTBRED COWS

The third step in starting a crossbreeding program is to start with your present herd. The straightbred Hereford females at the Carrington Irrigation Station were bred randomly to Hereford (H), Red Angus (R) and Tarentaise (T) sires. Different numbers of progeny in each breed group are the result of different numbers of cows in each management group, clean up bull allotment and chance. Data in table 1 presents the information from calving through weaning for all progeny over a 4-year period. Little difference is detected at calving. Slightly higher birth weights for Tarentaise sired calves did not have a great effect on assistance required. Weaning data shows a greater actual weaning weight for RH calves at 419 lb. in mid-September but age adjustments to 205 day gives a slight edge to TH calves. Crossbred calves from straightbred cows averaged 11 pounds heavier than straightbred calves.

Table 1. **CROSSBRED AND STRAIGHTBRED CALVES FROM STRAIGHTBRED HEREFORD COWS**
4-Year Summary

	Hereford	Red Angus	Tarentaise
Calving:			
Number of Head	111	149	132
Average Birth Weight (Lb)	85	82	86
Assisted Births (%)	11	10	12
Number Sires Reported	11	10	9
Weaning:			
Number of Head	109	149	131
Actual Weaning Weight (Lb)	396	419	403
Adjusted Weaning Weight (Lb)	509	518	522

CROSSBRED VS STRAIGHTBRED COWS

The data in the table below are a summary of two years trials. It represents performance of the cow and calf from early May to weaning in mid-September. Cows were offered a ration of 40 lb. corn silage and 15 lb. chopped alfalfa hay daily. Calves were allowed to free choice creep feed consisting of half chopped hay and half rolled grain (oats and barley).

Cow weights were similar at the start of the summer drylot management trial. During the summer, RH cross cows lost more weight than the TH or the straightbred HH cows. Calf performance favored the progeny from the crossbred cows by a substantial margin. End weights in this trial taken in mid-September reflect a 42 to 51 pound advantage over calves from straightbred cows. Calves from crossbred cows were sired by mostly the same sires as calves from straightbred cows. Growth rate was highest for the three way cross calves when compared to the straightbred and two way cross calves.

Table 2. PREWEANING PERFORMANCE OF CROSSBRED & STRAIGHTBRED COW/CALF PAIRS IN DRYLOT (2-Year Summary)[1]

Breed of Dam[2]	**HH**	**RH**	**TH**
Breed of Sire	**H, R, T**	**T**	**R**
Number of Pairs	19	41	28
Cows:			
Start Wt. (lb)	1038	1044	1040
End Wt. (lb)	1046	1026	1040
Gain/Loss (lb)	+ 8	- 18	0
Calves:			
Start Wt. (lb)	149	173	175
End Wt. (lb)	409	451	460
Avg. Daily Gain (lb)	2.15	2.30	2.41

1. Trial started mid-May and ended mid-September
2. H=Hereford, R=Red Angus, T=Tarentaise

FEEDLOT AND CARCASS DATA

All calves were weaned in mid-September and placed on a growing ration for 3 to 4 months until reaching approximately 700 pounds. A high energy finishing ration was fed until slaughter in April and May. During the feedlot phase of the trial, HH steers gained the fastest on less feed than any of the crossbred steers. F_1, RH and TH steers genrally were quite close in rate of gain and feed efficiency. Three way cross steers were less efficient and gained slower than any of the other groups. Carcass evaluations revealed that RX steers had higher carcass value due to higher USDA quality grade than other breed groups. TX steers were leaner with less waste and larger loin eye area than other groups.

Table 3. FEEDLOT PERFORMANCE OF STRAIGHTBRED AND CROSSBRED STEERS (4-Year Summary)

	HH	RH	TH	3X[1]
Number of Head	56	64	63	27
Start Wt. (lb)	439	453	440	501
End Wt. (lb)	1090	1090	1080	1109
Avg. Daily Gain	2.72	2.66	2.59	2.50

1. 2-Year's Data Only

Table 4. CARCASS DATA FROM STRAIGHTBRED AND CROSSBRED STEERS (4-Year Summary)

	HH	RH	TH	3X[1]
Number of Head	50	61	60	25
Hot Carcass Wt.	633	653	648	669
Dress %	60.68	62.40	62.26	61.73
Length	48.05	48.36	49.01	49.22
Loin Eye Area	10.81	11.11	12.00	12.53
Fat Thickness	.45	.52	.28	.37
KPH %	2.34	2.77	2.62	2.71
Yield Gain[2]	3.10	3.33	2.40	2.53
USDA Quality Gr.[3]	8.88	9.66	9.08	9.51

1. 2-Year's Data Only
2. 1 = Very Lean 5 = Very Fat
3. 9 = High Good 10 = Low Choice

BACKGROUNDING REPLACEMENT HEIFERS

One of the most crucial management areas for cattlemen is growing out replacement heifers. The period from weaning to breeding is crucial to a highly productive cows' start in the herd. Genetic advantages and management tools are places to improve production and reduce costs. Table 5 gives information on growing replacement heifers summarized for the last 4 years. Heifers were fed chopped alfalfa hay and corn silage approximately half and half by weight as fed. Bovatec or Rumensin was also used in the ration. All growth rates and final weights were very satisfactory and well above minimums suggested for heifers to be cycling at breeding. F_1 cross females (RH and TH) exhibited slightly faster rates of gain. Three way cross (3X) females were 50 pounds heavier coming into the trial and exhibited lower average daily gains.

Table 5. **BACKGROUND REPLACEMENT HEIFERS (4-Year Summary)**

	HH	**RH**	**TH**	**3X**[1]
Number of Head	27	54	47	22
Start Weight. (Late Sept.)	411	432	430	472
End Weight (Early May)	731	777	763	753
Average Daily Gain	1.42	1.54	1.49	1.31

1. 2-Year's data only

PELVIC MEASUREMENTS

Prebreeding pelvic measurement has been suggested as a management tool to reduce calving trouble and associated production losses and Veterinary bills.

A relatively high correlation of .7 exists between prebreeding and precalving pelvic measurements making it useful as a culling tool. Table 6 gives pelvic measurements by breed group prior to breeding in May, 1985. Variation is high between individuals of the same weight. Three heifers were culled due to small pelvic openings. A rule of thumb is heifers should generally be able to calve unassisted if the calf weighs, in pounds, half the number of the pelvic opening, (i.e., heifer with a 180 sq cm pelvic opening should be able to have a 90 lb. calf unassisted). This rule applies only to prebreeding pelvic measurement. Analyzing the data for pelvic measurements suggests a linear relationship between weight and pelvic opening.

Table 6. **PELVIC MEASUREMENT AND WEIGHT OF REPLACEMENT HEIFERS PRIOR TO BREEDING – 1985**

	HH	**RH**	**TH**	**3X**[1]
Number of Head	3	14	10	12
Average Weight (lb)	685	781	771	725
Avg. Pelvic Opening (sq cm)	170	188	191	175

One year's experience with precalving pelvic measurements does not completely agree with general trends. Lighter birth weight calves from HH first calf heifers produced a calving score of 2.00 with 1 being unassisted and 5, a C-section. The lighter weight heifers (969 lbs.) had an average pelvic opening of 201 sq cm, comparing relatively close to measurements of 206 for RH and 209 for TH heifers. This emphasizes the need to grow out replacement females prior to calving to reduce calving problems as much as possible. Birth weights of calves from RH and TH cows were heavier at 83 and 81 lb. respectively than from HH cows. Sire effects may account for some differences but at 75 lbs., average birth weights were not excessive for any sire represented. TH females had the easiest time at calving yet produced a higher proportion of bull calves.

Table 7. **PRE CALVING PELVIC MEASUREMENTS**

Breed of Dam	**HH**	**RH**	**TH**
Breed of Sire	**H, R, T**	**T**	**R**
Number of Head	7	14	14
Pre Calving Wt. (lb)	969	1053	1033
Pelvic Area (sq cm)	201	206	209
Calving Difficulty Score[1]	2.00	1.93	1.57
Birth Weight (lb)	75	83	81
Sex Ration[2]	.17	.46	.64

1. 1 = Unassisted 2 = Easy Pull 3 = Mechanical Pull
   4 = Mal-Presentation 5 = C-Section

2. 1 = Male 0 = Female

REBREEDING PERFORMANCE

Preliminary information on rebreeding performance favors the British type female of lower milk production potential in the drylot environment. Altering the rations by offering more energy to the dairy cross type female may be necessary to keep her bred and producing. The economics of this are yet to be evaluated. With two sets of first calf heifers and one set of 3 year old cows included in the data, 11% of the HH cows were open, 5% of the RH cows and 29% of the TH cows after a 45 day breeding season (Table 8).

At this point in the study, British cross females (i.e. red baldies) appear to be more fertile than the other two groups.

Table 8. **REBREEDING PERFORMANCE OF STRAIGHTBRED AND F_1 CROSSBRED COWS (2-Year Summary)**

Breed of Dam	**HH**	**RH**	**TH**
Number of Head	18	40	28
Number Open	2	2	8
Percent Open	11	5	29

CONCLUSIONS:

Generally, each of the breeds selected for the rotation are contributing the traits for which they were chosen. The three-way cross female is yet to be evaluated. Any system of breeding or breeds used can be successful if the producer provides the required inputs. Optimum production generally comes with cattle that are not extreme but excel in many areas of which maternal traits and efficient conversion of forage are foremost. Efficient production comes with integrating a beef enterprise into a farming operation to enhance the value of forages and residues and serve as a marketing channel for them.

Electricity Used and Operation of
Different Designs of Livestock Water Fountains

of

V. L. Anderson

Mother nature kindly provided -100° wind chills and several consecutive days of -20° to -35° F temperatures during a field trial evaluating automatic livestock waterers at the Carrington Irrigation Station Livestock Unit. Several different designs of waterers were studied. Observations were made on energy requirements and performance of individual waterers during the past three North Dakota winters. The following designs were evaluated (1) standard metal automatic water fountain, (2) super insulated standard metal fountain, (3) concrete fountain, (4) recirculating fountain and (5) energy free waterer.

The standard automatic water fountain has electrically heated reservoirs and a float valve centrally located under a protective cover but readily accessible for maintenance. Two widely used waterers were used to represent this design, the Ritchie No. 5 and the Pride of the Farm Model WE-4 and Model WE-50. The second design studied was a home insulated version of the standard fountain. A Pride of the Farm Model WE-4 was super insulated with 2" of styrofoam surrounding the exterior housing of the waterer. A plywood cover protects the insulation. The concrete waterer is the same basic design as the standard metal fountain but is made of poured concrete insulated inside with 2" of styrofoam. The fourth design in the study was a recirculating waterer that required no supplemental heat. The Johnson Artificial Spring has a submerged pump that runs continually to recirculate water from a fiberglass reservoir 10 feet in the ground to the surface bowl. A 24" culvert, 10 feet long, connects the buried reservoir with 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 the water level drops. A fifth design in the study was an energy free waterer. The Mirafount 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" in diameter, installed to a depth of 10 feet, provides a place for the insulated feeder line to come up to the waterer from the buried line. Drinker floats block out the cold winter wind and reduce heat loss from the surface of the water. A minimum of four cattle are required to keep the waterer operational during the subfreezing weather according to the company.

All waterers in the study were in fenceline installations with 20 to 30 head of cattle on each side. Water temperature was maintained at 40-50° F. Electrical meters calibrated by the NDSU Ag. Engineering Dept. were installed on the circuit to the waterers. Energy use was monitored from early November through late March.

The results of the first year were somewhat inconclusive due to the exceptionally mild winter. Temperatures during the winter were the second warmest on record and the waterers were not really challenged. The second winter provided a real challenge however with two weeks in December of near record setting cold. The third winter all waterers performed relatively satisfactorily during the test. Extreme cold dictates daily checks for frozen floats, valves, etc. Most waterers required thawing once or twice during -25° weather. The standard design fountains required a heat tape or bulb installed on the riser pipe to prevent freezing.

Electrical usage is reported in table in terms of KWH per day. Electricity was turned on an average of 140 days per winter extending from early November to late March. Occasionally, periods of warm weather occurred in the fall and spring when electricity could have been turned off manually or by properly adjusted thermostats. Periodic checking of water temperature is suggested as some thermostats tend to drift and cause excessive heating of water in the bowl.

The Mirafount required no electricity but was occasionally thawed out with hot water when temperatures dropped to -30° or colder and wind chills approached -100°. A thin layer of ice formed on some areas of the Johnson Artificial Spring but was easily removed during the same extreme conditions. Running 24 hours per day, average electrical cost was $.43 per day compared to $.50 for the Bohlman, $.61 for the super-insulated, $.70 for the Ritchie and $.75 for the Pride of the Farm.

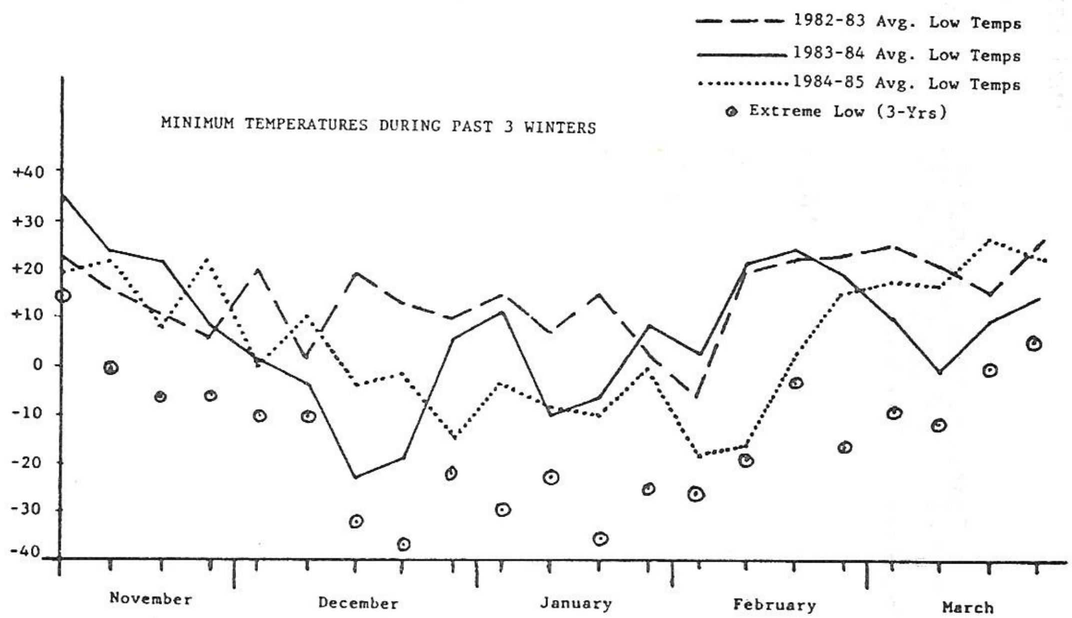
Initial costs vary from $300.00 for the Pride of the Farm Model We-50 to $695.00 for the Mirafount.

The recirculating waterer partially froze over during the bitter cold temperatures. This waterer ran 24 hours per day. It is possible to install a timer in the Johnson Artificial Spring waterer to reduce electricity used. The self draining feature of the bowl prevents freeze up when the power is off. Running time of the waterer is based on the number and type of cattle being watered. If the waterer were run for only two hours per day instead of twenty-four, power costs would drop from $60.48 for the winter to $5.04 with electricity priced at .08/KWH. When the pump is operating, the sound of falling water seems to attract animals, especially young calves or newly placed feeders. This waterer requires electricity to operate throughout the year, other designs require electricity for heating only during sub-freezing temperatures. The Johnson Artificial Spring is sold in a kit form with the 24" x 10' culvert procured locally. The height of the waterer can be adjusted using a culvert splicing collar.

The Mirafount is constructed of high impact black polyethylene. Specific installation instructions are provided along with specialized parts. Animals easily adapted to depressing the drinker floats to find water when the built-in drinker float hold down was used. Water dripping from cows after drinking would freeze around the top and float area requiring occasional removal at -25° and colder. Continued build-up would prevent drinker floats from sealing allowing freezing inside the reservoir.

Some techniques can be used to improve energy use efficiency that were not all incorporated in waterers in this trial. A "thermal blanket" available from and used on the Pride of the Farm waterer Model-50 reduces water surface. It is a closed cell ¼" thick foam layer cut to slightly smaller size than the water surface. It is held in place by nylon cord tied to weights at the bottom of the reservoir. Mounting a fenceline waterer 90 degrees opposite recommended orientation allows covering one reservoir during cold with resultant heat savings from reduced wind and water surface exposed. Waterers can be manually covered with tarps or fitted covers at night during extreme cold.

There are several more brands and sizes of commercial waterers available. This trial should help producers evaluate waterer designs included in the study. No single fountain or system is foolproof. All require checking and occasional maintenance in a frigid climate. Much of the operational success depends on strictly following manufacturers installation instructions. The question which waterer is "best" is answered best by each producer. Intial cost, electricity costs, installation, parts availability, waterers presently used and number of animals serviced may all affect this judgement.


1982-83 Avg. Low Temps
1983-84 Avg. Low Temps
1984-85 Avg. Low Temps
Extreme Low (3-Yrs)
MINIMUM TEMPERATURES DURING PAST 3 WINTERS
+40
+30
+20
+10
0
-10
-20
-30
-40
November
December
January
February
March

Livestock Water Fountain Electrical Usage
Final Report

	Standard Metal Fountains			Super Insulated Std. Fountain	Concrete Fountain	Recircu-lating 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
Price	281.75	300.00	304.99	281.75 + insul.	338.95	460.00	695.00
KWH/Day	9.99	9.32	8.70	7.65	6.31	5.40	0
Cost/Day	.80	.75	.70	.61	.50	.43	0
Cost/Winter	111.89	104.38	97.44	85.40	70.67	60.48	0

SECTION IV

Special Report

Effects of Implanting Spring Steer Calves with Testicular Tissue and Compudose

by

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Central Grasslands Station

Effects of Implanting Spring Steer Calves
With Testicular Tissue, Compudose and
Testicular Tissue and Compudose in Combination
By
Tom D. Stromberg

Introduction:

In the past several years a considerable amount of work has been done in the practice of spaying (ovariectomizing) heifers and transplanting a part of the ovarian tissue back into the animal. Dr. D. H. Hastings of Bismarck, North Dakota became intrigued with the transplant concept after reading about South African Veterinarian Dr. P. H. LeRoux who was using autografting (transport of part of ovary within the animal) to prevent the total castration effect in dogs. Hastings speculated that what LeRoux found to be true in his experiments with ovariectomized autografted bitches would also occur in heifers. In Hasting's pilot study, funded by the North Dakota Beef Commission, ovary autografted heifers out-performed their spayed controls significantly in feedlot performance.[3] The autograft becomes like a permanent implant – it should continue to produce estrogen (the female sex hormone) for some time after the graft and produces natural growth stimulation without the objectional features of chemical estrogen implants.[1] Normally, any castrated or spayed animal loses 10% of its capacity for efficient weight gain.[1] It became Hasting's contention that the mechanism causing ovarian autografted heifers to undergo heightened weight gain was that the estrogen from the implant increased the spayed animals' appetites by keeping thyroxine levels high.[2]

LeRoux had reported that, "Testicular transplants have been adequately reported in lab animals and the effect of castration and ovariectomy is identical in respect of thyroid function."[5] He had tried transplants on both male and female dogs and got survival of the graft in both. In males, subsequent histology showed metabolically active intestisal cells while in the females, the grafts are comprised of primordial to graffian follicles and contain some very cellular germinal epithelium which remains metabolically active for at least up to a year post transplantation.[8] These grafted cells should therefore produce sex hormones.

From these findings came the idea to try testicular implanting of steer calves. Dr. Hastings contacted the Central Grasslands Research Station early in 1985 and this project resulted from our discussions. All attempts were made to keep techniques practical and consistent with normal castration and implantation procedures. The significance of this procedure as well as that of ovarian autografting and their potential effect on the meat industry is quite exciting, especially in light of the public becoming wary of synthetic products, including synthetic hormones used in beef production.

Materials and Methods:

The entire 1985 steer calf crop at the Central Grasslands Research Station was randomly sorted into four treatment groups across all grazing trials for the 1985 grazing season according to birth date, age and breed of dam, and sire. The four groups were:

Group I – Control, no implant
Group II – Compudose
Group III - Compudose and testicular implant
Group IV – Testicular implant

On the 23rd and 24th of May all cows and calves were processed and sorted into their respective pasture groups to start grazing trials on May 28th. All bull calves were treated the same in every respect except implant i.e. branded, castrated, vaccinated with a 7-way clostridium vaccine, and horned calves dehorned. Castration was done by splitting the scrotum with a knife and removing the testicles and as much cord as possible.

The testicular tissue implantation was made by taking one testicle from each calf, splitting the tunica albiginua which is the membrane around the testicle with a scalpel, shelling out the inner "pulp" and pushing 1/2 - 3/4 cc into the barrel of a small syringe the inside of which had been coated with gentocin sulfate solution (50 mg/cc) to help avoid contamination and subsequent infection. The testicular tissue was then implanted through a 1" x 18 GA needle into the soft tissue at the base of the right ear – Compudose implants were put into left ear.

Calves were weighed initially on May 28th when grazing trials began and were scheduled to be weighed at 56 days (7/24) and from then on at 28-day intervals until weaning in early to mid-October depending on range conditions.

After a 3-4 week preconditioning period to get calves weaned and started on feed, the steers will be sorted and penned by implant treatment. This will allow for detecting possible differences in feed efficiency as well as rate of gain for post-weaning performance. The steers will be finished and carcass data collected to analyze those differences if any exist. Additionally, after weaning and preconditioning, at least a sample of steers from each group will be bled and samples assayed for testosterone and thyroxine levels.

Results to Date:

Steer calf data – implant study 1985

Treatment	Number of Animals	5/28 Initial Avg. Wt.	ADG 5/28-7/24 (56 days)	ADG 5/28-8/21 (84 days)	Avg. Wt.	ADG (___days)
1	29	164	2.37	2.30	-----	-----
2	32	161	2.34	2.27	-----	-----
3	28	172	2.62	2.46	-----	-----
4	31	179	2.40	2.30	-----	-----

Discussion:

Since this project is currently in progress (at this writing 84-day weights have just been taken) it is too early to discuss in depth or make conclusions. However, the testicular implant in combination with Compudose looks promising although there is no explanation for not seeing some response to either type implant over controls. It is hoped we will get survival of the graft, to produce enough testosterone to stimulate growth, however not enough to produce secondary sex characteristics which could influence steer behavior and carcass characteristics.

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SECTION V

Special Report

Bovine Respiratory Disease
Present Perspective, Future Prospects

by

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BOVINE RESPIRATORY DISEASE
PRESENT PERSPECTIVE, FUTURE PROSPECTS

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A review of progress made in the control of bovine respiratory disease (BRD) over the past 15-20 years ends in disappointment. In spite of the availability of effective vaccines and innovative management strategies BRD still is the most costly disease facing the beef cattle industry.

In order to place this disease issue in the proper perspective it would be helpful to review some of the complexity of contributors to the disease and then examine what the future holds for controlling or modifying these contributors.

AGENTS INVOLVED IN BRD

1. **VIRUSES –** It is quite well recognized that a virus or viruses act as triggers to initiate respiratory disease. This probably is done in several manners. Some viruses inhibit the action of cilia in the respiratory tract – thus not sweeping air passages clear of the many bacteria that are breathed in. Viruses can also depress the immune system, making the calf more susceptable to any infection. Other mechanisms are also important.

1. IBR Virus – (Infectious bovine rhinotracheitis or "Red Nose") is probably the best known respiratory virus. It usually does not produce severe respiratory disease by itself but can initiate disease with the combination of stress and bacterial infection. It is often responsible for severe disease in heavier feedlot cattle. Effective vaccines, both modified live and inactivated, are available. The modified live vaccines have the disadvantage of producing persistent infections. However, molecular studies with the virus at the Department of Veterinary Science, NDSU, should produce information that will make it possible to engineer a vaccine without this disadvantage and yet retain all the advantages of modified live vaccines.

2. PI-3 Virus – (Parainfluenza 3) – the earliest virus associated with BRD, mainly because it is relatively easy to isolate. The virus can be often isolated from clinically normal animals. Again, a combination of stress and bacteria can result in disease triggered by the virus.

3. BVD Virus – (Bovine virus diarrhea) is probably one of the most, if not the most, economically important viruses or disease agents in cattle. It can cause a variety of disease conditions, including respiratory disease. The complexity and multiplicity of disease conditions involving BVD are probably due to several subtypes of the virus varying in disease producing capability. However, at the present time only one type of virus is recognized. The virus is known to suppress the immune system, however, this in itself does not explain all the disease manifestations attributed to the virus.

4. Bovine Respiratory Syncytial (sin-si'-shul) virus (BRSV) has been recognized in cattle for about 15 years. Many do not accept that the virus is an important respiratory disease producer. As more and more evidence accumulates it becomes quite apparent that BRSV is the most important respiratory disease producing virus. This could readily explain why respiratory disease outbreaks can still be explosive in cattle vaccinated for all the better known viruses (IBR, PI-3, BVD).

5. Other viruses known to be implicated in BRD.

   1) Herpesvirus other than IBR – type 4 (Movar).
   2) Adenoviruses – 8 types known in cattle.
   3) Reoviruses – 3 types known – importance not known – viruses are widespread.
   4) Rhinoviruses – 2 types known – widespread (most important respiratory virus in humans - more than 100 types).

2. BACTERIA - As more is known about the development of BRD it becomes apparent that usually bacteria are in the final common pathway leading to pneumonia. This is not to say that some viruses (IBR, BRSV) cannot cause severe disease and pneumonia by themselves. Bacteria are commonly known as secondary invaders, the pathway for their invasion paved by viruses.

1. Pasteurella hemolytica is the most important secondary invader and is most often implicated in the cause of death – fibrinous pneumonia. This organism cannot produce severe disease by itself. It is found in the majority of the nasal passages of normal cattle and multiplies explosively with stress and virus infection. There have been a variety of vaccines on the market for many years. Most are bacterins, or killed bacteria, and are uniformly ineffective. In the past several years modified bacterial or live bacterial vaccines have been developed for intramuscular and intradermal use respectively. These vaccines do seem to have some value. However, the ultimate pasteurella vaccine has not been developed. More work needs to be done on the disease producing fractions of the organism as well as on the fractions that produce immunity. The ideal pasteurella vaccine should have a significant impact on BRD. However, it is thought that if P. hemolytica is controlled by vaccination that other types of the same organism or other bacteria such as Hemophilus somnus will fill the void.

2. Pasteurella multocida – is an organism increasingly recognized as being involved in BRD. It is also found in the nasal passages of many normal animals. Vaccines have been prepared but their usefulness have not been proven.

3. Hemophilus somnus – causes a severe, usually fatal, brain infection known as "thrombo" or thromboembolic meningo encephalitis (TEME). It can also cause blood infection or septicemia, and pneumonia. This organism probably is not real important in BRD but when it causes TEME in feed lot cattle the results can be devastating. A 2 dose vaccine is available and its value is equivocal.

4. Mycoplasma – several species have been associated with respiratory disease: M. bovirhinis, M. bovis, M. dispar and Ureaplasmas. These organisms also are found in the nasal passages of healthy calves. There is no doubt that these bacteria are involved in BRD but the role they play is not entirely known. There are no vaccines available but they do respond to antibiotic therapy.

There are numerous other bacteria isolated from pneumonic lungs but the role they play in BRD is unclear.

The foregoing brief description of the various agents involved in BRD, in addition to other environmental entities, summed up in "stress", point to BRD being a multifactorial disease and as such does not bend to simplistic one shot solutions. The way disease is produced by blending several or many of these factors is not at all clear. It is virtually impossible to produce severe BRD experimentally except by using the most severe and unnatural conditions. It is largely due to this that the ideal management practices have not been developed.

Therefore, with our present state of knowledge, BRD is not being controlled to the extent we would like. The program of preconditioning, or any similar program that minimizes stress, is commendable and points in the right direction. Specific recommendations on implementing a program to minimize the economic burden due to BRD must be left to the rancher and his veterinarian. Whatever plan that works best for the individual rancher is the best one.

FUTURE PROSPECTS

It would be difficult to be very optimistic if we felt that all the work that has been done on BRD over the past 15-20 years left us with our present state of knowledge. However, with basic studies in modern biotechnology, in both human and veterinary areas, there are several items that may give us some optimism for cutting the cost of producing beef calves.

IMMUNOMODULATORS

A whole new area, unheard about a few years ago, is now being explored. This is the area of immunomodulation. Knowing that the immune system is responsible for protecting all animals from infectious diseases, has pointed to any avenue possible to influence the immune system to be more responsive to any given situation. There are several products now available that have been shown to modulate the immune system and have been tested in animal and human systems.

The first compound is interferon. Interferon was first identified in the mid 1950's. Interferon is a product of virus infected cells that when administered to other cells prevents those cells from being infected by any virus. This broad spectrum effect has many implications for any virus infection. However, it was very difficult to produce enough interferon for studies of any magnitude. In the past 2-3 years, however, genetic engineering techniques have resulted in the breakthrough that now gives us very ample quantities of interferon. In fact, at the present time some very interesting studies are being carried out by veterinary researchers in Amarillo, Texas using genetically engineered human interferon. However, interferon is not a panacea. In BRD it does appear that if it is administered before there are any clinical signs of disease there is some benefit as measured by weight gain differences. However, the differences in weight gains were slight and would be detected only in closely monitored animals. In addition, the dosage is critical and any overdosage results in reduced feed intake and decreased gains. Interferon does, however, offer promise in the right direction in very well managed feedlots. It will not be a substitute for other good management practices.

Another compound known to have immunomodulator effects is levamisol (Levasol) a widely used injectable wormer. This product appears to have the greatest effect on animals whose immune system is not functioning properly, with little or no effect noted in normal animals. However, since calves threatened by BRD are usually under some degree of stress it is presumed that their immune systems are not functioning normally. Some studies have documented very positive effects due to levamisol treatment whereas others have been equivocal.

Thiabendazole, another wormer used in cattle, has also been reported to have immunomodulating properties. The response to thiabendazole is dose dependent and too great a dose is immunosuppressive. It appears that with both levamisol and thiabendazole dosage, frequency and timing of administration are critical to obtaining immunostimulation.

One further compound, a lipoidal amine designated CP 20,961, appears to have some immunomodulative properties. However, further work will have to be done to further define this.

There are several specific antiviral compounds that have been used in human medicine. Although none of them seem suitable for use in beef cattle the study of these compounds may very well lead to something useful in BRD.

A summary statement concerning the present and future state of affairs in bovine respiratory disease research has been put no better than by Dr. James Roth of Iowa State University at a Bovine Respiratory Disease Symposium at Amarillo, Texas in 1983:

> There is ample evidence that impairment of host defense mechanisms by stressors, viruses and/or mycoplasmas are prerequisite for the establishment of bacterial pneumonia in the bovine lung (with a reasonable bacterial challenge). Even when the immune system is impaired by these factors, there is still sufficient pulmonary defense to prevent infection by the majority of bacteria in the bovine environment. The bacteria which can successfully colonize the lung in immunosuppressed cattle are species which have specialized virulence factors that inhibit phagocytic cells. These virulence factors by themselves will not allow the bacteria to colonize the lower respiratory tract unless the pulmonary defense mechanisms have already been impaired. These observations suggest that pulmonary defense mechanisms in normal cattle are quite efficient and a "multiple hit" on these defense mechanisms is necessary for the development of respiratory disease. If man could intervene and reduce the number of "hits" on the defense mechanisms, the incidence of bovine respiratory disease should be decreased. Possible approaches are:
>
> 1. Reduce the amount of stress on the animals.
> 2. Use immunomodulators to reduce the effects of stress on the immune system.
> 3. Vaccinate to prevent infection by viruses and mycoplasmas.
> 4. Use immunomodulators to reduce the immunosuppressive effects of viruses and mycoplasmas.
> 5. Block the activity of the bacterial virulence factors through pharmacologic or immunologic means.
> 6. Enhance immunity against the bacterial agents through effective vaccines.

A special problem with vaccination is that there are several viruses and mycoplasma species which are widespread and capable of predisposing to bacterial pneumonia. It may be necessary to induce immunity to a majority of these before a reduction in the incidence of respiratory disease is seen. Similarly with the bacterial agents, an immunosuppressed animal which is immune to two of the common bacterial agents is still susceptible to the third. It will be difficult to induce effective immunity against all three common agents in one animal.

The use of immunomodulators to prevent or reverse the immunosuppression also promises to be complex. Stress and the various viruses, mycoplasma and bacteria probably use a variety of mechanisms to induce immunosuppression. It is unlikely that a single immunomodulator will be effective against this host of immunosuppressive factors. Experimentation on compounds which have been shown to have some immunomodulatory activity indicates that the dosage and time of administration relative to the initiation of immunosuppression are critical for determining the effectiveness of the immunomodulator. Until this problem is overcome, it will limit the clinical usefulness or immunomodulators.

There is currently a great deal of research aimed at producing and characterizing new immunomodulating compounds for eventual use in man. In order to take full advantage of this research and apply it to the bovine respiratory disease problem, the nature of the immunosuppression which occurs in BRD due to stress or infectious disease must be thoroughly characterized. This knowledge would provide a basis for predicting the properties that would be desirable in an immunomodulator for use in stressed or virus-infected cattle.

SECTION VI

Special Report

The Puzzle of Commercial Cow Type

by

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