TWENTY FOURTH ANNUAL LIVESTOCK RESEARCH ROUNDUP

Dickinson Experiment Station
Dickinson, North Dakota
December 5, 1973

ROUNDUP DIGEST

by

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1. **USING STRAW IN COW WINTERING RATIONS**
   A ration of half hay and half straw for a 60 day period did not adversely affect calf birth weight or livability. See Section I, pp 1-2.

2. **SELF FEEDING REPLACEMENT HEIFERS**
   Replacement heifers can be self fed successfully on a ration of 25% oats - 75% hay, and make better gains on less grain and more hay than when hand-fed. See Section I, pp 3-4.

3. **EARLY AND LATE CALVING COMPARED**
   Early calves are heavier at weaning time. If you want an early calving herd start with the heifers. Shifting a cow herd to earlier calving requires special management. See Section I, pp 5-7.

4. **EARLY AND LATE CASTRATION COMPARED**
   No advantage shown for delayed castration. See Section I, pp 8-9.

5. **VALUE OF VITAMIN INJECTIONS FOR CALVES**
   No benefit shown for injectible vitamins. See Section I, pp 10-11.

6. **CROSSBREDS VS. STRAIGHTBREDS**
   Not much difference either on pasture or in the feedlot. Returns in this years' trial favored crossbreds because of higher grades. See Section I, pp 12-16.

7. **IS SUPPLEMENTAL PROTEIN NECESSARY IN FATTENING RATIONS**
   Supplemental protein did not affect rate of gain but significantly affected feed cost/cwt gain. See Section I, pp 17-19.

8. **SELF-FEEDING COMPLETE MIXED RATIONS**
   Rations used produced gains of 2.02 to 2.17 pounds per day with steers. The half oats – half hay ration may be too low in energy to provide optimum gains. See Section I, pp 20-21 .

9. **HAND FEEDING AND SELF FEEDING COMPARED**.
   Self fed steers finished 49 days earlier than hand fed steers. See Section I, pp 22-24.

10. **FEEDING LIQUID WHEY IN SWINE FATTENING RATIONS**
    Gains from rations supplemented with whey were equal to gains from rations supplemented with soybean oilmeal or amino acids. Whey fed pigs were more efficient and had a lower cost of gain. See Section I, pp 25-26.

11. **SWINE FEEDING TRIALS**
    Triticale and barley were equal in gain produced in swine feeding trials. See Section I, pp 27-31.

12. **ANTIBIOTICS IN SOW RATIONS TO REDUCE PIG LOSSES**
    Sows fed neomycin weaned 26% more pigs. Additional trials are planned. See Section I, pp 32-34.

13. **THREE - PASTURE GRAZING SYSTEM**

Steers on fertilized pastures gained 99 lbs./acre, and on unfertilized pastures 65 lbs./acre. Use of biuret urea supplement seemed effective on mature native grass but questionable on late season Russian wild-rye. See Section III.

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Section I

Reports of
Livestock Research in Progress

at the

Dickinson Experiment Station

Presented by the
Station Staff

at the

24th Annual Livestock Research Roundup

Dickinson Experiment Station
Dickinson, North Dakota

December 5, 1973

USING STRAW IN COW WINTERING RATIONS

Past research at this station has indicated that small grain straw and adequate supplemental protein can replace up to two-thirds of the hay fed in wintering rations to pregnant beef cows.

This trial compares a 100% hay ration with a 50% hay – 50% straw ration for wintering pregnant beef cows with no supplemental protein fed in either ration.

The station's commercial Hereford cow herd was used in this trial. After the calves were weaned (October 27, 1972) the cow herd was grazed on good to excellent native range until the end of November, 1972. During this one month period, despite supplemental feeding of protein blocks, the cows lost an average of 55 pounds of weight and a corresponding loss of body condition.

On December 1, 1972, the cows were randomly allotted by age into two feeding groups. Group A received a ration of mixed brome and crested wheatgrass hay while Group B was fed a ration of 50% hay and 50% oat straw by weight. A salt-mineral mixture and water were available free choice. During the trial, both groups were held in lots with a slatted board fence for protection from the wind and weather.

On February 1, 1973, one month before the first calves were due, the straw feeding was discontinued. At this time the straw was replaced with hay and supplemental grain feeding (1 pound/head/day of rolled barley) was started.

Table 1 shows the average feed consumption, costs and body weight changes.

Table 2 shows the calf birth weights and mortality.

Summary:

It appears that feeding a ration of 50% hay and 50% oat straw for a 60 day feeding period did not adversely affect either calf birth weight or livability when compared to cows fed 100% tame hay. As expected, the young cows wintered on the 50% hay - 50% oat straw ration lost the most weight. Normally, this weight loss would not be serious for cows that started the winter feeding period in moderately good condition.

Using straw in the ration did reduce the cost of wintering by about one dollar per cow per month in this trial. Under conditions of higher feed costs and insufficient feed supplies, this savings could substantially increase.

Table 1 -- Cow weight change, feed consumption and cost of wintering

	Hay			Hay & Straw		
	3 yr. olds	**4-5-6 yr. olds**	**7 Yrs. & older**	**3 yr. olds**	**4-5-6 yr. olds**	**7 Yrs. & older**
Average weight:						
Pre trial, Oct. 27, lb.	951.7	1084.6	1171.2	971.1	1106.9	1179.0
December 1, lb.	917.2	1042.8	1120.7	923.6	1053.5	1126.0
Wt. change, lb. 1/	-34.5	-76.3	-50.5	-47.5	-53.4	-53.0
Feb. 1, lb.	921.1	1052.4	1118.3	898.6	1036.9	1118.3
Entire trial wt. change, lb. (Dec. 1 – Feb. 1)	+3.9	+9.6	-2.4	-25.0	-16.6	-7.7
Feed consumption:						
Mixed hay, lb. 2/	69,300			43,350		
Oat straw, lb.				25,750		
Feed/hd./day, lb.	21.4			21.4		
Feed cost at $18/ton hay, $10/ton straw:						
Per head/day	$0.19			$0.16		
Per head, entire trial	11.71			9.79		

1/ Weight lost on native grass prior to start of winter trial**.**
2/ As analyzed: brome, 8.8% protein; crested wheatgrass, 11.6% protein; oat straw, 4.8% protein.

Table 2 – 1973 Calf birth weights and mortality

	Hay			Hay & Straw		
	3 yr. olds	**4-5-6 yr. olds**	**7 Yrs. & older**	**3 yr. olds**	**4-5-6 yr. olds**	**7 Yrs. & older**
Heifers						
No. of head	6	10	10	8	10	9
Birth weight, lb.	61.0	64.3	65.3	52.5	61.7	65.9
Steers						
No. of head	2	12	8	5	13	6
Birth weight, lb.	56.0	65.8	65.0	67.0	67.9	69.0
Combined average-weight, lb.						
	26 Heifers 63.9			27 Heifers 60.4		
	22 Steers 64.6			24 Steers 68.0		
	1/ All calves 64.22			2/ All calves 63.98		

1/ 1 cow died, 2 cows open, 1 cow aborted, 1 calf died.
2/ 1 calf born dead; 2 late calves, no birth weight.

SELF FEEDING REPLACEMENT HEIFERS

Research from the U.S. Range Livestock Station, Miles City, Montana; South Dakota State University's Antelope Range Field Station, and this station, indicates that replacement heifer calves should be fed to gain from 1.25 to 1.5 pounds per head per day during their first winter. This rate of gain will promote good, economical growth without causing the heifers to get overly fleshy or fat.

The current interest in self-feeding and excellent past performance of the self-fed complete mixed ration under feedlot conditions here at this station prompted this trial, which was designed to compare a self-fed ration of 25% oats and 75% hay with a hand-fed ration in which the oats and hay were adjusted to give the desired rate of gain of 1.25 pounds per head per day.

In this trial, straight bred Hereford heifer calves averaging 400 pounds were wintered from October 27, 1972 to April 13, 1973, a total of 168 days, in lots at the station having a nine foot slatted board fence shelter for weather protection.

The self-fed ration was prepared by weight through a portable grinder-mixer.

All heifers were provided with straw for bedding on a regular interval and had access to automatic water fountains.

The performance of the heifers is tabulated in Table 3, while Table 4 shows the average ration fed and the feed cost.

Summary:

This year's data indicate that replacement heifers can be successfully self-fed on a ration of 25% oats and 75% tame hay. Rations containing this high a percentage of hay are somewhat difficult to prepare, especially during periods of damp weather. Although the total cost of feeding the self-fed heifers was $1.27 more per head, they made significantly faster gains than those hand-fed. If we look at the cost of feed per pound of gain then the self-fed heifers become more efficient (14.2¢ per lb. gain vs. 18.5¢ per lb. gain) than the heifers hand-fed. Also, the self-fed heifers were able to make better gains on less grain and more hay, which is important to the livestock producer short on grain but with adequate hay supplies.

This trial will be continued for several more years to determine long time effects.

Table 3 – Performance of 1972-73 replacement heifer calves under two feeding systems

	Hand-fed	Self-fed
Number of head	12	12
Days fed, (Oct. 27-April 13)	168	168
Average initial weight, lb.	409.6	408.3
Average final weight, lb.	587.9	649.6
Average winter gain, lb.	178.3	1/ 241.2
Average daily gain, lb.	1.06	1.44

1/ Gain significantly greater. Least significant difference @ 5% = 25 pounds.

Table 4 -- Rations fed and cost of feeding of 1972-73 replacement heifer calves under two feeding systems

	Hand - fed		Self - fed	
	Total pounds	Cost	Total pounds	Cost
Ration as fed:				
Oats	10,392	$210.96	7,461.9	$151.48
Tame hay	11,900	107.10	20,324.5	182.92
Alfalfa hay	3,600	45.00	1,413.2	17.66
Mineral mix	400.8	22.85		
Di-cal			282.6	18.65
Trace mineral salt			364.5	10.94
Grinding		10.39		29.85
Ration cost per lot		$396.29		$411.50
Total ration cost:				
Per head		$33.02		$34.29
Per pound gain		18.5		14.2
Per day		19.6		20.4
Average feed consumed/ head/day, lb.	13.1		14.8	

EARLY CALVING AND LATE CALVING COMPARED

Beef cows provide the single greatest income from livestock in North Dakota. This income is in direct proportion to the number and weight of marketable calves at weaning. Calf weight at weaning is dependent upon three primary variables, namely; (1) genetic potential, (2) adequate nutritional intake and (3) age at weaning. Early calving is one management tool that allows for older calves at weaning. It is expected that early calves will be better able to utilize the forage material available during the summer grazing period.

Early calving is not traditional in this area and may require additional feed, labor and housing facilities to be handled successfully. Due to the length of gestation (283 days) in cattle, it requires special care to change a cow's calving interval in a foreward manner after she drops her first calf. Therefore it is important that producers make every effort to develop and breed heifers so they will calve at the desired time. We recommend this date to be three weeks before the cow herd.

With these facts in mind, a trial was designed to study the effect of shifting a herd of cows from April 1st to March 1st calving.

The station's cow herd was split into two groups in May, 1972 with calving date uniformly distributed between lots. The early calving lot was exposed to fertile bulls on May 25th, 1972 for March, 1973 calving. The late calving lot was exposed to bulls beginning on June 25th, 1972 for April, 1973 calving.

Replacement heifers were wintered to gain 1.25 – 1.50 lbs./head/day and were exposed to bulls on May 3rd, 1972 so calving could start about the 10th of February, three weeks before the early calving lot began.

Weather conditions during the calving period February to May at the station were as follows:

Month	Avg. high	Avg. low	Deviation from normal	Precipitation
February	31.6	9.3	+6.8	.42
March	47.2	23.8	+11.2	.39
April	51.2	27.8	-1.5	3.21
May	65.7	37.5	-1.6	1.30

During the summer, May-October, the calves were handled in a uniform manner. All calves were weighed and weaned on November 1, 1973.

Table 5 shows the cow ration as fed and the feed costs from February 1st to May 15th, 1973.

Table 6 gives the calf weights and ages of the calves from each breeding herd.

Table 7 shows the calf weights arranged by date of birth.

Table 5--Average ration and costs of period February 1, 1973 – May 15, 1973

	Early calving	Late calving
Number of head	54	51
Days fed	103	103
Tame hay/cow/day, lb.	23.5	23.2
Cost at 0.009¢/lb./cow	$21.66	$20.88
Ground barley/cow/day, lb.	3.2	2.3
Cost at 0.0177¢/lb./cow	$6.25	$4.47
Total feed cost/cow 1/	$27.91	$25.35
Avg. cost/cow/day	0.27	0.25

1/ Does not include cost of minerals or vitamin injections.

Table 6--Calf weights and ages from each breeding herd

	No. calves	Birth wt.	Weaning wt.	Age	Average daily gain
Early calving cows:					
Heifers	26	63.9	366.5	202	1.50
Steers	26	67.3	386.7	206	1.56
Late calving cows:					
Heifers	27	60.9	339.1	191	1.45
Steers	18	65.4	385.3	193	1.66

Early cows, 54 head started; one cow died, 53 calves born, 52 calves weaned, 2 calves died prior to weaning, 96.3%.

Late cows, 53 head started; two cows sold (open), 1 calf aborted, 1 calf born dead, 2 calves died after birth, 88.2%.

Table 7—Calf weights arranged by date of birth

	Calves	Birth wt.	Weaning wt.	Summer Gain	Age (days)	Avg. daily gain
Calves from 2-yr. old heifers born Feb. – March:						
Steers	12	73.7	436.3	362.6	245	1.48
Heifers	9	66.8	393.9	327.1	237	1.38
Avg.		70.7	418.1	347.4	241	1.44
Calves from cows born March 1 - April 1:						
Steers	15	66.1	414.4	348.3	222	1.57
Heifers	9	59.3	381.7	322.4	222	1.45
Avg.		63.6	402.1	335.4	222	1.51
Calves from cows born April - May:						
Steers	19	68.2	386.3	318.1	198	1.61
Heifers	36	62.4	357.5	295.1	199	1.48
Avg.		65.6	374.3	308.7	198	1.56
Calves from cows born May - June or later:						
Steers	10	63.9	343.5	279.6	172	1.62
Heifers	8	65.8	297.5	231.7	158	1.47
Avg.		64.7	323.0	258.3	165	1.56

Summary:

Some progress was made in moving the expected calving date forward since the "early" calves averaged 12 days older and 19 pounds heavier than the late calves at weaning with the most weight advantage demonstrated by the 1973 heifer calves. This advantage amounts to 1.58 pounds gain per day and extra age.

It costs $2.56 more to winter the early calving cows ($27.91 vs. $25.35) from February 1 to May 15th, a period of 103 days. Calving percentage at weaning of cows starting the winter trial was 96.3% in the early calving herd and 88.2% in the late calving herd.

It is interesting to note that calves from the first calf heifers were 19 days older and averaged 16 pounds heavier than the calves in the early calving herd.

Based on the results of this first year, three or four years will be required to change from April to March calving.

Although the weather was milder than normal during February and March, the early calves did not present any more than normal calf problems.

EFFECTS OF EARLY CASTRATION AND LATE CASTRATION OF BULL CALVES COMPARED

Is there any advantage to be gained from fall castration of spring calves? Does fall castration affect weight gains at weaning? How does late castration affect performance in the feedlot? What problems are encountered, and are there any risks involved in fall castration of spring calves?

This trial, begun in the spring of 1972, was designed to evaluate and compare the effects of early castration, (at 3 to 8 weeks of age), and late castration, (at 6 months of age). Bull calves from the station herd were assigned by age, at random, to either the early or late castration dates. A total of 112 calves have been included in this trial to date.

All calves were operated on using an approved veterinary procedure which minimized blood loss and stressed strict sanitation.

The calves in the late castration group were allowed to remain with their mothers for approximately thirty days following the operation.

In addition to the record of weight gains for both groups from birth to weaning for 1972 and 1973, as summarized in tables 8, 9 to 10, weight gains in the feedlot for the respective treatment groups in 1972 are presented in table 11.

Summary:

Delaying castration until the calves are about 6 months old was of no value in improving weight at weaning, as shown in table 8. Combined data for 1972 and 1973 also shows no advantage for delayed castration. The small weight difference of 3.6 pounds in favor of early castration is not significant.

Feedlot data presented in table 11 shows no difference of significance in gain, dressed weight, dressing per cent, grade or value.

Although no serious problems were encountered at either time of castration, the job is simpler, easier and offers less risk to the calf when performed at an early age.

Table 8--Comparison of effect of spring and fall castration on weight gains of calves in 1973

Castration date	Weight gain May 15-Sept. 26	Weight gain Sept. 27-Nov. 1	Weighted Avg. gain
May 15 (25 head)	238.0	41.2	279.2
Sept. 26 (25 head)	244.4	34.6	279.0

Table 9--Effect of spring and fall castration on weight gains of early and late born calves in 1973

		Weight gain		
Castration date	Calves born	May 15-Sept. 26	Sept. 27-Nov. 1	Average gain
May 15	Early (17 hd.)	241.8	36.2	278.0
	Late (8 hd.)	230.0	51.9	281.9
Sept. 26	Early (18 hd.)	243.9	31.9	275.8
	Late (7 hd.)	245.7	41.4	287.1

Table 10--Comparison of effect of spring and fall castration on weight gains of calves (two year average 1972-1973)

Castration date	Average May 15 – Sept. 26	Weight gains Sept. 27 – Nov. 1	Total
Early (57 hd.)	226.7	42.5	269.2
Late (55 hd.)	230.5	35.1	265.6

Table 11--Gains in the feedlot, carcass data and value of steers castrated early and late in 1972

Castration date	Gain	Dressed weight	Dressing per cent	Grade	Value
Early (20 head)	702.0	650.3	59.3	12.04	$412.38
Late (15 head)	692.3	649.9	59.5	12.08	$408.39

VALUE OF INJECTING CALVES AT BIRTH WITH VITAMINS A, D_2, AND E

Supplementary vitamin sources are readily available to livestock producers in several forms. These include feed additives, tablets and injectible solutions. This trial was designed to evaluate the effects of a vitamin injection to calves at birth, from cows handled in a recommended manner.

In this trial, straight bred calves born at the Dickinson station from February to May were allotted by age to either the treatment group or the untreated control group. Within twenty four hours after birth, every calf in the treatment group was injected intramuscularly with two cubic centimeters of a vitamin A, D_2, and E solution. This solution contained 500,000 I.U. of vitamin A, 75,000 I.U. vitamin D_2 and 50 I.U. of vitamin E per cubic centimeter.

The mothers of these calves had been wintered on a high straw plus protein ration in 1971-72. The cows in 1972-73 were wintered on a half hay-half straw ration. About the first of February both years, each cow received a 5cc injection of the vitamin combination.

A record of all treatments administered for lung congestions and scours was kept until calves were turned on grass, about the first of May. The calves were weighed and weaned on November 1st.

Tables 12, 13 and 14 summarize the results of this study.

Summary:

The administration of injectible vitamins A, D_2, and E combination to calves from cows adequately fed and supplemented had no apparent influence on either the calves disease resistance or on its subsequent summer gains. However, the use of vitamin injections did require additional handling, labor and expense.

Table 12--Effect of injectible vitamins on weight gains of calves in 1973

	Average weight gains			
	Treatment group		Untreated group	
Steers	(29 hd.)	327.7 lbs.	(27 hd.)	330.0 lbs.
Heifers	(32 hd.)	293.8	(31 hd.)	293.3
Average	(61 hd.)	309.9	(58 hd.)	310.4

Table 13--Effect of injectible vitamins on weight gains of calves in 1972-73

	Average weight gains			
	Treatment group		Untreated group	
1972 Steers	(33 hd.)	305.1 lbs.	(33 hd.)	304.3 lbs.
1973 Steers	(29 hd.)	327.7	(27 hd.)	330.0
Average	(62 hd.)	315.7	(60 hd.)	315.9
1972 Heifers	(22 hd.)	301.2 lbs.	(23 hd.)	296.4 lbs.
1973 Heifers	(32 hd.)	293.8	(31 hd.)	293.3
Average	(54 hd.)	296.8	(54 hd.)	294.6
Combined total	(116 hd.)	306.9 lbs.	(114 hd.)	305.8 lbs.

Table 14--Number of calves treated for scours and lung congestions with and without vitamin A

	With vitamin A	Without vitamin A
1973	6	7
1972	19	10
2 – Year average	12	8

CROSSBREDS VS. STRAIGHTBREDS

With the current interest in crossbreeding, a trial was started to compare Hereford and Angus X Hereford steers under uniform conditions in western North Dakota. The steers were pastured for six months and then finished in dry lot for five months.

The steers were purchased from one herd at an initial weight of approximately 600 pounds. Ten Hereford (H) and ten Angus X Hereford (BWF) steers were randomly allotted by weight. During the pasture phase (Phase I), the steers were grazed and handled in a similar manner. During the dry lot phase (Phase II), the steers were fed in straight Hereford or BWF groups in order to measure feed efficiency.

All steers were pastured and fed an equal number of days.

Carcass information was obtained on all steers.

During the pasture phase, the steers grazed on three types of pasture, namely crested wheatgrass, native, and Russian wildrye. Table 15 shows the results of the pasture phase.

Discussion:

During the pasture phase, the BWF outgained the Herefords only while grazing crested wheatgrass. Neither group gained well on the native pasture although there was ample forage available. It is believed that protein was limiting for adequate gains. Gains on Russian wildrye pasture were good while they lasted, but limited forage material caused earlier than expected drylotting of steers.

In dry lot, each group of steers was divided into either Hereford or BWF and placed on a grain and corn silage ration. All steers were marketed when average lot weights were between 1050-1100 pounds.

Table 16 shows the average ration fed during the drylot phase.

Table 17 shows the results of drylot feeding, over-all carcass quality and value returned.

Summary:

In this first year's trial the crossbred steers outgained the Herefords on crested wheatgrass pasture, but were no better on native or Russian wildrye pastures.

In dry lot, there was no significant difference between the two groups. The BWF crossbreds returned almost $40 more per animal than the Hereford straightbreds due largely to better grading (9 choice vs. 2 choice) carcasses which sold for $3.50 more per hundred. Feed costs per hundred pounds gain was also in favor of the BWF by $1.23.

This trial is being repeated to determine if the trend will continue over another year.

Table 15--Yearling steer gains on pasture

Pasture grazed:	Hereford	BWF	Difference in favor of crossbreds
Crested (May 12 to July 7)			
Steer days	560	560	
Total gain, lb.	1095	1335	+243
Gain per head, lb.	109.5	133.5	+.24
Average daily gain, lb.	1.96	2.38	+.42
L.s.d. average gain @ 1%, lb.			1/ 24.3
Native (July 7 to Sept. 1)			
Steer days	560	560	
Total gain, lb.	435	415	-20
Gain per head, lb.	43.5	41.5	-2.0
Average daily gain, lb.	.78	.74	-.04
L.s.d. average gain @ 1%, lb.			24.4
Russian wildrye - (Sept 1 to Oct. 27)			
Steer days	560	560	
Total gain, lb.	845	810	-35
Gain per head, lb.	84.5	81.0	-3.5
Average daily gain, lb.	1.51	1.45	-.06
L.s.d. average gain @ 1%, lb.			24.6
Combined pasture – (May 12 to Oct. 27)			
Steer days	1680	1680	
Total gain, lb.	2375	2560	+185
Gain per head, lb.	237.5	256.0	+18.5
Average daily gain, lb.	1.41	1.52	+.09
L.s.d. average gain @ 1%, lb.			39.3

1/ Significant at 5%.
Ten steers in each group.

Table 16--Ration fed in drylot

	Hereford	BWF
Number of head	10	10
Grain:		
60% barley	10,902 lbs.	10,902 lbs.
40% oats	7,268	7,268
Alfalfa hay	2,680	2,680
Corn silage	27,550	27,950
Minerals	274	274
Total feed cost + grinding	$565.46	$566.90

Table 17--Steer gains in drylot

	Hereford	BWF
Number of head	10	10
Initial weight, lb.	847.0	851.5
Final weight, lb.	1075.0	1092.0
Average gain, lb.	228.0	241.5
Days fed	137	137
Average daily gain, lb.	1.66	1.76
Hot carcass weight, lb.	607.8	640.9
Dressing percent	56.54	58.69
Grade:		
Choice = $73.50	2	9
Good = $70.00	8	1
Average carcass value	$429.66	$468.85
Average feed cost/animal	$56.55	$56.69
Value over feed	373.11	412.16
Feed cost/cwt. gain	24.80	23.57
Advantage of crossbreds per head = $39.05		

COMPARISON OF BWF AND HEREFORD STEER CALVES UNDER GROWING CONDITIONS

This trial is a phase of a comparison of crossbred Angus-Hereford (BWF) steers with Hereford steers under both pasture and feedlot conditions.

In this trial, steer calves were wintered to gain approximately 1.5 pounds per day on a limited grain-high roughage growing ration. In this trial, two lots of 13 steers each of BWF and Hereford type were wintered for 92 days, from January 24th to April 26, 1973. During this time, each calf was fed a ration of 4 pounds of oats, 2 pounds alfalfa hay, 0.2 pound mineral mix and corn silage free choice. The calves were weighed monthly and feed consumption per lot was recorded.

Table 18 shows the results of the 1973 winter period.

Table 19 shows the feed consumption and cost per 100 pounds gain.

Table 18--Results of the 1973 winter growing period with BWF and Hereford steers

	BWF	Hereford
Number of head	13	13
Initial weight, lb.		
(Jan. 24, 1973)	408.1	407.3
Final weight, lb.		
(April 26, 1973)	560.4	542.3
Average steer gain, lb.	152.3	135.0
Difference, lb. 1/	+17.3	
Days fed	92	92
Average daily gain, lb.	1.66	1.47

1/ Difference in weight gain not statistically significant. Required l.s.d. @ 5% is 23.2 pounds.

Table 19--Ration fed, feed consumption and cost per hundredweight gain

	BWF		Hereford	
	Lbs./hd. per day	**Total cost**	**Lbs./hd. per day**	**Total cost**
Ration as fed:				
Oats	4.0	$97.12	4.0	$97.12
Alfalfa hay	2.0	29.90	2.0	29.90
Corn silage	20.8	89.55	19.6	84.33
Mineral mix	0.2	13.63	0.2	13.63
Total feed consumed	27.0		25.8	
Ration cost:				
Per lot		$230.20		$224.98
Per head		17.71		17.31
Per 100 lb. gain		11.63		12.82

Feed costs in this ration figured at:

.0203 for oats
.0125 for alfalfa
.0036 for corn silage
.057 for mineral mix

Summary:

During this wintering phase, the BWF steers were more efficient than the Hereford steers requiring $1.19 less feed per one hundred pounds gain.

The BWF steers gained 17.3 pounds more per head than the Herefords, although this difference was not statistically significant at the 95 percent probability level.

Twelve steers from each group were pastured together and will be finished in dry lot following the summer grazing period.

IS SUPPLEMENTAL PROTEIN NECESSARY FOR FATTENING STEERS ON COMPLETE MIXED RATIONS?

Complete mixed rations which include alfalfa as 5% of the ration have performed well in trials at this station in the past. However, performance on higher levels of alfalfa has not been determined.

There is concern about the problem of bloat, and its relationship to the level of alfalfa in the ration. Some producers have plenty of alfalfa and would like to use as much as is practicable. Others have limited amounts and want to use it to the best possible advantage, in combination with other hay. The value of additional protein in self-fed rations also needs to be determined.

Self-fed rations containing no alfalfa, and alfalfa in the amount of 5%, 15% and 25% of the total ration were fed to steer calves from a starting weight of 425 pounds to slaughter weights of about 1050 pounds.

A 5% alfalfa ration which included soybean oilmeal as a supplemental protein was also included.

The 5% alfalfa ration was fed to both Hereford and crossbred (Angus X Hereford) steers to compare performance.

Five lots of Hereford steers and one lot of crossbred steers were allotted on January 15, 1973. After a two week warm up period, all steers were started on self-feeders. The feeding period extended from February 2 until November 19, 1973, a total of 308 days.

During the feeding period, oats in the ration was shifted to barley as shown in table 20. The trial summary is presented in table 21.

Summary:

All rations were apparently adequate in protein, since the addition of soybean oilmeal did not improve average daily gains. The level of alfalfa did not significantly affect rate of gain.

The cost of feed per 100 pound of gain varied from $16.74 in the 5% alfalfa lot to a high of $27.10 in the lot receiving soybean oilmeal.

There was no significant difference between the straightbred or crossbred steers fed the 5% alfalfa ration as far as gain is concerned. The Hereford steers appeared to be somewhat more efficient, having a lower cost ($16.74 vs. $19.41) per hundred weight gain.

Table 20--Composition of self-fed rations by weight for the feeding period January 15 – November 19, 1973[1/]

Lot 8 – 25% alfalfa, no tame hay	
February 3 – April 25	10% barley, 65% oats
April 26 – June 26	25% barley, 50% oats
June 27 – July 22	40% barley, 35% oats
July 23 – November 19	45% barley, 30% oats
Lot 11 – 5% alfalfa, 20% tame hay and 7.4% soybean oilmeal	
February 3 – April 25	2.6% barley, 65% oats
April 26 – June 26	17.6% barley, 50% oats
June 27 – July 22	32.6% barley, 35% oats
July 23 – November 19	37.6% barley, 30% oats
Lot 10 – no alfalfa, 25% tame hay	
February 3 – April 25	10% barley, 65% oats
April 26 – June 26	25% barley, 50% oats
June 27 – July 22	40% barley, 35% oats
July 23 – November 19	45% barley, 30% oats
Lots 16 & 17 (BWF) – 5% alfalfa, 20% tame hay	
February 3 – April 25	10% barley, 65% oats
April 26 - June 26	25% barley, 50% oats
June 27 – July 22	40% barley, 35% oats
July 23 – November 19	45% barley, 30% oats
Lot 7 – 15% alfalfa, 10% tame hay	
February 3 – April 25	10% barley, 65% oats
April 26 – June 26	25% barley, 50% oats
June 27 – July 22	40% barley, 35% oats
July 23 – November 19	45% barley, 30% oats

1/ All lots received minerals at the rate of 10 pounds of dicalcium phosphate per 1000 pounds of feed. Salt was added to the rations at the rate of 10 pounds/1000 during the first period and 20 pounds/1000 during the last three periods.

Table 21--Data on weights, gains and feed costs in trials comparing alfalfa and soybean oilmeal as a protein supplement

	No alfalfa	Herefords 5% alfalfa	BWF 5% alfalfa	Herefords 15% alfalfa	Herefords 25% alfalfa	Herefords SBOM
Initial wt., lb.	429	428	428	429	429	429
Final wt., lb.	1059	1106	1042	1091	1098	1015
Gain/hd., lb.	630	678	614	662	669	586
Days fed	308	308	308	308	308	308
Avg. daily gain., lb.	2.05	2.20	1.99	2.15	2.17	1.90
Lbs. feed/hd./day	17.6	18.4	19.3	21.3	18.6	18.6
Feed cost/100 lb. gain	$17.05	$16.74	$19.41	$20.10	$17.60	$27.10
Feed cost/hd./day	$0.35	$0.37	$0.39	$0.43	$0.38	$0.52

SELF FEEDING COMPLETE MIXED RATIONS TO CALVES FROM WEANING TO SLAUGHTER

Steer and heifer calves were fed from weaning to slaughter in 339 days on self-fed complete mixed rations based on oats, barley and hay.

This trial, started in November, 1971, and continued in November, 1972, utilized four lots of Hereford steer calves and two lots of Hereford heifer calves. After a twelve day warm up period on whole oats and hay, all lots were started on their respective self-fed rations, as described below. Minerals force fed in all rations were 10 pounds di-calcium phosphate and 20 pounds of salt added to each 1000 pounds of mixed feed.

Ration 1 – 50% oats, 45% tame hay, 5% alfalfa plus minerals.

Ration 2 – 50% oats, 45% tame hay, 5% alfalfa plus minerals.
When calves reached 650 pounds, barley was substituted for 15% of oats each month until barley made up 100% of the grain in the ration.

Ration 3 – 75% oats, 20% tame hay, 5% alfalfa plus minerals.

Ration 4 – 75% oats, 20% tame hay, 5% alfalfa plus minerals.
After calves reached 650 pounds, barley was substituted for 15% of the oats each month until barley made up 60% of the grain in the ration.

A portable grinder-mixer using a 3/16 inch screen for the grain and a one inch screen for the hay was used to process the rations. The mixed rations were fed in straight walled self feeders designed for high roughage mixed rations.

The calves were fed until they reached an average choice slaughter grade, a period of 339 days in 1972 – 73.

Summary:

The rations used in this trial provided gains of from 2.02 to 2.17 pounds per head per day with steers and 1.74 to 1.81 for heifers. On similar rations (75% grain, 25% hay), the steers outgained the heifers by an average of 110 pounds per head. There was no significant difference in gain between steers fed 75% oats, 25% hay; 75% oats changing to barley, 25% hay; and 50% oats changing to barley and 50% hay. Steers fed the 50% oats changing to barley gained faster than steers fed the 50% oats – 50% hay ration. Calves generally ate on an energy basis, consuming more feed on the higher roughage lower energy rations. Highest return was $311 for steers fed both the 75% oat – 25% hay ration and the 50% oat changing to barley ration. Two years data suggests that the 50% oat – 50% hay ration is too low in energy to provide optimum gains with steers.

Table 22--Weights, gain, carcass data, feed cost and return from self-fed complete mixed rations

Ration #	1 Steers	3 Steers	3 Heifers	2 Steers	4 Steers	4 Heifers
Initial wt., lb.	397	396	339	396	396	338
Final wt., lb.	1081	1118	951	1132	1097	929
Gain/hd., lb.	684	722	612	736	701	591
Days fed	339	339	339	339	339	339
Avg. daily gain, lb.	2.02	2.13	1.81	2.17	2.07	1.74
Hot carcass wt., lb.	628	670	572	666	658	562
Avg. grade	11.7	12.4	12.7	12.4	12.7	12.9
Dressing percent	58.0	60.0	60.1	58.8	60.0	60.5
Avg. carcass value	$392	$429	$355	$426	$421	$354
Feed cost/head	$105	$118	$105	$115	$124	$108
Return/hd. over feed	287	311	250	311	297	246
Avg. cost/cwt gain	15.41	16.29	17.14	15.62	17.63	18.24
Lbs. feed/day	18.9	18.1	16.2	19.8	18.3	16.1

Table 23--Summary of trials with self-fed complete mixed rations

Ration #	1 2 Yrs. Steers	3 2 Yrs. Heifers	3 3 Yrs. Steers	2 2 Yrs. Steers	4 2 Yrs. Heifers	4 3 Yrs. Steers
Feedlot gain, lb.	636	617	673	688	596	676
Avg. daily gain, lb.	1.98	1.94	2.08	2.14	1.86	2.09
Carcass wt., lb.	612	576	650	645	563	659
Carcass value	$350	$327	$361	$377	$321	$364
Cost/cwt gain	$14.98	$15.74	$14.97	$14.56	$16.36	$15.32
Lbs. feed/day	20.6	16.8	17.8	19.5	16.4	17.8

HAND FEEDING & SELF-FEEDING COMPARED

How does hand feeding compare with self-feeding when beef calves are fed oats from weaning to slaughter? What benefits are derived from grinding the oats, and will the substitution of barley for oats improve feedlot performance and returns?

On October 27th, 1972, three lots of steer calves were started on feed to get some answers to these questions. The steers were placed on their respective rations after a 12 day warm up period on whole oats and tame hay.

One lot of steers was started on a self-fed ration of ground oats and minerals with 3 pounds tame hay and 2 pounds alfalfa hay fed daily in long form. When the steers averaged about 650 pounds, 15% of the ground oats was replaced with ground barley. The barley was increased in 15% increments each month until it reached 60% of the total grain being fed. The minerals in the self-fed rations were mixed with the grain and force fed at the rate of 10 pounds of di-calcium phosphate and 20 pounds of salt per 1000 pounds of grain.

Another lot of steers was hand fed daily a ration of whole oats to appetite, 3 pounds tame hay, 2 pounds alfalfa hay, and 0.2 pounds minerals. When the steers averaged about 650 pounds, the oats was ground and fed in that form to the end of the trial.

The third lot of steers was hand fed daily a ration of ground oats to appetite, 3 pounds tame hay, 2 pounds alfalfa hay and 0.2 pounds minerals. When these steers averaged about 650 pounds, barley was substituted for 15% of the oats monthly until the level of barley made up 60% of the grain fed. The mineral mixture fed to both hand fed lots was three parts di-calcium phosphate and one part trace mineral salt.

All three lots were fed until they averaged approximately 1050 pounds and would yield a high good to choice carcass.

Table 24--Results of hand feeding vs. self-feeding during the winter phase, October-March

	Whole oats hand fed	Ground oats hand fed	Ground oats self-fed
October 27th wt., lb.	396	396	399
March 23rd wt., lb.	639	606	681
Avg. winter gain, lb.	243	210	282
Days fed	147	147	147
Average daily gain, lb.	1.65	1.43	1.90
Avg. ration fed, lbs./hd./day:			
Whole oats	7.1		
Ground oats		7.1	10.6
Tame hay	3.3	3.3	3.3
Alfalfa	1.8	1.8	1.8
Minerals	0.18	0.18	0.32
Feed cost/head (*includes grinding)	$30.37	$31.42*	$42.99*
Cost/cwt gain	12.50	14.96	15.24

Table 25--Results of hand feeding vs. self-feeding during the summer phase, March to finish

	Whole oats hand fed	Ground oats hand fed	Ground oats self-fed
March 23rd wt., lb.	639	606	681
Finish wt.:			
October 1st			1044
November 19th	1096	1105	
Summer gain, lb.	457	499	363
Days fed	241	241	192
Average daily gain, lb.	1.90	2.07	1.89
Avg. ration fed, lbs./hd./day:			
Ground oats	14.4	6.5	8.6
Ground barley	--	7.9	6.8
Tame hay	3.0	3.0	3.0
Alfalfa hay	2.0	2.0	2.0
Minerals	0.2	0.2	0.41
Feed cost/head	$89.07	$93.99	$79.74
Cost/cwt gain	19.49	18.84	21.97

Table 26--Summary of hand feeding vs. self-feeding trial

	Whole oats hand fed	Ground oats hand fed	Ground oats self fed
Initial wt., lb.	396	396	399
Final wt., lb.	1096	1105	1044
Gain/hd. lb.	700	709	645
Days fed	388	388	339
Avg. daily gain, lb.	1.80	1.83	1.90
Feed cost/head	$119.44	$125.41	$122.72
Cost/cwt gain	17.06	17.70	19.01

Summary:

During the winter phase, the self-fed steers outgained the steers hand fed ground oats by 0.47 pounds per head per day. In this first year's trial, the whole oat fed steers performed better than the ground oat fed steers, and produced the cheapest gains during the winter phase.

During the summer phase, the steers fed ground oats plus barley made the fastest gains (2.07 lbs./hd./day) and had the lowest cost ($18.84) per 100 pounds gain.

The self-fed steers consumed one pound of grain more per day than the hand fed steers, and were slaughtered after 339 days on feed, 49 days earlier than those hand fed.

An analysis of the daily gains of steers in all lots shows no significant difference.

Based upon the results shown in table 24, whole oats performed as well as ground oats for less cost until the steers weighed 600 to 650 pounds.

The substitution of barley for oats apparently allowed for faster gains when compared to straight oats, although the difference was not great.

Extra salt was fed in the self-fed ration in an effort to reduce over consumption of grain. No steers in the lot showed signs of founder caused by overeating.

FEEDING LIQUID WHEY IN SWINE FATTENING RATIONS

The disposal of liquid whey, a by-product of cheese manufacture at North Dakota cheese plants, has been a problem. Its resistance to decomposition in sewage systems has made it necessary to find other means of disposal. Its use as a fertilizer is of limited value. However, it can be used in swine feeding to provide necessary protein.

This trial was designed to investigate the feasibility of using liquid whey as a supplement in swine fattening rations. In this experiment, whey, soybean oilmeal and lysine-methionine are compared, as supplements to a basic barley and oats fattening ration. Pigs of two starting weights were used, and all lots were fed in concrete dry lot. The pigs were started on whey gradually, and did not develop any scouring or diarrhea.

Liquid whey was self-fed using nipple type waterers. The whey fed pigs received no extra water after the first month, their entire liquid intake coming from the whey. The whey was furnished daily by the Dickinson Cheese Company, stored in fiber glass tanks at the station for twenty four hours, and fed in sour form. The whey was furnished at no cost, but in ration computations, a charge of 1/2 cent per gallon was made to cover cost of hauling and handling.

Although the utilization of whey was impossible to measure accurately because of waste in feeding, it amounted to approximately 2.8 gallons per pig per day. This is in agreement with figures for liquid consumption as presented by the National Research Council.

Table 1 shows ration composition and costs. Table 2 summarizes weights, gains and feed costs in the 1973 trials.

Summary:

Barley-oats rations supplemented with whey were equal to rations supplemented with either soybean oilmeal or amino acids lysine and methionine. The whey fed pigs were more efficient and had a lower cost of gain than either the soybean oilmeal or the amino acid fed pigs. The whey fed pigs required approximately 100 pounds less dry feed per 100 pounds gain than the other rations. This amounted to a savings of about $3/100 pounds gain over the amino acid fed pigs and $5/100 pounds gain over the soybean oilmeal fed pigs.

It appears from this trial that whey can be utilized very satisfactorily in a swine feeding program if: the source of whey is adequate and dependable; the pigs weight at least 35 pounds; and, proper liquid feeding devices (stainless steel or PVC plastic) are utilized to minimize contamination, fly and odor problems.

Table 1--Rations fed in swine feeding trials – summer, 1973

Ingredients	Barley + SBOM	Barley + lysine & methionine	Barley + whey
Oats, lb.	200	231	236
Barley, lb.	676	737.5	740
Soybean oilmeal, lb.	100	--	--
Di-calcium phosphate, lb.	9	9	9
Limestone, lb.	9	9	9
Trace mineral salt, lb.	5	5	5
Vitamin B complex, lb.	1	1	1
Lyamine (50%), lb.	--	6	--
Methionine (99%), lb.	--	1.5	--
Vitamin A, gram	30	30	30
Vitamin D_3, gram	14	14	14
Zinc sulphate, gram	180	180	180
Total, lb.	1000	1000	1000
Cost/100 lbs. feed 1/	$3.50	$3.00	$2.46

1/ Includes $1.50/1000 lbs. for grinding, and 50¢/100 gallons for hauling whey.

Table 2--Weights, gains and feed costs in whey feeding trials – summer, 1973

	Barley + whey		Barley + lysine & methionine		Barley + SBOM	
Initial wt., lb.	35.7	53.6	36.3	53.3	36.7	54.3
Final wt., lb.	206.9	217.5	211.2	214.0	200.7	220.3
Gain, lb.	171.2	163.9	174.8	160.7	164.0	166.0
Days fed	135	121	135	121	135	121
Avg. daily gain, lb.	1.27	1.35	1.30	1.33	1.21	1.37
Dry feed/cwt gain, lb.	261.2	283.4	361.3	368.9	376.3	353.4
Whey/cwt, gallons	218	207	--	--	--	--
Feed cost/cwt gain	$7.52	$8.00	$10.84	$11.07	$13.53	$12.71

SWINE FEEDING TRIALS
SUMMER-1973

The summer hog feeding trials included a comparison of triticale and barley, supplemented with soybean oilmeal or the amino acids lysine and methionine. The rations were self-fed in meal form to both barrows and gilts, in groups of seven, on a spring seeded winter wheat pasture.

The pigs fed were purebred Yorkshires farrowed during March and April. Their average starting weight was 36 pounds and they were fed for 126 days. The trials were closed when the pigs averaged 220 pounds.

Table 3 shows the rations as fed and their cost per 100 pounds.

Table 4 gives the performance of pigs by ration and shows feed efficiency and cost per 100 pounds gain.

Summary:

Due to the high cost for soybean oilmeal ($270/ton) the rations supplemented with lysine and methionine were about $0.65/100 pounds cheaper to prepare.

There was no statistically significant difference between the rations, sex, or ration x sex interaction as far as gain was concerned.

It appears that all rations gave good feed efficiency, with the triticale and soybean oilmeal showing up best.

The lowest cost per 100 pounds gain was produced by the triticale plus lysine ration at $9.86 per l00 pound gain.

In summary, it appears that clean ergot-free triticale can substitute for barley on a 1 to 1 basis without adversely affecting gains.

It should also be noted that the amino acids lysine and methionine gave gains equal to soybean oilmeal when used to supplement the barley-oats rations. However, lysine was in very short supply during 1973, and difficult to obtain.

Table 3--Rations fed in swine feeding trials – summer, 1973

Ingredient	Barley + SBOM	Triticale + SBOM	Triticale + lysine & methionine
Barley, lb.	676	--	--
Triticale, lb.	--	676	769.5
Oats, lb.	200	200	200
Soybean oilmeal, lb.	100	100	--
Lyamine (50%), lb.	--	--	5
Methionine (99%), lb.	--	--	1.5
Di-calcium phosphate, lb.	9	9	9
Limestone, lb.	9	9	9
Trace mineral salt, lb.	5	5	5
Vitamin B complex, lb.	1	1	1
Vitamin A, gram	30	30	30
Vitamin D_3, gram	14	14	14
Zinc sulphate, gram	180	180	180
Total, lb.	1000	1000	1000
Cost/100 lbs. feed 1/	$3.60	$3.60	$2.95

1/ Includes $1.50/1000 lbs. for grinding.

Table 4--Performance of pigs in feeding trials – summer, 1973

	Barley + SBOM		Triticale + SBOM		Triticale + lysine & methionine	
	Barrows	Gilts	Barrows	Gilts	Barrows	Gilts
Initial wt., lb.	35.4	36.6	36.2	36.9	36.1	36.7
Final wt., lb.	230.0	223.6	231.8	224.4	229.0	224.1
Gain, lb.	194.6	187.0	195.7	187.6	192.9	187.4
Days fed	126	126	126	126	126	126
Avg. daily gain, lb.	1.54	1.48	1.55	1.49	1.53	1.49
Feed/cwt gain, lb.	366.7	337.7	333.5	321.8	338.5	330.8
Feed cost/cwt gain	$13.19	$12.14	$11.99	$11.57	$9.97	$9.75

SWINE FEEDING TRIALS
WINTER 1972-73

Swine fattening rations in which triticale or barley as the major grain ingredient were used in these trials. Both natural protein (soybean oilmeal) and the amino acids (lysine and methionine) were also tested as suitable ration supplements. Any interaction between sex and ration was also measured.

Hogs started on trial at an initial weight between 40 and 50 pounds, and were fed for a period of 120-148 days depending upon sex and ration. All rations were processed in a portable grinder-mixer and self-fed in meal form. The purebred Yorkshire pigs used in the trial were farrowed during August and September, 1972. All pigs were wormed with dichlorvos at the beginning of the trial.

The ration ingredients, costs and calculated protein levels are shown in table 5.

Table 6 summarizes performance of both barrows and gilts.

Table 7 shows the results of barrows fed either the barley ration, triticale ration, triticale plus lysine and methionine or triticale plus barley.

Summary:

The first years' data show no significant difference in gain produced by feeding either barley or triticale based rations. There was no apparent interaction between sex and ration.

Faster and more efficient gains were produced by barrows than the gilts. This is partly because the gilts were fed to slightly heavy final weights and were somewhat lighter at the start. None of the lots were very efficient, requiring 439 to 516 pounds of feed per hundred weight gain. The high cost of soybean oilmeal ($270/ton) caused an increase of almost 50% over previous years feed costs for barley based rations.

No statistically significant difference was measured between gains of barrows fed any of the four rations. The barley and soybean oilmeal ration gave the most efficient gains while the triticale plus lysine and methionine was the least expensive to feed. Feed efficiencies were similar in all rations. The replacement of oats with barley in triticale based rations did not improve rate of gain or feed efficiency.

Table 5--Average ration composition, cost per 100 lbs. and calculated protein levels

Ingredients	Barley + SBOM	Triticale + SBOM	Triticale + lysine & methionine	Triticale, barley + SBOM
Barley, lb.	678.5	--	--	200
Triticale, lb.	--	678.5	772	678.5
Oats, lb.	200	200	200	--
Soybean oilmeal, lb.	100	100	--	100
Lyamine (50%), lb.	--	--	5	--
Methionine (99%), lb.	--	--	1.5	--
Limestone, lb.	10	10	10	10
Di-calcium phosphate, lb.	5	5	5	5
Trace mineral salt, lb.	5	5	5	5
Vitamin B complex, lb.	1	1	1	1
Vitamin A, gram	30	30	30	30
Vitamin D_3, gram	14	14	14	14
Zinc sulphate, gram	180	180	180	180
Total, lb.	1000	1000	1000	1000
Cost/100 lbs. feed	$3.43	$3.43	$2.78	$3.48
Calculated protein	14.7%	16.3%	13.1%	16.5%

Table 6--Weights, gains and feed costs in feeding trials – winter 1972 – 73

	Barley + SBOM		Triticale + SBOM	
	Barrows	Gilts	Barrows	Gilts
Initial wt., lb.	52.5	45.2	53.4	45.1
Final wt., lb.	218.4	232.3	216.6	220.7
Gain, lb.	165.9	187.1	163.2	175.6
Days fed	120	148	120	148
Avg. daily gain, lb.	1.38	1.26	1.36	1.19
Feed/cwt gain, lb.	448.8	515.0	438.7	516.5
Feed cost/cwt gain	$15.37	$17.64	$15.03	$17.70

Table 7—Weights, gains and feed costs in feeding trial with barrows – winter 1972 -73

	Barley + SBOM	**Triticale + oats**	**Triticale + lysine**	**Triticale + barley**
Initial wt., lb.	42.7	41.7	44.2	43.9
Final wt., lb.	205.1	201.9	204.7	190.7
Gain, lb. 1/	162.4	160.2	160.5	146.9
Days fed	120	120	120	120
Avg. daily gain, lb.	1.35	1.34	1.34	1.22
Feed/cwt gain, lb.	417.8	441.3	423.5	447.5
Feed cost/cwt gain	$14.31	$15.12	$11.77	$15.56

1/ No significant difference at 5% level.

INCLUDING ANTIBIOTICS IN SOW RATIONS TO REDUCE BABY PIG LOSSES

Many baby pigs die before weaning from scours, miscellaneous infections and starvation caused by a sow failing to milk. Feeding high levels of antibiotics two weeks before and for three weeks after farrowing is reported to reduce baby pig losses, improve milk production in the sow and increase numbers of pigs weaned.

In August, 1973, 24 bred sows and gilts were divided into nearly equal groups based on breeding dates. Two weeks before the first litters were due, the antibiotic, neomycin oxytetracycline, was added to the gestation rations at the rate of 7.5 pounds per ton of feed. Each pound of the antibiotic mixture provided 20 grams oxytetracycline and 14 grams of neomycin. This level of medication was also added to the lactation rations and fed for three weeks following farrowing. The control sows were handled in an identical manner except their rations did not include any antibiotic. Individual sows and pigs were treated with antibiotics, serum, and oxytocin only when their condition warranted a specific treatment.

The rations fed are shown in table 8.

The trial summary is tabulated in table 9.

Table 8--1973 sow gestation and lactation rations

	Gestation ration[1/]	Lactation ration[1/]
Alfalfa hay, lb.	600	--
Barley, lb.	--	900
Oats, lb.	1345	880
Soybean oilmeal, lb.	--	180
Limestone, lb.	20	22
Di-calcium phosphate, lb.	20	12
Trace mineral salt, lb.	15	10
Vitamin B complex, lb.	2	1
Vitamin A, gram	150	60
Vitamin D_3, gram	--	20

1/ 7.5 pounds of neomycin-oxytetracycline added per ton in medicated feeds.

Table 9--Results of trials with the use of neomycin-oxytetracycline in sow rations

	Treated	Check
Number of litters	12	1/ 11
Crossbred	8	2
Straightbred	4	9
Number living at birth	129	131
Avg. birth wt., lb.	2.60	2.45
Number living at weaning	113	81
Avg. weaning wt., lb.	28.2	29.9
Avg. age at weaning, days	51	56
Avg. daily gain, birth to weaning, lb.	0.50	0.52
Percent alive at weaning	88	62
Sows requiring additional medication	5	3

1/ One sow not included because she farrowed unattended in a portable house and lost most of her pigs.

Summary:

The sows fed neomycin weaned 26% more pigs than the control sows. There did not appear to be any consistant difference between treatments with respect to average age at weaning, birth weight, weaning weight or average daily gain from birth to weaning..

Results of this trial could be biased because of unequal numbers of crossbred sows in the medicated group. Additional trials are planned.

Feed Prices and Feed Analysis, 1973

Ingredient	Price/unit	% Protein
Alfalfa hay	$25/ton	14.8
Crested wheatgrass hay	18/ton	11.6
Oat straw	10/ton	4.8
Barley	$1.10/bushel	12.4
Oats	0.65/bushel	11.5
Triticale	1.10/bushel	14.1
Soybean oilmeal	$270/ton	
Di-calcium phosphate	$132/ton	
Trace mineral salt	56/ton	
Limestone	50/ton	
Zinc sulphate	$2.99/pound	
Vitamin A	0.50/pound	
Vitamin D_3	2.42/pound	
Vitamin B complex	0.22/pound	
Lyamine-50 (50% lysine)	0.65/pound	
dl Methionine (99%)	1.10/pound	
Whey (liquid)	50¢/100 gallons	
101 block (Kedlor)	$11.10/100 pounds	
Grinding	$3.00/ton	

Section II

Management of Cows for Good Reproductive Quality

by

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MANAGEMENT OF COWS FOR HIGH FERTILITY

J. N. Wiltbank, J. C. Spitzer and D. G. LeFever (1973)

High fertility means a large number of cows pregnant early in the breeding season. This means a large number of cows must show heat early in the breeding season and a large number must conceive at first service. To accomplish this cows must have a long interval from calving to the start of the breeding season and must receive the proper level of nutrition. The purpose of this paper is to discuss a management system that has accomplished this.

To make it possible for cows to have a long interval from calving to the start of breeding, cows must calve early. Therefore, an experiment was designed to make certain heifers calved early with the first calf and that the rest of the calves were also dropped over a short period of time. This type of system was contrasted with a group of cows calving over a long period of time.

One hundred and forty Angus, yearling heifers were divided by age, weight and source into a Control (C) and New Management group (NM). The differences between the two groups appears in the following table.

Group	New Management	Control
Number pregnant replacements needed	50	50
Number exposed for breeding	85	54
Breeding season started		
As heifers	4-22	5-12
As cows	5-12	5-12
Length of breeding (days)	45	90
Estrus synchronization	yes	no
Selection criteria	Early pregnancy	Pregnancy--adjusted weaning weight and conformation score.

This caused more heifers to calve early as seen in the next table.

Calving Time When Cows Were Two Years of Age.

Calving Time	New Management Group	Control Group
February 9 or before	31	0
February 10 to March 6	19	23
March 7 to March 26	0	7
March 27 to April 16	0	7
April 17 and After	0	3
Total	50	40

With this system we can now contrast cows calving for the first time in a short concentrated period versus those calving over a long period. The question we attempted to answer was the effect of this short calving period on future reproductive performance. The methods of measuring reproductive performance were cows pregnant and cows in heat. In following years replacement heifers which were retained, were handled as in the first table and were not switched between herds.

In subsequent years more cows in the NM group became pregnant early in the breeding season than in the controls. An average of 70 percent of the New Management cows were pregnant after 21 days of breeding compared to 46 percent in the controls. The difference varied from 10 percent in the third year of the experiment to 38 percent in the fifth year.

Pregnant Cows--At Various Times

Pregnant	New Management Group	Control Group	Difference
After 21 days (%)	70 (54-86)[a]	46 (38-58)	24 (10-38)
After 45 days (%)	87 (74-94)	75 (51-89)	12 (3-23)
At end of breeding season (%)[b]	87 (74-94)	90 (77-98)	3 (-2-+7)

[a] Range in four different years.
[b] Forty-five days in NM Group and 90 days in C Group.

A 12 percent average difference in cows pregnant after 45 days of breeding was noted between NM cows and Control cows. The difference varied from 23 percent in the second year of the experiment to 3 percent in the fifth year of the experiment. The proportion pregnant at the end of the breeding season (45 days for NM and 90 days for the Control) was 87 percent for the NM group and 90 percent for the Controls. In the second year of the experiment only 74 percent of the cows in the NM group and 77 percent of the cows in the Control group became pregnant. This was thought to be the result of using poor semen as most cows were cycling and gaining weight during the breeding season. In the other three years the pregnancy rate at the end of the breeding season varied from 90 to 98 percent and the difference in pregnancy rate between the NM and Control groups was 3 percent, -2 percent and 7 percent.

The reason more cows became pregnant early in the breeding season in the NM group was because more cows were in heat early in the breeding season. The proportion of NM cows showing heat the first 21 days of the breeding season varied from 92 percent to 100 percent compared to 67 percent to 92 percent in the Controls. There was an average difference of 18 percent and the difference varies from 8 percent to 29 percent. The differences after 45 days of breeding were small as all cows in the NM group and nearly all in the Control group had been in heat by this time.

Cows Showing Heat at Various Times

Shown Heat	New Management Group	Control Group	Difference
After 21 days of breeding (%)	95 (92-100)	77 (67-92)	18 (8-29)
After 45 days of breeding (%)	100	96 (93-100)	4 (0-7)

The increase in reproductive performance led to an increase in the weaning weight of the calves in the NM group. Calves from the NM group averaged 433 pounds at weaning compared to 396 pounds in the Control group or a difference of 37 pounds. The range in average difference was from 67 pounds to 15 pounds. This shows the pounds of calf in a cow herd can be increased by using simple inexpensive techniques. It also shows that good reproductive performance can be achieved in short breeding periods.

Weaning Weight of the Calves

	New Management Group (lbs.)	**Control Group (lbs.)**	**Difference (lbs.)**
Average	433	396	37
Average range for four years	409-452	342-423	15-67

In 1971, 86 percent of the cows became pregnant after 21 days of breeding and in 1972, 87 percent of the cows were pregnant after 25 days of breeding. How was this made possible? First, we selected early calving cows so they had time for the uterus to clean up and time for the cows to come back in heat during the first 21 days of breeding. Second, we fed the cows properly. The nutrition didn't do it as both groups of cows received the same level of nutrition. It was the combination of making sure the heifers calved early and the right feed. We therefore have a system to start and keep cows calving early and over a short period of time.

Next, the importance of feed level in improving reproductive performance will be discussed. I want to first stress again the importance of feeding heifers properly so most will be cycling at the start of the breeding season. The results of that are discussed in another paper. Here I would like to emphasize the importance of feeding cows during late pregnancy and after calving.

A cow suckling a calf must receive adequate levels of energy or she will not become pregnant early in the breeding season. The level of energy a cow receives prior to calving influences when a cow will return to heat after calving while the level of energy a cow receives after calving influences the conception rate at first service. The results of several experiments have been summarized and results given in the next few tables.

Fewer cows losing weight before calving become pregnant the first 20 days of the breeding season. In cows calving between the first and the twentieth day of the calving season 64 percent of the cows gaining 1/2 to 1 pound before calving became pregnant compared to 57 percent in cows losing weight after calving. This happened because fewer cows showed heat the first 20 days of breeding in cows losing weight. Only 85 percent of these cows showed heat compared to 95 percent in cows gaining weight. The difference in pregnancy rate between cows on two levels of feed was 11 percent in cows calving between the twenty-first and fortieth days of the calving season, 13 percent in cows calving between the forty-first and sixtieth days of the calving season. Thus, the onset of heat after calving is delayed in cows either making no weight gain or losing weight 120 days before calving and this means fewer cows pregnant early in the breeding season. You can also see the effect of calving time and nutrition level in this chart, both are important. You can't get large numbers of cows cycling unless proper levels of feed are fed and cows calve early.

Gain Before Calving and Reproductive Performance

Calving Time	Daily Wt. Gain For 120 Days Before Calving To Calving (lbs.)	First 20 Days of Breeding				
		In Heat		Conceived First Service		Pregnant
1st to 20th Day	1/2 to 1	95	X	67	=	64
	0 to -1	85	X	67	=	57
21st to 40th Day	1/2 to 1	90	X	58	=	52
	0 to -1	70	X	58	=	41
41st to 60th Day	1/2 to 1	65	X	33	=	21
	0 to -1	25	X	33	=	8

Cows losing weight after calving have poorer reproductive performance than cows gaining weight after calving. The number of cows pregnant early in the breeding season is decreased in cows losing weight because there is a marked decrease in the proportion of cows conceiving on first service and somewhat fewer cows show heat early in the breeding season. In cows calving early 64 percent of the cows gaining weight after calving became pregnant the first 20 days of breeding, compared to 37 percent in cows losing weight. A comparable figure for cows calving between the twenty-first and fortieth days was 52 percent for cows gaining weight and 31 percent for cows losing weight. This shows that to have good reproductive performance cows must gain weight after calving.

Gain After Calving and Reproductive Performance

Calving time	Daily Wt. Gain After Calving (lbs.)	First 20 Days of Breeding				
		In Heat (%)		Conception Rate (%)		Pregnant (%)
1st to 20th Day	1/4 to 1/2	95	X	67	=	64
	- 1/2 to -1	88	X	42	=	37
21st to 40th Day	1/4 to 1/2	90	X	58	=	52
	- 1/2 to -1	85	X	37	=	31
41st to 60th Day	1/4 to 1/2	65	X	33	=	21
	- 1/2 to – 1	78	X	20	=	16

When cows lose weight before and after calving, reproductive performance is a disaster. In cows on inadequate levels of energy both before and after calving only 36 percent of the early calving cows became pregnant early in the calving season, this declined to 26 and 5 percent in later calving cows.

Weight Gains Before and After Calving and Reproductive Performance

Calving Time	Level Of Energy	First 20 Days of Breeding				
		In Heat		Conceived First Service		Pregnant
1st to 20th Day	A	95	X	67	=	64
	I	85	X	42	=	36
21st to 40th Day	A	90	X	58	=	52
	I	70	X	37	=	26
41st to 60th Day	A	65	X	33	=	21
	I	25	X	20	=	5

A : Adequate -- Gained 1/2 to 1 lb. before calving and 1/2 to 1 lb. after calving.
I : Inadequate -- Lost weight both before and after calving.

These tables point out the principles. Now let's see what happens to reproduction after 20 days and look at the original data so you can project. The level of energy fed before and after calving has a marked effect on pregnancy rate. Energy level exerts its effect by influencing the occurrence of post-partum estrus and conception rate at first service. This was demonstrated in a series of experiments conducted on cows confined to a dry lot.

Cows received adequate levels of protein, minerals and vitamins in all experiments and thus it was hoped that the difference noted was mainly the result of differences in energy intake. Checks for estrus were made at least twice daily. In most cases sterilized bulls wearing a marking device were placed in lots with the cows for at least six to eight hours each day. Breeding was done by hand mating the first two experiments and by artificial insemination in the last experiment. Rectal examinations for ovarian activity and pregnancy were done routinely.

In cows receiving low levels of energy both before and after calving, only 20 percent became pregnant in a 90 day breeding season. This poor reproductive performance was the result of only 22 percent of the cows showing estrus and a low conception rate at first service (33 percent). Thus, continuously low levels of energy are disastrous as far as reproductive performance is concerned.

Reproductive Performance of Cows on Inadequate Energy Levels

Before Calving (lbs.)	After Calving (lbs.)	No. Cows	Cows Pregnant		Cows Showing Estr.			Preg. From First Serv.
			First 20 Days Brdg. (%)	End of Brdg. (%)	50 Days After Calv. (%)	70 Days After Calv. (%)	90 Days After Calv. (%)	
9.0	16	21	60	95	65	90	95	67
4.5	8	20	15	20	22	22	22	33

In cows receiving a low level of energy before calving, but adequate levels of energy after calving, little or no difference in pregnancy rate at the end of the breeding season was noted; but the number of cows becoming pregnant early in the breeding season was decreased with 6 to 22 percent more cows on the high level of feed becoming pregnant in the first 20 days of the breeding season.

Pregnancy Rate and Early Calving in Cows on Two Levels of Energy Prior to Calving

Level of Feed		No. Cows	Weight Changes		Pregnant (%)	
Before Calv. lbs. TDN	After Calv. lbs. TDN		Start of Expt. to One week Before Calving	24 hours after Calving to 90 days Post-Calv.	At end of 20 days of Brdg.	End of Breeding Season
Older Cows						
9.0	16.0	21	67	-14	60	95
4.5	16.0	20	-118	22	46	95
Two-Year-Old Cows						
8.0	13.0	37	115	81	54	71
4.3	13.0	41	18	136	32	73
Two-Year-Old Cows						
8.0	13.0	24	129	43	54	79
4.3	13.0	23	6	87	48	83

This effect was the result of delay in the onset of estrus following calving. At 50 days post-calving, 65, 68 and 38 percent of the cows in the different experiments and receiving the 8 to 9 pounds of TDN before calving had shown heat compared to 25, 27 and 30 percent in cows on the lower level of TDN before calving. At 60 and 70 days post-calving large differences in the proportion which had shown heat were still apparent.

The number of cows conceiving at first service was not affected by the level of energy fed prior to calving. Thus, the level of energy prior to calving has a marked effect on the occurrence of early estrus following calving, while conception rate at first service was not influenced by energy level prior to calving.

Occurrence of Post-Partum Estrus and Conception Rate in Cows on Two Levels Of Energy Prior to Calving

Level of Feed		Percent Which Had Shown Heat						
		40	50	60	70	80	90	
Before Calving lbs. TDN	After Calving lbs. TDN	Days After Calving						Pregnant From First Service
Older Cows								
9.0	16.0	--	65	80	90	90	95	67
4.5	16.0	--	25	45	70	80	85	65
Two-Year-Old-Cows								
8.0	13.0	22	68	81	90	92	97	63
4.3	13.0	7	27	49	66	73	83	53
Two-Year-Old Cows								
8.0	13.0	21	38	71	92	96	100	50
4.3	13.0	13	30	52	70	83	91	56

Cows which had been on an adequate level of energy prior to calving, but received a low level of energy after calving, showed a marked decrease in the proportion of cows pregnant either after 20 days of breeding or at the end of the breeding season. In the older cows at the end of 20 days of breeding 60 percent of those receiving adequate levels of energy (9 pounds before and 16 pounds after) were pregnant while only 34 percent of the cows which received adequate levels before (9 pounds) and a low level after (8 pounds) were pregnant. The differences in percent pregnant at the end of 20 days of breeding in two-year-old cows was also large and favored cows receiving adequate energy both before and after calving. The differences in the percent pregnant at the end of the breeding season in all cases favored the cows on adequate levels of feed. In the older cows, 95 percent were pregnant at the end of the breeding season when cows received adequate levels of energy but only 77 percent when the cows received a low level of feed after calving. In younger cows the differences were not nearly as large with the difference in percent pregnant being 7 percent in one group and 3 percent in the next.

Pregnancy Rate and Early Calves on Two Levels of Feed After Calving

Level of Feed			Weight Changes		Pregnant (%)	
Before Calving lbs. TDN	After Calving lbs. TDN	No. Cows	Start of Expt. to one week before Calving	24 hours after Calving to 90 days post-calv.	At end of 20 Days of Breeding	End of Breeding Season
Older Cows						
9.0	16.0	21	67	-14	60	95
9.0	8.0	22	89	-97	34	77
Two-Year-Old-Cows						
8.0	13.0	37	155	81	54	71
8.0	7.0	42	192	-79	33	64
Two-Year-Old-Cows						
8.0	13.0	24	129	43	54	79
8.0	7.0	13	138	-56	23	76

There are two reasons for poor reproductive performance in cows which are on low levels of feed following calving and are consequently losing weight. There is a certain number of cows in this category which do not show heat during the breeding season. In these older cows on inadequate energy level after calving there was only 86 percent which had shown heat at 90-day post-calving and no more showed heat after this time. In the younger cows, comparable figures were 81 percent and 92 percent. In cows on adequate levels of feed after calving 95 percent to 100 percent had shown heat at this time. The second reason for poor reproductive performance is the low conception at first service. The conception rate at first service decreased from 10 to 25 percent in the different experiments.

Occurrence of Post-Partum Estrus and Conception Rate in Cows on Two Levels of Energy Post-Calving

Level of Feed								
Before Calving Lbs. TDN	After Calving Lbs. TDN	Percent Which Had Shown Heat						Pregnant From First Service
		40	50	60	70	80	90	
		Days After Calving						
Older Cows								
9.0	16.0	--	65	80	90	90	95	67
9.0	8.0	--	76	81	81	86	86	42
Two-Year-Old Cows								
8.0	13.0	22	68	81	90	92	97	63
8.0	7.0	6	73	64	81	81	81	53
Two-Year-Old Cows								
8.0	13.0	21	38	71	92	96	--	50
8.0	7.0	23	85	92	92	92	--	37

In an effort to overcome the detrimental effects of low levels of energy prior to calving, cows were fed high levels of energy after calving. Cows were put on self-feeders from calving until they were diagnosed pregnant or the end of the breeding season. In the first experiment, 92 percent of the cows which were full fed were pregnant at the end of a 90 day breeding season compared to 72 and 79 percent in two other groups which received lower levels of energy. This increase in reproductive performance for cows on the high level of feed after calving was mostly a result of an increase in conception rate at first service. In this experiment, 83 percent of the cows on full feed after calving conceived on first service compared to 54 and 31 percent of the cows in the other two groups. The same trends were observed in two-year-old cows. The onset of estrus was delayed in the older cows on the high level of energy. This same trend was apparent in the two-year-old cows, however, the difference observed was again not significant. Marked differences in ovarian follicular growth were noted in both experiments.

Pregnancy Rate and Early Calves in Cows on High Levels of Energy After Calving

Level of Feed		No. Cows	Weight Changes		Pregnant (%)	
Before Calving lbs. TDN	After Calving lbs. TDN		Start of Expt. to one week before Calving	24 hours after Calving to 90 days Post-calv.	At end of 20 days of Breeding	End of Breeding Season
Older Cows						
4.7	12.0	14	-69	-1	23	72
4.7	16.0	14	-69	36	24	79
4.7	25.0	13	-69	247	38	92
Two-Year-Old Cows						
4.3	13.0	41	18	136	32	73
4.3	22.0	41	15	284	51	90
8.0	13.0	37	155	52	54	73
8.0	22.0	42	148	258	56	78

Occurrence of Estrus and Conception Rate in Cows on High Level of Energy After Calving

Level of Feed		Percent Which Had Shown Heat					Pregnant from First Breeding (%)
Before Calving lbs. TDN	After Calving lbs. TDN	50	60	70	80	90	
		Days After Calving					
Older Cows							
4.7	12.0	7	--	43	--	64	54
4.7	16.0	57	--	78	--	93	34
4.7	25.0	15	--	46	--	77	83
Two-Year-Old Cows							
4.3	13.0	27	49	66	73	83	53
4.3	22.0	20	39	80	88	93	73
8.0	13.0	68	81	90	92	97	63
8.0	22.0	40	62	90	93	95	63

Two experiments were then designed to: (a) confirm the results of the last experiments that high levels of energy after calving had a beneficial effect on reproductive performance and (b) to determine if cows could be full fed for short periods of time and receive the beneficial effects of high level of energy feeding noted.

In the next two experiments all cows were fed 4.3 pounds of TDN prior to calving. After calving they received full feed for varying periods of time. Breeding started 60 days after calving and continued for 120 days post-calving, so some cows were full fed for 20, 40 or 60 days before breeding. The results of high energy feeding noted in the last two experiments were not confirmed in these two experiments. Little or no difference in pregnancy rate was noted between cows fed 13 pounds of TDN continuously after calving and those full fed for varying periods after calving. The onset of estrus and conception rate at first service was remarkedly similar in all groups. It was concluded from these data that full feeding after calving has little or no effect on reproductive performance in young cows.

Reproductive Performance of Cows Full Fed for Varying Periods of Time After Calving

No. Day of Full Feeding	No. Cows	Wt. Change Calving to 120 days Post-Calv.	Pregnant (%)				In Heat (%)					First Conc. First Serv. (%)
			80	100	120		50	60	70	80	90	
			Days Post-Calving				Days Post-Calving					
Two-Year-Old Cows												
0	23	100	48	74	83		30	53	70	83	91	56
80	25	210	36	72	76		28	56	68	69	96	54
100	25	250	44	66	76		16	48	72	84	96	56
120	27	256	37	74	85		22	41	66	85	89	56
Three-Year-Old Cows												
0	30		33	67	80		43	70	80	90	97	50
90	38		37	58	76		32	53	68	84	89	37
120	34		50	68	79		32	59	68	88	94	58

From these experiments two conclusions can be drawn, cows should gain 1/2 to 1 pound a day prior to calving and 1/4 to 1/2 pound a day after calving. Weight gains lower than these could lead to detrimental effects on reproductive performance. These weight gains cannot be measured with the eye, but a sample of cows should be weighed. I know of no other way to make certain cows are making proper weight gain. You can hope they are but sooner or later you will make a wrong guess. Weigh a sample of 15 to 20 cows every two weeks and know what your cows are doing. Weigh the same cows, mark them with paint over the withers. This will give you some control over your nutrition level.

What does all this mean as far as supplementation is concerned. It means you need to supplement cows according to need and the need will vary from one year to the next and from one season to the next. Again as you weigh cows you know what they are doing and you feed them to meet their requirements.

Reproductive performance can be improved. It doesn't come by hoping, it comes because you obey the laws. You make it happen. You pay attention to details. To do this, you need a written plan. This plan should contain present reproduction, goals, methods to reach the goals, projection of what will happen to reproduction as you change and what will happen to costs and return. The figures given here on effect of nutrition on reproduction can be useful in projection of results.

RELATIONSHIP OF ENERGY, COW SIZE AND SIRE TO CALVING DIFFICULTY

J. N. Wiltbank and Tom Price (1973)

Bellows (1971) has indicated that 50 percent of the calf losses at or near birth could be prevented by improved management. He also indicated that age of dam had a marked effect on calving difficulty and this was related to the cow size. Bellows (1971) and Rice and Wiltbank (1970) have reported that birth weight of calf is the most important cause of calving difficulty in two-year-old heifers.

Methods for decreasing calf birth weight or calf size at calving time, increasing or predicting size of the pelvic opening of the cow at calving time could be useful in decreasing calving difficulty and consequently losses at or near calving. This paper will explore several methods for predicting or altering calf size, the relationship between pelvic size and calving difficulty and methods of predicting pelvic size.

Most producers feel that decreasing the level of feed a heifer receives prior the calving will decrease losses at or near calving time. Heifers which are extremely fat do have more calving problems and losses at calving are higher (Wiltbank et al., 1965). Heifers in this study received either a high, medium, or low level of energy from the time they were weaned until calving time at approximately two years of age. It can be seen that heifers on the high level of feed weighed 1085 pounds after calving. Heifers fed the moderate level of feed weighed 862 pounds and those on the low level of feed 609 pounds. These heifers differed markedly in condition at this time. Heifers on the high level were extremely fat, heifers on medium level of feed were in good flesh and those on low level were thin. Losses at or near calving were high in the heifers on the high level of feed. Four calves out of 22 were dead at birth (18 percent), six more died within 24 hours (27 percent) and two more died before two weeks of age. This is in contrast to a loss of one calf in the heifers receiving medium level of feed and one calf in the heifers receiving the low level of feed. The cause of this high loss in the heifers fed the high levels of feed was not because birth weight was increased. The birth weight was 61 pounds for heifers receiving a high level of feed and 61 pounds for heifers receiving a medium level of feed while the birth weight of calves from heifers receiving the low level of feed was 46 pounds. These data make an important point. Birth weight is not increased by feeding high levels of feed, however, it is decreased if heifers do not receive adequate levels of feed. An increased birth weight was not the cause of the high losses encountered near calving time in this experiment. Two other factors appear to be responsible for these losses. Most of the calves born to the heifers being fed the high level of feed were presented backwards and most heifers appeared to have large amounts of fat in the pelvic region which could have decreased the size of the pelvic opening. Thus, calving losses are increased in heifers that receive high levels of feed for long periods of time and become extremely fat. However, calving losses were not decreased when heifers were put on low levels of feed even though birth weight was markedly decreased.

Table 1. Level of Energy and Calf Losses (Two-Year-Old Cows)

	Level of Energy[a]		
	High	**Medium**	**Low**
Heifer weight after calving (lbs.)	1085	862	609
No. cows calving	22	22	18
Calves living at			
Birth	18	21	17
24 hours	12	21	17
2 weeks	10	21	17
Calf birth weight (lbs.)	61	61	46
Gestation length (days)	278	277	280

[a] Fed from weaning to calving.

The effect of two levels of energy on calving difficulty and calving losses was determined at Fort Robinson Beef Cattle Research Station (USDA and University of Nebraska cooperating). Details of the rations used were reported by Dunn et al. (1969). In general, the heifers received two levels of feed. One supplied 8 pounds TDN and the other 4.3 pounds of TDN. Heifers on the moderate level of TDN (8 pounds) gained 120 to 150 pounds the 120 days prior to calving; in contrast, the heifers fed the low level of energy (4.3 pounds TDN) gained only 13 or 35 pounds during this same period of time. It should be noted that the losses in weight at calving time reduced the heifers on the moderate level of feed to approximately the same weight they were at the start of the experiment. While heifers on the low level of feed averaged 125 to 130 pounds less after calving than they did 120 days prior to calving (Table 2). The average birth weight of the calves from cows fed the low level of feed was 63 pounds one year and 64 pounds the next year, compared to 70 pounds from heifers fed the high level of feed. The losses at or near calving were similar for the two groups with 96 or 97 percent of the calves living at birth and 95 to 97 percent alive at 24 hours after birth. For calves born in 1963, 3 percent more calves born to heifers receiving the moderate level of feed had to be assisted (37 percent versus 34 percent) and there was 6 percent more of the calves from these heifers that had to be assisted when the calf was presented normally at the time of birth (24 percent versus 18 percent). The difference in calves that had to be assisted between the two levels of feed for calves born in 1964 was larger (36 percent versus 20 percent). In heifers in which the calf was presented normally 4 percent more calves from the heifers on a moderate level of feed had a very difficult birth and 9 percent more had to have pullers used when compared to heifers receiving a low level of feed. It should be noted, however, that this did not lead to an increase in losses at or near birth. From these data, I would conclude that losses at or near calving cannot be decreased markedly by placing heifers on low levels of feed prior to calving. In other words, you cannot starve calving losses out of a group of heifers. It should also be noted that the low level of feed used here has a detrimental effect on reproductive performance such that heifers receiving this low level of feed do not return to heat and conceive as readily as heifers on the moderate level of feed (Wiltbank, 1970). Consequently, it is recommended that heifers be placed on the moderate level of feed for 120 days prior to calving for optimum reproductive performance. This moderate level of feed would cause heifers to gain approximately 1 pound per head per day for the last 100 to 120 days prior to calving and heifers would be fed approximately 8 pounds of TDN.

Table 2. Level of Energy, Calving Difficulty and Calf Losses (Two-Year-Old Angus and Hereford Cows)

	1963		1964	
	Moderate 8 lbs. TDN	**Low 4.3 lbs. TDN**	**Moderate 8 lbs. TDN**	**Low 4.3 lbs. TDN**
No. Cows	140	94	123	111
Heifer weight				
120 days before calving (lbs.)	774	794	762	760
7 days before calving (lbs.)	924	829	882	773
1 day after calving (lbs.)	780	664	752	635
Birth weight of calf (lbs.)	70	63	70	64
Calves alive at				
Birth (%)	96	97	97	96
24 hours after birth (%)	95	97	96	95
2 weeks after birth (%)	94	96	93	94
Cows experiencing calving difficulty (%)	37	34	36	20
Cows experiencing calving difficulty in which calf was presented abnormally (%)	13	16	5	5
Cows experiencing calving difficulty in which calf was presented normally				
Total (%)	24	18	31	15
Very difficult birth (%)	1	2	5	1
Pullers needed (%)	18	15	23	14
Slight difficulty (%)	5	1	3	1

Crossbreeding and Sire of Calves

One other method that has been suggested for decreasing birth weight and calving difficulty is to breed Hereford heifers to Angus bulls. The data in Table 3 indicates no decrease in calving difficulty as a result of using Angus bulls on Hereford heifers, in fact, there was an increase from 24 percent when Hereford bulls were bred to Hereford heifers to 30 percent when Angus bulls were bred to Hereford heifers in 1963 and in the following year an increase from 52 percent to 56 percent was noted so indiscriminate crossing of this type does not lead to a decrease in calving difficulty.

There are bulls, however, that can be used on heifers in both Angus and Hereford breeds that will decrease calving difficulty. The information in Table 4 points this out. There were two Angus bulls, 602 and 611, and three Hereford bulls, 702, 705 and 750, which sired calves where a lot of difficulty was encountered while only a little difficulty was encountered in heifers bred to Angus bulls 609 and 610 and Hereford bull 753. Consequently, selecting a bull to breed to heifers could be profitable. It should be noted that while the birth weight was decreased somewhat in bulls where calving difficulty was less, this was not a marked decrease. It should also be stated that this type of bull cannot be determined by “eye balling” but must be chosen on the basis of his performance.

Table 3. Effect of Crossbreeding on Calving Difficulty (Two-Year-Old Heifers)

	1963		1964	
	Number Calves Born	Calving Difficulty (%)	Number Calves Born	Calving Difficulty (%)
Hereford Hereford	84	24	64	52
Angus Hereford	71	30	61	56
Hereford Angus	67	29	56	64
Angus Angus	55	26	55	59

Table 4. Effect of Sire on Calving Difficulty in Two-Year-Old Heifers (1964)

	Angus Sires					Hereford Sires			
	602	609	610	611		702	705	750	753
Number of calves born	30	30	29	25		29	34	35	22
Birth Weight (lbs.)	68	64	62	70		69	68	71	66
Cows experiencing calving difficulty (%)	44	13	20	36		31	40	23	13
Cows experiencing calving difficulty in which calf was presented abnormally (%)	3	3	7	4		3	8	3	9
Cows experiencing calving difficulty in which calf was presented normally									
Total (%)	41	10	13	32		28	32	20	4
Very difficult birth (%)	7	0	0	8		7	3	0	0
Pullers needed (%)	27	10	10	24		21	29	17	4
Slight difficulty (%)	7	0	3	0		0	0	3	0
Live calves at 24 hours (%)	87	100	93	96		96	100	94	100

Data from one other study involving 19 Hereford and Angus bulls bred to AxH Crossbred heifers or Angus Heifers are available. Twelve bulls sired between 40 or 50 calves each, two bulls sired between 30 and 40 calves each. While one bull sired 18 calves and one bull sired 96 calves. The incidence of calving difficulty for calves from different sires varied from 9 to 60 percent.

Reasons for differences in calving difficulty were hard to characterize. For the purpose of showing this, the 12 Angus bulls were broken into three groups. Bulls in group 1 that had between 45 and 47 percent calving difficulty, group 2 bulls that had between 34 and 43 percent calving difficulty and group 3 bulls that had between 9 and 24 percent calving difficulty.

In the three groups the average birth weight was 64, 61 and 60 pounds, average length was 48.5, 47.9 and 47.3 and average width was 17.2, 16.9 and 16.8. In an attempt to measure the density of the calf, the ratio of body weight to length and body weight to width were used. Average weights, lengths and widths of calves as well as ratios varied somewhat with groups having greatest difficulty having the biggest calves. But look at the range. There was considerable overlap in each characteristic. When it came to individual bulls, there were a lot of problems in predicting calving difficulty. To illustrate this, four Angus bulls were selected. Dystocia varied from 9 to 47 percent. Compare Sire 1 with Sire 2. Average birth weight was 67 pounds for Sire 1 and 61 pounds for Sire 2. Body weight to length ratio was 136 for Sire 1 and 127 for Sire 2. Similar differences were noted in body weight to width ratio. The percent of the calves having a birth weight less than 60 pounds was 16 and 49 percent. The average pelvic area of cows giving birth to their calves was similar. Thus it would appear Sire 1 had more difficulty because his calves were bigger. Next look at Sire 3, he had the same amount of calving difficulty as Sire 1, however, birth weight wasn't much different than that noted in Sire 2. Average length and width was also similar to Sire 2. The ratios tended to be intermediate between Sire 1 and 2. While the average birth weight was similar, Sire 3 had some big calves (21 percent weighed over 70 pounds). This appears to be one reason for increased calving difficulty. The other is found in the decrease in average size of pelvic area of heifers siring his calves. What about Sire 4? Calves sired by him experienced a lot of dystocia. Why? Average birth weight again is not markedly different than Sire 2, but again he sired some heavy calves.

What does this mean? It means it's difficult to predict calf size. Again bulls needed to be selected because they sire calves with little calving difficulty average birth weights of their calves may be meaningless. If you look at birth weights to select a bull, don't look at the average look at the range and the variation.

Pelvic Opening

The pelvis grows in a linear fashion from breeding time to calving time. This can be illustrated by looking at the results of one experiment.

The purposes of the experiment were to determine the pelvic growth rate of first-calf heifers from breeding to parturition and to find a means to accurately predict pelvic area at calving from pelvic measurements taken at breeding. The results of the experiment proved to be very successful. The pelvis grows at a constant rate of approximately .5 cm^2 daily throughout pregnancy. The real value is the fact that at any time from breeding to parturition it is possible to predict the size of an individuals pelvic opening at calving time. The practical application of this knowledge is especially important when we consider this chart. The chart indicates that heifers which measure in the low 25 percent at breeding time will also measure in the lower 25 percent at calving time (Chart 1).

Table 5.

Group	No. Bulls	Dystocia		Average Birth Weight		Average Length	
		Ave. (%)	Range (%)	Ave. (%)	Range	Ave. (cm)	Range (cm)
1	4	46	45-47	64	67-62	48.5	47.4 – 49.2
2	4	38	34-43	61	59-64	47.9	47.0 – 49.0
3	4	19	9-24	60	58-61	47.3	47.1 – 47.9

Table 5. (Continued):

	Average Width At Hooks		Average Weight/Length Ratio		Average Width/Weight Ratio		Average Gestation Length
Group	Ave.	Range	Ave.	Range	Ave.	Range	
1	17.2	16.7-17.7	132	130-136	372	366-377	280
2	16.9	16.7-17.1	127	126-130	360	354-371	278
3	16.8	16.5-17.0	125	124-127	354	350-361	279

Table 6.

Sire	Dystocia (%)	Ave. Birth wt.	Length (cm)	Width (cm)	Wt./ Length	Wt./ Width	60 or under (%)	61-70 (%)	Over 70 (%)	Pelvic Area of Dam of Calves
1	47	67	49.2	17.7	136	377	16	38	47	191.7±18.8
2	9	61	47.9	16.9	127	361	49	51	0	101.9±19.2
3	46	62	47.4	16.7	130	368	49	30	21	185.3±17.4
4	45	63	48.6	17.1	131	371	37	41	22	189.8±18.5

What is the relationship between pelvic opening and calving difficulty? This is impossible to discuss without also discussing calf size. Data from 1,000 first-calf heifers was available. The pelvis of heifers were measured 35 to 40 days after breeding. At calving time calves weighed, tagged and length and width of the calves were measured. Utilizing this it was possible to look at the relationships between calving difficulty, calf size and pelvic opening. Calves were divided into six groups by 10 pound increments of birth weight. Little or no calving difficulty was experienced in heifers giving birth to calves under 50 pounds. Look at calves weighing between 51 and 60 pounds at birth. There were four calves born to heifers which had a pelvic opening of less than 150 square cm and all four heifers experienced calving difficulty. Nineteen heifers had a pelvic opening of 151 and 160 square cm and 58 percent had calving difficulty. The incidence of calving difficulty was 43 percent in heifers having a pelvic opening between 161 and 170 square cm. You can see calving difficulty declined as heifers had a larger pelvis. The same type of pattern is evident in calves weighing 61 and 70 pounds at birth and 71 to 80 pounds at birth. It should be noted that it requires approximately 20 square sm more of pelvis for each 10 pound increase in birth weight. As an example, in calves weighing between 51 and 60 pounds the incidence of calving difficulty was 11 percent in heifers with a pelvic opening between181 and 190 square cm while in calves weighing 61 and 70 pounds the incidence of calving difficulty was 15 percent in heifers having a pelvic opening between 201 and 210 square cm and in heifers having 221 to 230 square cm of pelvis and giving birth to 71 and 80 pound calves, no calving difficulty was noted. The incidence of calving difficulty was high in calves weighing over 80 pounds.

What size calf will come through what size pelvis? To help answer this we next arranged cows by pelvic opening size. Take a look at proportion having dystocia with pelvic areas of different sizes. There were only six heifers that had a pelvic area of less than 150 square cm, but all six experienced dystocia. Those kind need to be sold. In heifers having a pelvic area between 151 and 160 square cm and 161 to 170 square cm the incidence of calving difficulty was also high. If birth weight could be controlled so it was less than 60 pounds the incidence of calving difficulty would be approximately 20 percent. You can go to each size of pelvis and decide what size calf will come through without much calving difficulty (Chart 2).

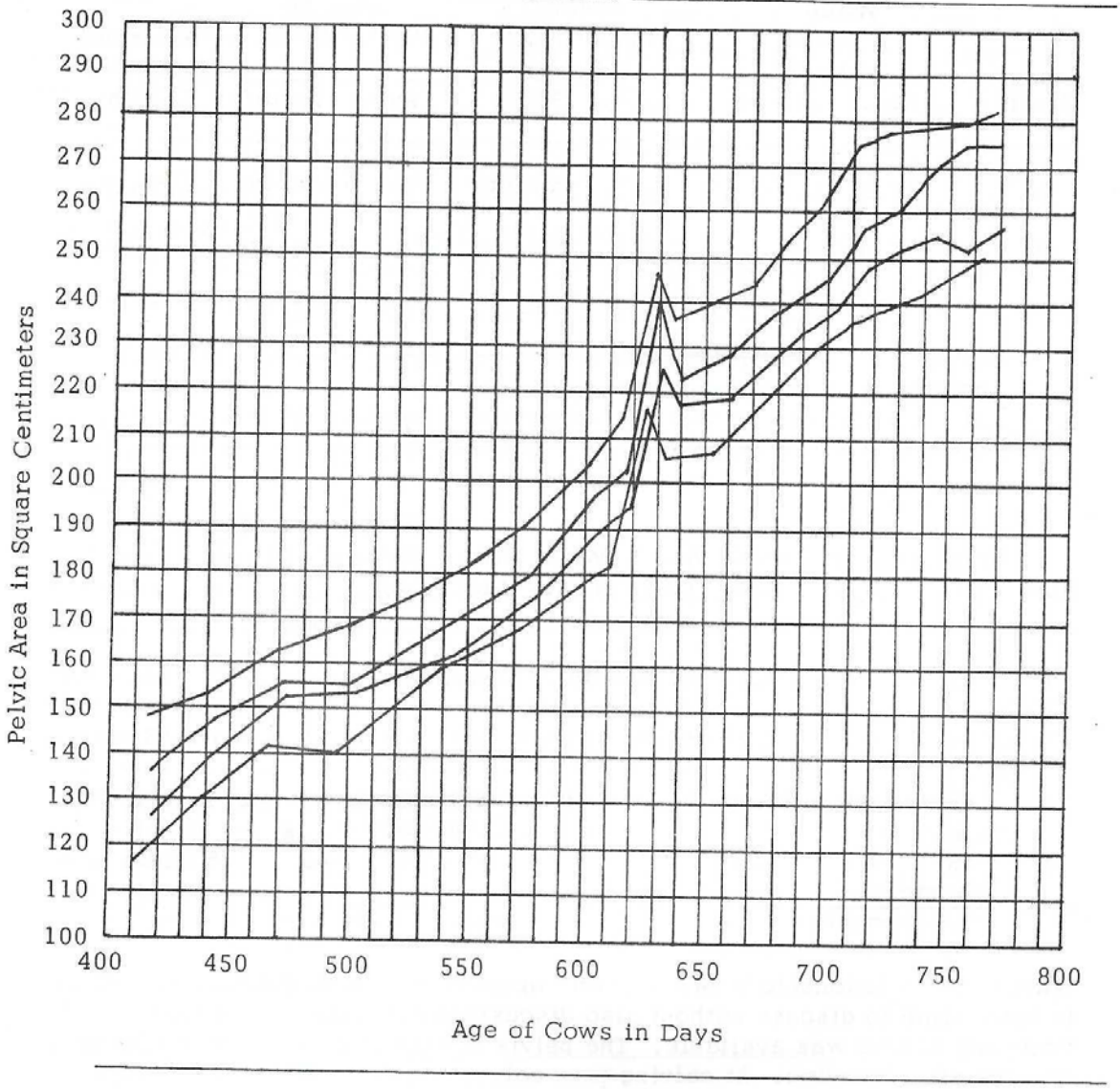
Similar relationships exist between body weight/length ratios. Now how do we predict calf size? As pointed out previously, this is a real problem. Work is continuing on this but at present you progeny test bulls.

Calving difficulty cannot be decreased by feeding low levels of feed to heifers in late pregnancy. Crossbreeding will also not consistently decrease calving difficulty. Wise selection of bulls and culling of heifers with small pelvic openings could lead to a decrease in dystocia.

Pelvic Area in Older Cows

With the increasing use of exotic bulls, an increase in calving difficulty in older cows has been noted. This undoubtedly is a result of an increase in birth weight. With an increase in size of the calf at birth, the size of pelvis in mature cows becomes more important. The variation in pelvic size in mature cows can be seen in Table 7. Pelvic size varied from 230 square cm to 409 square cm. Most of the cows have a pelvis greater than 300 square cm. Much of the calving difficulty encountered when mature cows are bred to exotic bulls might be related to pelvic size. The relationship between size of the pelvis and calving difficulty when cows are bred to bulls might give us a useful way to decrease calving difficulty.

Chart 1. Growth Curve: Area Vs. Age



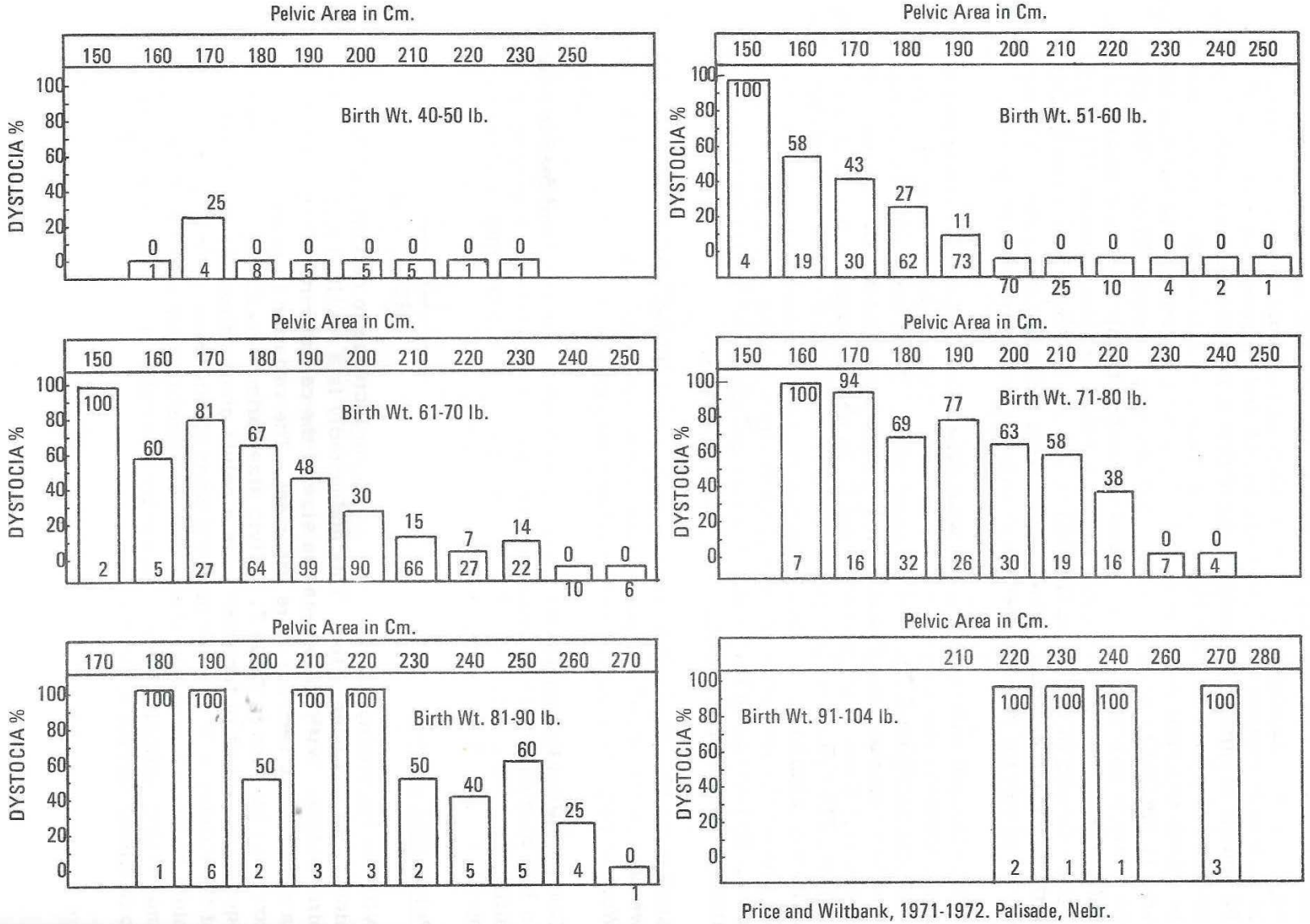
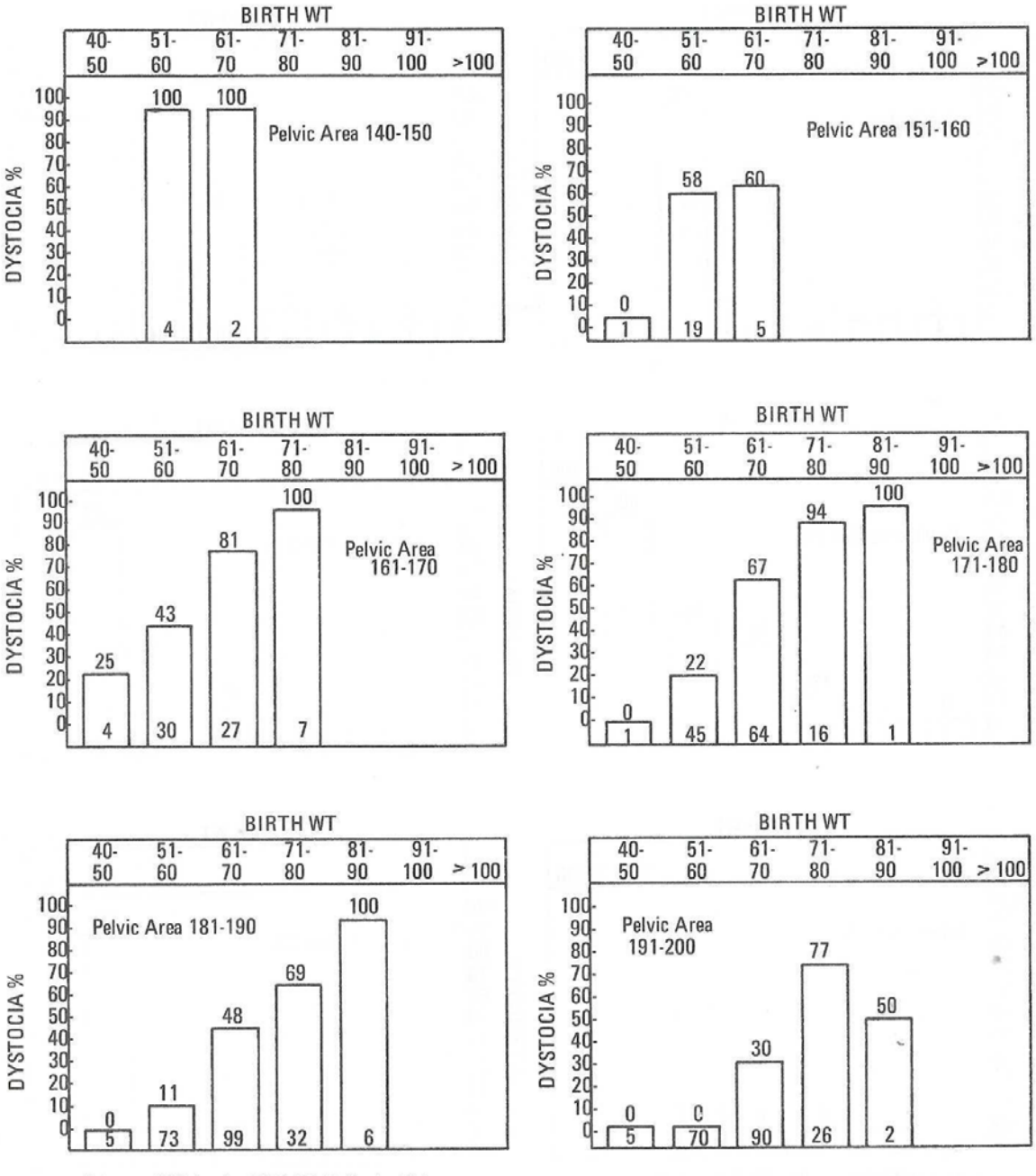


Chart 2.

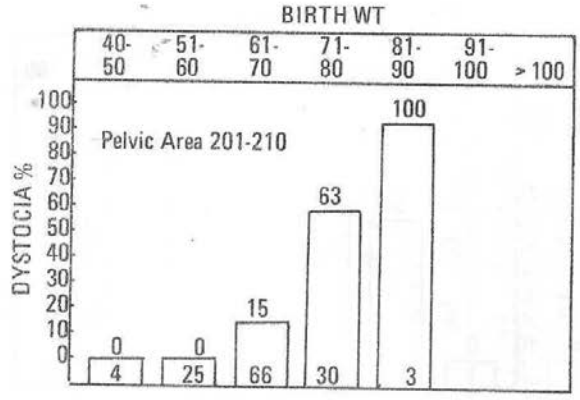
Price and Wiltbank, 1971-1972. Palisade, Nebr.

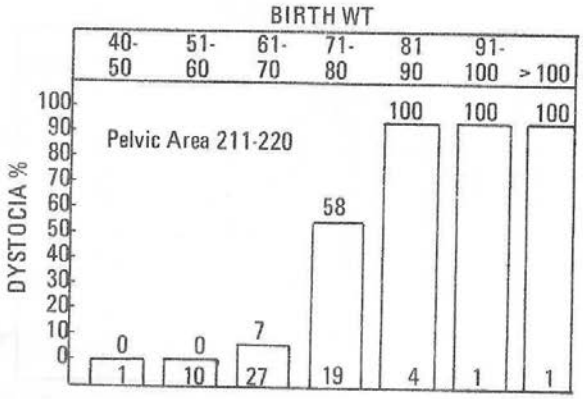
Chart 2. (continued)

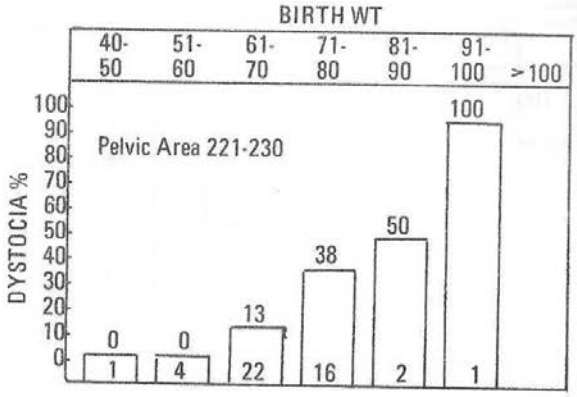


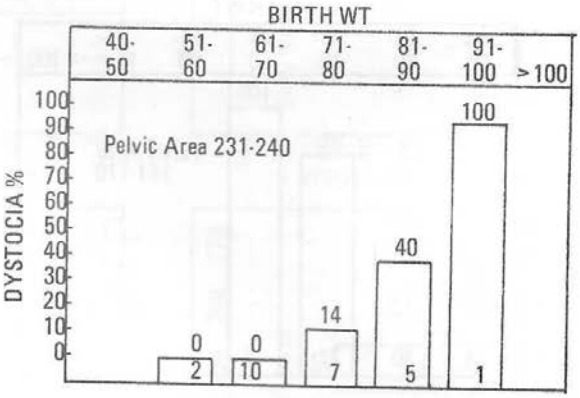
Price and Wiltbank, 1971-72. Palisade, Nebr.

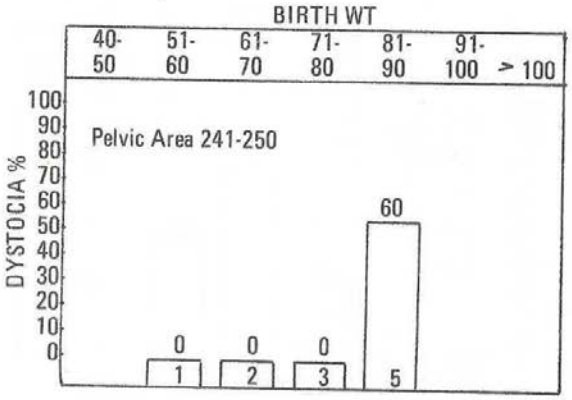
Chart 2. (continued)

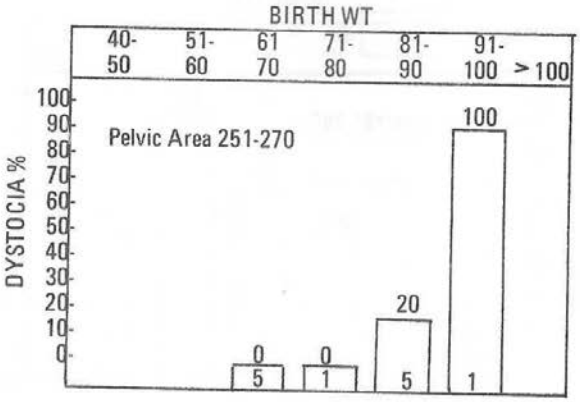












Price and Wiltbank, 1971-72. Palisade, Nebr.

Table 7. Pelvic Area in Cows Four to Eight Years Old.

Pelvic Area (sq. cm)	No. Cows	Cows Having This Size Pelvis (%)
230-259	1	> 0.01
260-289	10	4
290-319	60	23
320-349	110	42
350-379	64	25
380-409	15	6
Total	260	

Literature Cited

Bellows, R. A. 1971. Proceedings, Fifth Conference on Artificial Insemination in Beef Cattle. Denver, Colorado.

Dunn, T. G., J. E. Ingalls, D. R. Zimmerman and J. N. Wiltbank. 1969. Reproductive Performance of Two-Year-Old Hereford and Angus Heifers as Influenced in Pre– and Post–Calving Energy Intake. J. Ani. Sci. 29:719.

LeFever, D. G. and J. N. Wiltbank. 1961. Save More Calves at Birth. Neb. Expt. Sta. Quarterly, Summer.

Rice, L. E. and J. N. Wiltbank. 1970. Dystocia in Beef Heifers. Proc. West. Sect. Am. Soc. Anim. Sci. Vol. 21.

Wiltbank, J. N. 1970. Proc. Fourth Conference on Artificial Insemination of Beef Cattle. Denver, Colorado.

Wiltbank, J. N., J. Bond and E. J. Warwick, 1965. Influence of Total Feed and Protein Intake on Reproductive Performance of the Beef Female through Second Calving. USDA Tech. Bull. 1314.

Section III

Reports of
Range and Pasture Management Research

at the

Dickinson Experiment Station

Presented by
Dr. Warren C. Whitman, Botanist

at the

24th Annual Livestock Research Roundup

Dickinson Experiment Station
Dickinson, North Dakota

December 5, 1973

THREE-PASTURE SYSTEM GRAZING TRIAL

The grazing trial using crested wheatgrass for spring and early summer grazing, native grass in mid and late summer, and Russian wildrye for fall grazing was continued for the second year at the Dickinson Station in the 1973 season. The trial has been intended to compare fertilized crested wheatgrass, fertilized native, and fertilized Russian wildrye pastures with unfertilized pastures of the same kinds. However, in the 2 years of the trial the Russian wildrye pastures have all been fertilized, and a comparison with unfertilized pastures for the fall grazing period has not been made. The Russian wildrye pastures have been low in vigor and consequently have been fertilized rather heavily in an attempt to increase their productivity. In the 1972 season the Russian wildrye pastures all received a total of 75 lbs nitrogen per acre, and in the 1973 season they were all treated with 150 lbs nitrogen.

The grazing plan for the 1973 season is shown in Table 1. This year 12 yearling steers were used on each pasture, while only 10 were used in the 1972 season. Two of the Russian wildrye pastures were grazed from late August to early October, while the remaining two pastures were grazed in October and November.

Forage production and grazing utilization of the forage on the pastures for the 1973 season are shown in Table 2. Forage production on the crested wheatgrass pastures in 1973 was from 30% lower on the unfertilized to about 50% lower on the fertilized pastures than in the 1972 season, but the supply of forage was satisfactory for both pastures, as shown by a total utilization of 59% on the unfertilized and 68% on the fertilized crested. The grazing period on the crested wheatgrass pastures was 56 days, extending from Arpil 26 to June 21.

Production on both the unfertilized and fertilized native grass pastures in the 1973 season was about 75% of the 1972 production, and this good production was reflected in the final total utilization values of 43% on the unfertilized and 48% on the fertilized pastures. These pastures could have been utilized somewhat heavier than they were. The grazing period on these pastures was from June 21 to August 23, a total of 63 days.

Production on the Russian wildrye pastures in the 1973 season was only about 13% more than in the 1972 season despite the heavy fertilization. Utilization on the first two 8-acre Russian wildrye pastures was very heavy by the end of the grazing period, being virtually complete with the stubble remaining only about 1-2 inches in height. The steers grazed on the first two wildrye pastures from Aug. 23 to Oct. 5, a period of 43 days. The steers were moved to the remaining two wildrye pastures on Oct. 5 and were still grazing there at the time this report was prepared.

The performance of the steers on the pastures is shown in the data of Table 3. The steers did not do as well on the crested wheatgrass pastures as they did last year, averaging 1.66 lbs/head/day on the unfertilized crested and 1.32 lbs on the fertilized crested. Last year gains on both pastures were over 2 lbs/head per day. Gains per acre were down somewhat from last year also, averaging 69.7 lbs on the unfertilized and 110.6 lbs on the fertilized.

This year the steers were moved from the crested wheatgrass pastures to the native grass pastures on June 21, about three weeks earlier than last year, in order to see whether they would make better gains if moved to the native grass while it was less mature. The steers did make both better per-head and per-acre gains in the 1973 season on the native grass than they did in 1972. Daily gains per head averaged 1.61 lbs on the unfertilized native grass and 1.81 lbs on the fertilized. Last year gains on both pastures averaged about 0.75 lbs/head/day. Gains per acre were 67.5 lbs on the unfertilized native and 113.8 lbs on the fertilized. In

1972 the respective per acre gains were 23.9 and 35.0 lbs. The steers were on the native grass pastures from June 21 to Aug. 23, a period of 63 days.

Reference to the data of Table 4 shows that the gains per head were especially high on the native grass during the period from June 21 – July 24. On the fertilized pasture these gains averaged 2.52 lbs/head/day and 1.97 lbs on the unfertilized. In the following period, July 24 - August 23, gains dropped to 1.02 lbs/head/day on the fertilized pasture and 1.21 lbs on the unfertilized. This reduction in gains of the steers seems to be an obvious reflection of decrease in quality of the forage with the advance of the season.

The data given in Table 3 show the steer weights and gains for the Russian wildrye pastures just as they were taken for the period Aug. 23 – Oct. 5. However, the distribution of the animals was changed somewhat when they were transferred to the wildrye pastures. The daily gains for the animals on both pastures averaged 0.88 lbs/head. The per acre gains averaged 56.9 lbs for the same period. The data of Table 3, however, show that the per head and per acre gains were much less on the #2 Russian wildrye pasture than on the #1 wildrye pasture. Part of the explanation for this difference is shown in Table 4.

Each of the two lots of animals grazed on the pastures consisted of 6 Hereford and 6 black whiteface steers (Angus X Hereford). The average daily gains of both groups of steers in the lot continuously on the fertilized pastures and the gains of the groups in the lot continuously on the unfertilized pastures until going on the Russian wildrye pasture are given in Table 4. There are some inconsistencies in the data, but in general the black whitefaces and the Herefords made about the same daily gains per head on the crested wheatgrass and the native grass pastures. On the Russian wildrye pastures, however, the black whitefaces made somewhat better gains than the Herefords. The black whitefaces grazed previously on the unfertilized pastures averaged 0.83 lbs/head/day over the 43-day grazing period on the wildrye, while the Herefords from the same treatments averaged 0.68 lbs during the same period. The black whitefaces from the fertilized pastures averaged 1.10 lbs/head/day, and the Herefords from the same treatment averaged 0.91 lbs on the Russian wildrye. On the seasonlong basis, however, there seems to have been very little difference between the daily gains of the black whitefaces and the Herefords.

Half of each lot of steers was fed Kedlor (biuret) while the animals were on the native grass pastures. This was done to see whether this supplement would compensate for the loss of quality in the forage as it matured. When the animals were moved from the native grass to the Russian wildrye pastures, all the steers that had been fed Kedlor were put in pasture #2, while the animals which had not received the supplement were all placed in pasture #1. The very interesting results obtained from this treatment are shown in Table 5.

Table 5 shows that Kedlor had little or no effect on the gains of the steers on either the fertilized or unfertilized native grass during the first 33-day period from June 21 to July 24. However, during the second period on the native grass, the 30 days from July 24-August 23, the gains of the steers receiving the Kedlor supplement were 2.8 times better than the gains of the steers without supplement on both the fertilized and unfertilized pastures. Overall daily gains were somewhat better on the unfertilized pastures than on the fertilized pastures during this period.

The data of Table 5 indicate that the feeding of the Kedlor supplement on the Russian wildrye pasture during the 43-day period from Aug. 23-Oct. 5 had a near disastrous effect on gains. The steers without Kedlor gained 1.38 lbs/head/day during this period, while the steers receiving the Kedlor supplement gained only 0.39 lbs/head/day. The reason for this difference is unknown. The pasture and water facilities in the two Russian wildrye pastures appeared to be nearly identical. It is possible that the consumption of the Kedlor set up some kind of nutritional imbalance in the steers relative to the nutritional characteristics of the Russian wildrye forage available.

A summary of the 1973 results with the 3-pasture grazing system shows that the 12 yearling steers on the fertilized pastures gained an average of 231.2 lbs each during a 162-day grazing period each utilizing about 60 percent of the total forage produced on 2.3 acres. This represents an overall average gain of 99.1 lbs/acre. On the unfertilized pastures the steers gained an average of 227.1 lbs each during the same period, utilizing somewhat less than 60 percent of the forage on 3.5 acres. The overall gain per acre on these pastures is thus 64.9 lbs. The use of the Kedlor supplement seemed effective in maintaining gains of the steers on near-mature native grass, but its use may be questionable on late season Russian wildrye.

Table 6 gives a summary of the 2-year results of the trial. The 3-pasture system seems to be fairly well adapted to the conditions existing in the west-river area. The use of fertilizer in the system gives the obvious advantage of greatly increased grazing capacity. A number of management factors must still be worked out before the most efficient way to use the system can be determined.

Table 1. Proposed grazing plan for the three-pasture trial with 12 yearling steers per pasture for the 1973 season.

Pasture	Grazing period	Pasture size acres	Stocking rate – acres per steer per month
Crested wheatgrass	April – June	16	0.7
Crested wheatgrass + 50 lbs N	April – June	8	0.3
Native grass	July – Aug.	18	0.7
Native grass + 50 lbs N	July – Aug.	12	0.5
#1 – Russian wildrye + 150 lbs N	Sept.	8	0.3
#2 – Russian wildrye + 150 lbs N	Sept.	8	0.3
#3 – Russian wildrye + 150 lbs N	Oct.	8	0.3
#4 – Russian wildrye + 150 lbs N	Oct.	8	0.3

Table 2. Pasture systems grazing trial. Forage production and utilization on pastures grazed by yearling steers – 1973 season.

Pasture	Pasture size-acres	Period grazed	Days in period	Forage produced-lbs/acre	Forage utilized-lbs/acre	Forage left on ground-lbs/acre	% utilization
Crested wheatgrass	16	4/26 – 6/21	56	1637	959	678	59
Crested + 50 lbs N	8	4/26 – 6/21	56	1988	1355	633	68
Native grass	18	6/21 – 8/23	63	2367	1005	1362	43
Native + 50 lbs N	12	6/21 – 8/23	63	3448	1659	1789	48
#1 – Russian wildrye + 150 lbs N	8	8/23 – 10/5	43	1716	1633	83	95
#2 – Russian wildrye + 150 lbs N	8	8/23 – 10/5	43	1742	1683	59	97

Table 3. Pasture systems grazing trial. Weights and gains of yearling steers on crested wheatgrass, native grass, and Russian wildrye pastures – 1973 season.

Pasture	Period grazed	Days in period	No. of steers	Avg. initial wt/steer lbs	Avg. final wt/steer lbs	Gain per head-lbs	Avg. daily gain per head-lbs	Avg. gain per acre lbs
Crested wheatgrass	4/26 – 6/21	56	12	548.3	641.2	92.9	1.66	69.7
Crested + 50 lbs N	4/26 – 6/21	56	12	556.2	630.0	73.8	1.32	110.6
Native grass	6/21 – 8/23	63	12	641.7	743.0	101.3	1.61	67.5
Native + 50 lbs N	6/21 – 8/23	63	12	630.0	743.8	113.8	1.81	113.8
#1 Russian wildrye + 150 lbs N	8/23 – 10/5	43	12	729.2	788.3	59.1	1.37	88.8
#2 Russian wildrye + 150 lbs N	8/23 – 10/5	43	12	757.5	774.2	16.7	.39	1/ 25.0

1/ Steers in this pasture all receiving Kedlor.

Table 4. Average daily gains (lbs) of Herefords and Black Whiteface[1/] steers on unfertilized and fertilized pastures during the 162-day experimental grazing period in the 1973 season.

Pasture Treatment	Steers	Crested wheatgrass 4/26-5/29 33 days	Crested wheatgrass 5/29-6/21 23 days	Native grass 6/21-7/24 33 days	Native grass 7/24-8/23 30 days	Russian wildrye[2/] 8/23-10/5 43 days	Seasonal avg. (162 days)
Unfertilized	Herefords	1.82	1.34	1.94	1.28	.68	1.37
	Black WF	1.59	1.85	2.00	1.14	.83	1.43
	AVG.	1.71	1.60	1.97	1.21	.76	1.40
Fertilized	Herefords	1.41	1.20	2.60	1.11	0.91	1.44
	Black WF	1.36	1.23	2.44	.92	1.10	1.41
	AVG.	1.38	1.22	2.52	1.02	1.01	1.42

1/ Each lot of 12 steers consisted of 6 Herefords and 6 Angus X Hereford steers.

2 Both sets of Russian wildrye pastures were fertilized. The gain per head figures represent the weights of the animals distributed as they were on the crested wheatgrass and the native grass pastures.

Table 5. Daily gains per head (lbs) of steers with and without Kedlor supplement on native grass and Russian wildrye pastures in the 1973 season.

Pasture treatment	Supplement treatment	Native grass 6/21 – 7/24 (33 days)	Native grass 7/24 – 8/23 (30 days)	Russian wildrye 8/23 – 10/5 (43 days)
Unfertilized	With Kedlor	1.94	1.78	-----
	W/o Kedlor	2.00	.64	-----
Fertilized	With Kedlor	2.42	1.50	.39
	W/o Kedlor	2.62	.53	1.38

Table 6. Two-year average weights and gains of yearling steers on crested wheatgrass, native grass, and Russian wildrye pastures, 1972-1973 seasons.

Pasture	Size of pastures-acres	Avg. no. days grazed	No. of steers	Avg. initial wt/steer-lbs	Avg. final wt/steer-lbs	Avg. gain per head lbs	Avg. daily gain per head lbs	Avg. gain per acre-lbs
Crested wheatgrass	16	56	11	575.4	684.4	109.0	1.94	73.9
Crested + 50 lbs N	8	56	11	579.4	675.2	95.8	1.71	129.1
Native grass	18	60	11	684.6	756.8	72.2	1.20	45.7
Native + 50 lbs N	12	60	11	675.2	753.2	78.0	1.30	74.4
#1 Russian wildrye + 150 lbs N	8	34	11	749.9	802.9	53.0	1.56	73.7
#2 Russian wildrye + 150 lbs N	8	34	11	760.0	800.8	40.8	1.20	53.2

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SELF FEEDER FOR CATTLE

THOMAS CONLON and DEXTER JOHNSON

The building plans for the self-feeders being used at the Dickinson station to handle complete mixed rations of grain and roughage are presented in this issue of North Dakota Farm Research because of numerous requests from farmers and ranchers for this plan.

A number of different self-feeder designs have been used at the Dickinson station over the past several years. This plan incorporates the best features of all those that have been tried so far. It is simple to build, and utilizes full 4x8 foot plywood sheets wherever possible for ease of construction.

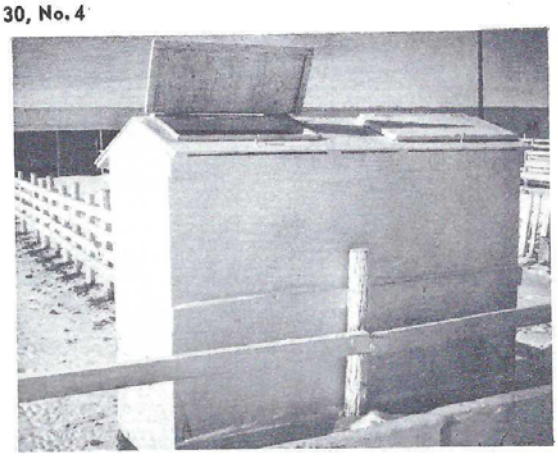
It has adequate capacity, holding from 150 to 200 pounds of feed per linear foot, depending on the amount of grain in the ration being used, yet is small enough to be moved easily when necessary.

Based on self-feeder space requirements of 6-8 inches per calf, as adapted from the Nutritional Council of American Feed Manufacturers Association, this feeder will accommodate 25 to 30 head.

This type of feeder has been in use at the Dickinson Experiment Station for several years. Rations of different proportions of oats; whole, rolled or ground, barley; ground or rolled, and, crested wheatgrass, bromegrass and alfalfa hay, chopped or ground, and mineral supplements can be successfully fed as complete mixed rations. Very few plugging or bridging problems have been encountered when rations have been augered into the feeders. If a blower is used to fill the feeders, the feed should go through a dust collector and drop from the collector into the feeder. Feed blown directly into a feeder has a tendency to pack, which may cause bridging problems. Grain alone, in any form, can also be successfully fed from this feeder, by adding an adjustable gate to regulate the flow of grain into the manger.

This feeder has been used to feed calves and yearlings as well as larger animals, by adjusting the height of the manger to accommodate the size of the cattle using it.

Conlon is superintendent of Dickinson Branch Experiment Station; Dexter Johnson is Extension Agricultural Engineer.



LIST OF MATERIALS

Number	Item	Dimension
2	Skids	4 x 4 x 16 ft.
34	Flooring	2 x 6 x 4 ft.
24	Wall Studs	2 x 4 x 7'-5"
9	Rafters	2 x 4 x 5'-4"
3	Girts & Facia	2 x 4 x 16 ft.
9	Girts	2 x 6 x 16 ft.
1	Plank	2 x 10 x 16 ft.
1	Ridge Board	1 x 6 x 16 ft.
8	2 x 2 Framing	2 x 2 x 8 ft.
8	1 x 2 Framing	1 x 2 x 8 ft.
10	Wall Sheathing	3/4" x 4 ft. x 8 ft.
2	Roof Sheathing	3/4" x 4 ft. x 8 ft.
1	Cover	1/2" x 4 ft. x 6 ft.
12	Tie Rods	1/2" x 3 ft.
2	Strap Iron	1/4" x 1" x 24"
	8d Galv. Nails	Approx. 10 lbs.
	10d Galv. Nails	Approx. 3 lbs.
2	Galv. Flashing	3" wide x 6 ft. long
6	Hinges	Heavy Gauge T-Hinges