28th ANNUAL
LIVESTOCK RESEARCH
ROUND-UP

Dickinson Experiment Station
Dickinson, North Dakota
December 7, 1977

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Reports of
Cattle Research in Progress
at the
Dickinson Experiment Station

Presented by the

Station Staff

at the

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Dickinson Experiment Station
Dickinson, North Dakota

December 7, 1977

FEEDLOT COMPARISON OF HEREFORD, ANGUS X HEREFORD, AND LONGHORN X HEREFORD STEERS

This trial was designed to study the performance of Longhorn X Hereford crossbred calves in comparison to either straight Hereford or Angus X Hereford crossbred calves.

Producers using Longhorn bulls on straight bred beef heifers are discounted when these calves are placed on the feeder market. Feeders are reluctant to buy these calves, since very little documented information is available as to how these crossbred calves perform in the feedlot. Again, there is almost no carcass information available on these cattle, especially when graded under the current grading standards.

In the first year of the trial, two sets of LH X H steer calves were purchased from the Harold Hanson Ranch of Reeder and the Bloom Ranch of Taylor, North Dakota. Hereford and BWF calves for comparison were either raised at the Dickinson Experiment Station or were purchased through the local auction market. At the time these calves were purchased, there was approximately a five dollar per hundredweight discount on the LH X H steers. Calves were worked through our chutes for the usual branding, dehorning and vaccination. All the LH X H calves were dehorned which was not so with the BWF or the Hereford calves since they were naturally polled. During the second year of this trial the LH X H calves were raised at the Station and were all sired by the same Longhorn bull that was made available to us by the Harold Hanson Ranch.

The steers were self-fed complete mixed rations according to the schedule shown in table 1. All of the calves received calfhood vaccinations for blackleg, hemorrhagic septicemia, malignant edema and enterotoxemia types C and D prior to entering the feedlot. No other vaccinations were used since IBR, BVD, etc. have not been a problem at this Station.

The steers were fed from November 22, 1976 until August 16, 1977 at which time they were shipped by truck to Flavorland Dressed Beef in West Fargo, North Dakota, a distance of 300 miles. The steers were sold on a grade and weight basis, with additional carcass information gathered with the help of the Department of Animal Science, NDSU.

The results of the trial are shown in table 2 and 3.

Table 1. Self fed ration changes, 1977

	Warm-up ration	**Dec. 1, 1976**	**Feb 22**	**May 17- to finish**
Oats	25	50	75	50
Tame hay	72.5	47.5	22.5	22.5
Barley	--	--	--	25
Di-cal	.5	.5	.5	.5
Salt	2	2	2	2

Table 2. Feed consumption per head, 1976-77

	BWF		Hereford		Longhorn X Hereford	
	1976	**1977**	**1976**	**1977**	**1976**	**1977**
Ingredients: [1/]						
Oats, lbs.	9.98	13.30	9.49	12.70	9.08	11.59
Barley, lbs.	3.32	2.20	2.97	2.12	2.83	1.79
Tame hay, lbs.	5.92	7.20	5.57	6.80	5.29	6.36
Alfalfa, lbs.	.99	--	.92	--	.88	--
Di-cal, lbs.	.10	.12	.10	.11	.10	.10
Salt, lbs.	.41	.46	.38	.44	.36	.44
Avg. daily consumption	20.72	23.28	19.84	22.17	18.54	20.25

[1/] The amounts shown are averages for the entire feeding trial and are not the amounts as they were fed each day.

Table 3. Feedlot data + carcass information, 2-year average

	BWF	Hereford	Longhorn X Hereford
No. head	13	13	26
Days fed	291	291	291
Final wt., lbs.	1086	1080	991
Starting wt., lbs.	447	432	420
Feedlot gain, lbs.	639	648	572
ADG, lbs.	2.20	2.23	1.91
Pounds feed/lb gain	9.98	9.31	9.99
Cost/100 lbs. gain, $	41.51	38.84	41.32
Total feed cost/head, $	265.27	251.66	236.35
Carcass trait:			
Avg. hot wt., lbs.	644	638	578
Dressing, %	60	58.5	58.5
Kidney est. wt., lbs.	24	19	25
Loin eye area, sq. in.	11.92	11.48	11.25
Fat cover, in.	.81	.61	.37
Cal. yield grade	2.9	2.8	2.04
Percent cut out	45.7	47.27	49.12
Difference	-3.42	-1.85	

Table 4. Analysis of costs and returns, 1976-77

	BWF		Hereford		Longhorn	
	1976	**1977**	**1976**	**1977**	**1976**	**1977**
Cost of calf, $	164.40	169.00	158.40	164.00	141.05	158.50
Cost of feed, $	269.13	261.41	251.82	251.51	240.49	228.07
Total cost, $	433.53	430.41	410.22	415.51	381.54	386.57
Carcass value, $	367.92	391.02	361.35	391.53	333.57	349.40
Net gain or loss, $	-65.61	-39.39	-48.87	-23.98	-47.97	-37.17
Avg. net loss, $	-52.50		-36.42		-42.57	

Discussion:

Soon after the calves were started on feed, during the first year of this study, an outbreak of shipping fever – pneumonia occurred throughout the majority of the lots at the Station. Although numerous Hereford and BWF calves were treated and cured, no problems were observed in either pen of LH X H calves. Although our sample numbers were small, it does appear that this LH X H cross is hardy and at least in this study showed some resistance to disease.

Summary:

Results of this feeding trial indicate that the LH X H steers gain about three tenths pound slower on slightly more feed; reach maturity at about 1000 pounds, and yield a high percentage of choice carcasses at slaughter. Although their rate of gain was less, their cost per hundred pounds of gain was $41.32, which is slightly less than the BWF steers and two dollars and forty eight cents more than the Hereford steers.

A review of carcass information shows that the LH X H steers graded essentially the same as the Hereford or BWF and the differences in dressing percentage were very slight. Both the BWF and Hereford steers had heavier carcasses, larger loin eye areas, and significantly thicker fat cover. The significant fat cover reduction among the LH X H steers resulted in an average calculated yield grade of two, compared to two and eighty five hundredths for the BWF and Hereford steers. The thinner fat covers also contributed to a higher calculated cutout percentage, which was 49.12% for the LH X H; 47.27% for the Hereford; and 45.7% for the BWF steers.

After feed, mixing and grinding, and calf costs were deducted from the gross return, the BWF steers had the greatest net loss of $52.50, followed by net loss of $42.57 for the LH X H crosses. More efficiency among the Hereford steers resulted in the least net loss of $36.42.

FEEDLOT PERFORMANCE COMPARISON OF BULLS & STEERS

This trial was designed to compare feedlot performance and market potential of bulls and steers under similiar feeding and marketing conditions.

The feeding of bull calves to produce "bullock" beef at approximately 1050 pounds, or 16 to 18 months of age, has been demonstrated to be a very efficient method of producing good quality beef. However, to date, the meat trade has discounted "bullock" meat due to lack of consumer acceptance. Thus, the economics of producing "bullock" beef has suffered.

In this first year of the trial, weanling bull and steer calves of Hereford and Angus X Hereford breeding were allotted and started on trial December 1, 1975. The bull calves were all purchased, and it was difficult to find as uniform a group as we would have liked, because of lack of numbers on the market. The steers were mostly from the Station herd, with a few purchased animals added. The second year of the trial, a more uniform group of Hereford and Angus X Hereford bulls and steers were randomly selected from the Station herd and started on trial November 22, 1976. All groups, steers and bulls, were treated as uniformly as possible with regard to vaccinations, feeding, weighing and handling. The animals were shipped for slaughter when they reached average lot weights of 1050 to 1100 pounds. The calves were all self-fed a mixed hay and grain ration including minerals according to the schedule shown in table 5. Average feed consumption is shown in table 6.

The cattle were shipped by truck to Flavorland Dressed Beef in West Fargo, North Dakota for slaughter. They sold on an individual grade and weight basis. Additional carcass information was gathered with the assistance of the meat's department, Department of Animal Science, North Dakota State University. Feedlot performance and carcass data for two years trial is summarized in tables 7 and 8.

Discussion:

Bulls, as expected, gain at a faster rate and are more efficient. As previously mentioned, the bulls fed the first year of this study were heavier at the start of the trial and therefore, finished considerably sooner than the steers. Finishing 85 days sooner is naturally more than should be expected from bull and steer calves started at an equal weight and age. Bulls fed in 1977 were started at more uniform weights and reached the target slaughter weight of 1050 to 1100 pounds 55 days sooner than the steers, which is more typical. In the experiment at this Station bulls and steers handled equally well. The numbers were small, however. Research conducted at other research facilities indicates that larger numbers of bulls can be easily fed without excessive fighting provided that sorting or new individuals are not added to the pen during the feeding period.

Eighty percent of the bull carcasses were graded U.S.D.A. "stag" since no market is readily available for the "bullock" grade. The remaining 20% of the bull carcasses, which were predominantly Angus X Hereford crossbreds, received higher quality grades. The bull carcasses did not show the coarsness usually associated with bull beef in the past, and were described by meat's department personnel from North Dakota State University as being, "very desirable." In spite of this, the meat packers are reluctant to buy young bull beef; and when they do, the carcasses are discounted from 5 to 11 dollars per hundred weight. Bull beef has been characterized by the meat trade as being "dark-cutting" carcasses because the darker colored cuts, when intermixed with steer beef in meat cases, have not been readily accepted by the consumer.

Table 5. Rations as fed to bulls and steers

	Dates started			
Ingredients, %	**Nov 22**	**Dec 2**	**Feb 23**	**May 17**
Oats	25	50	75	50
Barley	--	--	--	25
Tame hay	72.5	47.5	22.5	22.5
Di-cal	.5	.5	.5	.5
Salt	2.0	2.0	2.0	2.0

Table 6. Average daily feed consumption

Ingredients	**BWF bulls**	**Hereford bulls**	**BWF steers**	**Hereford steers**
Oats, lbs.	14.60	13.28	13.30	12.70
Barley, lbs.	1.20	1.07	2.20	2.10
Tame hay, lbs.	8.10	7.30	7.20	6.80
Di-cal, lb.	.12	.11	.12	.11
Salt, lb.	.49	.44	.46	.44
Total, lbs.	24.51	22.20	23.28	22.15

Table 7. Feedlot performance – two year average, 1975-77

	BWF bulls	**Hereford bulls**	**BWF steers**	**Hereford steers**
Days on feed	221	221	292	292
Finish wt., lbs.	1091	1078	1087	1081
Starting wt., lbs.	488	515	447	433
Gain, lbs.	603	563	640	648
ADG, lbs.	2.72	2.54	2.19	2.23
Feed/100 lbs. gain	815	855	998	931
Feed cost/hd, $	200.61	197.22	265.27	251.67
Cost/100 lbs. of gain, $	33.23	35.04	41.63	38.88
Carcass value, $	339.84	328.05	379.47	376.44
Carcass value less – feed cost, $	139.23	130.83	114.20	124.77
Avg. difference, $	+15.54			

Table 8. Carcass data – two year average, 1975-77

Data on:	BWF bulls	Hereford bulls	BWF steers	Hereford steers
Hot carcass wt., lbs.	635	637	644	639
U.S.D.A. grade & carcass-value/cwt: Choice	1@61.25	----	12@59.38	12@59.38
Good	3@56.25	1@56.25	1@56.25	1@56.25
Stag	7@51.00	11@51.00	----	----
Avg. carcass value, $	339.84	328.05	379.47	376.44
Dressing %	58.2	59.1	59.2	59.0
Kidney knob est., lbs.	13.6	15.3	24.0	19.2
Loin eye, sq. in.	13.9	13.3	11.9	11.5
External fat thickness, in.	.36	.34	.81	.61

Summary:

Hereford and Angus X Hereford bulls gained faster and were more efficient than steers fed and handled under similiar conditions. In the 1977 trial the Hereford bulls gained .33 pound per day faster and the BWF bulls gained .72 pound per day faster than the steer comparisons.

Efficiency of feed conversion and rate of gain for the bulls was significantly greater than the steers and amounted to approximately eight dollars less feed per 100 pounds of gain for the BWF bulls and four dollars less feed per 100 pounds of gain for the Hereford bulls. Major carcass differences between bulls and steers were found in both fat deposition and muscling traits. The percent of internal fat (kidney knob), marbling, and fat cover were significantly greater for the steers. Bull carcasses yielded substantially larger loin eye areas, less trimable fat and therefore a higher percentage of red meat. Meat quality grades were significantly higher among the steer carcasses. Although measurements for color were not taken, the color of lean, according to the federal grades was somewhat darker and contributed heavily to the lower quality grades received among the bull carcasses.

Although the steers produced significantly higher meat quality grades the net return after feed costs were deducted favored bull feeding. The two year average net return for the BWF bulls was $26.42 and $5.99 more for the Hereford bulls when compared to their steer counterparts.

GRASS FED BEEF

A beef production system using all or nearly all roughage rations has been evaluated at the Dickinson Experiment Station since 1974.

This trial was designed with three feeding phases: the calf wintering phase, the summer grazing phase and the feedlot finishing phase.

In the calf wintering phase, Hereford and Angus-Hereford crossbred calves were self-fed a limited grain-high roughage growing ration to produce gains of 1.25 to 1.50 pounds per day. The wintering rations was composed of 20% ground oats and 80% chopped hay self-fed with minerals added at the rate of 10 pounds of di-calcium phosphate and 40 pounds of salt per ton of mixed feed. The three year results of the wintering phase are shown in table 9. The normal wintering phase lasted from early November until May, a period of approximately 160 days.

Table 9. Winter gains, calf wintering phase

	1973-74	1974-75	1975-76	3 Yr. Avg.
Initial wt. (Fall)				
BWF	367	367	475	403
Hereford	374	374	469	405
Spring wt. (May)				
BWF	552	621	707	627
Hereford	583	607	708	633
Days fed	152	175	157	161
Avg. daily gain, lbs.				
BWF	1.21	1.45	1.46	1.37
Hereford	1.37	1.33	1.52	1.41

Following the wintering phase, the steers were pastured from May until late October on a series of three pastures; crested wheatgrass, native range and Russian wildrye. This pasture grazing period lasted 196 days in 1974 and 1975, and 168 days in 1976.

Results of the pasturing phase for the three year period are shown in table 10.

Table 10. Average steer gains, pasture phase

	1974	1975	1976	3 Yr. avg.
Crested wheatgrass				
Days	55	56	53	54.7
Gain/lbs. - BWF	84	68	56	69.3
Hereford	90	69	62	73.7
ADG/lbs. - BWF	1.53	1.21	1.06	1.27
Hereford	1.64	1.23	1.17	1.35
Native Range				
Days	71	57	46	58
Gain/lbs. - BWF	130	129	52	103.7
Hereford	108	133	46	95.7
ADG/lbs. - BWF	1.83	2.26	1.13	1.74
Hereford	1.52	2.33	1.00	1.62
Russian wildrye				
Days	70	83	69	74
Gain/lbs. - BWF	37	33	67	45.7
Hereford	36	15	58	36.3
ADG/lbs. - BWF	0.52	0.40 [1/]	0.97	0.63
Hereford	0.52	0.18	0.83	0.51
Total pasture period, days	187			
Total gain, lbs.- BWF	218.7			
Hereford	205.7			
ADG/lbs. - BWF	1.17			
Hereford	1.10			

[1/] Gains low due to a snow storm.

After the grazing period, the steers were randomly placed into two groups for the feedlot finishing phase. One half of each group was selected to be sold at 975 to 1000 pounds while the rest were to continue on feed until they reached normal slaughter weights of 1050 to 1100 pounds.

Each group was self-fed a chopped mixed hay ration of approximately 30% alfalfa and 70% brome-crested wheatgrass hay. This hay was very good quality, having good color, odor and abundance of fine stems and leaves. In addition to the chopped hay, one group of steers was hand fed oats and barley at the rate of one percent of their body weight.

Except for minerals free choice, the steers did not receive any additional feed additives, supplements or growth stimulants.

Upon reaching slaughter weights, all were shipped approximately 300 miles to Flavorland Dressed Beef in West Fargo, North Dakota. Individual carcass data was collected with the assistance of the Animal Science Department, North Dakota State University.

Average trial results for three years are summarized in tables 11 and 12.

Table 11. Weights and gains, carcass data and returns – short fed drylot phase 1974-77

	1% Grain ration		Chopped hay ration	
	BWF	**Hereford**	**BWF**	**Hereford**
Weights and gains				
Initial wt., lbs.	865	846	858	854
Final wt., lbs.	993	976	1004	1007
Days fed	62	62	116	116
ADG, lbs.	2.62	2.53	1.31	1.37
Carcass information				
Hot carcass wt., lbs.	539	526	540	530
Dressing %	54.2	53.4	53.7	52.7
U.S.D.A. grades	3 Cho 6 Gd	 9 Gd	7 Cho 2 Gd	3 Cho 6 Gd
Selling price				
1974-75	3/4/75 Cho $54.40 Gd $50.50		4/16/75 Cho $66.00 Gd $62	
1975-76	1/20/76 Gd $59.00		3/25/76 Cho $55.00 Gd $53	
1976-77	11/16/76 Cho $59.50 Gd $55.50		1/10/77 Cho $59.50 Gd $55	
Avg. carcass value, $	303.46	290.73	320.02	303.24
Avg. feed costs, $	51.75	51.75	76.46	76.46
Return over feed, $	251.70	238.98	243.55	226.78

Table 12. Weights and gains, carcass data and returns – long fed drylot phase 1974-77

	1% Grain ration		Chopped hay ration	
	BWF	**Hereford**	**BWF**	**Hereford**
Weights and gains				
Initial wt., lbs.	863	847	840	849
Final wt., lbs.	1083	1045	1026	1030
Days fed	116	116	162	162
ADG, lbs.	1.98	1.72	1.18	1.12
Carcass information				
Hot carcass wt., lbs.	607	594	567	565
Dressing %	56	56.7	55.3	54.7
U.S.D.A. grades	1 Pr 5 Cho 2 Gd 1 Std	3 Cho 6 Gd	8 Cho 1 Gd	2 Cho 7 Gd
Selling price				
1974-75	4/16/75 Cho $66.00 Gd $62		6/11/75 Cho $81.00 Gd $73.00	
1975-76	3/25/76 Pr $56.00 Cho $55		5/12/76 Cho $61.50 Gd $59.50	
	Std $51.00			
1976-77	1/10/77 Cho $59.50 Gd $55		2/14/77 Cho $57.00 Gd $54.00	
Avg. carcass value, $	356.93	344.29	374.53	354.77
Avg. feed costs, $	103.57	103.57	107.83	107.83
Return over feed, $	253.36	240.72	266.70	246.93

Discussion:

This trial has shown that calves can be wintered in good growing condition using a self fed ration of approximately 20% oats and 80% tame hay plus minerals.

As expected, pasture gains varied somewhat from year to year, but the three pasture system did allow an extended grazing period. Results of the pasture grazing phase is shown in detail on page 8 of this report.

Performance of steers in dry lot was about as expected. Steers receiving grain at the rate of one percent of their body weight were marketed in less time, averaging 54 less days in the early selling and 46 less days in the normal selling groups.

Although the hay fed steers required more time to reach the same market weight, returns over feed were not appreciably different. The hay fed steers graded good to choice at the weights sold.

Over the years, the crossbred steers graded higher than the straightbred steers, largely because they expressed more marbling in the loin eye muscle.

Summary:

This trial has demonstrated that Hereford or BWF steer calves can be fed from weaning to slaughter on rations composed almost entirely of roughage, without the use of feed additives, supplements, or synthetic growth stimulants. When conditions of high grain price and normal roughage costs exist, this feeding system may well be utilized with good results.

LEAST COST COMPUTER RATIONS FOR BEEF CATTLE

Can the computer be used as a tool to aid the cattle producer in figuring how to prepare balanced rations for different classes of livestock, at the least possible cost?

The Cooperative Extension Service has access to a Michigan State University computer program, developed by two Michigan researchers, Dr. Roy Black and Dr. Daniel Fox, to do just that.

The program permits the stockman, with the help of the County Agent or experiment station personnel, to load the computer with information on: the class of cattle being fed; performance desired; various feeds available and their price; and, percentage at which feeds can be used in the ration. Once these inputs have been made, the computer figures a balanced ration at the lowest possible cost for that particular class of livestock. Thus, in theory, the North Dakota livestock producer has computer technology available to help him figure nutritionally balanced, economical livestock rations.

This trial was designed to see how the program worked in actual practice; and, to see what modifications would be needed for the Michigan program to make it fit North Dakota conditions. Working in cooperation with the Stark-Billings County Agent, the program was run according to recommended procedure, just as would be done for any individual area livestock producer, and a computer formulated ration was developed. An oats-barley-tame hay ration that has been used successfully at the Station for several years was used as the control. Twenty four Angus X Hereford heifer calves from the Station herd were equally divided into four lots, two lots receiving the "computer" ration beginning on November 17, 1976.

All heifers were implanted with Synovex-H on December 3rd. As the heifers reached about 650 pounds the program was run again, and because of changes in nutrient requirements and feed prices the recommended ration was changed on February 11, 1977. On February 22 the control ration was also changed, as shown in table 15.

On May 31, 1977, after a feeding period of 195 days during which they had gained about 425 pounds, all were shipped to Flavorland Dressed Beef in West Fargo for slaughter on a grade and weight basis. Weights, gains and feed costs are shown in table 16. Carcass data and returns are summarized in table 17.

Discussion:

As with any new procedure, using the computer program for the formulation of "least cost" rations required a combination of patience and study, and a good understanding of cattle feeding. While the computer response is very rapid once the proper inputs have been made, results are dependent on the accuracy of information fed into the machine. Results of the first year's trial were about equal for both methods of feeding, with the computer ration utilizing some feeds not commonly used in feedlot rations in this area.

Although not shown in the data, the gains of all lots of heifers were well above two and one-half pounds until about the end of March then, for some unexplained reason, the computer fed heifers dropped to only about one pound per head per day, while the control heifers continued to gain at from one and one-half to two pounds per head per day.

All four lots of heifers had satisfactory carcass weights and grades, with no apparent differences between treatments.

Getting the computer fed heifers on feed did not prove to be any problem, although about 10 days were required to work them up to the full 50% wheat ration.

Table 13. Feed inputs and costs entered into the computer for least cost ration formulation

	Initial run	February, 1977 run
Feed	**Price/cwt as fed basis**	
Barley	4.48	4.48
Corn	4.80	4.98
Oats	4.40	5.00
HRS wheat	4.50	4.50
Beet pulp	4.50	4.50
Linseed oil meal	9.00	9.00
Soybean oil meal	9.75	9.75
Alfalfa	2.75	2.75
Brome-alfalfa hay	2.25	2.25
Oat straw	.90	.99
Di-cal	13.00	13.00
Limestone	4.00	4.00
Trace mineral salt	3.80	3.80
Wheat straw	.90	.90
20% commercial supplement	9.10	9.10
32% commercial supplement	9.70	9.70

Table 14. Least cost computer rations as fed

Ingredients	Initial computer ration	Second run
Barley, lbs.	191	602
HRS wheat, lbs.	502	166
Soybean oilmeal, lbs.	49	--
Alfalfa, lbs.	50	--
Oat straw, lbs.	199	223 [1/]
Limestone, lbs.	7	6.36
Trace mineral salt, lbs.	2.24	2.24
Total lbs.	1000	1000

[1/] Wheat straw used.

Table 15. Control ration as fed

Ingredients	Initial control ration	Second run
Oats, lbs.	500	750
Tame hay, lbs.	475	225
Di-cal, lbs.	5	5
Trace mineral salt, lbs.	20	20

Table 16. Weights, gains and feed costs

	Control	Control	Computer	Computer
Initial wt., lbs.	487	487	489	488
Final wt., lbs.	923	940	914	876
Feedlot gain, lbs.	436[1/]	453[1/]	425	388
Days fed	195	195	195	195
ADG, lbs.	2.23	2.32	2.17	1.98
Pounds feed/lb. gain	9.49	9.54	9.25	10.7
Feed cost/hd/$	175.39	182.97	167.34	175.36
Feed cost/cwt gain/$	40.24	40.36	39.37	45.25

[1/] Feedlot gain of control heifers significantly better (P .05) than computer fed heifers.

Table 17. Carcass data and return

	Control lots		Computer lots	
Hot carcass wt., lbs.	543	556	543	524
Dressing %	58	59	59.4	59.8
U.S.D.A. grades	4 Cho 2 Gd	3 Cho 3 Gd	4 Cho 2 Gd	5 Cho 1 Gd
Carcass value, $	321.55	325.27	321.00	313.85
Return over feed, $	146.17	142.30	153.66	138.49
Two lot average, $	144.24		146.08	

HEI-GRO DEVICE FOR FEEDLOT HEIFERS

A relatively new non-chemical growth stimulant known as the Hei-Gro device is being marketed to livestock feeders by Agrophysics Inc. of San Francisco, California. This device, composed of injection molded good grade nylon, looks somewhat like a miniature Christmas tree. It is inserted deep into a feedlot heifer's vagina and left there, where it is supposed to stimulate the heifer's natural body mechanisms to produce faster growth.

According to company literature, when the device is used as recommended, it should produce additional returns of from seven to nine dollars per head. It is also reported to give faster growth, better feed conversion, reduced bulling, 99% retention, simpler feeding procedures and show no effects of breed or season.

A trial was started in the fall of 1976 to compare response from weaning to market of heifer calves with or without the device. Heifer calves used in this trial were Angus-Hereford crossbreds averaging about 485 pounds. Twenty four head were randomly allotted into four equal lots. Two lots served as controls and two lots were given the Hei-Gro device at the beginning of the trial on December 3. All heifers were implanted in the ear with a Synovex-H implant at the start of the trial. The heifers were self-fed completely mixed grain-roughage rations designed to produce gains of from two and one-fourth to two and one-half pounds per head per day.

Feedlots used in this trial were at least 50 feet from lots where steers or bulls were being fed, as recommended by Agrophysics, Inc.

All heifers were sold on a grade and yield basis at a slaughter weight of approximately 920 pounds.

Results of the trial are summarized in table 18.

Summary:

First years' results using the Hei-Gro device do not indicate any improvement in rate of gain or feed efficiency.

The device was not difficult to insert and there were no restrictions or market clearances required.

Table 18. Weights, gains and feed costs, carcass data and returns

Data on:	Control	Hei-Gro treatment
Initial wt., lbs.	488	488
Final wt., lbs.	918	908
Gain, lbs.	430	420
Days fed	195	195
Average daily gain	2.21	2.16
Feed efficiency	9.38	10.06
Feed cost/hd., $	171.36	179.17
Cost/hd/day, $	.88	.92
Cost/cwt gain, $	39.81	42.61
Hot carcass wt., lbs.	543	540
Dressing %	59.1	59.4
U.S.D.A. grade	8 Cho @ $60.75 4 Gd @ $56.25	8 Cho @ $60.75 4 Gd @ $56.25
Carcass value, $	321.28	319.56
Net return, $ [1/]	149.91	140.40

[1/] Carcass value less feed cost.

FEEDING TRIALS WITH RUMENSIN

Rumensin®, (monensin sodium), is a new feed additive for beef cattle that is reported to improve feed efficiency by increasing the energy available from a given amount of ration. This is accomplished by altering rumen fermentation to increase the proportionate amounts of useable volatile fatty acids with less loss of carbon dioxide and methane gas.

In this trial, two pens of straightbred Hereford steer calves of similiar background were randomly allotted on February 10, 1976. Both groups were started on a ration of four pounds of ground oats per head per day and self-fed a chopped mixed hay consisting of approximately 20% alfalfa and 80% tame grass. Both lots were also self-fed a mineral mixture of two parts dicalcium phosphate and one part trace mineral salt.

The lot receiving Rumensin was fed 150 mg per head per day in the ground oats until May 22, at which time the level of Rumensin was increased to 200 mg per head per day. The Rumensin fed steers averaged about 610 pounds at this time. On October 13, ground barley was added to the ration at the level of three pounds per steer per day. On December 8, the oats was increased to six pounds and the level of Rumensin to 300 mg per head per day.

Both lots of steers remained on feed until February 14, 1977 at which time they were sold on a grade and yield basis.

Results of this trial are shown in the following tables.

Summary:

Although the problem corrected itself, the calves were somewhat reluctant to accept the ration containing Rumensin for the first three or four days.

The Rumensin fed steers in this trial gained 0.23 pounds per head per day faster than the control steers. The carcass data shows that because of a longer feeding period, the control steers were somewhat fatter, having a higher dressing percentage and deeper backfat measurement. Although the Rumensin fed steers consumed about one pound per head per day more hay, their costs were $18.15 less per steer than with the controls. This savings in feed amounted to an eight and six tenths percent advantage for the steers receiving Rumensin.

A second trial is currently in progress.

Table 19. Feed record, Rumensin feeding trial, 1976-77

Average feed per day:	Control	Rumensin
Oats, lbs.	4.47	4.37
Barley, lbs.	2.97	2.96
Chopped mixed hay, lbs.	12.1	13.1
Minerals, lbs.	0.2	0.2
Average lbs. feed/lb. gain	11.12	10.16
Feed savings, %	--	8.6
Feed cost:		
Total per head, $	252.15	237.79
Avg/hd/day, $	0.62	0.64
Avg/cwt gain, $	38.71	35.12
Calculated return:		
Carcass value ($58 cho - $55 gd)	348.28	350.31
Less feed cost, $	252.15	237.79
Difference, $	96.13	112.52
Added value/hd, $	--	16.39

Average feed costs: Oats $1.55, barley $2.42, hay $40/ton, salt $4.20/cwt, Di-cal $14.40/cwt, processing $10/ton, Rumensin at .05¢/gram.

Table 20. Weights and gains – Rumensin feeding trial, 1976-77

Data on:	Control	Rumensin
Initial wt., lbs, Feb 10, 1976	405.7	411.4
Final wt., lbs, Feb 14, 1977	--	1088.6
March 21, 1977	1057.1	--
Feedlot gain/hd/lbs.	651.4	677.1
Actual days on feed	405	370
Average daily gain	1.60	1.83

Table 21. Carcass data – Rumensin feeding trial, 1976-77

Data on:	Control	Rumensin
Hot carcass wt., lbs.	605.3	617.3
Avg. dressing percent	57.25	56.70
Grade & price	5 Cho @ $58 2 Gd @ $55	3 Cho @ $57 4 Gd @ $54
Actual carcass value, avg., $	348. 29	341.28
Calculated value based on equal price, $	348.29	350.31
Inches backfat cover, avg.	0.60	0.44
Est. kidney knob, lbs.	21	19
Loin eye – sq. in. avg.	11.2	11.9
Calculated yield grade	2.7	2.2
Calculated percent cutout	50.5	51.8

FEEDING TRIALS WITH RUMENSIN, RALGRO, AND RUMENSIN-RALGRO COMBINATION

Feeding trials with steers, comparing Rumensin® (monensin sodium), Ralgro (zeranol), Rumensin and Ralgro combined, and an untreated control were begun in November, 1976.

In this study 24 Angus X Hereford crossbred steer calves were randomly allotted into four lots of six steers each. All lots were fed for 333 days on a high roughage growing-fattening ration of oats, barley and chopped tame hay. The grain portion of the ration was hand fed on a daily basis and the roughage was self-fed. Levels of grain were increased periodically throughout the feeding period as follows: from December 1, 1976 - May 20, 1977 the ration fed all lots was four pounds oats and tame hay self-fed; from May 20 – August 9, four pounds oats, three pounds barley and tame hay self-fed; from August 9 – August 24, five pounds oats, four pounds barley and tame hay self-fed; and from August 24 – October 18, 6 pounds oats, four pounds barley and tame hay self-fed.

Steers in the Ralgro and Combination lots received a 36 mg zeranol implant in the ear at the beginning of the trial and again 151 days later. Cost of the implant was 60 cents per steer per implant, or a total of $1.20 for the feeding period. This does not include labor cost of implanting.

Steers in the Rumensin and Combination lots received monensin sodium daily in their grain ration at the following levels:

Warm-up period – 12 days, no Rumensin
Next 170 days, 150 mg/hd/day
Next 81 days, 200 mg/hd/day
Next 15 days, 250 mg/hd/day
Next 55 days, 300 mg/hd/day

The control lot received only the basic grain and chopped hay ration. All lots received a trace mineral salt and di-calcium phosphate mineral mixture free choice.

All steers were weighed on a 28 day schedule throughout the trial. They were slaughtered at Flavorland Dressed Beef in West Fargo, North Dakota.

Table 22. Weights and gains – Rumensin, Ralgro, Combination Trial – 1976-77.

Data on:	Control	Rumensin	Combination	Ralgro
Initial wt., lbs.	412	412	412	414
Final wt., lbs.	1020	1035	1025	1052
Feedlot gain, lbs.	608	623	613	638
Days fed	333	333	333	333
Avg. daily gain, lbs.	1.82	1.87	1.84	1.91

Table 23. Carcass data – Rumensin, Ralgro, Combination Trial – 1976-77.

Data on:	Control	Rumensin	Combination	Ralgro
Hot carcass wt., lbs.	574	588	573	580
Avg. dressing percent	56	57	56	55
USDA grade 1/	6 Cho	3 Cho 3 Gd	3 Cho 3 Gd	5 Cho 1 Gd
Actual carcass value, $	364.17	357.82	347.96	362.89
Calculated value, $ based on choice grade	364.17	373.67	363.85	368.30

1/ Choice @ $63.50/cwt, good @ $58.00/cwt.

Table 24. Feed consumption – Rumensin, Ralgro, Combination Trial – 1976-77.

Data on:	Control	Rumensin	Combination	Ralgro
Oats, lbs.	8,490	8,490	8,490	8,490
Barley, lbs.	3,138	3,138	3,138	3,138
Tame hay, lbs.	27,565	23,850	25,420	27,505
Total	39,193	35,478	37,048	39,133
Kcal/Kg gain	22.3	19.1	21.0	21.3
% Feed saving	--	10.8	5.8	4.5

Table 25. Feed cost and returns – Rumensin, Ralgro, Combination Tria1 1976-77.

Feed and cost:	Control	Rumensin	Combination	Ralgro
Oats @ $1.55/bu.	411.23	411.23	411.23	411.23
Barley @ $2.42/bu.	158.21	158.21	158.21	158.21
Hay @ $40/ton 1/	551.30	477.00	508.40	550.10
Processing @ $10/ton	137.82	119.25	127.10	137.52
Rumensin @ 5¢/gram	--	18.60	18.60	--
Ralgro @ 60¢/implant	--	--	7.20	7.20
Total cost/lot, $	1258.56	1184.29	1230.74	1264.26
Return/lot, $	2185.02	2146.97	2087.77	2177.34
Net return less feed, $	926.46	962.68	857.03	913.08
Net return per head, $	154.41	160.45	142.84	152.18
Calculated net based on equal grade – choice, $	154.41	176.28	158.72	157.59

1/ Lower hay consumption in the treatment lots resulted in a feed saving of 10.8% in the Rumensin lot; 5.8% in the Combination lot; and, 4.5% in the Ralgro lot.

Summary:

The use of Rumensin in high roughage feedlot rations resulted in feed savings of from 5.8% to 10.8% when compared to the control ration. The use of Ralgro implants appeared to improve feed efficiency about 4.5%

Considering only the feed cost and actual market value, the Rumensin lot returned $6.04 per steer more than the control. The Ralgro lot returned $2.00 less and the Combination lot $11.57 less than the control. This difference was primarily because of a $5.30/cwt price differential between USDA choice and USDA good grade, and because several steers in the treatment lots graded good. If all of the treatment steers had graded choice, as did the control steers, the dollar advantage over the control would have been $21.00 for the Rumensin treatment, $3.18 for the Ralgro treatment and $4.31 for the Combination treatment.

The trial is being repeated in the 1977-78 feeding period.

WINTERING REPLACEMENT HEIFERS FOR BREEDING SUCCESS

Winter feeding of replacement heifer calves is an important phase of the cow-calf industry. Unless heifer calves are well grown and have adequate condition or weight, they may not cycle and conceive early in the breeding season. Because of normal variation in weights at weaning, the livestock producer has an important management decision to make. If he feeds all his replacement heifer calves so the lighter ones will be heavy enough by breeding season, he will more than likely be overfeeding the larger, growthier heifers. Or, if he feeds so the larger heifers are not over conditioned, the smaller heifers will not be large enough to breed early in the season. However, if it were possible to divide his replacement heifers into uniform weight groups, he could then feed each group so they would reach puberty prior to the actual time of breeding. This would allow all heifers to breed and conceive early in the breeding season. Also, each heifer would have been wintered as economically as possible consistant with reproductive success. Results at this station show that a heifer that calves early as a two year old, will continue to calve early as a producing cow. Conversely a late calving heifer will more likely continue to calve late as a producing cow. A missed cycle with a late calving female produces a very late calf – with the likelihood that she will continue to calve later than desired.

With these thoughts in mind, a trial was started to evaluate the economics, performance and reproductive efficiency of heifers managed as previously outlined.

In this trial, a group of 40 Hereford heifer calves, some from the Station herd and some purchased, were divided by weight into four equal lots. A target weight of 650 pounds by the beginning of the breeding season, May 1, was established.

Starting on February 9th, 1977, 84 days before breeding was to begin, all lots were fed chopped mixed tame hay consisting of brome, crested and alfalfa. In addition, depending on initial weight and rate of gain required, one lot received two pounds, one lot four pounds and one lot six pounds of a grain mixture consisting of 50% oats and 50% wheat. One lot was not fed any grain.

Following the winter phase all lots were recombined into two breeding herds. They were turned on pasture, exposed to bulls from May 3rd to June 20th, a period of 48 days, and continued on grass for the rest of the summer.

On August 10th, all heifers were weighed individually. On August 19th all heifers were palpated for pregnancy with estimates made for age of fetus.

Results of the first years' trial are shown in tables 26, 27, and 28.

Table 26. Results of the winter phase of the wintering heifer trial.

	Group 1 all hay	Group 2 hay+2#grain	Group 3 hay+4#grain	Group 4 hay+6#grain
February 9, 1977 wt., lbs.	586	548	524	493
May 3, 1977 wt., lbs.	670	673	656	645
84 day winter gain, lbs.	84	125	132	152
ADG, lbs.	1.00	1.48	1.56	1.81

Table 27. Feed consumed per heifer for 84 days.

	Group 1 all hay	Group 2 hay+2#grain	Group 3 hay+4#grain	Group 4 hay+6#grain
50% oats, - 50% wheat mix, lbs.	--	170	333	483
Chopped tame hay, lbs.	1183	977	947	609
Minerals – (2 salt, 1 dical), lbs.	16.8	16.8	16.8	16.8
Winter feed cost/hd, $	27.78	30.70	37.28	36.35
Feed cost/day, ¢	33.1	36.5	44.4	43.3
Feed cost/cwt gain, $	33.07	24.56	28.24	23.91
Avg. lbs. feed/cwt-gain, lbs.	14.3	9.31	9.82	7.29

Table 28. Gain on grass and pregnancy status.

	Group 1 all hay	Group 2 hay+2#grain	Group 3 hay+4#grain	Group 4 hay+6#grain
August 10th wt., lbs.	819	795	762	769
99 day summer gain, lbs.	149	122	106	110
ADG on grass, lbs.	1.50	1.23	1.07	1.11
% of heifers pregnant [1/]	66	70	70	90
Estimated age of fetus – days	84	69	93	91

[1/] Percent pregnant low due to a sub fertile bull.

Discussion:

With the type and weight of heifers used in this trial, adding grain at levels of two, four or six pounds per head per day did allow heifers to reach the target weight by May 3, 1977.

We found at the close of the trial that one bull used was sub fertile, with a number of heifers exposed to him showing open.

Summary:

Dividing heifers into uniform weight groups did allow all of them to reach the target weight of 650 pounds without any of them getting overly conditioned. Cost of feed per day was almost 11 cents cheaper for the heavier heifers than for the lightest group.

The pregnancy test did not show any marked differences between any of the four groups.

The trial will be repeated in 1977-78.

HEIFER MANAGEMENT STUDY

North Dakota stockmen can't afford the luxury of keeping a heifer until she is three years old before she has her first calf. However, heifers bred to calve at two years must be properly managed if the calving season is to be successful. They should be fed so they will be well grown but not fat at calving. They should be bred to calve about three weeks earlier than the cow herd; and, they should be bred to bulls known to sire small framed calves having low birth weights.

Identification of "easy-calving" bulls under natural breeding conditions presents a real problem. One breed of cattle, the Texas Longhorn, is reported to minimize calving difficulties when crossed with Hereford or Angus heifers. However, very little research data is available to confirm or disprove these claims. Several area ranchers have used Longhorn bulls on first calf heifers with apparent success. However, these crossbred calves are often discounted at market time, due to their type, although little or no performance or carcass data are available to justify these discounts. Other area producers report good success by using small framed Angus bulls on Hereford heifers to reduce calving difficulties.

With these ideas in mind, a trial was designed to compare calving difficulty with first calf Hereford heifers bred to either Angus or Longhorn bulls.

In May, 1975, 40 straightbred Hereford heifers weighing approximately 680 pounds were assigned at random to one of two breeding groups. One group of 20 heifers was exposed to a two year old Longhorn bull while the other group was exposed to a two year old registered Angus bull. Both bulls remained with the heifers from May 7th to July 8th, a period of 62 days. During this period the heifers grazed on fertilized tame grass pasture. Upon removal of the Longhorn and Angus bulls, Polled Hereford bulls were run with the heifers. The heifers grazed on native range until October 16th when they were pregnancy checked. This check revealed one heifer not bred because of an infantile reproductive tract, and two suspected late calves.

In 1976, the trial was repeated with another forty Hereford heifers. The Longhorn and Angus bulls were turned in with the heifers on May 3rd and remained with them until July 1st, a period of 59 days. After July 1st, Polled Hereford bulls were with the heifers until the first of August. All heifers were pregnancy tested on September 14, 1976 by a local veterinarian.

The heifers ran together and were wintered as a group until they were moved into calving lots in early February. The heifers were wintered on a full feed of tame hay plus salt and minerals free choice. After calving, each heifer received approximately two pounds of ground oats in addition to chopped hay free choice.

A close watch and record was kept of each birth including birth date, weight, sex and ease of delivery. Type of delivery was scored from 1 to 5 as follows: 1 no help, 2 slight pull, 3 hard pull, 4 Caesarian, 5 born dead.

Weaning weights were recorded at approximately 205 days of age.

Table 29. Calving difficulty score – heifer management trial 1975-77

	Angus		Longhorn	
	1976	**1977**	**1976**	**1977**
Calving with:				
(1) No difficulty	16	16	19	16
(2) Light pull	--	1	--	1
(3) Hard pull	1	2	--	--
(4) Caesarian section	--	--	--	--
(5) Born dead	--	1	--	--
Possible live calves	18	19	19	17
% Born without difficulty	89	84	100	94

Summary:

The two calving seasons represented in this data indicate that Longhorn bulls mated to Hereford heifers will reduce calving losses and problems to a very minimum.

The economics of this practice appear to favor the Angus X Hereford matings due to heavier weaning weights of 34 pounds for steer calves and 36 pounds for heifer calves. These heavier weaning weights plus no discount at market time seem to favor the standard beef breeds if the operator can spend time with his first calf heifers at calving.

It is also much harder to select an easy calving Angus bull than it is a Longhorn bull.

Table 30. Two years calving data – heifer management trial 1975-77

	1975-76	1976-77	Total
	Number of heifers bred		
Angus	20	20	40
Longhorn	20	20	40
	Number of heifers calving		
Angus	18 1/	20	38
Longhorn	19 2/	17 3/	36
1/ One cow removed because of abnormal reproductive tract. 2/ One cow not included, late calving with a Hereford calf. 3/ Three cows not included, late calving with straight Hereford calves.			
	1976	**1977**	**Avg.**
	Average birth weights of bull calves		
Angus	7 hd = 70#	8 hd = 73#	15 hd = 72#
Longhorn	13 hd = 66#	8 hd = 63#	21 hd = 65#
	Average birth weights of heifer calves		
Angus	10 hd = 68#	12 hd = 65#	22 hd = 66#
Longhorn	6 hd = 58#	9 hd = 59#	15 hd = 59#
	Average weaning weights of steers		
Angus -actual	5 hd = 454#	7 hd = 440#	12 hd = 446#
-adjusted	5 hd = 462#	7 hd = 486#	12 hd = 476#
Longhorn -actual	13 hd = 407#	8 hd = 424#	21 hd = 413#
-adjusted	13 hd = 426#	8 hd = 468#	21 hd = 442#
	Average weaning weights of heifers		
Angus -actual	10 hd = 400#	12 hd = 425#	22 hd = 414#
-adjusted	10 hd = 401#	12 hd = 480#	22 hd = 444#
Longhorn -actual	5 hd = 369#	7 hd = 358#1/	12 hd = 364#
-adjusted	5 hd = 369#	7 hd = 436#	12 hd = 408#
1/ Two heifers not included, one calf sick at weaning, one calf died in September of unknown causes.			
	Estimated calf value at weaning		
	Steer calves		
Angus	5 hd@$177.06	7hd@$215.60	12hd=$199.54
Longhorn	13hd@$146.68	8hd@$195.04	21hd=$165.10
	Heifer calves		
Angus	10hd@$131.93	12hd@$182.75	22hd=$159.65
Longhorn	5hd@$110.70	7hd@$143.20	12hd=$129.66
1/ Price estimates based on actual weaning weight times price. BWF steers at $49, BWF heifers @ $43, Longhorn X Hereford steers at $46, LXH heifers at $40 in 1977. 1976 prices were 10¢ per pound less.			
	Return per heifer bred		
	1976	**1977**	
Angus	$122.48	$186.93	
Longhorn	$129.49	$170.85	

PROSTAGLANDINS FOR SYNCHRONIZATION OF ESTRUS IN BEEF CATTLE

A cooperative trial to evaluate Prostin F2 Alpha (dinoprost tromethamine) for the control of estrus in beef cows was started in June, 1976.

Prostin F2 Alpha is a registered prostaglandin analog produced and developed by the Upjohn Company, Kalamazoo, Michigan. To date, it is available in the United States for experimental use only.

Basically, the drug acts to interrupt the estrus cycle of a normally cycling cow, starting the cycle over in a normal manner. Thus, cows treated as a group will re-cycle as a group and can be bred or artificially inseminated as a group.

The trial involved 72 commercial Hereford and Angus X Hereford cows three years old and older, belonging to the Osteroos Ranch of Des Lacs, North Dakota.

The Upjohn Company provided the Prostin F2 Alpha used in the trial. Dr. Edward Moody, a reproductive physiologist with the Upjohn Company, palpated all cows for evidence of pregnancy and estimated age of fetus on September 25, 1976.

Dickinson station personnel assisted in allotting the cattle into treatment groups, made the two required injections of Prostin F2 Alpha, and analyzed the results of the trial.

All care and handling, artificial insemination and field insemination and field record keeping of the cows in this trial was done by Mr. Loren Osteroos.

Group one, designated as the control group, was handled in a normal A.I. breeding program. They were detected for estrus and artificially inseminated 12 to 14 hours following visual detection of standing heat. Heat detection began on July 10th, with the first insemination made on July 12th. The cows were bred A.I. as they were detected over a 24 day period. After a minimum of 10 days following A.I., the cows were moved into a cleanup pasture where they were exposed to a functional bull equipped with a chin ball marker. Cows not detected during the 24 day A.I. period were also moved into the cleanup pasture. Records were kept of cows bred into the cleanup pasture. All cows in the control group were worked through the chutes the same as treatments two and three although they did not receive any injections.

Group two, designated as the group inseminated at 80 hours following Prostin F2 Alpha injection, was maintained separately from groups one and three because no heat detection was required. Cows were injected beginning at 8:00 A.M., on June 28, 1976. The second injection was given at 8:00 A.M., on July 10th, 1976. Eighty hours following the second injection, starting at 4:00 P.M., on July 13th, all cows were inseminated. Twelve days following insemination the cows were moved into the cleanup pasture.

Group three, synchronized and inseminated as detected was maintained with group one in the detection pasture. They received the same injections as group two. Following the second injection a “gomer” bull wearing a chin ball marker was turned in and cows were inseminated approximately 12 hours after the first indications of standing heat. All cows were maintained at least ten days after insemination before they were turned into the cleanup pasture. Any cows not detected during the 24 day detection period were moved into the cleanup pasture.

Actual calving started about the middle of April in 1977.

Results of the trial are shown in the following table.

Table 31. Results of estrus synchronization using Prostin F2 Alpha.

	Group 1 normal A.I.	**Group 2 A.I. at 80 hrs**	**Group 3 A.I. at estrus**
Number of cows allotted	21 [1/]	25	26
Number of cows bred-			
First 21 days	16	25	23
Not detected	3	--	3
Bred in 21 days	84%	100%	88%
Pregnancy test Sept. 25, 1976-			
Cows pregnant the first 21 days	12 of 19 63%	16 of 25 64%	17 of 26 65%
Cows pregnant the first 24 days	14 of 19 74%	21 of 25 84%	21 of 26 81%
Number cows diagnosed pregnant	19 of 19 100%	25 of 25 100%	26 of 26 100%
Actual calving data-			
Cows calving first 21 days	12 of 19 63.2%	16 of 25 64%	16 of 26 61.5%
Cows calving first 24 days	14 of 19 73.6%	20 of 25 80%	20 of 26 76.9%
Cows calving later than 24 days	5 of 19 26.4%	5 of 25 20%	6 of 26 23.1%

[1/] Two cows removed from study. One died, one was bred early.

Summary:

The results of this, and similiar trials conducted across the country by the Upjohn Company are typical, and show that normal, cycling cows can be treated with Prostin F2 Alpha, and successfully inseminated on a synchronized schedule.

Concern has been expressed over the possibility that synchronization would result in having a concentrated calving period of one or two days, with the possibility of this occurring during a period of severe weather. Cows bred on a synchronized estrus in this trial calved over a 10 to 12 day period indicating that natural variation in the brood cow herd prevented a concentrated calving period from occurring.

USING STRAW IN COW WINTERING RATIONS

Straw feeding at various levels to replace part of the hay in wintering rations for pregnant beef cows has been recommended by this station and others in the United States and Canada. Past research at this station indicates that two-thirds of the hay in wintering rations can be replaced with straw, provided sufficient protein is available. Wintering rations of half hay and half oat straw and no supplemental protein have reduced wintering costs without affecting calving performance.

More efficient hay making equipment and portable tub grinders make possible the production of palatable, high quality rations containing various levels of hay and straw that can be blended and fed with little waste.

This cow wintering trial, started during the 1975-76 wintering season, is designed to evaluate the nutritional as well as the economic aspects of processing hay and straw, as compared to feeding these roughages in their long form.

Only mature cows that were at least four years old or older were used, and were fed a period of 70 days in 1976 and 84 days in 1977. Two experimental groups were selected randomly according to age and fed a wintering ration of four parts mixed hay (crested wheatgrass and bromegrass + alfalfa) and three parts oat straw. Daily consumption of approximately 23 pounds of forage as fed was desired. Utilizing a fenceline feeder, group 1 received this ration after it had been processed in a tub grinder through a two inch screen. Group 2, which was fed in a conventional manner on the ground, received the same ratio of hay and straw in the long form on alternate days; hay being fed on Tuesday, Thursday, Saturday and Sunday, and oat or barley straw fed on Monday, Wednesday and Friday of each week. Both lots received minerals free choice. On February 1st, approximately 30 days before calving, each cow received an enterotoxemia booster shot and one-million units of vitamin A, intramuscularly.

Results of the trial are summarized in tables 32 through 34.

Summary:

Results of this trial show that chopping a ration of four parts mixed hay and three parts oat straw through a tub grinder produced an economical, highly palatable wintering ration for mature cows that was readily consumed, regardless of weather conditions, up to the start of calving. Costs for chopping amounted to $2.10/ton.

Cows receiving the unprocessed hay and straw consumed an average 2.0 pounds less total feed per day, and wasted substantially more straw, especially on mild winter days, as compared to a very minimal amount of waste, and continued voluntary intake among the cows fed chopped forage.

The greatest amount of weight loss was experienced among the cows being fed unprocessed forage. Although weight loss was experienced by all age groups of cows calf birth weights and livability was unaffected by either method of feeding. The cows fed chopped blended hay and straw consumed the ration readily and some of their increase in weight is certainly to be considered as fill, which is very difficult to measure.

Table 32. Feed consumption, chopping costs and wintering economics – winters, 1975-77.

	Group 1 Chopped hay+straw		Group 2 Long form hay+straw	
	1976	**1977**	**1976**	**1977**
Days fed	70	84	70	84
Number of head	32	36 [1/]	42	37
Mixed hay, lbs.	32919	39533 [2/]	40959	41075
Straw, lbs.	24690	29262	23300	27876
Feed/hd/day, lbs.	25.7	22.7	21.7	22.2
Total feed cost, $ [3/]	853.51	1088.99	1022.48	1042.40
Daily feed cost/hd, $	0.381	0.366	0.348	0.335
Chopping cost/cow, $ [4/]	1.89	1.84	--	--
Total feed cost/hd, $	28.56	32.58	24.34	28.14

[1/] One cow removed January 3.
[2/] 2700 pounds long hay fed during severe storms.
[3/] Mixed hay @ $40/ton, oat straw @ $10/ton, salt-mineral mixture fed free choice @ $104/ton. Mineral used is 17% phosphorous, 25% calcium, mixed at the rate of one part mineral mix to two parts white salt.
[4/] Chopping costs, $2.10/ton.

Table 33. Weight changes, 1976-77.

	Group 1 chopped hay+straw			Group 2 long form hay+straw		
Age of cow	4	5,6,7	8,9,10	4	5,6,7	8,9,10
Weight change, lbs.						
1976	+67	+56	+62	-10	+5	+1
1977	+62	+43	+47	-7	-27	-38

Table 34. Two year average calf birth weights.

	Group 1 chopped hay+straw			Group 2 long form hay+straw		
Age of cow	4	5,6,7	8,9,10	4	5,6,7	8,9,10
Heifers:						
Avg. birth wt., lbs.	73	72	70	65	73	73
Steers:						
Avg. birth wt., lbs.	73	73	71	80	73	74

A COMPARISON OF BEEF CATTLE BREEDING METHODS TO IMPROVE PERFORMANCE

Artificial insemination is a management method that is available to livestock producers through various artificial breeding organizations. Superior sires can be selected from a large number of animals on the basis of their weaning and yearling performance as well as progeny records. Crossbreeding has also been shown to be an effective method of increasing the total pounds of calf weaned through the effects of hybrid vigor and the resulting improved performance. At a time when stockmen are faced with an ever increasing price-cost squeeze they must use every management tool at their disposal to produce more pounds of beef at the lowest possible cost. The purpose of this long range study, is to evaluate crossbreeding and purebreeding management systems using natural service and artificial insemination followed by clean-up bulls.

In the trial, Hereford cows from the main Dickinson Station herd were randomly divided by age and date of calving into three breeding groups. Approximately 60 cows were assigned to the artificial breeding system and about 30 cows were assigned to the natural service purebred and crossbred breeding groups. Purebred horned and polled Hereford bulls were used in the straightbred treatment (HxH) and purebred Angus bulls were used in the crossbreeding treatment (AxH).

Cows selected for A.I. breeding in 1976 received two pounds dry rolled oats per head per day during the 25 day breeding season. Since no breeding facility was available in the pastures grazed, the A.I. cows were trailed one-half mile each morning to a holding area where the supplemental grain was fed and those cows that had been detected in standing heat were sorted out. Breeding was done on a twice a day basis and when the cows were no longer in standing heat they were turned in with an Angus clean-up bull. To facilitate heat detection a detector bull equipped with a chin ball marker was used. Breeding among all treatment groups was started on May 27th and ran for 60 days, when the bulls were removed. Fall pregnancy testing identified open cows, and any old cows or poor producers were culled.

The following changes were made in 1977. Prior to the beginning of the breeding season a handling facility and holding area for grain feeding was constructed adjacent to the water supply in the crested wheatgrass pasture used as the breeding pasture. Eight pounds of a mixture of equal parts of grain and chopped hay was fed per head per day. This, and the provision for adequate bunk space eliminated competition for grain between older and younger cows. Twice a day breeding was discontinued in favor of once a day early morning breeding. All breeding groups were grazed on separate crested wheatgrass pastures until approximately July 1st of each year, depending on pasture condition, and were then moved to native pasture. Minerals were fed free choice in a 2:1 salt – di-calcium phosphate mixture to insure adequate phosphorous intake. Also, during the early spring on crested pasture a level of 15% magnesium oxide was added to the mineral mixture as a grass tetany preventative.

A summary of the results to date are shown in table 35, 36, and 37.

Summary:

Although a breeding study of this type has many hidden factors at work, the results to-date favor the natural service crossbreeding management system in which a return of $10 more per cow calved was experienced. The average pounds of calf weaned is not appreciably different between the A.I. and crossbred systems, however breeding costs and labor inputs were much higher for the A.I. system. The small number of A.I. calves born resulted in a high breeding cost per cow, as well as, a loss in pounds of calf weaned among cows that didn't settle on the first service. In addition to the loss in pounds of calf, cows that didn't settle on the first service were set back at least one heat cycle and possibly more if they didn't conceive early when exposed to the natural service clean-up bull. Setbacks such as this, in the reproductive cycle of a cow are difficult to regain.

Table 35. Breeding management systems summary – 1976-77 calving combined.

	A.I. system		**Natural service**		
	A.I. (HxH)	**Angus clean-up (AxH)**	**Hereford (HxH)**	**Crossbred (AxH)**	**(HxH)**
Total No. cows	131		57	56	
Total No. cows inseminated	131		--	--	
No. sold for management reasons	29		21	12	
No. having A.I. calves	38		--	--	
1st service conception rate of cows calved, %	37		--	63	
No. cows having (AxH) calves from Angus clean-up bull	--	62	--	--	
No. dead calves	3	3	7	3	
No. and sex of calf obtained-					
Steers	16	36	14	16	3
Heifers	19	26	15	18	4

Table 36. Weaning data and adjusted calf weights – 1976-77 calving combined

	A.I. system		Natural service	Natural service crossbred	
	(HxH)	(AxH)	Hereford (HxH)	(AxH)	(HxH)
Steers- actual	454	411	417	448	420
adjusted	472	473	450	475	458
Heifers- actual	391	383	366	424	347
adjusted	445	465	437	465	482

Table 37. Net return per cow – breeding management systems trial

	A.I. system				Natural Service			Natural Service		
			(HxH)	(AxH)	Hereford			Crossbred		
	No. head	Avg. wt.	$ value	$ value	No. head	Avg. wt.	$ value	No. head	Avg. wt.	$ value
Steers	16	454	3,269		14	417	2,627	16	448	3,226
@ 45¢	36	411		6,658				3	420	576
Heifers	19	391	3,046		15	366	2,251	18	424	3,129
@ 41¢	26	383		4,083				4	347	569
Gross return, $			17,056.00		4,878.00			7,500.00		
Avg. return/cow calved			165.59 [1/]		135.50 [2/]			170.45 [3/]		
Less breeding expense			-17.19		-11.50			-11.00		
Net return, $			148.40		124.00			158.95		

[1/] Includes 6 dead calves.
[2/] Includes 7 dead calves.
[3/] Includes 3 dead calves.

COMMERCIAL WEANING RATIONS AND HOME GROWN FEEDS COMPARED FOR PRE-CONDITIONING CALVES

North Dakota cattlemen have asked this station to evaluate the performance of calves fed commercial weaning rations. Their interest has been in regard to expected daily feed consumption, resistance to stress related health problems, and overall economics of using the commercial program.

Past experience from numerous trials conducted at this station has shown that self-fed rations composed of home grown mixed hay and oats will promote good, steady, economical gains in calves following weaning.

This trial, then, is designed to compare the "Home Grown" ration and the commercial ration with respect to animal response and cost.

On November 2, 1977 Hereford and Hereford X Longhorn crossbred calves from the station herd were weighed, weaned and sorted within breed and sex into six equal feeding groups. Three groups were assigned to be fed the commercial ration, and three groups served as controls and were fed the "Home Grown" ration. Based on the recommendations of the commercial feed distributor the trial was designed to run for not less than 21 days, and preferably for 28 days. The trial as actually completed this year was for the 28 day period.

All calves in the trial were vaccinated with Electroid Seven on October 17th and were given a booster at the beginning of the trial. Careful daily observations for any health problems were made throughout the trial with treatment made where necessary.

The Home Grown ration consisted of 20% oats and 80% mixed hay at the beginning of the trial. It was changed by gradually increasing the percentage of oats so that by the end of the 28 day period the calves were eating a ration of 40% oats and 60% hay by weight. This ration also contained 20 pounds of salt and 10 pounds di-calcium phosphate per ton. The commercial ration used this year was Purina Preconditioning/Receiving Chow. Both rations were self-fed in straight sided self-feeders designed for feeding high roughage rations. All feed was weighed in during the trial and feed left at the end of the trial was weighed back to give an accurate record of the amount of feed used. Feed waste was monitored throughout the trial, and was very minimal for both rations.

At the end of the trial period the crossbred calves were sold through the local auction market to evaluate any differences in "buyer appeal." The straightbreds will be carried through to finish.

Results of the first years' trial are shown in the following tables.

Table 38. Calf preconditioning trial results – 1977

	Home-Grown Hereford	Commercial Steers	Home-Grown Longhorn X Hereford	Commercial Longhorn X Hereford	Home-Grown Hereford	Commercial Heifers
No. head	6*	7	10	10	10	10
Nov. 3rd wt. lbs.	428	424	401	393	431	428
Dec. 1st wt. lbs.	478	486	453	446	480	478
28 day gain, lbs.	50	62	52	53	49	50
ADG, lbs.	1.78	2.21	1.86	1.89	1.75	1.78
Total gain/lot, lbs.	300	434	520	530	490	500
Pounds feed fed	1959 2/	2750 1/	2896 2/	4200 1/	3121 2/	3940 1/
Feed/lb. gain	6.53	6.32	5.57	8.0	6.24	7.9
Feed/hd/day, lbs.	11.7	14.0	10.3	15.0	11.2	14.1
Cost feed/hd, $	12.25	22.56	10.89	24.12	11.81	22.63
Cost feed/cwt gain, $	24.50	36.31	20.93	45.95	23.62	45.26
Actual selling value	--	--	$148.47	$148.02	--	--

* One steer died of bloat on November 16, 1977.

1/ Commercial – Purina Pre-conditioning Chow Sm-AB (G) medicated – chlortetracycline and sulfamethazine.

2/ Homegrown rations: 29% rolled oats, 70% chopped hay, 0.5% di-calcium phosphate, 1% salt.

Summary:

One calf was lost to bloat on the homegrown ration. No other calves required any medication or treatment.

Homegrown feeds used were of excellent quality, with hay averaging 10.7% protein and oats at 12%.

Gains on both rations were very satisfactory averaging 1.75 pounds or more per day.

Final weight was made after calves were off water for 16 hours. Feed was available up to the time of weighing.

Section II

Reports of
Swine Research in Progress
at the
Dickinson Experiment Station

Presented by the

Station Staff

at the

28th Annual Livestock Research Roundup

Dickinson Experiment Station
Dickinson, North Dakota

December 7, 1977

DRIED SWEET WHEY IN
GROWING-FINISHING RATIONS FOR SWINE

This feeding trial is designed to determine the substitution value of dried sweet whey compared with barley in swine growing-finishing rations; and, to determine the optimum amount of whey that can be fed without causing undesirable side effects such as scours and blindness.

Whey, a by product of North Dakota cheese plants, can be used successfully as livestock feed. Feeding trials at the Dickinson Experiment Station, show liquid whey to be a practical and economical feed in rations for growing-finishing pigs. Dried sweet whey has a protein and energy analysis similiar to barley, possesses a well balanced amino acid and vitamin B complex level, and is superior to barley in lysine. Drying liquid whey eliminates problems associated with handling a bulky liquid, and results in a product that can be stored, handled and mixed as a dry feed.

Research conducted at the Illinois Agricultural Experiment Station indicates that when rations containing 60% dried whey were fed to growing-finishing pigs a depression in rate of gain and daily feed intake was experienced as well as a tendency toward scours. In addition to the 60% level, rations containing 0, 5, 10, 20 and 40% dried whey were fed and performed satisfactorily.

Crossbred and straightbred pigs produced at the Dickinson Experiment Station, averaging 37 pounds, were randomly allotted into eight groups. To provide for pen replication two feeding units of four pens each were used. The rations fed, as shown in tables 1 and 2, consisted of a basic barley and oat control ration and three experimental rations in which barley was replaced with either 15, 30, or 45% dried sweet whey. The crude protein level was maintained at 15.5% until the pen averaged 120 pounds, at which time the protein was lowered to 12%. A portable mixer-grinder was used to process the rations which were self fed in meal form.

The experiment was duplicated under fall/winter feeding conditions with pigs having an average starting weight of 57 pounds.

Summer housing consisted of exposed solid concrete floored pens equipped with open front shelters and automatic waterers. Winter housing consisted of a drylot arrangement equipped with automatic waterers, self-feeders and closed front lean-to shelters that were bedded with straw on a routine basis. The pigs were weighed at two week intervals with records maintained on condition of health, with particular attention to the incidence of scours and blindness. Prior to the start of the trial the pigs were routinely vaccinated for erysipelas and wormed with Atgard.

Dried whey product, which was used in these feeding experiments at no cost, was donated by Mr. Joel Johnson, Whey-To-Go Plant, Mandan, North Dakota. Calculations for ration costs were made using the current agricultural market price of six and one-half cents per pound.

The rations as they were fed are shown in tables 1 and 2.

Weights, gains, and feeding economics for the summer and fall/winter trials have been summarized in tables 3 and 4.

At the close of each trial one half of the pigs were randomly selected to be slaughtered at Hormel's grade and yield plant at Mitchell, South Dakota. A summary of the carcass data is shown in table 5.

Summary:

The results of this trial indicate that dried sweet whey product can very successfully replace up to 45% of the barley in swine growing and finishing rations. Problems such as scours and blindness that were reported by researchers in Illinois were not detected at the 45% level, which was the highest level fed in this study.

All rations containing dried sweet whey, when compared with the basic barley and oats control ration, were more palatable and had a lower fiber content, which resulted in faster gains and better feed efficiency. Feed efficiency, as shown in tables 3 and 4, ranged from no difference to approximately 15% less feed per pound of gain.

Although net returns from all levels of dried whey feeding were higher than those received from pigs fed the control ration, the highest returns were attained at the 15% level of dried whey, and ranged from $3.60 more per head under summer feeding conditions to $6.41 more per head under the fall/winter feeding conditions.

Table 1. Rations as fed to 120 pounds.

Ingredients in pounds	**#1 0% Whey**	**#2 15% Whey**	**#3 30% Whey**	**#4 45% Whey**
Dried sweet whey	--	150	300	450
Oats	285	285	285	285
Barley	572	425	278	131
SBOM	120	120	120	120
Di-cal	6	5	4	3
Limestone	11	9	7	5
Vitamins & minerals [1/]	6	6	6	6
Total	1,000	1,000	1,000	1,000
Cost/lb. of feed, Whey: 6.5¢		.0604	.0626	.0648
Gross energy (Kcal/lb.)	1,832	1,791	1,755	1,716
% protein	15.5	15.6	15.7	15.8
% calcium	0.617	0.621	0.602	0.628
% phosphorus	0.528	0.537	0.549	0.559

[1/] Includes trace mineral salt, 5 lbs.; vitamin B complex, 1 lb.; vitamin A, 30 grams; vitamin D, 14 grams; and zinc sulfate, 180 grams.

Table 2. Rations as fed from 120 pounds to market.

Ingredients in pounds	#1 0% Whey	#2 15% Whey	#3 30% Whey	#4 45% Whey
Dried sweet whey	--	150	300	450
Oats	285	285	285	285
Barley	673	525	378	231
SBOM	20	20	20	20
Di-cal	6	5	4	3
Limestone	10	9	7	5
Vitamins & minerals [1/]	6	6	6	6
Total	1,000	1,000	1,000	1,000
Cost/lb. of feed, Whey: 6.5¢	.0533	.0554	.0576	.0598
Gross energy (Kcal/lb.)	1,832	1,791	1,755	1,716
% protein	15.5	15.6	15.7	15.8
% calcium	0.560	0.597	0.600	0.570
% phosphorus	0.503	0.513	0.524	0.534

[1/] Includes trace mineral salt, 5 lbs.; vitamin B complex, 1 lb.; vitamin A, 30 grams; vitamin D, 14 grams; and zinc sulfate, 180 grams.

Table 3. Weights, gains and feeding economics – summer 1976.

	No Whey	15%	30%	45%
No. head	13	14	14	14
No. days on feed	118	118	118	118
Initial wt., lbs.	37	37	37	36
Final wt., lbs.	197	217	229	223
Total gain, lbs.	160	180	192	187
ADG, lbs.	1.36	1.53	1.63	1.58
Feed/hd/day, lbs.	5.00	5.32	5.96	5.48
Feed/lb gain, lbs.	3.68	3.48	3.66	3.47
Cost/lb feed, $	.0555	.0576	.0612	.062
Cost/cwt gain, $	20.42	20.04	22.40	21.51
Feeding economics:				
Return/hd @ $35/cwt	68.95	75.95	80.15	78.05
Feed cost/hd, $	-32.67	-36.07	-43.01	-40.22
Feeder pig cost/hd, $	-30.00	-30.00	-30.00	-30.00
Net return, $ [1/]	6.28	9.88	7.14	7.83

Table 4. Weights, gains and feeding economics – fall/winter 1976-77.

	No Whey	15%	30%	45%
No. head	14	13[2/]	14	14
No. days on feed	102	102	102	102
Initial wt., lbs.	57	58	56	57
Final wt., lbs.	218	237	236	234
Total gain, lbs.	161	178	180	176
ADG, lbs.	1.58	1.75	1.76	1.73
Feed/hd/day, lbs.	6.70	6.64	6.34	6.27
Feed/lb., gain, lbs.	4.24	3.79	3.60	3.62
Cost/lb. feed, $	.0555	.0576	.0612	.062
Cost/cwt gain, $	23.53	21.83	22.03	22.37
Feeding economics:				
Return/hd @ $38.80/cwt	84.58	91.96	91.57	90.79
Feed cost, $	-37.88	-38.85	-39.65	-39.37
Feeder pig cost/hd, $	-23.33	-23.33	-23.33	-23.33
Net return, $ [1/]	23.37	29.78	28.59	28.09

[1/] Net return figure is market value less cost of feeder pig and feed costs, and does not include costs for veterinary supplies, equipment, housing, depreciation, taxes, insurance, etc.

[2/] One pig removed from trial due to pneumonia.

Table 5. Carcass summary.

	No whey	15%	30%	45%
Summer 1976				
Live wt., lbs.	211	226	230	225
Carcass wt., lbs.	150	160	164	163
Carcass dressing %	71	71	71	72
Carcass length, in.	31	31	31.5	31.4
10^{th} rib backfat, in.	.9	1.2	1.2	1.1
Loin eye muscle, in.	2.6	2.6	2.7	2.7
Quality score:				
Loin eye area, sq. in.	4.5	4.0	4.2	4.1
Percent lean	54.6	50.3	51.0	51.4
Fall/winter 1976-77				
Live wt., lbs.	225	232	245	233
Carcass wt., lbs.	165	170	182	173
Carcass dressing %	73	73	74	74
Carcass length, in.	31.7	31.8	31.6	31.8
10^{th} rib backfat, in.	.72	.82	.81	.69
Loin eye muscle, in.	2.8	2.9	2.0	2.4
Quality score:				
Loin eye area, sq. in.	5.1	4.3	5.6	5.5
Percent lean	57.0	55.3	57.0	58.0

DRIED SWEET WHEY AND WHEAT COMBINATION FOR GROWING-FINISHING SWINE

Recent changes in grain values have again made wheat feeding an economical practice. In addition, work just completed at this Station and summarized on page eight of this progress report indicates that when dried sweet whey replaced 15, 30 or 45% of the barley in growing-finishing rations palatability and total digestible nutrients were increased. The result was a greater net return among all three levels of dried whey feeding when compared to the control ration which contained no whey. The purpose of the most recent trial was to further evaluate dried sweet whey when fed in combination with wheat to growing-finishing swine.

Feeder pigs used in the study averaged 53 pounds when the trial was started on June 7th, 1977, and average market weights were reached in 107 days. Housing for the pigs consisted of open front sheds on concrete floors, automatic waterers and self-feeders. The pigs were wormed with Atgard swine wormer at the start of the trial and again when they averaged approximately 150 pounds.

Rations used contained the following energy feedstuffs: dried sweet whey, wheat and barley or oats, but not both. Dried whey was included at either 15 or 30% of the ration, and wheat was held at 40% in all cases. The barley or oats portions varied with respect to the amount of dried whey that was included in each of the experimental rations. The rations as they were fed are shown in tables 6 and 7.

At the completion of the trial three barrows from each treatment were shipped to Hormel and Company's plant at Mitchell, South Dakota for carcass measurement and evaluation. A summary of that carcass data is shown in table 8.

Weights, gains, feed efficiency and net returns have been tabulated and are shown in table 9.

Summary:

Pigs consuming the lower levels of whey were the most efficient in this first feeding trial in which wheat and dried sweet whey were combined. The 15% whey-wheat-barley combination was the most economical followed by the 15% whey-wheat-oats ration in which an eight and eight tenths percent lower feed efficiency was experienced. Carcass data favored the 30% whey-wheat-barley combination which was the least efficient ration. Future trials are planned using these ration combinations.

Table 6. Rations as fed from start to 120 pounds.

Ingredients in pounds	15% whey wheat + barley	30% whey wheat + barley	15% whey wheat + oats	30% whey wheat + oats
Dried sweet whey	150	300	150	300
Oats	330	183	--	--
Barley	--	--	330	182.5
Winter wheat	400	400	400	400
SBOM	100	100	100	100
Di-cal	5	4	4	4
Limestone	9	7	10	7.5
Trace mineral salt	5	5	5	5
Vitamin B complex	1	1	1	1
Vitamin A, gms.	30	30	30	30
Vitamin D, gms.	14	14	14	14
Zinc sulfate, gms.	180	180	180	180
Total	1,000	1,000	1,000	1,000
Gross energy (Kcal/lb.)	1,923	1,872	1,908	1,864
% protein	16.0	15.9	16.3	16.3
% calcium	0.666	0.653	0.673	0.669
% phosphorous	0.522	0.542	0.529	0.555

Table 7. Rations as fed from 120 pounds to finish.

Ingredients in pounds	15% whey wheat + barley	30% whey wheat + barley	15% whey wheat + oats	30% whey wheat + oats
Dried sweet whey	150	300	150	300
Oats	409	263	--	--
Barley	--	--	411	263
Winter wheat	400	400	400	400
SBOM	20	20	20	20
Di-cal	6	4	4	4
Limestone	9	7	9	7
Trace mineral salt	5	5	5	5
Vitamin B complex	1	1	1	1
Vitamin A, gms.	30	30	30	30
Vitamin D, gms.	14	14	14	14
Zinc sulfate, gms.	180	180	180	180
Total	1,000	1,000	1,000	1,000
Gross energy (Kcal/lb.)	1,923	1,877	1,904	1,865
% protein	13.6	13.5	13.8	13.6
% calcium	0.623	0.610	0.615	0.629
% phosphorous	0.513	0.515	0.505	0.535

Table 8. Carcass summary.

Carcass measurements	15 % whey wheat + barley	30% whey wheat + barley	15% whey wheat + oats	30% whey wheat + oats
Length	31.50	32.36	31.28	31.63
10^{th} rib backfat, in.	1.42	1.25	1.16	1.43
Loin eye, sq. in.	3.62	4.29	3.48	3.85
Loin eye quality	2.5	2.6	3.0	2.66
% Lean meat	47.61	50.48	49.27	48.24

Table 9. Weights, gains, feed efficiency and net return.

	15% whey wheat + oats	30% whey wheat + oats	15% whey wheat + barley	30% whey wheat + barley
No. head	11[1/]	12	6[2/]	12
Days fed	107	107	107	107
Starting wt., lbs.	53	53	46	52
Finish wt., lbs.	210	217	207	227
Gain, lbs.	157	164	161	175
ADG, lbs.	1.46	1.53	1.50	1.63
Feed/hd/day, $	5.56	6.12	5.09	6.82
Feed/lb gain, $	3.81	4.00	3.37	4.18
Cost/cwt gain, $	21.21	23.20	18.76	24.15
Gross return @ $40/cwt	84.00	86.80	82.80	90.80
Feeder pig cost/hd., $	-27.00	-27.00	-25.50	-27.00
Feed cost, $	-33.30	-38.05	-30.20	-42.26
Net return, $	23.70	21.75	27.10	21.54

[1/] One pig removed because of lameness.
[2/] One replicated lot removed because of disease problems unrelated to ration comparison.

SWINE ARTIFICIAL INSEMINATION PILOT TRIAL

Artificial insemination of swine is not new. Until boar semen could be successfully frozen and stored, and the optimum time of insemination became better understood, it was not very practical for the commercial pork producer and was used only to a limited extent by purebred breeders. Recently, USDA-ARS scientists at Beltsville, Maryland perfected the technique that is now being used to freeze and thaw boar semen. These freezing and thawing techniques, and improved semen extenders in which fresh collected semen can be successfully held for as long as 72 hours, have made AI for swine a practical possibility, creating considerable interest among commercial pork producers as well as purebred breeders. In response to this new interest, a pilot breeding trial was conducted at the Dickinson Experiment Station to lay the ground work for future trials.

Throughout this study mature sows were used. To reduce labor involved in heat detection and to evaluate the use of heat synchronization hormones, sows were synchronized using the hormones pregnant mare serum (PMS), and human chorionic gonadotrophin (HCG) following lactation. PMS was administered subcutaneously the first morning after weaning, and HCG was given intramuscularly 56 hours following the PMS injection. Insemination was done 24 hours after the HCG injections without regard to standing heat.

At the outset, natural service was compared with a single artificial service following heat synchronization as described above. It should be pointed out that only those sows selected to be bred artificially were synchronized. A 58% conception rate was attained from breeding AI, which left ample room for improvement. In an attempt to improve conception rate, and litter size as well, the natural service comparison was set aside, since sow numbers were limited, so that subsequent to heat synchronization one insemination could be compared with two inseminations separated by eight hours.

Breeding data obtained from the two investigations has been summarized in tables 10 and 11.

Frozen semen used was purchased at a cost of four to eight dollars per ampule from United Suppliers, Inc., Box 538, Eldora, Iowa; the only commercial supplier of frozen boar semen in the United States at this time. Shipping and handling charges amounted to approximately two dollars per ampule.

Discussion:

A lot of information has been gleaned from this preliminary investigation. The first and foremost point to be made is that we have only scratched the surface of swine AI; and the other is that, although varied, the results obtained are promising enough to warrant further investigation. Swine AI is not going to be a panacea for the pork producer. However it does provide an opportunity for both the purebred breeder as well as the commercial producer to make herd improvement through the use of proven sires. AI is not intended to supplant the purebred breeders. Instead, it makes it possible for large and small purebred and commercial producers alike to have available to them some very good bloodlines that they would not otherwise have access to. It can be used very well by the purebred producer to create herd improvements that could result in a greater demand for his purebred stock. It can also be put to good use in herd health management since a closed herd can be maintained. In view of potentially dangerous herd health problems such as pseudorabies, which is on the increase, swine AI may provide an avenue of prevention that swine producers may not have already considered.

Offspring produced from AI matings at this Station have been very desirable showing good balance, length and above average muscling and carcass quality.

Significantly lower conception rates were experienced in two out of the three artificial breedings in this preliminary study. Probable cause for this, in one of two instances, points out a major weakness of swine AI today, that is, the wide variation in semen freezing quality. The problem doesn't seem to be specific, but appears to be a problem of certain individuals within any breed. Amount the small number of boars used in our breeding, semen of Yorkshire origin had a 20% settling rate as compared to an 86% settling rate for semen of Hampshire origin.

In the fall of 1976 an especially low conception rate and litter size prevailed. Although boar variability is certainly a potential cause, it is felt that heat stress was the major contributing factor. Research conducted by Edwards (1968) and Teague (1970) clearly illustrates that high air temperatures reduce the incidence of estrus, decrease ovulation rate, decrease embryo survival, and increase the number of stillborn pigs. However, when air temperatures were kept below 85°F. ovulation rate and embryo survival were highest.

The average daytime high in August was 86°F. and September averaged 77°F. Seventeen days during August were 85°F or above with seven of those days having daytime temperatures between 91 to 100°F. As expected, September had a cooler average temperature; however, one week near the time of breeding was very warm with a record 103°F recorded on September 7th.

Summary:

The results of this preliminary breeding trial indicate that when using superior sires, typical of those available through artificial insemination, excellent quality offspring can be produced.

Conception rate was variable and ranged from a high of 87.5% where two inseminations separated by eight hours were used down to 50% when the influence of heat stress prevailed. Although a double insemination resulted in a significant increase in conception rate, no measurable increase in litter size was experienced.

When a single insemination was used conception rates ranged from a high of 58% to a low of 33%.

Pigs treated with the synchronization hormones PMS/HCG were satisfactorily synchronized. Additional research is necessary however, to pinpoint the optimum time of insemination when using them.

Table 10. Sow performance, AI pilot breeding trial.

	Artificially inseminated	Naturally serviced
Winter 1975:		
No. sows exposed	12	10
No. sows settled	7	8
Conception, %	58	80
Avg. pigs born/sow	6.0	9.8
Avg. pigs weaned/sow	5.7	9.3

Table 11. Sow performance, AI pilot breeding trial, one insemination vs. two inseminations.

	One insemination	Two inseminations separated by 8 hours
Spring 1976:		
No. sows exposed	7	8
No. sows settled	5	7
Conception, %	71.9	87.5
Avg. no. pigs born alive	6.8	6.8
Avg. no. pigs weaned	6.0	4.9
Fall 1976:		
No. sows exposed	6	6
No. sows settled	2	3
Conception, %	33	50
Avg. no. pigs born alive	3.5	4.3
Avg. no. pigs weaned	3.5	4.3

BREEDING GILTS ARTIFICIALLY USING FROZEN SEMEN

This trial was designed to further investigate conception rate and litter size, as well as semen handling, timing and insemination techniques according to current recommendations using non-synchronized gilts under typical farm conditions.

Twenty-two non-synchronized virgin gilts that averaged approximately 280 pounds were randomly assigned to either a natural, or AI breeding treatment. The naturally bred gilts were pen mated to two fertile Yorkshire boars which were rotated every other day until breeding was completed. The gilts were checked twice daily to record breeding information.

Gilts in the AI treatment were checked for standing heat twice daily using an intact detector boar. Twelve hours following detection of standing heat the gilts were inseminated with extended thawed semen, using procedures outlined by International Boar Semen, a division of United Suppliers, Inc., of Eldora, Iowa. If the gilts were still in standing heat 12 hours following the first insemination, they were re-inseminated. During the course of breeding a detector boar was used across the fence as a breeding stimulus. The frozen semen used was a composite of three breeds, Duroc, Landrace and Chester White, to reduce the probability of sire effect with the frozen semen. Following insemination, the gilts were checked for return to estrus using the detector boar.

The gilts were housed in dirt lots equipped with portable houses, automatic waterers and self-feeders.

Breeding and farrowing results have been summarized in table 12.

Summary:

Satisfactory conception rate and litter size were obtained when non-synchronized gilts were artificially inseminated using frozen boar semen. Success is attributed to the three-way semen composite that represented the Duroc, Landrace, and Chester White breeds, as well as the use of a detector boar and strict adherence to procedures as outlined by International Boar semen for semen thawing, extending and inseminating. By using the three-way semen, boar variability which has been a problem in other AI breeding trials conducted at this Station, was reduced.

Conception rate in the natural service treatment was 100% as compared to 90% among the gilts inseminated artificially.

There was no difference between treatments in the number of pigs born alive; however, survival rate among artificially sired pigs was significantly better.

Time required for inseminating averaged approximately 15 minutes per gilt.

The results of this trial represent a limited number of individuals and therefore future trials are planned.

Table 12. Breeding summary AI vs. natural service of non-synchronized gilts.

	AI	Natural service
Number of gilts	11[1/]	11
Number of gilts settled	9	11
Percent conception	90	100
Pigs born alive	8.8	8.9
Pigs weaned	7.8	6.5

[1/] One gilt removed after being bred by herd boar.

USING ALFALFA IN RATIONS FOR GESTATING GILTS AND SOWS

How much alfalfa can be used in self-fed gestation rations for gilts and sows?

This study, started at the request of North Dakota pork producers, was designed to evaluate moderate and high levels of alfalfa in self-fed gilt and sow gestation rations under North Dakota winter conditions.

Research conducted in Nebraska indicates that lower cost gestation rations can be formulated using high levels of alfalfa, without affecting gilt development, litter size, birth weights, number of pigs weaned or weaning weights.

Purebred Yorkshire gilts were randomly allotted into two groups. Each group was fed a 15% protein gestation ration containing either 40% or 70% alfalfa, and balanced according to NRC requirements.

Both groups were sheltered in portable houses under drylot conditions, and had free access to automatic waterers and self-feeders equipped with openings large enough to handle the bulky rations satisfactorily.

The two rations as fed are shown in table 13. During the feeding period the gilts were weighed bi-monthly. Their weights, gains and feed costs are summarized in table 14. Litter production data are shown in table 15.

Table 13. Gestation ration composition

	40% alfalfa	**70% alfalfa**
Alfalfa, lbs.	400.0	700.0
Oats, lbs.	526.5	179.0
Soybean oilmeal, lbs.	63.0	107.5
Tripoly phosphate, lbs.	4.0	7.0
Vitamins and minerals, lbs. [1/]	6.5	6.5
Total, lbs.	1000.0	1000.0
Protein, %	15.0	15.0
Cal. dig. energy, Kcal/lb.	988	826
Cost/lb., $	.04132	.03814

[1/] Includes trace mineral salt, 5 lbs.; B-complex vitamins, 1 lb.; vitamin A, 75 gms.; vitamin D, 5 gm.; and zinc sulfate, 180 gms.

Table 14. Gestation weights, gains and feed costs, 2-year average

	40% alfalfa		70% alfalfa	
	Gilts	2nd litter sows	Gilts	2nd litter sows
Weights and gains:				
No. head	12	10	11	10
Initial wt., lbs.	324	455	323	438
Pre-farrowing wt., lbs.	426	577	373	508
Gain, lbs.	102	122	50	71
Days on test	75	66	75	66
Avg. daily gain, lbs.	1.36	1.84	.66	1.08
Feed and costs:				
Feed/hd/day, lbs.	9.7	14.2	9.0	12
Ration cost/day, $	.39	.59	.34	.46
Feeding period cost, $	29.25	36.47	25.50	29.49

Table 15. Litter production data, 2-year average

	40% alfalfa		70% alfalfa	
	Gilts	2nd litter sows	Gilts	2nd litter sows
Birth data:				
No. of litters	11	10	10	9.5
Litter size	9.8	8.7	8.8	9.2
Litter wt., lbs.	30.6	32.0	24.3	27.4
Avg. individual pig wt., lbs.	3.1	3.7	2.7	3.0
Weaning data:				
No. of litters	11	10	10	9
Litter size	8.7	7.8	7.9	8
Litter wt., lbs.	282	225	226	210
Avg. weaning wt./pig, lbs.	33	32	29	28
Percent survival	88	91	88	87

Summary:

Gestation diets containing either 40% or 70% alfalfa were self-fed to gilts and second litter sows during the last two-thirds of gestation. Gilts fed the two rations performed most favorably with the 40% level of alfalfa. Those gilts fed the 70% alfalfa ration consumed approximately one pound less feed per day at a savings of $3.75 for the feeding period. Although a savings was realized, the amount was not nearly enough to offset the significant loss in litter production. Feeding the higher energy 40% ration, which was more suitable for gilt development and litter production, resulted in one additional pig being farrowed per sow, heavier pigs at birth, and more and heavier pigs at weaning. Total litter production at weaning among those gilts fed 40% alfalfa was an average 57 pounds heavier than litters from the 70% group.

Second litter sows in phase II of this trial, which is designed to evaluate the long term effect of feeding moderate versus high levels of alfafa in gestation rations, performed satisfactorily under both levels of alfalfa. Although no problems were experienced, daily feed consumption was high for both levels of alfalfa and resulted in a 2-year average daily feed cost of $.59 among those pigs fed 40% alfalfa and $.46 among the pigs receiving 70% alfalfa, which resulted in a savings of $6.97.

Results of this study indicate that even when high levels of roughage are used in sow rations some kind of restriction is necessary to avoid expensive over consumption.

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Hog Marketing Alternatives Selling Packer Grade and Yield vs. Selling Locally

Douglas G. Landblom and James L. Nelson

What is your best hog marketing alternative? Hogmen attending the 1976 Southwest Area Pork Producers annual meeting were encouraged by a Hormel and Company representative to consider selling on a grade and yield basis as one of their marketing alternatives.

Since the job of raising pork isn't finished until marketing has been completed, a study was initiated in 1976 and completed in 1977 at the Dickinson Experiment Station to evaluate the economics of selling market hogs at a local buying station, compared to selling on a grade-and-yield basis from the Dickinson, North Dakota, area. In this economic study, above average quality crossbred York X Hamp and straightbred Yorkshire market barrows raised at the Dickinson Station were randomly assigned to be marketed at either the Hormel and Company plant, Mitchell, South Dakota, or Western Livestock Company, Dickinson, North Dakota.

Three separate comparative marketings were made for each selling method. The hogs selected for slaughter at Mitchell, 450 miles from Dickinson, were weighed and shipped directly via a commercial livestock hauling firm. Storm-related problems were encountered during one of the two winter marketings. Those hogs that were marketed on March 12, 1976 had originally been scheduled for shipment one week earlier. However, a severe winter storm interrupted normal livestock movements and arrangements had to be made for a later shipping date. As a result, several of the hogs became heavier than desirable.

The hogs marketed locally were to be hauled directly to the Western buying station according to the project's original design. However, no measurable shrinkage was recorded after the first group of hogs were sold locally, since the Dickinson Station is located within two miles of Western. Thus, the original design was modified and in an effort to typify a regular farm marketing, the second group of hogs sold locally were weighed and transported 30 miles before being delivered to the buying station.

Compared to no measurable weight loss in the first group (Table 1), an average live weight loss of 4.7 pounds per head occurred in the second group sold locally, which amounted to an average shrinkage of 2 per cent. The third group assigned to be sold locally were marketed but not actually sold, since most of them were kept for replacement purposes.

Origin, destination weight and shrinkage, as well as the market value per hundred weight, have been summarized for both marketing types in Table 1.

Discussion

Selling grade-and-yield carcasses differs substantially from selling live hogs at a local buying station. Buying stations purchase hogs in groups, sort out the obvious individuals that are either light or heavy and pay a lower price. In grade and yield marketing, however, each pig is sold on an individual basis. Those that are either under- or over-finished are bought on a calculated meat price that is determined by dividing the liveweight market value per hundred weight by a standard yield factor that is predetermined by the packer. Hormel's standard yield factor was derived from the actual yields taken from a large number of hogs that were slaughtered in each liveweight category.

In Table 2, the meat price has been calculated using the standard yield conversion factor for those hogs shipped to Mitchell. Also in Table 2, it can be seen that improper sorting of hogs to be sold on a grade-and-yield basis can result in a substantial loss. This is not to say that sorting losses can be eliminated completely. However, they can be reduced considerably, especially when a scale is employed.

Grade-and-yield premiums are paid for those carcasses which possess above average quality. Carcass quality is graded on a scale from 1 to 4, and those carcasses that are considered to be of high enough quality to be given a number 1 or 2 grade are paid a premium per hundred pounds of carcass according to the schedule shown in Table 3. Any carcass graded as number three in quality is said to be standard and no premium is paid. Quality grade number 4 is reserved for over-finished hogs and a dockage of $2.00 per hundred weight is levied. Each of the three grade-and-yield marketings have been summarized in Table 4.

Compared to Hormel's standard yield, pigs sold from the Dickinson Station were above average in quality and also yielded 2.5 per cent, 1.9 per cent and 1.7 per cent higher in groups I, II and III, respectively. In all cases the gross return per hundredweight was higher for hogs marketed grade-and-yield; however, net return was less in two of the three shipments after trucking and shrinkage expenses were deducted.

When compared on an equal weight basis of 220 pounds (Table 5), a slight net return of $.85 per head was received for the first group marketed grade-and-yield. The net return for groups 2 and 3 favored local marketing and amounted to $.61 and $1.41 more per head, respectively. Average shipping cost from the Dickinson area amounted to $3.04 per head. Shrinkage expense above that encountered with local selling amounted to an average $1.21 per head.

Summary

Results of this trial, after three marketings, indicate that there is no advantage for selling on a grade-and-yield basis from the Dickinson area. Grade-and-yield premiums contributed to a higher gross return than that received from local selling, but on the average the premiums were not enough higher to substantially offset the high cost of trucking and liveweight shrinkage. Although no economic advantage was obtained by selling grade-and-yield from the Dickinson area, producers situated within a reasonable hauling distance of 130-175 miles may want to consider selling grade-and-yield if they are able to sort and market 30-40 butcher hogs at a time that are above average in quality and will weigh within the desirable weight range of 200-230 pounds on arrival at the packer.

For those producers situated within a reasonable hauling distance and considering grade-and-yield marketing, the following guidelines should be adhered to: market price information should be obtained from the packer and the local buyer prior to shipment to determine which marketing method has the potential to yield the most return. In an attempt to avoid sorting losses when selling grade-and-yield, it is essential that each hog be weighed before shipment, and those that are too heavy should be sold locally, and those hogs that are lighter than desirable, should be continued on feed.

Winter weather should be watched closely when hogs are approaching optimum market weight because severe winter storms can interfere with normal transportation movement, and hogs can easily become heavier than 200-230 pounds. When small or part semi-loads are being shipped commercially, trucking arrangements should be made in advance to allow the trucker ample time to arrange for livestock to fill out the remainder of his load.

Landblom is assistant animal husbandman and Nelson is animal husbandman, Dickinson Branch Experiment Station.

Table 1. Weight summary and market value of pigs sold grade and yield vs. local marketing.

		Grade and Yield				Local marketing		
Date marketed		**Mar 12**	**Oct 1**	**Jan 7**		**Mar 12**	**Oct 1**	**Jan 7**
No. head		36	28	29		19	7	24
Base market value/cwt, $		45.00	33.24	37.36		43.75	33.75	37.25
Dickinson wt., lbs.		8729	6247	7075		4459	1653	5161
Avg. wt./pig, lbs.		242.5	223.1	243.9		234.7	236.1	215
Destination wt., lbs.		8555	6025	6770		4459	1620	[1]
Shrink, lbs.		174	222	305		--	33	--
Shring/pig, lbs.		4.9	7.9	10.5		--	4.7	--
Per cent shrink		2.02	3.5	4.3		--	2.0	--

[1]Pigs in this group were not actually marketed locally since they were retained for replacement purposes.

Table 2. Live market price, standard yield + meat price/cwt of carcass sold grade + yield

	Live market price				Standard		Extended meat price $/cwt.		
Live wt.	**Mar 12 1976**	**Oct 1 1976**	**Jan 7 1977**	**÷**	**yield conv. factor**	**=**	**Mar 12 1976**	**Oct 1 1976**	**Jan 7 1977**
170-180	43.50	31.75	35.50		.704		61.79	45.10	50.43
181-190	43.50	32.00	36.50		.709		61.35	45.13	51.48
191-200	44.50	33.00	37.50		.713		62.40	46.28	52.59
201-230	45.00	33.50	38.00		.720		62.50	46.52	52.77
231-240	44.75	33.25	37.75		.725		61.72	45.86	52.06
241-250	44.25	33.00	37.25		.727		60.86	45.39	51.23
251-260	43.75	32.50	36.75		.729		60.01	44.58	50.41
261-270	43.25	32.00	36.25		.730		59.24	43.83	49.67
271-280	42.25	31.00	35.25		.732		57.71	42.35	48.16
281-290	41.25	30.00	34.25		.733		56.27	40.92	46.73

Table 3. Weight categories and premiums paid for number 1 and 2 hogs.

					Premium $/carcass cwt.	
Live wt. range		**Carcass wt. range**		**Mar 12 and Oct 1**		**Jan 7**
No. 1 grade						
180-240		128-176		+$1.75/cwt		+$2.00/cwt
240-270		177-199		+$1.25/cwt		+$1.50/cwt
270-330		200-245		+$1.00/cwt		+$1.25/cwt
No. 2 grade:						
180-240		128-176		+$1.00/cwt		+$1.25/cwt
240-270		177-199		+$0.75/cwt		+$1.00/cwt
270-330		200-245		+$0.50/cwt		+$0.75/cwt

Table 4. Grade and yield summary.

Group I, marketed March 12th, 36 head.		**Group II, marketed October 1, 1976, 28 head.**		**Group III, marketed January 7, 1977, 29 head.**	
Actual yield 6417 ÷ 8555=	75.0%	Actual yield 4456 ÷ 6025=	73.96%	Actual yield	73.8%
Hormel's average standard yield=	72.5%	Hormel's average standard yield=	72.08%	Hormel's average standard yield	72.1%
Yield increase	2.5%	Yield increase	+ 1.88%	Yield increase	1.7%
Market value excluding grade + yield	$45.00/cwt	Market value excluding grade + yield	$33.24/cwt	Market value excluding grade + yield	$37.36/cwt
Market value increase for yield	+$ 0.41/cwt	Market value increase for yield	+$ 0.87/cwt	Market value increase for yield	+$ 0.70/cwt
Market value increase for grade	+$ 0.73/cwt	Market value increase for grade	+$ 1.00/cwt	Market value increase for grade	+$ 0.76/cwt
	$46.14/cwt		$35.11/cwt		$38.82/cwt
Local market value	$43.75/cwt	Local market value	$33.75/cwt	Local market value	$37.25/cwt

Table 5. Comparison of grade and yield marketing vs. local marketing based on equal weight.

	Grade and yield				Local selling		
Marketing group	**I**	**II**	**III**		**I**	**II**	**III**
Date	Mar 12	Oct 1	Jan 7		Mar 12	Oct 1	Jan 7
Live wt. value/cwt, $	46.14	35.11	38.82		43.75	33.75	37.25
Gross return, 220 lb. hog, $	101.51	77.24	85.40		96.25	74.25	81.95
Expenses: trucking, $	-2.77	-3.03	-3.33		-0.50	-0.50	-0.50
shrinkage, $	-2.14	-2.66	-3.67		--	-1.59	-1.64
Net return/head, $	96.60	71.55	78.40		95.75	72.16	79.81
Difference, $	+0.85					+0.61	+1.41

Section III

Reports of
Range and Pasture Management Research
at the
Dickinson Experiment Station

Presented by

Dr. Warren C. Whitman, Botanist

Mr. Paul Nyren, Botanist

at the

28th Annual Livestock Research Roundup

Dickinson Experiment Station
Dickinson, North Dakota

December 7, 1977

COW-CALF
GRAZING ON A 3-PASTURE SYSTEM

A trial to investigate the benefits of a three pasture grazing system on cow-calf performance was started in the spring of 1977. The trial consists of a grazing system utilizing crested wheatgrass for spring and early summer grazing, native range for mid and late summer and Russian wildrye for fall grazing. The crested wheatgrass and native range was divided into two parts, one of which was fertilized with 50 pounds nitrogen per acre. The Russian wildrye was divided into four equal pastures, all receiving 50 pounds nitrogen and 30 pounds P_2O_5 per acre. The fertilized pastures were made smaller than the unfertilized in order to keep the grazing pressure equal on both sets of pastures without varying the number of cow-calf pairs. (see table 1)

Ten cow-calf pairs were used on each of the sets of pastures. Cows were selected for uniformity of weight with all calves having been sired by the same bull. One bull was run with each set of cows from May 20 until July 8. Bulls were also selected as nearly equal in weight as possible weighing 1535 and 1565 pounds respectively. One calf died during the study. The cow was removed and replaced by a different cow-calf pair. Cows and their calves were weighed before being placed on the crested pastures, when they were transferred to a new set of pastures and at the end of the grazing season.

Because of the dry spring the animals were not turned out until May 13. Despite the late turnout date the cows and calves on the fertilized pasture ran out of forage 12 days later. The unfertilized pasture had considerably more forage available because of its larger size. The animals on the fertilized pasture were moved to an auxiliary pasture on May 25 and remained there until June 6 (table 1). On June 7 both groups of animals were moved from the crested wheatgrass to pastures one and three of the Russian wildrye. The wildrye pastures were grazed before the native because the cool season Russian wildrye had produced more forage. Following the rainy period in early June the fertilized crested wheatgrass pasture produced considerable regrowth. On July 7 the animals grazing the fertilized set were returned to the crested pastures while those on the unfertilized pastures were moved to the native range. The cows and calves grazed the regrowth on the fertilized crested for 20 days and on July 28 were moved to the fertilized native. On August 3 the animals on the unfertilized native had consumed 48 percent of the available forage and were moved to one of the remaining Russian wildrye pastures. They remained on the wildrye until August 31 when they were removed from the study and placed on other pasture. The other group of cows and calves were transferred from the fertilized native to the wildrye on August 30 and remained there until September 23.

The cows and calves on the unfertilized pastures grazed a total of 110 days. They consumed an average of 67 percent of the forage on 50 acres. The cows gained an average of 30 pounds per acre for the season while their calves gained 44 pounds per acre. The cows and calves on the fertilized pastures utilized 66 percent of the forage on 36 acres. The total grazing season was 133 days of which 13 were on the auxiliary crested wheatgrass pasture. The cows gained an average of 32 pounds per acre for the entire grazing season. Gains for the 120 days on fertilized pastures (excluding the 13 days on the auxiliary crested) was 36 pounds per acre. The calves on the fertilized system gained 51 pounds per acre for the entire 133 day season and 69 pounds per acre for the 120 days on fertilized grass.

Total gains on the unfertilized system were 74 pounds per acre. On the fertilized system gains for the 133 day season were 83 pounds per acre and for the 120 days on fertilized grass 105 pounds per acre.

Table 1. Forage production and utilization during the grazing periods on crested wheatgrass, native grass, and Russian wildrye pastures – 1977 season.

Pastures	Pasture size acres	Period grazed	Days in period	Forage produced lbs/acre	Forage utilized lbs/acre	Forage left on ground lbs/acre	Percent utilization
Crested wheat-grass (unfert)	16	5/13/6/ 6	25	1310	681	629	52
Crested wheatgrass		5/13-5/24	12	634	300	334	47
+ 50 lbs N/A	8	7/ 8-7/28	21	1840	859	981	47
Auxillary crested wheatgrass	16	5/25/6/ 6	13	860	353	507	41
Native grass (unfertilized)	18	7/ 8-8/ 3	27	1640	787	853	48
Native grass + 50 lbs N/A	12	7/29-8/30	33	2021	1141	880	56
Russian wildrye							
Pasture #1	8	6/ 7-7/ 7	31	1628	1212	416	74
#3	8	6/ 7-7/ 7	31	1628	1165	463	72
Russian wildrye							
Pasture #4	8	8/ 4-8/31	28	1331	1264	67	95
#2	8	8/31-9/23	23	1135	1022	114	90

Table 2. Pasture systems grazing trial, weights and gains of cows and one bull on crested wheatgrass, native grass, and Russian wildrye pastures – 1977 season.

Pastures	Period grazed	Days in period	No. of cows & bull [1/]	Avg. initial wt./cow lbs.	Avg. final wt./cow lbs.	Avg. gain/hd lbs.	Avg. daily gain/hd lbs.	Avg. gain/A lbs. [2/]
Crested wheat-grass (unfert)	5/13-6/ 6	25	10 (1)	912 (1535)	944 (1510)	32 (-25)	1.3 (-1.0)	18.4
Crested wheatgrass + 50 lbs N/A	5/13-5/24	12	10 (1)	894 (1565)	916 (1580)	23 (15)	1.9 (1.2)	30.6
	7/ 8-7/28	21	10 (0)	988	1026	38	1.8	48.1
Auxillary cres-ted wheatgrass	5/25-6/ 6	13	10 (1)	916 (1580)	954 (1640)	38 (60)	2.9 (4.6)	55.0
Native grass (unfertilized)	7/ 8-8/ 3	27	10 (0)	1004	1047	43	1.6	23.9
Native grass + 50 lbs N/A	7/29-8/30	33	10 (0)	1026	1046	20	0.6	16.7
Russian wildrye								
Pasture #1	6/ 7-7/ 7	31	10 (1)	944 (1510)	1004 (1585)	60 (75)	1.9 (2.4)	84.4
Pasture #3	6/ 7-7/ 7	31	10 (1)	954 (1640)	988 (1685)	34 (45)	1.1 (1.4)	48.1
Pasture #4	8/ 4-8/31	28	10 (0)	1047	1060	14	0.5	16.9
Pasture #2	8/31-9/23	23	10 (0)	1046	1060	13	0.6	16.2

[1/] ( ) indicates data pertaining to bulls.

[2/] Avg. gain/A for crested wheatgrass and pastures 1 & 3 Russian wildrye includes total of 11 head (10 cows, 1 bull).

Table 3. Pasture systems grazing trial, weights and gains of calves on crested wheatgrass, native grass, and Russian wildrye pastures – 1977 season.

Pastures	Period grazed	Days in period	No. of calves	Avg. initial wt./calf lbs.	Avg. final wt./calf lbs.	Avg. gain/hd lbs.	Avg. daily gain/hd lbs.	Avg. gain/A
Crested wheat-grass (unfert)	5/13-6/ 6	25	10	120	164	44	1.8	28
Crested wheatgrass	5/13-5/24	12	10	119	148	29	2.4	18
+ 50 lbs N/A	7/ 8-7/28	21	10	220	263	42	2.0	53
Auxillary cres-ted wheatgrass	5/25-6/ 6	13	10	148	162	14	1.1	9
Native grass (unfertilized)	7/ 8-8/ 3	27	10	226	281	56	2.1	31
Native grass + 50 lbs N/A	7/29-8/30	33	10	263	334	71	2.1	59
Russian wildrye								
Pasture #1	6/ 7-7/ 7	31	10	164	226	62	2.0	78
#3	6/ 7-7/ 7	31	10	162	220	58	1.9	72
#4	8/ 4-8/31	28	10	282	338	57	2.0	71
#2	8/31-9/23	23	10	334	384	50	2.2	62

[1/] All 4 Russian wildrye pastures received 50 lbs. N and 30 lbs. P_2O_5 per acre.

INTERSEEDING OF NATIVE MIXED PRAIRIE IN WESTERN NORTH DAKOTA

In the fall of 1969 a small plot interseeding trial was seeded at the Dickinson Experiment Station in southwestern North Dakota. The area used for the study was native mixed grass prairie dominated by western wheatgrass and green needlegrass on Morton fine sandy loam soils. Five species of grasses and five legumes were seeded in rows on 50 x 150 foot plots replicated three times. Species used in the trial were western wheatgrass, green needlegrass, crested wheatgrass, Russian wildrye, smooth bromegrass, Ladak, Vernal, Travois alfalfa, Eski sainfoin and Emerald crownvetch. In addition to the above species a check-plowed treatment was also included where the plots were treated with the machine but not seeded.

The plots were seeded with a two row machine which mounted on a standard farm tractor three point hitch. This machine used a lister blade to open and remove the sod from a 14 inch strip. The blade was followed by stationary seed tubes which deposited the seed. The seed was then covered and the seedbed firmed by a metal pack wheel. The seed boxes utilized a fluted seed metering wheel which handled all species satisfactorily. The rate of seeding, however, was difficult to control on the legumes with a heavier than normal rate being applied. The grasses were seeded at a rate of 15 pounds per acre and the legumes at eight pounds per acre.

All interseeded species germinated well in the spring of 1970 but a week of hot weather caused high mortality among some of the species. Western wheatgrass, Russian wildrye, Eski sainfoin, and Emerald crownvetch never recovered sufficiently to warrant further study.

Forage yields were taken by clipping nine frames 12 by 80 inches in each plot. The samples clipped from each frame were separated into grasses, forbs, and interseeded species. Percent composition of the individual species was estimated and the height of both the seed stalks and leaves of the grasses were measured. Total height measurements were taken for the forbs. Following harvest the samples were dried at 150° F. and oven dried weights recorded.

Results:

In the analysis of the results of the study the forage harvested from the plots was grouped into eight classes; midgrasses, shortgrasses, perennial forbs, annual forbs, interseeded species, total grasses, total forbs and total production. Table 1 shows the average forage yields for the six years of the trial from 1971 to 1976. The highest producing treatment, Travois alfalfa yielded 3056 pounds per acre. All three of the alfalfa varieties produced significantly more total forage than any of the grasses. Smooth brome was the highest producing grass with 2492 pounds per acre but this was not significantly different than green stipa with 2347 pounds per acre. The crested wheatgrass as well as the check plowed treatments produced less than the untreated check although differences were not significant.

Interseeding smooth brome stimulated the production of the midgrasses as much as Vernal and Ladak alfalfa and significantly more than Travois. All interseeding treatments increased the production of midgrasses except crested wheatgrass.

The production of shortgrasses was significantly decreased by all the interseeding treatments including the check plowed.

Smooth brome, Travois, and Vernal alfalfa all had significantly less perennial forbs than did the check plots. Green stipa, crested wheatgrass, Travois, and the check-plowed plots had significantly greater production from annual forbs than the other treatments or the check plots.

Travois alfalfa (1199 lbs/A) was significantly the highest producing interseeded species during the six years of the trial. Vernal (782 lbs/A) and Ladak (594 lbs/A) both produced more forage than the other interseeded species in the study. Smooth brome (246 lbs/A), crested wheatgrass (218 lbs/A) and the invading species of the check-plowed plots (188 lbs/A) were not significantly different. Green stipa (76 lbs/A) was the lowest producer and showed no significant increase over the check plots.

Table 2 gives the percent of yield increase or decrease compared to the check plots. Travois alfalfa, the highest producing treatment showed a 37% increase over the check plots. Vernal (27%, Ladak (23%) and smooth brome (7%) were also significantly higher producers than the check.

Summary and Discussion:

Interseeding native mixed grass prairie in western North Dakota has the potential of significantly increasing the forage production. A small plot trial studied the effects of seeding native and introduced grasses as well as legumes into mixed grass prairie. Results of six years of study have shown that interseeding with alfalfa gave a 32% increase in forage production. Smooth brome, the highest producing grass gave a total of seven percent increase in yield over the untreated check. The physical disturbance of the site without seeding (check-plowed treatment) had no significant effect on forage production. The disturbance of the native range by the interseeder did have the adverse effect of decreasing the shortgrasses. This would be a disadvantage of interseeding since the shortgrass component of the range was made up of blue grama and sedges which are highly palatable nutritious forages. This decline in shortgrasses had not completely recovered at the end of six years of study. In 1969 the check plots had significantly more shortgrass production than only three of the treatments; smooth brome, Ladak and Travois alfalfa. The continued low production in these plots could be as a result of the competition for light and soil moisture afforded by these interseeded species.

The production of perennial forbs seemed to be related to the amount of production of the interseeded species rather than what was interseeded. The high producers such as the alfalfas and smooth brome showed a decline in perennial forb production. Annual forb production had no correlation with production of the interseeded species. The two low producing grasses both had over 100% increase and Travois alfalfa, the highest producing treatment, had a 92% increase over the untreated check plots.

The lister type interseeder used in this trial had the advantage of giving good sod control and opening a furrow which will decrease runoff and aid infiltration. Initially the scalped area had a very destructive appearance. While the furrows have a much smoother appearance than they did in 1969 the ground surface is still too rough to be walked or driven across with ease. The initial destructive appearance and remaining rough surface are the biggest deterrent to a more general use of this type of interseeder by ranchers. Work is now underway at the Dickinson Experiment Station to design an interseeder which will give adequate mechanical sod control and yet not leave the soil surface rough and unsightly.

Table 1. Average forage yields 1971-1976 (lbs/acre)

	Treatment							
	Crested wheatgrass	**Smooth brome**	**Check**	**Check plowed**	**Ladak**	**Green stipa**	**Travois**	**Vernal**
Mid grasses	1099	1537	1122	1264	1480	1317	1351	1468
Short grasses	542	425	856	453	446	500	227	442
Perennial forbs	359	253	314	337	297	392	222	214
Annual forbs	58	27	27	39	31	59	52	31
Interseeded species	218	246	--	188 [1/]	594	76	1198	781
Total grass	1641	1962	1978	1717	1926	1817	1578	1910
Total forbs	417	280	341	376	328	451	275	244
Total production	2276	2489	2318	2282	2848	2344	3052	2936

[1/] Yields for the interseeded species under the check plowed treatment are for the vegetation re-invading the center 4 inches of the tilled strip.

Table 2. Percent increase or decrease in production as compared to the check treatment. 1/

	Treatment							
	Crested wheatgrass	**Smooth brome**	**Check**	**Check plowed**	**Ladak**	**Green stipa**	**Travois**	**Vernal**
Mid grasses	-2	37	0	13	32	17	20	31
Short grasses	-37	-50	0	-47	-48	-42	-73	-48
Perennial forbs	14	-19	0	7	-5	25	-29	-32
Annual forbs	115	0	0	44	15	118	92	15
Interseeded species 1/	16	31	0	0	216	-60	537	315
Total grass	-17	-1	0	-13	-3	-8	-20	-3
Total forbs	22	-18	0	10	-4	32	-19	-28
Total production	-2	7	0	-2	23	1	32	27

1/ Values for interseeded species were calvulated as a percent of the invading species in the check plowed treatment.

IMPROVING INTERSEEDING TECHNIQUE

Because of increasing interest in both interseeding and minimum tillage seeding several equipment manufacturers have developed drills of various designs for these purposes. One such drill, used in this trial in 1976, is the John Deere Powr till seeder. This machine uses power driven rotating colters to cut through the sod and prepare a seedbed. When used for interseeding, competition from established vegetation must be controlled with an herbicide. Under early spring growing conditions here, herbicide application was found to be both costly and ineffective.

In the spring of 1977 work was begun with the Melroe 701 drill. This drill was chosen because of its availability, and because its design facilitated making the modifications necessary to control established vegetation by mechanical means. The 701 drill is equipped with straight rolling coulters followed by double disk furrow openers, and is designed so that the entire weight of the drill can be placed on the coulters, causing them to penetrate even frozen ground.

The first modification consisted of moving the rolling coulter forward and placing a 12 inch cultivator sweep mounted on a heavy shank in front of the double disk furrow openers. The double disk openers followed in the cut left by the coulter and sweep which were run at a depth of one and one-half to two inches. At this depth the roots of existing vegetation were cut, without disturbing the surface of the soil.

Twenty five acres were interseeded with the 701 drill at the Dickinson Station the second week of May. Vegetation control obtained from using the sweeps was very good throughout. Seventy five to 90 percent of the vegetation was killed within two to three days following treatment. Fifteen of the 25 acres were seeded to Russian wildrye at a rate of 15 pounds per acre. The remaining ten acres were seeded at the rate of four pounds per acre with Travois alfalfa. Because of the small size of the seed being used the furrow openers were run at a depth of about one-half to three-fourths inch. At this depth the double disk openers failed to rotate evenly because of lack of contact with the sides of the furrows left by the sweep and shank, which caused the seed to be distributed unevenly. The wet weather in June resulted in good germination, and good but uneven stands resulted. Both pastures were grazed during the month of July with little sign of damage to the seedlings. Visual inspection of the alfalfa showed the taller plants had been grazed but no permanent damage had been done.

Further modifications are being made to correct the problem of uneven seed distribution.

PASTURE PROFIT POTENTIAL

W. C. Whitman

Does it pay to use a fertilized pasture system? This a question that must be satisfactorily answered before there can be any widespread use of pasture fertilization in the West River Country. Our 3-pasture trial, which was started in 1972 and concluded at the end of the 1976 season, provides information which will determine the profitability of pasture fertilization in this region.

The system involved the comparison of unfertilized and fertilized crested wheatgrass pastures for spring and early summer grazing with yearling steers, followed by the use of unfertilized and fertilized native grass pastures for mid and late summer grazing. The steers finished the fall grazing period on Russian wildrye pastures, all Russian wildrye being fertilized. The results of the 5-year trial showed an average grazing season of 165 days (5½ months) for both lots of steers. Fertilizer applications were 50 lbs N/acre annually on the crested wheatgrass and native grass pastures. Additional fertilizer was used on the Russian wildrye pastures including some phosphorus.

The situation regarding the Russian wildrye pastures requires some explanation. At the beginning of the trial these pastures were extremely low in vigor. It was obvious that all Russian wildrye pastures would require some fertilization if they were to produce any appreciable amount of grazable forage. Accordingly, fertilizer was used on these pastures throughout the trial with one very heavy application of nitrogen being made in the 1973 season (150 lbs N/acre). Thereafter 50 lbs N/acre and 30 lbs P_2O_5 were applied annually.

In order to arrive at a value of fertilized versus unfertilized Russian wildrye pastures in this trial the following assumptions have been made. First: grass production on the fertilized pastures was double that which would have been produced on unfertilized Russian wildrye pastures. Secondly: beef production was increased by 60% on fertilized over unfertilized pastures. Both of these assumptions seem reasonable on the basis of the conditions prevailing in this trial.

What actually did the fertilizer do? First, it produced more grass. On the fertilized crested wheatgrass pastures the average dry weight production of grass over the 5-year period was 2996 lbs/acre. On the unfertilized pastures it was 2116 lbs/acre. The increased grass production on these pastures was thus 880 lbs/acre. On native grass the fertilized pastures produced 4010 lbs/acre and unfertilized pastures 2677 lbs/acre – an average increase of 1333 lbs/acre. Using our prestated assumptions regarding the Russian wildrye pastures the grass production on the fertilized pastures would have been 1994 lbs/acre and 997 lbs on the unfertilized, an increase of 997 lbs/acre. The increased production of grass resulting from fertilization may be summarized:

Crested wheatgrass	880 lbs/a
Native grass	1333 lbs/a
Russian wildrye	997 lbs/a
Total for 3 acres	3210 lbs

Extra production from one fertilized acre thus would be 1070 lbs.

Increased beef production per acre can be summarized as follows.

Table 1. Average beef production – 1972-76

	Fertilized	Unfertilized	Increase
Crested wheatgrass	112 lbs/a	67	45
Native grass	89 lbs/a	56	33
Russian wildrye	56 lbs/a	35	21
Average	86	53	33

Thus the use of the fertilizer in this trial with the 3-pasture system produced 33 lbs more beef per acre averaged over the period of the trial than would be produced without the fertilizer.

With the fertilized pasture system producing an average of 33 lbs more beef per acre than the same system without fertilizer it is obvious that the potential for profit measured in beef production will depend on the relation of beef prices and fertilizer prices. Low beef prices can make fertilizer use marginal. With the costs of fertilizer too high the effect will be the same. During the period of the trial fertilizer costs were as shown in table 2.

Table 2. Fertilizer costs in pasture trial

Year	Cost/acre
1972	$ 5.00
1973	5.52
1974	10.45
1975	15.28
1976	10.80
Average	$ 9.41

Fertilizer was applied to the same trial pastures in the 1977 season at the same rates as before. The fertilizer cost last spring was $4.60/acre. The indication might be that high per acre fertilizer costs, such as prevailed in 1974, 1975 and 1976, would not continue to prevail over an extended period, but rather represented a somewhat unusual situation. However, the results of the trial do not provide the basis for making such an assumption.

Last year's Roundup Report presented a significant analysis of the price for beef needed to "break even" on the basis of the costs of fertilizer actually incurred during the trial and beef produced. With costs of fertilizer averaging $9.41/acre and an additional 33 lbs of beef being produced per fertilized acre the calculation of the break even point for the whole system becomes: 9.41 ÷ 33 = 28.5¢

The immediate conclusion is that with average fertilizer costs as experienced in this trial 30¢-beef is marginal.

However, if an average fertilizer cost is calculated using the costs for the first 2 years of the trial and the 1977 cost for fertilizer the result is an average per acre cost of $5.04. Calculating the break-even point again gives us: 5.04 ÷ 33 = 15.3¢

This means that 30¢-beef would be substantially profitable as far as the actual fertilizer costs are concerned. On the basis of generally prevailing beef prices of between 30¢ and 40¢ per lb, as has occurred over most of the last few years, a good rule-of-thumb would be: When fertilizer costs approach $10.00/acre, beef prices should be substantially greater than 30¢/lb before the use of fertilizer is justified (break even point 30¢/lb).

Balancing beef production and prices against fertilizer costs, while a convenient way of evaluating the possible benefits of using fertilizer in a pasture system, is not the only significant measure of potential fertilizer value. Increased grazing capacity could also be used as a measure. It should be remembered that an extra 1000 lbs of grass/acre was produced on the fertilized pastures in the trial. Translated into actual grazing capacity this represented about a 35% increase. This would be difficult to translate directly into dollars, but if more pasture is needed a way of providing that pasture without buying or renting additional land is available through the use of fertilizer.

At this stage the results of our trials indicate that the use of fertilizer on pastures still is a potentially profitable practice. However, careful attention must be given to balancing costs and returns. We should remember that there will continue to be seasons when weather, livestock performance, or unfavorable price relations will result in unsatisfactory returns from fertilizer.

Section IV

Application of AI with Synchronization of Estrus in Cattle

by

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Application of AI with Synchronization of Estrus in Cattle

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Controlled breeding (synchronization of heat) in cattle has been a desired endpoint of considerable research in reproductive physiology for the past 20 years. Since the introduction of artificial insemination (AI) in the early 1940's, researchers and livestock producers have recognized that the economic feasibility of the use of AI could be increased substantially particularly in beef cattle production with the development of a practical method of ovulation control, commonly referred to as synchronization of estrus (heat).

The history of the use of AI in the dairy cattle industry has been impressive not only in the United States, but in most of the developed countries around the world. In 1945, less than 1% of the lactating dairy cows in the United States were bred by AI contrasted to over 55% in 1976 (Figure 1). Artificial insemination has provided a means to obtain wider use of sires with proven superior genetic merit. During this 30 year period, milk production per dairy cow has more than doubled. There have been many factors which have made major contributions to the increase in milk production such as better nutrition and general management practices; however, the fact remains that the increased use of sires with proven superior genetic merit through AI has also made a major contribution.

Since AI has been very successfully used in lactating dairy cows in the United States, one may ask the question, "Why not greater use of AI in dairy heifers (10%) and beef cattle (3-5%)?" The answer to this is readily available and is not controversial. Dairy heifers are managed more like beef cattle than lactating dairy cows and routine management of beef cattle does not lend itself to the application of AI. Unlike the intense management of lactating dairy cattle where the use of AI presents no major problems, beef cattle managed under range conditions may be several miles from the nearest corral during the breeding season; therefore, making detection of estrus and AI difficult as well as costly. This is a major economic problem which reduces the feasibility of using AI and explains why only 3 to 5% of the beef cattle are bred by AI.

This does not mean that the beef industry would not benefit from the use of AI in the same way the dairy industry is benefiting. In fact, the heritability estimates of the economically important traits for beef production are considerably more highly heritable than milk production (table 1). Therefore, the wider use of sires with proven superior genetic merit through AI could provide a means for more rapid genetic improvement in the beef cattle industry than was possible in the dairy cattle industry. In addition to this advantage, crossbreeding which can increase beef production 10 to 20% can become just another management decision with the use of AI rather than a major herd management problem.

Synchronization of estrus could provide beef producers with a feasible management system which would enable them to take advantage of the benefits of AI and minimize the disadvantages. There are four potential products at present which are currently being tested by pharmaceutical companies to accumulate data for evaluation by Food and Drug Administration (FDA). These four potential products are in various stages of the required evaluation procedures, and eventual clearance or rejection by each of these potential products is the responsibility of FDA. This author's prognosis is that prostaglandin $F_{2\acute{\alpha}}$ (The Upjohn Company) and prostaglandin $F_{2\acute{\alpha}}$ analogue (Imperial Chemical Industries) will be cleared by FDA well in advance of the other two potential products. The Upjohn Company's product should be cleared for use in beef cattle and dairy heifers by or soon after mid-1978. I expect the Imperial Chemical Industries' product will be granted final approval sometime in 1979. However, keep in mind that these are my estimations and may or may not be highly correlated with the future clearance dates of these potential products.

The final question I would like to address is, "Does synchronization of estrus in cattle really work?" In this presentation, I am not going to summarize extensive data on each of the four potential products but only review my experiences with the use of prostaglandin $F_{2\acute{\alpha}}$ ($PGF_{2\acute{\alpha}}$) to synchronize estrus in cattle. Data from the Montana Agricultural Experimental Station, The National Field Trial (The Upjohn Company, 1976-77) and numerous research scientists are thoroughly convincing that $PGF_{2\acute{\alpha}}$ injected into reproductively cycling cattle will synchronize estrus with fertility on the synchronized estrus being comparable to nonsynchronized controls. Research work from Montana has consistently demonstrated that as many cows become pregnant in the first eight days of a $PGF_{2\acute{\alpha}}$ synchronization program as in 25 days of a nonsynchronized control program. These data are consistent with the conclusions of numerous other studies. The answer to the question is, "Yes, synchronization of estrus does work when applied to reproductively cycling cattle." Cattle which are not reproductively cycling do not respond to $PGF_{2\acute{\alpha}}$.

The use of AI in synchronization of estrus in cattle does require specialized management. This specialized management has to assure that a very high percentage of the cattle are reproductively cycling before the start of the breeding season. Management practices which ensure short calving seasons (45 days) are essential for the successful use of synchronization of estrus. The cow that calved the last day of a 45 day calving season has 35 days to recover before the start of the breeding season; whereas, in a 60 day calving season, she would only have 20 days (table 2). Several management systems utilizing $PGF_{2\acute{\alpha}}$ to synchronize estrus have been tested and 3 of these systems are diagramed in tables 3, 4 and 5. Each producer will have to make the judgement for his particular operation as to whether or not the benefits are sufficient to leave a good profit over the additional costs of the specialized management practices.

Prostaglandin $F_{2\acute{\alpha}}$ and other synchronization of estrus agents are not "wonder drugs" or "cure-alls." They are powerful management tools which will require specialized management for successful use. They will provide the dairy and beef cattle industry with some alternatives for the more extensive application of sires with proven superior genetic merit and wider use of well planned crossbreeding programs.

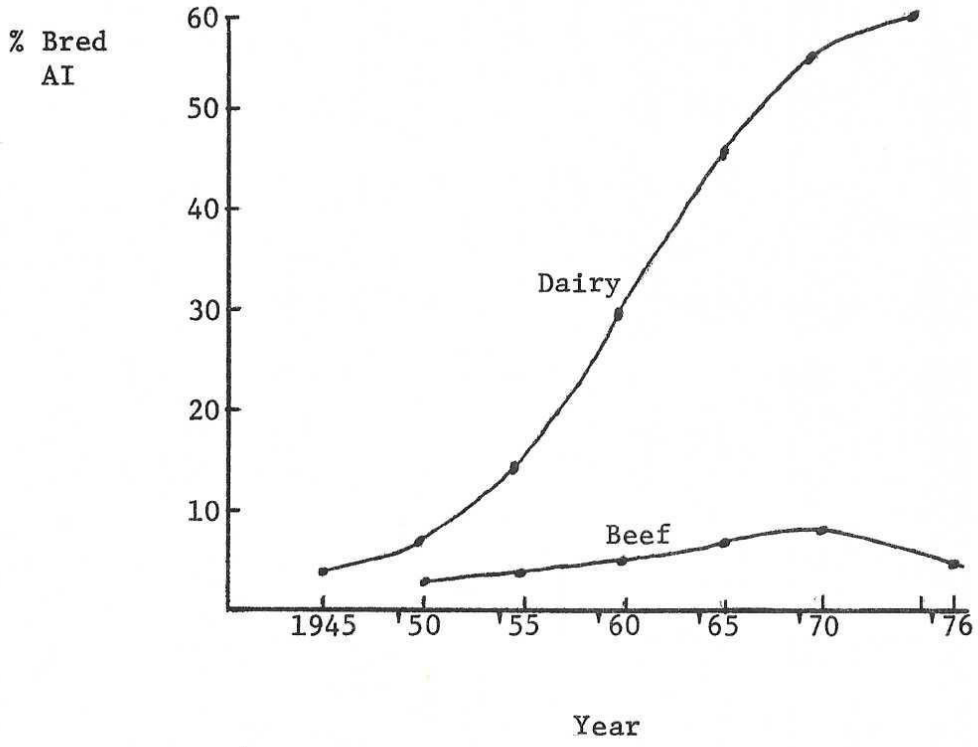

Figure 1. Percentage of Dairy Cows and Beef Cattle Bred AI in the U.S.

TABLE 1. HERITABILITY OF PRODUCTION TRAITS IN CATTLE

Trait	Heritability (%)
Milk production (dairy)	20
Weaning wt.	30
Wt. gain from birth to weaning	30
Post-weaning feedlot gain	45
Wt. at 12 months	50

TABLE 2. EVENTS FOR A 365 DAY CALVING INTERVAL

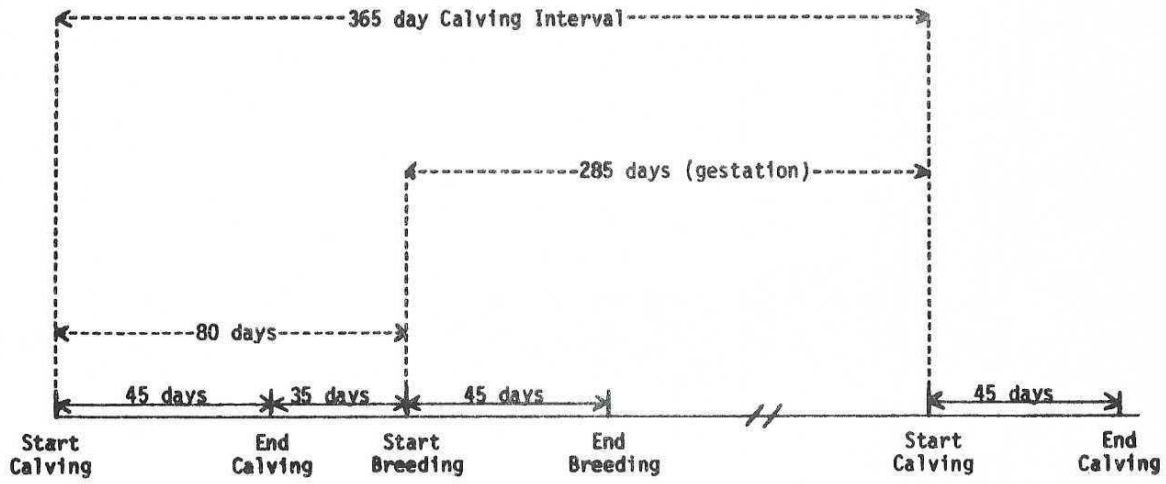

TABLE 3. TWO INJECTIONS OF $PGF_{2\alpha}$ AT AN ELEVEN DAY INTERVAL FOLLOWED BY A TIMED BREEDING SYSTEM

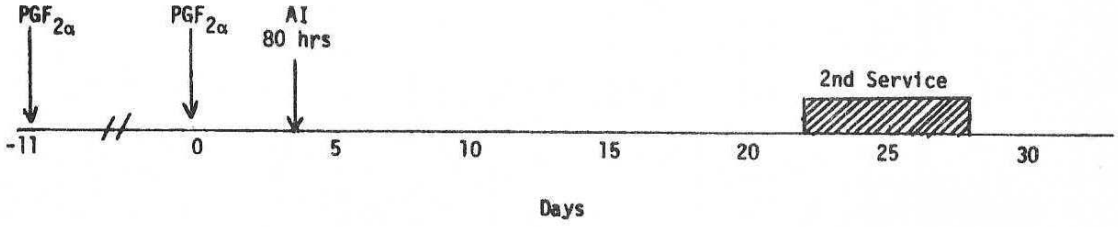

TABLE 4. SINGLE INJECTION $PGF_{2\alpha}$ AND BREED FOR FIVE DAY SYSTEM

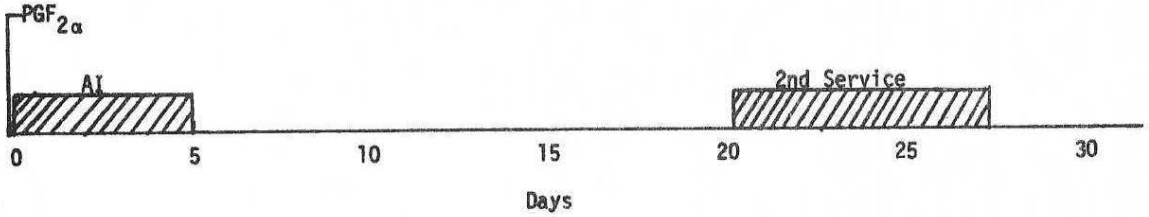

TABLE 5. EIGHT DAY BREEDING SYSTEM WITH A SINGLE INJECTION OF $PGF_{2\alpha}$