ANNUAL REPORT

DICKINSON AGRICULTURAL EXPERIMENT STATION

1982

REPORT OF
AGRONOMIC INVESTIGATIONS
AT THE
DICKINSON EXPERIMENT STATION
DICKINSON, NORTH DAKOTA
1982

By

THOMAS J. CONLON

Superintendent
and
Agronomist

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GROWING CONDITIONS – 1982

Precipitation during the last four months of 1981 was above average, providing a good soil water recharge. Snowfall was above average throughout the winter months, providing nearly three inches of precipitation from January thru March. Above average precipitation throughout the growing season was well distributed. Cool temperatures in April delayed spring field work until the last week of that month. The season is best characterized as cool, wet, and late, favoring small grain crop production which was much above average. Late season sun-flowers produced average yields. Weather in August and most of September was favorable harvest weather. Rain beginning in late September and lasting through October set an all time record for those two months since 1892. The wet fall weather was very good for establishment of a vigorous winter wheat and winter rye crop and improved grain and forage crop prospects for 1983.

Weather Data Summary

Precipitation	Inches	
	1981-82	90 Yr. Avg.
September-December	4.34	3.09
January-March	2.93	1.55
April-June	9.60	7.34
July-August	4.65	3.90
Total	21.52	15.88

Average temperature – degree F.

	Maximum	Minimum	Mean	72-year Mean
April	48	25	34	42
May	61	40	48	53
June	72	47	55	62
July	82	54	62	69
August	81	50	59	67

AGRONOMIC PROCEDURE

Seeding dates for winter wheat were: September 14 at Dickinson, September 15 at Hettinger and Scranton and September 16 at Beach. Winter rye was seeded at Dickinson September 14.

At Dickinson, spring wheat variety trials were seeded on April 27, oats on April 28, and durum and barley on April 29.

Off station spring grain variety trials were seeded at Beach on April 30, Hettinger May 3, Scranton May 4, Regent May 5, Glen Ullin May 6, Manning May 7, and at Beulah May 28.

All nursery trials were seeded on May 7. All crops in the cropping systems trials and the minimum tillage trials were seeded on May 27.

Sunflower trials were planted on June 4.

All winter grain variety trials were seeded with a John Deere deep furrow drill equipped with 10 cm spear point shovels spaced 25.4 cm, and pneumatic rubber tire packer wheels. All spring grain variety trails were seeded with the John Deere show drill. All small grain variety trials were seeded on summerfallow. Seeding rates in Kg/ha were: rye 63, winter wheat 56, durum, hard spring wheat and barley 67 and oats 54.

Commercial fertilizer was applied according to soil water test for an expected yield goal of 2350 kg/ha.

Hoelon and bromoxynil were used at all locations for wild oats and broadleaf weed control, following recommended rates and application procedures.

Table 1. Hard red spring wheat variety trial – Dickinson, 1982.						
Variety	Avg. Yield bu/acre		Test weight		Heading date	Height inches
Waldron	46.8		61.5		7-4	37
Olaf	48.7		59.5		7-6	30
Len	49.8		62.0		7-6	29
Butte	50.9		63.0		7-2	34
Coteau	47.3		61.0		7-6	35
Alex	57.5		63.0		7-6	38
Marshall	53.9		61.5		7-6	29
Walera	60.8		61.5		7-9	30
Oslo	55.6		60.0		7-3	30
PR 260	54.2		61.0		7-5	33
Pro Brand 711	48.1		61.5		7-5	30
Pro Brand 715	62.2		61.5		7-8	33
Solar	50.1		61.5		7-9	28
Era	60.0		63.0		7-9	31
Columbus	49.0		61.5		7-7	40
Centa	51.4		62.0		7-2	35
Leader	41.3		62.0		7-6	34
Lew	44.3		63.0		7-6	32
Mt 7819	49.8		61.0		7-6	32
ND 580	45.1		61.0		7-6	35
ND 574	42.3		61.0		7-5	35
ND 582	49.5		62.0		7-5	36
ND 586	56.4		60.5		7-8	30
MP 108	44.0		61.5		7-5	30
ND 587	49.8		63.5		7-4	37
ND 588	49.8		61.0		7-5	32

Table 1. Hard red spring wheat variety trial – Dickinson, 1982 continued.						
Variety	Avg. Yield bu/acre		Test weight		Heading date	Height inches
ND 589	52.0		62.5		7-4	36
ND 590	58.3		59.0		7-9	33
ND 591	48.4		63.0		7-3	34
ND 593	50.3		61.5		7-5	29
ND 79304	60.0		65.0		7-8	32
2369	58.6		61.5		7-6	30
	50.3		59.5		7-7	38
Lsd, bpa 6.6	51.7		60.4			
CV = 5%						

Table 2. Long term yield comparison – hard red spring wheat variety trial.

Yield in bushels per acre

Variety	1978	1979	1980	1981	1982	5-yr Avg.
Waldron	46	38	23	41	47	39
Olaf	50	43	24	45	49	42
Lew	47	35	23	39	44	38
Butte	53	39	21	41	51	41
Coteau	51	43	23	44	47	42
Len	45	38	23	44	50	40
Alex	53	38	23	48	58	44
Solar	63	44	24	53	50	47
Oslo				49	56	
Tracey				50		

Table 3. Hard red spring wheat – Dickinson and off-station sites – 1982.

Variety	Dickinson	Beach	Beulah	Bowman	Glen Ullin	Hettinger	Manning	Re
Waldron	47	55	23	55	51	44	12	
Olaf	49	61	19	50	56	50	21	
Len	50	55	26	47	53	44	21	
Butte	51	56	26	46	53	41	11	
Coteau	47	56	23	44	56	40	26	
Alex	58	55	24	56	55	47	22	
Marshall	53	59	28	55	59	44	26	
Waldera	61	62	22	51	59	38	29	
Oslo	56	58	23	49	53	44	19	
Era	60	60	21	50	56	39	28	
Solar	50	61	20	39	54	40	28	
Lsd, bpa	6.6	3.3	3.1	5.7	4.2	3.6	3.0	
CV %	5	4	11	11	7	7	11	

Table 4. Hard red spring wheat – Dickinson and off-station sites – 1982.

Variety	Test weight per bushel							
	Dickinson	Beach	Beulah	Bowman	Glen Ullin	Hettinger	Manning	R[illegible]
Waldron	62	56	56	60	58	59	60	
Olaf	60	54	58	61	59	59	61	
Len	62	58	58	60	60	57	62	
Butte	63	57	59	61	60	60	62	
Coteau	62	56	58	60	59	60	61	
Alex	63	58	59	62	61	61	62	
Marshall	62	56	58	60	60	59	62	
Waldera	62	58	54	59	59	59	62	
Oslo	60	55	55	58	58	57	61	
Era	63	56	55	60	60	59	62	
Solar	62	58	55	60	59	59	62	

Table 5. Hard red spring wheat – Dickinson and off-station sites – 1982.

Variety	Protein Percent at 14% Moisture							
	Dickinson	Beach	Beulah	Bowman	Glen Ullin	Hettinger	Manning	Re
Waldron	15.9	15.7	16.0	13.4	15.8	17.2	16.5	1
Era	13.5	14.8	15.0	11.8	13.2	14.8	12.7	1
Olaf	14.8	16.2	15.3	13.5	15.2	16.6	16.0	1
Butte	14.3	15.9	15.3	13.0	15.7	15.9	15.7	1
Coteau	15.9	15.8	16.4	14.3	15.7	17.1	15.1	1
Solar	13.4	14.2	14.6	11.8	12.8	14.9	12.4	1
Len	15.8	15.7	15.4	13.4	15.7	16.7	16.5	1
Waldera	13.5	14.6	14.9	13.7	12.9	14.6	12.7	1
Oslo	12.8	16.0	15.0	12.8	13.6	14.9	13.8	1
Alex	14.8	16.7	16.5	13.3	15.3	16.7	15.5	1
Marshall	13.5	15.7	14.8	12.5	13.6	15.2	13.9	1
Pro Brand 711	13.9							

Table 6. Durum variety trials – Dickinson, 1982.

Variety	Avg. yield bu/acre	Test weight	Heading date	Height inches
Rolette	49.5	62.5	7-4	36
Ward	52.3	61.0	7-5	38
Crosby	53.6	62.0	7-4	37
Rugby	52.3	60.5	7-6	37
Cando	57.2	62.0	7-5	28
Coulter	54.5	61.0	7-6	36
Vic	51.2	62.5	7-6	35
D 771	63.3	60.5	7-6	29
D 7609	53.1	62.0	7-6	37
D 785	53.6	61.5	7-6	34
D 7733	52.0	62.0	7-7	36
D 7751	49.2	63.0	7-6	36
D 7798	52.5	62.5	7-7	37
D 77200	57.2	62.5	7-6	30
D 792	48.1	62.5	7-4	35
D 793	55.0	61.5	7-5	35
D 78127	58.0	63.0	7-6	29
D 78140	56.1	63.0	7-6	29
D 78168	59.1	61.5	7-6	27
D 78177	57.2	61.0	7-6	26
D 801	62.4	60.0	7-6	28
D 802	62.2	61.5	7-6	29
D 803	60.5	59.5	7-8	27
D 804	63.0	62.5	7-8	27
Lsd, bpa 4.2	1333.1	1481.5		
CV % 7	55.5	61.7		

Table 7. Long term yield comparison of Durum varieties.

		Yield in bushels per acre				
Variety	1978	1979	1980	1981	1982	5 yr. average
Rolette	40.0	35.0	14.0	44.0	49.5	36.5
Ward	43.0	39.0	16.0	45.0	52.3	39.1
Crosby	40.0	38.0	15.0	43.0	53.6	37.9
Rugby	42.0	40.0	17.0	39.0	52.3	38.1
Cando	39.0	42.0	16.0	40.0	57.2	39.0
Coulter	38.0	40.0	18.0	41.0	54.5	37.9
Vic	34.0	36.0	20.4	41.0	51.2	36.0
Lloyd	--	--		45.4	63.3	

Table 8. Durum wheat variety trials – Dickinson and off-station sites, 1982.

	Yield in bushels per acre							
Variety	Dickinson	Beach	Beulah	Bowman	Glen Ullin	Hettinger	Manning	Re
Vic	51	48	30	51	47	51	19	[illegible]
Cando	57	48	28	56	54	50	32	[illegible]
Rolette	50	51	34	45	43	53	13	[illegible]
Ward	52	48	33	49	50	53	18	[illegible]
Rugby	52	50	35	52	50	50	18	[illegible]
Lsd, bpa	4.2	3.3	3.1	3.0	2.9	3.1	3.0	[illegible]
CV %	7	3	4	5	5	5	9	

	Test weight per bushel							
Vic	63	59	59	61	60	58	60	
Cando	62	56	59	61	59	57	61	
Rolette	63	60	60	62	60	61	61	
Ward	61	58	60	62	60	58	61	
Rugby	61	58	60	61	60	57	61	

Table 9. Winter wheat variety trial – Hettinger, 1982.				
		Avg. yield bu/acre		Test weight
Roughrider		53.6		58.0
Norstar		65.5		60.0
Froid		53.9		55.5
Winoka		48.1		60.0
Gent		53.1		58.0
Agate		44.0		54.0
Centurk		38.5		55.5
Lsd, bpa 4.9				
CV 9%				

Table 10. Oat variety trial – Dickinson, 1982.

	Avg. yield bu/acre	Test weight	Heading date	Height inches
Kelsey	103.7	32.0	7-6	36
Otana	103.7	33.0	7-10	35
Marathon	97.5	31.0	7-9	39
Menominee	92.0	33.0	7-10	33
Ogle	100.9	33.0	7-4	31
Hudson	106.4	30.0	7-8	34
Fidler	80.3	31.0	7-12	32
Porter	103.7	35.0	7-9	32
Pierce	96.8	30.0	7-9	30
ND 77-66-13	96.1	35.0	7-8	32
ND 76-530-301	92.7	35.5	7-8	31
ND 77-62-3646	100.9	32.5	7-9	32
Lsd, bpa 8.9				
CV % 7				

Table 11. Long term yield comparison, oat variety trial.

	Yield in bushels per acre					
	1978	1979	1980	1981	1982	5-yr. Avg.
Kelsey	96	95	45	55	104	79
Harmon	81	85	38	72		
Hudson	92	96	42	35	106	74
Otana	99	98	48	60	104	82
Menominee	86	93	49	48	92	74
Marathon				42	98	
Fidler				61	80	
Ogle				60	101	
Porter					104	

Table 12. Oat variety trials – Dickinson and off-station sites, 1982.

	Yield in bushels per acre						
Variety	Dickinson	Beach	Beulah	Bowman	Glen Ullin	Manning	Regent
Kelsey	104	63	52	75	85	49	92
Otana	104	76	54	82	91	59	95
Menominee	92	66	57	77	94	60	94
Marathon	98	76	27	80	83	50	97
Ogle	101	52	73	77	64	39	92
Lsd, bpa	8.9	6.0	11.8	11.8	1.5	8.2	6.0
CV %	7	7	16	14	5	14	8

Test weight per bushel							
Kelsey	32	35	37	39	39	34	40
Otana	33	35	36	40	40	37	40
Menominee	33	35	36	39	40	37	40
Marathon	31	33	35	41	37	35	41
Ogle	33	32	35	37	39	36	36

Table 13. Oat variety trials – Dickinson, 1982.

Variety	Avg. yield bu/acre	Test weight	Heading date	Height inches
Larker	63.3	50.5	6-28	30
Bedford	77.7	48.5	7-4	30
Glenn	77.4	47.0	6-28	35
Morex	75.6	46.0	6-28	35
Bumper	80.1	44.5	7-3	33
Azure	63.3	48.5	6-30	32
ND 4242	72.2	48.0	6-28	32
ND 5377	77.7	44.0	6-29	31
ND 5424	80.5	49.5	6-29	32
ND 5569	79.4	49.0	7-1	33
M 36	83.6	48.5	7-1	31
Hector 2R	80.8	47.0	7-3	30
Harrington 2R	85.3	46.5	7-5	27
Summit 2R	85.3	48.0	7-4	29
Clark 2R	74.6	49.5	7-5	29
ND 4758 2R	89.0	48.5	7-3	30
ND 4994 2R	87.3	53.0	6-29	30
ND 5698 2R	92.1	48.5	7-4	31
Lsd, bpa 7.2				
CV 8%				

		Table 14. Long term yield comparison, barley variety trials 1982.				
			Yield in bushels per acre			
Variety	1978	1979	1980	1981	1982	5-yr. avg.
Larker	54	63	27	43	63	50
Glenn	66	56	35	45	77	56
Hector	72	72	44	53	81	64
Summit	76	72	38	48	85	64
Morex	62	64	34	52	76	58
Bumper				48	80	

Table 15. Barley variety trials – Dickinson and off-station sites, 1982.

	Yield in bushels per acre							
Variety	Dickinson	Beach	Beulah	Bowman	Glen Ullin	Hettinger	Manning	Re
Glenn	77	61	49	81	62	81	16	[illegible]
Morex	76	58	40	80	52	78	13	
Azure	81	67	48	83	65	94	12	
Hector	81	70	43	84	71	80	38	
Clark	75	70	34	79	68	80	39	
Bumper	80	65	45	85	72	82	30	
Lsd, bpa	7.2	5.6	3.0	5.0	3.6	6.1	2.8	9
CV %	8	8	6	6	5	7	7	
	Test weight per bushel							
Glenn	47	46	44	50	52	46	44	[illegible]
Morex	46	46	46	50	52	48	45	
Azure	49	48	46	51	52	48	45	
Hector	47	50	47	52	53	50	50	
Clark	50	50	47	50	52	47	49	
Bumper	45	47	46	48	49	44	45	

Table 16. Winter rye variety trial – Dickinson, 1982.				
		Avg. yield bu/acre		Test weight
Musketer		18		51
Couger		18		51
Chaupon		23		47
Hancosk		17		47
Puma		31		52
Lsd, bpa	7.1			
CV %	27			

Table 17. Uniform regional hard red spring wheat nursery, 1982.

Variety	Avg. Yield bu/acre		Test weight	1000 KW	Heading date	Height inches
CI 3651	32.1		60.0	36	7-12	36
CI 13751	38.1		60.0	30	7-12	35
CI 13958	38.9		59.5	36	7-12	33
CI 13986	50.3		60.5	34	7-14	27
CI 17681	42.0		60.0	36	7-9	31
SD 2861	43.1		59.0	40	7-9	27
SD 2854	50.8		58.0	38	7-11	30
SD 8015	55.9		60.5	38	7-10	27
SD 2903	48.4		62.0	34	7-9	32
SD 2881	47.3		60.5	42	7-10	31
MT 7836	47.6		60.0	38	7-13	32
MT 8017	35.7		59.5	35	7-14	29
MN 7529	44.0		60.5	41	7-10	27
MN 7663	40.3		60.5	37	7-14	25
MN 7357	52.1		58.0	40	7-14	25
MN 73167	42.8		58.0	38	7-14	26
ND 574	40.7		56.0	35	7-13	32
ND 582	42.7		60.0	34	7-14	30
ND 586	51.6		57.0	35	7-16	26
ND 590	46.3		57.0	38	7-16	26
ND 594	44.0		61.0	33	7-10	27
NK 775 8002	48.1		60.5	37	7-13	26
NK 775 4374	46.7		62.0	47	7-10	25
NK 775 4342	42.9		59.5	39	7-14	27
HS 79304	46.0		60.0	32	7-15	26
HS 79561	42.3		58.5	40	7-14	29

Table 17. Uniform regional hard red spring wheat nursery, 1982 continued.

Variety	Avg. Yield bu/acre		Test weight	1000 KW	Heading date	Height inches
HS 79400	39.7		60.0	36	7-15	28
PR 2369	43.9		61.0	39	7-14	28
X 7993	38.9		60.5	35	7-15	33
X 9882	38.4		59.0	39	7-14	27
WA 6922	37.7		60.0	36	7-14	25
WA 6923	39.5		58.0	35	7-14	28
WRP-8-1	40.8		61.0	35	7-10	24
WRP-8-30	38.8		61.5	35	7-9	24
Lsd, bpa = 8.4						
CV = 17%						

WINTER WHEAT NURSERIES

The Elite Yield and Advanced Winter Wheat nurseries were seeded on summer fallow in early September. Germination and fall growth was satisfactory, but as was the case with the field plot trials, the nursery seedlings failed to survive the winter at Dickinson.

Table 18. Uniform regional durum nursery, 1982.

Variety	Avg. Yield bu/acre		Test weight	1000 KW	Heading date	Height inches
Mindum	42.6		63.0	50	7-12	36
Rolette	48.5		62.0	44	7-7	27
Ward	47.1		63.0	46	7-9	31
Crosby	44.5		62.0	44	7-8	32
Rugby	38.4		62.0	46	7-10	28
Cando	33.0		62.5	52	7-10	29
Coulter	41.4		62.5	50	7-10	29
Vic	39.3		61.5	44	7-10	33
D 771	30.1		62.5	52	7-10	26
D7609	37.7		61.0	50	7-10	32
D785	36.4		61.0	46	7-10	30
DT433	42.1		63.0	52	7-10	31
D7733	38.8		62.0	52	7-11	30
D7751	34.6		62.0	52	7-10	32
D7798	45.0		62.0	54	7-11	32
D77200	39.4		62.5	46	7-11	29
D792	36.2		61.5	52	7-10	32
D793	44.9		61.5	52	7-7	31
DTY369	40.3		61.0	48	7-9	26
DT371	34.4		61.5	50	7-9	27
D78127	42.0		63.5	50	7-9	31
D78140	39.5		62.0	48	7-10	29
D78168	39.2		61.5	48	7-11	30
D78177	41.1		62.0	50	7-10	27
D801	38.7		63.0	46	7-11	29
D802	41.4		62.5	46	7-10	26

Table 18. Uniform regional durum nursery, 1982 continued.						
Variety	Avg. Yield bu/acre		Test weight	1000 KW	Heading date	Height inches
D803	41.5		61.5	46	7-12	28
D804	42.5		63.5	46	7-11	29
Lsd = 5.9%						
CV = 15%						

Table 19. Uniform early oats nursery Dickinson, 1982.						
Variety	Avg. yield bu/acre		Test weight		Heading date	Height inches
Otee	56.7		38.5		7-6	29
IL 75-5681	68.3		37.5		7-5	30
Lang	77.7		38.0		7-6	28
IA Multiline X-2	78.0		37.5		7-5	30
Clintford	70.7		38.0		7-6	30
SD 740065	72.0		37.0		7-5	30
SD 743358-06	60.3		39.5		7-6	29
MN 80116	65.7		38.0		7-5	30
Andrew	76.7		35.0		7-5	32
MO 06195	70.0		36.5		7-7	26
MO 06197	65.7		40.0		7-6	27
MO 06035	71.7		36.5		7-6	29
MO 07233	75.7		36.5		7-6	26
MO 07091	55.0		37.5		7-5	28
MO 06922	53.7		37.0		7-5	23
Bates	62.3		38.0		7-5	27
Lsd - 9.3						
CV = 11%						

Table 20. Uniform midseason oats nursery Dickinson, 1982.

Variety	Avg. yield bu/acre		Test weight		Heading date	Height inches
WI X3612-2	65.7		34.0		7-15	34
WI X4024-7	65.3		36.0		7-9	32
WI X3620-7	67.0		36.0		7-6	30
Dal	65.0		34.0		7-11	32
IL 75-1056	61.0		36.0		7-6	25
IL 75-5860	71.3		36.0		7-5	28
IL 75-1065	72.7		36.0		7-6	26
Igle	89.7		34.0		7-6	29
W 76121	95.3		33.0		7-14	31
W 78286	92.0		34.5		7-14	34
W 78296	110.0		34.0		7-14	33
NY A-11	89.3		34.0		7-9	27
PA 7967-11759	78.3		37.0		7-16	26
PA 7967-11690	83.7		37.0		7-6	28
SD 780304	93.7		35.5		7-10	32
SD 780393	75.3		35.0		7-7	36
SD 743358-12	63.0		32.0		7-11	36
SD 780352	74.7		36.0		7-9	31
Clintland	57.7		34.0		7-5	33
MN 78211	71.7		33		7-10	34
MN 79229	64.7		36		7-9	31
MN 80111	79.7		30.5		7-8	31
MN 80118	55.3		30		7-6	30
MN 80227	78.0		36.5		7-8	31
ND 77-61-311	85.0		36.5		7-11	30
ND 77-66-13	77.0		34.5		7-11	31

Table 20. Uniform midseason oats nursery Dickinson, 1982 continued.

Variety	Avg. yield bu/acre		Test weight		Heading date	Height inches
ND 76-530-301	74.0		30.0		7-11	31
Gopher	92.3		35.0		7-7	32
P 72266B1-2-3-2	78.3		35.0		7-5	30
P 72282RB6-5-3-59	59.3		34.0		7-6	31
P 72288RBI-3-4-3	57.0		33.0		7-6	28
P 73118A3-5-2	73.3		35.0		7-5	29
Lsd = 12.6						
CV = 14%						

Table 21. Station oats nursery, 1982.

Variety	Avg. yield bu/acre		Test weight		Heading date	Height inches
ND 78379-6B1	89.7		36.0		7-9	31
ND78119-12B2	79.7		36.5		7-11	32
ND 78376-12B2	93.7		37.0		7-9	33
ND76-530-301	87.7		37.0		7-14	30
Menominee	105.7		38.0		7-14	29
ND 77-64-13	73.3		38.5		7-11	31
ND 77-64-152	74.7		35.5		7-10	31
ND 77-66-364	93.0		37.0		7-11	31
ND 77-61-311	84.0		38.0		7-11	30
Fidler	90.0		35.5		7-14	30
Otana	104.7		37.0		7-14	34
Porter	98.3		37.5		7-11	29
Ogle	80.7		34.5		7-7	28
Lsd = 11.7						
CV - 11%						

Table 22. Uniform Great Plains barley nursery, 1982.

Variety	Avg. yield bu/acre		Test weight		Heading date	Height inches
Firlbecks III	58.8		50.0		7-10	27
Primus II	53.5		46.0		7-3	27
Larker	64.3		48.0		7-5	29
Bedford	55.8		47.5		7-9	27
Br DS4-1	76.1		44.0		7-5	28
ND 3529	48.5		48.0		7-11	32
ND 3715	53.3		44.5		7-9	28
ND 4208	63.8		44.0		7-9	30
SD 79-426	53.8		46.0		7-5	32
SD 79-435	61.0		48.5		7-8	31
SD 79-446	55.2		49.0		7-5	30
Azure	67.3		47.0		7-6	32
ND 5377	71.2		43.5		7-4	28
ND 5569	51.7		44.0		7-4	28
Lsd = 9.5						
CV - 13%						

Table 23. Western dryland spring barley nursery, 1982.

Variety	Avg. yield bu/acre		Test weight		Heading date	Height inches
Munsing	63.3		50.5		7-11	24
Galt	66.2		48.0		7-9	27
Steptoe	65.0		46.5		7-6	26
Hector	70.8		51.0		7-16	29
Clark	72.0		50.0		7-16	28
Zephyr	74.5		49.0		7-13	27
MT 311031	70.5		51.5		7-11	26
MT 311576	70.8		50.0		7-11	29
WA 969175	75.0		48.0		7-11	26
MT 657399	70.8		49.5		7-11	29
MT 312620	69.2		50.5		7-9	26
MT313104	72.3		50.0		7-10	28
ID 810264	61.0		48.0		7-14	27
ID 810099	72.8		48.5		7-16	27
MT 853287	71.8		48.5		7-8	30
MT853320	74.0		49.0		7-8	31
MT853345	49.5		52.0		7-3	25
ND 4994	54.6		52.5		7-8	27
ND 47581	73.7		50.0		7-13	30
OR 74352	62.8		46.0		7-11	26
UT 1427	79.2		48.0		7-3	28
UT 1513	73.7		43.5		7-9	28
WA 836678	78.0		44.5		7-9	28
WA 106987	66.7		45.5		7-16	23
Lsd = 8.6						
CV - 11%						

Table 24. Western spring barley nursery, 1982.

Variety	Avg. yield bu/acre		Test weight		Heading date	Height inches
Trebi	65.7		47.5		7-7	26
Steptoe	72.2		44.5		7-6	25
Klages	65.2		46.5		7-15	25
Morex	60.8		47.5		7-7	28
Clark	62.2		47.5		7-15	26
ID 410167	66.3		48.0		7-14	26
MT 547354	71.7		51.0		7-11	27
MT 31972	68.0		49.0		7-14	28
OR 743521	59.5		46.5		7-16	23
WA 969175	62.8		48.5		7-16	25
CA 75790	66.0		47.5		7-18	24
MT 311031	67.0		50.0		7-11	25
MT 311576	55.1		49.5		7-14	25
OR 73341	51.0		41.5		7-17	19
OR 73343	54.7		45.5		7-17	22
SK 76333	71.0		49.0		7-14	26
UT 1427	68.8		45.0		7-5	23
ID 786871	58.5		48.5		7-14	23
ID 810264	61.2		49.0		7-14	27
ID 789009	70.8		47.5		7-5	26
MB 731540	70.2		47.0		7-5	25
MT 41279	50.7		47.5		7-15	24
MT 853183	58.2		48.0		7-15	18
UT 464	64.3		44.0		7-6	25
UT 1513	68.5		46.5		7-10	27
UT 1759	64.0		46.5		7-10	27

Table 24. Western spring barley nursery, 1982 continued.						
Variety	Avg. yield bu/acre		Test weight		Heading date	Height inches
WA 145837	57.0		43.5		7-10	24
WA 854378	62.2		44.5		7-9	26
WA 106987	64.0		45.0		7-10	21
WA 112967	62.2		46.5		7-11	26
Lsd = 8.1						
CV - 13%						

Table 25. Advanced two row barley nursery, 1982.						
Variety	Avg. yield bu/acre		Test weight		Heading date	Height inches
Morex	44.2		47.5		7.7	28
Glenn	55.5		48.0		7.5	26
Flages	56.7		48.5		7.14	28
Harrington	61.0		48.0		7-14	27
Hector	66.5		50.0		7-10	32
ND 5093-2	58.7		50.0		7-10	30
ND 5096-2	53.3		51.0		7-5	29
ND 5692	48.3		52.0		7-8	30
ND 4991-3	57.7		51.0		7-8	30
ND 4974-1	71.2		49.5		7-10	29
ND 6894	48.2		49.5		7-9	28
ND 6817	49.2		50.0		7-14	29
ND 5993	57.5		50.0		7-7	31
ND 6806	51.0		50.5		7-9	31
ND 5998	60.3		49.5		7-9	30
TR 521	64.3		51.5		7-9	29
TR 604	66.7		48.0		7-10	25
TR 215	62.7		49.5		7-16	27
ND 2679-4-2	55.0		50.5		7-7	28
ID 10167	58.2		49.0		7-11	29
ND 5971	55.0		48.0		7-10	27
ND5950	55.7		49.5		7-8	30
ND5972	61.2		48.5		7-10	28
ND5876	56.7		50.5		7-10	28
ND 5883	69.3		50.5		7-10	26
Lsd = 5.8						
CV =8%						

MINIMUM TILLAGE AND SEEDING, AND DOUBLE DISKING AND CONVENTIONAL SEEDING ON SECOND CROPPING

In 1976, there was no significant difference inwheat production between minimum tillage on second cropping. Growing conditions were excellent in 1976.

In 1977, hot, dry spring weather conditions were not particularly favorable to germination and early crop growth because of dry surface soil. Because of the small diameter of the rotating coulters on the John Deere 1500 Power till seeder, it was not possible to place seed deep enough to get it into moist soil. As a consequence germination was spotty and delayed until later rainfall came. Excessive weed growth was also a problem on this treatment. Penetration of the surface soil and satisfactory seed placement was not as difficult with the Melore 701 minimum tillage drill. Germination and growth was satisfactory and production was double that for the Power till seeder. Conventional disking and seeding was the best production method in the 1977 comparison.

In 1978 and 1979 only the Melroe 701 and the conventional tillage and seeding treatments were compared. Initial growth was slower on the minimum tillage treatment. This may be partly due to lower surface temperatures caused by the reflective and insulting effects of the straw and stubble on the field surface. Weed problems were also a greater problem on the minimum tillage treatment.

In 1980 the Melroe 701 drill and conventional seeding was compared once again. Because of severe drought, production was zero for both treatments.

In 1981 the John Deere hoe drill was used for seeding the minimum tillage treatment. A good stand of wheat resulted from both the minimum tillage seeding and the conventional seeding, with the minimum tillage treatment producing slightly higher yields for the first time since the trial was begun.

in 1982 the John Deere hoe drill was once again used for seeding the minimum tillage treatment, with the conventional treatment consisting of double disking and seeding with the double disk press drill. Excellent growing conditions produced the highest yields recorded in this trial over the past seven year period. Yields for the trials are summarized in table 26.

Table 26. Minimum tillage and double disking and seeding for wheat production on recrop.

	Yield in bushels per acre on	
Year	Minimum tillage and seeding	Double disking and conventional seeding
1976	28.0	27.0
1977	12.6	15.0
1978	10.3	28.5
1979	9.6	15.9
1980	0.0	0.0
1981	15.3	14.3
1982	20.9	31.8
7-yr. average	13.8	18.9

WHEAT PRODUCTION ON FALLOW,
SECOND CROPPING AND CONTINUOUS CROPPING

in 1976, an excellent year for small grain production on stubble land, in southwestern North Dakota, yields on conventional summerfallow were 43 bushels per acre and on continuous cropping 22 bushels per acre. In 1977, a year when hot, dry spring weather conditions were not particularly favorable to the germination and early growth of the crop, yields were appreciably reduced, even through rainfall in late May and June provided ample soil water for satisfactory crop growth. Yields on fallow were 26.9 bushels per acre, on second cropping 11.5 and on continuous cropping 5.5 bushels per acre. Relative difference between production methods were remarkably similar for both years.

In 1978, wheat on summerfallow averaged 38.5 bushels per acre in this trial compared with 31.4 on second cropping and 30.6 on continuous cropping. High yields on stubble land were a result of the excellent soil water recharge provided by the well above average precipitation coming in the fall of 1977 plus adequate seasonal moisture and cool growing season temperatures.

In 1978, fall precipitation was only 4.58 inches compared to more than 10 inches in 1977. In addition, a late spring planting date and a very dry period extending from April 20 to June 18 was unfavorable for good, uniform germination and early crop growth. The effectiveness of stored soil water in fallow under stressed conditions is readily evident in the harvested yields.

In 1980, severe drought conditions prevailed through the third week in June. Grain production was reduced on summerfallow and was zero on recrop and conditions cropping treatments.

In 1981 early seeded small grain crops were severely frosted by a severe freeze on May 9th, but seemed to recover very well. The most severe weather affecting crop production occurred the first ten days in July when temperatures of 93° and above were recorded on 7 days, with a maximum reading of 110°. Evaporation measured 3.93 inches during this ten day period.

Precipitation during the last four months of 1981 was above average, providing a good soil water recharge. Snowfall was above average throughout the winter months, providing nearly three inches of precipitation from January thru March. Above average rainfall thru the growing season was well distributed.

The growing season of 1982 is best characterized as cool, wet and late.

A summary of wheat production in this trial is shown in table 27.

Table 27. Wheat production on fallow, recrop and continuous cropping.

	Yield in bushels per acre							
Treatment	1976	1977	1978	1979	1980	1981	1982	7-yr. avg.
Fallow	43.0	26.9	38.5	32.4	22.3	21.3	33.9	31.2
Recrop	27.0	11.5	31.4	15.9	0.0	14.5	25.7	18.0
Continuous cropping	22.0	5.0	30.6	12.8	0.0	14.0	24.9	15.7

CROPPING SYSTEMS STUDY

The cropping systems trial which attempted to evaluate alternate methods of crop production in southwestern North Dakota was phased out because of certain faulty design aspects. The trial was re-designed as follows, to include a comparison of several cropping systems.

Treatment 1: Compares a two year rotation of wheat and corn with a two year fallow-wheat rotation. Early corn varieties for grain production will be used in this comparison.

Treatment 2: Compares a two year rotation of wheat and sunflowers with a two year fallow-wheat rotation.

Treatment 3: Records production in a four year cropping sequence of sunflower on wheat stubble, barley on sunflower stubble, fallow on barley stubble and wheat on fallow.

Treatment 4: Compares wheat on fallow, wheat on continuous cropping and wheat on no-till recrop.

Initially, an attempt will be made to incorporate chemical fallow into the system in random arrangement in all treatments. Some difficultly has been experienced with being able to make the chemical application at the proper time without damage to adjacent plots. If chemical fallow can be used, seeding will be done with the no-till drill on these plots.

Plans are to remove soil fertility and weed growth as limiting factors.

Weed control in treatment #3 is designed to provide Treflan residual on barley and Glean residual from barley to carryover on fallow.

Fertilizer rates for recrop will be 60 lbs. actual Nitrogen and 30 lbs. P_2O_5 per acre. On fallow th erates will be 30 lbs. N and 30 lbs. P_2O_5.

The field plot diagram attached shows the planting plan for the 1983 season, as each crop is planted on the appropriate previous crop or fallow, as provided for in 1982, the year of establishment of the cropping sequence

Dickinson Experiment Station
Dickinson, ND Main Field

				107 Fallow	76 Wheat No till Re crop	75 Wheat Cont crop	44	43	12	
167	138	137	108	106 Wheat No till Re crop	77 Wheat Cont crop	74 Wheat on fallow	45	42	13	
166	139	136	109	105 Wheat Cont crop	78 Wheat on fallow	73 Fallow	46	41	14	
165	140	135	110	104 Wheat on fallow	79 Fallow	72 Wheat No till Re crop	47	40	15	
164	141	134	111	103 Sun flrs on Wheat stub	80 Fallow Bly stub	71 Barley on S. Flr.	48	39	16	
163	142	133	112	102 Barley on S. Flr	81 Wheat on fallow	70 Fallow Bly stub	49	38	17	11
162	143	132	113	101 Fallow Bly stub	82 Sun flr on Wheat stub	69 Sun flr on wheat stub	50	37	18	10
161	144	131	114	100 Wheat on fallow	83 Barley on S. Flr.	68 Wheat on Fallow	51	36	19	9
160	145	130	115	99 Sun flr on Wheat Stub	84 Fallow	67 Wheat on S. Flrs	52	35	20	8
159	146	129	116	98 Wheat on S. Flrs.	85 Wheat on Fallow	66 Sun flr on Wheat stub	53	34	21	7
158	147	128	117	97 Fallow	86 Sun flr on Wheat stub	65 Fallow	54	33	22	6
157	148	127	118	96 Wheat on fallow	87 Wheat on S. flrs	64 Wheat on Fallow	55	32	23	5
156	149	126	119	95 Corn on wheat stub	88 Fallow	63 Wheat on corn stub	56	31	24	4
155	150	125	120	94 Wheat on Corn stub	89 Wheat on fallow	62 Corn	57	30	25	3
154	151	124	121	93 Fallow	90 Corn on Wheat stub	61 Fallow	58	29	26	2
153	152	123	122	92 Wheat on fallow	91 Wheat on corn stub	60 wheat on Fallow	59	28	27	1

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SECTION II

LIVESTOCK
FEEDING, BREEDING

and

MANAGEMENT TRIALS

ESTRUS SYNCHRONIZATION CALVING EASE AMONG FIRST CALF HEIFERS

D.G. Landblom and J.L. Nelson

Managing heifer replacements so they will calve as two year olds with a minimum of difficulty has been, and continues to be a problem for many cow calf producers. Over the years numerous sire breed types have been used for calving ease and range from the Angus breed which has been most common, to dairy types such as the Jersey, and most recently the Longhorn. Success, of course, has been as diverse as the breed types used. Calving at three years of age normally results in very little calving difficulty, but is rarely worth mentioning since the economics of beef cattle production won't allow such a lengthy delay. Several management tools are at the producers disposal, which when combined may be useful in getting more heifers bred early in the breeding season to sires known for calving ease. The management tools being considered are:

1. Artificial insemination.
2. Selection of progeny tested sires that are know for calving ease and performance in 1st calf heifers.
3. Estrus synchronization with Lutalyse to reduce labor.
4. Clean-up breeding with the Longhorn breed.
5. Short 45 day breeding season.

Combining artificial insemination and estrus synchronization, sires with above average performance and known calving ease can be used artificially in an AI breeding program while using only 1/4-1/3 of the time previously needed. Synchronization of heat cycles is being done with a naturally occurring compound called prostaglandin, which was released for use in this country in 1980 and is sold by veterinarians under the trade name, Lutalyse. Breeding artificially almost never results in 100% conception and therefore necessities the need for clean-up bulls. Studies at this station have shown the Longhorn breed to be very easy calving type and is being used for clean-up purposes. Adhering to a short breeding season of 45 days produces heifers that are either bred early in the breeding season or are open and can be sold or fed as feeder cattle.

Considering the criteria just discussed, a breeding management study was designed with the following objectives: 1) to evaluate two methods of synchronization with Lutalyse; 2) to minimize calving difficulty by using AI and progeny tested sires followed by clean-up with the Longhorn breed; and 3) to evaluate the overall efficiency and effectiveness of the heifer management systems being suggested.

During the winter growing period following weaning, Hereford and crossbred Angus X Hereford heifer calves are sorted by weight and fed to gain sufficiently to weigh 650-700 pounds at the start of the breeding season.

In order for estrus synchronization to be successful beef females must be sexually mature and cycling properly. In 1979, KaMar heat detection devices and rectal palpation were used to identify those heifers that were cycling. This method was found to be totally unacceptable and a waste of time and money. In all other years of the study epididectomized sterile bulls with marking harnesses have been used to measure pre-breeding estrus activity. All animals that were wintered, with limited exceptions were used in the breeding studies and were not eliminated identified as open after being pregnancy tested.

Two breeding groups are being used in this study to evaluate two different management methods for using the estrus synchronizing compound, Lutalyse. A single injection of Lutalyse is being compared with the recommended souble injection.

Group one was synchronized using the single injection method. With this method, heifers are inseminated conventionally during the first five days of the breeding season. On the sixth day at 8:00 am all heifers not inseminated during the first five days of breeding are given 25 mg Lutalyse. After the Lutalyse is administered, AI breeding is continued until 8- hours has elapsed. At that time all remaining undetected heifers were inseminated as a group. Following the group insemination and a five day waiting period, the heifers were exposed to a Longhorn clean-up bull equipped with a chin-ball marker. Group two was synchronized with the double injection method. Using this method, two injections of Lutalyse separated by eleven days are used. None of the heifers were inseminated during the eleven day period between injections. Our abbreviated description of how each group was synchronized is shown in table 1.

Table 1. Design for estrus synchronization.

	Day of breeding season.	
Single Injection Method.		
	1	
	2	
Period I	3 4	Inseminate normally 1st five days of breeding season.
	5	
	6	8 am administer 25 mg Lutalyse to all heifers not inseminated during period I.
Period II	7 8	Continue breeding normally until 80 hrs post injection time.
	9	At 4 pm (80 hrs after the Lutalyse injection) all heifers not inseminated during periods I and II were inseminated as a group without regard to standing heat.
Double Injection Method.		
	Day of breeding season.	
	11 days before start of breeding season.	Administer 25 mg Lutalyse.
	1	The 2nd injection of Lutalyse is given at 8 am on the 11th day, which is the start of the breeding season.
	2 3	Inseminate normally all heifers found in standing heat until 80 hours post injection time.
	4	at 4 pm (80 hrs after the 2nd injection of Lutalyse) all heifers not inseminated during the 80 hr period are inseminated as a group without regard to standing heat.

The heifers were placed with a Longhorn clean-up bull after a five day waiting period.

Semen from an Angus sire, Shoshone Monitor 17An50, was purchased from Minnesota Valley Breeders Assn. in 1979, and in 1980 and 1981 semen from an Angus bull, Kadence Shoshone 7An47, was purchased from Select Sires, Plain City, Ohio. These sires have both been recommended by the suppliers as being easy calvers and known to transmit growth performance to their offspring.

Accumulated breeding results, calving difficulty, birth weights, and adjusted weaning weights are given in tables 2, 3, 4, and 5.

Summary:

1. Three years of synchronization and calving data, and two years of weaning data have been summarized in this progress report.

2. Success with synchronization has been variable, ranging from no response in 1979 to a 74% conception rate this past year.

The combined three year average conception rate for the single injection group was 41% and 46% for the double injection group.

3. Combined three year average cost/cow conceiving for semen and Lutalyse was $26.50 for the single injection groups and $37.65 for the double injection groups.

4. There was a high correlation between the number of heifers cycling before the start of the breeding season and the number of heifers responding to estrus synchronization.

5. Calving difficulty has been extremely variable. In 1981, calving difficulty with the Kadence Shoshone Angus bull was zero, however, the next year 62% of the heifers required assistance. Since the heifers originate from several diverse sire lines it is our feeling that the semen used was improperly labeled.

6. Trial is being continued and will conclude and be finalized when the calves are weaned in the fall of 1983.

Table 2. Single injection method of synchronization among first calf heifers.

	Single Injection			
Breeding/calving year	1979-80	1980-81	1981-82	3-yr. Average
No. head	20	24	19	63
No. in heat before breeding started	3	21	19	43 (68%)
No. inseminated 1st 5 days of breeding	4	9	5	18 (28.5%)
No. in heat and inseminated before 80 hours	0	9	10	19 (30.2%)
No. not showing heat but inseminated at 80 hours	16	6	4	26 (41%)
No. open	1	8	0	9 (14.3%)
Conception rate for management system	1 (5%)	11 (46%)	14 (74%)	26 (41%)
Economic:				
Breeding expense for semen and Lutalyse	$200	$267	$222	= $689
No. conceiving to synchronization	1	11	14	= 26
3-year average cost/heifer conceiving				
		$26.50		

Table 3. Double injection method of synchronization among first calf heifers.

	Double Injection			
Breeding/calving year	1979-80	1980-81	1981-82	3-yr. Average
No. head	21	24	18	63
No. in heat before breeding started	7	21	18	56 (73%)
No. in heat and inseminated before 80 hours	4	18	14	36 (51.7%)
No. not showing heat but inseminated at 80 hours	17	6	4	27 (42.9%)
No. open	1	3	1	5 (7.9%)
Conception rate for management system	4 (19%)	14 (58%)	11 (61%)	29 (46%)
Economic:				
Breeding expense for semen and Lutalyse	$336	$432	$324	= $1092
No. conceiving to synchronization	4	14	11	= 29
3-year average cost/heifer conceiving		$37.65		

Table 4. Calving difficulty and birth weights among synchronized first calf heifers.

	Single Injection				Double Injection			
Management Method	1979-80	1980-81	1981-82	3-yr total	1979-80	1980-81	1981-82	3-yr total
No. calving	19	16	18[1/]	53	20	21	17	58
No. calving unassisted	18	16	10	44	17	21	9	47
Calving difficulty [2/]								
AI Angus								
Shoshone Monitor (17An50)	1/1	-	-	1	4/2	-	-	2
Kadence Shoshone (7An47)	-	11/0	13/8	8	-	14/0	11/7	7
Station Angus (A94)	2/0	-	-		5/1	-	-	1
Longhorn	16/0	5/0	5/0		11/0	7/0	6/1	1
% Difficulty	33% Angus 0% Longhorn				29% Angus 4% Longhorn			

Birth weight summary 3 year average	Single Injection Bulls	Single Injection Heifers	Double Injection Bulls	Double Injection Heifers
AI Angus				
Shoshone Monitor (17An50)	72	-	85	72
Kadence Shoshone (7An47)	72	68.5	71.3	69.5
Station Angus (A94)	73	-	67	70
Longhorn	63.6	57.6	63.6	58.5

1 One calf died

2/ First number indicates number of calves sired.
Second number indicates number of calving with difficulty.

Table 5. Two year adjusted weights among first calf heifers bred to Angus artificially and clean-up with Longhorn.

	Single Injection				Double Injection			
	1979		1980		1979		1980	
	Bulls	Hfrs.	Bulls	Hfrs.	Bulls	Hfrs.	Bulls	Hfrs.
AI Angus								
Shoshone Monitor (17AN50)					556 (2)	589 (2)		
Kadence Shoshone (7AN47)			519 (5)	524 (5)			399 (7)	564 (2)
Station Angus (A94)	520 (2)				473 (3)	544 (2)		
Longhorn			404 (3)	561 (1)				
Longhorn					463 (5)	362 (6)		382 (4)

A COMPARISON OF TWO ESTRUS SYNCHRONIZATION METHODS IN MATURE COWS

D.G. Landblom and J.L. Nelson

Lutalyse, a naturally occurring compound in animal systems, has been released by the Food and Drug Administration under the direction of veterinarians for synchronization of estrus in beef cattle. Previous research conducted at many universities in the US and at this station clearly shows that estrus can be successfully synchronized in cattle that are cycling normally. Each injection costs approximately $5.00 at today's prices, and requires handling he cows twice. While requirements of the FDA clearance were being satisfied, extensive data was collected with the double injection method. At the same time alternate methods using a single dose of lutalyse were being proposed in an effort to obtain equally good results at a lower cost to the producer. This experiment, which compares single versus double injections of lutalyse, is designed to evaluate overall effectiveness, management and economics of the two methods under typical ranch conditions.

Hereford cows ranging in age from 5 to 10 years were randomly assigned according to their post calving interval to either the single or double injection group. Each of the methods has been outlines in detail in table 1.

To reduce sire vulnerability, five different AI bulls were used at random, and were as follows: Kadence Shoshone 520 (7An47), PS Sasquatch 904 (7An61), Emulous 494 GDAR (7An41), Black Dot Chaparral King 276 (7An52) and PS Franco 064157 (7An56). Average semen cost was $6.00 per straw. Hereford clean-up bulls were used to completer a 60 day breeding season. The cows were palpated in the fall and any identified as open were sold.

A detailed description of each synchronization method is shown in table 1.

Two years breeding results have been accumulated and summarized in table 2.

Summary

1. Lutalyse (Prostaglandin F_2 Alpha) can be used several different ways to synchronize estrus cycles in beef cattle. This trial has been designed to evaluate two of those methods in a attempt to reduce labor, handling and costs while maintaining equal or better reproductive performance. A single injection of Lutalyse given one to all cows not detected and inseminated after five days or artificial breeding was compared with administering two injections separated by eleven days.

2. Labor requirements for injections and heat detection ranged from five days in the double injection group to eight days in the single injection group.

3. Conception rate favored the single injection group by 13% after two years of data collection.

4. Using the single injection method has resulted in a substantial reduction in the cost per cow conceiving, and ranged from $16.09 in the single group to $31.50 in the double injection group.

5. Following the first injection in the double injection group, 71% of the cows responded. Although those cows responding were not inseminated until after the second dose of Lutalyse, this is one of the other single injection methods that have been used. The major problem with using a single dose of Lutalyse is that if any group of cows are not cycling sufficiently Lutalyse will not work and money and time are wasted. Therefore, when selecting methods to research, we placed our emphasis on the five day pre-breeding method before the single injection so we could evaluate estrus activity while breeding conventionally.

6. Synchronization of estrus was successfully completed using Lutalyse in this study. Using five day pre-breeding followed by a single dose of Lutalyse resulted in the highest conception rate of 70% and the lowest cost per cow conceiving.

Table 1. Design for estrus synchronization with mature cows.

Single Injection Method	Day of breeding season:	
	1	
	2	
Period I	3	Inseminate normally 1st five days of breeding season.
	4	
	5	
	6	8 am administer 25 mg Lutalyse to all heifers not inseminated during period I.
Period II	7	Continue breeding normally until 80 hours post injection time.
	8	
	9	At 4 pm (80 hours after the Lutalyse injection) all heifers not inseminated during periods I and II were inseminated as a group without regard to standing heat.
Double Injection Method	Day of	
	11 days before start of breeding season	Administer 25 mg Lutalyse
	1	The 2nd injection of Lutalyse is given at 8 am on the 11 day which is the start of the breeding season.
	2	Inseminate normally all heifers found in standing heat until 80 hours post injection time.
	3	
	4	At 4 pm (80 hours after the 2nd injection of Lutalyse) all heifers not inseminated during the 80 hour period are inseminated as a group without regard to standing heat.

Table 2. Single vs. double injection method of synchronization among mature cows.

Management Method	Single Injection 1980-81	1981-82	2-yr total	%	Double Injection 1980-81	1981-82	2-yr total	%
No. head	22	25	47		25	24	49	
No. inseminated 1st 5 days	8	10	18	38	-	-	-	-
No. responding to 1st injection in the double injection group	-	-	-	-	19	16	35	71
No. in heat before 80 hours	9	6	15	32	19	13	32	65
No. that did not show heat but were inseminated at 80 hours	5	4	9	19	6	11	17	35
No. conceiving that cycled after 80 hours	5	1	6	66	2	0	2	12
No. open	2	5	7	15	3	0	3	6
Conception rate for management system	18	15	33	70.2	13	15	28	57
Days of labor			8				5	
Economics:								
Breeding costs for semen and lutalyse	$256	$275	= $311		$450	$432	= $882	
No. head conceiving to synchronized estrus	18	15	15		13	15	28	
Semen and lutalyse cost/cow conceiving to synchronization			$16.09				$31.50	

TIME OF FEEDING AND ITS EFFECTS ON TIME OF CALVING - A PRACTICAL APPROACH

D.G. Lanblom and J.L. Nelson

Calving time is probably the most intense period in the livestock production year. Following its discovery by a Canadian cattleman, research conducted by Agriculture Canada at Brandon, Manitoba resulted in a significant increase in daytime calvings when cows were fed at either 11 am or 9 pm. Conversely, a negative response was obtained from 8 am plus 3 pm feedings. Several factors were measured, however the only one having any significant effect on daytime calvings was the calves sire.

The inconsistency of a favorable response late morning and early evening necessitates the need for further investigation into this unique phenomena. To evaluate time of calving from a practical standpoint, feeding times of 8 am and 5 pm were selected. The experiment was started during the winter of 1981-82, when 164 straightbred Hereford and crossbred Angus X Hereford cows ranging in age from 2-10 years were separated into two groups. Both were fed complete mixed balanced wintering rations as close to the predetermined feeding times of 8 am and 5 pm as possible.

Ration composition in group I (8am) consisted of sudan silage, alfalfa hay, wheat straw, and minerals, whereas group II received sudan silage, alfalfa hay, corn grain, and minerals.

Parameters being evaluated include age of cow, and size, sex and birth weight of calves.

Summary:

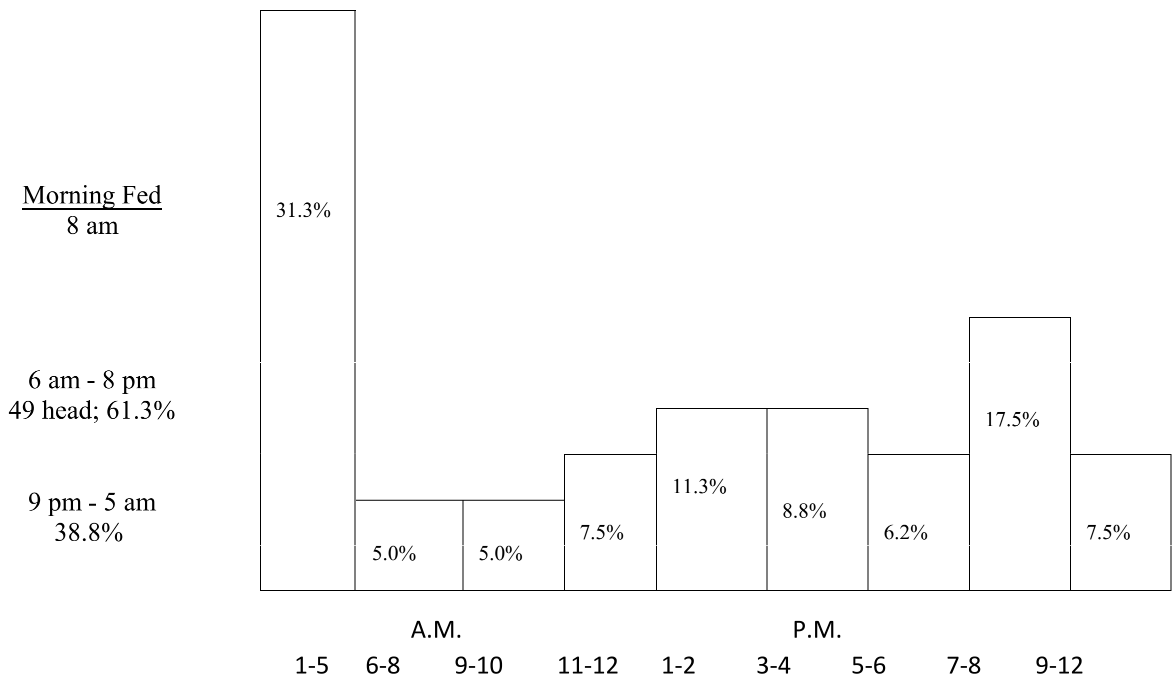
1. A total of 164 straightbred Hereford and crossbred Angus X Hereford cows were used to evaluated the effect of morning (8 am) versus late afternoon (5 pm) feeding on time of calving.

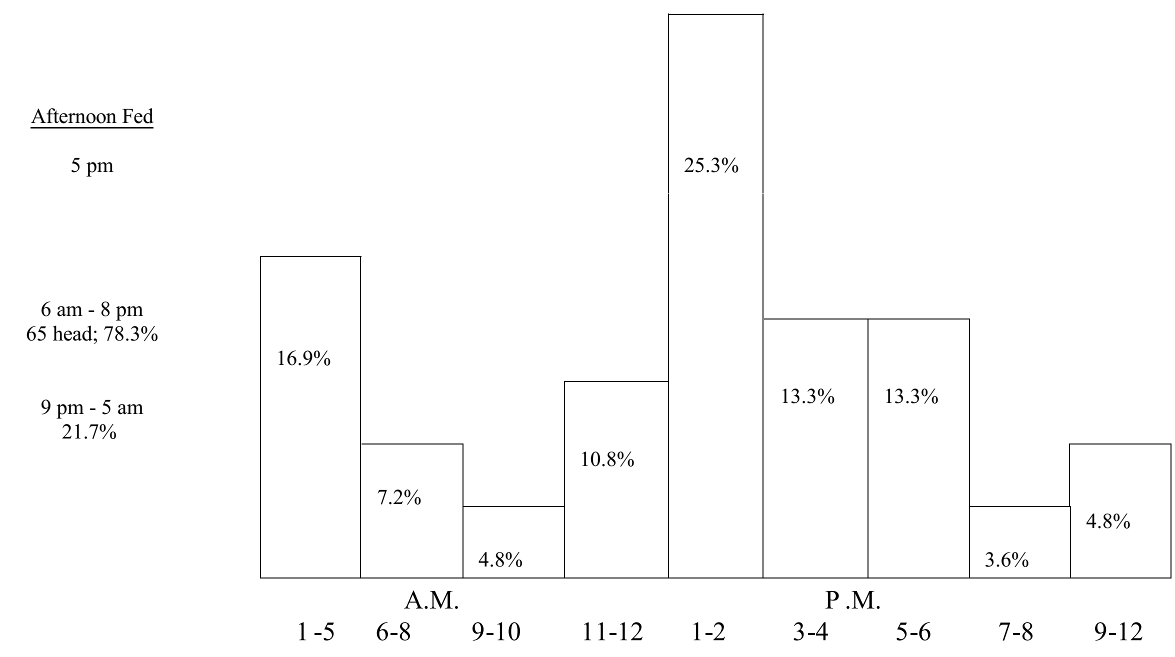
2. Late afternoon feeding (5 pm) resulted in 17% more calvings between 6 am and 8 pm, with 67.5% of all calvings occurring during the most desirable daytime hours between 9 am and 6 pm.

3. Calvings among morning fed cows were distributed throughout the 24 hours period, however the greatest concentration occurred during the evening and early morning hours between 7 pm and 5 am.

4. No differences were measured when the effects of cow age, and sex, birth weight and sire of calf were analyzed.

5. While preliminary, these initial results indicate that the number of daytime calvings can be increased with a late afternoon 5 pm feeding time.


Morning Fed
8 am
6 am - 8 pm
49 head; 61.3%
9 pm - 5 am
38.8%
31.3%
5.0%
5.0%
7.5%
11.3%
8.8%
6.2%
17.5%
7.5%
A.M.
P.M.
1-5
6-8
9-10
11-12
1-2
3-4
5-6
7-8
9-12


Afternoon Fed
5 pm
6 am - 8 pm
65 head; 78.3%
9 pm - 5 am
21.7%
16.9%
7.2%
4.8%
10.8%
25.3%
13.3%
13.3%
3.6%
4.8%
A.M.
P .M.
1 -5
6-8
9-10
11-12
1-2
3-4
5-6
7-8
9-12

USING AN ENZYME PRODUCT IN BACKGROUNDING RATIONS FOR STEER CALVES

J.L. Nelson and D.G. Landblom

The vitamin-mineral enzyme supplements used in this trial are being used and sold in this area with apparent success. Earlier research work reported by E.D. Holfield and D.L. Hixon in the 1975 Illinois Beef Cattle Day Report indicate an improvement in performance of 0.28 pounds per head per day. However, in the 53rd Roundup Report of Beef Cattle Feeding Investigations of the Fort Hayes Branch Station, little or no advantage was found for feeding the enzyme product. Because of questions being asked by producers and the divergence of opinion in the literature, the product is being evaluated under conditions in southwestern North Dakota.

“Vita Charge and Vita Ferm Cow Calf 5" are trade names of a commercial vitamin-mineral enzyme product containing an enzyme component Amafirm^R, produced by the fermentation of sucrose by Aspergillus Flavus-oryzae (a fungus). These products were evaluated when fed to backgrounded steer valves for approximately 145 days.

In this trial, light weight steer valves, born in the spring were purchased at a local livestock market. Following an overnight shrink without feed or water, they were weighted, ear tagged and allotted into two uniform feeding groups with respect to weight, breed, and prior owner. The steers were handled and fed as recommended by the Vita-Ferm company representatives. These recommendations included an initial oral drench of approximately 1½ quarts of a solution made up of 4 oz. Vita Charge, 1 oz. C.R. (Corn) oil and 1½ quarts warm water. The steers were drenched at the time of processing (branding, vaccination for blackleg and enterotoxemia, ear tagging, etc.). Immediately after processing they were started on a control feeding system or the control feeding system plus the Vita-Charge supplement as recommended by the Vita-Ferm company. The treatment calves were fed the control ration plus 4 oz./hd/day of Vita-Charge for the first fourteen days. They were then switched to the control ration plus 4 oz./hd/day of Vita-Ferm Cow Calf 5 for the duration of the trail. All feed was self-fed in straight sided feeders. The calves started on a ration of 1/3 oats, 2/3 roughage for the first fourteen days and were then switched to a ration of approximately 50% oats, 50% roughage for the balance of the trial. Vita-charge and Vita-Ferm Cow Calf 5 were added to the total mix so that each calf would consume a minimum of 4 oz. of supplement per day. Rations as fed are shown in Table 1.

Discussion

During all three years this trial was conducted, calves in both groups made a rapid adjustment to rations and housing.

Neither group required any medication or treatment except one calf in the Vita-Ferm group in 1982. This calf made a rapid response to treatment and was not removed from trial.

In 1980, the first year of this trial, the calves fed Vita-Ferm were about ten pounds per head heavier than the control calves after 145 days on feed. They also had a $4.25 per head advantage when sold. However, because of higher feed cost per head, the actual dollar return over feed cost per head favored the control calves by $12.09 per head.

In 1981 (see Table 3) the Vita-Ferm calves were six pounds heavier after 139 days on feed (252 vs. 246) than the control calves. At the market they sold for $1.93 more per hundred weight. This amounted to $4.18 more gross dollars per head. Again, in 1981, feed cost for the Vita-Ferm fed calves was $6.64 higher than the controls. Return over feed cost favored the control calves by $2.46.

In 1982, the Vita-Ferm calves averaged 12 pounds heavier after 146 days on feed, and returned $4.06 more per head than the control calves when sold. However, the control calves were slightly more efficient (8.95 vs. 9.00) and consumed less feed per lot (2278 pounds vs. 2418 pounds). Thus, the feed cost per the control calves was $17.43 less than the Vita-Ferm fed calves. Total returns (calf value-feed cost) favored the control calves by $13.37 in 1982.

When all three years are averaged together, the Vita-Ferm fed calves appeared to gain slightly faster and sold for more dollars per head.

However, they consumed more feed per head (2436 pounds vs. 2358 pounds) and incurred a higher feed bill per head ($140.26 vs. $126.70).

Thus, the slower gaining control calves returned $9.31 more per head than the Vita-Ferm fed calves.

Summary:

During a three year period from 1980 to 1982, calves fed according to the Vita-Ferm program tended to eat more feed and gain slightly faster, but returned less net dollars than control calves.

Table 1. Rations as fed in the Vita-Ferm trial 1980-1982.

Ration I for first 14 days:		
	Control	Vita-Charge
Oats	330.0	330.0
Chopped Tame Hay	657.5	636.5
Di cal	2.5	2.5
Vita Charge	-	21.0
Ration II-Day 15 to end of trial:	1,000.0	1,000.0
	Control	Vita-Charge
Oats	500.0	500.0
Chopped Tame Hay487.5	487.5	469.5
Trace mineral salt10.0	10.0	10.0
Di cal2.5	2.5	2.5
Vita-Ferm Cow Calf 5-	-	18.0
	1,000.0	1,000.0

A record was kept of feed eaten, twenty-eight day weights, final weight and selling weight and price. The calves were sold in two groups representing each method of feedings. All performance and total economic records are shown in Tables 2, 3, and 4.

Table 2. Performance and economic summary of Vita-Ferm trial-1980.

	Control	Vita-Ferm
No. of head on trial	9	9
Initial wt. lbs Dec. 18	3225	3225
Average per head, lbs	358	358
Wt. off trial, lbs May 22	5815	5905
Average per head, lbs	646	656
Gain for 145 days, lbs	2590	2680
Average gain/hd., lbs	288	298
Average gain/day, lbs	1.98	2.05
Wt. at market, lbs	5825	5900
Average/lot, lbs	647	656
Total price, lbs	3951.59	3992.35
Value/hd., $	439.07	443.59
Value/lb., $	67.8	67.7
Pounds feed/lot	23,015	23,830
Pounds of feed/hd	2,557.2	2,647.8
Pounds of feed/day	17.6	18.26
Pounds of feed/lb gain	8.89	8.89
Cost of feed + grinding/lot, $	882.95	1030.37
Cost of feed + grinding/hd, $	98.10	114.71 (includes 23¢ for drench)
Cost/lb of gain, $	0.34	0.38
Return over feed/hd, $	340.97	328.88
Difference, $	+12.09	

Table 3. Performance and economic summary of Vita-Ferm trial-1981.

	Control	Vita-Ferm
No. of head on trial	10	10
Initial wt. lbs Dec. 3	3790	3780
Average per head, lbs	379	378
Wt. off trial, lbs April 21	6255	6300
Average per head, lbs	625.5	630
Gain for 139 days, lbs	2465	2520
Average gain/hd., lbs	246	252
Average gain/day, lbs	1.77	1.81
Wt. at market, lbs	6140	6028
Average/lot, lbs	614.0	602.8
Total price, lbs	4087.40	4129.18
Value/hd., $	408.74	412.92
Value/lb., $	66.57	68.50
Pounds feed/lot	22,380	22,415
Pounds of feed/hd	2,238	2,241.5
Pounds of feed/day	16.1	16.1
Pounds of feed/lb gain	9.1	8.9
Cost of feed + grinding/lot, $	1560.73	1627.10
Cost of feed + grinding/hd, $	156.07	162.71
Cost/lb of gain, $	.63	.65
Return over feed/hd, $	252.67	250.21
Difference, $	2.46	

Table 4. Performance and economic summary of Vita-Ferm trial-1982.

	Control	Vita-Ferm
No. of head on trial	10	10
Initial wt. lbs Dec. 3	3660	3665
Average per head, lbs	366.0	366.5
Wt. off trial, lbs April 21	6205	6325
Average per head, lbs	620.5	632.5
Gain for 139 days, lbs	2545	2660
Average gain/hd., lbs	254.5	2660
Average gain/day, lbs	1.74	1.82
Wt. at market, lbs	6060	6170
Average/lot, lbs	606.0	617.0
Total price, lbs	3942.25	3982.88
Value/hd., $	394.23	398.29
Value/lb., $	65.00	64.50
Pounds feed/lot	22,775	24,185
Pounds of feed/hd	2,277.5	2,418.5
Pounds of feed/day	15.6	16.6
Pounds of feed/lb gain	8.95	9.09
Cost of feed + grinding/lot, $	1,259.16	1,433.53
Cost of feed + grinding/hd, $	125.92	143.35
Cost/lb of gain, $	49.48	53.89
Return over feed/hd, $	268.31	254.94
Difference, $	+13.37	

Table 5. Three years average performance and economic summary.

	Control	Vita-Ferm
Total Head	10	10
Average:		
Initial wt., lbs	367.7	367.3
Final wt., lbs	630.7	639.3
Gain, lbs	262.7	272.0
Days fed	143	143
Daily gain, lbs	1.83	1.89
Wt. at market, lbs	622.3	625.3
Value/hd., $	414.01	418.27
Value/cwt., $	66.46	66.89
Pounds of feed/hd	2,357.7	2,436.0
Pounds of feed/day	16.4	17.0
Pounds of feed/lb. gain	8.98	8.96
Cost of feed + grinding/lot, $	1,234.23	1,363.67
Cost of feed + grinding/hd, $	126.70	140.26
Cost/cwt. gain, $	48.97	52.32
Return over feed/hd., $	287.32	278.01
Difference, $	+9.31	

IMPROVING STRAW QUALITY WITH ANHYDROUS AMMONIA

J.L. Nelson and D.G. Landblom

According to the 1980 issue of North Dakota Agricultural Statistics, North Dakota farmers harvested more than twelve million acres of small grain. According to the same source there were approximately two million head of cattle on North Dakota farms on January 1980. Figuring a conservative yield of one third ton of straw per harvested acre, livestock producers have a potential feed source of approximately two tons per head. Cereal straws in their natural stage have low protein levels and poor digestibility which limits their use in rations for cattle to some percentage of ration, usually less than fifty percent. Straw digestibility and intake by cattle can be improved by treatment with Sodium hydroxide (NaOH) or anhydrous ammonia (NH_3). Research by Hugh Nicholson at the University of Saskatchewan indicated an improvement of from 4% crude protein for untreated straw to 10-12% for straw treated with 3.5% anhydrous ammonia. He also reports 45 to 48% for treated straw. This level of crude protein and TDN is about equal to most medium quality hays. This improvement in straw quality could be worth many dollars to North Dakota grain and livestock producers.

In the fall of 1979, a trial was designed to evaluate the treatment of wheat straw with 3.5% anhydrous ammonia. Steer calves fed a backgrounding ration were used to evaluate treatment effects. The trial was continued in 1980 and 1981, thus providing three years replicated results.

In all three years, large bales of wheat straw were hauled to the experiment station feedlot. A moisture sample was taken and bale weights were adjusted to a dry matter basis of approximately 675 to 700 pounds per bale. The bales were then lined up side by side on a sheet (28 X 100') of 4 ml black plastic, which was then wrapped over the bales and sealed to make an air tight package (16 bales). Used rubber tires were piled on top and along the sides of the stack to reduce wind damage. An anhydrous ammonia nurse tank from the local Farmers Union Oil Co. was flow calibrated under water prior to injection of the anhydrous ammonia. Injection of approximately 3.5% dry matter weight was made into the core of each bale using a four foot long perforated metal pipe (1" OD) that was sealed and brought to a point on one end. The other end of the pipe was fitted with an adapter that allowed the injection pipe to be connected to the nurse tank delivery hose. Extreme care and safety precautions were exercised while handling the anhydrous ammonia.

in 1979, the 94% dry matter straw was treated on September 24th; and in 1980 the straw contained 88% dry matter and was treated on September 24th; in 1981 the straw contained 86% dry matter and was treated on October 5th. The straw remained covered from 55 to 60 days, after which the plastic was removed and bales were processes through a New Holland tub grinder. The cost of the plastic cover plus the 3.5% anhydrous treatment increased the cost of the straw to $15.50 per ton in 1979 and $20.04 per ton in 1980 and 1981. This does not include any cost for labor to handle and treat the straw.

In late November, 36 head of 450-550 pound steer calves were allotted to six uniform lots of six head per lot. Two lots were self fed a complete mixed ration of oats, mixed hay and minerals. Two lots were self fed a mixed ration that contained 30% anhydrous ammonia treated straw, while another two lots received a complete mixed ration containing 30% untreated wheat straw and served as the control. The rations were formulated with the aid of AGNET to promote gains of 1.5 to 2.0 pounds per head per day.

The steers in trial were weighed every twenty eight days and were sold at backgrounded weights of 750-800 pounds at a local auction market in treatment groups.

Table 1 shows the 1982 results of feeding the ammoniated straw.

Table 2 shows the 3 year results of feeding ammoniated straw.

Discussion:

The treatment of wheat straw with 35% NH_3 was not a difficult task, although care must be exercised whenever NH_3 is handled. We found a better response to the treatment as level of moisture in the straw increased. Calves fed the treated straw in 1982 consumed about one pound of straw more than calves fed untreated straw. They were the heaviest of all calves marketed and sold for the most gross dollars. However, because of high consumption they incurred a higher feed bill which lowered return per calf. Perhaps a more efficient method of treating the large bales of straw would help reduce the cost of the feed. For example, a producer with adequate straw that could be fed for just the cost of baling and handling and with the ability to lower his cost of his plastic covering by using it more than one year, would be very competitive with the producer feeding hay.

Over the three years, the NH_3 treated straw ration promoted faster daily gains, heavier market weights and higher market values than the control rations with untreated straw. However, due to higher feed cost per head, returns per calf fed the treated straw was only slightly better than those realized when regular straw was used in the ration.

Summary:

Results from three years feeding show that wheat straw treated with 3.5% anhydrous ammonia (NH_3) increased intake, improved average daily gain and increased the market value of calves when compared to feeding untreated straw. However, the extra cost incurred due to treatment (NH_3 and plastic covering) reduced returns per calf to less than one dollar per calf over feeding regular straw. The best gains were made by calves fed a mixed hay grain ration.

Table 1. Results from the feeding trial with ammoniated straw - 1982.

	30% Untreated Straw		30% Ammoniated Straw		All Hay-Control	
	Lot 2	Lot 4	Lot 3	Lot 5	Lot 6	Lot 7
No. head	6	6	6	6	6	6
Final wt. lbs	708	709	715	769	733	736
Initial wt. lbs	504	505	506	506	506	499
Gain/lbs	204	204	209	263	227	237
Days fed	127	127	127	127	127	127
ADG/lbs	1.60	1.61	1.65	2.07	1.79	1.86
Actual market wt, lbs	687	687	715	715	709	709
Avg market value, $	444.89	444.89	465.02	465.02	460.96	460.96
Percent shrink	3.0	3.0	3.65	3.48	3.5	3.5
Feed/hd/day, lbs						
Barley	2.1	2.1	2.3	2.4	1.1	1.0
Oats	5.1	4.9	5.4	5.9	6.3	6.1
Mixed hay	6.1	6.1	6.5	7.1	12.3	12.0
Straw	5.9	5.8	6.3	6.9	-	-
Di-cal	.12	.10	.12	.14	.16	.15
Limestone	.03	.04	.03	.04	.01	.01
Salt	.38	.37	.40	.44	.40	.39
Total lbs/hd/day	19.73	19.41	21.05	22.92	20.27	19.65
Feed cost/hd, $	120.23	117.74	136.33	148.37	132.09	127.88
Return/calf, $	324.69	327.15	328.69	316.65	328.87	333.08
Avg feed/cwt gain, $	59.12	57.66	65.17	56.33	58.10	54.00

Table 2. Three year combined results from the feeding trial with ammonia treated straw.

	30% Untreated Straw	30% Ammoniated Straw	All Hay-Control
No. head	36	36	36
Final wt. lbs	753.7	779.2	809.7
Initial wt. lbs	506.7	506.8	505.8
Gain/lbs	247.0	272.3	303.8
Days fed	141	141	141
ADG/lbs	1.75	1.92	2.13
Actual market wt, lbs	735.3	750.8	779.8
Avg market value, $	453.70	469.83	484.25
Percent shrink	2.45	3.60	3.70
Feed/hd/day, lbs			
Barley	3.17	3.17	0.35
Oats	3.53	3.77	6.80
Alfalfa	2.98	2.90	3.41
Mixed hay	3.89	4.11	9.63
Straw	5.78	5.82	-
Di-cal	.04	.06	.12
Limestone	.02	.02	.07
Salt	.20	.22	.41
Total lbs/hd/day	19.62	20.08	20.79
Feed cost/hd, $	106.91	117.21	123.17
Return/calf, $	346.79	347.62	361.08
Avg feed/cwt gain, $	44.84	44.44	42.13

USE OF MONENSIN SODIUM IN RATIONS FED TO REPLACEMENT HEIFER CALVES DURING THE WINTERING PERIOD

J.L. Nelson and D.G. Landblom

The North Dakota Agricultural Statistics Bulletin number 48 for 1981 indicates there were 120,000 replacement beef heifers in the state. Management and feeding of these heifers so they will grow and mature into useful productive cows is of prime concern to North Dakota cattlemen. Since feed makes up a large percentage of the cost of raising replacement heifers, anything that will reduce the feed cost without reducing or impairing reproductive performance should be incorporated into the overall management system.

The feed additive, monensin sodium, has been shown to be effective in reducing feed intake by 6-10% without affecting gains under feedlot conditions. With a six month wintering period, and heifers consuming approximately 17 pounds of feed per day, an 8% saving in feed would amount to some 245 pounds. At four cents per pound of feed this would amount to $9.79 per heifer wintered, or approximately 1.2 million dollars in feed savings across the state.

Steer feeding trials reported in the 28th and 29th Annual Livestock Research Roundup indicate a feed savings and cost advantage when monensin was fed at levels of from 150-300 mg per head per day.

Numerous research reports from across the United States have shown both a feed savings and a cost advantage when monensin is fed. However, information on how monensin might affect reproductive performance in heifers is rather limited.

In December, 1981, a trials was started to determine the effects in incorporating 150-200 mg monensin per head per day in rations fed to replacement quality beef breeding heifers. The trial was designed to monitor feed intake and efficiency, economics, weight gain or loss, time of first estrus and over-all reproductive efficiency.

Commercial quality Angus X Hereford heifer calves weighing approximately 520 pounds were allotted to either a control ration or a control ration plus monensin sodium. Both rations fed as complete mixed rations, self-fed in straight sided self feeders. Rations were formulated to promote 1.5 to 1.7 pounds of gain per day. Monensin was added to the ration so that heifers received between 150 and 200 mg per head per day. Heifers were weighted every 28 days to monitor weight gain and feed intake.

On February 9th, sterilized detector bulls were added to each group to help determine estrus activity. On April 26th both lots of a treatment group were weighed and combined and moved to large holding lots where they continued on their respective rations until May 17 at which time, the heifers were weighed and turned out to pasture. Records were kept on time of first estrus and all heifers were inseminated in June. Fertile Milking Shorthorn bulls were used for cleanup following the A.I. program.

The initial ration formulation and results of this first years' trial are shown in the following tables.

Table 1. Ration.
Table 2. Results of winter feeding phase.
Table 3. Heat detection record.
Table 4. Pregnancy test data.

<u>Discussion:</u>

Heifers fed rations containing monensin sodium were able to gain weight faster (1.69 vs. 1.52 average daily gain) and on May 17th they were 26.9 pounds heavier after 154 days on trial. Heifers fed monensin also ate less feed per day (20.7 vs. 21.2 pounds) and were therefore more efficient. However, due to the cost of the supplement containing the monensin, actual feed cost savings per day were only one cent per head per day, for a cost of $1.54 per head.

It appeared that about 14% more heifers fed the monensin sodium reached puberty by the end of March. However, data based on pregnancy test show no differences as it relates to stage of pregnancy.

Summary:

The feeding of 150-200 mg per head per day of monensin sodium allowed crossbred Hereford-Angus heifers to gain 27 pounds more bodyweight during the 154 day feeding period in 1981-1982. These heifers also ate less feed and were more efficient, although they only saved $1.54 on feed costs over control fed heifers. It appears that 14% more heifers reached puberty prior to the first of April, although this early puberty did not result in a better or earlier conception rate.

This trial will be continued for at least another two years.

Table 1. Initial rations of monensin sodium trials with replacement heifers.

Trail rations	Control	Monensin
Alfalfa-grass hay, %	56.5	56.5
Corn, %	41.0	39.75
SBOM, %	1.8	1.8
Beef Mix 600*	-	1.25
Di cal, %	0.1	0.1
Linestone, %	0.1	0.1
Trace mineral salt, %	0.5	0.5
	100.00	100.00

*Beef mix 600 will provide 7.5 mg of monensin per pound of complete feed consumed. At 20 pounds of intake heifers will get 150 mg of monensin.

Table 2. Combined data for the replacement heifer trial with and without Rumensin from December 14 to May 17, 1982.

	With Rumensin	Control
No, head	34	34
Days fed	154	154
May 17 wt/lot, lbs	26,585	25,670
Avg wt/hd, lbs	781.91	755.0
Dec 14 wt/lot, lbs	17,745	17,700
Avg wt/hd, lbs	521.91	520.6
Total gain/lot, lbs	8,840	7,970
Avg gain/hd, lbs	260.0	234.4
ADG, lbs	1.69	1.52
Feed consumption/day, lbs		
Corn	9.79	10.36
SBOM	0.31	0.32
Mixed hay	10.09	10.33
Di-cal	0.03	0.03
Limestone	0.02	0.02
Trace mineral salt	0.15	0.15
Beef Mix 600	0.27	-
Total feed/hd/day	20.66	21.21
Feed cost/lot, $		
Corn	2,761.15	2,923.81
SBOM	192.20	200.32
Mixed hay	1,485.08	1,520.47
Di-cal	35.79	35.62
Limestone	5.32	5.55
Trace mineral salt	54.09	54.16
Beef Mix 600	187.90	-
Grinding	1,382.88	1,420.13
Total cost/lot	6104.41	6160.06
Cost/hd/day, $	1.14	1.15
Cost/hd $	175.56	177.10
Cost/cwt gain, $	67.52	75.55

Table 3. Replacement heifers with or without Rumensin date before lots were combined on April 16, 1982.

	With Rumensin 19	With Rumensin 21	Without Rumensin 20	Without Rumensin 22
No, head	17	17	17	17
Days fed	133	133	133	133
April 26 wt/lot, lbs	27,915	13.005	12,615	21,175
Avg wt/hd, lbs	759.7	765.0	742.1	716.2
Dec 14 wt/lot, lbs	8,855	8,890.0	8,840	8,860
Avg wt/hd, lbs	520.9	522.9	520.0	521.2
Total gain/lot, lbs	4,060	4,115	3,775	3,315
Avg gain/hd, lbs	238.8	242.0	222.0	195.0
ADG, lbs	1.80	1.82	1.67	1.47
Feed consumption/day, lbs				
Corn	22,432	22,369.9	23,948.1	23,775.1
SBOM	697.4	696.9	743.5	724.6
Mixed hay	23,464.6	23,381.7	24,100.1	24,117
Di-cal	83.4	82.9	81.1	84.4
Limestone	38.7	38.6	41.2	40.1
Trace mineral salt	372.5	370.2	366.1	378.5
Beef Mix 600	606.2	604.8	-	-
Total feed	47,695	47,545	49,280	49,120
Animal days	2,309	2,309	2,309	2,309
Feed consumption/day, lbs				
Corn	9.72	9.69	10.37	10.30
SBOM	.30	.30	.32	.31
Mixed hay	10.16	10.13	10.44	10.44
Di-cal	.04	.04	.04	.04
Limestone	.02	.02	.02	.02
Trace mineral salt	.16	.16	.16	.16
Beef Mix 600	.26	.26	-	-
Total lbs/day	20.66	20.59	21.34	21.27

Table 3. Replacement heifers with or without Rumensin date before lots were combined on April 16, 1982 continued.

	With Rumensin 19	With Rumensin 21	Without Rumensin 20	Without Rumensin 22
Feed cost/lot, $				
Corn	1,182.17	1,178.89	1,262.06	1,252.95
SBOM	80.20	80.14	85.50	83.33
Mixed hay	645.28	643.00	662.75	663.22
Di-cal	16.43	16.33	15.98	16.63
Limestone	2.22	2.22	2.37	2.30
Trace mineral salt	24.58	24.43	24.16	24.98
Beef Mix 600	77.59	77.41	-	-
Grinding	596.19	594.31	616.00	614.00
Total cost/lot, $	2,624.66	2,616.73	2,668.82	2,657.41
Cost/hd/day, $	1.14	1.13	1.16	1.15
Cost/hd $	151.62	150.29	154.28	152.95
Cost/cwt gain, $	63.49	62.10	69.50	78.44

Table 4. Data on 21 day combined feeding period for the replacement heifer trial with and without Rumensin from April 26 to May 17, 1982.

Lot Numbers	19 & 21	20 & 22
	(735 Animal Days)	
No, head	34 + bull	34 + bull
Days fed	21	21
May 17 wt/lot, lbs	26,585	25,670
Avg wt/hd, lbs	781.9	755.0
April 26 wt/lot, lbs	95,920	24,790
Avg wt/hd, lbs	762.4	729.1
Total gain/lot, lbs	665.0	880.0
Avg gain/hd, lbs	19.6	25.9
ADG, lbs	0.93	1.23
Feed consumption/lot, lbs		
Corn	7,591.8	7,757.1
SBOM	277.0	273.8
Tame hay	7,156.4	7,072.7
Di-cal	15.4	15.3
Limestone	15.4	15.3
Trace mineral salt	76.9	76.1
Beef Mix 600	257.0	-
Total feed	15,390	15210.3
Feed consumption/day, lbs		
Corn	10.3	10.6
SBOM	0.38	0.37
Tame hay	9.74	9.62
Di-cal	0.02	0.02
Limestone	0.02	0.02
Trace mineral salt	0.10	0.10
Beef Mix 600	0.35	-
Total lbs/day	20.91	20.73

Table 4. Data on 21 day combined feeding period for the replacement heifer trial with and without Rumensin from April 26 to May 17, 1982 continued.

Lot Numbers	19 & 21	20 & 22
	(735 Animal Days)	
Feed cost/lot, $		
Corn	400.09	408.80
SBOM	31.86	31.49
Tame hay	196.80	194.50
Di-cal	3.03	3.01
Limestone	0.88	0.88
Trace mineral salt	5.08	5.02
Beef Mix 600	32.90	-
Grinding	192.38	190.13
Total cost/lot, $	863.02	833.83
Cost/hd/day, $	1.17	1.13
Cost/hd $	24.57	23.73
Cost/cwt gain, $	125.36	91.62

Table 5. Pregnancy palpation data collected on September 13, 1982.

	Rumensin		Control	
Estimated days pregnant	Number head	%	Number head	%
150+	12	35.3	12	35.3
120+	12	35.3	13	38.2
90+	3	8.8	3	8.8
Open	7	20.6	6	17.6
Total	34	100.0	34	100.0

Table 6. Time of first estrus in heifers fed with or without monensin sodium.

	Rumensin		Control	
Time of detection	Number head	%	Number head	%
March	10	29	5	15
April	16	47	22	65
May	5	15	3	9
Not detected or prepuberal	3	9	4	11
Total	34	100	34	100

WEANING MANAGEMENT STUDY

D.G. Landblom and J.L. Nelson

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

The purpose of this trial is to evaluate three different methods of weaning that range from an abrupt separation of cow and calf and placement in drylot, to a transitionary step by step weaning in which all changes don't occur simultaneously. Stress may be minimized and continued strong gains may be experienced using a transitionary scheme. Using a 30-40 day backgrounding period any carry over effects will be measured.

The following three comparisons are being evaluated:

1. Conventional drylot weaning (control).
2. Short term pre-wean creep feeding (28 days) followed by drylot weaning with creep feed.
3. Short term pre-wean creep feeding (28 days) followed by weaning on native range pasture with creep feed for 2 weeks before being moved to drylot with creep feed.

Twenty-six Hereford and Angus X Hereford cow-calf pairs ranging in age from 3 to 11 years were used in each of the treatments briefly described above. In 1982, the pre-weaning creep feeding period ran from September 20th to October 27th.

Group I-Conventional Weaning (control) grazed native range with no supplementation except minerals until weaning on October 27th. At weaning, the calves were separated from their mother, weighed, and transported by trailer to drylot holding pens where they were started on a low energy/high roughage complete mixed ration as shown in Table 1.

Group II-Calves in this treatment grazed native range and had access to a self-fed creep ration consisting of 62% dry rolled oats, 33% dry rolled barley, 5% mollasses and vitamins A and D. When weaned on October 27th, the calves were weighed, and transported by trailer to drylot where they were given free-choices chopped mixed hay in the bunk-line and had free choice access to the dame self-fed creep feed ration fed on pasture. The creep ration was fed using portable wooden creep feeders.

Group III-Pasture weaning characterized this treatment. The cows and calves grazed native range and the calves had access to creep feed during the pre-weaning period. Creep feed composition was the same as that used in Treatment II. On weaning day for groups I and II, group III was moved to a 40 acre ungrazed native pasture that had been set aside. Cows in this group remained with their calves for one week which allowed the calves time to adjust to their new surroundings, and to find the water source, mineral feeder, and creep feeder. After this short adjustment period, the cows were removed, calves weighed and turned out to continue grazing and eating creep feed for an additional two weeks. Following the two week grazing, they were re-weighed, placed in drylot, given access to the same self-fed creep ration fed on pasture, and fed chopped mixed hay free choice in the bunk line.

After the pasture weaned group was in the drylot environment for 10 days, calves in all treatments were switched to a complete mixed ration containing 45% dry rolled oats, for a 39 day growing period.

While initial weights were being taken on pasture the calves were vaccinated with a 7-way vaccine to protect them from diseases associated with clostridium organisms. Final weights taken following an overnight feed and water shrink.

Composition of as fed rations are shown in table 1, and consumption and economics are shown in table 2.

Weight changes were monitored at selected intervals throughout the experiment. A summary of weight fluctuations by intervals is given in table 3 for the 30 day period following weaning. Table 4 contains a summary of pre-weaning, post-weaning (30 day), short backgrounding, and combined results.

<u>Summary:</u>

1. No unusual physical problems were encountered with conventionally weaned and creep fed calves moved directly to drylot at weaning. Although not a big problem, cows from calves weaned on pasture managed to work a gate loose and get back along side to set aside pasture and had to be driven back. Strong fences and considerable distance between cows and weaned calves is very important.

2. Short term (28 day) late fall creep feeding aided in reducing weaning stress as measured by total weight gain and interval weight changes.

3. Calves weaned conventionally lost significantly more weight during the first week following weaning. By two weeks post weaning daily feed intake and body weight gain had increased significantly and leveled off by three weeks post weaning time.

4. Cost per pound of gain was very similar among different methods. Calves creep fed on pasture and weaned into drylot with creep ration were the most efficient, gaining 111 pounds during the period at a cost of 33¢ per pound of gain. Conventionally weaned calves gained 102 pounds at a cost of 35¢ per pound of gain. Pasture weaned calves gained slightly slower, 95 pounds, at a cost of 38.4¢ per pound of gain. Calves pasture weaned utilized less total pounds of precessed feed, but also gained slower and were slightly less efficient than their drylot confined counterparts. While their overall gains were slower, the large initial weight loss followed by heavy fills measured in group I were not experienced in group II. In terms of weight loss immediately after weaning, group II was intermediate.

5. Illness among calves was encountered in all treatments, and ranged from one case of hardware disease and two cases of coccidosis to scattered cases of upper respiratory illness. It should be noted that no illness was detected in calves weaned on pasture until they moved into the drylot environment.

6. This trial will be continued to measure effects of yearly variation.

Table 1. Creep feed and complete mixed rations used.

Creep Feed Dry rolled grain mixture:			
Oats, %	62		
Barley, %	33		
Mollasses, %	.5		
Viatmin A, IU/lb	5,000		
Vitamin D, IU/lb	500		
Mixed Ration:	Base ration	1st change	2nd change
Mixed hay, %	74	64	54
Dry rolled oats. %	25	35	45
T.M. salt, %	.5	.5	.5
Di cal, %	.5	.5	.5
Vitamin A, IU/lb	5,000	5,000	5,000
Complete mixed growing ration:			
Mixed hay, %	54		
Dry rolled oats, %	45		
T.M. salt, %	.5		
Di cal, %	.5		
Vitamin A, IU/lb	5,000		
	100%		

Table 2. Feed consumption and economics among calves comparing three weaning management methods.

	Control conventional weaning	Pasture creep drylot weaning/creep	Pasture/creep pasture weaning w/creep drylot w/creep
Number head	26	25	26
Creep feed before weaning, lbs		1422	2154
Lbs/head		56.9	82.8
Total creep cost $		68.28	103.66
Creep cost/hd, $		2.73	3.99
Creep on pasture after weaning, lbs			
Lbs/head			1654
Total creep cost, $			63.6
Creep cost/hd, $			81.70
Pasture cost/hd, $			3.14
Drylot Phase:			3.20
Mixed hay, lbs		1735	922
Cost/head, lls		2.08	1.06
Creep feed, lbs		6518	2060
Cost/head, $		12.19	3.72
Mixed ration, lbs	24941	12742	14192
Cost/head, $	36.31	19.65	21.37
Total cost, $	36.31	36.65	36.48
Total gain, lbs	102	111	95
Cost/lb gain, ¢	35.5	33.0	38.4
Treatments	1 lung cong. 2 coccidiosis	2 lung cong. 1 hardware disease	2 lung cong.

Table 3. Weight gains at selected intervals during the 30 day period following weaning on October 27th.

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

1/ Weaned on pasture one week after groups II and III.

Table 4. Weight gains among calves using three weaning management methods.

	Pre-weaning gain	30 day post-weaning gain	Post weaning backgrounding	Combined gains
Days	28	30	39	97
Conventional-weaning (Control)	1.26	1.11	.91	1.05
Pasture creep drylot wean-with creep	.64	1.15	1.47	1.14
Pasture creep pasture wean with creep Drylot with-creep	.86	.97	1.18	.97

CALF ENTERITIS INVESTIGATION

I.A. Schipper, D. Lanblom, J. Pommer, T.J. Conlon

Detection of Rotavirus in Feces of Diarrheic and Non-diarrheic Calves.

Fecal samples of calves with clinical diarrhea and those not exhibiting clinical diarrhea were examined by three different laboratory methods to determine the presence or absence of the rotavirus. Rotavirus is considered one of the major causes of diarrhea in neonatal calves as well as other farm animals and humans.

The testing procedures utilized included culturing of the fecal specimens on cells (cell culture), and enzyme-peroxidase test (Rotasyme) and electron microscope examination of feces (EM).

The fecal specimens were examined from 20 calves exhibiting clinical diarrhea and 29 calves exhibiting no clinical signs of diarrhea.

The results of this investigation indicated no correlation between the testing procedures and based on the testing procedures the rotavirus was not a factor in the cause of clinical diarrhea in these experimental animals. See Table 1.

Table 1.

Clinical Cell Diarrhea	Culture	Royazyme	EM
20+ Calves	-	2+	-
29- Calves	-	3+	-

Solar Radiation in Relation to Calf Diarrhea.

Temperature, humidity, and solar radiation were recorded in the environment of 39 new born beef calves. No significant relationship of clinical enteritis was detected for humidity and temperature only.

Solar radiation (recorded as Kjoules/m^2 (K)) was 12,000 to 25,000 K through April and up to May 9. During this period 89.4% of the cows involved in this investigation had calved. On May 9, solar radiation decreased to 5,000-10,000 K and remained at this level until May 18 when it increased to 20,000-25,000 K. On May 16, six days following the initial decrease of solar radiation, 2.6% of the calves exhibited clinical diarrhea. Clinical enteritis was exhibited on May 17 (2.6%) and May 18 (13.0%), one day after the solar radiation increased (May 19), no clinical signs of enteritis were recorded.

Preliminary date obtained would indicate that solar radiation is a major contributing factor to the prevention of calf enteritis.

Vaccination with E. coli Bacterins

The cows involved in this investigation had been vaccinated one year previously thus only a booster or single vaccination was given in 1981-1982 calving season. The results of this investigation are presented in Table II.

Table 2.

	Controls	K99 Vaccine	Coligen Vaccine
Total No.	34	29	27
Clinical Enteritis	4	5	7
Percent Clinical Enteritis	11.8%	17.2%	26.0%

Based on the results of this investigation, vaccination with E. coli bacterins had no demonstrable preventive activity to clinical enteritis in the neonatal calf.

TRACE ELEMENT INVESTIGATION

H. Casper, D. Landblom, W. Slanger, C. Keller

In the 1982 serum and hair samples were collected from cow-calf pairs shortly after calving. These samples were assayed to determine if there were trace mineral differences between healthy and scouring calves. The serum was analyzed for copper content and the hair samples were assayed for copper, zinc, manganese, magnesium, and iron. We also determined the copper levels in serums collected at calving in 1979 and 1980. The results of the hair and serum assays are shown in Tables 1 and 2.

Table 1. Serum Copper Levels

		Serum Copper*		
Year	No.	Cow	Calf	ADG**
1979	33	-	.48-.12	1.94+.24
1980	48	.70+10	.51+.09	1.98+.20
1982	140	.29-.13	.29+.09	1.63+.24

* Parts Per Million
** Average Daily Gain for Animals Samples.

Table 2. Trace Minerals in Hair*

	Cow Hair		Cow Hair	
Year	Scours	Healthy	Scours	Healthy
Copper	6.2+1.4	6.1+1.5	9.9+1.4	8.8+1.8
Zinc	122+12	122+10	116+12	119+18
Manganese	16.6+4.8	16.3+7.9	3.5+2.4	3.2+1.7
Magnesium	356+85	375+115	313+134	286+89
Iron	114+78	110+58	81+55	67+45
Number	12	19	12	19

* Parts Per Million-Dry Matter Basis

The serum copper levels varied substantially from year to year. The 1982 average level (0.29+.13) was substantially below the recommended minimum of 0.5 ppm. Greater than 95% of the calf serum copper were less than 0.45 ppm. Levels consistently below 0.5 ppm may be indicative of copper deficiency. The correlation between the herd averages of calf serum copper and ADG, for 3 years, was substantial (r=0.999), but it's ramification is not yet known. Blood samples will be collected during the 1983 calving season to see of the pattern continues.

Trace mineral analysis did not show a significant difference between hair samples from healthy and scouring animals. The correlation between the various trace elements and also between those minerals and growth rates is being evaluated. Initial examination indicates there are several correlations but the practical use of these interactions is not clear. Hair samples from other experiment stations and ranches have been analyzed and will be statistically evaluated.

SECTION III

RANGE AND PASTURE

MANAGEMENT TRIALS

COMPLEMENTARY TAME GRASS GRAZING SYSTEM-1982

L. Manske

The complimentary tame grass grazing system at the Dickinson Experiment Station consists of a crested wheatgrass pasture for spring grazing, a native range pasture for summer grazing and a Russian wildrye pasture for fall grazing. The study compares animal performance and herbage production between two treatments. One treatment has an annual spring broadcast application of 50 lbs of nitrogen per acre in the form of ammonium nitrate and the other treatment has no fertilizer applies. Yearling steers were used in the study from 1972 through 1976. Cow/calf units have been used from 1977 through the present.

The animals were rotated to the different pastures based on nearly identical percentage of utilization of the herbage of the reciprocal treatments from 1972-1981. In 1982, the animals were rotated to the different pastures at the same time (table 1) to acquire same season of use data. The animals were removed from the unfertilized Russian wildrye pasture seven days earlier then the fertilized pasture because of a shortage of forage in 1982.

The fertilized system has been superior to the unfertilized system. The mean above ground herbage production per acre (Table 2) and the mean gains per acre per day in pounds of beef (Table 3) showed a distinct advantage for the fertilized system during the ten years of data collection for the steers and cow/calf units.

The individual pastures of the fertilized system showed trends of increased production over the pastures of the unfertilized system. The mean above ground herbage production (Table 4) was greater in the fertilized treatments of all three pastures for the periods of grazing by steers and cow/calf units. The mean gain in pounds of beef per acre per day for the steers and calves (Table 5) was greater in the fertilized treatments of the crested wheatgrass and native range pastures. No data was available for steer gains on the unfertilized Russian wildrye during the period of the trial. The gains for calves on the fertilized Russian rye were slightly lower than on the unfertilized for the period of 1978-1981 and for 1982. The mean gain in pounds of beef per acre per day for cows (Table 5) was greater on the fertilized treatments of the crested wheatgrass and Russian wildrye pastures but lower on the fertilized native range pasture in 1978-1981. The cow gains in pounds per acre per day were greater on the fertilized crested wheatgrass and native range pastures but lower on the fertilized Russian wildrye pasture in 1982.

Table 1. The rotation dates and stocking pressure data for the fertilized and unfertilized complimentary grazing systems at the Dickinson Experiment Station-1982.

Pasture Treatment	Pasture size acres	Period grazed	Days in period	No. of head	No. Of AUM	Stocking rate AUM/acre
Crested Wheatgrass						
Fertilized	8	May 20-Jun 21	32	10 cow/calf	11.5	1.4
		May 20-Jun 21	32	1 bull		
Unfertilized	16	May 20-Jun 21	32	10 cow/calf	11.5	0.7
		May 20-Jun 21	32	1 bull		
Native Range						
Fertilized	12	Jun 21-Aug 20	60	10 cow/calf	21.1	1.8
		Jun 21-Aug 4	44	1 bull		
Unfertilized	18	Jun 21-Aug 20	60	10 cow/calf	21.1	1.2
		Jun 21-Aug 4	44	1 bull		
Russian wildrye						
Fertilized	16	Aug 20-Oct 4	45	10 cow/calf	14.8	0.9
Unfertilized	16	Aug 20-Sep 24	38	10 cow/calf	12.5	0.8

Table 2. Mean above ground herbage production for the unfertilized and fertilized complimentary grazing systems at the Dickinson Experiment Station, given in lbs/acre.

	Unfertilized system	Fertilized system
1972-1976		
Steer	2296.0	3027.0
1978-1981		
Cow/calf	1413.0	2405.0
1982		
Cow/calf	1972.0	3844.0

Table 3. Mean gains of beef for the unfertilized and fertilized complimentary grazing systems at the Dickinson Experiment Station, given in lbs/acre/day.

	Unfertilized system	Fertilized system
1972-1976		
Steer	1.21	1.66
1978-1981		
Calf	1.06	1.49
Cow	0.41	0.82
Cow/calf	1.47	2.30
1982		
Calf	2.08	2.76
Cow	1.21	1.65
Cow/calf	3.29	4.41

Table 4. Mean aboveground herbage production when the animals came off for each pasture of the complimentary grazing system at Dickinson Experiment Station, given in lbs/acre.

	Crested Wheatgrass		Native Range		Russian Wildrye	
	Unfertilized	Fertilized	Unfertilized	Fertilized	Unfertilized	Fertilized
1972-1976 Steer	2136.0	2996.0	2667.0	4010.0	-	2074.0
1978-1981 Cow/calf	1504.0	2772.0	1470.0	2404.0	1266.0	2038.0
1982 Cow/calf	2455.0	4779.0	1923.0	40470.0	1538.0	2706.0

Table 4. Mean gains of beef when the animals came off for each pasture of the complimentary grazing system at Dickinson Experiment Station, given in lbs/acre/day.

	Crested Wheatgrass		Native Range		Russian Wildrye	
	Unfertilized	Fertilized	Unfertilized	Fertilized	Unfertilized	Fertilized
1972-1976 Steer	1.21	2.03	0.94	1.49	-	1.47
1978-1981						
Calf	1.07	2.34	0.94	1.05	1.16	1.08
Cow	0.53	1.52	0.31	0.04	0.39	0.90
Cow/calf	1.60	3.85	1.25	1.09	1.55	1.97
1982						
Calf	1.23	2.70	2.19	3.25	2.80	2.41
Cow	2.09	4.88	0.76	1.02	0.82	0.50
Cow/calf	3.32	7.58	2.95	4.27	3.62	2.91

The aboveground herbage production data in 1982 was collected on a biweekly basis for the pastures being grazed and on a monthly basis for pastures not being grazed. These biweekly and monthly clipping data are shown in table 6. The percentage of difference between the ungrazed and grazed treatments of each pasture includes the amount of herbage consumed by the grazing animal and the amount lost due to trampling. These percentage difference data are shown in table 7. Fertilization increases herbage production. The amount of increased herbage production is variable between clip periods and between pastures (Table 8). The percent basal cover was greatest on the unfertilized native range pasture and lowest on the unfertilized crested wheatgrass pasture Table 9).

The animal weight gains by weight period are shown on table 10. The gain per acre of the calves in 1982 on the fertilized and unfertilized systems was 74.9 lbs and 53.2 lbs per acre respectively. The calf beef produced on the fertilized system was 21.7 lbs per acre greater than on the unfertilized system. Assuming an average selling price of $0.72 per pound for the calves in the fall of 1982, the gross return would be $15.62 per acre greater for the fertilized system. The cost of the fertilizer in the spring for 1982 was $13.40 per acre. The net return would be $2.22 per acre greater on the fertilized system.

Table 6. Mean aboveground ground herbage production of each pasture of the complimentary grazing system at Dickinson Experiment Station. Data was collected biweekly for the pastures being grazed and monthly for all pastures, 1982.

	15 May	1 Jun	15 Jun	20 Jun	1 Jul	15 Jul	1 Aug	15 Aug	20 Aug	30 Aug	15 Sep	1 Oct	30 Oct
Crested Wheatgrass													
Unfertilized													
Ungrazed		1253	1508	2455		2132		2507			3192		2705
	874												
Grazed		691	697	692		1264		1039			1811		1238
Fertilized													
Ungrazed		2895	3913	4779		6203		4857			4946		6263
	1612												
Grazed		1748	2574	1758		2056		2546			3709		4182
Native Range													
Unfertilized													
Ungrazed					2081	2250	2301	2421	1923		1755		2486
	448		1212										
Grazed					1682	1306	1263	1097	871		1422		1434
Fertilized													
Ungrazed					4308	4867	4546	3840	4047		2757		5246
	1148		3169										
Grazed					3260	3309	2601	2200	1095		1888		3020
Russian Wildrye													
Unfertilized													
Ungrazed										1791	1538	1673	1970
	576		1491			3214		2163					
Grazed										1279	879	316	723
Fertilized													
Ungrazed										3382	2706	3389	4801
	1336		3079			4409		3579					
Grazed										2654	1774	1387	2870

Table 7. Mean aboveground ground herbage production in lbs/acre on the ungrazed treatments and percentage difference between the ungrazed and grazed treatments of each pasture of the complimentary grazing system at Dickinson Experiment Station-1982.

	15 May	1 Jun	15 Jun	20 Jun	1 Jul	15 Jul	1 Aug	15 Aug	20 Aug	30 Aug	15 Sep	1 Oct	30 Oct
<u>Crested Wheatgrass</u>													
Unfertilized													
lbs/acre	8.74	1253	1508	2455		2132		2507			3192		2705
% difference	0.0	44.8	53.7	71.8		40.7		58.6			43.3		54.2
Fertilized													
lbs/acre	1612	2895	3913	4779		6203		4857			4946		6263
% Difference	0.0	39.6	34.2	63.2		66.9		47.6			25.0		33.2
Native Range													
Unfertilized													
lbs/acre	448		1212		2081	2250	2301	2421	1923		1755		2486
% difference	0.0		0.0		19.2	42.0	45.1	54.7	54.7		19.0		42.3
Fertilized													
lbs/acre	1148		3169		4308	4867	4546	3840	4047		2757		5246
% difference	0.0		0.0		24.3	32.0	42.8	42.7	73.0		31.5		42.4
Russian Wildrye													
Unfertilized													
lbs/acre	576		1491			3214		2163		1791	1538	1673	1970
% difference	0.0		0.0			0.0		0.0		38.4	42.9	81.1	63.3
Fertilized													
lbs/acre	1336		3079			4409		3579		3382	2706	3389	4801
% difference	0.0		0.0			0.0		0.0		24.0	34.4	59.1	40.2

Table 8. Percentage of aboveground ground herbage production on the fertilized pastures compared to the herbage production on the unfertilized pastures on the complimentary grazing system at Dickinson Experiment Station-1982.

	15 May	1 Jun	15 Jun	20 Jun	1 Jul	15 Jul	1 Aug	15 Aug	20 Aug	30 Aug	15 Sep	1 Oct	30 Oct
Crested Wheatgrass													
% Fert/Unfert	184.5	231.0	259.5	194.7		291.0		193.8			155.0		231.6
Native Range													
% Fert/Unfert	256.2		261.5		207.0	216.4	197.5	158.7	210.4		157.0		211.0
Russian Wildrye													
% Fert/Unfert	232.2		206.5			137.2		165.4		188.9	175.9	202.5	243.7

Table 9. Percent basal cover on the Fertilized and Unfertilized pastures of the complimentary grazing system at the Dickinson Experiment Station-1982.

	Crested Wheatgrass		Native Range		Russian Wildrye	
	Fertilized	Unfertilized	Fertilized	Unfertilized	Fertilized	Unfertilized
Litter	73.0	73.1	78.1	63.7	64.0	56.7
Soil	11.9	17.2	4.1	6.8	19.1	31.0
Grass	15.0	7.9	17.1	21.4	16.7	11.7
Forbs	0.1	1.8	0.4	1.4	0.1	0.6
Club Moss	0.0	0.0	0.2	6.7	0.1	0.0

Table 10. The mean weight, the gain in pounds per day per head and the gain in pounds per day per acre by weigh period for the calves and cows on the unfertilized and fertilized complimentary grazing systems at Dickinson Experiment Station-1982.

	20 May		21 Jun		19 Jul		20 Aug		10 Sep		27 Sep	4 Oct
		Crested Wheatgrass				Native Range				Russian Wildrye		
Unfertilized System												
Calf												
Mean weight	137.5		200.5		261.0		317.5		366.5		403.0	
gain lbs/day/head		1.97		2.18		1.77		2.33		2.15		
gain lbs/day/acre		1.23		1.21		0.98		1.46		1.34		
Cow												
Mean weight	897.0		1004.0		1049.5		1041.5		1066.0		1068.5	
gain lbs/day/head		3.35		1.63		-.0.25		1.17		0.15		
gain lbs/day/acre		2.09		0.90		-0.14		0.73		0.09		
Fertilized System												
Calf												
Mean weight	139.5		208.5		277.0		323.5		374.0			409.0
gain lbs/day/head		2.16		2.45		1.45		2.40		1.46		
gain lbs/day/acre		2.70		2.04		1.21		1.50		0.91		
Cow												
Mean weight	893.5		1018.5		1082.5		1048.5		1085.0			1062.5
gain lbs/day/head		3.91		2.29		-1.06		1.74		-0.94		
gain lbs/day/acre		4.88		1.91		-0.89		1.09		-0.59		

NATIVE RANGE FERTILIZATION WITH AMMONIA AND UREA-1982

H. Goetz and L. Manske

A study that compares fertilization of native range between ammonium nitrate and urea was started at the Dickinson Experiment Station in the spring of 1982. The trial was established of 2.6 acres located on the SW¼ SW¼ NW¼ sec. 16, T. 143 N., N 96 W. At the ranch headquarters of the Dickinson Experiment Station. The 30 X 60 foot plots were arranged in a randomized block design with three replications. The alleys between the replications were 10 feet wide and the perimeter border was 40 feet wide. A barbed wire fence was constructed to exclude grazing on the plots until after all of the data for the season were collected. The soil is moreau silty clay. The range site is clayey. The fertilization treatments were 40 and 60 pounds of nitrogen per acre for ammonium nitrate and urea applied annually and biennially, and 100 pounds of nitrogen per acre for ammonium nitrate and urea applied biennially. A total of ten fertilizer treatments and two control plots with no treatment were included in each replication. The fertilizer was broadcast applied on 4 May 1982. The data that were collected from these plots were: biweekly aboveground herbage production separated into six categories, biweekly leaf height measurements and phenological phases of five major graminoid species, carbohydrate content of roots, shoots, and leaves of two major grass species, quantitative species composition, biweekly soil moisture and monthly soil nutrient content at increments to 48 inches in depth.

The biweekly aboveground herbage production was sampled by clipping to ground level two ¼m^2 quadrats for each plot. The herbage was separated into six categories, cool short, warm short, cool mid, warm mid, western wheatgrass and forbs. The samples were oven dried at 80°C. The dried samples were then weighted in grams. The average weight of each category for the two ¼m^2 quadrats were determined and the average pounds per acre of herbage production was calculated for each category by multiplying the average weight in grams by 35.8. The total production for each plot was found by summation of the average pounds per acre for each category. The reported figures are mean of the three replications for each treatment. Five biweekly clips were made for the 1982 season. The 9-13 August, and 20-23 August.

The herbage samples were ground in a Wiley mill and analyzed for nutrient content by proximate analysis at the nutrition laboratory in the animal science department at North Dakota State University under direction of Dr. Duane Erickson. The results of these analysis will be made available at a later date.

Biweekly leaf height measurements and phenological development of the flower stalks were collected for five dominant graminoid species. Carex helophila, Bouteloua gracilis. Twelve plants of each species were selected at random outstretched and measured to the nearest millimeter in sequence from the oldest to the newest. Along with the length measurements, the degree of dryness for the leaf blades were recorded. The categories of dryness used were: 0, .01-2, 2.1-25, 25.1-50, 50.1-75.1, 75.1-98 and 100 percent dry. The highest figure of the category was used to record the percentage of dryness for each leaf blade.

If the flower stalks were present, the height was measured and the phenological stage of development was recorded. The categories used were: flower stalk developing, head emergence, anthesis, seeds developing, and seeds being shed. Seven biweekly leaf height and phenological development data were collected in the 1982 season. The dates for these were 27 May, 2-3, 7, 11 June, 21, 25, 28 June, 15, 19-20 July, 30 July, 2, 4 August, 12, 13, 18 August, and 24-25 August.

Carbohydrate content samples of roots, shoots, and leaves for Bouteloua gracilis, and Agropyron smithii were collected. Random plants of each species were collected from each plot. The soil was washed from the samples. The samples were divided into roots, shoots, and leaves in the field and placed in a cooler containing dry ice. The samples from the three replications of each treatment were combined. The samples will be analyzed in the laboratory. Four carbohydrate content sample collections were made in the 1982 season. The dates for these were 18 June, 9 July, 3 August, and 30 August.

Quantitative species composition data for each plot was collected during the period of 27 August to 2 September for the 1982 season. The herbacious plants were sampled by the ten pin point-frame method (Levy and Madden 1933, Tinney, Aamodt, and Ahlgren 1937, Heady and Raden 1958, and Smith 1959). The point frame is a metal frame that is constructed to stand at a 60° angle with holes for ten pins spaced at 5 cm intervals. The frame was set down and the pins raised and then allowed to move down through the existing vegetation. If a pin hit the basal portion of a living plant, the species of that plant was recorded. Hts on Selaginella densa and the various species of lichens wer also recorded as hits. The pins that did not make contact with living vegetation were counted as no hits. These were divided into litter (dead and decaying vegetation) soil (mineral soil not covered by litter or living vegetqation) and rock (a hard mass of mineral substance large enough to obstruct plant growth, about the size of a half dollar ot larger). Aerial hits were not recorded. Fifteen hundred points were read for each treatment (500 points per plot). A systematic sampling scheme was used for each plot. A permanent major transect was established two feet inside and parallel to the north boundary of each plot. Five minor transects were established perpendicular to the major transect at three foot intervals starting three feet from the east boundary of the plot. One hundred points were read on each minor transect. A species present list for forbs and shrubs on each plot was completed 2 September.

Soil moisture by the gravimetric method was taken four times during the 1982 season. The dates of these 16 June, 6 July, 20 July, and 11 August. The one inch Veihmeyer soil tube was used to collect the samples. Three locations were separated as sample sites for the trial, at the north end, in the center and at the south end. Two replications were taken at each location. The samples were collected at increments of 0-6, 6-12, 12-24, 24-36, and 36-48 inches in depth. Each subsample was placed in a numbered steel can of known weight. These were weighed, then oven dried at 100° C. The dried soil cans were again weighed. The difference in weight is the weight of the soil water. Percent soil moisture then can be calculated.

Soil nutrient content was collected monthly during the 1982 season. The samples were collected using the one inch Veihmeyer soil tube. Two replications were taken from each plot. The samples were collected at increments of 0-6, 6-12, 12-24, 24-36, and 36-48 inches in depth. Each subsample was placed in labeled soil bags and frozen. The samples will be analyzed for nutrient content by the soil laboratory at North Dakota State University. The results of these analysis will be made available at a later date.

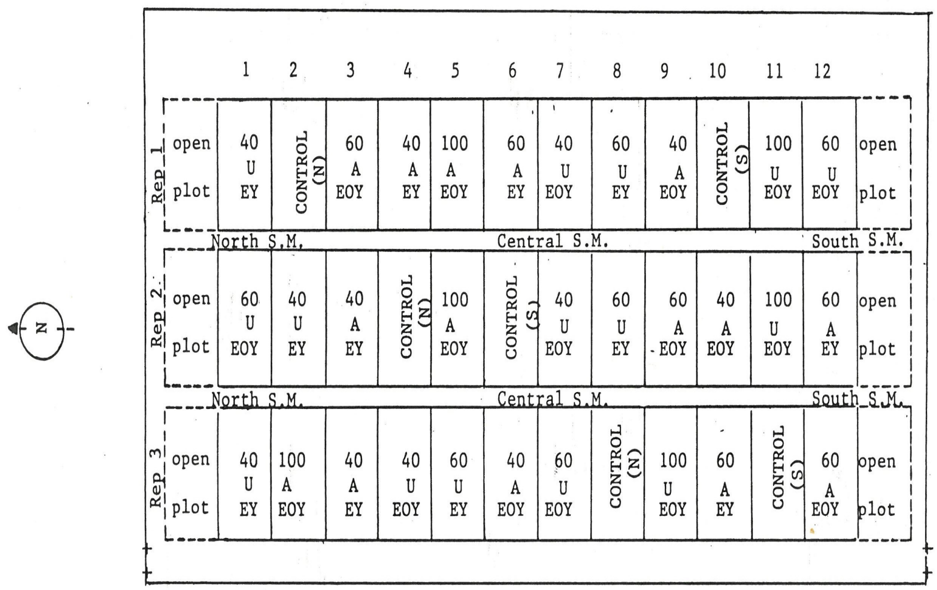


Figure 1. Native range fertilization with ammonium nitrate (A) and urea (U) randomized block plot design with three replications. Rates are 40, 60 and 100 lbs. of nitrogen per acre. Fertilizer is broadcast applied annually (EY) or biennially (EOY). Soil moisture (S.M.) samples collected at north, central and south location in each alley.

Table 1. Monthly mean maximum, minimum, and average temperatures in centigrade (°C) and fahrenheit (°F) and monthly precipitation in millimeters (mm) and inches (in) at the ranch Headquarters, Dickinson Experiment Station, Sep 1981-Dec 1982.

	Temperature			Temperature			Precipitation	
Year Month	Max (°C)	Min (°C)	Average (°C)	Max (°F)	Min (°F)	Average (°F)	(mm)	(In)
1981								
Sep	23.04	5.26	14.15	73.48	41.47	57.47	23.88	0.94
Oct	13.23	-0.97	6.13	55.81	30.26	43.03	12.45	0.49
Nov	9.06	-3.93	2.57	48.30	24.93	36.62	13.72	0.54
Dec	-3.64	-13.26	-8.45	25.45	8.13	16.79	15.24	0.60
1982								
Jan	-13.39	-27.19	-20.43	7.90	-16.94	-4.77	27.69	1.09
Feb	-6.01	-17.30	-11.66	21.18	0.86	11.02	12.45	0.49
Mar	-0.63	-10.30	-5.38	30.87	13.77	22.32	49.02	1.93
Apr	8.96	-33.09	2.93	48.13	26.43	37.28	34.80	1.37
May	14.77	3.87	9.32	58.58	38.97	48.77	68.33	2.69
Jun	18.32	6.63	13.94	64.97	43.94	57.09	109.22	4.30
Jul	27.06	12.99	20.03	80.71	55.39	68.05	89.92	3.54
Aug	N/A (1)	10.88	N/A	N/A	51.58	N/A	44.45	1.75
Sep	N/A	4.33	N/A	N/A	39.80	N/A	42.93	1.69
Oct	N/A	0.32	N/A	N/A	32.58	N/A	146.05	5.75
Nov	2.02	-9.82	-3.90	35.63	14.33	24.98	6.60	0.26
Dec	-0.82	-11.77	-6.30	30.52	10.81	20.66	11.43	0.45

Table 2. Mean biweekly aboveground herbage production by category in lbs/acre for the ammonium nitrate fertilization treatment on native range at the Dickinson Experiment Station-1982.

Lbs of N/acre EY=annually EOY=biennially	9-11 Jun	23-24 Jun	9-12 Jul	22-23 Jul	9-13 Aug	20-23 Aug
40 EY						
cool short		416.7	594.1	522.7	428.2	491.7
warm short		226.6	286.2	544.8	233.7	293.7
cool mid		316.5	278.3	398.6	273.0	428.2
warm mid						224.8
western whtg		305.8	312.9	370.0	205.2	331.8
forbs		309.7	607.3	535.2	162.3	395.0
TOTAL		1575.3	2078.8	2371.3	1302.4	2165.2
40 EOY						
cool short		454.9	617.3	633.3	451.4	463.8
warm short		307.6	257.6	407.5	349.7	283.7
cool mid		297.9	252.6	459.6	116.0	388.3
warm mid			153.4			
western whtg		171.3	129.5	212.3	299.0	248.7
forbs		265.1	341.8	651.9	90.8	131.0
TOTAL		1496.8	1752.2	2364.6	1306.9	1515.5
Control						
cool short		280.1	253.3	292.6	182.0	285.1
warm short		226.9	256.9	260.5	250.7	332.7
cool mid		127.6	291.9	244.9	212.3	193.0
warm mid		10.7				
western whtg		151.1	124.9	142.7	155.2	155.2
forbs		233.2	260.3	380.4	86.5	236.0
TOTAL		1029.6	1187.3	1321.1	886.7	1202.0

Table 2 (cont). Mean biweekly aboveground herbage production by category in lbs/acre for the ammonium nitrate fertilization treatment on native range at the Dickinson Experiment Station-1982.

Lbs of N/acre EY=annually EOY=biennially	9-11 Jun	23-24 Jun	9-12 Jul	22-23 Jul	9-13 Aug	20-23 Aug
60 EY						
cool short		530.6	473.5	823.5	406.8	636.9
warm short		310.4	457.4	444.2	314.9	512.0
cool mid		337.9	489.9	574.5	240.8	280.1
warm mid		39.3	146.3			
western whtg		184.5	267.6	299.7	107.0	141.7
forbs		328.3	530.9	484.5	114.2	467.4
TOTAL		1731.0	2365.6	2626.4	1183.7	2038.1
60 EOY						
cool short		428.9	538.8	539.8	743.9	639.7
warm short		372.1	425.3	413.2	287.2	309.4
cool mid		378.9	374.6	624.4	60.7	538.1
warm mid						
western whtg		166.6	248.7	334.3	388.9	182.0
forbs		253.3	482.4	353.2	80.3	339.7
TOTAL		1599.8	2069.8	2264.9	1561.0	2008.9
100 EOY						
cool short		670.1	644.7	809.2	706.5	626.2
warm short		282.6	509.5	390.7	371.1	553.0
cool mid		239.1	293.7	407.8	287.2	394.3
warm mid						130.2
western whtg		379.3	701.1	311.5	413.9	789.6
forbs		293.7	384.3	581.6	374.6	256.2
TOTAL		1864.8	2533.3	2500.8	2153.3	2749.5

Table 3. Mean biweekly aboveground herbage production by category in lbs/acre for the urea fertilization treatment on native range at the Dickinson Experiment Station-1982.

Lbs of N/acre EY=annually EOY=biennially	9-11 Jun	23-24 Jun	9-12 Jul	22-23 Jul	9-13 Aug	20-23 Aug
40 EY						
cool short		402.5	388.2	363.9	367.5	397.8
warm short		238.3	382.5	411.4	342.5	313.3
cool mid		279.4	266.5	258.7	19.6	397.8
warm mid						
western whtg		412.8	428.2	407.5	779.6	706.5
forbs		471.7	422.1	676.1	199.8	254.4
TOTAL		1804.7	1887.5	2117.6	1709.0	2069.8
40 EOY						
cool short		404.3	531.6	543.4	251.5	632.6
warm short		238.3	307.6	360.4	447.8	327.2
cool mid		192.0	205.9	270.1	140.9	188.4
warm mid		74.9				
western whtg		220.5	192.0	180.9	217.7	420.3
forbs		305.1	380.0	393.6	396.1	208.0
TOTAL		1435.1	1617.1	1748.4	1454.0	1776.5
Control						
cool short		280.1	253.3	292.6	182.0	285.1
warm short		226.9	256.9	260.5	250.7	332.7
cool mid		127.6	291.9	244.9	212.3	193.0
warm mid		10.7				
western whtg		151.1	124.9	142.7	155.2	155.2
forbs		233.2	260.3	380.4	86.5	236.0
TOTAL		1029.6	1187.3	1321.1	886.7	1202.0

Table 3 (cont). Mean biweekly aboveground herbage production by category in lbs/acre for the urea fertilization treatment on native range at the Dickinson Experiment Station-1982.

Lbs of N/acre EY=annually EOY=biennially	9-11 Jun	23-24 Jun	9-12 Jul	22-23 Jul	9-13 Aug	20-23 Aug
60 EY						
cool short		595.1	465.6	456.0	365.7	315.8
warm short		246.9	409.3	373.9	658.3	370.0
cool mid		252.3	189.8	391.8	105.3	390.0
warm mid						
western whtg		191.6	229.1	365.0	212.3	336.1
forbs		227.3	425.3	328.3	267.6	381.1
TOTAL		1513.2	1719.1	1915.0	1609.2	1793.0
60 EOY						
cool short		415.0	473.5	521.6	713.6	433.5
warm short		301.5	332.9	334.3	413.9	387.8
cool mid		403.2	305.8	895.6	162.3	570.2
warm mid		17.8				
western whtg		241.6	343.2	331.8	331.8	324.7
forbs		287.2	453.9	578.7	454.9	335.4
TOTAL		1666.3	1909.3	2662.0	2076.5	2051.6
100 EOY						
cool short		686.8	548.8	742.9	429.0	788.5
warm short		306.1	476.8	551.3	743.9	500.6
cool mid		286.5	399.6	454.9	462.9	640.5
warm mid						
western whtg		278.3	448.5	489.9	503.1	543.4
forbs		287.9	410.3	617.3	242.6	306.1
TOTAL		1845.6	2284.0	2856.3	2381.5	2779.1

Table 4. Mean biweekly total aboveground herbage production, given in lbs/acre, for the fertilization treatments on native range of ammonium nitrate and urea at the Dickinson Experiment Station-1982.

	Ammonium Nitrate						Urea					
	9-11 Jun	23-24 Jun	9-12 Jul	22-23 Jul	9-13 Aug	20-23 Aug	9-11 Jun	23-24 Jun	9-12 Jul	22-23 Jul	9-13 Aug	20-23 Aug
Rate lbs of N/acre EY=annually EOY=biennially												
40 EU		1575	2079	2371	1302	2165		1805	1887	2118	1709	2070
40 EOY		1497	1752	2365	1308	1515		1435	1617	1748	1454	1777
60 EY		1731	2366	2626	1183	2038		1513	1719	1915	1609	1793
60 EOY		1600	2070	2265	1561	2009		1666	1909	2662	2076	2052
100 EOY		1865	2533	2501	2153	2749		1846	2284	2856	2389	2779
Control		1024	1187	1321	887	1202		1024	1187	1321	887	1202

Table 5. Points analysis of the ammonium nitrate treatment at the 40 pounds of nitrogen per acre rate applied annually for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover	Relative Cover	% Frequency	Relative % Frequency	Importance Value
Agropyron smithii	3.07	6.09	4.94	6.60	12.69
Bouteloua gracilis	14.47	29.37	15.27	20.87	50.23
Calamagrostis montanensis	0.27	0.57	0.63	0.85	1.43
Koeleria pyramidata	6.00	12.91	10.29	14.15	27.05
Muhlenbergia cuspidata	0.60	1.52	1.33	1.90	3.43
Stipa comata	2.13	4.25	4.24	5.73	9.98
Stipa viridula	1.80	3.75	3.24	4.41	8.16
Carex filifolia	1.93	4.00	3.95	5.36	9.36
Carex heliophila	1.47	3.38	3.34	4.66	8.04
Achillea millefolium	0.27	0.54	0.61	0.82	1.37
Antennaria parvifolia	0.53	1.25	1.15	1.63	2.88
Artemisia dracunculus	0.13	0.30	0.31	0.44	0.73
Artemisia frigida	0.73	1.50	1.38	1.87	3.38
Collomia linearis	0.13	0.29	0.31	0.43	0.71
Hedeoma hispidum	0.13	0.26	0.30	0.40	0.65
Linum lewisii	0.13	0.29	0.31	0.43	0.71
Lotus americanus	0.20	0.41	0.46	0.62	1.03
Orthocarpus luteus	0.33	0.79	0.64	0.89	1.69
Phlox hoodii	0.67	1.26	1.47	1.95	3.21
Plantago purshii	0.47	0.95	1.07	1.44	2.38
Ratibida columnifera	0.13	0.26	0.30	0.40	0.65
Solidago missouriensis	0.07	0.11	0.14	0.18	0.30
Selaginella densa	5.53	13.13	7.60	10.71	23.84
Lichen spp.	5.93	12.84	9.64	13.25	26.09
Litter	50.87		23.52		
Soil	2.00		3.56		
Rock	0.00		0.00		

Table 6. Points analysis of the ammonium nitrate treatment at the 40 pounds of nitrogen per acre rate applied biennially for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover	Relative Cover	% Frequency	Relative% Frequency	Importance Value
Agropyron smithii	0.73	1.54	1.50	2.38	3.91
Bouteloua gracilis	13.13	31.87	17.75	27.51	59.38
Buchloe dactyloides	0.07	0.14	0.15	0.24	0.38
Calamagrostis montanensis	0.13	0.29	0.29	0.48	0.77
Koeleria pyramidata	3.73	7.99	6.56	9.74	17.73
Muhlenbergia cuspidata	1.93	3.97	2.16	3.25	7.22
Stipa comata	2.13	5.36	5.08	8.11	13.48
Stipa viridula	0.67	1.38	1.20	1.89	3.27
Carex filifolia	3.07	7.24	6.08	9.39	16.62
Carex heliophila	0.53	1.28	1.32	2.02	3.30
Antennaria parvifolia	0.27	0.85	0.75	1.19	2.05
Artemisia dracunculus	0.07	0.13	0.16	0.22	0.35
Echinacea angustifolia	0.07	0.14	0.15	0.24	0.38
Hedeoma hispidum	0.07	0.13	0.16	0.22	0.35
Liatris punctata	0.13	0.47	0.40	0.63	1.11
Lotus americanus	0.13	0.47	0.40	0.63	1.11
Orthocarpus lambertii	0.07	0.13	0.16	0.22	0.35
Phlox hoodii	0.20	0.60	0.56	0.86	1.46
Plantago purshii	0.13	0.29	0.29	0.48	0.77
Potentilla pensylvanica	0.07	0.13	0.16	0.22	0.35
Ratibida columnifera	0.13	0.25	0.32	0.44	0.69
Sphaeralcea coccinea	0.13	0.47	0.40	0.63	1.11
Selaginella densa	8.93	19.62	9.28	13.52	33.14
Lichen spp.	6.07	15.27	10.06	15.44	30.71
Litter	50.33		25.06		
Soil	7.07		9.59		
Rock	0.00		0.00		

Table 7. Points analysis of the ammonium nitrate treatment at the 60 pounds of nitrogen per acre rate applied annually for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover	Relative Cover	% Frequency	Relative % Frequency	Importance Value
Agropyron smithii	2.13	4.66	4.63	6.71	11.36
Bouteloua gracilis	17.93	39.17	18.62	27.29	66.34
Koeleria pyramidata	4.13	8.94	7.91	11.50	20.45
Muhlenbergia cuspidata	0.20	0.46	0.46	0.67	1.13
Stipa comata	2.93	7.06	6.02	8.89	15.95
Stipa viridula	0.20	0.39	0.47	0.66	1.05
Carex filifolia	3.53	7.92	6.38	9.31	17.24
Carex heliophila	1.33	3.29	3.13	4.67	7.95
Achillea millefolium	0.13	0.34	0.32	0.48	0.82
Antennaria parvifolia	0.20	0.46	0.46	0.67	1.13
Artemisia dracunculus	0.07	0.15	0.19	0.27	0.42
Artemisia frigida	0.67	1.52	1.39	2.00	0.42
Aster ericoides	0.07	0.12	0.14	0.19	3.52
Erysimum asperum	0.20	0.36	0.42	0.58	0.93
Gutierrezia sarothrae		0.12	0.14	0.19	0.31
Hedeoma hispidum	0.07	0.12	0.14	0.19	0.31
Linum lewisii	0.07	0.15	0.19	0.27	0.42
Lotus americanus	0.13	0.24	0.14	0.19	0.43
Oxytropis lambertii	0.07	0.12	0.14	0.19	0.31
Phlox hoodii	0.47	1.04	1.06	1.53	2.57
Plantago purshii	0.27	0.61	0.65	0.94	1.55
Potentilla pensylvanica	0.13	0.24	0.28	0.39	0.62
Ratibida columnifera	0.33	0.63	0.75	1.04	1.67
Solidago missouriensis	0.07	0.15	0.19	0.27	0.43
Sphaeralcea coccinea	0.27	0.74	0.73	1.12	2.28
Selaginella densa	3.87	9.57	5.16	7.69	17.26
Lichen spp.	4.13	11.49	7.92	12.08	23.57
Litter	51.93		25.30		
Soil	4.40		6.68		
Rock	0.00		0.00		

Table 8. Points analysis of the ammonium nitrate treatment at the 60 pounds of nitrogen per acre rate applied biennially for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover	Relative Cover	% Frequency	Relative % Frequency	Importance Value
Agropyron smithii	1.67	4.44	3.79	5.66	10.10
Bouteloua gracilis	17.00	36.71	20.61	30.23	66.94
Koeleria pyramidata	4.00	7.82	7.82	11.19	19.01
Muhlenbergia cuspidata	0.07	0.21	0.20	0.30	0.51
Stipa comata	3.07	7.10	6.69	9.77	16.86
Stipa viridula	0.33	0.94	0.93	1.43	2.37
Carex filifolia	1.60	3.95	3.88	5.81	9.77
Carex heliophila	0.93	2.31	2.29	3.38	5.70
Achillea millefolium	0.07	0.10	0.15	0.20	0.30
Antennaria parvifolia	0.33	0.56	0.47	0.66	1.22
Artemisia dracunculus	0.13	0.37	0.37	0.56	0.93
Artemisia frigida	0.13	0.41	0.39	0.61	1.02
Chenopodium album	0.07	0.21	0.20	0.30	0.51
Chenopodium leptophyllum	0.07	0.16	0.17	0.26	0.42
Phlox hoodii	0.13	0.32	0.34	0.52	0.84
Plantago purshii	0.33	0.90	0.91	1.39	2.28
Ratibida columnifera	0.07	0.21	0.20	0.30	0.51
Sphaeralcea coccinea	0.07	0.21	0.20	0.30	0.51
Selaginella densa	13.47	26.56	13.27	19.25	45.81
Lichen spp.	3.33	6.51	5.49	7.87	14.38
Litter	49.80		25.69		
Soil	3.33		5.94		
Rock	0.00		0.00		

Table 9. Points analysis of the ammonium nitrate treatment at the 100 pounds of nitrogen per acre rate applied biennially for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover	Relative Cover	% Frequency	Relative % Frequency	Importance Value
Agropyron smithii	1.33	3.01	3.17	4.74	7.74
Bouteloua gracilis	13.87	31.02	16.98	24.78	55.80
Koeleria pyramidata	6.40	14.36	11.30	16.43	30.79
Muhlenbergia cuspidata	0.67	1.70	1.72	2.65	4.35
Panicum oligosanthes	0.20	0.59	0.39	0.61	1.20
Stipa comata	2.07	4.97	4.18	6.17	11.14
Stipa viridula	0.67	1.57	1.62	2.49	4.06
Carex filifolia	3.93	8.96	6.58	9.36	18.32
Carex heliophila	2.13	4.71	4.10	5.85	10.56
Antennaria parvifolia	0.53	1.31	1.17	1.73	3.04
Artemisia frigida	0.27	0.60	0.65	0.93	1.53
Chenopodium album	0.07	0.12	0.14	0.19	0.31
Phlox hoodii	0.27	0.60	0.50	0.74	1.34
Plantago purshii	0.13	0.35	0.36	0.55	0.90
Potentilla pensylvanica	0.07	0.20	0.19	0.30	0.50
Solidago missouriensis	0.07	0.20	0.19	0.30	0.50
Selaginella densa	1.67	4.44	2.35	3.60	8.04
Lichen spp.	9.27	21.29	12.69	18.58	39.87
Litter	51.93		24.94		
Soil	4.47		6.78		
Rock	0.00		0.00		

Table 10. Points analysis of the urea treatment at the 40 pounds of nitrogen per acre rate applied annually for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover	Relative Cover	% Frequency	Relative % Frequency	Importance Value
Agropyron smithii	3.40	6.23	6.14	8.51	14.74
Bouteloua gracilis	15.80	29.45	16.17	22.87	52.31
Koeleria pyramidata	5.80	11.05	10.62	15.04	26.09
Panicum oligosanthes	0.07	0.11	0.14	0.19	0.30
Stipa comata	1.33	2.30	2.48	3.32	5.62
Stipa viridula	1.80	3.47	2.95	4.24	7.98
Carex filifolia	0.33	0.67	0.80	1.15	1.82
Carex heliophila	0.53	0.97	0.91	1.26	2.23
Achillea millefolium	0.13	0.28	0.32	0.48	0.76
Antennaria parvifolia	2.33	4.63	3.68	5.36	9.99
Artemisia frigida	0.40	0.73	0.89	1.24	1.98
Lotus americanus	0.13	0.28	0.32	0.48	0.76
Orthocarpus luteus	0.07	0.17	0.18	0.29	0.45
Phlox hoodii	0.53	0.97	0.61	0.86	1.82
Plantago purshii	0.07	0.12	0.15	0.21	0.33
Potentilla pensylvanica	0.07	0.11	0.13	0.19	0.30
Ratibida columnifera	0.47	0.83	1.03	1.40	2.23
Solidago missouriensis	0.20	0.34	0.43	0.57	0.91
Sphaeralcea coccinea	0.07	0.17	0.18	0.29	0.45
Symphoricarpos occidentalis	0.13	0.33	0.36	0.57	0.91
Selaginella densa	12.47	26.95	11.94	17.80	44.74
Lichen spp.	4.73	9.84	9.48	13.66	23.50
Litter	45.53		23.81		
Soil	3.60		6.23		
Rock	0.00		0.00		

Table 11. Points analysis of the urea treatment at the 40 pounds of nitrogen per acre rate applied biennially for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover	Relative Cover	% Frequency	Relative % Frequency	Importance Value
Agropyron smithii	1.67	3.67	3.59	5.43	9.10
Bouteloua gracilis	17.47	38.51	18.98	28.62	67.14
Calamagrostis montanensis	0.07	0.15	0.15	0.21	0.36
Koeleria pyramidata	4.20	9.57	7.80	11.71	21.28
Muhlenbergia cuspidata	0.53	1.21	0.97	1.47	2.68
Stipa comata	1.87	4.10	4.07	6.18	10.28
Stipa viridula	0.93	2.03	1.99	2.89	4.92
Carex filifolia	2.07	4.38	3.51	5.31	9.69
Carex heliophila	1.47	3.26	3.44	5.19	8.46
Achillea millefolium	0.07	0.15	0.15	0.21	0.36
Antennaria parvifolia	0.73	1.60	0.94	1.45	3..05
Artemisia dracunculus	0.07	0.13	0.15	0.23	0.36
Artemisia frigida	0.33	0.71	0.60	0.89	1.60
Cerastium arvense	0.07	0.13	0.15	0.23	0.37
Lotus americanus	0.07	0.15	0.15	0.21	0.36
Orthocarpus luteus	0.27	0.58	0.61	0.85	1.44
Phlox hoodii	0.27	0.55	0.60	0.91	1.46
Plantago purshii	0.27	0.56	0.60	0.89	1.45
Potentilla pensylvanica	0.13	0.32	0.32	0.48	0.80
Ratibida columnifera	0.07	0.15	0.15	0.21	0.36
Selaginella densa	2.93	6.69	4.89	7.29	13.98
Lichen spp.	9.13	21.40	12.77	19.11	40.52
Litter	48.87		23.67		
Soil	6.47		9.74		
Rock	0.00		0.00		

Table 12. Points analysis of the urea treatment at the 60 pounds of nitrogen per acre rate applied annually for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover	Relative Cover	% Frequency	Relative % Frequency	Importance Value
Agropyron smithii	2.33	4.77	4.35	6.03	10.80
Bouteloua gracilis	13.87	30.10	16.20	23.39	53.49
Calamagrostis montanensis	0.47	0.93	0.89	1.24	2.17
Koeleria pyramidata	6.07	13.13	10.78	15.33	28.46
Muhlenbergia cuspidata	1.47	2.99	1.97	2.76	5.75
Stipa comata	2.47	5.19	4.91	6.90	12.09
Stipa viridula	1.13	2.33	2.42	3.37	5.72
Carex filifolia	2.13	4.56	4.20	5.97	10.53
Carex heliophila	0.47	1.10	1.15	1.69	2.79
Achillea millefolium	0.13	0.32	0.34	0.49	0.82
Antennaria parvifolia	0.53	1.28	1.15	1.70	2.98
Artemisia dracunculus	0.07	0.14	0.15	0.20	0.34
Artemisia frigida	0.27	0.53	0.45	0.62	1.15
Cerastium arvense	0.13	0.28	0.15	0.20	0.48
Erysimum asperum	0.07	0.13	0.15	0.21	0.34
Lotus americanus	0.07	0.13	0.15	0.21	0.34
Orthocarpus luteus	0.07	0.14	0.15	0.20	0.34
Petalostemon purpureum	0.07	0.18	0.19	0.29	0.48
Phlox hoodii	0.20	0.51	0.34	0.49	1.00
Plantago purshii	0.40	0.88	0.78	1.09	1.96
Potentilla pensylvanica	0.07	0.14	0.15	0.20	0.34
Ratibida columnifera	0.27	0.55	0.74	1.00	1.55
Solidago missouriensis	0.07	0.14	0.15	0.20	0.34
Solidago mollis	0.07	0.14	0.15	0.20	0.34
Selaginella densa	6.93	16.18	9.37	13.55	29.73
Lichen spp.	5.20	13.24	8.20	12.45	25.69
Litter	50.53		23.99		
Soil	4.47		6.41		
Rock	0.00		0.00		

Table 13. Points analysis of the urea treatment at the 60 pounds of nitrogen per acre rate applied biennially for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover	Relative Cover	% Frequency	Relative % Frequency	Importance Value
Agropyron smithii	3.00	5.85	5.35	7.41	13.26
Bouteloua gracilis	14.13	27.86	16.39	22.47	50.33
Buchloe dactyloides	0.33	0.66	0.72	0.96	1.62
Calamagrostis montanensis	0.47	0.91	0.86	1.16	2.07
Koeleria pyramidata	3.67	7.43	6.62	8.94	16.37
Muhlenbergia cuspidata	1.60	3.11	2.33	3.16	6.27
Stipa comata	4.93	9.74	8.67	11.80	21.54
Stipa viridula	0.47	0.95	1.06	1.49	2.44
Carex filifolia	4.27	8.35	6.51	8.75	17.09
Carex heliophila	1.13	2.29	2.38	3.26	5.54
Achillea millefolium	0.13	0.28	0.30	0.42	0.69
Antennaria parvifolia	0.47	0.97	0.94	1.37	2.34
Artemisia dracunculus	0.27	0.53	0.58	0.77	1.30
Artemisia frigida	0.40	0.80	0.89	1.23	2.03
Aster ericoides	0.13	0.27	0.29	0.38	0.66
Echinacea angustifolia	0.07	0.14	0.15	0.19	0.33
Erysimum asperum	0.07	0.14	0.15	0.19	0.33
Haplopappus spinulosus	0.20	0.37	0.43	0.58	0.95
Liatris punctata	0.20	0.40	0.43	0.58	0.97
Linum rigidum	0.07	0.14	0.15	0.19	0.33
Lotus americanus	0.07	0.14	0.15	0.19	0.33
Oxytropis lambertii	0.07	0.12	0.14	0.19	0.32
Petalostemon purpureum	0.07	0.12	0.14	0.19	0.32
Phlox hoodii	0.07	0.14	0.15	0.19	0.32
Plantago purshii	0.20	0.40	0.43	0.58	0.97
Potentilla pensylvanica	0.07	0.14	0.15	0.19	0.33
Solidago missouriensis	0.13	0.27	0.29	0.38	0.66
Selaginella densa	6.87	14.13	8.17	11.39	25.52
Lichen spp.	6.53	13.34	8.07	11.39	24.73
Litter	45.87		21.98		
Soil	4.07		5.13		
Rock	0.00		0.00		

Table 14. Points analysis of the urea treatment at the 100 pounds of nitrogen per acre rate applied biennially for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover	Relative Cover	% Frequency	Relative % Frequency	Importance Value
Agropyron smithii	2.53	5.26	4.89	7.18	12.44
Bouteloua gracilis	18.13	41.35	19.24	30.31	71.66
Buchloe dactyloides	0.13	0.30	0.29	0.05	0.80
Calamagrostis montanensis	0.40	0.85	0.89	1.40	2.25
Koeleria pyramidata	3.20	7.12	5.60	8.69	15.81
Muhlenbergia cuspidata	0.73	1.50	1.05	1.50	3.00
Poa compressa	0.07	0.13	0.15	0.20	0.33
Stipa comata	3.13	6.85	5.84	9.15	15.99
Stipa viridula	0.53	1.20	1.53	2.37	3.57
Carex filifolia	4.93	10.92	7.80	12.37	23.28
Carex heliophila	1.53	3.71	3.33	5.41	9.12
Antennaria parvifolia	0.47	0.88	0.33	0.40	1.28
Artemisia dracunculus	0.13	0.25	0.30	0.40	0.65
Artemisia frigida	0.20	0.43	0.47	0.68	1.11
Aster ericoides	0.13	0.25	0.30	0.40	0.65
Linum rigidum	0.07	0.18	0.17	0.28	0.46
Lotus americanus	0.07	0.18	0.17	0.28	0.46
Petalostemon purpureum	0.07	0.13	0.15	0.20	0.33
Plantago purshii	0.13	0.30	0.29	0.50	0.80
Selaginella densa	6.40	13.51	7.43	10.66	24.17
Lichen spp.	2.00	4.71	4.41	7.13	11.83
Litter	43.80		23.32		
Soil	11.20		11.98		
Rock	0.00		0.00		

Table 15. Points analysis of the control treatment(N) and (S) for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover	Relative Cover	% Frequency	Relative % Frequency	Importance Value
Agropyron smithii	1.37	3.47	3.12	4.94	8.40
Bouteloua curtipendula	0.17	0.44	0.35	0.54	0.98
Bouteloua gracilis	12.64	32.40	19.08	30.07	62.46
Buchloe dactyloides	0.20	0.52	0.26	0.41	0.93
Koeleria pyramidata	2.54	6.91	5.55	8.86	15.77
Muhlenbergia cuspidata	0.77	1.93	1.02	1.61	3.53
Stipa comata	1.60	4.31	4.01	6.38	10.65
Stipa viridula	0.37	0.93	0.94	1.49	2.42
Carex filifolia	1.74	4.19	4.08	6.26	10.46
Carex heliophila	0.80	2.06	2.23	3.44	5.50
Antennaria parvifolia	0.33	0.90	0.72	1.15	2.05
Artemisia dracunculus	0.14	0.32	0.35	0.53	0.85
Artemisia frigida	0.30	0.78	0.80	1.25	2.03
Erysimum inconspicum	0.04	0.09	0.09	0.14	0.22
Hedeoma hispidum	0.07	0.17	0.17	0.27	0.44
Linum lewisii	0.04	0.09	0.09	0.14	0.22
Lotus americanus	0.17	0.33	0.36	0.51	0.84
Orthocarpus luteus	0.04	0.09	0.09	0.14	0.22
Petalostemon purpureum	0.07	0.17	0.17	0.27	0.44
Phlox hoodii	0.14	0.30	0.37	0.55	0.85
Plantago purshii	0.14	0.30	0.35	0.53	0.83
Psoralea argophylla	0.04	0.11	0.10	0.16	0.26
Ratibida columnifera	0.04	0.06	0.09	0.13	0.19
Solidago missouriensis	0.04	0.06	0.09	0.13	0.19
Solidago mollis	0.04	0.12	0.10	0.18	0.29
Sphaeralcea coccinea	0.04	0.08	0.09	0.14	0.21
Selaginella densa	10.87	23.89	11.08	16.86	40.74
Lichen spp.	5.14	15.08	8.00	13.02	28.10
Litter	55.34		26.97		
Soil	4.90		9.35		
Rock	0.00		0.00		

Table 16. Points analysis of the three replications of the ammonium nitrate treatment at the 40 pounds of nitrogen per acre rate applied annually for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover			Relative Cover			Percent Frequency			Relative % Frequency			Importance Value		
	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3
Ag sm	3.80	0.20	5.20	6.51	0.55	11.21	6.78	0.52	7.51	8.79	0.76	10.26	15.30	1.31	21.47
Bo gr	20.60	6.40	16.40	35.27	17.49	35.34	16.95	12.44	16.43	21.98	18.18	22.44	57.25	35.67	57.78
Ca mo			0.80			1.72			1.88			2.56			4.28
Ko py	7.20	5.40	5.40	12.33	14.75	11.64	10.17	10.36	10.33	13.19	15.15	14.10	25.52	29.90	25.74
Mu cu		1.20	0.60		3.28	1.29		2.59	1.41		3.79	1.92		7.07	3.21
St co	4.20	1.40	0.80	7.19	3.83	1.72	7.20	3.63	1.88	9.34	5.30	2.56	16.53	9.13	4.28
St vi	1.40	0.40	3.60	2.40	1.09	7.76	2.21	1.04	6.57	2.75	1.52	8.97	5.15	2.61	16.73
Ca fi	3.00	1.40	1.40	5.14	3.83	3.02	5.93	3.11	2.82	7.69	4.55	3.85	12.83	8.38	6.87
Ca he	1.40	2.20	0.80	2.40	6.01	1.72	2.97	5.18	1.88	3.85	7.58	2.56	6.25	13.59	4.28
Ac mi	0.20		0.60	0.34		1.29	0.42		1.41	0.55		1.92	0.89		3.21
An pa	0.60	1.00		1.02	2.73		0.85	2.59		1.10	3.79		2.12	6.52	
At dr	0.20	0.20		0.34	0.55		0.42	0.52		0.55	0.76		0.89	1.31	
Ar fr	0.80	0.20	1.20	1.37	0.55	2.59	1.27	0.52	2.35	1.65	0.76	3.21	3.02	1.31	5.80
Co li			0.40			0.86			0.94			1.28			2.14
He hi	0.20		0.20	0.34		0.43	0.42		0.47	0.55		0.64	0.89		1.07
Li ri			0.40			0.86			0.94			1.28			2.14
Lo am	0.40	0.20		0.68	0.55		0.85	0.52		1.10	0.76		1.78	1.31	
Or lu		0.40	0.60		1.09	1.29		0.52	1.41		0.76	1.92		1.85	3.21
Ph ho	1.20		0.80	2.05		1.72	2.54		1.88	3.30		2.56	5.35		4.28
Pl pu	0.40		1.00	0.68		2.16	0.85		2.35	1.10		3.21	1.78		5.37
Ra co	0.20		0.20	0.34		0.43	0.42		0.47	0.55		0.64	0.89		1.07
So mi	0.20			0.34			0.42			0.55			0.89		
Se de	5.40	10.40	0.80	9.25	28.42	1.72	6.36	15.03	1.41	8.24	21.97	1.92	17.49	50.39	3.64
Lichen	7.00	5.60	5.20	12.00	15.30	11.21	10.17	9.84	8.92	13.19	14.39	12.18	25.19	29.69	23.39
Litter	40.80	60.00	51.80				21.19	25.91	23.47						
Soil	0.80	3.40	1.80				1.69	5.70	3.29						
Rock	0.00	0.00	0.00				0.00	0.00	0.00						

Table 17. Points analysis of the three replications of the ammonium nitrate treatment at the 40 pounds of nitrogen per acre rate applied biennially for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover			Relative Cover			Percent Frequency			Relative % Frequency			Importance Value		
	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3
Ag sm	1.80		0.40	3.86		0.75	3.54		0.96	5.80		1.33	9.66		2.08
Bo gr	20.60	9.60	9.20	44.21	34.04	17.36	18.58	19.76	14.90	30.43	31.43	20.67	74.64	65.64	38.03
Bu da	0.20			0.43			0.44			0.72			1.15		
Ca mo	0.40			0.86			0.88			1.45			2.31		
Ko py	3.20	1.20	6.80	6.87	4.26	12.83	5.75	2.40	11.54	9.42	3.81	16.00	16.29	8.07	28.83
Mu cu	3.80		2.00	8.15		3.77	3.10		3.37	5.07		4.67	13.22		8.44
St co	4.00	1.80	0.60	8.58	6.38	1.13	8.41	5.39	1.44	13.77	8.57	2.00	22.35	14.95	3.13
St vi	1.40		0.60	3.00		1.13	2.65		0.96	4.35		1.33	7.35		2.46
Ca fi	4.00	2.00	3.20	8.58	7.09	6.04	7.08	5.39	5.77	11.59	8.57	8.00	20.17	15.66	14.04
Ca he	0.60	0.40	0.60	1.29	1.42	1.13	1.33	1.20	1.44	2.17	1.90	2.00	3.46	3.32	3.13
An pa	0.20	0.60		0.43	2.13		0.44	1.80		0.72	2.86		1.15	4.99	
At dr			0.20			0.38			0.48			0.67			1.05
Ec an	0.20			0.43			0.44			0.72			1.15		
He hi			0.20			0.38			0.48			0.67			1.05
Li pu		0.40			1.42			1.20			1.90			3.32	
Lo am		0.40			1.42			1.20			1.90			3.32	
Ox la			0.20			0.38			0.48			0.67			1.05
Ph ho		0.40	0.20		1.42	0.38		1.20	0.48		1.90	0.67		3.32	1.05
Pl pu	0.40			0.86			0.88			1.45			2.31		
Po pe			0.20			0.38			0.48			0.67			1.05
Ra co			0.40			0.75			0.96			1.33			2.08
Sp co		0.40			1.42			1.20			1.90			3.32	
Se de		5.00	21.80		17.73	41.13		9.58	18.27		15.24	25.33		32.97	66.46
Lichen	5.80	6.00	6.40	12.45	21.28	12.08	7.52	12.57	10.10	12.32	20.00	14.00	24.77	41.28	26.08
Litter	37.80	68.80	44.40				21.68	29.94	23.56						
Soil	15.60	3.00	2.60				17.26	7.19	4.33						
Rock	0.00	0.00	0.00				0.00	0.00	0.00						

Table 18. Points analysis of the three replications of the ammonium nitrate treatment at the 60 pounds of nitrogen per acre rate applied annually for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover			Relative Cover			Percent Frequency			Relative % Frequency			Importance Value		
	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3
Ag sm	3.60	1.20	1.60	6.43	3.95	3.59	6.75	3.23	3.92	9.25	5.13	5.74	15.68	9.08	9.33
Bo gr	25.20	8.00	20.60	45.00	26.32	46.19	18.99	14.52	22.35	26.01	23.08	32.79	71.01	49.04	78.98
Ko py	7.20	2.20	3.00	12.86	7.24	6.73	10.55	5.91	7.26	14.45	9.40	10.66	27.31	16.64	17.39
Mu cu	0.40	0.20		0.71	0.66		0.84	0.54		1.16	0.85		1.87	1.51	
St co	4.20	3.20	1.40	7.50	10.53	3.14	7.17	6.99	3.91	9.83	11.11	5.74	17.33	21.64	8.88
St vi	0.40		0.20	0.71		0.45	0.84		0.56	1.16		0.82	1.87		1.27
Ca fi	4.60	2.00	4.00	8.21	6.58	8.97	7.59	4.84	6.70	10.40	7.69	9.84	18.60	14.27	18.84
Ca he	0.80	1.20	2.00	1.43	3.95	4.48	1.69	3.23	4.47	2.31	5.13	6.56	3.74	9.08	11.04
Ac mi	0.20	0.20		0.36	0.66		0.42	0.54		0.58	0.85		0.94	1.51	
An pa	0.40	0.20		0.71	0.66		0.84	0.54		1.16	0.85		1.87	1.51	
At dr			0.20			0.45			0.56			0.82			1.27
Ar fr	1.20	0.60	0.20	2.14	1.97	0.45	2.53	1.08	0.56	3.47	1.71	0.82	5.61	3.68	1.27
As er	0.20			0.36			0.42			0.58			0.94		
Er as	0.60			1.07			1.27			1.73			2.80		
Gu sa	0.20			0.36			0.42			0.58			0.94		
He hi	0.20			0.36			0.42			0.58			0.94		
Li le			0.20			0.45			0.56			0.82			1.27
Lo am	0.40			0.71			0.42			0.58			0.94		
Ox la	0.20			0.36			0.42			0.58			0.94		
Ph ho	1.00	0.40		1.79	1.32		2.11	1.08		2.89	1.71		4.68	3.03	
Pl pu	0.40	0.20	0.20	0.71	0.66	0.45	0.84	0.54	0.56	1.16	0.85	0.82	1.87	1.51	1.27
Po pe	0.40			0.71			0.84			1.16			1.87		
Ra co	0.80		0.20	1.43		0.45	1.69		0.56	2.31		0.82	3.74		1.27
So mi			0.20			0.45			0.56			0.82			1.27
Sp co		0.40	0.40		1.32	0.90		1.08	1.12		1.71	1.64		4.30	2.54
Se de	1.00	3.00	7.60	1.79	9.87	17.04	1.69	4.30	9.50	2.31	6.84	13.93	4.10	16.71	30.97
Lichen	2.40	7.40	2.60	4.29	24.34	5.83	4.22	14.52	5.03	5.78	23.08	7.38	10.07	47.42	13.21
Litter	4.40	62.20	53.20				21.10	26.88	27.93						
Soil	3.60	7.40	2.20				5.91	10.22	3.91						
Rock	0.00	0.00	0.00				0.00	0.00	0.00						

Table 19. Points analysis of the three replications of the ammonium nitrate treatment at the 60 pounds of nitrogen per acre rate applied biennially for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover			Relative Cover			Percent Frequency			Relative % Frequency			Importance Value		
	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3
Ag sm	1.20	0.40	3.40	1.79	0.97	10.56	2.70	1.03	7.65	3.61	1.56	11.82	5.40	2.53	22.38
Bo gr	24.00	13.80	13.20	35.82	33.33	40.99	21.62	18.46	21.76	28.92	28.13	33.64	64.74	61.46	74.63
Ko py	7.20	3.20	1.60	10.75	7.73	4.97	12.16	7.18	4.12	16.27	10.94	6.36	27.02	18.67	11.33
Mu cu			0.20			0.62			0.59			0.91			1.53
St co	4.00	1.20	4.00	5.97	2.90	12.42	8.11	2.56	9.41	10.84	3.91	14.55	16.81	6.81	26.97
St vi		0.40	0.60		0.97	1.86		1.03	1.76		1.56	2.73		2.53	4.59
Ca fi	1.20	1.60	0.20	1.79	3.86	6.21	2.25	4.10	5.29	3.01	6.25	8.18	4.80	10.11	14.39
Ca he	1.00	0.20	1.60	1.49	0.48	4.97	2.25	0.51	4.12	3.01	0.78	6.36	4.50	1.26	11.33
Ac mi	0.20			0.30			0.45			0.60			0.90		
An pa	0.80	0.20		1.19	0.48		0.90	0.51		1.20	0.78		2.39	1.26	
At dr		0.20	0.20		0.48	0.62		0.51	0.59		0.78	0.91		1.26	1.53
Ar fr			0.40			1.24			1.18			1.82			3.06
Ch al			0.20			0.62			0.59			0.91			1.53
Ch le		0.20			0.48			0.51			0.78			1.26	
Ph ho		0.40			0.97			1.03			1.56			2.53	
Pl pu		0.60	0.40		1.45	1.24		1.54	1.18		2.34	1.82		3.79	3.06
Ra co			0.20			0.62			0.59			0.91			1.53
Sp co			0.20			0.62			0.59			0.91			1.53
Se de	21.80	15.40	3.20	32.54	37.20	9.94	16.22	19.49	4.11	21.69	29.69	6.36	54.23	66.89	16.30
Lichen	5.60	3.60	0.80	8.36	8.70	2.48	8.11	7.18	1.18	10.84	10.94	1.82	19.20	19.64	4.30
Litter	31.40	52.40	65.60				22.53	25.13	29.41						
Soil	1.60	6.20	2.20				2.70	9.23	5.88						
Rock	0.00	0.00	0.00				0.00	0.00	0.00						

Table 20. Points analysis of the three replications of the ammonium nitrate treatment at the 100 pounds of nitrogen per acre rate applied biennially for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover			Relative Cover			Percent Frequency			Relative % Frequency			Importance Value		
	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3
Ag sm	0.80		3.20	1.47		7.55	1.73		7.77	2.27		11.94	3.74		19.49
Bo gr	17.80	7.20	16.60	32.60	21.30	39.15	19.48	11.56	19.90	25.57	18.18	30.60	58.17	39.48	69.75
Ko py	9.40	4.60	5.20	17.22	13.61	12.26	14.29	10.40	9.22	18.75	16.36	14.18	35.97	29.97	26.44
Mu cu	0.20	0.80	1.00	0.37	2.37	2.36	0.43	2.31	2.43	0.57	3.64	3.73	0.94	6.01	6.09
Pa ol		0.60			1.78			1.16			1.82			3.60	
St co	2.40	2.60	1.20	4.40	7.69	2.83	4.33	5.78	2.43	5.68	9.09	3.73	10.08	16.78	6.56
St vi			2.00			4.72			4.85			7.46			12.18
Ca fi	6.80	4.40	0.60	12.45	13.02	1.42	11.26	7.51	0.97	14.77	11.82	1.49	27.22	24.84	2.91
Ca he	3.40	1.40	1.60	6.23	4.14	3.77	6.49	2.89	2.91	8.52	4.55	4.48	14.75	8.69	8.25
An pa	0.60	0.80	0.20	1.10	2.37	0.47	1.30	1.73	0.49	1.70	2.73	0.75	2.80	5.10	1.22
Ar fr	0.40	0.20	0.20	0.73	0.59	0.47	0.87	0.58	0.49	1.14	0.91	0.75	1.87	1.50	1.22
Ch al	0.20			0.37			0.43			0.57			0.94		
Ph ho	0.40	0.20	0.20	0.73	0.59	0.47	0.43	0.58	0.49	0.57	0.91	0.75	1.30	1.50	1.22
Pl pu		0.20	0.20		0.59	0.47		0.58	0.49		0.91	0.75		1.50	1.22
Po pe		0.20			0.59			0.58			0.91			1.50	
So mi		0.20			0.59			0.58			0.91			1.50	
Se de	1.00	3.40	0.60	1.83	10.06	1.42	0.87	5.20	0.97	1.14	8.18	1.49	2.97	18.24	2.91
Lichen	11.20	7.00	9.60	20.51	20.71	22.64	14.29	12.14	11.65	18.75	19.09	17.91	39.26	39.80	40.55
Litter	44.20	62.60	49.00				21.65	28.90	24.27						
Soil	1.20	3.60	8.60				2.16	7.51	10.68						
Rock	0.00	0.00	0.00				0.00	0.00	0.00						

Table 21. Points analysis of the three replications of the urea treatment at the 40 pounds of nitrogen per acre rate applied annually for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover			Relative Cover			Percent Frequency			Relative % Frequency			Importance Value		
	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3
Ag sm	3.40	0.40	6.40	5.78	1.00	11.90	6.52	1.09	10.81	8.62	1.72	15.19	14.40	2.72	27.09
Bo gr	19.60	5.20	22.60	33.33	13.00	42.01	18.26	10.87	19.37	24.14	17.24	27.22	57.47	30.24	69.23
Ko py	5.20	2.60	9.60	8.80	6.50	17.84	9.57	6.52	15.77	12.64	10.34	22.15	21.44	16.84	39.99
Pa ol	0.20			0.34			0.43			0.57			0.91		
St co	3.40		0.60	5.78		1.12	6.09		1.35	8.05		1.90	13.83		3.02
St vi		0.60	4.80		1.50	8.92		1.63	7.21		2.59	10.13		4.09	19.05
Ca fi	0.60	0.40		1.02	1.00		1.30	1.09		1.72	1.72		2.74	2.72	
Ca he	1.20	0.20	0.20	2.04	0.50	0.37	1.74	0.54	0.45	2.30	0.86	0.63	4.34	1.36	1.00
Ac mi	0.20	0.20		0.34	0.50		0.43	0.54		0.57	0.86		0.91	1.36	
An pa	3.40	2.20	1.40	5.78	5.50	2.60	3.91	4.89	2.25	5.17	7.76	3.16	10.95	13.26	5.76
Ar fr	0.20		1.00	0.34		1.86	0.43		2.25	0.57		3.16	0.91		5.02
Lo am	0.20	0.20		0.34	0.50		0.43	0.54		0.57	0.86		0.91	1.36	
Or lu		0.20			0.50			0.54			0.86			1.36	
Ph ho	1.40	0.20		2.38	0.50		1.30	0.54		1.72	0.86		4.10	1.36	
Pl pu			0.20			0.37			0.45			0.63			1.00
Po pe	0.20			0.34			0.40			0.57			0.91		
Ra co	0.80		0.60	1.36		1.12	1.74		1.35	2.30		1.90	3.66		3.02
So mi	0.60			1.02			1.30			1.72			2.74		
Sp co		0.20			0.50			0.54			0.86			1.36	
Sy oc		0.40			1.00			1.09			1.72			2.72	
Se de	15.20	21.40	0.80	25.85	53.50	1.47	11.74	22.28	1.80	15.52	35.34	2.53	41.37	88.84	4.02
Lichen	3.00	5.60	5.60	5.10	14.00	10.41	10.00	10.33	8.11	13.22	16.38	11.39	18.32	30.38	21.80
Litter	39.60	54.40	42.60				21.74	27.17	22.52						
Soil	1.60	5.60	3.60				2.61	9.78	6.31						
Rock	0.00	0.00	0.00				0.00	0.00	0.00						

Table 22 . Points analysis of the three replications of the urea treatment at the 40 pounds of nitrogen per acre rate applied biennially for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover			Relative Cover			Percent Frequency			Relative % Frequency			Importance Value		
	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3
Ag sm	2.40	1.20	1.40	4.86	3.09	3.06	4.50	3.09	3.18	6.99	4.80	4.49	11.85	7.89	7.55
Bo gr	24.60	12.80	15.00	49.80	32.99	32.75	21.17	18.04	17.73	32.87	28.00	25.00	82.67	60.99	57.75
Ko py	3.40	4.40	4.80	6.88	11.34	10.48	5.41	9.80	8.18	8.39	15.20	11.54	15.27	26.54	22.02
Mu cu	0.60	0.60	0.40	1.21	1.55	0.87	0.45	1.55	0.91	0.70	2.44	1.28	1.91	3.99	2.15
St co	3.00	1.40	1.20	6.07	3.61	2.62	5.86	3.61	2.73	9.09	5.60	3.85	15.16	9.21	6.47
St vi	0.60	0.20	2.00	1.21	0.52	4.37	1.35	0.52	4.09	2.10	0.80	5.77	3.31	1.32	10.14
Ca fi	4.00	0.60	1.60	8.10	1.55	3.49	6.76	1.03	2.73	10.49	1.60	3.85	18.59	3.15	7.34
Ca he	1.80	1.20	1.40	3.64	3.09	3.06	4.05	3.09	3.18	6.29	4.80	4.49	9.53	7.89	7.55
Ac mi			0.20			0.44			0.45			0.64			1.08
An pa	1.00	0.40	0.80	2.02	1.03	1.75	1.35	1.03	0.45	2.10	1.60	0.64	4.12	2.63	2.39
At dr	0.20			0.40			0.45			0.70			1.10		
Ar fr	0.40		0.60	0.81		1.31	0.90		0.91	1.40		1.28	2.21		2.59
Ce ar	0.20			0.40			0.45			0.70			1.10		
Lo am			0.20			0.44			0.45			0.64			1.08
Or lu			0.80			1.75			1.82			2.56			4.31
Ph ho	0.60		0.20	1.21		0.44	1.35		0.45	2.10		0.64	3.31		1.08
Pl pu	0.40		0.40	0.81		0.87	0.90		0.91	1.40		1.28	2.21		2.15
Po pe		0.20	0.20		0.52	0.44		0.52	0.45		0.80	0.64		1.32	1.08
Ra co			0.20			0.44			0.45			0.64			1.08
Se de	2.60	3.20	3.00	5.26	8.25	6.55	3.15	5.15	6.36	4.90	8.00	8.97	10.16	16.25	15.52
Lichen	3.60	12.60	11.20	7.29	32.47	24.45	6.31	17.01	15.00	9.79	26.40	21.15	17.08	58.87	45.60
Litter	41.00	55.00	50.60				22.52	25.77	22.73						
Soil	9.60	6.20	3.60				13.06	9.79	6.36						
Rock	0.00	0.00	0.00				0.00	0.00	0.00						

Table 23. Points analysis of the three replications of the urea treatment at the 60 pounds of nitrogen per acre rate applied annually for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover			Relative Cover			Percent Frequency			Relative % Frequency			Importance Value		
	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3
Ag sm	3.60	0.20	3.20	7.09	0.55	6.67	7.11	0.56	5.38	10.06	0.88	7.14	17.15	1.43	13.81
Bo gr	21.60	9.00	11.00	42.52	24.86	22.92	17.78	15.56	15.25	25.16	24.78	20.24	67.68	49.64	43.16
Ca mo	1.00		0.40	1.97		0.83	1.78		0.90	2.52		1.19	4.49		2.02
Ko py	7.20	3.40	7.60	14.17	9.39	15.83	11.56	7.78	13.00	16.35	12.39	17.26	30.52	21.78	33.09
Mu cu	3.00	0.20	1.20	5.91	0.55	2.50	3.56	0.56	1.79	5.03	0.88	2.38	10.94	1.43	4.88
St co	3.40	0.80	3.20	6.69	2.21	6.67	6.67	2.22	5.83	9.43	3.54	7.74	16.12	5.75	14.41
St vi	2.00	0.20	1.20	3.94	0.55	2.50	4.00	0.56	2.69	5.66	0.88	3.57	9.66	1.43	6.07
Ca fi	3.00	1.00	2.40	5.91	2.76	5.00	5.33	2.78	4.48	7.55	4.42	5.95	13.46	7.18	10.95
Ca he	0.20	0.60	0.60	0.39	1.66	1.25	0.44	1.67	1.35	0.63	2.65	1.79	1.02	4.31	3.04
Ac mi		0.20	0.20		0.55	0.42		0.56	0.45		0.88	0.60		1.43	1.02
An pa	0.40	0.80	0.40	0.79	2.21	0.83	0.89	1.67	0.90	1.26	2.65	1.19	2.05	4.86	2.02
At dr			0.20			0.42			0.45			0.60			1.02
Ar fr	0.60		0.20	1.18		0.42	0.89		0.45	1.26		0.60	2.44		1.02
Ce ar			0.40			0.83			0.45			0.60			1.43
Er as	0.20			0.39			0.44			0.63			1.02		
Lo am	0.20			0.39			0.44			0.63			1.02		
Or lu			0.20			0.42			0.45			0.60			1.02
Pe pu		0.20			0.55			0.56			0.88			1.43	
Ph ho		0.40	0.20		1.10	0.42		0.56	0.45		0.88	0.60		1.98	1.02
Pl pu		0.20	1.00		0.55	2.08		0.56	1.79		0.88	2.38		1.43	4.46
Po pe			0.20			0.42			0.45			0.60			1.02
Ra co	0.20		0.60	0.39		1.25	0.44		1.79	0.63		2.38	1.02		3.63
So mi			0.20			0.42			0.45			0.60			1.02
So mo			0.20			0.42			0.45			0.60			1.02
Se de	2.00	8.00	10.80	3.94	22.10	22.50	4.44	11.11	12.56	6.29	17.70	16.67	10.23	39.80	39.17
Lichen	2.20	11.00	2.40	4.33	30.39	5.00	4.89	16.11	3.59	6.92	25.66	4.76	11.25	56.05	9.76
Litter	41.40	59.20	51.00				21.78	27.78	22.42						
Soil	7.80	4.60	1.00				7.56	9.44	2.24						
Rock	0.00	0.00	0.00				0.00	0.00	0.00						

Table 24. Points analysis of the three replications of the urea treatment at the 60 pounds of nitrogen per acre rate applied biennially for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover			Relative Cover			Percent Frequency			Relative % Frequency			Importance Value		
	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3
Ag sm	5.40	2.60	1.00	10.07	5.42	2.06	7.73	6.13	2.18	10.47	8.90	2.87	20.54	14.32	4.93
Bo gr	20.40	10.20	11.80	38.06	21.25	24.28	19.31	14.15	15.72	26.16	20.55	20.69	64.22	41.80	44.97
Bu da	0.40		0.60	0.75		1.23	0.86		1.31	1.16		1.72	1.91		2.95
Ca mo	0.80		0.60	1.49		1.23	1.72		0.87	2.33		1.15	3.82		2.38
Ko py	2.00	1.60	7.40	3.73	3.33	15.23	4.29	3.77	11.79	5.81	5.48	15.52	9.54	8.81	30.75
Mu cu	2.80	0.40	1.60	5.22	0.83	3.29	3.43	0.94	2.62	4.65	1.37	3.45	9.87	2.20	6.74
St co	6.80	3.00	5.00	12.69	6.25	10.29	10.73	5.66	9.61	14.53	8.22	12.64	27.22	14.47	22.93
St vi	0.20	0.80	0.40	0.37	1.67	0.82	0.43	1.89	0.87	0.58	2.74	1.15	0.95	4.41	1.97
Ca fi	6.80	0.40	5.60	12.69	0.83	11.52	10.73	0.94	7.86	14.53	1.37	10.34	27.22	2.20	21.86
Ca he	0.80	1.00	1.60	1.49	2.08	3.29	1.72	2.36	3.06	2.33	3.42	4.02	3.82	5.50	7.31
Ac mi		0.20	0.20		0.42	0.41		0.47	0.44		0.68	0.57		1.10	0.98
An pa		1.40			2.92			2.83			4.11			7.03	
At dr	0.20		0.60	0.37		1.23	0.73		1.31	0.58		1.72	0.95		2.95
Ar fr	0.40	0.40	0.40	0.75	0.83	0.82	0.86	0.94	0.87	1.16	1.37	1.15	1.91	2.20	1.97
As er			0.40			0.82			0.87			1.15			1.97
Ec an			0.20			0.41			0.44			0.57			0.98
Er as			0.20			0.41			0.44			0.57			0.98
Ha sp	0.60			1.12			1.29			1.74					
Li pu	0.20		0.40	0.37		0.82	0.43		0.87	0.58		1.15			1.97
Li ri			0.20			0.41			0.44			0.57			0.98
Lo am			0.20			0.41			0.44			0.57			0.98
Ox la	0.20			0.37			0.43			0.58			2.86		
Pe pu	0.20			0.37			0.43			0.58			0.95		
Ph ho			0.20			0.41			0.44			0.57			0.98
Pl pu	0.20		0.40	0.37		0.82	0.43		0.87	0.58		1.15	0.95		1.97
Po pe			0.20			0.41			0.44			0.57			0.98
So mi			0.40			0.82			0.87			1.15			1.97
Se de	1.60	11.40	7.60	2.99	23.75	15.64	3.00	13.21	8.30	4.07	19.18	10.92	7.06	42.93	26.56
Lichen	3.60	14.60	1.40	6.72	30.42	2.88	5.58	15.57	3.06	7.56	22.60	4.02	14.28	53.02	6.90
Litter	42.60	44.80	50.20				21.46	22.64	21.83						
Soil	3.80	7.20	1.20				4.72	8.49	2.18						
Rock	0.00	0.00	0.00				0.00	0.00	0.00						

Table 25 . Points analysis of the three replications of the urea treatment at the 100 pounds of nitrogen per acre rate applied biennially for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover			Relative Cover			Percent Frequency			Relative % Frequency			Importance Value		
	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3
Ag sm	2.20	0.80	4.60	4.89	2.14	8.75	3.98	2.00	8.68	6.77	3.39	11.38	11.66	5.53	20.13
Bo gr	22.40	17.40	14.60	49.78	46.52	27.76	19.47	20.00	18.26	33.08	33.90	23.95	82.86	80.42	51.71
Bu da	0.40			0.89			0.88			1.50			2.39		
Ca mo	0.80		0.40	1.78		0.76	1.77		0.91	3.01		1.20	4.79		1.96
Ko py	2.00	3.20	4.40	4.44	8.56	8.37	4.42	6.00	6.39	7.52	10.17	8.38	11.96	18.73	16.75
Mu cu	1.00		1.20	2.22		2.28	0.88		2.28	1.50		2.99	3.72		5.27
Po co			0.20			0.38			0.46	12.03	7.63	0.60			0.98
St co	4.00	1.80	3.60	8.89	4.81	6.34	7.08	4.50	5.94	3.01	1.69	7.78	20.92	12.44	14.62
St vi	0.80	0.40	0.40	1.78	1.07	0.76	1.77	1.00	1.83	18.80	9.32	2.40	4.79	2.76	3.16
Ca fi	7.60	2.80	4.40	16.89	7.49	8.37	11.06	5.50	6.85	4.51	9.32	8.98	35.69	16.81	17.35
Ca he	1.20	2.60	0.80	2.67	6.95	1.52	2.65	5.50	1.83			2.40	7.18	16.27	3.92
An pa			1.40			2.63			0.91			1.20			3.83
At dr			0.40			0.76			0.91			1.20			1.96
Ar fr		0.20	0.40		0.53	0.76		0.50	0.91		0.85	1.20		1.38	1.96
As er			0.40			0.76			0.91			1.20			1.96
Li ri		0.20			0.53			0.50			0.85			1.38	
Lo am		0.20			0.53			0.50			0.85			1.38	
Pe pu			0.20			0.38			0.46			0.60			0.98
Pl pu	0.40			0.89			0.88			1.50			2.39		
Se de		5.20	14.00		13.90	26.62		6.50	15.98		11.02	20.96		24.92	47.58
Lichen	2.20	2.60	1.20	4.89	6.95	2.28	3.98	6.50	2.74	6.77	11.02	3.59	11.66	17.97	5.87
Litter	37.50	47.00	47.00				22.12	25.00	22.83						
Soil	17.60	15.60	0.40				19.03	16.00	0.91						
Rock	0.00	0.00	0.00				0.00	0.00	0.00						

Table 26 . Points analysis of the three replications of the control treatment (N) for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover			Relative Cover			Percent Frequency			Relative % Frequency			Importance Value		
	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3
Ag sm	1.00	0.60	0.60	2.25	1.85	1.08	2.59	1.69	1.08	4.07	2.78	1.49	6.32	4.63	2.57
Bo gr	9.40	7.40	11.00	21.17	22.84	19.86	16.06	15.82	18.38	25.20	25.93	25.37	46.37	48.77	45.23
Ko py	1.60	2.80	1.80	3.60	8.64	3.25	3.63	6.21	3.24	5.69	10.19	4.48	9.29	18.83	7.73
Mu cu	0.20		0.20	0.45		0.36	0.52		0.54	0.81		0.75	1.26		1.11
St co	1.00	0.80	1.60	2.25	2.47	2.89	2.59	2.26	3.24	4.07	3.70	4.48	6.32	6.17	7.37
St vi	0.20			0.45			0.52			0.81			1.26		
Ca fi	0.20	1.00	3.60	0.45	3.09	6.50	0.52	2.82	8.11	0.81	4.63	11.19	1.26	7.72	17.69
Ca he	0.20	0.60	1.80	0.45	1.85	3.25	0.52	1.69	4.86	0.81	2.78	6.72	1.26	4.63	9.97
An pa	0.40	0.40	0.20	0.90	1.23	0.36	1.04	1.13	0.54	1.63	1.85	0.75	2.53	3.08	1.11
At dr			0.20			0.36			0.54			0.75			1.11
Ar fr		0.40	0.20		1.23	0.36		1.13	0.54		1.85	0.75		3.08	1.11
Lo am			0.80			1.44			1.62			2.24			3.68
Ph ho			0.60			1.08			1.62			2.24			3.32
Pl pu	0.40		0.20	0.90		0.36	1.04		0.54	1.63		0.75	2.53		1.11
Ps ar		0.20			0.62			0.56			0.93			1.55	
Ra co			0.20			0.36			0.54			0.75			1.11
So mi			0.20			0.36			0.54			0.75			1.11
Sp co	0.20			0.45			0.51			0.81			1.26		
Se de	21.40	7.80	31.60	48.20	24.07	57.04	21.76	11.86	24.86	34.15	19.44	34.33	82.35	43.51	91.37
Lichen	8.20	10.40	0.60	18.47	32.10	1.08	12.44	15.82	1.62	19.51	25.93	2.24	37.98	58.03	3.34
Litter	48.60	62.80	44.00				25.91	28.25	25.95						
Soil	7.00	4.80	0.60				10.36	10.73	1.62						
Rock	0.00	0.00	0.00				0.00	0.00	0.00						

Table 27 . Points analysis of the three replications of the control treatment (S) for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover			Relative Cover			Percent Frequency			Relative % Frequency			Importance Value		
	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3	R-1	R2	R3
Ag sm	3.40	0.20	2.40	8.67	0.69	6.25	7.04	0.61	5.70	11.29	1.04	8.94	19.96	1.73	15.19
Bo cu			1.00			2.60			2.07			3.25			5.85
Bo gr	20.20	7.60	20.20	51.53	26.39	52.60	23.62	17.79	22.80	37.90	30.21	35.77	89.43	56.60	88.37
Bu da	0.20		1.00	0.51		2.60	0.50		1.04	0.81		1.63	1.32		4.23
Ko py	1.40	3.00	4.60	3.57	10.42	11.98	3.52	7.36	9.33	5.65	12.50	14.63	9.22	22.92	26.61
Mu cu	3.60		0.60	9.18		1.56	4.02		1.04	6.45		1.62	15.63		3.18
St co	1.60	2.20	2.40	4.08	7.64	6.25	3.52	6.75	5.70	5.65	11.46	8.94	9.73	19.10	15.19
St vi	1.20		0.80	3.06		2.08	3.02		2.07	4.84		3.25	7.90		5.33
Ca fi	3.00	0.80	1.80	7.65	2.78	4.69	6.53	1.84	4.66	10.48	3.13	7.32	18.13	5.91	12.01
Ca he		1.20	1.00		4.17	2.60		3.68	2.59		6.25	4.07		10.42	6.67
An pa	0.60	0.40		1.53	1.39		1.01	0.61		1.61	1.04		3.14	2.43	
At dr			0.60			1.56			1.55			2.44			4.00
Ar fr	0.40		0.80	1.02		2.08	1.01		2.07	1.61		3.25	2.63		5.33
Er in	0.20			0.51			0.50			0.81			1.32		
He hi	0.40			1.02			1.01			1.61			2.63		
Li ri			0.20			0.52			0.52			0.81			1.33
Lo am	0.20			0.51			0.50			0.81			1.32		
Or lu	0.20			0.51			0.50			0.81			1.32		
Pe pu	0.40			1.02			1.01			1.61			2.63		
Ph ho		0.20			0.69			0.61			1.04			1.73	
Pl pu			0.20			0.52			0.52			0.81			1.33
So mo		0.20			0.69			0.61			1.04			1.73	
Se de	0.60	3.00	0.80	1.53	10.42	2.08	1.01	4.91	2.07	1.61	8.33	3.25	3.14	18.75	5.33
Lichen	1.60	10.00		4.08	34.72		4.02	14.11		6.45	23.96		10.53	58.68	
Litter	53.40	66.40	56.80				25.13	30.67	25.91						
Soil	7.60	4.80	4.80				12.56	10.43	10.36						
Rock	0.00	0.00	0.00				0.00	0.00	0.00						

Table 28. Points analysis of the control treatment (N) for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover	Relative Cover	% Frequency	Relative % Frequency	Importance Value
Agropyron smithii	0.73	1.73	1.79	2.78	4.51
Bouteloua gracilis	9.27	21.29	16.75	25.50	46.79
Koeleria pyramidata	2.07	5.16	4.36	6.79	11.95
Muhlenbergia cuspidata	0.13	0.27	0.35	0.52	0.79
Stipa comata	1.13	2.62	2.70	4.08	6.62
Stipa viridula	0.07	0.15	0.17	0.27	0.42
Carex filifolia	1.60	3.34	3.82	5.54	8.89
Carex heliophila	0.87	1.85	2.36	3.44	5.29
Antennaria parvifolia	0.33	0.83	0.90	1.41	2.24
Artemisia dracunculus	0.07	0.12	0.18	0.25	0.37
Artemisia frigida	0.20	0.53	0.56	0.87	1.40
Lotus americanus	0.27	0.48	0.54	0.75	1.23
Phlox hoodii	0.20	0.36	0.54	0.75	1.11
Plantago purshii	0.20	0.42	0.53	0.79	1.21
Psoralea argophylla	0.07	0.21	0.19	0.31	0.52
Ratibida columnifera	0.07	0.12	0.18	0.25	0.37
Solidago missouriensis	0.07	0.12	0.18	0.25	0.37
Sphaeralcea coccinea	0.07	0.15	0.17	0.27	0.42
Selaginella densa	20.27	43.10	19.49	29.31	72.41
Lichen spp.	6.40	17.22	9.96	15.89	33.12
Litter	51.80		26.70		
Soil	4.13		7.57		
Rock	0.00		0.00		

Table 29. Points analysis of the control treatment (S) for the Native Range Fertilization Trial at Dickinson Experiment Station, 1982.

Species	Basal Cover	Relative Cover	% Frequency	Relative % Frequency	Importance Value
Agropyron smithii	2.00	5.00	4.45	7.09	12.29
Bouteloua curtipendula	0.33	0.87	0.69	1.08	1.95
Bouteloua gracilis	16.00	43.51	21.40	34.63	78.13
Buchloe dactyloides	0.40	1.04	0.51	0.81	1.85
Koeleria pyramidata	0.30	8.66	6.74	10.93	19.58
Muhlenbergia cuspidata	1.40	3.58	1.69	2.69	6.27
Stipa comata	2.07	5.99	5.32	8.68	14.67
Stipa viridula	0.67	1.70	1.70	2.70	4.41
Carex filifolia	1.87	5.04	4.34	6.98	12.02
Carex heliophila	0.73	2.26	2.09	3.44	5.70
Antennaria parvifolia	0.33	0.97	0.54	0.88	1.86
Artemisia dracunculus	0.20	0.52	0.52	0.81	1.33
Artemisia frigida	0.40	1.03	1.03	1.62	2.65
Erysimum inconspicum	0.07	0.17	0.17	0.27	0.44
Hedeoma hispidum	0.13	0.34	0.34	0.54	0.88
Linum lewisii	0.07	0.17	0.17	0.27	0.44
Lotus americanus	0.07	0.17	0.17	0.27	0.44
Orthocarpus luteus	0.07	0.17	0.17	0.27	0.44
Petalostemon purpureum	0.13	0.34	0.34	0.54	0.88
Phlox hoodii	0.07	0.23	0.20	0.35	0.58
Plantago purshii	0.07	0.17	0.17	0.27	0.44
Solidago missouriensis	0.07	0.23	0.20	0.35	0.58
Selaginella densa	1.47	4.68	2.66	4.40	9.07
Lichen spp.	3.87	12.93	6.04	10.14	23.07
Litter	58.87		27.24		
Soil	5.67		11.12		
Rock	0.00		0.00		

Table 30. Percent soil moisture for Native Range Fertilization Trial, Dickinson Experiment Station, 1982.

	6 Jun			6 Jul			20 Jul			11 Aug		
Sample Location Depth (in)	East Rep	West Rep	Mean	East Rep	West Rep	Mean	East Rep	West Rep	Mean	East Rep	West Rep	Mean
South												
0-6	28.99	29.57	29.28	17.07	17.70	17.39	17.31	19.10	18.21	16.45	11.71	14.08
6-12	23.08	26.50	24.79	15.76	16.44	16.10	16.40	15.60	16.00	15.48	13.27	14.38
12-24	22.95	21.44	22.20	19.83	16.20	18.02	16.49	13.17	14.83	14.85	13.06	13.96
24-36	12.07	15.71	13.89	11.48	12.16	11.82	11.87	12.18	12.03	14.66	11.37	13.02
36-48	14.68	13.67	14.18	15.63	17.37	16.50	14.95	16.37	15.66	12.06	12.28	12.17
Central												
0-6	25.27	31.05	28.16	17.78	20.51	19.15	19.57	21.07	20.32	14.20	11.66	12.93
6-12	25.17	23.71	24.44	18.54	16.18	17.36	16.84	17.62	17.23	14.48	10.33	12.41
12-24	2308.00	20.13	21.61	18.42	19.26	18.84	17.46	16.71	17.09	15.15	10.15	12.65
24-36	17.62	11.14	14.38	18.75	9.64	14.20	18.16	9.26	13.71	15.59	11.21	13.40
36-48	13.49	11.60	12.55	13.17	7.86	10.52	12.67	6.99	9.83	9.27	14.23	11.75
North												
0-6	28.70	31.86	30.28	19.79	17.90	18.85	23.85	21.97	22.91	11.83	11.75	11.79
6-12	26.50	25.70	26.10	18.64	18.64	18.64	20.80	19.28	20.16	10.81	12.80	11.81
12-24	21.68	22.31	22.00	17.79	17.46	17.63	18.16	19.52	18.84	12.82	12.12	12.47
24-36	18.96	11.08	15.02	20.86	20.77	20.82	15.75	17.58	16.67	12.64	11.90	12.27
36-48	14.52	12.82	13.67	13.01	12.57	12.79	13.01	6.39	9.70	15.16	13.76	14.46

Table 31. Mean percent soil moisture for Native Range Fertilization Trial, Dickinson Experiment Station, 1982.

Depth in inches	16 Jun	6 Jul	20 Jul	11 Aug
0-6	29.24	18.46	20.48	12.93
6-12	25.11	17.37	17.80	12.87
12-24	21.94	18.16	16.92	13.03
24-36	14.43	15.61	14.14	12.90
36-48	13.47	13.27	11.73	12.79

Plants present on Native Range Fertilization Study Dickinson Experiment Station-Ranch Headquarters

Graminoids		
AG SM	Agropyron smithii	Western wheatgrass
BO CU	Bouteloua curtipendula	Side-oats grama
BO GR	Bouteloua gracilis	Blue grama
BU DA	Buchloe dactyloides	Buffalo grass
CA MO	Calamagrostis montanensis	Plains reedgrass
KO PY	Koeleria pyramidata	Prairie Junegrass
MU CU	Muhlenbergia cuspidata	Plains muhly
PA OL	Panicum oligosanthes	Scribner panic grass
PO CO	Poa compressa	Canada bluegrass
SC PA	Schedonnardus paniculatus	Tumblegrass
SC SC	Schizachyrium scoparium	Little bluestem
ST VI	Stipa viridula	Green needlegrass
CA FI	Carex filifolia	Threadleaf sedge
CA HE	Carex heliophila	Sun sedge or Yellow sedge
Forbs		
AC MI	Achillea millefolium	Western yarrow
AL TE	Allium textile	White wild onion
AM PS	Ambrosia psilostachya	Pusseytoes
AN OC	Androsace occidentalis	Fairy candelabra or W. rock jasmine
AN PA	Antennaria parvifolia	Pussytoes
AR DR	Artemisia dracunculus	Green sage
AR FR	Artemisia frigida	Fringed sage
AR LU	Artemisia ludoviciana	White sage
AS ER	Aster ericoides	White prairie aster
AS OB	Aster oblongifolius	Aromatic aster
4AS CA	Astragalus canadensis	Canada milkvetch or Little rattlepod
AS CR	Astragalus crassicarpus	Ground plum
CE AR	Cerastium arvense	Prairie chickweed
CH AL	Chenopodium album	Lamb's quarters
CH LE	Chenopodium leptophyllum	Narrow-leaved goosefoot

CH VI	Chrysopsis villosa	Goldenaster
CI UN	Cirsium undulatum	Wavyleaf thistle
CO LI	Collomia linearis	Collomia
CO AR	Convolvulus arvensis	Field bindweed
CO CA	Conyza canadensis	Horseweed
EC AN	Echinacea angustifolia	Purple coneflower
ER SPP	Erigeron spp.	Daisy Fleabane
ER AS	Erysimum asperum	Western wallflower
ER IN	Erysimum inconspicum	Small erysimum
GA BO	Galium boreale	Northern bedstraw
GA CO	Gaura coccinea	Scarlet gaura
GE TR	Geum triflorum	Prairie smoke
GR SQ	Grindelia squarrosa	Curlycup gumweed
GU SA	Gutierrezia sarothrae	Broom snakeweed
HA SP	Haplopappus spinulosus	Spiny ironweed
HE HI	Hedeoma hispidum	Rough pennyroyal
HE AN	Helianthus annuus	Common sunflower
HE RI	Helianthus rigidus	Stiff sunflower
LA OB	Lactuca oblongifolia	Blue wild lettuce
LA SE	Lactuca serriola	Prickly lettuce
LE DE	Lepidium densiflorum	Peppergrass
LI PU	Liatris punctata	Narrowleaved blazing star
LI LE	*Linum lewisii	Wild blue flax
LI RI	Linum rigidum	Stiffstem flax or Yellow flax
LI IN	Lithospermum incisum	Narrowleaved puccoon
LO AM	Lotus americanus	Deer vetch or Prairie trefoil
MA VI	Mamillaria vivipara	Ball cactus
ME SPP.	Melilotus spp.	Sweet clover
ME LA	Mertensia lanceolata	Blue lungwort
OP FR	Opuntia fragilis	Brittle prickly pear
OR LU	Orthocarpus luteus	Owl clover

OX LA	Oxytropis lambertii	Purple locoweed
PE AL	Penstemon albidus	White beardtongue
PE PU	Petalostemon purpureum	Purple prairie clover
PH HO	Phlox hoodii	Hood's phlox
PL PU	Plantago purshii	Wooly plantain
PO PE	Potentilla pensylvanica	Prairie cinquefoil
PS AR	Psoralea argophylla	Silverleaf scurfpea
PS ES	Psoralea esculenta	Indian breadroot
RA CO	Ratibida columnifera	Long-headed coneflower
SA KA	Salsola kali	Russian thistle
SO MI	Solidago missouriensis	Early goldenrod
SO MO	Solidago mollis	Soft goldenrod
SO RI	Solidago rigida	Stiff goldenrod
SP CO	Sphaeralcea coccinea	Scarlet globemallow
TA OF	Taraxacum officinale	Dandelion
TR DU	Tragopogon dubius	Goat's beard
VI AM	Vicia americana	American wildvetch
VI NU	Viola nuttallii	Nutall's violet
<u>Shrubs</u>		
RO AR	Rosa arkansana	Prairie wild rose
SY OC	Symphoricarpos occidentalis	Buckbrush, Western snowberry,
<u>Lycopods</u>		
SE DE	Selaginella densa	Club moss
<u>Eumycota</u>		
LI SPP.	Lichen species	Lichen

ALFALFA INTERSEEDED PASTURE GRAZING TRIAL-1982

L. Manske

The pasture interseeded pasture grazing trials was seeded in may of 1977. A pasture type alfalfa (Travois) was interseeded into 10 acres of mixed grass prairie using a mechanical sod control method. The seeding rate was 4 pounds per acre. Data was collected from two other similar native range pastures for comparative purposes. One of these pastures, 12 acres in size, was annually treated with 50 pounds of nitrogen per acre and the other pasture, 18 acres in size, has had no treatments was used as the control. The three pastures were annually grazed with 7 to 10 cow/calf pairs primarily during the month of July. Animal performance and herbage were collected and were used for a comparison between the treatments.

The alfalfa interseeded pasture was not grazed in 1982 so that the alfalfa plants could recover from drought conditions of the previous years. No animal data was collected in 1982. The alfalfa plant density counts, herbage production and quantitative species composition data was collected.

The year of establishment (1977) was favorable for good alfalfa seed germination but because of problems with the seeding mechanism the distribution of the seed was uneven. In 1978, the mean number of alfalfa plants per meter was 10.95. The mean number of plants per meter row was 1.34 in 1982. Much of this apparent decrease of alfalfa plant density can be attributed to the drought conditions of 1980.

The aboveground herbage production (Table 1) was greatest in the fertilized pasture with 4546 pounds per acre. The alfalfa interseeded pasture produced 3068 pounds per acre with the alfalfa comprising nearly 30%. The control pasture had 2301 pounds of herbage per acre. The addition of 50 pounds of nitrogen per acre nearly doubled the herbage production over the control. The alfalfa interseeded pasture had 33% increase in herbage production over the control.

The percent basal over for the three pastures is shown in table 2. The alfalfa interseeded pasture had the greatest percent basal cover of living plant material with 44.8%. The control and fertilized pasture had 29.5% and 17.7% respectively.

The alfalfa interseeded pasture had the lowest amount of litter cover and the greatest amount of bare soil (Table 2). The fertilized pasture had the greatest amount of litter cover and the lowest amount of bare soil (Table 2). The fertilized pasture had the lowest basal cover (Tbale 2) but had the greatest herbage production (Table 1).

Table 1. Aboveground herbage production, given in lbs/acre, on the three pasture treatments on the native range interseeding study, Dickinson Experiment Station, 29 July 1982.

	Alfalfa Interseeded	Fertilized	Control
Grass and Forbs	2160	4546	2301
Alfalfa	908	0	0
Total	3068	4546	2301

Table 2. Percentage basal cover on the three pasture treatments on the native range interseeding study, Dickinson Experiment Station, 1982.

	Alfalfa Interseeded	Fertilized	Control
Litter	47.2	78.1	63.7
Soil	8.2	4.1	6.8
Grass	32.9	17.1	21.4
Forbs	5.5	0.4	1.4
Alfalfa	1.3	0.0	0.0
Club Moss	5.1	0.2	6.7

ALFALFA VARIETY TRIAL-1982

L. Manske and H. Goetz

An alfalfa variety trial was seeded at the Dickinson Experiment Station in May 1979. A similar trial was seeded at the Hettinger Experiment Station and the Central Grasslands Research Station I May 1981. The trial was designed to evaluate the performance of the varieties on the basis of dry weight herbage production and compared to a standard variety (Vernal). Five pasture and sixteeen dryland hay type alfalfa varieties were included in the Dickinson Station trial. Six pasture and twenty one dryland hay type varieties were seeded in Hettinger Station and the Central Grasslands Research Station.

The dry weight aboveground herbage production and the percentage of production of Vernal at the Dickinson Experiment Station, the Hettinger Experiment Station and the Central Grasslands Research Station are shown in table 1. One cutting was taken at the Dickinson and Hettinger Stations. Two cuttings were taken at the Central Grasslands Research Station.

The five highest producing varieties at the Dickinson Experiment Station were Kane, Spredor II, Noreseman, Trovois, and Rangelander with 6139, 5260, 5210, 5077, and 4981 pounds of herbage production per acre respectively. At the Hettinger Experiment Station, the five highest producing varieties were Prowler, Travois, Spredor II, Nuggett and Iroquois with 5244, 5191, 4986, 4790, and 4782 pounds of herbage production per acre respectively. Rangelander, Drylander, Baker, Nuggett and Polar II were the five highest producing varieties at the Central Grasslands Research Station for the first cutting with 6444, 6277, 5980, 5798, and 5587 pounds of herbage production per acre respectively.

The mean herbage production for the pasture type alfalfa varieties was greater at the Dickinson Experiment Station, the Hettinger Experiment Station and the first cutting and the total of two cuttings at the Central Grasslands Research Station than the mean total herbage production for the dryland hay typw alfalfas (Table 2). The mean herbage production was greater for the hay type varieties for the second cutting at the Central Grasslands Research Station.

Alfalfa varieties are often separated into categories based on their adaptability to survive the winter. The alfalfa varieties in these trials have been separated into three winterhardy categories. These categories are: very winterhardy, winterhardy, and moderately winterhardy. The mean herbage production for the very winterhardy varieties was greatest at the Dickinson Experiment Station, the Hettinger Experiment Station and for the first cutting at the Central Grassland Research Station (Table 3). The moderately winterhardy alfalfa varieties had the greatest mean herbage production for the second cutting and for the total of the two cutting at the Central Grasslands Research Station.

Table 1. Alfalfa Variety Adaptation Trial-1982

	Dickinson		Hettinger		Central Grasslands Station					
	Clip-2 July		Clip-7 July		Clip-30 June		Clip-30 August			
Variety	Total lbs/acre	% Vernal	Total lbs/acre	% Vernal	lbs/acre	% Vernal	lbs/acre	% Vernal	Total lbs/acre	% Vernal
Agate	3832	86	3908	104	5302	105	3644	114	8946	108
Anik	4563	103								
AS-67			3923	104	4329	86	4041	126	8370	101
Baker	4011	91	4550	121	5980	118	3207	100	9187	111
D-III	3944	89	3999	106	4541	90	3613	113	8154	99
Drylander			4604	122	6277	124	3105	97	9382	114
Futura			4752	126	5207	103	3427	107	8634	105
Iroquois	4794	108	4782	127	4676	93	2873	90	7549	91
Kane	6139	139	3644	97	5132	102	3023	95	8155	99
Ladak	4796	108								
Ladak-65	4785	108	4469	119	4995	99	3290	103	8285	100
Magnum			4507	120	5349	106	3567	112	8916	108
Norseman	5210	118	4406	117	3840	76	3528	110	7386	90
Nuggett	4558	103	4790	127	5798	115	3118	98	8916	108
Perry			4478	119	5053	100	3479	109	8532	103

Table 1 continued. Alfalfa Variety Adaptation Trial-1982

	Dickinson		Hettinger		Central Grasslands Station					
	Clip-2 July		Clip-7 July		Clip-30 June		Clip-30 August			
Variety	Total lbs/acre	% Vernal	Total lbs/acre	% Vernal	lbs/acre	% Vernal	lbs/acre	% Vernal	Total lbs/acre	% Vernal
Polar I	4695	106	4603	122	4793	95	3423	107	8216	100
Polar II			4016	107	5587	111	3764	118	9351	113
Prowler			5244	139	5231	104	2955	92	8186	99
Ramsey	4804	108	4027	107	4427	88	3000	94	7427	90
Rangelander	4981	112	4184	111	6444	128	4034	126	10478	127
Ranger	4455	101	4298	114	4322	86	3542	111	7864	95
Spredor II	5260	119	4986	132	5304	104	3071	96	8375	102
Thor	4158	94	4015	107	4867	96	3202	100	8069	98
Travois	5077	115	5191	138	4482	89	3237	102	7719	94
Trek	4282	97	4162	110	3899	77	2781	87	6680	81
Vernal	4425	100	3768	100	5054	100	3197	100	8251	100
520	4274	96	4512	120	5559	110	3761	118	9320	113
524	4121	93	4440	118	4612	91	3611	113	8223	100
532			3832	102	4650	92	3563	111	8213	100

Table 2. Mean herbage production (lbs/acre) for the pasture and dryland hay type alfalfa varieties, 1982.

Location		Pasture Type	Hay Type
Dickinson Experiment Station		5364	4453
Hettinger Experiment Station		4642	4297
Central Grasslands Research Station	1st cutting	5478	4897
	2nd cutting	3238	3411
	Total of two cuttings	8716	8309

Table 2. Mean herbage production (lbs/acre) for the alfalfa varieties in three winterhardy categories, 1982.

Location		Very Winterhardy	Winterhardy	Moderately Winterhardy
Dickinson Experiment Station		5104	4348	4158
Hettinger Experiment Station		4536	4366	4174
Central Grasslands Research Station	1st cutting	5142	4968	4998
	2nd cutting	3247	3349	3594
	Total of two cuttings	8389	8317	8592

BROME VARIETY TRIAL-1982

L. Manske and H. Goetz

A bromegrass variety trial was seeded at the Dickinson Experiment Station in the spring of 1979. A similar trial was seeded at the Central Grasslands Research Station in the spring of 1981. Eleven varieties of smooth bromegrass (Bromus inermis) and one selection of meadow bromegrass (Bromus biebersteinii) were seeded at the Dickinson Experiment Station. The same varieties were included in the trial at the Central Grasslands Research Station except one variety of smooth bromegrass was omitted because seed was not available. The trial was designed to evaluate the performance of the varieties in western and central North Dakota on the basis of dry weight herbage production.

The dry weight aboveground herbage production at the Dickinson Experiment Station and the Central Grasslands Research Station for each variety are shown in table 1. One cutting was taken at the Dickinson Experiment Station and two cutting were taken at the Central Grasslands Research Station.

The three highest producing bromegrasses at the Dickinson Experiment Station were Baylor, Meadow brome and Rebound with 3792, 3249 and 3239 pounds of herbage production per acre respectively. At the Central Grasslands Research Station, the three highest producing varieties were Blair, Baylor and Barton with 6374, 6158 and 6080 pounds of herbage production per acre respectively for the first cutting. Meadow bromegrass ranked fifth in the herbage production with 5095 pounds per acre for the first cutting.

Table 1. Bromegrass Variety Trial-1982

	Dickinson	Central Grasslands Station		
	Clip-28 June	Clip-29 June	Clip-11 August	
Variety	Total lbs/acre	lbs/acre	lbs/acre	Total lbs/acre
Barton SB	2364	6080	1591	7671
Baylor SB	3792	6158	1510	7668
Beacon SB	1902	4715	906	5621
Blair SB	2224	6374	1254	7628
Fox SB	2576	4795	1494	6289
Lancaster SB	2752			
Lincoln SB	2384	5563	1192	6755
Lyon SB	2342	4798	1406	6204
Manchar SB	1995	2820	1099	3919
Mandan 404 SB	2105	4597	958	5555
Rebound SB	3239	3242	1211	4453
Meadow Brome	3249	5095	1251	6346

SB-smooth bromegrass-bromus inermis
meadow bromegrass-Bromus biebersteinii

Hatch-1922: Short Term Grazing Systems-Dickinson Experiment Station.

D. Kirby

Short duration grazing systems use: (1) multiple pastures, 3 to 60, (2) 1 to 15 day grazing periods, (3) 23 to 60 day rest periods, and (4) 1 herd stocked at a heavier rate when compared with recommended seasonlong stocking rates. It has been suggested that this system will maintain or improve range condition and increase carrying capacity over conventional rangeland management systems. This project was initiated to test this hypothesis.

The grazing trial begin in June, 1981 by dividing Section 16, Dickinson Experiment Station, Ranch Headquarters, into 320 acre seasonlong (SL) pasture and 8-40 acre short duration grazed (SDG) pastures. On June 25, 1981 and June 22, 1982, 20 cow-calf paris and 12 bull were allocated to the SL pasture and 35 cow-calf pairs and 1 bull allocated to the SDG system. Cattle were rotated every 5 days on the SDG system as pastur4es received 35 days rest between grazings. Drought, causing low forage production, forced removal of livestock from both systems on September 3 in 1981. In 1982, cattle wer removed October 12 concluding an 112 day grazing season.

Forage production and utilization and livestock performance are summarized in Table 1. Forage produced and utilized was similar between grazing treatments despite a75% greater stocking rate on the SDG system. Over one-third of the forage produced were forbs which were avoided by the cattle. Livestock performance per head was similar but production per acre was higher for the SDG system which reflects the increasing stocking rate.

Cow diets indicated seasonal decreases in % crude protein and % in vitro dry matter digestibility but little to no decreases in these nutrients over the 5-day grazing period (Table 2).

Botanical composition (%) of cow diets indicated cattle select more grasses throughout the grazing season (Table 3). However, selectivity among warm and cool season grass components varied considerably over the grazing season. Forbs were an important part of diet in early summer, while browse increased in diets as the grazing season progressed. Over the 5-day grazing period on selected pastures the grass component of the diet decreased while the forb component increased and browse showed mixed results (Table 4).

Preference, as determined by forage availability and composition of the diets, is summarized in Table 5. Grass was a preferred class of forage throughout the season while forbs were preferred only in early summer and browse was mainly avoided by the grazing cattle. Cool season and warm season grasses as groups were preferred throughout the season. Western wheatgrass, a col season grass and blue grama, a warm season grass were the only species preferred throughout the grazing season. Needle and thread and Junegrass, cool season grasses were also preferred in early summer, while plains muhly, a warm season grass, was preferred in the later portions of the grazing season.

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

				Livestock			
		Forage		Cows		Calves	
Year	System	Production (lbs/ac)	Utilization %	ADG (lbs)	AG/ac (lbs)	ADG (lbs)	AG/ac (lbs)
1981	Short-duration	678	55	0.4	3	2.2	16
	Seasonlong	679	51	0.7	3	2.3	10
1982	Short-duration	1645	37	0.3	4	2.1	25
	Seasonlong	1766	36	0.5	4	2.1	15

Table 2. Percent crude protein and in vitro dry matter digestibility in forage ingested by cows seasonally and over a 5-day grazing period on a short duration grazing system, Dickinson Experiment Station, Ranch Headquarters, 1981.

Season	5-day grazing period	Crude protein %	in vitro dry matter digestibility (%)
early summer	before	9.3	52
	after	8.7	52
	mean	9	52
summer	before	8.7	41
	after	8.3	37
	mean	8.5	39
early fall	after		36

Table 3. Botanical composition (%) of cow diets on a short duration grazing system, Dickinson Experiment Station, Ranch Headquarters, 1981.

	Season		
Forage class and species	Early Summer	Summer	Early Fall
Grass	86.7	92.3	85.2
Western wheatgrass	33.1	28.5	22.7
Needle and thread	16.5	7.4	1.1
Junegrass	9.5	-	
Carex spp.	2.1	-	-
Other cool season	1.5	4.2	-
Total cool season	62.7	40.1	23.8
Blue grama	21.8	43.3	55.7
Plains muhly	-	2.7	3.4
Buffalograss	-	1.5	-
Other warm season	-	2.6	-
Total warm season	21.8	50.1	59.1
Unknown grasses	2.2	2.1	2.3
Forb	12.5	3.6	1.1
Browse	0.8	4.2	13.6

Table 4. Botanical composition (%) of cow diets over a five day grazing period under short duration grazing on the Dickinson Experiment Station, Ranch Headquarters, 1981.

		% of Diet	
Season	Forage Class	Before	After
Early summer	Grass		
	Cool season	64.4	61.1
	Warm season	24.2	20.3
	Unknown	2.7	1.7
	Total grass	92.3	83.1
	Total Forb	6.0	16.6
	Total Shrub	1.7	0.3
Summer	Grass		
	Cool season	44.2	35.8
	Warm season	50.5	49.7
	Unknown	--	4.2
	Total grass	94.7	89.7
	Total Forb	1.7	5.5
	Total Shrub	3.7	4.8
Early Fall	Grass		
	Cool season		23.8
	Warm season		59.1
	Unknown		2.3
	Total grass		85.2
	Total Forb		1.1
	Total Shrub		13.6

Table 5. Seasonal forage preferences for cows grazing a short duration grazing system, Dickinson Experiment Station, Ranch Headquarters, 1981.

	Season		
Forage Class and Species	Early Summer	Summer	Early Fall
Grass	†	†	†
Western wheatgrass	†	†	††
Needle and thread	††	†	-
Junegrass	†	- -*	- -*
Carex spp.	- -	- -	- -
Other cool season	- -	- -	- -
Total cool season	†	†	†
Blue grama	†	††	††
Plains muhly	- -*	††	††
Buffalo grass	- -*	-	- -*
Other warm season	- -	†	- -*
Total warm season	†	††	†
Forb	†	-	- -
Browse	- -	- -	- -

++highly preferred --mainly avoided

+preferred -non preferred

*not found in the diet

SUMMARY

CUTWORM PHEROMONE PROJECT

1982

By

John D. Busacca

Dennis D. Kopp

1 982 Statewide Cutworm Pheromone Project Summary

Dep artment of Entomology
No rth Dakota State University
Farg o, North Dakota

J ohn D. Busacca
Den nis D. Kopp

Trap catches for almost all locations and species were down significantly this year compared to last years' counts. In addition to lower numbers of these species, the emergence period of many was delayed almost two weeks from 1981 emergence periods. This delay was more apparent in the early season, cutworms (i.e. Leucania & Scotogramma) than in the later season cutworm. (i.e. E. messoria).

The darksided cutworm (Euxoa messoria) was the only species with an increased catch. Most of the state total was contributed by Carrinton (new this year) and Dickinson which had more than doubled its catch from last year. Other locations did have a lower catch this year although it did not seem to be reduced as much as other insect species.

This year the sunflower moth pheromone was added to our trap line. It caught very few moths even though adults wer observed in nearby fields. Conversations with researchers who developed this pheromone indicate that the trap design was not effective for this moth. The pheromone itself is being tested for purity but is not suspect at this time. Next year a new, more efficient trap will be used.

We hope to have an improved armyworm pheromone for next year. The pheromone we now use is a single component pheromone but a more effective multi-component pheromone is now available from Canadian researchers. This should improve our ability to monitor armyworm moth populations and make our trap counts more reflective of actual field population levels.

The extreme cold this past winter probably was the major factor contributing to the decline in trap catch this past season. We would expect that another hard winter would again take its toll on resident, overwintering populations. If we get the predicted hard winter we can expect another moderate problem with cutworms next spring, as we had this year. We can say, al least, that in most trapped locations we are probably entering the winter with a similar overwintering population of cutworms than last year.

Species Abbreviation	Species Name	Common Name
Em	Euxoa messoria	darksided cutworm
Eo	Euxoa orchrogaster	redbacked cutworm
Et	Euxoa tessellata	striped cutworm
Ea	Euxoa auxiliaris	army cutworm
Ps	Peridroma saucia	variegated cutworm
St	Scotograma trifolii	clover cutworm
Ao	Agreotis orthogonia	pale western cutworm
He	Homoesoma electellum	sunflower moth
Lc	Leucania commoides	
Pu	Pseudaletia unipuncta	anyworm

1982 Cutworm Pheromone Trap Catch

	Pu	St	Ps	Lc	Ea	Ao	Et	Eo	Em	He	Total
Bismarck	27	37	102	432	3	2	144	20	135	3	905
Carrington	21	50	127	161	8	1	166	174	834	1	1543
Dickinson	90	132	296	284	6	9	173	24	634	1	1649
Hettinger	4	91	56	156	12	5	101	9	98	18	550
Langdon	15	30	55	190	0	5	38	179	157	3	672
Minot	1	59	13	37	1	2	238	49	215	0	615
Williston	20	72	103	150	20	52	144	34	19	2	616
Straubville	1	34	41	293	3	1	12	1	15	7	408
Total	179	505	793	1703	53	77	1016	490	2107	35	6958