1976

ANNUAL REPORT

DICKINSON EXPERIMENT STATION

DICKINSON, NORTH DAKOTA

Report of
Agronomic Investigations
At the
Dickinson Experiment Station
Dickinson, North Dakota
1976

By

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Growing Conditions – 1976

The total precipitation recorded at the Dickinson Experiment Station for the twelve month period September – 1975 through August – 1976 was 3.67 inches below normal. However, favorable distribution of precipitation and low minimum temperatures during the growing season helped to compensate for deficient precipitation, and small grain production was above average as a consequence.

Dickinson precipitation – inches:

	1975-76	84 yr. avg.
September-December	2.76	2.98
January-March	1.03	1.57
April-June	7.27	7.40
July-August	1.15	3.93
Total	12.21	15.88

Dickinson temperatures – degrees F.

	Avg. max.	Avg. min.	Avg. mean
April	57	33	45
May	69	39	54
June	76	52	64
July	87	55	71
August	86	55	72

Weather and growing conditions were locally variable as usual, with hail, high winds, heavy rains, weeds and some grasshopper damage responsible for reducing yields as certain locations. Reseeding was necessary at Killdeer where wild oats infested the early seeding. The second seeding was infested with pigeon grass and valid comparison between varieties were not possible. Hail destroyed the oats and barley planting at Beach and causes some damage to both winter wheat and spring wheat planting. Reseeding was necessary at Hettinger because of soil crusting and resulting poor emergence, caused by heavy rainfall. Hail damage just prior to harvest reduced spring wheat yields and estimated 20 percent, with oats and barley damaged more severely. No violent weather damage was recorded at the Dickinson, Mandan, Glen Ullin or Bowman sites.

Seeding Dates and Procedure

Winter wheat trial were seeded at Beach on September 8, 1975, at Glen Ullin on September 10 and at Hettinger and Bowman on September 11.

Winter rye was seeded at Dickinson on September 10.

Variety trials with spring grain were seeded at Beach April 30, Bowman April 14, Glen Ullin April 28, Killdeer April 29, Mandan April 27 and Hettinger April 13. Oats and barley was seeded at Dickinson on April 22, spring wheat on April 23 and durum on May 3.

Trials with spring grain were seeded with a double disk press drill at the rate of 1 bushel per acre for spring wheat and durum, 1 ¼ bushel per acre for barley and 1 ½ bushel per acre for oats.

Winter grains were seeded with a deep furrow drill equipped with 4 inch spear point shovels spaced 10 inches apart. Seeding rates were 1 bushel per acre for rye and 50 pounds per acre for winter wheat.

The Uniform Regional Spring Wheat Nursery was seeded on April 27; Uniform Regional Durum on April 29; Unifor Early and Midseason Oats on April 29; Great Plains Barley on April 20; Western Spring and Western Dryland barley on April 30 and Uniform Flax on May 4.

Trial Results

Data for all small grain production trial conducted in 1975 are presented in tables 1 thru 35. Unless noted otherwise, all yields are reported in bushels per acre, and test weights are reported in pounds per bushel.

Table 1 – Hard red spring wheat variety trial

Variety	Avg. Yield bu/acre	Test weight	Heading date	Height inches
Chris	41.2	59.5	6-30	34
Waldron	40.7	58.5	6-30	33
Era	51.7	59.5	7-3	29
Olaf	42.4	60.0	6-29	31
Ellar	40.2	59.0	6-26	36
Profit 75	44.8	59.0	6-25	29
Protor	56.9	61.0	6-27	29
Prodax	53.1	57.5	6-26	28
Wared	51.5	59.5	7-5	28
Bounty 309	48.7	60.0	6-26	30
Tioga	38.5	60.5	7-1	32
Sinton	36.8	59.5	6-27	35
Canuck	38.8	60.5	6-30	37
Chester	34.4	59.0	6-29	35
Lew	46.8	61.5	7-1	35
Newana	50.3	61.0	6-29	28
Kitt	33.8	58.0	7-2	30
MP-25B	52.8	59.5	6-25	29
ND 519	41.3	61.0	6-24	31
ND 522	41.5	58.5	6-27	32
ND 531	47.3	60.0	6-27	33
ND 536	40.7	60.5	6-27	31
ND 538	44.6	59.5	7-1	35
ND 541	39.9	60.5	7-1	35
ND 542	36.0	59.5	6-24	36
ND 543	47.6	59.5	6-26	32
ND 546	39.3	60.5	6-26	33
ND 547	40.4	60.0	6-26	33
ND 548	33.6	59.5	7-2	36
S 7003	37.4	59.5	6-27	35

Standard error of a treatment mean = 1.8870
L.s.d. @ 5% = 5.2838
The c.v. = 8.71 p.c.

Table 2 – Long term yield comparison of hard spring wheat varieties

	Yields in bushels per acre					
Variety	1972	1973	1974	1975	1976	5 yr. Avg.
Waldron	25	53	34	37	41	38
Ellar	-	-	33	36	40	-
Olaf	27	62	38	42	42	42
Wared	-	-	41	46	52	-
Era	35	71	42	51	52	50
Prodax	-	-	37	48	53	-
Protor	-	-	36	37	57	-
Tioga	-	-	29	33	39	-
Chris	22	50	33	36	41	36
S 7003	-	-	33	31	37	-
ND 519	-	-	33	41	41	-
ND 522	-	-	42	45	42	-
L.s.d. @ 5%	6.1	5.2	6.4	5.4	5.3	-

Table 3 – Hard spring wheat variety trials Dickinson and off-station sites

Yields in bushels per acre

Variety	Dickinson	Beach	Bowman	Glen Ullin	Hettinger	Killdeer	Mandan	Avg. 6-station
Waldron	41	20 1/	40	43	21	Not	28	35
Ellar	40	7 1/	36	43	20	Harvested	27	33
Olaf	42	31	48	49	24		33	38
Era	52	36	49	61	22		44	44
Wared	52	37	51	64	23		39	44
Profit 75	45	32	52	56	23		25	39
Prodax	53	45	53	59	25		37	45
Fortuna	35	25	35	43	22		28	31
Bounty 309	49	33	49	51	24		28	39
Kitt	34	30	42	47	21		31	34
ND 519	41	23	49	51	23		22	35
ND 522	42	32	53	54	24		33	40
Standard error					20% hail			
of a treatment					damage			
mean	1.9	1.7	2.7	1.3	0.8		1.5	
L.s.d @ 5%	5.3	4.8	7.8	3.8	2.4		4.4	
The c.v.=P.C.	8.7	11.3	11.6	5.1	7.4		9.8	

1/ Yields at Beach severely reduced by hail. Not included in average.

Table 4 – Hard spring wheat variety trials Dickinson and off-station sites

Test weight per bushel

Variety	Dickinson	Beach	Bowman	Geln Ullin	Hettinger	Killdeer	Mandan	Avg. 6-station
Waldron	58.5	57	58.5	59.5	52.5	Not	58.5	57
Ellar	59	55.4	59.5	60.5	53	harvested	58	58
Olaf	60	59.5	59.5	60.5	53	↓	59	59
Era	59.5	61.8	59	61	50		58	58
Wared	59.5	61.4	57.5	61	49		57.5	58
Profit 75	59	61.6	59.5	61	55		59.3	59
Prodax	57.5	60.6	57	59	52		56	57
Fortuna	61	56.8	61	61.5	57		56.5	59
Bounty 309	60	59.4	58	61	54.5		55	58
Kitt	58	59	56	58.5	49.5		53.4	56
ND 519	61	60	60	62.5	55		60.2	60
ND 522	58.5	59.4	59	59.5	52.5		58	58

Table 5 – Hard spring wheat variety trials Dickinson and Off-station sites

Protein Percent

Variety	Dickinson	Beach	Bowman	Geln Ullin	Hettinger	Killdeer	Mandan	Avg. 6-station
Waldron	17.7	17.7	14.1	16.4	17.5	Not	14.7	16.4
Ellar	17.1	17.9	13.9	16.1	18.4	harvested	14.3	16.3
Olaf	17.3	15.9	13.9	15.6	17.9	↓	12.8	15.6
Era	16.1	14.3	11.8	13.9	16.7		11.5	14.1
Wared	16	14.9	12.6	14.3	16.9		13.2	14.7
Profit 75	15.7	14.7	13	14.3	15.7		13.5	14.5
Prodax	17.2	14.7	13.3	15.1	16.4		13.5	15
Fortuna	14.2	15.3	13.8	14.9	16.1		13.9	14.7
Bounty 309	16.3	15.4	13.7	14.8	16.1		14	15.1
Kitt	17.5	15.2	13.6	15.3	17.9		14	15.6
ND 519	16.7	16	14.1	16	16.4		14.4	15.6
ND 522	17.4	16.2	14.1	15.2	16.5		13.6	15.5

Wheat protein at 14.0% moisture.

Table 6 – Off station winter wheat variety trials

Variety	Beach	Yield in bushels per acre Bowman	Hettinger	Glen Ullin	3-Sta. avg.	3-Sta. avg.
Froid	29.8	43.1	34.5	35.3	35.8	35.7
Winoka	32.5	46.2	34.2	36.3	37.6	37.3
Lancer	32.0	43.7	35.7	39.0	37.1	37.6
Centurk	32.8	43.5	37.3	27.2	37.9	35.2
Bronze	26.8	45.6	34.9	13.0	35.8	30.1
Gent	27.8	44.8	33.8	1/	35.5	
Roughrider	27.3	48.5	36.5	1/	37.4	
Standard error of a Treatment mean =	0.9	1.1	0.9	1.4		
L.s.d. @ 5%	2.8	3.3	2.6	4.4		
The c.v. = p.c.	6.2	5.0	5.0	9.4		

1/ Not grown because of seed shortage.

Table 7 – Off-station winter wheat variety trials

Variety	Beach	Test weight per bushel Bowman	Hettinger	Glen Ullin	3-Sta. Avg.	3-Sta. Avg.
Froid	61.0	61.0	60.0	59.5	60.7	60.4
Winoka	63.0	62.0	62.0	60.0	62.3	61.8
Lancer	63.5	61.0	61.5	59.0	62.0	61.2
Centurk	63.5	59.0	62.0	58.0	61.5	60.6
Bronze	61.5	61.5	61.0	58.5	61.3	60.6
Gent	62.5	63.0	60.0	1/	61.8	
Roughrider	61.5	62.0	61.5	1/	61.7	

1/ Not grown because of seed shortage.

Table 8 – Off-station winter wheat variety trials

	Protein percent				
Variety	Beach	Bowman	Hettinger	Glen Ullin	4-Sta. avg.
Froid	14.0	13.9	10.0	13.9	12.9
Winoka	13.6	13.8	10.0	14.4	12.9
Lancer	12.9	13.8	10.6	14.1	12.8
Centurk	12.1	13.7	11.6	12.3	12.4
Bronze	13.7	14.5	10.1	12.6	12.7
Gent	12.4	13.6	12.7	1/	12.9
Roughrider	13.8	14.0	10.7	1/	12.8

Wheat protein @ 14.0% moisture.
1/ Not grown because of seed shortage.

Table 9 – Durum wheat variety trials

Variety	Avg. Yield bu/acre	Test weight	Heading date	Height inches
Wells	31.6	59.5	7-2	37
Rolette	38.8	62.0	6-24	34
Ward	31.3	60.0	6-29	36
Wakooma	30.2	60.0	7-4	39
Crosby	29.7	60.0	6-26	35
Botno	30.5	61.0	6-26	35
Rugby	29.4	60.5	6-30	37
Cando	32.7	61.0	6-30	29
DT 411	32.2	60.0	7-2	38
D 7047	32.2	62.0	6-28	28
D 7175	33.3	60.5	6-29	35
D 71101	31.6	61.0	6-26	35
D 71111	31.9	61.0	6-29	35
D 71117	26.1	59.5	6-29	38
D 7233	28.6	60.5	6-28	36
D 7266	29.2	59.5	6-25	28
D 7275	27.5	61.5	6-26	35
D 72114	29.4	59.5	6-28	34
D 7224	31.1	60.0	7-1	29
MEX 1	35.8	60.0	6-28	37
MEX 2	32.1	60.5	6-28	35
MEX 3	30.8	60.5	6-28	36
MEX 4	32.4	60.5	6-29	36
MEX 5	31.4	60.5	6-30	37
MEX 6	31.9	59.5	6-29	37

Standard error of a treatment mean = 2.1679
L.s.d. @ 5% = 6.0703
The c.v. = 13.89 p.c.

Table 10 – Long term yield comparison of durum wheat varieties

Yield in bushels per acre

Variety	1972	1973	1974	1775	1976	5-yr avg.
Wells	24	46	34	42	32	36
Rolette	23	41	36	38	39	35
Ward			35	37	31	
Wakooma			29	39	30	
Crosby			34	37	30	
Botno			33	33	31	
Rugby			33	38	29	
D7047			32	37	32	
D 71111			36	35	32	
D 71117			35	35	26	
D 7233				35	29	
DT 411				37	32	
D 72114				28	29	
L.s.d. @ 5%	3.5	3.9	4.7	3.1	6.1	

Table 11 – Durum variety trials – Dickinson and off-station sites

Yields in bushels per acre

Variety	Dickinson	Beach	Bowman	Glen Ullin	Hettinger	Killdeer	Mandan	Avg. 6-station
Wells	32	33	50	46	23	Not	19	34
Rugby	29	29	50	45	26	Harvested	11	32
Ward	31	33	50	49	23	↓	21	35
Crosby	30	37	50	49	25		18	35
Botno	31	34	49	48	24		18	34
					20% Hail			
					damage			
Standard error of								
a treatment mean =	2.2	0.5	1.6	0.7	0.6		1	
L.s.d. @ 5%	6.1	1.7	5.1	2.1	2		3	
The c.v. = p.c.	13.9	3.2	6.6	2.8	5.3		11	

Table 12 – Durum variety trials Dickinson and Off-station sites

Test weight per bushel

Variety	Dickinson	Beach	Bowman	Glen Ullin	Hettinger	Killdeer	Mandan	Avg. 6-station
Wells	59.5	61.5	59.5	61.5	55	Not	58.5	59.3
Rugby	60.5	59.7	60.5	62	58.5	harvested	57.5	59.8
Ward	60	60	60	61	54.5	↓	59	59.1
Crosby	60	60.8	59.5	61.5	56.5	↓	58	59.4
Botno	61	57.8	60	61	56.5	↓	58	59.1

Table 13 – Oat Variety trial

Variety	Avg. Yield bu/acre	Test weight	Heading date	Height inches
Mariner	82.9	37.5	6-22	35
Wright	86.0	35.5	6-21	34
Garry	96.3	35.0	6-24	37
Russell	87.6	36.5	6-22	35
Sioux	90.7	34.5	6-24	35
Kelsey	102.0	33.5	6-22	33
Cayuse	101.0	33.5	6-22	29
Lodi	99.0	32.5	6-27	36
Harmon	92.2	36.0	6-27	36
Hudson	89.2	33.0	6-27	35
Minn. 71101	85.5	35.5	6-22	36
Ill. 67-1514	83.4	36.5	6-21	31
Noble	79.8	35.0	6-21	29
Random	94.8	35.0	6-23	34
Astro	87.6	32.5	6-24	28

Standard error of a treatment mean = 2.7167

L.s.d. @5% = 7.7

The c.v. = 6.0 p.c.

Table 14 – Long term yield comparison of oat varieties

Yield in bushels per acre

Variety	1972	1973	1974	1975	1976	5-yr.avg.
Kelsey	47	89	61	67	102	73
Cayuse	57	90	72	69	101	78
Random	49	85	48	65	95	68
Astro		67	50	74	88	
Mariner		82	55	52	83	
Hudson			47	72	89	
Sioux	41	85	59	71	91	69
Garry	47	87	64	55	96	69
Lodi	43	87	55	59	99	68
L.s.d. @ 5%	9.5	8.2	7.1	6.3	7.7	

Table 15 – Oat variety trial Dickinson and Off-station sites

Yield in bushel per acre

Variety	Dickinson	Beach	Bowman	Glen Ullin	Hettinger	Killdeer	Mandan	Avg. 5-station
Kelsey	102	Hailed	83	81	39	Not	77	76
Harmon	92	out	67	65	33	harvested	68	65
Hudson	89		58	66	26		79	64
Noble	80		56	66	38		68	62
Cayuse	101		81	97	42		85	81
Random	95		60	67	37		60	64
					Hail			
					damage			
Standar error of a								
treatment mean =	2.7		2.9	1.8	2.7		2.4	
L.s.d. @ 5%	7.7		8.9	5.4	8.3		7.3	
The c.v. = p.c.	6		8.7	4.9	15.4		6.7	

Table 16 – Oat variety trials Dickinson and off-station sites

Test weight per bushel

Variety	Dickinson	Beach	Bowman	Glen Ullin	Hettinger	Killdeer	Mandan	Avg. 5-station
Kelsey	33.5	Hailed	36.5	36.5	31.5	Not	34.5	34.5
Harmon	36	out	37	36	30.5	Harvested	33	34.5
Hudson	33		34	33.5	29.5		31.5	32.3
Noble	35		38	34.5	35		36	36
Cayuse	33.5		34.5	36	32.5		32.5	34
Random	35	↓	34.5	33	32.5	↓	31.5	33.3

Table 17 – Barley variety trial

Variety	Avg. Yield bu/acre	Test weight	Heading date	Height inches
Larker	72.5	52.5	6-22	29
Dickinson	72.6	51.0	6-23	30
Beacon	66.0	48.0	6-21	30
Nordic	70.8	50.5	6-23	29
Karl	78.4	50.5	6-21	25
Hector	79.7	53.5	6-25	30
Klages	73.9	50.5	6-28	30
Multum	77.3	48.5	6-26	27
Georgie	78.8	51.0	6-26	24
Lud	66.0	51.5	6-21	33
ND 231	65.0	51.0	6-22	31
ND 718	77.0	50.5	6-21	29
ND 1311	69.8	48.5	6-21	31
ND 1265	73.2	51.0	6-20	31
ND 1470	83.2	52.5	6-21	29

Standard error of a treatment mean = 2.5911
L.s.d. @5% = 7.3
The c.v. = 7.04 p.c.

Table 18 – Long term comparison of barley varieties

Variety	1972	1973	1974	1975	1976	5-yr. avg.
	Yield in bushels per acre					
Nordic	59	67	39	52	71	58
Hector			56	61	80	
Dickinson	57	64	36	50	73	56
Beacon	46	63	40	51	66	53
Klages			38	51	74	
ND 231	47	66	38	48	65	53
ND 718	48	65	41	52	77	57
L.s.d. @ 5%	9.6	3.1	7.1	8.2	7.3	

Table 19 – Barley variety trial Dickinson and off-station sites

Yield in bushels per acre

Variety	Dickinson	Beach	Bowman	Glen Ullin	Hettinger	Killdeer	Mandan	Avg. 5-station
Hector	80	Hailed	43	69	29	Not	60	56
Multum	77	out	47	69	28	harvested	60	56
Lud	66	↓	17	48	28	↓	44	40
Georgie	79		53	77	32		57	60
Nordic	71		21	66	27		49	47
Beacon	66		19	62	28		41	43
					Hail			
					damage			
Standard error of a								
treatment mean =	2.6		1.3	1.9	1.7		0.9	
L.s.d @ 5% =	7.3		4.1	5.8	5.2		2.8	
The c.v. = p.c.	7		8.1	5.8	12		3.6	

Test weight per bushel

Variety	Dickinson	Beach	Bowman	Glen Ullin	Hettinger	Killdeer	Mandan	Avg. 5-station
Hector	53.5	Hailed	49.5	47	42	Not	46	47.6
Multum	48.5	out	47.5	49.5	39	harvested	46.5	46.2
Lud	51.5	↓	46	47	40	↓	44.5	45.8
Georgie	51	↓	48.5	48	37	↓	46.5	46.2
Nordic	50.5	↓	47.5	53	38.5	↓	44	46.7
Beacon	48	↓	46.5	48	39.5	↓	43.5	45.1

Table 21 – Winter rye variety trial

Variety	Avg. Yield bu/acre	Test weight	Heading date	Height inches
Cougar	57.4	58.5	5-30	43
Rymin	58.6	59.5	5-30	44
Caribou	44.2	60.0	5-27	45
Puma	48.0	59.0	5-29	44
Frontier	45.1	61.0	5-27	44

Standard error of a treatment mean = 2.0895

L.s.d. @ 5% = 6.4388

The c.v. = 8.25 p.c.

Nursery Trials With Small Grain

The cooperative nursery trials grown at Dickinson in 1976 and the leaders responsible for each trial are:

Uniform Regional Hard Red Spring Wheat Nursery; Dr. R.E. Heiner, ARS-USDA, Institute of Agriculture, St. Paul, Minnesota.

Uniform Regional Durum Nursery; Dr. J.S. Quick, Agronomy Department, North Dakota State University, Fargo, North Dakota.

Uniform Early Oat Nursery, and Uniform Midseason Oat Nursery; Mr. Richard Halstead, ARS-USDA, Institute of Agriculture, St. Paul Minnesota.

Great Plains Barley Nursery; Dr. P. B. Price, ARS-USDA, Agronomy Department, South Dakota State University, Brookings, South Dakota.

Western Spring Barley and Western Dryland Spring Barley; Dr. E. A. Hockett, ARS-USDA, Plant and Soil Science Department, Montana State University, Bozeman, Montana.

Uniform Regional Flax Nursery; Dr. James Hammond, Agronomy Department, North Dakota State University, Fargo, North Dakota.

Data from the 1976 nursery trials are summarized in tables 22 through 29.

Table 22 – Uniform regional hard red spring wheat nursery

Variety	Avg. Yield bu/acre	Test weight	Heading date	Height inches
Marquis	33.7	56.5	6-26	38
Justin	37.6	57.0	6-28	40
Selkirk	34.3	58.0	6-25	38
Chris	37.2	59.0	6-25	40
Waldron	43.2	59.5	6-22	37
ND 519	42.8	62.0	6-19	36
ND 531	42.0	61.0	6-25	39
ND 536	38.1	62.0	6-20	36
ND 538	42.8	60.5	6-25	37
ND 541	38.5	60.5	6-23	39
ND 542	46.0	59.5	6-19	36
ND 544	46.6	59.5	6-25	37
SD 2273	50.0	61.5	6-19	34
ND 522	55.2	58.0	6-23	35
ND 543	48.8	60.0	6-23	33
MNII-64-27	59.6	61.0	6-24	33
MN 7086	45.6	59.0	6-26	34
MN 70113	39.2	60.0	6-20	33
MN 70175	43.4	57.5	6-26	30
MN 70170	46.3	59.0	6-25	31
MN 70202	42.3	60.5	6-23	30
MN 7125	53.0	59.0	6-23	34
MN 7142	47.9	56.5	6-24	31
MN 7155	50.3	58.5	6-22	33
MN 7170	49.2	54.0	6-27	34
SD 2271	42.3	58.5	6-19	33
SD 2288	37.1	59.5	6-20	31
MT 749	46.9	60.0	6-20	32
MT 7416	55.9	59.5	6-19	33
H678-1-64311	44.2	59.0	6-20	33
II-62-48	45.1	56.5	6-28	32
Era	55.9	57.5	6-27	32

Standard error of a treatment mean = 3.5177
L.s.d. @ 5% = 9.8501
The c.v. = 13.53 p.c.

Table 23 – Uniform regional durum nursery

Variety	Avg. Yield bu/acre	Test weight	Heading date	Height inches
MIndum	46.1	60.0	7-4	43
Wells	45.2	61.3	7-1	39
Rolette	47.6	62.3	6-22	37
Ward	45.8	58.8	6-28	38
Wakooma	40.3	56.5	7-4	40
Crosby	42.3	59.0	6-28	37
Botno	44.0	61.0	6-26	37
Rugby	40.3	59.5	6-29	38
Cando	49.8	58.5	7-2	29
D 7047	52.1	59.0	6-29	27
D 71117	50.1	60.3	6-28	39
DT 411	50.1	60.5	6-29	39
D 7175	47.7	58.8	6-27	38
D 71111	49.9	60.5	6-28	39
D 71101	45.6	61.5	6-22	36
D 7233	52.2	61.0	6-23	38
D 7266	51.2	59.5	6.28	30
D 72114	47.6	60.0	6-23	34
D 7275	41.2	61.5	6-22	38
D 71104	41.7	60.3	6-23	34
D 7224	50.5	59.3	6-28	31
D 7270	45.9	57.3	6-29	30
D 7298	50.7	62.0	6-23	36
DT 354	43.0	56.8	6-30	40
D 74107	51.8	61.5	6-24	38
D 74110	53.5	61.5	6-24	37
D 74111	51.7	61.3	6-25	37
D 74112	54.5	61.5	6-26	38
D 74114	52.3	61.8	6-27	37
D 74116	52.9	61.3	6-27	36

Standard error of a treatment mean = 3.1876
L.s.d. @ 5% = 8.9259
The c.v. = 13.31 p.c.

Table 24 – Uniform early oat performance nursery

Variety	Avg. Yield bu/acre	Test weight	Heading date	Height inches
Jaycee	70.4	39.5	6-16	34
I1. 71-1158	74.8	36.5	6-16	33
I1. 69-7648	73.5	36.5	6-17	32
I1. 71-1139	72.9	39.5	6-16	32
I1. 73-2186	85.8	36.0	6-17	31
Clintford	73.2	39.0	6-17	34
Multiline E 77	61.4	36.0	6-23	34
Andrew	73.7	40.0	6-16	36
MO. 06204	92.2	38.0	6-20	31
MO. 06035	71.5	38.0	6-17	35
MO. 06425	71.6	40.5	6-17	29
MO. 06328	64.4	40.5	6-17	28
MO. 06195	59.5	40.5	6-16	31
MN 74125	62.6	41.0	6-17	37
MO. 0-205	66.6	41.0	6-17	34

Standard error of a treatment mean = 6.2655
L.s.d. @5% = 18.1467
The c.v. = 15.16 p.c.

Table 25 – Uniform midseason oat performance nursery

Variety	Avg. Yield bu/acre	Test weight	Heading date	Height inches
Lodi	71.2	32.5	6-28	38
Wix 1986-1	62.1	40.0	6-21	33
Wix 2456-2	79.8	32.5	6-28	34
Wix 1839-1	78.1	32.0	6-29	38
Wix 2221-2	77.6	39.0	6-22	32
Wix 3086-1	84.4	34.5	6-29	34
Dal	91.6	35.5	6-30	36
I1. 67-1514	82.6	35.5	6-17	32
I1. 69-7669	82.4	36.8	6-25	36
I1. 69-6198	69.1	36.5	6.21	31
I1. 71-1161	68.0	37.5	6-18	33
I1. 73-2664	77.7	35.0	6-21	33
Orbit	88.8	33.5	6.25	34
RL 2966	49.5	40.5	6-28	36
OA 269	73.7	36.0	6-23	36
OA 313	94.4	38.5	6-16	35
OA 338	93.8	39.0	6-18	36
NY 6083-26	86.1	32.5	6-26	34
NY 5740-11	88.7	34.5	6-28	35
OC-I-23	70.8	40.0	6-19	35
OC-I-36	71.4	36.0	6-22	27
OTEE	68.0	39.5	6-20	35
Multiline EM	70.5	40.5	6-17	34
SD 711045	73.3	36.0	6-23	33
SD 9095	82.0	37.0	6-20	34
MI 64-151-123	100.5	38.0	6-30	36
Clintland 64	57.6	39.0	6-18	35
MN 71211	71.9	36.0	6-23	37
MN 71205	104.6	36.5	6-25	37
MN 73231	83.6	36.5	6-25	38
MN 74230	95.2	35.5	6-19	36
Chief	59.8	37.5	6-19	35
MN 74217	73.3	40.0	6-21	36
Gopher	89.0	37.5	6-23	37
Pur. 666 DI-24-2-3-1	90.1	38.0	6-23	34
Pur. 666 DI-42-2-4-5	89.0	37.5	6-23	31

The standard error of a treatment mean = 7.0318
L.s.d. @ 5% = 19.6901
The c.v. = 15.38 p.c.

Table 26 – Uniform great plains barley nursery

Variety	Avg. Yield bu/acre	Test weight	Heading date	Height inches
Firlbecks III	56.2	51.5	6-22	28
Primus II	51.3	50.0	6-11	30
Larker	60.3	51.5	6-19	30
Galt	67.4	46.0	6-20	30
Manker	43.4	51.0	6-19	30
Beacon	45.8	49.5	6-19	33
ND 759	60.1	48.5	6-19	31
ND 1265	49.9	48.5	6-19	32
ND 1311	47.9	48.0	6-20	31
Br YG 3-4	61.1	46.5	6-24	31
Steptoe	64.0	44.0	6-19	28
SD 69-1781	65.3	50.0	6-22	34
SD 71-672	51.1	52.5	6-23	31
SD 71-698	48.4	51.5	6-23	30
M 25	61.9	49.5	6-22	33
Br YKQ – 1	63.7	46.0	6-20	32
Br A 31-1	65.4	52.0	6-20	32
C 42-1	70.9	50.0	6-20	31

Standard error of a treatment mean = 5.6322
L.s.d. @ 5% = 16.0974
The c.v. = 16.98 p.c.

Table 27 – Uniform western spring barley nursery

Variety	Avg. Yield grams	Test weight	Heading date	Height inches
Firlbecks III	522	52.5	6-25	30
Trebi	452	45.0	6-24	31
Steptoe	639	45.0	6-22	28
Shabet	515	48.0	6-29	30
Vanguard	519	51.5	6-26	28
Larker	493	51.0	6-22	31
Klages	383	45.5	6-30	31
WA 766467	587	48.5	6-27	30
WA 765267	518	48.0	6-29	30
AT 506	483	50.0	6-28	29
ID 714552	449	45.0	7-4	33
MT 148366	559	50.0	6-29	30
MT 13455	402	43.5	7-3	26
MT 267105	458	49.0	6-29	26
CA 73104	565	47.0	6-24	26
CA 73107	517	48.5	6-25	33
UT 484	495	48.5	6-23	33
CI 7130	448	50.5	6.22	25
MT 926132	492	51.0	6-22	27
Mt 92656	572	50.5	6-22	27
MT 926125	428	47.0	6-22	26
MT 92655	485	52.0	6-22	26

Standard error of a treatment mean = 56.2655
L.s.d. @ 5% = 159.1428
The c.v. = 19.52 p.c.

Table 28 – Western dryland spring barley nursery

Variety	Avg. Yields grams	Test weight	Heading date	Height inches
Munsing	515	50.0	6-20	26
Untian	514	46.0	6-20	30
Galt	637	46.5	6-26	30
ID 143411	586	51.5	6-20	28
Steptoe	583	44.0	6-20	29
Shabet	587	47.5	6-30	31
Piroline	587	51.0	6-27	28
Hector	605	49.0	6-28	32
MT 125265	487	48.5	6-23	30
ID 143413	546	48.0	6-23	30
ID 711180	603	49.0	6-26	31
MT 3492	624	47.0	6-30	29
MT 4524	377	52.0	6-16	27
MT 4472	626	48.5	6-26	30
MT 4474	619	50.0	6-25	29
Dekap	589	49.5	6-24	29
Carlsberg II	559	46.0	6-30	28
MT 752335	514	52.0	6-19	28
MT 752328	600	50.5	6-20	26
MT 752358	570	46.5	6-16	27
MT 752346	492	45.5	6-20	27

Standard error of a treatment mean = 47.7046

L.s.d. @ 5% = 136.3458

The c.v. = 14.54 p.c.

Table 29 – Uniform regional flax nursery

Variety	Avg. Yields bu/acre	Test weight	Heading date	Height inches
CI 389	13.0	55.0	7-1	22
CI 2292	14.8	56.0	7-1	22
CI 2522	14.3	53.8	6-23	21
CI 2776	15.4	54.6	6-23	21
CI 2797	14.7	55.0	6-28	22
CI 2802	15.9	53.5	7-1	23
CI 2808	13.4	54.0	7-2	22
CI 2814	15.8	55.2	6-29	24
CI 2816	14.8	54.0	6-23	23
CI 2819	13.7	53.5	6-29	22
CI 2820	13.2	54.0	6-29	24
CI 2822	16.8	54.0	6-22	22
CI 2838	17.8	53.5	6-23	22
CI 2840	16.7	54.8	6-29	23
CI 2841	15.1	54.6	6-29	22
CI 2842	16.6	53.7	6-23	23
CI 2843	15.4	54.4	6-24	24
CI 2844	13.9	54.3	6-29	22
CI 2845	13.1	54.0	6-28	22
CI 2846	16.6	55.0	6-28	22
CI 2847	16.9	55.0	6-25	22
CI 2848	15.5	54.7	6-30	24

Standard error of a treatment mean = 1.0620

L. s.d @ 5% - 3.0037
The c.v. – 12.14 p.c.

Table 37. Exp 2 Elite Yield Dickinson, NF

Culticar or Line	Spring Surivive Percent	Spring Vigor 0-5	June Head Date	Leaf Rust % RX	Stem Rust % RX	Leaf Spot 0-9	Plant Height	Lodge 0-9	Yield Bu/A	Test Weight Lbs/Bu
Roughrider	0	0	9			0	90	1	45.7	61.2
ND7249	0	0	10			0	101	1.7	46.3	61.7
ND7269	0	0	10			0	98	2.3	34.6	60.5
ND7274	0	0	9			0	101	1.7	39.5	61.2
SD56713-10	0	0	7			0	89	1.3	38.3	61.2
68F6635	0	0	7			0	85	1	48	61.3
ND7301	0	0	8			0	97	1	43.9	60.2
ND7302	0	0	8			0	95	2	48.7	62.3
ND 7305	0	0	8			0	89	2	50.1	62.2
WT86	0	0	9			0	89	2	51	61.7
NE68463	0	0	8			0	83	1	39.7	60.8
MT7254	0	0	10			0	94	1	37.8	61.5
MT7256	0	0	8			0	89	1	36.1	61.2
WM-1	0	0	5			0	74	1	42.6	61.7
WM-2	0	0	4			0	76	1	46.1	61.8
NE701286	0	0	7			0	87	1	44.4	61
ND7263	0	0	9			0	98	2.7	39.2	60.8
HIPLAINS	0	0	6			0	80	1	40.3	61.7
Gent	0	0	5			0	83	1	49.7	61.7
Bronze	0	0	6			0	82	1.7	46.7	61.5
Sundance	0	0	12			0	107	2	48.4	59
Centurk	0	0	7			0	76	1	40.8	62.3
Winoka	0	0	9			0	90	1.7	45.4	62
Froid	0	0	9			0	101	2	35.2	60.3
Mean	0	0	8			0	90	1.5	43.3	61.3
High mean	0	0	12			0	107	2.7	51	62.3
Low mean	0	0	4			0	74	1	34.6	59
Coeff. Of Variation	0	0	8			0	4	25.4	8.4	0.6
LSD (.01 Percent)	0	0	1			0	9	0.8	7.9	0.7
LSD (.05 Percent)	0	0	1			0	6	0.6	6	0.6
NO. of Rep	3	3	3			3	3	3	3	3

Table 46. EXP 3 Advanced Yield Dickinson ND

	Spring	Spring	June	Leaf	Stem	Leaf	Plant			Test
	Survive	Vigor	Head	Rust	Rust	Spot	Height	Lodge	Yield	Weight
Cultivar or Line	Percent	0-5	Date	% RX	% RX	0-9		0-9	BU/A	Lbs/BU
ND7407	0	0	8			0	94	1.3	42.9	60.5
ND7408	0	0	9			0	97	2.7	49.9	61
ND7409	0	0	9			0	96	1	46.8	61.3
ND7412	0	0	10			0	98	2	54.2	61.5
ND7417	0	0	7			0	90	1.3	46.6	61.7
ND7424	0	0	8			0	93	1	44.5	61.3
ND7428	0	0	8			0	94	2	47.3	61.3
ND7432	0	0	9			0	96	1	47.7	60.7
ND7441	0	0	9			0	100	3	44.3	61.7
ND7442	0	0	7			0	95	1	43.5	61
ND7447	0	0	8			0	95	2	51.6	61.2
ND7449	0	0	8			0	98	1	50.6	61.3
ND7451	0	0	8			0	95	1.3	52.8	61.3
ND7453	0	0	9			0	96	1.7	44.3	61.8
ND7461	0	0	8			0	98	1.3	46.7	61
ND7462	0	0	8			0	99	1	46.6	61.2
ND7468	0	0	7			0	89	2.3	50.2	62.3
ND7469	0	0	7			0	98	1.3	47.8	60.8
ND7473	0	0	8			0	98	1	38.1	61
ND7474	0	0	6			0	92	1.3	47.8	62.2
ND7475	0	0	7			0	87	1	45.3	61
ND7476	0	0	9			0	103	1.7	34.9	61.2
ND7481	0	0	9			0	93	1	47.8	61.2
ND7495	0	0	9			0	98	1	33	60.7
ND7497	0	0	7			0	89	1	41.7	60.7
ND74100	0	0	7			0	93	2.3	49.7	61.7
ND74102	0	0	8			0	98	1.3	49.8	61.2
ND74108	0	0	9			0	99	1.3	47.1	61
ND74117	0	0	9			0	94	1.7	52.3	61.7
ND74118	0	0	7			0	86	2	51.8	62
ND74122	0	0	9			0	101	2	47.2	61.5
ND74124	0	0	10			0	101	1	37.3	61.2
Minter	0	0	10			0	108	2.7	48.2	61.2
Centurk	0	0	6			0	79	1	40.8	62.2
Winoka	0	0	9			0	98	2	45.9	62.2
Froid	0	0	10			0	99	1.7	39	60.3
Mean	0	0	8			0	96	1.5	46	61.3
High Mean	0	0	10			0	108	3	54.2	62.3
Low Mean	0	0	6			0	79	1	33	60.3
Coeff. Of Variation	0	0	7			0	3	26	7.6	0.4
LSD (.01 Percent)	0	0	1			0	7	0.9	7.5	0.6
LSD (.05 Perecnt)	0	0	1			0	5	0.6	5.7	0.4
NO. of Rep	3	3	3			3	3	3	3	3

Table 30 – Sunflower variety trial

	Yield in pounds per acre							
Variety	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Avg.	Test Weight
Peridovick	1070	1072	929	1013	953	1056	1016	31.3
Hybrid 894	1037	1154	809	989	934	979	984	28.8
N.K. 212	1114	1294	883	931	749	998	995	31.6
Sundak	1253	1534	1030	1147	1056	1176	1199	26.4

Tillage for Seeding on Chemical Fallow

Three tillage treatments in preparation for seeding on chemical summerfallow were compared. The treatments were : spring plowing and seeding with double disk drill; double disking and harrowing, and seeding with a double disk drill; and, minimum tillage and seeding with the 1500 power till seeder. Conventional summerfallow tilled with a duckfoot cultivator and seeded with a double disk drill was also included in the comparison. All trials were fertilized at 75 pounds 18-46-0.

Heavy growth of annual weeds which were difficult to control under cold spring temperature was one of the principal reasons for the low yields produced by the power till seeded.

Table 31 – Tillage for seeding on chemical and conventional fallow

	Yield in bushels per acre					
Treatment	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Avg.
Double disk on Chemical fallow	30.3	29.3	28.4	27.5	27.5	28.6
Spring plow on Chemical fallow	33.9	33.9	32.1	32.1	32.1	32.8
Minimum till On chemical fallow	11.0	11.7	10.3	9.6	9.6	10.4
Duckfoot on Conventional fallow	42.7	43.6	43.6	45.3	46.2	44.3

L.s.d. @ 5% = 2.9 bushels per acre.

Wheat Production On Fallow, Second Cropping and Continuous Cropping

Wheat production was compared on continuous cropping, second cropping and conventional fallow, and results of the trial are summarized in the following table. The relationship of yields, particularly from fallow and continuous cropping are practically identical to those established for the long term average. Yields, however, were nearly double in each instance.

Table 32 – Wheat production on fallow, second cropping and continuous cropping

	Yield in bushels per acre				
Treatment	Rep 1	Rep 2	Rep 3	Rep 4	Avg.
Continuous cropping	21.3	20.3	24.0	22.2	22.0
Second cropping	27.7	28.6	26.8	25.0	27.0
Fallow	42.8	44.4	42.8	42.0	43.0

L.s.d. @ 5% = 3.7 bushels per acre.

Minimum Tillage and Seeding, And Double Disking And Conventional Seeding on Second Cropping Compared

Wheat production on second cropping seeded after minimum tillage, and seeded following double disking were compared. Production on second cropping was good for both methods but there was no significant difference in production in this years' trial.

Table 33 – Minimum tillage and double disking for wheat production on second cropping

	Yield in bushels per acre				
Treatment	Rep 1	Rep 2	Rep 3	Rep 4	Avg.
Minimum tillage And seeding	25.9	30.5	30.5	25.0	28.0
Double disk and Conventional seeding	27.7	28.6	26.8	25.0	27.0

No significant difference.

Rate of Seeding

Rate of seeding trials with small grains have established the optimum amounts for seeding in southwestern North Dakota. However, amounts seeded by farmers in this area, as well as in other parts of North Dakota, are often greater than optimum amounts established by experimentation. This increases the cost of production unnecessarily.

Periodically, rate of seeding trials are re-run, to serve as a demonstration of established principles of dryland farming, and to re-affirm previous testing.

In 1976, Waldron wheat, with 99.9% purity and 96% germination was seeded on clean fallow on April 9th, at the rates of 1 bushel, 1 ½ bushels and 2 bushels per acre. All seedings were fertilized according to soil test, at a rate of 25 lbs N, and 25 lbs P_2O_5 per acre for a 40 bushel yield goal.

Results of the trial show the optimum seeding rate for hard red spring wheat to be on bushel per acre to one and one-half bushels per acre, the least significant difference at 5 % exactly equalling the difference in production.

Table 34 – Rate of seeding with hard red spring wheat

	Yield in bushels per acre					
Rate per acre	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Avg.
1 bushel	42.7	43.6	43.6	45.3	46.2	44.3
1 ½ bushel	44.4	44.4	46.2	47.9	47.0	46.0
2 bushels	41.7	44.4	45.3	46.2	47.0	45.0

L.s.d. @ 5% = 1.7 per acre

Wheat Production From SOECO Treated Seed
Compared with Production from Untreated Seed

A comparison of wheat production from seed treated with SOECO seed inoculant and from untreated seed demonstrated no benefit from the seed inoculant, as shown in table 35.

Table 35 – Wheat production – SOECO treated and untreated seed

		Yield in bushels per acre				
Treatment	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Avg.
SOECO treated seed	43.6	44.4	46.2	42.7	46.2	44.6
Untreated seed	42.7	43.6	43.6	45.3	46.2	44.3

The seed inoculant used is described in the following brochure. If the material is locally available commercially in the 1977 crop year the trial will be repeated.

Report of
Livestock Investigations
At the
Dickinson Experiment Station
Dickinson, North Dakota

1976

By
James L. Nelson & Douglas G. Landblom

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Using Straw In Cow Wintering Rations

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

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

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

Only mature cows that were at least four years old or older were used in this trial, which started on December 19th, and continued until February 27th, a period of seventy days. Two experimental groups were selected randomly according to age and fed a wintering ration of four parts mixed hay (crested wheatgrass and bromegrass + alfalfa) and three parts oat straw. Daily consumption of approximately twenty-three pounds of forage as fed was desired. Utilizing a fence line feeder, group I received this ration after it had been processed in a tub grinder through a two inch screen. Group 2, which was fed in a conventional manner on the ground, received the same ratio of hay and straw in the long form on alternate days; hay being fed Tuesday, Thursday, Saturday and Sunday, and oat straw fed on Monday, Wednesday and Friday of each week. Both lots received mineral free choice. On February 1st, approximately thirty days before calving, each cow received an enterotoxemia booster shot and one-million units of vitamin A, intramuscularly.

Results of the trial are summarized in tables 1 through 4.

Summary:

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

Cows receiving the unprocessed hay and straw consumed 4.0 pounds less total feed per day, and wasted more straw, especially on mild winter days, as compared to a very minimal amount of waste, and continued voluntary intake among the cows fed chopped forage.

Body weight changes were not seriously affected by either feeding regime. The group that received unprocessed hay and straw maintained their starting weight, while those cows fed chopped hay and straw has an average increase in body weight of sixty-one pounds per head.

Calving results, as shown in table 3, indicate that feeding chopped or unprocessed hay and straw had no effect on calf birth weight or livability.

Table 1. Feed consumption, chopping costs and wintering economics – winter, 1975-76.

	Group 1 Chopped Hay and straw	Group 2 long form Hay and straw
Days fed	70	70
No. of head	32	42
Mixed hay, lbs.	32919	40595
Oat straw, lbs.	24690	23300
Feed/hd./day, lbs.	25.7	21.7
Total feed cost, $	853.51	1022.48
Daily feed cost/hd., $	.381	.348
Chopping data:		
Chopping cost/cow, $	1.89	--
Total feed cost/hd, $	28.56	24.34

1/ Mixed hay @ $40/ton, oat straw @ $10/ton, minerals @ $104/ton, fed free choice.
2/ Mineral used is 17% phosphorus, 25% calcium, mixed at the rate of one part mineral mix to two parts white salt.
3/ Chopping costs, $2.10/ton.

Table 2. Body weight changes

	Group 1 Chopped Hay and straw			Group 2 long form hay and straw		
Age of cow	4	5,6,7	8,9,10	4	5,6,7	8,9,10
Initial wt., lbs.- (Dec. 16, 1975)	983	1086	1168	945	1078	1142
Final wt., lbs. (Feb. 27, 1976)	1050	1142	1230	935	1083	1143
Gain or loss, lbs.	+67	+56	+62	-10	+5	+1

Table 3. Calf birth weights and livability

	Group 1 Chopped Hay and Straw			Group 2 Long form Hay and Straw		
Age of cow	4	5,6,7	8,9,10	4	5,6,7	8,9,10
No. heifer calves	3	5	4	5[1/]	8	4
Avg. birth wt., lbs.	76	70	69	67	70	74
No. steer calves	2	10[1/]	6	2	9	11
Avg. birth wt., lbs.	73	74	72	76	69	77

[1/] One calf born dead

Table 4. Calculated wintering cost when 23 pounds of " as fed " forage are fed under three feeding regimes to 250 cows for 70 days

	All Mixed hay		Chopped 4 parts hay- 3 parts straw		Long form 4 parts hay- 3 parts straw
Cost/lb. feed, $ 1/	.02		.0146		.0136
Lbs. feed/cow/day	23		23		23
Cost/hd./day, $	.492		.368		.345
Cost 250 cows, - 70 days, $	8,610		6,440		6,038
Difference, $		2170		402	

1/ See table 1 for feed costs, chopping costs and minerals used.

Heifer Management Study

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

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

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

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

The heifers were wintered as a mixed group on a full feed of hay until February 5th, 1976. At this time, the heifers were moved into calving lots and self-fed a chopped mixed hay ration plus minerals. After calving, each heifer received approximately two pounds of ground oats in addition to the chopped hay.

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

Weaning weights were recorded at approximately 205 days of age.

Table 5. Calving data – Heifer Management Study, 1975-76.

	Angus x Hereford			Longhorn x Hereford		
No. heifers exposed	20			20		
No. heifers calving	18 [1/ 2/]			19[2/]		
Avg. birth wt.	17 hd avg. = 69#[3/]			19 hd avg. = 63#		
Steers	7 hd = 70#			13 hd = 66#		
Heifers	10 hd = 68#			6 hd = 58#		
Avg. age at weaning	203 days			197 days		
Weaning wt.		Actual	Adjusted		Actual	Adjusted
Steers	5 hd	454	462	13 hd	407	426
Heifers	10 hd	400	401	5 hd	369	369
Estimated calf value [5/]						
Steers	5 hd @ $177.06			13 hd @ $146.68		
Heifers	10 hd @ $131.93			5 hd @ $110.70		
Avg.	$146.97			$136.69		
Return/cow exposed [4/]	$ 122.48			$129.49		
Calving score –						
No difficulty	16[3/]			19		
Hard pull	1			0		

[1/] One cow removed because of abnormal reproductive tract.
[2/] One cow removed, late calving straight Hereford calf.
[3/] One BWF calf born deformed, dead at birth, not included.
[4/] Return based on cows capable of breeding in both herds. Value of cows producing straightbred Hereford calves not included.
[5/] BWF steers @ 39censts, heifers @ 33cents, LxH steers @ 36cents, heifers @ 30cents.

Summary:

In this first years' trial no serious calving problems were experienced with either bull, although all of the calves sired by the Longhorn bull were born unassisted. The Angus X Hereford bull calves were four pounds heavier, and the heifer calves ten pounds heavier at birth than the Longhorn X Hereford calves. At weaning on Sept. 28, the Angus X Hereford steer calves averaged 47 pounds heavier, and the heifers 31 pounds heavier than the Longhorn X Hereford calves. Using current market values, the Angus X Hereford steer calves would return $30.38 and the heifer calves $21.33 more than the Longhorn X Hereford calves. However, on a per cow exposed basis, the Longhorn X Hereford calves actually returned about $7.00 more per cow because more calves were alive at weaning. Because of the limited numbers of animals involved, this report is not intended to be conclusive. This year's trial did show Longhorn X Hereford calves to be easy to deliver, but that they weighed less at birth and weaning, and would sell for less than the Angus X Hereford calves.

Wintering Replacement Heifer Calves

Heifer replacement calves can ne wintered to gain from 1.25 to 1.50 pounds per head per day without becoming over-conditioned according to research conducted at the U.S. Range Livestock Station, Miles City, Montana; South Dakota State University's Antelope Range Field Station, and the Dickinson Experiment Station. Heifer calves fed to gain at this rate will produce good economical gains and will be cycling early in the breeding season.

Straightbred Hereford heifer calves were wintered a total of 141 days, December 1 to April 20, in this trial under two feeding regimes. Two lots of 10 head each, received a self-fed mixed growing ration and one lot of 20 head was had fed. All three lots were provided with pole barn shelters and automatic waterers. Straw bedding was used on a routine basis.

Self-fed rations, balanced according to the NRC requirements, were prepared through a portable mixer grinder and fed in self-feeders of Dickinson Experiment Station design. Weights and gains of the heifers in drylot are shown in table 6; rations as there were fed are shown in table 7: and , wintering data for the four year period 1973-76 have been summarized in table 8.

Table 6. Weights and gains in drylot under two feeding systems

	Self-fed	Self-fed	Hand-fed
No. head	10	10	20
Days fed	141	141	141
Initial wt., lbs.	425	427	429
Final wt., lbs.	624	632	589
Gain, lbs.	199	205	160
Avg. daily gain, lbs.	1.41	1.45	1.13

Self feeding a high roughage growing ration of chopped hay and oats to replacement heifer calves has produced good, steady winter gains without evidence of overconsumptions of bloating problems. Since there was very little waste when the ration was self-fed, the cost of winter gain for self-fed heifers amounted to $28.50 per hundredweight, as compared to $34.00 per hundred-weight for the hand fed heifers. The self-fed heifers are also able to consume more total roughage in the self-fed rations, and consequently require less grain to make gains equal to heifers being hand fed. Although the hand fed heifers made compensatory gain during the summer grazing period, the self-fed heifers apparently were able to cycle and conceive earlier in the breeding season, as indicated by the fall pregnancy test. It is important for the replacement heifers to conceive early and calve early in order to maintain an early calving cow herd.

Table 7. Average feed consumed daily and cost of gain, 1976

	Self-fed	Self-fed	Hand-fed
No. head	10	10	20
Oats, lbs.	2.48	2.51	3.49
Tame hay, lbs.	12.90	12.90	10.10
Alfalfa hay, lbs.	.68	.69	.07
Minerals, lbs.	.4	.40	.35
Total consumed, lbs.	16.40	16.50	14.64
Feed cost/hd, $	57.71	53.20	54.40
Feed cost/hd/day, $	.40	.41	.39
Feed cost/cwt gain, $	29.00	28.00	34.00

Table 8. Feed consumption, gain and cost of wintering heifers, self-fed and hand-fed, 1973-76.

	Hand-fed				Self-fed			
	1973	1974	1975	1976	1973	1974	1975	1976
No. head	12	12	8	20	12	12	23	20
Days fed	168	181	155	141	168	181	155	141
Initial wt., lbs.	410	417	459	429	408	417	455	426
Spring wt., lbs.	588	660	656	589	650	700	716	628
Winter gain, lbs.	178	243	196	160	241	284	262	202
Avg. daily gain, lbs.	1.06	1.34	1.26	1.13	1.44	1.57	1.55	1.43
Lbs. feed/hd/day	13.1	17.2	13.8	14.64	14.8	14.0	17.8	16.44
Feed cost/hd/$	33.02	79.47	64.57	54.40	34.29	67.46	83.11	56.40
Feed cost /hd/day, cents	19.6	43.9	38.4	39.0	20.4	37.3	49.5	40.0
Feed cost/cwt gain, $	18.50	28.01	32.84	34.00	14.20	23.78	31.76	28.0

Following the drylot wintering phase, all heifers were separated into sire groups and turned into Russian wildrye pasture on April 20th. On may 25th, they were moved to crested wheatgrass pasture where they remained until they were moved to native grass pasture on July 1. Weights and gains for the pasturing phase are summarized in table 9.

On September 14 all heifers were pregnancy tested. Results the test are shown in table10.

Table 9. Weight gain on grass April 20 to September 14th (147 days)

	Hand-fed	Self-fed
Russian wildrye (April 20 – May 25, 35days)		
No. head	20	20
Initial wt., lbs.	589	628
Final wt., lbs.	653	663
Gain, lbs.	64	35
Avg. daily gain, lbs.	1.82	1.00
Crested wheatgrass (May 25 – July 1, 37 days)		
No. head	20	20
Initial wt., lbs.	653	663
Final wt., lbs.	733	744
Gain, lbs.	80	81
Avg. daily gain,lbs.	2.14	2.19
Native range (July 1- Sept. 14, 75 days)		
No. head	20	20
Initial wt., lbs.	733	744
Final wt., lbs.	806	806
Gain, lbs.	73	58
Avg. daily gain, lbs.	.97	.83
Total summer gain on grass, lbs.	217	174
Avg. daily gain- (147 days), lbs.	1.48	1.18

Table 10. Pregnancy test results on September 14th. Exposed to fertile bulls from May 3rd to August 1st.

	Self-fed	Hand-fed
No. head		
Estimated age of fetus:		
100-120 days	12-60%	6-30%
80-99 days	4-20%	8-40%
60-79 days	3-15%	5-25%
40-59 days	1-5%	1-5%

Effects of Brucellosis Vaccination on Winter Gain

Heifers in this trial were vaccinated for brucellosis with strain 19 organisms on two dates, December 4 and January 27. Winter gains were not significantly affected when brucellosis vaccinations were administered either early or late, as shown in table 11.

Table 11. Effects of brucellosis vaccination on winter gain – 1973-76

	Date vaccinated					
	Nov. 11-73	Jan. 14-74	Nov. 29-74	Jan. 28-75	Dec. 4-75	Jan. 27-76
No. head	16	16	16	15	20	20
Avg. wt. gain/hd, lbs.-						
(Nov 1- Dec 18)	68	76				
(Nov – Dec 26)			35	36		
(Dec 1 – Dec 29)					33	35
Avg. wt. Gain/hd, lbs. –						
(Nov 1 – Feb 14)	136	151[1/]				
(Nov 19- Feb 24)			127	121		
(Dec 1 - Feb 24)					122	114
Total wt. gain/hd, lbs.-						
(Nov – May 1)	221	283				
(Nov 19 – May 17)			247	239		
(Dec 1 – Apr 20)					187	175

[1/] Significant at the 5% level.

Prostoglandins For Synchronization of Estrus In Beef Cows

A cooperative trial to evaluate Prostin F2 Alpha for the control of estrus in beef cows, to permit synchronized artificial insemination, was started in June, 1976.

Prostin F2 Alpha is a prostaglandin analog, produced by the Up-john Company, Kalamazoo, Michigan. At present it is available for experimental use only.

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

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

The Upjohn Company provided the Prostin F2 Alpha used in the trial. Dr. Ed Moody, with Upjohn, palpated all cows for evidence of pregnancy, and estimated age of each fetus.

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

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

The trial involved 72 cows, 3 years old and older, randomly divided by age and calving date into three treatment groups.

Group one, designated as the control group, was handled in a normal A.I. breeding program. They were observed for estrus and artificially inseminated 12 to 14 hours following visual detection. Observation began on July 10, with first insemination made on July 12. To equalize the amount of handling in all groups, this group was run through the chutes along with the groups being treated.

Each cow in group two was treated with a 5 ml injection of Prostin F2 Alpha (5mg/ml) on June 29 and again on July 10th, starting at 8:00 A.M. They were artificially inseminated 12 to 14 hours after detection of standing heat, following the second injection of the drug.

Group three received the same Prostin F2 Alpha injections outlined for group two. Cows in group three were then artificially inseminated 80 hours after the final injection of the drug, regardless of the appearance of estrus.

Fertile clean up bulls with marking halters were turned with the cows on July 28.

On September 25 all cows were palpated for evidence of pregnancy, and the age of each fetus was estimated.

Results of the trial to date are summarized in table 12. It should be noted that in the control herd one cow was bred early and one cow dies during the breeding season. These cows are not included in the analysis.

<u>Summary:</u>

While actual calving results will not be available until the spring of 1977, on the basis of pregnancy tests it appears that treatment with Prostin F2 Alpha will permit the breeding of normal, cycling cows at a specific time, with no reduction in conception rates. In a normal 25 day breeding period, 10 percent more cows had apparently settled in the treated herd than in the control herd.

Prostin F2 Alpha appears effective in synchronizing estrus in beef cows. By eliminating the need for heat detection and reducing labor requirements necessary in a normal A.I. breeding program, it may offer a potential for more widespread use of artificial insemination in commercial beef herds.

Table 12. Results of estrus synchronization using Prostin F2 Alpha

	Group 1 Normal AI	Group 2 AI at estrus	Group 3 AI at 80 hrs.
No. of cows allotted	21[1/]	26	25
No. of cows bred –			
First 21 days	16	23	25
Not detected	3	3	--
Percent cows bred first 21 days	84%	88%	100%
<u>Results of pregnancy test on September 25, 1976:</u>			
Cows diagnosed pregnant	12 of 19	17 of 26	16 of 25
The first 21 days	63%	65%	64%
Cows diagnosed pregnant	14 of 19	21 of 26	21 of 25
After 25 days	74%	81%	84%
Cows diagnosed	19 of19	26 of 26	25 of 25
Pregnant	100%	100%	100%

[1/] One cow dies, one cow bred early. Not included in calculations.

Comparison of Hereford and Angus-Hereford Crossbred Steer Calves Under Growing Conditions

This trial is the first phase of a comparison of straightbred Hereford and crossbred Angus-Hereford steer calves under both pasture and feedlot conditions.

The trial is designed to measure differences in rate of gain and feed efficiency when steers are "roughed" through the winter at a daily rate of gain of between 1.25 and 1.50 pounds, with the intention of turning them out to pasture the following summer.

In 1973-74 two lots of 13 steers of each type were wintered for 152 days, from November 30 to May 1; in 1974-75 the wintering period of 175 days was from November 19 to May 13, and in 1975-76 the wintering period of 157 days extended from December 1 to May 6.

Table 13. Ration fed, feed consumption and cost per hundred- weight gain

	BWF Lbs./hd. Per day			Hereford Lbs./hd. Per day		
Ration as fed:	1974	1975	1976	1974	1975	1976
Oats	3.0	2.9	2.4	3.0	2.7	2.4
Alfalfa Hay	2.0	0.7	0.7	2.0	0.6	0.7
Tame hay	9.8	10.7	14.0	9.8	9.9	14.3
Mineral mix	0.2	0.4	0.4	0.2	0.3	0.4
Total feed consumed	15.0	14.7	18.2	15.0	13.5	17.8
Lbs. feed/lb. gain	12.6	10.1	12.5	10.8	10.1	11.7
Ration cost :						
Per head $	51.20	68.48	68.99	49.89	63.79	67.40
Per 100 lbs. gain$	28.39	26.96	30.09	23.70	27.26	28.27
3-Yr. avg. cost/100# gain		$28.48			$26.40	

In this ration feed costs were figured at: $4.38/cwt for oats; $40/ton for alfalfa; $30/ton for tame hay; and $9.55/cwt for mineral mix in 1974. In 1975 alfalfa increased to $50/ton, tame hay increased to $40/ton, and there were no changes in the costs for mineral mix and oats. In 1976 the only cost the differed from 1975 was oats at $4.22/cwt.

Table 14. Weight and gain, winter growing period, 1974-75-76

	BWF				Hereford			
	1974	1975	1976	3-yr. avg.	1974	1975	1976	3-yr. avg.
No. head	13	13	13		12[1/]	13	13	
Initial wt., lbs.	366	367	475	402	375	373	469	406
Final wt., lbs.	547	621	707	625	583	607	709	633
Avg. steer gain, lbs.	180	254	232	222	208	234	240	227
Difference, lbs.		+20			+28		+8	
Days fed	152	175	157	161	152	175	157	161
ADG, lbs.	1.18	1.45	1.47	1.38	1.37	1.34	1.52	1.41

[1/] One steer removed because of lameness.

Summary:

During the 1974 and 1976 feeding periods the Hereford steers gained more and were slightly more efficient than the BWF steers. The BWF steers gained more and were more efficient than the Hereford steers during the 1975 wintering period. The 3-year average favors the Hereford steers which averaged 5 pounds heavier, and were more efficient than the BWF steers resulting in an average of $2.08 less feed per hundred pounds gain. Indications are that healthy individuals of either type will perform equally well under this type of winter feeding regime.

Grass Fed Beef

Current and future differences between feed grain prices and cattle prices seem to indicate that we may be forced into a beef production system utilizing all or nearly all-roughage rations. With todays fast, efficient hay handling equipment, producing and feeding high quality hay may make it possible to produce '"grass" fat beef using only limited amounts of concentrates in the ration.

This trial is designed in three phases, the calf wintering phase, the summer grazing phase and the feedlot finishing phase, to take steer calves from weaning to slaughter.

In the wintering phase, Hereford and Angus-Hereford crossbred calves were self-fed a limited grain-high roughage growing ration to produce gains of 1.25 to 1.50 pounds per day. Actual average daily gain for the 1974-75 winter period was 1.40 pounds per head per day for 175 days. The wintering ration was composed of 20% oats and 80% chopped hay self-fed, with minerals added at the rate of 10 pounds of dicalcium phosphate and 40 pounds of salt added per ton of feed. Average feed cost per steer for the winter period was $66.13.

Gains for the first two years of the wintering phase are shown in table 15.

Table 15. Gains – calf wintering phase, 1973-74 and 1974-75

	BWF		Hereford	
	1973-74	1974-75	1973-74	1974-75
Initial weight, Nov.	367	367	374	374
Spring weight, May	552	621	583	607
Days fed	152	175	152	175
Average daily gain	1.21	1.45	1.37	1.33
Two-year ADG	1.33		1.35	

The pasture phase utilizes a three-pasture grazing system using crested wheatgrass for spring and early summer, native range in mid and late summer and Russian wildrye for fall grazing. Beginning on May 13, 1975 the steers grazed until November 25, 1975, a period of 196 days. Average daily gain for the entire grazing period was 1.13 pounds per head per day. Details of performance for the different pasture periods are shown in table 16.

Table 16. Gains, pasture phase, 1974-1975

	BWF		Hereford	
	1974	1975	1974	1975
Crested Wheatgrass				
Early May	552	621	583	606
Late June	636	689	673	675
Avg. daily gain	1.53	1.22	1.64	1.21
	1.37		1.42	
Native range				
Early September	766	818	781	808
Avg. daily gain	1.83	2.26	1.51	2.34
	2.04		1.92	
Russian wildrye				
Late November	803	852	817	823
Avg. daily gain	0.52	0.40	0.52	0.18
	.46		.35	
Total gain on grass	251	230	234	217
Grazing period	196	196	196	196
Avg. daily gain	1.28	1.17	1.19	1.10
Two-year avg.	241		226	
Days grazed	196		196	
Avg. daily gain	1.22		1.14	

At the end of the grazing period in November, the steers were allotted at random for the finishing phase into two lots, each lot made up of 6 crossbred and 6 straightbred steers. In this phase, both lots were self-fed chopped hay and minerals. In addition to the hay, one lot was fed ground oats at the rate of one percent of their liveweight until the steers averaged about 900 pounds. From pounds to slaughter, ground barley was fed at the one percent rate.

These steers were scheduled to be marketed at two slaughter weights, a light weight of about 975 pounds and a normal market weight of about 1070 pounds. This was done to provide a comparison of both lots sold under weight constant and time constant conditions. Steers were selected at random for each marketing period, when the finishing phase was begun. Details of performance for the first two years are shown in tables 17 and 18.

Table 17. Two year gain, carcass, and feed data – short fed drylot phase

	1% Grain Ration		Chopped hay ration	
	BWF	Hereford	BWF	Hereford
Initial wt.				
1974-75	799	813	781	833
1975-76	897	853	877	855
Final wt.				
1974-75	990	1013	968	1035
1975-76	970	933	982	960
Days fed				
1974-75	110	110	152	152
1975-76	50	50	115	115
Avg. daily gain				
1974-75	1.73	1.81	1.23	1.33
1975-76	1.46	1.60	0.91	0.91
Hot carcass wt.				
1974-75	550	555	511	536
1975-76	520	489	533	507
Dressing %				
1974-75	56	55	53	52
1975-76	53	52	54	53
USDA grade				
1974-75	1 ch 2 gd	3 gd	1 ch 2 gd	3 gd
1975-76	3 gd	3 gd	3 ch	3 ch
Selling price:				
	March 4, 1975		April 16, 1975	
1974-75	CH = $54.40	Gd = $50.50	Ch = $66.00	Gd = $62.00
	Jan. 20, 1976		March 25, 1976	
1975-76	Gd = $59		Ch = $55	Gd = $53
Avg. carcass value $				
1974-75	284.90	280.44	323.42	332.73
1975-76	307.00	288.31	293.33	275.97
Avg. feed cost $				
1974-75	89.03	89.03	94.73	94.73
1975-76	42.77	42.77	74.00	74.00
Return over feed $				
1974-75	195.87	191.41	228.69	238.00
1975-76	264.23	245.54	219.33	201.97

Table 18. Two year gain, carcass and feed data – long fed drylot phase

	1% Grain ration		Chopped hay ration	
	BWF	Hereford	BWF	Hereford
Initial wt.				
1974-75	818	811	813	810
1975-76	893	847	843	857
Final wt.				
1974-75	1073	1048	1035	1060
1975-76	1087	1070	1012	1008
Days fed				
1974-75	152	152	208	208
1975-76	115	115	162	162
Avg. daily gain				
1974-75	1.68	1.56	1.07	1.20
1975-76	1.68	1.94	1.04	0.93
Hot carcass wt.				
1974-75	607	591	564	563
1975-76	606	594	564	560
Dressing %				
1974-75	57	56	55	53
1975-76	55	55	56	56
USDA grade				
1974-75	2 ch 1 gd	3 gd	3 ch	3 gd
	1 pr 1 ch 1 st	1 ch 2 gd	3 ch	3 gd
Selling price:				
1974-75	April 16, 1975		June 11, 1975	
	Ch=$66 Gd=$62		Ch=$81 Gd=$73	
	March 25, 1976		May 12, 1976	
1975-76	Pr=$56 Ch=$55 St=$51		Ch=$61.50 Gd= $59.50	
Avg. carcass value $				
1974-75	391.51	366.21	457.11	411.23
1975-76	326.61	316.75	346.70	333.00
Avg. feed cost $				
1974-75	134.72	134.72	129.82	129.82
1975-76	98.37	98.37	106.83	106.83
Return over feed $				
1974-75	256.79	231.49	327.29	281.41
1975-76	228.24	218.38	239.87	226.17

Summary:

Results from this trial show that steers can be fed to acceptable carcass weights and grades on an all roughage ration.

Feeding the two lots of steers to equal weights of about 1000 pounds required sixty five more days in 1976, and feed costs were $31.23 higher for the hay fed steers. However, the hay fed steers graded higher, averaging choice while the hay and 1% grain fed steers graded good. The hay fed steers also had slightly heavier carcasses and dressed about 1% higher.

On an equal weight basis of about 1050 pounds, the long grain fed steers reached market weights 47 days earlier and yielded about forty more pounds of carcass. There was no appreciable difference between feeding treatments on grade. In this comparison feed costs were about $8.50 more per steer for the hay fed group, when hay was prices at $40.00 per ton, oats at $1.35 per bushel, barley at $2.30 per bushel and $10.00 per ton for grinding the hay and grain.

Feedlot Comparison of Hereford, Angus X Hereford, and Longhorn X Hereford Steers

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

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

In this first year of the trial, two sets of LH X H steer calves were purchased from the Harold Hanson Ranch of Reeder and the Bloom Ranch of Taylor, North Dakota. Hereford and BWF calves for comparison were either raised at the Dickinson Experiment Station or were purchased through the local auction market. At the time these calves were purchased, there was approximately a $5/hundredweight discount on the LH X Hereford steers. Calves were worked through our chutes for the usual branding, , dehorning and vaccination. All the LH X H calves were dehorned which was not so with the BWF or the Hereford calves since they were naturally polled.

The calves were all self-fed a complete mixed ration composed of 50% chopped hay and 50% oats at the start of the trial on December 1, 1975. On April 1, the oats was increased to 75% and the hay decreased to 25% of the ration. On June 15th, 15% of the oats was replaced by barley. Barley was again increased by 15% on June 28 and July 13th. Twenty pounds salt and 5 pounds of di-calcium phosphate were added per 1000 pounds of ration.

The steers were fed from December 1, 1975 until October 12, 1976 at which time they were shipped by truck to Flavorland Dressed Beef in West Fargo, North Dakota, a distance of 300 miles. The steers were sold on a grade and weight basis, with additional carcass information gathered with the cooperation of the meats department of the Department of Animal Science, NDSU.

The results of the trial are shown in tables 19 and 20.

Table 19. Feedlot data and carcass information

	BWF	Hereford	Bloom LH	Hanson LH
No. head	7	7	7	7
Period on test	All lots on trial December 1- October 12			
Days fed	316	316	316	316
Final weight	1093	1063	999	980
Starting weight	411	396	401	405
Feedlot gain	682	667	598	575
Avg. daily gain	2.15	2.11	1.89	1.81
Pounds feed/lb gain, lbs.	9.6	9.2	9.9	10.1
Cost of feed/steer, $	269.13	251.82	243.45	237.53
Slaughter information:				
Hot carcass wt., lbs.	640	628	584	580
Dressing %	58.5	59.1	58.4	59.1
USDA grade	7 choice	7 choice	6 choice	7 choice
Selling price, $	7 hd@57.50	7 hd@57.50	6 hd@57.50	7 hd@57.50
Carcass value, $	367.92	361.35	333.63	333.50
Feed consumed – lbs/steer:				
Oats, lbs.	3156	2999	2873	2864
Barley, lbs.	1048	937	943	847
Tame hay, lbs.	1871	1760	1674	1672
Alfalfa, lbs.	314	292	282	276
Di-cal, lbs.	32	30	29	28
Salt, lbs.	129	120	115	113
Total, lbs.	6550	6138	5917	5801

Table 20. Analysis of costs and returns

	BWF	Hereford	Bloom LH	Hanson LH
Cost of calf, $[1/]	164.40	158.40	140.35	141.75
Cost of feed, $	269.13	251.82	243.45	237.53
Total cost, $	433.53	410.22	383.80	379.28
Carcass value, $	367.92	361.35	333.63	333.50
Loss, $	-65.61	-48.87	-50.17	-45.78

[1/] Hereford and BWF @ $40/cwt.
Longhorn X Hereford @ $35/cwt.

Discussion:

Early in the feeding period, an outbreak of shipping fever broke out in lots at the station. Although numerous Hereford and BWF calves were treated and cured, no problems were observed in either pern of LH X H steers. Although our sample numbers were small, it does appear that this LH X H cross is hardy and at least in this instance showed some resistance to disease.

Summary:

The LH X H steers gained about 0.2 of a pound slower than either the Hereford or BWF steers. Feed efficiency was lower with the LH X H steers, although total feed costs per head were about $25 cheaper than with either the Hereford or BWF.

A look at the carcass information shows that the LH X H steers graded essentially the same as the Hereford or BWF and had identical dressing percentages.

The total economic picture shows the LH X H steers equal to Herefords and slightly better than the BWF used in this trial based on the prices used.

Additional work will be carried out to see if these results will continue to hold true.

Feedlot Performance Comparison of Bulls & Steers

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

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

In this first year of the trial, weaning bull and steer calves of either Hereford or Angus X Hereford breeding were allotted and started on trial on December 1, 1975. The bull calves were all purchased, and we found it difficult to find as uniform a group as we would have liked, because of lack of numbers on the market. The steers were mostly from the Station herd, with a few purchased animals added. All groups, steers and bulls, were treated as uniformly as possible with regard to vaccinations, feeding, weighing and handling. The animals were shipped for slaughter when they reached average lot weights of 1050-1100 pounds. The calves were all self-fed a mixed hay and grain ration including minerals according to the schedule shown in table 21.

The cattle were shipped by truck to FLavorland Dressed Beef in West Fargo, North Dakota for slaughter. They sold on an individual grade and weight basis. Additional carcass information was gathered with the assistance of the meats department, Department of Animal Science, North Dakota State University.

<u>Discussion:</u>

The bulls were heavier at the beginning of the trial because of difficulty in obtaining them. They gained at a faster and more efficient rate than did the steers, and were ready for market 85 days earlier than the steers. Both bulls and steers handled equally well.

The bulls graded USDA stag, since there was no established market for “ bullock” grade. However, since these “bullock” carcasses did not show the coarseness usually associated with bull beef, they should have been very acceptable from the consumer viewpoint, according to meats department personnel of the Department of Animal Science, North Dakota State University.

<u>Summary:</u>

The Hereford bulls gained .29 pound/day faster, and the BWF bulls .35 pound/day faster than their steer counterparts. Feed efficiency also favored the bulls.

The bull carcasses had less waste fat in the kidney area, approximately 0.5 inches less back fat, and about 3 square inch larger loin eye.

Although the bull carcasses sold for $5.5/cwt less than the steer beef, on the basis of carcass value less feed costs the bulls returned almost $35.00 more per head than the steers.

Results of this trial indicate that "bullock" beef production is a method that can very well increase feedlot efficiency.

The trial will be continued in the 1976-77 feeding period with calves of more uniform starting weights and breeding.

Table 21. Rations as fed to bulls and steers

Ration	#1	#2	#3	#4	#5
Date started	Dec. 1	March 4	June 15	June 28	July 13-Finish
Ingredients – lbs.					
Oats	500	750	600	450	300
Alfalfa	50	50	50	50	50
Tame hay	450	250	200	200	200
Barley	--	--	150	300	450
Di-calcium	5	5	5	5	5
Salt	20	20	20	20	20
Total	1025	1025	1025	1025	1025

Table 22. Average feed consumption per head per day

	Pounds feed consumed per head per day			
Ingredients:	BWF bulls	Hereford bulls	BWF steers	Hereford steers
Oats	11.9	12.8	9.98	9.49
Alfalfa	0.89	1.0	0.99	0.92
Tame hay	6.18	6.13	5.92	5.56
Barley	0.71	0.87	3.31	2.96
Di-calcium	0.09	0.10	0.10	0.09
Salt	0.39	0.41	0.40	0.37
Total	20.16	21.31	20.70	19.39

Table 23. Feedlot performance comparison of bulls and steers

	BWF bulls	Hereford bulls	BWF steers	Hereford steers
No. of head	5[1/]	6	7	7
Period on test	Dec 1-July 19	Dec 1-July 19	Dec 1-Oct 12	Dec 1-Oct 12
Days fed	231	231	316	316
Slaughter wt., - (live), lbs.	1056	1098	1093	1063
Starting wt., lbs.	477	542	411	396
Gain in feedlot,- Lbs.	579	556	682	667
ADG, lbs.	2.50	2.40	2.15	2.11
Feed/100# gain	805	884	960	920
Cost of feed/hd,$	186.29	198.46	269.13	251.82
Cost/100# gain, $	32.17	35.69	39.46	37.75

[1/]One animal removed.

Table 24. Slaughter data comparison of bulls and steers

	BWF bulls	Hereford bulls	BWF steers	Hereford steers
Hot carcass wt, lbs.	611	658	640	628
USDA grade	5 stags	6 stags	7 choice	7 choice
Carcass value/cwt., $	52.00	52.00	57.50	57.50
Total carcass value, $	317.93	341.99	367.92	361.35
Dressing %	57.9	59.9	58.5	59.1
Kidney knob, lbs. est.	12.6	17.0	23.2	19.7
Loin eye, sq. inch	13.84	13.88	10.77	10.68
External fat thickness	0.27	0.27	0.94	0.74
Carcass value, less Feed cost, $	131.64	143.53	98.79	109.53

Comparison of Beef and Dairy Steers on Self Fed High Energy Fattening Rations

This trial was started in 1974 at the request of the North Dakota Milk Producers Association to study the management steps and feed requirements necessary to produce acceptable dairy beef, and to compare the economics of feeding dairy steers and beef steers.

Hereford and Holstein steers weighing about 420 pounds were started on a self-fed ration of oats, tame hay, alfalfa and minerals. After the steers reached an average of 650 pounds, barley was gradually substituted for oats until barley made up 60% of the total grain in the ration.

The Hereford steers and half of the Holstein steers were slaughtered at an average weight of about 1050 pounds. The remaining Holsteins were slaughtered when they weighed between 1175 and 1200 pounds.

Average feed consumption for the 1975-76 feeding period is shown in table 25. Average results for three feeding periods, from 1974 thru 1976 are summarized in table 26.

Summary:

Feeding either beef or dairy steers on a high energy fattening ration has not been a paying practice over the three year period of this trial.

Dairy steer calves were bought for $12.50 to $19.00 per hundred-weight less than beef steer calves, and with this kind of market spread in purchase price dairy steers can compete favorably with beef steers when both are fed to finish weights of 1050-1100 pounds.

After dairy steers reached weights of 1050-1100 pounds, both rate of gain and feed efficiency declined.

With the revised grading system placing less emphasis on conformation and more emphasis on rib eye marbling, well fed dairy steers are able to grade very well.

Bothe beef and dairy steers performed well in the feedlot in all three years of this trial, with no noticeable difference in sickness or other feedlot problems between breeds.

Table 25. Average feed consumption for steers fed from December 1, 1975 to August 24 or October 12, 1976.

	Hereford steers Sold Oct 12, 1976	Holstein steers sold Aug 24, 1976	Holstein steers sold Oct 12, 1976
	Average pounds feed per day		
Oats	10.8	12.7	11.9
Barley	3.0	2.0	3.3
Alfalfa	0.9	1.0	1.0
Tame hay	4.4	4.8	4.8
Di-cal	0.1	0.1	0.1
Salt	0.4	0.4	0.4
Total	19.6	21.0	21.4

Table 26. Weights, gains and return for beef bred and dairy bred steers – 3 year average

	Beef steers	Dairy steers	Dairy steers heavy
Initial wt., lbs.	428	448	437
Final wt., lbs.	1076	1088	1165
Gain, lbs.	647	640	728
Days fed	311	295	367
ADG, lbs.	2.09	2.18	2.0
Hot carcass wt., lbs.	637	634	676
Dressing %	59.0	57.3	57.9
USDA grade	76% choice	50% choice	57% choice
	23% good	40% good	38% good
		10% standard	5% standard
Avg. carcass value, $	393.25	374.77	379.02
Initial cost, $	181.91	125.90	123.58
Feed cost/hd., $	242.87	246.64	319.88
Total cost, $	424.78	372.54	443.46
Return, $	-31.53	+2.23	-65.44

Rumensin In High Roughage Fattening Rations

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

In this trial, two pend of straightbred Hereford steer calves of similar background were randomly allotted on February 10, 1976. Both pend were hand fed 4 pounds ground oats per head per day, and were self-fed chopped mixed hay consisting of approximately 20% alfalfa and 80% tame grass. Both lots were also self-fed a mineral mixture free choice.

In addition, one lot received 150 mg per head per day of Rumensin (monensin sodium) in the ground oats until May 22ns, at which time the level of Rumensin was increased to 200 mg per head per day. The Rumensin fed steers averaged about 610 pounds at this time. On October 13th, ground barley was added to the ration at the level of 3 pounds per steer per day.

The results of this trial after 274 days on feed are shown in table 27. The steers will continue on feed until they reach live weights of 1050-1100 pounds, at which time they will be slaughtered and carcass information gathered.

Summary:

Although no serious problems have been encountered with the use of this additive, the calves were somewhat reluctant to accept the ration for the first three or four days.

To date, the steers receiving Rumensin apparently have outgained the control steers. They have also required less feed per pound of gain, resulting in a lower cost.

A complete report on this trial will be available on request after February 1, 1977 and will be published in the 1977 Livestock Research Roundup handbook.

We would like to thank Elanco Company for the Rumensin used in this trial and Dr. William Dinusson for assistance in designing the trial.

Table 27. Weights, gains and feed cost to date. Rumensin feeding trial

	Rumensin	Check
No. head	7	7
Days fed (Feb 10-Nov 10)	274	274
Initial wt., lbs.	411	406
November wt., lbs.	911	861
Feedlot gain, lbs.	500	455
ADG, lbs.	1.82	1.66
Feed/pound gain, lbs.	9.41	10.00
Feed cost/cwt gain, $	28.83	30.82
Feed/head/day, lbs.	17.13	16.62
Feed cost/head/day, $ [1/]	0.526	0.513

[1/] Feed costs do not include cost of Rumensin or minerals. At this writing, cost of Rumensin at 150-200 mg per head per day should not exceed 2 cents per head per day.

Backgrounding of Finishing as Feeding Alternatives

There is a difference of opinion among North Dakota stockmen with regard to the net income that can be derived when calves are handled in a backgrounding program and marketed as feeders, weighing 700 to 800 pounds, compared to calves finished for slaughter. Some stockmen, because of the circumstances under which they operate, may not be able to hold their calves any longer than late winter or early spring, at which time they want to market at the top price for feeders. For those who could feed a greater length of time and utilize more cheap feed the question arises as to whether or not marketing as feeders will bring a greater income than those finished. There also is the question as to whether or not top market price is received for feeders when fed a good gaining ration up to 750 pounds. Some livestock men believe that calves fed a good gaining ration will carry too much condition to bring top market price as a 750 pound feeder, and that those sold as feeders cannot be fed a ration for good gains.

Little work has been done on this method of handling calves when fed for good gains either to be marketed as feeders or when finished for slaughter. Some reports indicate that the income for feeders up to 700-800 pounds will not be less if a ration is fed that gives a good gain resulting in growth along with additional condition. Others report that the increased weight which is cheaper because of faster gains will off-set the higher price that may received for an animal which has made slower gains and has more frame and less condition.

This trial was designed to compare the economics of backgrounding program with a finishing program for the North Dakota calf producer. Calves averaging 400-425 pounds were randomly assigned to be backgrounded at either a moderate or high level of energy, and when the calves averaged 700-750 pounds half of them were randomly selected to be sold while the remaining steers were finished as a high level of energy to slaughter weights.

The results of this year's trial and the three year averages have been summarized in tables 28 through 31.

<u>Summary:</u>

In 1974 expenses were much to high in relationship to selling price which resulted in a net loss for both backgrounding and finishing. In 1975 a more favorable balance resulted in a net above feed and calf costs for all feeding and marketing alternatives. This year calves backgrounded as a moderate level of gain produced less expensive gains resulting in an average $6.67 higher return. Finishing, during 1976 resulted in a net loss regardless of the backgrounding type, however, those calves backgrounded at a moderate level of gain and then finished at maximum level of gain yielded a net loss that was $11.00 less than the loss sustained under the heavy feeding regime.

Backgrounding at a moderate level of gain, when compared over the last three years, has resulted in an average net profit of $16.96 as compared to $2.28 when fed for maximum gains, and in addition, the moderate level of feeding has produced calves that are well framed, and carry only a moderate amount of condition.

Finishing at a high level of energy following backgrounding at a moderate level of energy resulted in a three year average net loss of $23.05 per head as compared to a net loss of $37.68 when a high level of energy was fed during both backgrounding and finishing.

Table 28. Backgrounding feed consumption and costs when fed at two levels of gain – December 1- April 29, 1976

Ingredients	Moderate	Heavy
Days fed	149	149
ADG, lbs.	1.83	2.15
Oats, lbs.	4.8	11.5
Alfalfa, lbs.	0.8	0.8
Mixed hay, lbs.	11.1	4.0
Di-cal phosphate, lbs.	0.08	0.08
Salt, lbs.	0.32	0.32
Total/hd/day, lbs.	17.10	16.70
Feed cost/lb., $	.03241	.04241
Feed/lb. gain, lbs.	9.34	7.77
Feed cost/cwt gain, $	30.27	32.95
Total feed cost/hd, $	82.33	102.80

Table 29. Backgrounding at two levels of gain – weight gains, returns and expenses – 1976 and 3 year average

	Dec 1 – April 29, 1976		3 Year Average	
	Moderate	Heavy	Moderate	Heavy
No. head	10	10	10	10
Days on feed	149	149		
Initial wt., lbs.	418	425	430	430
Final wt., lbs.	690	737	675	715
Gain, lbs.	272	312	245	285
ADG, lbs.	1.83	2.15		
Returns/hd @$41.40/cwt	285.66		264.88	271.21
@$41.00/cwt		302.17		
Expenses:				
Calf cost/hd, $	160.93	163.63	181.90	182.80
Feed cost/hd, $	82.37	102.85	66.02	86.13
Total expenses, $	243.30	266.48	247.92	268.93
Net gain/loss, $	+42.36	+35.69	+16.96	+2.28

Table 30. Finishing feed consumption and costs following backgrounding at two levels of gain, April 29-October 12, 1976

	Moderate	Heavy
Days fed	166	166
ADG, lbs.	2.34	1.93
Oats, lbs.	10.5	10.2
Alfalfa, lbs.	1.2	1.1
Mixed hay, lbs.	5.8	4.3
Barley, lbs.	6.4	5.9
Di-cal phosphate, lbs.	0.12	0.11
Salt, lbs.	0.48	0.42
Total daily consumption, lbs.	24.50	22.03
Feed cost/lbs, $	.04254	.04365
Feed/lb gain, lbs.	10.47	11.41
Feed cost/cwt gain, $	44.54	49.80
Total feed cost/hd, $	173.26	159.36

Table 31. Finishing weight gains, returns and expenses – 1976 and 3 year average

	April 29- Oct 12, 1976		3 Year average	
	Moderate	Heavy	Moderate	Heavy
No. head	10	10	10	10
Days on feed	166	166	176	176
Initial wt., lbs.	683	728	673	706
Final wt., lbs.	1072	1048	1045	1076
Gain, lbs.	389	320	372	370
ADG, lbs.	2.34	1.93	2.11	2.10
Returns:				
Avg. carcass wt., lbs.	635	630	618	639
Carcass grade	10 choice	10 choice	73% choice	77% choice
Dressing %	59.2	60.1	59.1	59.5
Avg. carcass value, $	365.13	362.25	379.98	394.36
Expenses:				
Calf cost, $	159.39	160.93	181.39	181.91
Feed cost, $	255.66	262.25	221.64	250.13
Total expenses, $	415.02	423.18	403.03	432.04
Net profit/loss, $	-49.92	-60.93	-23.05	-37.68

Calf Shelters

Calf shelters of one kind or another have been used by cattlemen for a long time, and many plans and designs are available from various sources.

Shelters used at the Dickinson Experiment Station are effective simple and easy as well as economical to build. This shelter shown in figure 1, is a balloon frame shed designed to utilize full 4’x8’ plywood sheets wherever possible, reducing cutting and fitting to a minimum.

Plans and specifications for this shelter are shown in figure 2. Briefly, it is eight feet square, five feet high at the open front, four feet high at the back, has a 2x6 positioned across the front to keep cows out, the entire unit riding on 4x4 skids beveled on both ends. Design considerations included maneuver-ability and sunlight penetration. Its relatively small size permits it to be easily moved by one man when wind direction changes occur. The shallow depth of eight feet permits sunlight penetration nearly to the back wall, enabling calves to lay in the sun and still be protected from the cold wind. No shelters have been blown over by wind in two years use. However, any operator concerned about this possibility could anchor the shelter with steel pins driven into the ground, and attached to the skid drag chains.

This size shelter will comfortably accommodate twelve to fifteen calves, and has been found very satisfactory, especially when used in combination with the slotted board fence shelter for the cow herd.

Calf shelters must be properly managed to avoid problems with scours. A shelter should never be bedded a second time in the same location. One of the advantages for smaller shelters is the ease with which they can be moves to new ground, making it easy to keep them clean and sanitary.

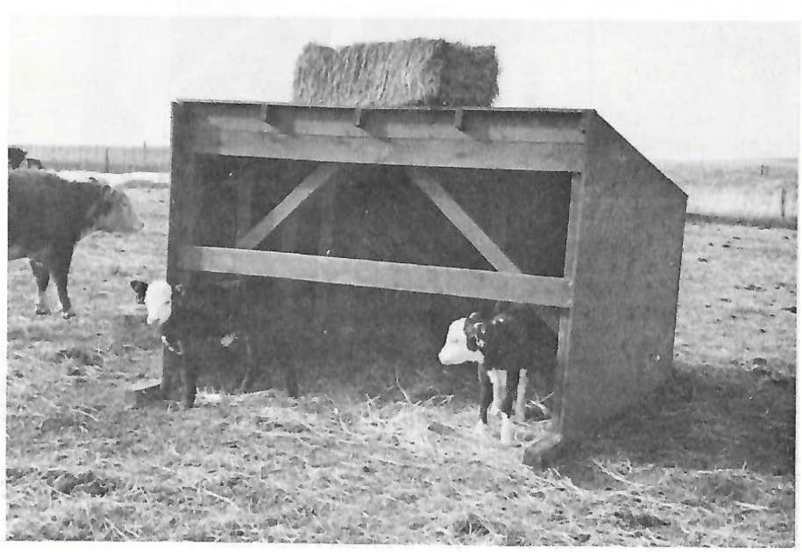
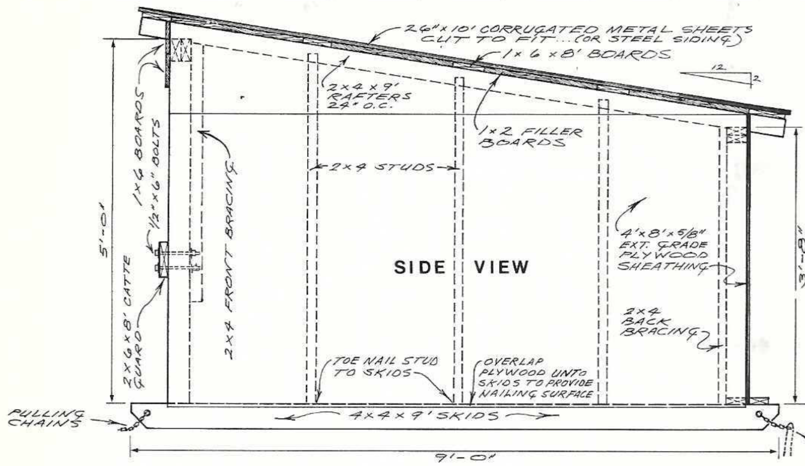
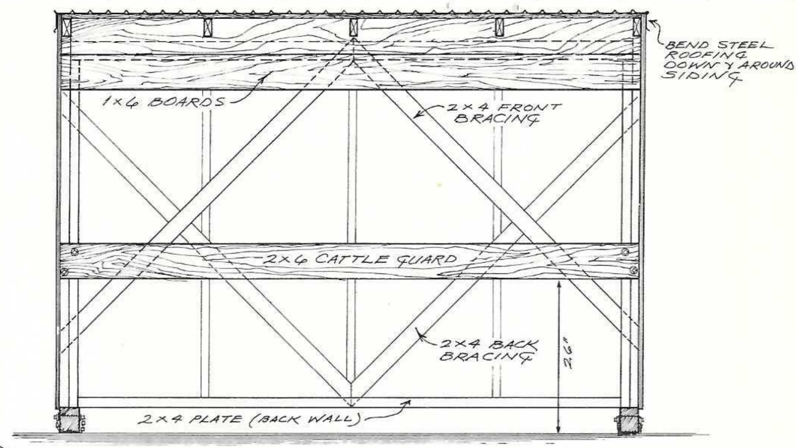


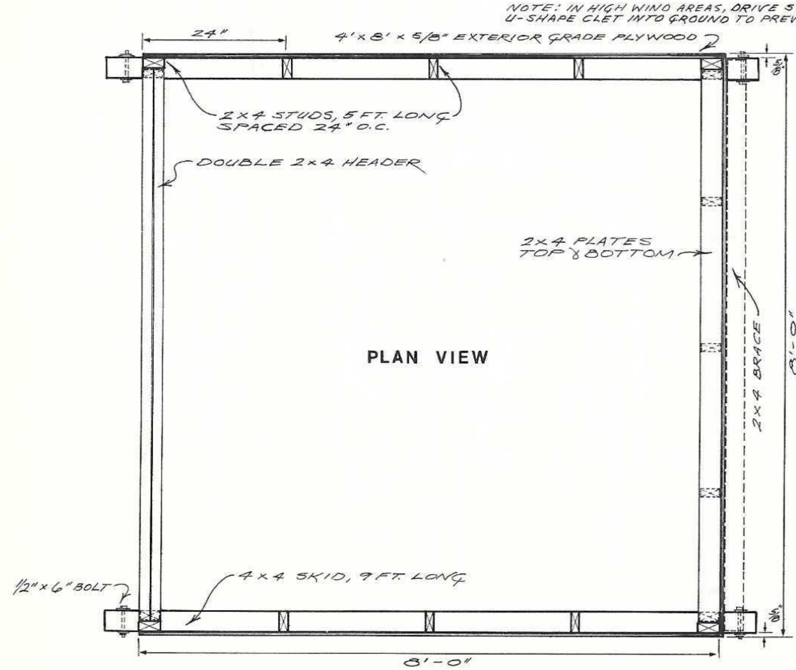
Fig. 1

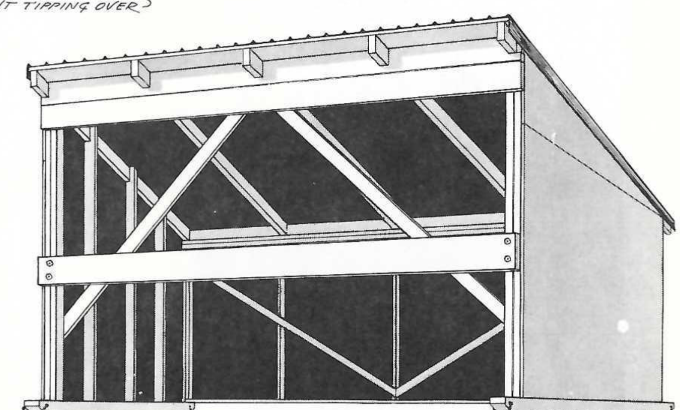
Calf shelter used at the Dickinson Station.





NOTE: IN HIGH WIND AREAS, DRIVE STEEL U-SHAPE CLET INTO GROUND TO PREVENT TIPPING OVER





PERSPECTIVE VIEW

Materials List

2 . . . 4 x 4 x 9' SKIDS
17 . . . 2 x 4 x 5' STUDS
5 . . . 2 x 4 x 9' RAFTERS
5 . . . 2 x 4 x 8' PLATES
4 . . . 2 x 4 x 6' BRACES
5 . . . 1 x 6 x 8' BOARDS
8 . . . 1 x 2 x 18" FILLER BOARDS
1 . . . 2 x 6 x 8' GUARD RAIL
4 . . . 4 x 8 x 5/8" EXTERIOR PLYWOOD
4 . . . 26" x 10' METAL ROOFING
8 . . . 1/2" x 6" BOLTS
4 . . . 16" PULL CHAINS

NAILS . . .
16 LBS. FRAMING NAILS (20d)
6 LBS. GALV. NAILS (6d)
2 LBS. GALV. ROOFING NAILS/LEAD WASHER
PAINT OR STAIN

Straw For Wintering Beef Cows
W.E. Dinusson

By-products from the production of agricultural crops are now, and have been for centuries, used as feeds for livestock. Straw and chaff from the cereal grains are no exception. In an old edition (1936) of Feeds and Feeding, Morrison stated, "Straw from the small grains is satisfactory as the chief feed or even as the only roughage for wintering beef breeding cows or young cattle over a year of age, if it is properly supplemented." In this statement what constitutes a "supplement?" Thus, misinterpretations of this statement were frequent.

Was the "straw" prior to 1936 the same as the straw of today? What changes have taken place in the last 40 to 50 years which may have affected the feeding value of straw? Probably the biggest change was a change in harvesting methods. The straws of today picked up by a baler usually do not have weed seeds, broken kernels, etc., so common in the straw stacks nor is the straw broken up as much by the combine as was the case with the old threshing machines. Even the chaff from chaff savers is different from the chaff found at two sides of the straw stack. The grains were usually cut on the "greener" side and let mature in shocks which preserved more of the leaves and weeds which accumulated in the straw pile.

A second major difference is the use of herbicides to control weeds. Many of the weeds common in cereal grains did have considerable nutrient value which tended to "supplement" the missing nutrients in the straw. Other differences are varieties. Cereal plant breeders are looking for and incorporating characteristics into the grains which tend to increase yields and ease of harvesting. What effect does the shorter, stiffer straw have? If increased straw strength is obtained, it is likely that there would be an increase in lignin which is not only indigestible but also reduces the digestibility of the cellulose part of the straw. Further, increases straw strength and reduced shattering permits the crop to stand until more mature before swathing or even straight combining and this would result in lower digestibility and lower nutritional value. Does increased resistance to disease in these crops result in an affect on nutritive value? Probably, because if the plant is more resistant to bacterial or fungal invasion, it is likely to also resist the ruminal bacterial action.

The trend toward rough-awned or bearded cereal grains to permit the swaths to stay on top of limited stubble may also cause problems when chaff savers are used. The rough beards have been known to cause sores and abscesses in the mouth and throat region when bearded cereal grains were cut for hay when overly mature. How much of a problem this would be when chaff savers are used remains to be seen.

Should plant breeders pay attention to possible feeding value of these by-products. Probably not at this time, because of economic considerations. In some countries of the world where the straws are a major feed for livestock this is considered, but the production from the cattle fed these by products as the major feeds is much below that demanded from livestock here.

What are the merits as well as weaknesses of straw as feeds for cattle and sheep. Table 1 presents some data found in textbooks and tables of feed composition. Many of these values were obtained 40 to 50 years ago and may not be a true estimate of the straws and chaffs of today. A couple of hays are included for comparisons. The NRC requirements for wintering pregnant beef cows are also listed. These percentage requirements are based on intakes of 1.8 to 2 pounds of ration per 100 pounds live weight.

Table 1. Straws and Chaffs
(as fed basis)

	TDN %	Protein %	DIG.PROT. %	Crude Fiber %	Phos. %
Alfalfa hay (med bloom)	51	16.5	11.4	26.8	.20
Prairie hay (cut early)	47	7.8	2.2	28.5	.17
Crested Wheat (cut early)	52	9.7	5.7	29.3	.13
Wheat Straw	43	3.2	0.4	37.1	.07
Wheat Chaff	37	5.1	0.8	29.8	.14
Oat Straw	46	3.8	1.1	36.3	.09
Oat Chaff	34	5.0	1.0	26.0	.30
Barley Straw	38	3.6	0.7	36.2	.09
Rye Straw	28	3.0	0.0	42.4	.09
Wintering Cow Requirements	47	5.4	2.5	-----	.16

A quick look at this table shows that as the only feed, only the hays have enough usable energy and because of the poor apparent digestibility of the protein, only two of the hays would meet the needs for digestible protein. One other fact is evident – either alfalfa or crested wheat hay cut early as 1/3 to ½ of the ration with most of the straws making up the rest of the ration would meet the requirements for wintering cows – at least up to the last month to 6 weeks of pregnancy.

It can be seen from these values that it's a toss-up which is more limiting – usable energy (TDN) or digestible protein. Unless minimum maintenance requirements are met, than any protein supplement, such as soybean oil meal, would be used for energy purposes. On the other hand if protein (nitrogen) is seriously lacking the energy would be poorly digested and utilized. This will be mentioned later in relation to the effect on voluntary intake. Straws can never be depended upon to supply vitamin A. Certainly following a dry year where cattle have grazed dry, dead grass for most of the fall, with no green regrowth, this could bring on a vitamin A deficiency and vitamin A should be included in the supplement unless the hay portion is exceptionally green and leafy. Neither can rations based on straw be depended on to supply phosphorus or trace minerals. Therefore a good salt-mineral mix should be available to provide phosphorus and trace minerals.

With all of its nutritional short comings, why is straw included in wintering rations? The reason is that straw, as a part of the ration, can be utilized to provide the heat necessary to maintain body temperature. It is well known that the poorer the roughage the greater is the heat increment. Heat increment is the amount of heat given off during the eating, digestion and metabolism of feedstuffs.

Thus if some feed is given to provide additional energy and protein the straw can be used as the rumen "filler" and provide the heat which is so necessary.

In addition to the reasons just mentioned, there is another factor to be considered when trying to winter cows on straw alone. The cows can't eat enough to meet their requirements: Research has shown that when cows are fed average to good grass hay they can eat about 2 to 2.2 pounds per 100 pounds of body weight. When fed straw alone, they can eat only 1 to 1.5 pounds per 100 pounds body weight daily (with excellent quality chopped straw intake might be slightly greater). Feeding some protein (nitrogen) may increase intake a bit, but some additional source of energy is also needed. Why is this? With low energy feeds, intake is limited by capacity of the rumen and digestive tract. In the case of straw the rate of digestion is much slower than for a better quality roughage. For example, had the cows been fed all the crested wheat hay referred to in Table 1 that they could eat, they would have consumed over 2 pounds per 100 pounds body weight. It would have taken 55 to 70 hours for any given feeding to be digested and the orts excreted. In the case of wheat straw alone, intake would have been about 1.3 pounds per 100 pounds of body weight and the transit time through the digestive system would have been 90 to 110 hours. In the case of the rye straw, had it been fed as the only feed, intake would have been less than one pound per hundred pounds, and impaction would have resulted. In fact, when roughages contain less than 35% TDN, cattle will hardly consume them unless forced by starvation or extremely cold weather. This brings up another factor. Cold weather stimulates a cow's appetite and will temporarily increase feed intake. Cold will also cause a reduction in less effect in March than it did have in November, it still has to be considered. Reports from the field have shown that cows have been wintered on poor quality roughages during mild weather only to have impactions following a real drop in temperature.

Can straw be used to advantage in rations for wintering cows? Some recent research sheds some light on how to use straw to the best advantage. In 1965 the Dickinson Station initiated some research on the use of straw. The rations used were 20 pounds of crested-bromegrass hay plus minerals compared with 7 pounds crested-bromegrass, one pound soybean oilmeal, and wheat straw free-choice, plus the same mineral mix. After the first year, because of waste, the straw was chopped and self fed. Chopping the straw also resulted in increased intake. About February 1 each year, both lots received two pounds of barley plus 10,000 I. U. of vitamin A per head per day. About March 15, the straw and soybean oilmeal were removed and hay increased to 20 pounds. Calving started the last week of March. Grain was also fed during lactation until cows went on pasture. Table 2 summarized the average of 4 years data. The straw consumed averaged 10.5 pounds per day.

Table 2. Straw Vs. Hay for Cows
(Four Year Summary)

	Hay Lot	Hay & Straw Lot
Cows No. (avg/year)	46.5	46.5
Initial wt. (Dec) lb.	1064.1	1060.3
Wt. (May) lb.	998.5	968.3
Difference lb.	-66.7	-92.0
Fall Wt. (Oct) lb.	1117.9	1100.5
Summer gain, lb.	119.5	132.2
Wt. Change (Dec-Oct) lb.	52.8	40.2
Calf birth wt., lb.	72.3	71.3
Calf weaning wt., lb.	378.1	376.7
Conception rate (3 yrs) (Cows and Heifers)		
First Cycle	27	27
Second Cycle	12	10
Third Cycle	5	5

In these trials the beef cows wintered on the hay rations lost weight in two of the four years, while those receiving one-third hay and two-thirds straw lost weight every winter. Average calf birth weights and weaning weights were essentially the same. Conception rates were about the same for both groups.

In another series of trials, straw was used in rations for wintering beef cows where two types of protein supplementation was tested, biuret vs. soybean oil meal. In the first years work the rations were about 7 pounds crested brome hay, 12 pounds of chopped wheat straw (fed free choice) and one pound of barley for the first 68 days, increased to 3 pounds per head for the least 45 days. The cows gained an average of one-third pound per day for this period with no observable difference in calf birth weights. In the second trial, crested brome hay was fed at a level of 5 pounds per head daily and chopped out straw fed free choice, plus one pound of barley per head daily and protein source plus minerals. The straw consumption for this trial was 15.4 and 16.8 pounds for the soybean oil meal and Kedlor lots respectively. The gains were about half a pound and a quarter pound daily for the cows, with no appreciable difference in calf birth weights. In the third trial similar rations were fed to the two groups except the out straw was fed in the long form and barley was not fed until the last 17 days at the rate of 2 pounds per head daily. The straw consumption amounted to about 14 pounds daily for each lot. In this experiment, they lost over a pound a day in the Kedlor treatment and 0.84 pounds in the soybean oil meal group. There was little difference in calf birth weights. Apparently there was lack of energy intake and the cows could not consume enough straw when it was fed in the long form.

In the third series of experiments at the Dickinson Experiment Station on the use of straw in rations for wintering beef cows mixed brome-crested hay was compared to a 50:50 mixture of brome-crested hay and oat straw. Both rations were fed in the long form with no supplemental protein. The hay appeared to have a high enough crude protein to provide the minimum protein needed. The rations were fed for about 60 days, starting about December 1, after which the straw was replaced with hay and supplemental grain feeding (one pound rolled barley per head per day) was fed to both groups. This was fed for 30 days until calving at which time the cows calving were moved to another lot and fed two pounds of oats, plus all the hat they would consume. A salt-mineral was available at all times.

The roughage intake was about 21.5 pounds per head daily, with the hay-straw lot eating a little less. A 3-year average shows that the hay fed lots gained about half a pound per day for the 60 day period on roughage alone, whereas the hay-straw fed lots maintained their weights. Birth weight of calves were similar between lots.

Another interesting observation in these trial, was the production of native dead grass or stubble aftermath when grazed from about November 1 to December 1. In all three years the cows lost weight during this period, even though supplemental protein blocks were provided. In fact, the average loss over the 3 years was over a pound a day per cow. Thus the average total loss of weight during the grazing period of 30 days was greater then the 60 day loss, even for those cows receiving half their ration as oat straw.

In the experiments just reviewed, although not designed to effectively measure the effect, the data suggests the first and second calf heifers should be in good condition in the fall if they are to be wintered on even 50 percent straw in their rations.

In the last couple of Feeder's Day Reports from the University of Alberta, research on the feeding of straws is reported. In a trial to measure the voluntary intake of oat straw was over 18 pounds per head daily and was not affected significantly by the various supplements fed or small changes in the fineness of chopping. Three, five or seven pounds of a grain and/or protein supplement resulted in gains of 0.8 to 1.18 pounds for the first 68 days of the wintering period. In the last month of the trial, gains of the cows were less and mixing a pound of molasses with the days feeding did not improve intake of straw appreciably not did the addition of a liquid sugar-urea mixture.

In continuing studies the following year, cows were wintered for 98 days on rations containing from 78 to 94% barley straw. Three physical forms of ration were used, pelleted, chopped or ground. In addition, three levels of protein were used and different amounts of barley grain was fed. All rations were adequately supplemented with minerals and vitamins. The cows fed the pelleted rations ate more (over 23 pounds per head per day) and gained more (0.9 lbs per day) than those receiving the ground rations (21 pounds and gain of 0.55 pounds per day) or those fed the chopped rations (20.5 lbs with gains of 0.42 pounds per day). There was little difference in feed intake with the different protein levels but the gains increased with each increase in protein level. The voluntary feed intake of the pelleted diets increased from 21.3 to 28 pounds per day as the percentage of straw was decreased from 94 to 78% of the pellets. However, the intake of straw remained relatively constant.

The researchers at Alberta started another experiment for further evaluate high level of straw in beef cow rations. In the previous experiment two cows had died. They had also been individually fed to measure feed wastage as well as intakes. To further check on group feeding of high straw rations, in this experiment, seven different rations containing different levels of protein and 85 to 100 percent straw were used. The cows fed the 100 percent straw diet were given 2 pounds of rapeseed meal per head daily for the first 10 days of straw feeding. The Bonanza barely straw used in this experiment was either fed from the bale or, in some lots, chopped. Minerals and vitamins were provided in all treatments.

After about 50 days on test, one of the sheds burned down and 4 of the 7 treatments had to be discontinued. However, some very interesting observations were made. Daily feed consumption for the 100% straw ration (supplemented with mineral and vitamins) was less than 15 pounds per head per day and the loss in weight was one-third pound per day. In addition, four cows on rations containing less than 15% concentrate (grain plus protein supplement) died of abomasal impaction. Three other cows showed problems and were removed from their pens and given limited hay for one to 3 days and recovered. In this experiment, chopping the straw did not increase intake but there was about 15% less waste of straw over that fed in long form.

From reviewing these and other experimental results some preliminary conclusions can be drawn:

1) Straw, even when supplemented with minerals and vitamins, should not be the only feed for wintering cows.
2) Straw can replace up to two-thirds of the hay, if supplemented with minerals and vitamins.
3) If the hay is a good quality (above 10.5 percent crude protein) additional protein supplementation should not ne necessary for wintering beef cows.
4) If the one-third hay is only fair to poor quality and less than 9% crude protein, additional supplementation with protein source is recommended.
5) Chopping of the straw will usually increase intake and reduce waste. Grinding straw (less than three-fourths inch lengths) is of questionable value.
6) With rations of straw and grain, or grain-protein-mineral-vitamin mixed, a minimum of three pounds of the concentrate needs to be fed to minimize difficulties from impaction and other heath related problems.
7) Two and three year old heifers and cows do not appear to get adequate nutrition on rations containing one-half to two-thirds straw when fed in competition with older cows.
8) Additional research is needed to find ways to more effectively use straw in beef cow rations

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

A study designed to evaluate the economics of selling market hogs on a grade and yield basis as compared to selling at a local buying station was initiated at the Dickinson Experiment Station in the 1975-76 winter season.

In this economic study, market barrows from the station were randomly assigned to be marketed at either the Hormel and Company plant, Mitchell, South Dakota or Western Livestock Company, Dickinson, North Dakota. The project called for one group to be sold on March 4th, and a second group on October 1st. Inclement weather during the first week of March, caused the scheduled March 4 selling to be delayed until March 12th.

On March 12th, thirty six market pigs were weighed, and shipped to the Hormel and Company plant at Mitchell, South Dakota, a distance of 450 miles. The average weight of the 36 pigs at Dickinson was 242.5 pounds. Upon arrival at Mitchell, the 36 pigs averaged 237.6 pounds. The average shrink of 4.9 pounds per head amounted to 2.02 percent. At Mitchell, the pigs were provided with shelter, feed, and water until being slaughtered, approximately sixty hours after leaving Dickinson.

Pigs marketed on October 1st averaged 223.1 pounds per head at Dickinson and on arrival at Mitchell their average weight was 215.2 pounds per head. Loss in transit of 7.9 pounds per head amounted to an average shrinkage of 3.5 percent. On arrival in Mitchell, after eight hours hauling time, the pigs stood and additional five hours before starting to the kill floor.

Dickinson weights, destination weights and percent shrinkage for liveweight marketing method are shown in table 1.

Table 1. Weight summary – pigs sold grade and yield vs. local marketing

Method of Marketing	Grade & Yield		Local market	
Date marketed	March 12	Oct. 1	March 12	Oct. 1
No. of head	36	28	19	7
Total Dickinson wt., lbs.	8729	6247	4459	1653
Avg. wt./pig, lbs.	242.5	223.1	234.7	236.1
Total wt. at desti-Nation, lbs.	8555	6025	4459	1620
Total shrink, lbs.	174	222	--	33
Shrink/pig, lbs.	4.9	7.9	--	4.7
Percent shrink	2.02	3.5	--	2.0

Those pigs selected for local marketing on March 12th were weighed and hauled directly to the local buying station at Western Livestock Company. Since the Experiment Station is located two miles from the local buying station no measurable shrinkage was experienced. Therefore, pigs marketed locally on October 1st were weighed, hauled thirty miles, and then sold to duplicate a typical trip to market. The pigs amounted to an average shrink of 2.0 percent as shown in table 1.

Grade and yield market information, meat price computation, premium payments for grade, and live values have been summarized in tables 2 through 4.

Table 2. Grade & yield data, Hormel & Company, Mitchell, South Dakota – hogs marketed March 12, 1976.

March 12 hog market (total liveweight marketed 8,555 lbs.)

Live wt.	Price/cwt	Live wt.	Price/cwt
180-190	44.50	250-260	43.75
200-230	45.00	260-270	43.25
230-240	44.75	270-280	42.25
240-250	44.25	280-290	41.25

Meat price computation and extended value:

Live wt.	Hot carcass	Mkt. price	÷	Yield conv. factor	=	Meat price/ cwt	Extended value, $
200-230	2059	(45.00	÷	.72)	=	$62.50	1,286.88
230-240	688	(44.75	÷	.725)	=	$61.75	424.63
240-250	543	(44.25	÷	.727)	=	$60.86	330.47
250-260	1513	(43.75	÷	.729)	=	$60.01	907.95
260-270	588	(43.25	÷	.730)	=	$59.27	348.33
270-280	605	(42.25	÷	.732)	=	$57.71	349.15
280-290	421	(41.25	÷	.733)	=	$56.27	236.89
	6417						3,884.30

Carcass grade and premium payment for grade:

Grade	No.head	Hot carcass wt.	Grade differential/cwt	Amount
1	10	1589	+$1.75	$27.80
1a	6	1131	+$1.25	$14.13
2	6	1004	+$1.00	$10.04
2a	5	950	+$0.75	$7.12
2b	4	818	+$0.50	$4.06
3	5	925	----	----
Totals	36	6417		$63.18

Total grade and yield value	$63.18			
	$3,884.30	$3,947.48		
	$3,947.48	85.55	=	$46.14/cwt

Table2. Grade & yield data – hogs marketed March 12th continued

Actual yield 6417 ÷ 8555 =	75.0%
Hormel's average standard yield @ 235 =	72.5%
Yield difference	+2.5%

Market value excluding grade	$45.00/cwt
Market value increase for yield	+$0.41/cwt
Market value increase for grade	+$0.73/cwt
	$46.14/cwt

Table 3. Grade & yield data, Hormel & Company, Mitchell, South Dakota – hogs marketed October 1, 1976.

October 1, hog market (total liveweight marketed 6,025 lbs.)

Live wt.	Price/cwt	Live wt.	Price/cwt
180-190	32.50	240-250	33.00
190-200	33.00	250-260	32.50
200-230	33.50	260-270	32.00
230-240	33.25	260-270	32.00

Meat price computation and extended value:

Live wt.	Hot carcass	Mkt. price	÷	Yield conv. factor	=	Meat price/ cwt	Extended value, $
180-190	267	(32.00	÷	.709)	=	45.13	120.49
190-200	280	(33.00	÷	.713)	=	46.28	129.58
200-230	2502	(33.50	÷	.720)	=	46.52	1,163.93
230-240	518	(33.25	÷	.725)	=	45.86	237.55
240-250	889	(33.00	÷	.727)	=	45.39	403.51
	4456						2,055.06

Carcass grades and grade differential:

Grade	No. head	Hot carcass wt.	Grad differential/cwt	Amount
1	17	2629	+$1.75	$46.00
1a	1	180	+$1.25	$2.25
2	6	938	+$1.00	$9.38
2a	2	355	+$0.75	$2.66
3	2	354	--	---
		4456		$60.29

Total grade and yield value:	$60.29			
	$2,055.06	$2,115.35	=	$35.11/cwt
	$2,115.35	60.26		

Actual yield 4456 ÷ 6025 =		73.96%
Hormel's average standard yield =		72.08%
Yield difference		+1.88%
Market value excluding grade	$33.50/cwt	
Market value increase for yield	.60/cwt	
Market value increase for grade	1.01/cwt	
Total grade and yield value	$35.11/cwt	

A comparison of these two marketing methods based on an equal weight of 220 pounds is shown in table 4.

Table 4. Comparison of grade and yield marketing vs. local marketing based on equal weight

Method of Marketing	Grade & yield		Local market	
Date marketed	March 12	Oct. 1	March 12	Oct. 1
Live wt. value/cwt	46.14	35.11	43.75	33.75
Gross return, 220 lb.				
Market hog, $	101.51	77.24	96.25	74.25
Expenses: trucking, $	-2.77	-3.03	-0.50	-0.50[1/]
Shrinkage, $	-2.14	-2.66	---	-1.59
Net return, $	96.60	71.55	95.75	72.16
Difference, $	+0.85			+0.61

[1/] Trucking is a variable cost, substitute your own value when evaluating your market situation.

<u>Summary:</u>

The results, after two marketing, indicate that there is no advantage for selling market hogs on a grade and yield basis from the Dickinson area. Trucking expense and an average liveweight shrinkage of 2.75% resulted in an average net cost of $3.21, which m the second marketing was not offset by grade and yield premiums.

Data summarized in tables two and three illustrates that the highest grade and yield premiums were paid for number one and two grade hogs that weighed from 200-230 pounds on arrival at Mitchell, South Dakota, and that prices paid for hogs lighter or heavier than the optimum 200-230 pound weight class were discounted heavily. Hogs can easily become heavier than the optimum weight when unexpected winter storms interfere with normal transportation movement.

Trucking arrangements, in addition to the problems already stated, can be difficult to arrange when small or part loads are involved.

Therefore, due to high cost of shipping, shrinkage, and the potential for death loss, only the producer situated within 130-175 miles of a grade and yield packer that is able to sell a minimum of 30-40 butcher hogs at a time, ranging from 200-300 pounds could profit from grade and yield marketing.

Swine Artificial Insemination Pilot Trial

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

Twenty-two second and third litter sows were selected for the study. Twelve were inseminated with one ampule of reconstituted frozen boar semen of either Hampshire or Yorkshire origin. The remaining ten sows were exposed to fertile Hampshire or Yorkshire boars.

To reduce the labor involved in heat detection, the sows were synchronized using the hormones pregnant mare serum (PMS), and human chorionic gonadotrophin (HCG) following lactation. PMS was administered the first morning after weaning, and HCF was given 56 hours following the PMS injection. Insemination was done twenty-four hours after the HCG injections without regard to standing heat.

In table 5, the percent conception rate, litter size, and number of pigs weaned per sow have been summarized. Table 6, shows each boar's performance.

The semen used in this breeding trial was purchased at a cost of $4.00 per ampule from United Suppliers, Inc., Box 538, Eldora, Iowa; the only commercial supplier of frozen boar semen in the United States at this time. Shipping and handling charges amounted to approximately $2.00 per ampule.

Summary:

Conception rate and litter size were considerably lower in those sows bred artificially, as compared to the naturally serviced group. As shown in table 5, seven of the twelve sows inseminated conceived, which resulted in a 58% conception rate versus an 80% conception rate for the sows serviced naturally. In addition to the higher conception rate, natural service also yielded significantly more pigs per sow than the AI group.

Boar performance, as shown in table 6, contributed heavily to the lowered conception rate of those sows bred artificially. The semen of Yorkshire origin settled only 20% of the five sows exposed, whereas 86% of those sows exposed to Hampshire semen were settled. In addition to the boar effect, time of insemination and number of inseminations can directly effect conception rate. The results of a breeding trial comparing one insemination with two inseminations separated by 8 hours is shown in table 7. Two inseminations did not affect the number of pigs born per sow, however, the conception rate was significantly increased.

Although the sows bred artificially farrowed smaller litters, the pigs farrowed were a superior quality and expressed above average muscling, length and balance. This pilot breeding trial indicates that when

using superior sires, such as those available through AI, excellent quality offspring can be produced without the expense of owning and keeping the sire. With this in mind, the commercial pork producer may want to consider swine artificial insemination as a breeding management method.

Table 5. Sow performance, AI pilot breeding trial, winter 1975-76

	Artificially Inseminated	Naturally serviced
No. sows exposed	12	10
No. sows settled	7	8
Conception, %	58	80
Avg. pigs born/sow	6.0	9.8
Avg. pigs weaned/sow	5.7	9.3
Baby pig ADG, lbs.	.68	.63

Table 6. Boar performance, AI pilot breeding trial, winter 1975-76

	Hamp (AI)	York (AI)	Hamp (n.s.)	York (n.s.)
No. sows exposed	7	5	5	5
No. sows settled	6	1	3	5
Conception, %	86	20	60	100

Table 7. Sow performance, AI pilot breeding trial, one insemination vs. two inseminations, spring, 1976

	One Insemination	Two inseminations separated by 8 hours
No. sows exposed	7	8
No. sows settled	5	7
Conception, %	71.9	87.5
Avg. no. pigs born alive	6.8	6.8
Avg. no. pigs weaned	6.0	4.9
Avg. weaning wt., lbs.	56	51

Swine Feeding Trials – Winter, 1975-76

Hulless barley is reported to be superior to hulled barley and equal to corn, in feeding value for growing-finishing pigs. According to research conducted in Montana and Oregon, the hull and fiber in barley contributes to lower gains of feeder pigs fed barley rations as compared to pigs fed grains with lower fiber content.

This trial, in its second year, was designed to compare rations of hulled barley, oats, and soybean oilmeal; hulless barley, oats and lysine; and hulless barly, oats and soybean oilmeal. The rations as shown in table 8, balanced according to the National Research Council's requirements, were processed in a portable mixer grinder and self-fed.

Crossbred barrows (Yorkshire X Hampshire) were compared with purebred Yorkshire barrows in this feeding trial. Pigs with an average starting weight of 46 pounds were used. All were wormed with dichlorvos swine wormer at the start of the trial. Weights, gains and feed costs have been summarized for all pigs in table 9. Table 10 summarizes the crossbred vs. straight comparison.

Summary:

Pigs that were fed hulless barley, supplemented with either soybean meal, or lysine, were slightly less efficient than those pigs fed hulled barley supplemented with soybean meal. However, the cost per hundred pounds gain was the least for pigs fed the hulless barley rations, since the cost per hundred pounds of feed was $.33 cheaper for the hulless barley supplemented with lysine, and $.41 cheaper for hulless barley supplemented with soybean meal.

Crossbred barrows fed hulless barley gained significantly better and were more efficient, which resulted in an average lower cost per hundred pounds gain of $1.64 for the hulless-lysine supplemented pigs and $1.97 for the hulless- SBOM supplemented pigs. The crossbred barrows that were fed hulled barley-SBOM did not out perform their straightbred counterparts.

Hulless barley varieties have not produced as much grain per acre as hulled varieties, in field trials in western North Dakota. Any advantage they might have in feed value would have to be enough to more than compensate for their lower yielding capability to make them useful to North Dakota producers.

Table 8. Rations as fed – swine feeding trial – winter, 1975-76

Ingredients	Ration 1 Hulled bly 50% oats+ SBOM	Ration 2 Hulless bly 50% oats + SBOM	Ration 3 Hulless bly 50% oats + SBOM
Hulled barley, lbs.	447.5	----	-----
Hulless barley, lbs.	----	487.0	440.5
Oats, lbs.	447.0	480.0	448.0
SBOM, lbs.	80.0	----	80.0
Lysine, 98%, lbs.	---	6.0	----
Dical, lbs.	8.0	7.5	6.0
Limestone, lbs.	11.0	13.0	11.0
Minerals & vitamins, 1/	6.5	6.5	6.5
Crude protein, %	15.5	15.2	17.5
Cost/100# feed, $ 2/	5.61	5.28	5.20

1/ Includes: 5 lbs. trace mineral salt, 1lb. fortafeed, 45 gms. Vitamin B_{12}, 30 gms,. Vitamin A, 6 gms. Vitamin D_3 and 180 gms. Zinc sulfate per 1000lbs. complete feed.
2/ Costs used for computing: hulless barley and hulled barley, $3.00/bu; oats, $1.35/bu.; SBOM, $182/ton.

Table 9. Weights, gains and costs – swine feeding trial – winter, 1975-76.

	Hulled bly Oats+SBOM	Hulless bly oats+lysine	Hulless bly oats+SBOM
Initial wt., lbs.	46	46	46
Final wt., lbs.	234	232	237
Gain, lbs.	187	186	191
Days fed	118	118	118
Avg. daily gain, lbs.	1.58	1.58	1.62
Feed/hd./day, lbs.	5.83	5.99	6.28
Feed/lb. gain, lbs.	3.70	3.79	3.87
Cost/100# gain, $	20.74	20.00	20.12

Table 10. Weights, gains and costs – crossbred vs. purebred barrows

	Hulled bly Oats + SBOM		Hulless bly oats + lysine		Hulless bly oats + SBOM	
	str.	X	str.	X	str.	X
Initial wt., lbs.	47	46	46	46	46	46
Final wt., lbs.	229	238	227	236	225	248
Gain, lbs.	182	192	181	190	179	202
Days fed	118	118	118	118	118	118
Avg. daily gain, lbs.	1.54	1.63	1.53	1.61	1.52	1.71
Feed/hd./day,lbs.	5.72	5.95	6.04	5.93	6.22	6.35
Feed/lb. gain, lbs.	3.71	3.65	3.95	3.64	4.09	3.71
Cost/100# gain, $	20.80	20.46	20.85	19.21	21.27	19.30
	.34		1.64		1.97	

Gains and feed efficiency of crossbred and straightbred gilts were compared when a basal ration supplemented with soybean oil-meal was fed. As indicated in table 11, the crossbred gilts gained significantly better and were more efficient which resulted in a savings of $2.58 per hundred pounds of gain.

Table 11. Comparison of crossbred vs. purebred gilts fed 14.7 percent barley + SBOM ration

	Yorkshire	Yorkshire + Hampshire
Initial wt., lbs.	59	73
Final wt., lbs.	195	228
Gain, lbs.	136	155
Days fed	102	102
Avg. daily gain, lbs.	1.33	1.52
Feed/hd./day, lbs.	5.92	6.07
Feed/lb. gain, lbs.	4.45	3.99
Cost/100# gain, $	24.95	22.37
Difference, $	2.58	

Feeding Liquid Whey in Swine 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.

Drying whey produces the most useful product. However, drying is a costly process and disposal in the liquid form is the most economical method.

Feeding trials conducted at the Dickinson Experiment Station over the past three years were designed to determine the feeding value of whey compared with the synthetic amino acid, lysine; and soybean oilmeal, used as protein supplements. Pigs were fed in partial confinement and on spring seeded winter wheat pasture. Each supplement as it was fed with a basic barley and oats growing-finishing ration is shown in table 12.

Liquid whey supplied by the Dickinson Cheese Company was hauled daily and stored in a elevated fiberglass holding tank. The whey was furnished at not cost but a charge of ½ cents per gallon was made to cover costs for hauling.

The whey was self-fed through a gravity flow system using PVC rigid plastic pipe and lixit nipple waterers. Due to the manner in which the liquid whey was fed it was impossible to measure consumption accurately because of waste in feeding. Approximately 2 ½ to 3 gallons were utilized per head daily.

Results and Discussion:

Three years data, which has been summarized in table 13, indicate that pigs can be raised to slaughter weights very efficiently and economically, using liquid whey as a protein supplement. Feed savings for the three year period amounted to 107 pounds less feed per 100 pounds gain, which resulted in a saving of approximately $5.60 per 100 pounds gain over the soybean meal fed pigs and $5.80 per 100 pounds gain over the lysine supplemented pigs.

Pigs will adjust to liquid whey very easily, and without scouring problems, if both liquid whey and water are available free choice for approximately two weeks before water feeding is discontinued. The nipple waterers, which are used to regulate the flow of whey, are located at a height of 15" while the pigs are becoming adjusted to liquid whey and learning to drink from the nipple waterers. Wastage rapidly becomes a problem, therefore, once the pigs have become accustomed to drinking whey from the nipple waterers it is necessary to raise the valves to a height of approximately 28". To help the pigs reach the 28" nipple, a step was positioned 18" below the nipple valve. When using the step just described the nipple valve is just within reach of the pig and waste is reduced considerably.

When feeding liquid whey it is extremely important that the whey be salt free. Always insure that they whey has been removed from the cheese process before salting has taken place.

Other Considerations:

Liquid whey feeding will be most successful when the following conditions exist; salt free whey is available on a regular basis; the pigs weigh at least 35 pounds; PVC plastic or stainless steel feeding equipment is used to reduce corrosion, contamination and fly and odor problem; and adequate protection from the weather is provided.

Table 12. Rations fed and three year average cost/ton, 1973-75

		Ration supplement		
Ingredient		SBOM	Lysine	Whey
Oats, lbs.		200	234	236
Barley, lbs.		676	739	740
Soybean oilmeal, lbs.		100	---	---
Lyamine, lbs.		---	3	---
Minerals, vitamins [1/]		24	24	24
Price/ton, $	1973	70	60	49
	1974	111	109	102
	1975	132	129	126
3-year average		104	99	92

[1/] Includes: Limestone 9lbs., di-cal 9lbs., trace mineral salt 5 lbs., vitamin B complex 1 lb., 30gms, vitamin A, 14 gms, vitamin D_3 and 180 gms, zinc sulphate per 1000 pounds feed.

Table 13. Three year average for weight, gain and feed cost, 1973-75

	Ration supplement					
	Whey		SBOM		Lysine	
Initial wt., lbs.	35	51	34	51	35	51
Final wt., lbs.	190	205	200	211	192	217
Gain, lbs.	156	154	165	160	158	166
Days fed	127	117	127	117	127	117
Avg. daily gain, lbs.	1.22	1.31	1.30	1.36	1.24	1.42
Feed/cwt gain, lbs.	285	297	410	397	395	386
Feed cost/cwt gain, $	14.49	14.89	20.78	19.85	20.74	20.41

Dried Sweet Whey In Growing-Finishing Rations For Swine

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

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

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

Crossbred and straightbred pigs produced at this station, averaging 37 pounds, were randomly allotted into eight groups. To provide for pen replication two feeding units of four pend each were used. The rations fed, as shown in tables 14 and 15, consisted of a basic barley and oat control ration and three experimental rations in which barley was replaced with either 15, 30, or 40 percent dried sweet whey. The crude protein level was maintained at 15.5 percent until the pen averaged 120 pounds, at which time the protein was lowered to 12 percent. A portable mixer-grinder was used to process the rations which were self fed in meal form.

Housing consisted of exposed solid concrete floored pens equipped with open front type shelters and automatic waterers. The pigs were weighed at two week intervals, with records maintained on condition of health, with particular attention to incidence of scours and blindness.

The results of this feeding trial indicate that dried sweet whey can successfully replace as much as forty-five percent of the barley in swine growing-finishing rations, and that the best performance and most economical gains were produced among pigs fed a ration containing fifteen percent dried sweet whey.

Rations containing dried sweet whey, when compared with the basic barley and oats control ration, had a lower fiber content that resulted in an increase in palatability, feed consumption, and average daily gain. Compared to the control ration, increased feed efficiency resulted among pigs receiving fifteen and forty-five percent dried sweet whey, and although no difference in feed efficiency occurred between the two rations, the cost per hundredweight gain was $1.47 more for those pigs receiving forty-five percent dried whey.

Pigs fed thirty percent dried whey consumed the largest amount of feed per head per day and gained as the fastest rate. However, they were equal in efficiency to the control pigs and less efficient than those pigs consuming either the fifteen or forty-five percent dried whey rations. The loss in efficiency which was experienced, is probably due to a mild outbreak of scours that set back the 30 percent pigs and resulted in an added cost of $2.36 per hundredweight gain when compared to the better performing and most economical fifteen percent dried whey ration.

Based on the results of this first feeding trial it appears that only slightly more per pound can be paid for dried whey than for barley when fed at the forty-five percent level.

Table 14. Rations as fed to 120 pounds, 1976

Ingredients In pounds	#1 0% whey	#2 15% whey	#3 30% whey	#4 45% whey
Dried sweet whey	--	150	300	450
Oats	285	285	285	285
Barley	572	425	278	131
SBOM	120	120	120	120
Dical	6	5	4	3
Limestone	11	9	7	5
Vitamins & minerals [1/]	6	6	6	6
Total	1,000	1,000	1,000	1,000
Cost/lb. of feed,-Whey: 6.5 cents		.0604	.0626	.0648
5.7 cents		.0593	.0604	.0614
Gross energy (Kcal/lb.)	1,832	1,791	1,755	1,716
% protein	15.5	15.6	15.7	15.8
% calcium	0.617	0.621	0.602	0.628
% phosphorus	0.528	0.537	0.549	0.559

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

Table 15. Rations as fed from 120 pounds to market, 1976

Ingredients In pounds	#1 0% whey	#2 15% whey	#3 30% whey	#4 45% whey
Dried sweet whey	--	150	300	450
Oats	285	285	285	285
Barley	673	525	378	231
SBOM	20	20	20	20
Dical	6	5	4	3
Limestone	10	9	7	5
Vitamins & minerals [1/]	6	6	6	6
Total	1,000	1,000	1,000	1,000
Cost/lbs. of feed, - Whey: 6.5 cents	.0533	.0554	.0576	.0598
5.75cents		.0593	.0604	.0614
Gross energy (Kcal/lbs.)	1,832	1,791	1,755	1,716
% protein	15.5	15.6	15.7	15.8
% calcium	0.560	0.597	0.600	0.570
% phosphorus	0.503	0.513	0.524	0.534

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

Table 16. Weights, gains and feeding economics – summer, 1976

	No whey	15%	30%	45%
No. head	13	14	14	14
No. days on feed	118	118	118	118
Initial wt., lbs.	37	37	37	36
Final wt., lbs.	197	217	229	223
Total gain, lbs.	160	180	192	187
Average daily gain, lbs.	1.36	1.53	1.63	1.58
Feed/hd/day, lbs.	5.00	5.32	5.96	5.48
Feed/lbs. gain, lbs.	3.68	3.48	3.66	3.47
Feeding economics:				
Computed when whey costs- 6.5 cents/lb.				
Cost/lbs. feed, $	.0555	.0576	.0612	.062
Cost/cwt gain, $	20.42	20.04	22.40	21.51
Computed when whey costs- 5.75 cents/lb.				
Cost/lb. feed, $	.0555	.0565	.0589	.0587
Cost/cwt gain, $	20.42	19.66	21.56	20.37

Using Alfalfa In Rations For Gestating Gilts And Sows

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

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

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

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

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

The two rations as fed are shown in table 17. During the feeding period the gilts were weighed by-monthly. Their weights, gain and feed costs are summarized in table 18. Litter production data are shown in table 19.

Table 17. Gestation ration composition – winter, 1975-76

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

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

Table 18. Gestation weights, gains and feed costs – winter, 1975-76.

Ration	40% Alfalfa gilts	40% Alfalfa 2nd litter sows	70% Alfalfa gilts	70% Alfalfa 2nd litter sows
Weight & gains:				
No. head	12	10	11	10
Avg. initial wt., lbs.	364	469	350	441
Avg. final wt., lbs.	465	584	396	536
Avg. gain, lbs.	101	115	46	95
Days on test	69	58	69	58
Avg. daily gain, lbs.	1.47	1.97	0.66	1.51
Feed & Costs:				
Total feed consumed, lbs.	708	900	651	800
Feed/hd./day, lbs.	10.3	15.5	9.4	13.8
Ration cost/day, $	.42	.64	.36	.53
Feeding period cost, $	28.98	37.18	24.84	30.51
Savings, $			4.14	6.67

Table19. Litter production data

Ration	40% Alfalfa gilts	40% Alfalfa 2nd litter sows	70% Alfalfa gilts	70% Alfalfa 2nd litter sows
Birth:				
No. of litters	12	10	11	9
Litter size	10.1	7.5	8.9	9.6
Litter wt., lbs.	32.9	28.1	25.1	27.7
Avg. individual pig wt., lbs.	3.3	3.7	2.8	2.9
Weaning:		To date		To date
No. of litters	12	10	11	9
Litter size	8.8	7.2	7.9	8.1
Litter wt., lbs.	253	1/	208	1/
Avg. individual pig wt., lbs.	29.0		26.3	
Percent survival	87.0	96.0	88.7	84.0

1/ Baby pigs not weaned at time of publication.

Summary:

Gestation diets containing either 40% or 70% alfalfa were fed to first litter gilts for the last sixty-nine days of gestation. All of the pigs were handled alike and were housed in drylot under North Dakota winter conditions. Those gilts fed the 70% alfalfa ration consumed approximately on pound less feed per head per day than those fed the 40% ration, which amounted to a saving of $4.14 per gilt for the feeding period. The savings in feed, however, did not nearly offset the loss in litter production. (See table 19) Those gilts fed the 40% gestation ration farrowed on more live pig per litter: had pigs weighing a half pound more at birth; and , weaned more and heavier pigs per litter which resulted in an average of 45 more pounds of feeder pig produced per gilt.

The results of this first farrowing indicate that the higher energy ration containing 40% alfalfa is more suitable for gilt development and litter production.

Second litter sows in phase II of this trial, which is designed to evaluate the long term effect of feeding moderate versus high levels of alfalfa in gestation rations, performed satisfactorily under both levels of alfalfa. Although no problems were experienced, daily feed consumption was high for both levels of alfalfa and resulted in an average daily feed cost of $.64 among those pigs fed 40% alfalfa and $.53 among the pigs receiving 70% alfalfa, which resulted in a savings of $6.67.

Litter production data is incomplete, since the pigs had not been weaned at the time this progress report was written. Although weaning data is not available, results indicates that sows fed 40% alfalfa farrowed 2.1 fewer pigs per litter that were an average .8 pound heavier at birth, an experienced a 12% better survival rate. Even though litter performance, especially survival rate, was better among sows fed at the 40% level, sows fed at the 70% level had .9 more pigs alive when this report was published. Based on the limited results of this first trial it appears that pigs born to sows fed 40% alfalfa are stronger and more vigorous. Future trials are planned to further investigate the level of alfalfa and its effect on baby pig survival.

Report of
Range And Pasture Management
And Other
Grass & Legume Investigations
At The
Dickinson Experiment Station

By

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3- Pasture System Grazing Trial

Paul E. Nyren, Warren C. Whitman,
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Today North Dakota's ranchers are being caught in a price-cost squeeze uncommon to most other industries. The cost and unavailability of land has made the expansion of the land base on which to operate difficult if not impossible! Under these circumstances the only solution it to produce more beef from those acres of land available. To accomplish this todays ranchers must implement new management techniques which will give the most production from each acre of land. In 1972, a study was undertaken at the Dickinson Experiment Station to evaluate a 3-pasture grazing system to increase gains by improving the quality of the forage and lengthening the grazing season.

Methods:
This study included two sets of pastures containing crested wheatgrass (Agropyron cristatum) for spring and early summer grazing, native mixed prairie for mid and late summer and Russian wildrye (Elymus junceus) for fall grazing. In one set of pastures the crested and native were fertilized with 50 lbs N per acre each year while in the other set these pastures were left unfertilized. All the Russian wildrye pastures were fertilized with 50 to 150 lbs N and 30 lbs of P_2 O_5 per acre annually.

Each set of pastures was grazed with yearling steers half of which were Hereford and half were Hereford-Angus cross. The steers were selected from the Experiment Station herd in the fall and wintered in drylot. The wintering ration was bunk fed and included 3 lbs oats, 2 lbs alfalfa, 9.8 lbs. tame hay, and 0.2 lbs mineral mix. The ration was designed to give a rate of gain of 1.25 to 1.50 lbs per day. Actual gains were 1.39 lbs/head/day. The steers were transferred to the crested wheatgrass pastures during the first week in May. (see table 1) The steers remained on the crested pastures for an average of 55 days. Transfer to the native pastures was made during the last week in June or the first week in July with the exception of 1973 when the steers were transferred on June 12th. The time spent on the native fluctuated more than it did on the crested, the longest being 71 days in 1974 and the shortest 46 days in 1976. The steers averaged 56 days on native for the five years of the trial. Transfer to the Russian pastures varied from mid August to the first of September. The animals remained on the Russian wildrye until snow forced their removal to drylot, a period which varied from 25 to 69 days and averaged 46 days. The total grazing period averaged 105 days for the 5 years of trial.

In attempt to maintain gains as forage matured in late summer and fall a biuret product Kedlor was fed to half of each lot of steers. Biuret when ingested by the animal gives a slow release of ammonium which can be utilized by the rumen with less potential of dangerously high levels being absorbed int to blood stream. Kedlor was first fed when the steers were on the native pastures and continued when the animals were transferred to the Russian wildrye.

Table 1. Treatments, dates grazed and grazing periods for pastures in the 3-pasture system

Pasture	Size in acres	Grazing Period Date on – date off (total days)				
		1972	1973	1974	1975	1976
Crested wheatgrass Unfertilized	16	5/12-7/7 (56)	4/26-6/21 (55)	5/1-6/25 (55)	5/13-7/8 (56)	5/6-6/28 (53)
Crested wheatgrass 50 lbs N/A/Yr	8	5/12-7/7 (56)	4/26-6/21 (56)	5/1-6/25 (55)	5/13-7/8 (56)	5/6-6/28 (53)
Native Unfertilized	18	7/1-9/1 (56)	6/21-8/23 (63)	6/25-9/4 (71)	7/8-9/3 (57)	6/28-8/13 (46)
Native 50 lbs N/A/Yr	12	7/7-9/1 (56)	6/21-8/23 (63)	6/25-9/4 (71)	7/8-9/3 (57)	6/28-8/13 (46)
Russian Whilrye 50-150 lbs N 30 lbs P_2O_5/A/Yr	4-8 acre pastures	9/1-9/28 (27)	8/23-40/5 (43)	9/4-10/11 (37)	9/3-10/27 (54)	8/13-10/21 (69)
Total grazing period		137	162	163	167	168

Forage samples were taken from each pasture prior to grazing, at 4 week intervals and when the animals were transferred to the next set of pastures. The forage sample consisted of clipping the total production within a 3 by 5 foot guadrat and estimating percent species composition. The forage samples were weighed, oven dried and reweighed to determine moisture content and total production on an oven dry basis. The samples were ground and sent to a lab for analysis of crude protein.

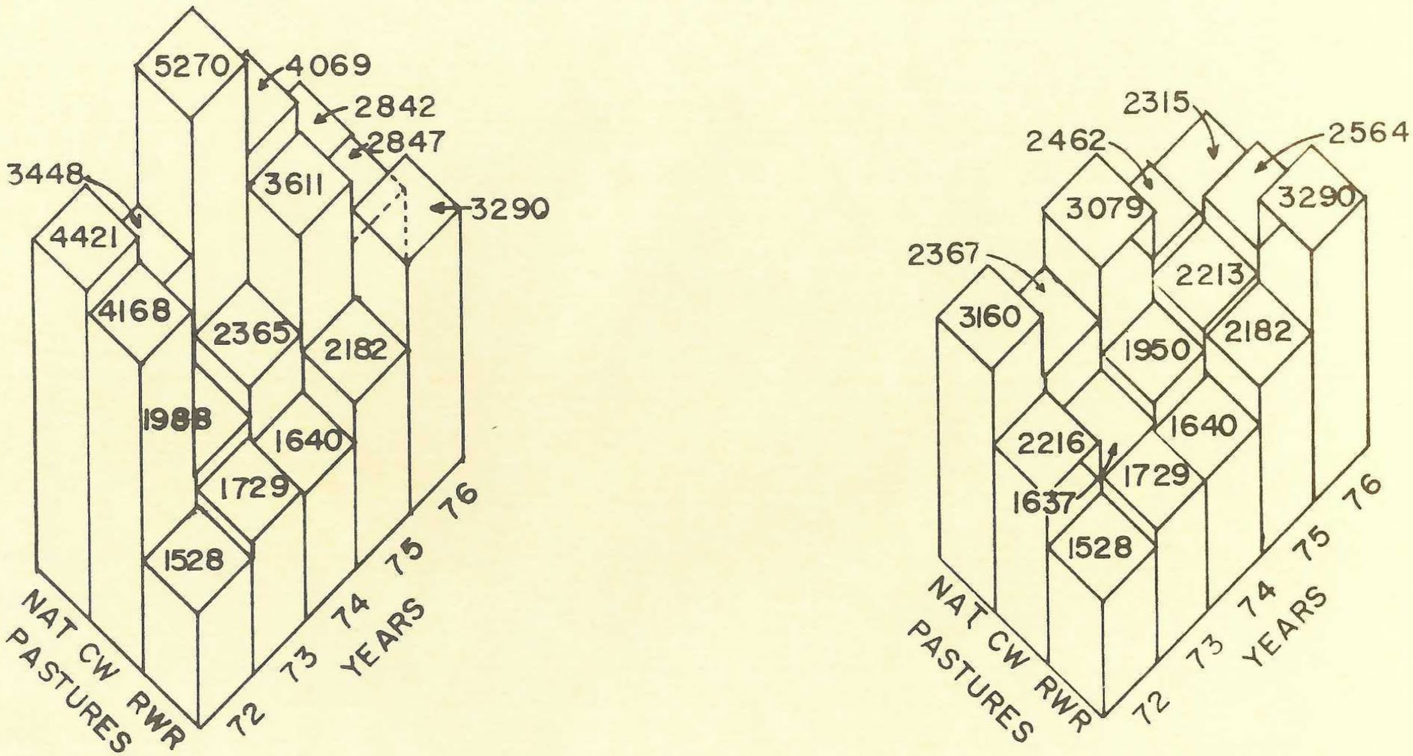
Enclosure cages were placed on the pastures prior to grazing and samples were clipped inside and outside to determine total yield and utilization.

Animal performance was monitored by weighing the steers before going on the pastures, at 4 intervals and when they were transferred to the next set of pastures.

Results and Discussion:

Forage production was greater on the fertilized pastures than the unfertilized in all years of the trial. (See fig. 1) An analysis of variance showed that the fertilized crested wheatgrass produced significantly greater than the unfertilized at the .90 level while the fertilized native mixed prairie produced more than the unfertilized at the .95 level. Since both Russian wildrye pastures were fertilized there was no unfertilized pastures for comparison. Figure 1 shows values for Russian wildrye in both the fertilized and unfertilized systems, these were obtained by averaging all four 8-acre pastures and were included because those steers in the unfertilized system grazed fertilized Russian wildrye pastures each year.

Animal performance was calculated in both average daily gain and gain per acre. Since the fertilized and unfertilized pastures were of different sizes gains per acre more closely reflect the production potential of the pasture systems. Figure 2 shows the beef production in lbs per acre. The fertilized crested wheatgrass pastures produce over 100 lbs of beef per acre each year of the trial except 1976. One reason for this lower production on the crested in 1976 was that the steers were 130 lbs heavier than the average of the four previous years of the trial when transferred from the wintering lots to the crested pastures. This added weight seemed to cause the animals to gain slower on the grass than in previous years. Beef production was also low on both the fertilized and unfertilized native in 1972. These poor gains were attributed to the late transfer of the animals from the crested wheatgrass. In 1973 and subsequent years the steers were moved before the native became so mature. This earlier transfer seemed to make the change to the new forage easier for the animals to adjust to and therefore improve gains.



FERTILIZED

UNFERTILIZED

Figure 1. Forage yields in lbs per acre. Russian wildrye yields were obtained by averaging all 4- 8 acre pastures.

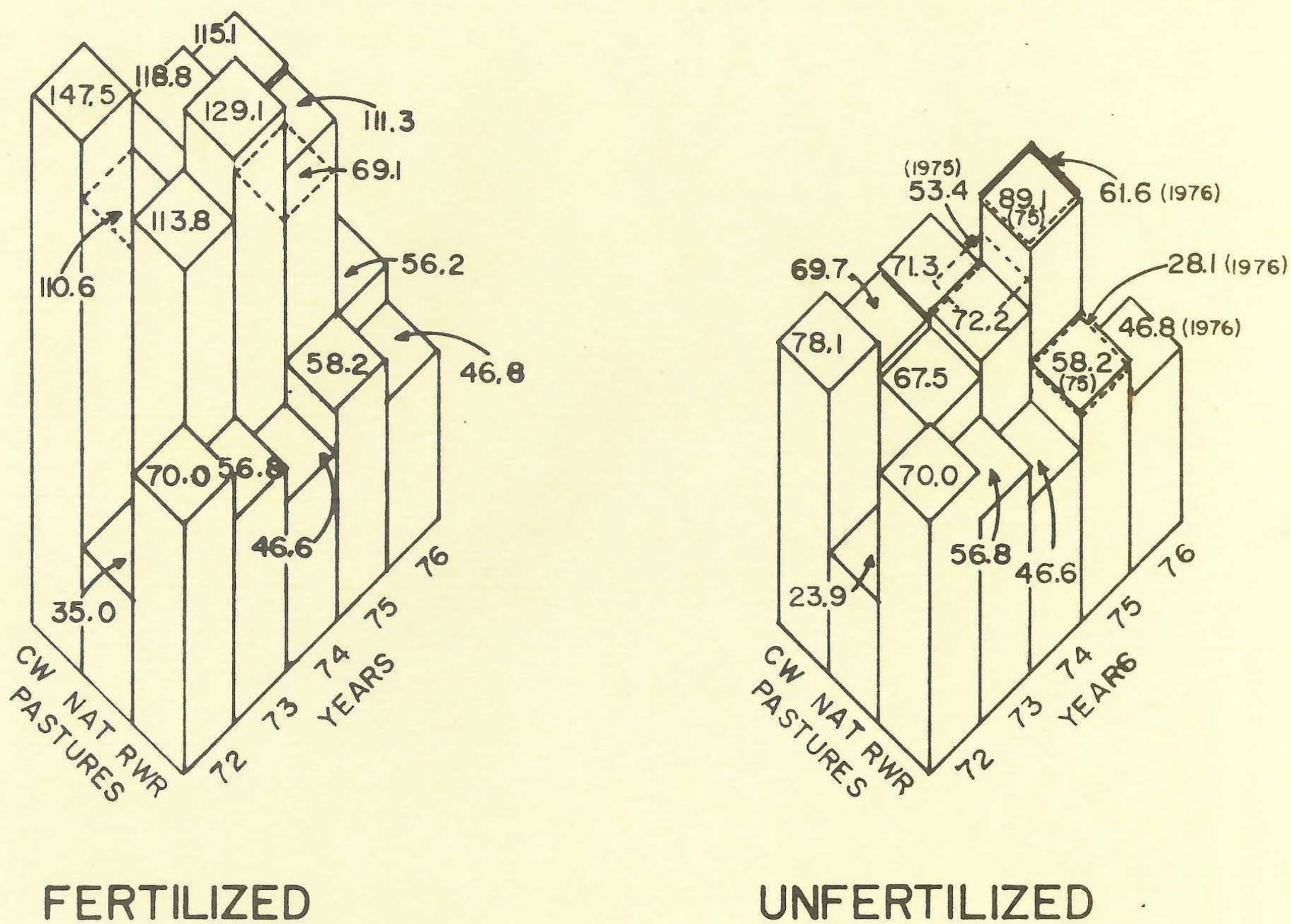


Figure 2. Beef production in lbs per acre.

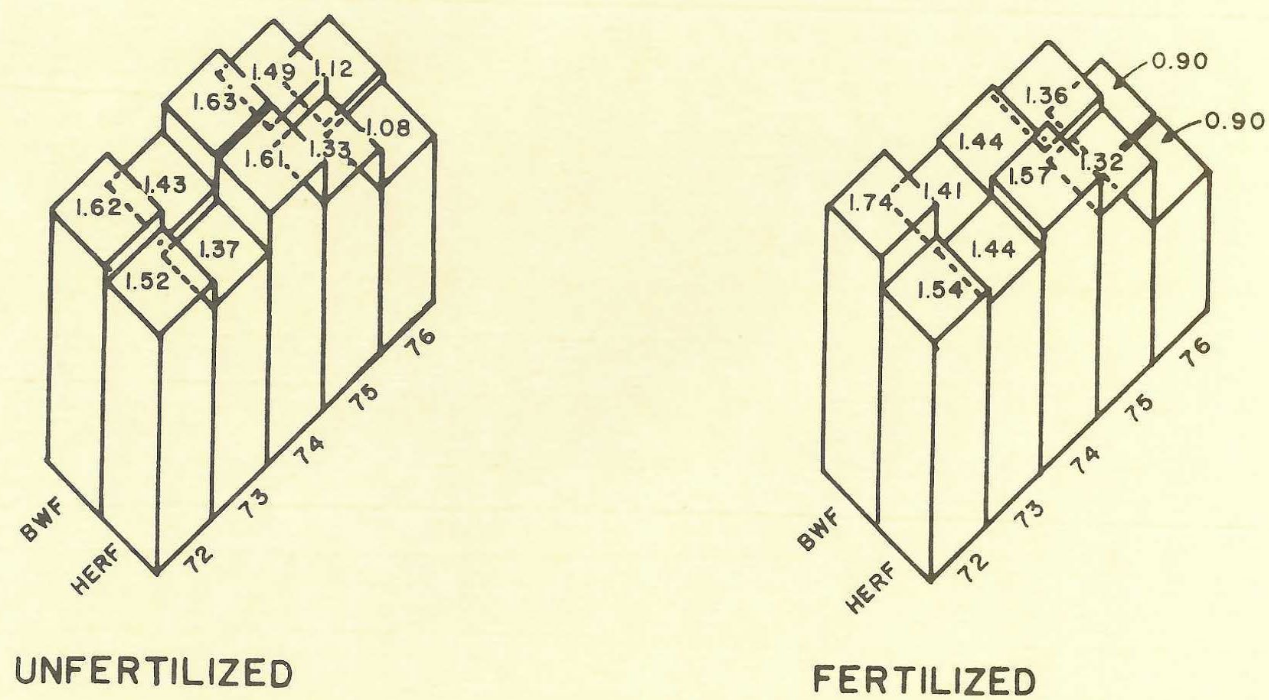


Figure 3. Average daily gains for Hereford and BWF steers in lbs per head per day.

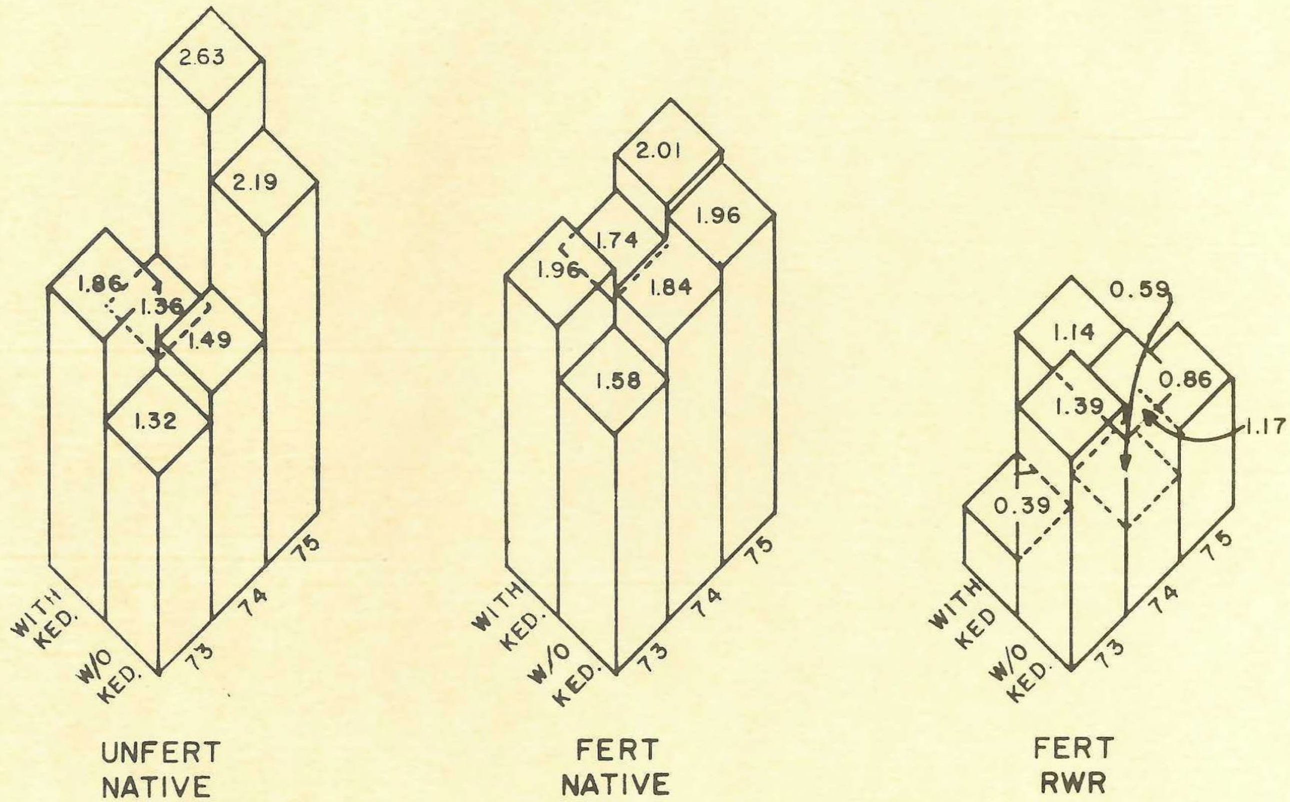


Figure 4. Effects of Kedlor on average daily gain.

The data collected from this trial show little difference between the Hereford and Hereford-Angus cross steers. Figure 3 shows the average daily gains for the animals during the five years of the trial. On the unfertilized pastures the BWF steers gained more than the Hereford each year of the trial. These added gains were small averaging only .04 lbs/head/day for the five years of the trial. On the fertilized pastures both the Hereford and BWF performed nearly equal. The five year average daily gains being 1.36 and 1.37 for the Hereford and BWF respectively. A statistical analysis of the data showed no significant difference between the Hereford and BWF on either the fertilized or unfertilized pastures.

Figure 4 gives the data on beef production from feeding the biuret supplement Kedlor in late summer and fall. On the unfertilized native pastures the animals fed Kedlor gained better in 1973 and 1975 than those not receiving the supplement. In 1974 the Kedlor fed animals did slightly poorer than those not receiving the supplement. On the fertilized pastures gains were increased some what in 1973 with Kedlor but declined in 1974 and were about the same in 1975. The most dramatic effects from the Kedlor was obtained on the Russian wildrye pastures. Here those animals fed Kedlor seemed to experience some type of nutritional imbalance consuming nearly twice the recommended daily rate of the supplement. In both 1973 and 1975 the Kedlor fed steers gained much less than did the non-supplemented animals. In 1974 both groups performed nearly equal. A statistical analysis of the data show no significant difference between the two groups of steers on the native mixed prairie. The same analysis of the Russian wildrye did, however, show a significant decline at the .80 level in animal gains with the use of the biuret supplement Kedlor.

While this study and others conducted in North Dakota have shown both improved forage and beef production from fertilization of native and tame pastures the real interest is in the value returned to the rancher. Table 2 gives a simple analysis of the costs and returns from the fertilization of the crested wheat and native pastures. Column 1 gives the amount paid for 50 lbs of N plus application cost. The second column shows these figures broken down into costs per acre. In an attempt to evaluate the value of the fertilizer in producing beef in the production on each unfertilized pasture was subtracted from the fertilized. The amount of increased production is listed in columns 3 and 4. If these values are divided by the cost per acre for fertilizer the value obtained is the amount of money which must be received for the beef to offset the cost of the fertilizer. These values are listed in columns 5 and 6. Examination of table 2 shows that both fertilizer costs and beef production on fertilized pastures has fluctuated a great deal during the 5 years of the trial. In an effort to determine what the returns would be for a rancher interested in a long term fertilization program columns 3 and 4 were averaged. The average gain in beef production was divided by the cost of fertilizer for each year of the trial. These new values appear in columns 7 and 8 of table 2. From this analysis of long term returns from N fertilization we see that if the cost of fertilizing crested wheatgrass pastures is $15.00 an acre the value of the beef had to be $.35 or more per lb if the rancher is going to realize even a small return on his investment. Since the production of beef on the native pastures was less the returns must be higher as the cost of fertilizer rises. Her $15.00 an acre for 50lbs of N requires $.47 or more return for beef.

Summary:

The arrangement of tame and native pastures in a complimentary grazing system can increase the production of beef from North Dakota ranges. The pasture system where only the Russian wildrye was fertilized showed a 20 percent increase in beef production over year long grazing of native ranges. In addition to this increase in production from the 3-pasture system the application of fertilizer in production from the 3-pasture system the application of fertilizer to the crested and native pastures again increased beef production. The 5-year average beef production from the fertilized system was 75 lbs per acre while the production from the unfertilized was 56 lbs, an increase of 34%.

A comparison of Hereford and Hereford-Angus cross steers showed no advantages for the BWF. While the BWF did perform better under some conditions the differences were small and inconsistent.

Feeding the biuret supplement Kedlor to yearling steers on native and Russian wildrye showed no advantage on the native but showed a significant decline in production when fed to steers grazing mature Russian wildrye.

Table2. Economical Analysis of Fertilizer Costs and Returns Required to Pay for Fertilizer and Application.

Year	Total Fert. cost	Cost/ Acre	Gain in Beef Prod. From Fert. Lbs/A C.W.	NAT.	Value of Beef to Breakeven C.W.	NAT.	Value of Beef to Breakeven Avg, Beef Prod. C.W.	NAT.
72	$100.00	$5.00	69.4	11.1	$.07	$.45	.11	.15
73	110.50	5.52	40.9	46.3	.13	.12	.12	.17
74	209.00	10.45	47.5	56.9	.22	.18	.23	.32
75	305.52	15.28	61.7	22.2	.25	.69	.34	.46
76	216.00	10.80	7.5	28.1	1.44	.38	.24	.33
			45.4	32.9				

Native Range Fertilization and Interseeding Studies

The native range fertilization and interseeding study initiated in the fall of 1969 was continued in the 1976 growing season. Fertilizer treatments consisted of a one time nitrogen application of 200, 300, and 400 lbs. per acre. Every year treatment included 67 and 100 lbs. per acre. Every year treatment included 67 and 100 lbs. per acre, 67N + 50P, 67N + 50P +200 lbs. K per acre, 50 lbs. P per acre, and 200 lbs. K per acre. Nitrogen alone is applied at the 100 lbs per acre rate at biennial intervals as another treatment.

Some of the parameters measured throughout the growing season by treatment at the 0-6, 6-12, 12-24, 24-36, and 36-48 inch soil depths at weekly intervals are available soil moisture, and available N, P, and K are determined at biweekly intervals at the same soil depth previously indicated. Protein content determinations are made from selected species at biweekly intervals. Production clippings are taken at the end of the growing season from all treatments, separated into categories of annual and perennial forbs, mid, short and tall grassed, dried and weighed. Species composition changes are determined by means of a 10-point frame on a percentage basis.

Available nutrient and soil moisture data indicate a cyclic phenomena closely associated with precipitation and plant development. Adequate soil moisture, nitrogen, phosphorus and potassium are available early in the growing season but are depleted to low levels soon after active growth commences. Available nitrogen is depleted more quickly than is apparent with the potassium or phosphorus and responds more closely to the depletion of the available soil moisture, especially in the upper levels of the soil profile. Phosphorus generally shows a decline with the active growing period but exhibits a much narrower range of fluctuation than observed by the nitrogen and potassium nutrients. Other peaks in available nutrients are observable following the active growing period in early spring and summer. One of the major late summer increases in soil nutrients occurs during the period immediately following summer dormancy and before active initiation of new growth by many species shortly before winter freeze up. A decline is again evident as winter approaches.

Average production data by yield components from the 7-year fertilizer trial indicates the highest forage yields were observed from the 50P + 67N every year treatment (table 1). The total yield of 3093 lbs. per acre was closely followed by the 300 N/A (3017 lbs. per acre), 400 N/A (3010 lbs. per acre), 100 N/A every year (2987 lbs. per acre), 67 N every year (2957 lbs. per acre) treatments. The 200 K/A treatment yielded 2575 lbs. per acre, considerably less than the highest yielding treatments but more than the check with 2300 lbs. per acre. The 50 P treatment was below the check plot yield with 2267 lbs. per acre while the 200 K/A plots were slightly higher producing 2356 lbs. per acre.

Table 1. Average forage production on fertilized native range, 1970-1976 seasons

Treatment # fertilizer/acre	Mid grass	Short grass	Perennial forbs	Annual forbs	Total grasses	Total forbs	Total yield
67N ev. yr.	1763	668	484	42	2431	526	2957
67N ev. other yr. [1/]	1346	708	423	42	2054	465	2519
100N ev. yr.	1859	641	449	35	2500	484	2984
100N ev. other yr.[1/]	1464	641	487	63	2105	550	2655
200N	1580	672	286	37	2252	323	2575
300N	1851	759	381	26	2610	407	3017
400N	1834	688	454	34	2522	488	3010
50P-67N ev. yr.	1810	828	428	27	2638	455	3093
50P-67N-200K ev.yr.[1/]	1950	482	454	29	2432	483	2915
50P	1039	781	351	96	1820	447	2267
200K [1/]	1121	915	263	57	2036	320	2356
Check (no fert.)	1231	817	208	44	2048	252	2300

[1/] Six year average (71, 72,73, 74, 75, 76) all other 7-year averages (70, 71, 72, 73, 74, 75, 76).

Table 2. Average percent composition of forage yields on fertilized native range, 1970-1976 seasons

Treatment # fertilizer-acre	Mid grass	Short grass	Perennial forbs	Annual forbs	Total grasses	Total forbs	Total yield
67N ev. yr.	59.6	22.6	16.4	1.4	82.2	17.8	2957
67N ev. other yr. [1/]	53.4	28.1	16.8	1.7	81.5	18.5	2519
100N ev. yr.	62.3	21.5	15.0	1.2	83.8	16.2	2984
100N ev. other yr.[1/]	55.1	24.1	18.4	2.4	79.3	20.7	2655
200N	61.4	26.1	11.1	1.4	87.4	12.6	2575
300N	61.4	25.1	12.6	.9	86.5	13.5	3017
400N	60.9	22.9	15.1	1.1	83.8	16.2	3010
50P-67N ev. yr.	58.5	26.8	13.8	.9	85.3	14.7	3093
50P-67N-200K ev. yr. [1/]	66.9	16.5	15.6	1.0	83.4	16.6	2915
50P	45.8	34.4	15.6	4.2	80.3	19.7	2267
200K [1/]	47.6	38.8	11.1	2.5	86.4	13.6	2356
Check (no fertilizer)	53.5	35.5	9.1	1.9	89.0	11.0	2300

[1/] Six year average (71, 72, 73, 74, 75, 76) all other 7-year averages (70, 71, 72, 73, 74, 75, and 76)

Table 3. Average percent composition of forage yields on interseeded native range, 1971-1976 seasons

Treatments	Mid Grasses	Short grasses	Perennial forbs	Annual forbs	Inter-seeded species	Total grasses	Total forbs	Total yield
Check-not plowed	50.0	36.2	12.7	1.1	--	86.2	13.8	2333
Check-plowed	57.1	18.7	13.8	1.9	8.5	75.9	15.6	3896
Crested wheatgrass	49.7	22.5	15.5	2.0	10.3	72.2	17.5	3872
Bromus Inermus	62.3	15.5	10.2	1.2	10.8	77.8	11.4	4395
Green Stipa	56.7	20.4	16.9	2.8	3.2	77.1	19.7	3991
Travois (alfalfa)	41.6	6.7	6.0	1.8	43.9	48.3	7.8	5485
Vernal (alfalfa)	48.0	13.4	6.7	1.1	30.8	61.4	7.8	5199
Ladak (alfalfa)	50.7	14.5	10.4	1.5	22.9	65.2	11.9	5035

Table 4. Average forage production in lbs./acre on interseeded native range, 1971-1976 seasons

Treatments	Mid Grasses	Short grasses	Perennial forbs	Annual forbs	Inter-seeded species	Total grasses	Total forbs	Total yield
Check-not plowed	1167a	844b	296a	26a	--	2011a	322a	2333a
Check-plowed	2225ab	729ab	537ab	73a	332ab	2954a	610ab	3896ab
Crested wheatgrass	1926ab	871b	600ab	78a	397ab	2797a	678ab	3872ab
Bromus Inermus	2741b	680ab	449ab	50a	474ab	3421a	499ab	4395ab
Green Stipa	2264ab	815b	675b	111a	126a	3079a	786b	3991ab
Travois (alfalfa)	2285ab	367a	331ab	91a	2411d	2652a	422ab	5485b
Vernal (alfalfa)	2495ab	696ab	349ab	55a	1603ab	3191a	404ab	5199b
Ladak (alfalfa)	2556ab	760ab	527ab	73a	1149bc	3286a	600ab	5035b

Protein content determinations for the past 4 years data along with anticipated digestibility and other proximate analysis is being done at the present time. Earlier data have been taken and analysis of protein content during the course of the growing season from western wheatgrass (Agropyron smithii), needle-and thread (Stipa comata), and blue grama (Bouteloua gracilis) have been carried out. The data indicates a high protein value early in the growing season by all species analyzed. Advanced of maturity results in a lowering of the protein content with values below the minimum nutritional requirements of livestock reached by early fall. Western wheatgrass is highest in protein early in the season, followed by needle-and-thread and blue grama, respectively, regardless of fertilizer treatments. Blue grama retains a higher level of protein in late fall than either of the two other species.

The range interseeding was continued through the 1976 season. Treatments studied were the interseeding of Lakak, Travois, and Vernal alfalfa, crested wheatgrass (Agropyron cristataum), smooth brome (Bromis inermis), green stipa (Stipa viridula), along with a plowed but not seeded and check plot. Production in the 1976 season was considerably below the 6-year average. Vernal alfalfa produced2495 lbs. per acre which was 48% below the 5199 lbs. per acre average (table 3). Travois was the second highest producing treatment in 1976 but still retains the highest average with 5498 lbs. per acre. Yields for the check plots have an average of 2333 lbs. per acre. Grasses interseeded into the native range did not contribute to the total yield as greatly as was observed in the alfalfa plots. Smooth brome continued to be the highest yielding grass with 4395 lbs. per acre. In terms of percentage increase over the observed from check plots, the plowed but not seeded treatment was nearly as successful at the grass interseeding.

It is readily apparent from the data thus far from both the fertilizer and interseeding trials that native range can be greatly improved as to total production. The application of fertilizer, especially nitrogen, has the advantage of being easy to apply and causes little or no physical damage to the land as does interseeding. Fertilization may be the most effective tool in changing the composition of a native grassland community from a low producing to a highly productive on over a relatively short period of time. Increases in annual production can also be accomplished by proper levels and timing of application. Increases in the protein content along with greater water use efficiency may ne other desirable benefits to fertilization. Increase in undesirable perennial forbs or annual grasses may be a disadvantage.

Interseeding of native rangelands may be highly successful on range sites which require the reintroduction of exotic or native forage species due to severe overuse. The establishment of alfalfa appears to hold some real promise by doubling of annual forage yields. The physical disturbance of the site is a disadvantage and extreme cautio is required to avoid erosion and runoff problems. Plowing alone in the absence of any interseeding may be highly effective if a rhizomatous grass species like wester wheatgrass is still present. The reduction in the sod forming species such as blue grama along with creation of an improved water and nutrient relationship allows a high degree of improved production by the process alone.

1972 New Alfalfa Trial

The new alfalfa trial was seeded at the Dickinson Experiment Station in the spring of 1972. The trial consisted of twelve varieties of alfalfa seeded in 6 by 30 foot plots replicated four times. Included were the newer released varieties of spreading type alfalfas as well as some of the older well established varieties.

First clipping yield data for 1976 is given in Table 6. In 1973, 1974, and 1975 a second slip was taken on the regrowth. (see table 6)

Yields for 1976 were below those of previous years. This may have been due in part to the low precipitation during the growing season and partly to the fact that the plants are growing older and are less productive.

The highest producing variety in 1976 was ATN-224 which produced 1404 lbs per acre. The next highest producing variety was Saranac with 1336 lbs. Spredor, Vernal, Drylander, Lakak-65, and Ladak all produced over 1200 lbs per acre. The poorest producing variety for 1976 was Weerlchek with 1083 lbs per acre.

The four year average of the first cutting shows ATN-224 to be consistently the highest producing variety in the trial with 3486 lbs per acre for the four years of the trial. Drylander, a close second, with 3446 and Vernal third with 3372 lbs per acre. All varieties in the trial were close with only 428 lbs separating the best from the lowest producer.

Three year averages for second cutting yields show Clacier to have the largest amount of regrowth with 1489 lbs per acre. ATN-224 was a close second with 1417 lbs. Again all varieties performed similarly with Ladak-65 being the only variety which averaged less than 1000 lbs per acre on the second cutting. No second cutting was taken in 1976 due to lack of regrowth.

1972 New Alfalfa trial

Table 6. Production of varieties in 1972 new alfalfa trial

Variety	1976 yields	4- year average 1st cutting	3- year average 2nd cutting	Total 1 & 2 cuttings
		Dry weight yields in lbs/acre		
ATN-224	1404	3486	1417	4903
Ladak	1220	3248	1249	4497
Drylander	1254	3446	1044	4490
Weevlchek	1083	3104	1163	4267
Vernal	1268	3372	1253	4625
Spredor	1273	3074	1305	4379
Ladak-65	1227	3153	825	3978
Glacier	1196	3059	1489	4548
Dorminar	1121	3058	1230	4288
Thor	1144	3067	1314	4381
Scout	1163	3191	1237	4428
Saranac	1336	3280	1314	4594
Average	1227	3212	1237	

1975 New Alfalfa Trial

A second alfalfa trial was established in the spring of 1975 to test the new varieties not included in the 1972 study. Ten varieties were included in the trial. Thor was included twice, once with the standard inoculant and once with a commercial seed treatment called Inoculime. The plots were 12 by 27 feet replicated four times.

The plots were harvested for the first time in 1976. (see table 8 for the yields) all plots produced better than either of the other alfalfa trials but not as well as the varieties in previous studies had done their first season.

Two varieties produced 1 ½ tons per acre, Kane with 3176 and Valor with 3000 lbs per acre. The next highest producing plot was WL-310 with 2750 lbs per acre. These varieties exhibited more variability in production with the lowest production being 1412 lbs per acre below that of the highest.

The second cutting was made on August 2nd. Again Kane was the highest producing variety although the yields for it were taken from reps 1,2, and 4 since rep three and been damaged by herbicide. G-777 and Thor (inoculimed) were second and third respectively with a production of 1641 and 1606 lbs per acre. The lowest producer, Spreador, yielded 1031 lbs per acre.

There was little difference between the two types of inoculate used on Thor. The plots treated with Inoculime produced slightly higher on the first cutting and 250 lbs per acre better on the second for a total of 3808 lbs per acre for the standard inoculated plots and 4091 for the inoculimed plots.

Table 8. Production of 1976 – new alfalfa trial for the 1976 season

Varieties	Dry weight yields lbs/acre			
	First cutting	Second cutting	Average	Total
Embro A—57	2441	1347	1894	3788
SX-10	2573	1561	2067	4134
Polar	1764	1604	1684	3368
Spreador	2529	1031	1780	3560
Thor (inoculized)	2455	1353	1904	3808
Kane	3176	1772	2474	4948
WL-310	2750	1586	2168	4336
Gladiator	2647	1443	2045	4090
G-777	2426	1641	2034	4067
Thor (inoculimed)	2485	1606	2046	4091
Valor	3000	1538	2269	4538
Average	2568	1498	2033	

Pasture-Type Alfalfa Trial

In the spring of 1972 twelve varieties of alfalfa, Emerald crownvetch, birdsfoot Treefoil, and Latana cicer milkvetch were seeded in 12 by 30 foot plots replicated four times.

Yields from the plots in 1976 (see table 7) were below 1975 and generally reflected the low spring precipitation. Only four varieties averaged over 2/4 ton per acre. The highest yielding of these was the synthetic variety developed by the research station in Swift Current SC-Syn 37025 which produced 1822 lbs per acre. Ladak was the second highest yielding variety with 1774 and Teton and Rambler were third and fourth with 1629 and 1505 lbs per acre respectively. Of the remaining varieties producing less the ¾ ton per acre two Swift Current selections produced best. These were Sc-Syn 3701-L and Sc-Syn 3703-L with 1490 and 1489 lbs per acre. The lowest producing variety of alfalfa in the trial was SC-MF 3713 which produced 1369 lbs per acre.

The four year average for the 12 varieties are listed in table 7. While all the averages dropped considerably from 1975 the relative positions from highest to lowest changed little. Sc-Syn 37025 moved from third to second highest producer behind Rambler producing 4243 lbs per acre. All varieties produced well over the four years of the trial and the variability between the highest and lowest producers is only 542 lbs.

As of yet none of the varieties in the trial have demonstrated a creeping habit. It is felt that this characteristic will be unlikely to develop as long as the plots are clipped rather than grazed. To date both vigor and stand maintenance have been good.

As in previous years the other legume species in the trial did not produce enough forage to warrant harvesting.

Pasture-type alfalfa trial

Table 7. Average yields of alfalfa varieties in the 1973-1976 seasons in the pasture-type alfalfa trial.

Variety	Dry- weight yield - lbs/ acre				4-year average yield
	1973	1974	1975	1976	
Rambler	5617	3931	6163	1505	4304
SC-Syn 37025	5186	4076	6232	1822	4329
Roamer	5254	3986	6359	1373	4243
SC-Syn 3703-L	5391	3851	6148	1489	4220
Ladak	4884	3527	6651	1774	4209
Teton	4700	3607	6575	1629	4128
SC-Syn 37045	4966	3635	6428	1390	4105
Drylander	4991	4015	5775	1439	4055
Travois	4783	3431	6496	1378	4022
Semi-Palatinsk	4254	3718	6279	1442	3923
SC- Syn 3801-L	4930	3395	5688	1490	3876
SC-MF 3713	4024	4102	5516	1369	3752
Average	4915	3773	6193	1508	4097

Grass Adaptation Trial

The grass adaptation trial seeded in 1972 was harvested for the fourth year in 1976. All varieties showed a decrease in production from 1975. Both selections of Alti wildrye were harvested for the first time since 1973. Both selections showed the highest production but this would be misleading since the plots hadn't been clipped the preceding two years.

In 1976 the Basin wildrye (SCS) was the highest producing variety with 3416 lbs. per acre. (see table 5) The Production is from several very robust plants widely spaced on the plots. The second highest producing variety was Turkey brome which produced 3181 lbs. per acre. Basin wildrye (Pullman) was a close third with 3003 lbs. per acre.

There was a large break between these top producers which all exceeded 1 ½ tons per acre and the remainder of the varieties. All the remaining species were closely clumped with only 672 lbs. difference in production between the highest and lowest producers. Of this group Pubescent wheatgrass #759 was highest with 2056 lbs. per acre followed by Sodar wheatgrass, Durar hard fescue, Nordan crested wheatgrass, Lodorm green stipa, green stipa (SCS), sheep fescue, and Topar pubescent wheatgrass all producing over 1500 lbs. per acre.

The production of Durar and sheep fescue was good for the 1976 season. These varieties are inherently low producing fine leaved bunchgrasses. Both species were the lowest producers in 1975 so while their production decreased in 1976 it demonstrated a much smaller decline than did many of the other varieties. This may have been partially due to their extensive root system which may have been able to extract more moisture from the soil during this dry year.

Of these varieties that have been harvested four years pubescent wheatgrass #759 has the highest average at 3662 lbs. per acre. Second is Lincoln brome with 3070 lbs. per acre.

Turkey brome has the highest average production of any of the grasses. This is only a three year average since the stand was considered too poor the first year to harvest. In spite of this slow start this variety had shown excellent production for the last 3 years.

Many of the varieties may have made stand improvements this past season but due to the low production of the dryer than normal year these improvements did not show up in production increases. Both selections of Alti wildrye have obviously increased in stand density since they were rogued in 1973. The increase in production is largely due to this stand improvement but may also contributed by the younger more vigorous plants which have reoccupied the plots. As these plants become older their production may decline as has some of the other varieties in the trial.

Table 5. Average Yields of Grass Varieties in the Grass Adaptation Trial Seeded in 1975

Variety	Dry Weight Yield – Lbs/Acre				
	1973	1974	1975	1976	Avg. Yield
Turkey Brome	N.H.	5355	5679	3181	[1/] 4738
Pubescent Wheatgrass	3551	4042	4999	2056	3662
Lincoln Bromegrass	1512	5001	4280	1489	3070
Topar Pub. Wheatgrass	1646	3629	4237	1684	2799
Mandan 404 Brome	1630	3772	3587	1384	2593
Nordan Crested Wheatgrass	2199	2484	4176	1805	2666
Lodorm Green Stipa	N.H.	2418	3309	1781	[1/] 2502
Sodar Wheatgrass	829	3804	3692	1991	2579
Mandan Wildrye	1427	3927	2872	1384	2402
Durar Hard Fescue	1136	3794	2302	1983	2304
Western Wheatgrass #456	1381	2689	3081	1352	2126
Vinall Russian Wildrye	471	3891	2766	1449	2144
Montana Wheatgrass	711	3679	2724	1433	2137
Green Stipa (SCS)	N.H.	1850	2700	1756	[1/] 1576
Sheep Fescue	N.H.	2246	2270	1756	[1/] 1568
Basin Wildrye (SCS)	N.H.	N.H.	5286	3416	[2/] 4351
Basin Wildrye (Pull)	n.h.	n.h.	3706	3003	[2/] 3354
Altai Wildrye (SCS)	2614	N.H.	N.H.	4258	[2/] 3436
Altai Wildrye (SADK.)	1933	N.H.	N.H.	4412	[2/] 3172
Mandan Ricegrass	N.H.	N.H.	N.H.	N.H.	0
Indian Ricegrass	N.H.	N.H.	N.H.	N.H.	0

[1/] 3 year Average

[2/] 2 Year Average

N.H. – Not Harvested Because of: (1) Lack of Vegetation (2) Infestation of Invading Plants