1969

ANNUAL REPORT

DICKINSON EXPERIMENT STATION

DICKINSON, NORTH DAKOTA

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DICKINSON, NORTH DAKOTA

by

THOMAS J. CONLON
and
RAYMOND J. DOUGLAS

SUPERINTENDENTS
January 1, 1969-December 31, 1969

TABLE OF CONTENTS

ANNUAL REPORT
of the
DICKINSON EXPERIMENT STATION

The need to provide a more stable income for our farmers and ranchers becomes greater each year. The overall agriculture operation is rapidly changing. This places a real burden on both farmers and ranchers in keeping up with the changes which result in an every increasing overhead. Need for the latest information on improving the farm or ranch operation becomes more critical as the years go by.

We believe the function of the Branch Station is to provide information to improve the income potential for the agricultural enterprises being carries on each unit. Information which results from our investigations in agronomy, grass and legume studies or animal science has a direct bearing on the future economy of our state and the welfare of our people. This information when released should contribute towards providing the greatest possible return from every dollar spent in the overall operation.

The results of our research must be presented in such a manner that those interested can use this information as guidelines for future operations. Progress reports on new projects are important along with the final summary of those projects completed.

Some of the problems confronting those who live on the land are of such magnitude that the information needed can only be achieved by close cooperation with the Main Station and other Branch Station.

NEEDS OF THE
DICKINSON EXPERIMENT STATION

An Experiment Station is in constant need of orderly improvement. This phase of our work which adds to the overhead is exceedingly important since the public often places appearance above the contribution towards experimental results. Along with keeping up the appearance of the station is the need for improving the methods and equipment used. There is also the job of selecting new projects which have a meaningful bearing upon the economy of the area.

Improvement and repair of equipment and facilities is a continuous job. Both must be in the best of repair and condition for reliable experimental results and to meet the test of a detailed and through inspection. This makes the proper overall functioning of an Experiment Station a costly operation.

I. LAND

1. In 1969 the option taken in 1968 on S ½, of Section 23, T 140, R 97, was exercised with the final payment to be made after January 1, 1970. The Experiment Station took possession of this land September 1, 1969.

   The option on NW ¼ of Section 23, T 140, R 97 will be exercised after January 1, 1970 with final payment on this tract to be after January 1, 1971.
2. We are in need of an additional 400 to 600 more acres of range land in the Badlands adjacent to Pyramid Park. It is hoped that in the not too distant future the land can be acquired from the Federal Government through the Forest Service and Bureau of Land Management.

   This land is needed so we can move entire cow herd to the Badlands for summer grazing from about June 25 until October 15 of each year. This increase in acreage would give us a sufficient grazing area and enable us to divide our herd into three separate lots for pasturing during the breeding season.

II. IMPROVEMENTS MADE IN 1969

1. Buildings on both the Agronomy Farm ans Livestock Farm in need of painting were painted during the year.
2. Dead and dying Spruce trees were replaced on both farms.
3 renovation of shelter belts was continued in 1969.
4. The old seed house was remodeled to serve as the main office for the station staff.
5. Natural gas was installed in the main resistance, office and field laboratory.
6. Considerable repair of all cattle lots and fences was accomplished.
7. The entire area used for swine pasturing trials was repaired in the fall of 1969.

III. IMPROVEMENTS TO BE MADE IN 1970

1. If funds permit, the shop foremen's residence will be put on the natural gas installation.
2. Granary acquired in the purchase of the S ½ Sec. 23, T 140, R 97 will be moved to the main station and used as a seed house, to replace space in old seed house now being used for office.
3. Repair of roofs and windows of the dwellings on the main station is imperative.
4. Search for a satisfactory site for the relocation of the livestock farm is pursued.

IV. INFORMATION

A summary of meetings, tours radio presentations etc. is included by each staff member in the appropriate section of this report.

In addition, the main station field days, both the Crops Day and Livestock Research Roundup were well attended. The 20th Anniversary issue of experiments in animal science, prepared for the Livestock Research Roundup was well received by farmers and ranchers of North Dakota. More than 200 copies of this publication have been distributed. About 2000 copies of the Progress Report on crops trials have also been distributed.

Articles on injectable vitamins and off-station trials were approved for publication early in 1970. Reports on creep feeding and steer feeding are being analyzed for possible publication.

V. WEATHER STATION

The weather records are reported to the National Weather Records Center, Arcade Bldg. Asheville, North Carolina. The records sent to the recording center the first of each month includes a daily record and a summary of the following.

1. The maximum, minimum and 7 a.m. dry bulb temperatures for each 24 hour period.
2. Wet bulb reading of the temperatures are recorded between April 1 and October 1 at the same time the other temperature readings are taken.
3. Wind velocity over each 24 hour period expressed as total miles of wind to pass a given point.
4. Free surface evaporation between April 1 and October 1.
5. Daily precipitation.
6. Snowfall and the amount of snow on the ground each day during the winter months.

VI. SUMMARY OF WEATHER RECORDS FOR 1969

A. Precipitation

		1892-1969				Last 10 Years		
Month	1969	Accum.	Summary*	Avg.	Accum.	Year	Apr-Jul	Annual
Jan	0.66	0.66	33.90	0.43	0.43	1960	6.22	10.23
Feb	0.36	1.02	33.08	0.85	.85	1961	7.81	13.90
Mar	0.25	1.27	56.80	1.58	1.58	1962	12.59	18.34
Apr	0.72	1.99	103.66	2.91	2.91	1963	13.58	18.94
May	1.32	3.31	178.65	5.20	5.20	1964	13.78	18.68
Jun	6.13	9.44	276.59	8.75	8.75	1965	16.81	21.63
Jul	4.40	13.84	173.94	10.98	10.98	1966	10.11	16.69
Aug	0.52	14.36	140.87	12.79	12.79	1967	9.01	14.24
Sep	0.31	14.67	93.79	13.99	13.99	1968	8.48	15.73
Oct	0.86	15.53	62.93	14.80	14.80	1969	12.57	16.37
Nov	T	15.53	39.88	15.31	15.31	1944**	21.20	31.16
Dec	0.84	16.37	31.42	15.71	15.71	1936***	2.03	6.72

78-Year Average Precipitation=15.71; 78-Year Average Precipitation, April-July=9.40; *Total Precipitation in inches per month for 78 years: **Greatest of Record; ***Least of Record; 1969 Greatest 24-hour precipitation, June 26, 2.65 inches. Above Normal for 1969 0.66 inch.

B. General Temperature Information.

Latest Killing in Spring
1969 June 20 27° F

Earliest Killing Frost in Fall
1917 Aug 9 30° F
1969 Oct 4 27° F

Frost-Free Season
1969 105 days

Shortest of Record
69 days in 1915-1917

Longest of Record
175 days-1962

Lowest of Record
1936 Feb 16 -47° F
1969 Jan 30 -31° F

Highest of Record
1936 July 6 114° F
1969 Aug 12 102° F

C. Wind Chill Index

Strong wind when combined with low temperatures causes a very rapid cooling of any exposed surface. Unprotected portions of the body, such s the face or hands, can chill rapidly and should be protected as much as possible form the cold wind. A very strong wind combined with a temperature slightly below freezing can have the same chilling effect as a temperature nearly 50° lower combined with the calm temperatures.

The problem of how much heat the body will lose under given conditions of temperature and wind has been studied for some time. Paul Siple, who accompanied Admiral Bryd to the Antarctic, came up

WIND CHILL TABLE

°F. Dry-bulb Temperature

	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
	WIND CHILL INDEX (EQUIVALENT TEMPERATURE) - Equivalent in cooling power on exposed flesh under calm conditions																
MPH CALM	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	33	27	21	16	12	7	1	-6	-11	-15	-20	-26	-31	-35	-41	-47	-54
10	21	16	9	2	-2	-9	-15	-22	-27	-31	-38	-45	-52	-58	-64	-70	-77
15	16	11	1	-6	-11	-18	-25	-33	-40	-45	-51	-60	-65	-70	-78	-85	-90
20	12	3	-4	-9	-17	-24	-32	-40	-46	-52	-60	-68	-76	-81	-88	-96	-103
25	7	0	-7	-15	-22	-29	-37	-45	-52	-58	-67	-75	-83	-89	-96	-104	-112
30	5	-2	-11	-18	-26	-33	-41	-49	-56	-63	-70	-78	-87	-94	-101	-109	-117
35	3	-4	-13	-20	-27	-35	-43	-52	-60	-67	-72	-83	-90	-98	-105	-113	-123
40	1	-4	-15	-22	-29	-36	-45	-54	-62	-69	-76	-87	-94	-101	-107	-116	-128
45	1	-6	-17	-24	-31	-38	-46	-54	-63	-70	-78	-87	-94	-101	-108	-118	-128
50	0	-7	-17	-24	-31	-38	-47	-56	-63	-70	-79	-88	-96	-103	-110	-120	-128

VERY COLD

BITTERLY COLD

EXTREME COLD

Wind speeds greater than 40 MPH have little additional chilling effect.

with some of the answers and during and after World War II the Quartermaster Corps and the Medical Research Laboratory of the U.S. Army did a lot of research on it. A reasonably satisfactory solution has been found. The result can be expressed as a "Cooling Power of the Air" or "Wind-Chill Index" is preferred because wind and temperature are the variable considered. The "Wind Chill Index" is shown on the attached table.

VII. BEEF CATTLE

A. Improving the Cow Herd.

1. A constant effort is being made to improve the cow herd. The Station is pointing towards one of the best commercial cow herd in North Dakota. In order to reach this goal the following program has been developed.

a. Rigid culling of the cow herd geared towards eliminating the poor producers the late producers and those with defects that impair their productivity. This policy is followed going as far each year as the number of replacement heifers selected will permit and still keep the breeding herd up at least 100 cows.

b. All heifers saved for replacements are selected through performance testing program and from the top 50% by weight of the current year's crop of heifer calves. The replacement heifers to calve for the first time in 1970 weighed 930 pounds on February 4 which was before they were teo years old.

c. No cows are kept after they are ten years of age, unless they are exceptionally good producers and sound.

d. Cows that wean a light calf are culled at the earliest possible date.

e. Dry cows are culled as soon as it is determined that they are not going to calve during the current year.

B. Bulls selected

1. At the present time the following bulls are in service at the Dickinson Experiment Station.

a. TTT aniety, Number 11,643,725
Calved, April 3, 1961
Bred by Thor Tagestad, Towner, North Dakota

b. Husky Pioneer 314, Number 12,874,443
Calved, April 15, 1963
Bred by Tony Stroh, Killdeer, North Dakota

c. Husky Pioneer 402, Number 13,351,427
Calved, April 5, 1964
Bred by Tony Stroh, Killdeer, North Dakota

d. BR Mill Iron 7115, Number 14,701,709
Calved March 22, 1967
Bred by Brooks Hereford Ranch, Burlington, North Dakota

e. BR Mill Iron 7179, Number 14,766,063
Calved May 2, 1967
Bred by Brooks Hereford Ranch, Burlington, North Dakota

f. A 1969 bull calf will be selected in 1970 from Brooks Hereford Ranch at Burlington, North Dakota. This bull will be selected on the basis of the gain for days of age, type, quality and ruggedness.

2. An effort has been made to increase the size and meatiness of our cows through the selection of the bulls used. The size, meatiness and weaning weight are essentials any breeder must consider an improving his herd. This becomes more necessary each year with the increasing overhead and narrow margins in the beef cattle enterprise.

C. Management of the Cow Herd.

1. Wintering the cow herd.

a. A comparison of soybean oil meal with Kedlor when used as a protein supplement in feeding straw to the cow herd. In this trial the following are taken into consideration:

aa. Weight of cows at the start and finish of the winter feeding period.

bb. Cow weights when calves are weaned.

cc. Vigor of the calf at birth.

dd. Death loss of the calves at birth.
Weight of calves at birth.

ee. Weight of calves at weaning.

2. Improving reproductive performance.

Supplementing half of the cow herd with barley pellets to shorten the calving period.
In this trial an effort is being made to determine if cows getting barley pellets and in a good gaining condition at the time of breeding will be more apt to conceive on the first heat cycle than those not receiving the supplement. In addition we are including the following.

a. Determine if the supplement increases the milk flow enough to increase weaning weight of the calves.

b. Change in body weight of the cows.

3. Wintering replacement heifers at a medium level of feed intake to gain one and one fourth pounds per head per day with and without bedding.

D. Management of Calves at Weaning.

1. Weaning and feeding a high energy ration to hold initial weaning weight and make additional gains for three weeks following weaning.

a. Value of “Red Nose” shots before weaning.

E. Trials with Steers and Heifers being fattened.

1. Realizing that there is no one best to “feed” cattle, those fattened on trials at the Dickinson Experiment Station are fed on a either high roughage and low grain, or high grain and low roughage

rations properly balanced in each case. In both types of rations the cost of gains are about the same, with the gains being just a little faster when high grain and low roughage rations are fed. The main purpose of our feeding program is to use home grown feeds as the major part of the ration. This applies especially to roughage which might be wasted or sold at a price below what it would bring, if included in the ration and marketed as beef. No feeder can afford not to feed a balanced ration which besides the grain and roughage include adequate protein, minerals and vitamins. Consideration is also being given to management and housing problems.

a. In our feeding program we are searching for reliable information on rate of gains, cost of gains, carcass grade and yield with regard to the following.

aa. Self-feeding a mixed roughage, grain ration as a complete ration, using North Dakota home grown feeds and minerals, but no protein supplement.

bb. Comparing MGA (Melengestrol Acetate) and Stilbestrol in fattening heifers.

cc. The value of de-worming North Dakota cattle in the feed lot.

dd. Economical shelters for wintering and fattening beef cattle.

ee. Feeding triticale as compared to barley for fattening beef cattle.

ff. Long and chopped hay for wintering beef animals.

gg. Implanting steers with stilbestrol during the nursing period until weaning.

hh. Different systems of wintering yearlings for dry lot finishing and pasture grazing followed by dry lot finishing.

VIII. SWINE IMPROVEMENT PROGAM

A. Our effort is directed towards improving the meat qualities of our breeding herd of Yorkshires, along with gaining ability, efficiency of gain, and type. This is accomplished through a rigid program of selection. An effort is also being made to secure the best boars available for the herd improvement program.

1. Boars used in our herd.

a. OAMC4 Model 297-404802
Farrowed July 26, 1964
Sire: OAMCO Model 65-28324583
Dam: OAMCI Miss Capre 18-324583
Bred by: Oklahoma State University

b. ISU6 White Flame 17-8
Farrowed May 26, 1966
Sire: HYP3 White Lightin' 12-12 377475 PR
Dam: ISU3 Princess Blender 7-8 387854 CL PR
Bred by: Iowa State University

c. ISU6 Rable Blend 11-6
Farrowed March 13, 1967
Sire: SSE4 The Rebel 391912CLCMS
Dam: ISU4 Blended Beauty 1-7 390505 CL PR****
Bred by: Iowa State University

d. DES8 Two
Farrowed February 25, 1968
Sire: ISU6 White Flame 17-8
Dam: DES6 One hundred Three 10 Fall 481517
Bred by: Dickinson Experiment Station

d. DES8 Nineteen 2 Fall 558198
Farrowed August 2, 1968
Sire: ISU6 White Flame 17-8 461422 CL
Dam: DES6 One hundred Three 10 Fall 481517
Bred by: Dickinson Experiment Station

2. Swine production problems being studied.
   a. Rations with varying levels of protein.
   b. Effect of sire line on rate of gain and feed efficiency for both barrows and gilts.
   c. The effect of sex on feed efficiency and rate of gain.
   d. Comparison of pigs fed on pasture to those fed in dry lot with a cement floor.
   e. New programs to be considered.
      aa. The most economical swine operation including labor, housing and feeding in over-all swine production.
      bb. Improving farrowing facilities.
      cc. Control of disease.
      dd. New rations.
      ee. New pasture crops.
      ff. Wind and snow protection for low cost housing.

Detailed reports of research in animal science, agronomy and range and pasture management are given in the following sections. Staff members as indicated are responsible for their respective research effort and report.

The general summary of Mr. Douglas' miscellaneous activities is included here. The summary of Mr. Conlon's miscellaneous activities is included in the section of agronomic investigations.

MEETINGS AND TOURS, 1969

Raymond J. Douglas

		Attendance
January 9	Dean Hazen-Meeting at Bismarck	3
January 23	Ward County Agr. Action Days	
	Trials at Dickinson Experiment Station	200
January 28	Morton County Agr Imp Ass'n	
	Care and Handling of Cow	40
January 31	North Dakota Livestock Producers	
	"More Beef From Less Acreage	28
February 1	Fairview Feeders Tour	
	"Care of the Cow-Calf Herd"	200
February 3	Sertoma Club-"Work at Dickinosn Experiment Station"	25
February 4	McKenzie County Livestock Association	
	"Handling the Cow Herd"	82
February 12	Hettinger-Sheep Day-attended	225
February 17	Dunn County Vocational Agr. Group	
	Tour of Station	42
February 19-20	Fargo, North Dakota Experiment Station Conference	attended
March 4	4-H Foundation Meeting	30
March 9-10	Valley City-North Dakota Winter Show	
March 13	4-H Meeting-Organization of Foundation Committee	
March 13	Hakenstaat and SCS Personnel=Program Plan	
March 17	Minot-Brook's Ranch Hereford Sale	
March 25-26	Bismarck-Nitrogen Workshop	
May 1	NDSU Memorial Foundation-Annual Meeting	8
May 8	Dr. Wm Dinusson, Walter Rudy, Dr. Brutsman Station Trials	3
May 14	Senior Citizens Seminar-Older workers at DES	40
May 16	Tour of Station-St. Patrick's-fifth graders	69
June 6	Area of Stock Judging-4-H	46
June 11	Ridl Ranch-Helping get calf herd ready for summer	6
June 12-13	Rabe Ranch-Helping get calf herd ready for summer	15
June 18	Dr. Brutsman-weigh cattle, make worm egg count	
June 18	SCS Tour-Farm Judging	
July 14	Hettinger Off-Station Crops Day	
	"Livestock Program at DES	30
July 16	Crops Day at DES	
	"Fertilizer and Tillage Practices	250
July 23	District Livestock Judging Contest	80
July 27	Crops Day at Beach Off-Station Trials	
	"Fertilizer Trials"	60
July 30	Crops Day at Killdeer Off-Station Trials	
	"Fertilizer Trials"	20
August 27	Soil Conservation Service-Tour of Station	4

Meetings & tours continued, 1969

		Attendance
September 2,3,4	Agricultural Advisory Council Prison and Training School	
September 23,24,25	Agricultural Advisory Council Jamestown Hospital, Soldiers Home at Lisbon Retarded Persons Hospital	400
September 29, 30	North Dakota Hereford Tour	
October 7	Dr. Wm. Dinusson “Plans for 1969 Trials	
October 8	Schnell’s Livestock Market-Pre-Conditioning Calves	attended
October 9	Tour of Livestock Projects-Dcikinson Central High School Agriculture Class	24
October 22	Agricultural Advisory Council “Discussing Final Report”	10
October 24	Devils Lake-Ramsey County Livestock Breeders “Improving our Livestock”	76
November 1	Beef Carcass Evaluation-attended	80
November 5	Dr. Wm. Dinusson-Aided in planning and starting trials	
November 5	Slope Seed Company	60
December 3	Livestock Research Roundup	1200

RADIO, 1969
Raymong J. Douglas

Date	Program
January 10	Replacement Value of Barley
January 24	Grazing Capacity of Grass-Native and Tame
February 7	Weather Report for 1968
February 21	Care of Sow Before and After Farrowing
March 14	Treating Cattle for Lice
March 17	Grass Fertilization
April 4	Fertilizing Grass
April 18	Our Best Roughage Crops
May 2	Importance of Breeding Season in Beef Production
May 23	Livestock Trials in Progress
June 6	Crops Day at Station
August 1	Roughing Steers Through the Winter for Good Gains on Grass
August 22	Wintering Beef Cattle on Straw
September 5	Improving Beef Production
October 10	Red Nose Shots and High Energy Rations for Calves
November 7	Livestock Research Roundup-December 3
November 28	Program for Livestock Research Roundup
December 19	Self-Fedding for Profit

GENERAL SUMMARY OF MISCELLANEOUS
ACTIVITIES OF RAYMOND J. DOUGLAS

Date 1969	Farm visits	No. tours	Attendance at meetings	Station calls	Radio talks	News Articles	Meetings attended
January	0	0	271	17	2	0	4
February	6	1	574	16	2	0	6
March	0	0	30	11	2	0	6
April	0	0	0	10	2	0	0
May	0	1	120	14	2	0	4
June	12	1	67	14	1	0	6
July	0	4	440	10	0	0	5
August	0	1	4	9	2	0	1
September	3	3	430	8	1	0	4
October	2	1	110	9	1	0	7
November	0	0	140	14	2	1	3
December	1	1	1200	9	1	1	1
Total	24	13	3386	141	18	2	47

REPORT OF

LIVESTOCK INVESTIGATIONS

DICKINSON EXPERIMENT STATION

DICKINSON, NORTH DAKOTA

1969

by

RAYMOND J. DOUGLAS
and
JAMES LEE NELSON

TABLE OF CONTENTS

WINTERING BEEF COWS ON HAY OR STRAW

Cow herds have been wintered on a straw with varying amounts being fed in the ration and with varying results.

In December, 1965 a trial was started to access the value of wheat straw when utilized by pregnant beef cows during the winter months (December-March).

The Dickinson Experiment Station cow herd was split by age into two lots. Each lot initially included heifers that would calve in the spring as two-year olds. After the second year the heifers were not included because they were unable to compete with the cows for proper development and condition when the ration fed was limited.

Each year, the hay-lot was fed 20 pounds per head per day of crested bromegrass hay plus minerals while the straw-lot cows were fed 7 pounds of crested bromegrass hay, 1 pound of soybean oil meal, minerals and wheat straw free choice.

Beginning the first of February each year, both lots received two pounds of barley plus 10,0000 International Units of Vitamin A per head per day. In mid-March, the straw and soybean meal were removed from the one ration and the hay or hay plus silage allowance increased to 20 pounds. The cows started calving the last week in March each year.

Table 1. Four year summary of the performance of beef cows on hay or hay and straw.

	Hay Lot				
	1965-66	1966-67	1967-68	1968-69	4-Yr Avg.
No. cows	52	49	42	43	
Avg. initial wt. (Dec)	1016.1	1047.7	1026.1	1172.7	1065.7
Avg. (May) wt.	1032.6	1009.8	980.4	971.0	998.5
Winter wt. chcange	+16.5	-35.9	-45.7	-201.7	-66.7
Avg. Fall (Oct) wt.	1101.8	1116.8	1113.1	1140.0	1117.9
Avg. summer gain	69.2	107.0	132.7	169.0	119.5
Avg. wt. change (Dec-Oct)	85.7	71.1	87.0	-32.7	52.8
Feed cost/hd	$32.28	$33.13	$34.33	$30.71	52.8
Avg. calf birth wt.	69.5	69.6	74.2	75.9	72.3
Avg. calf weaning wt.	349.0	380.9	389.3	393.0	378.1
Conception Rate		Bred In			
Cows and Heifers	1966	1967	1968	3-yr. Avg.	
1st Cycle	30	26	25	27	
2nd Cycle	11	10	14	12	
3 Cycle	2	4	5	5	

	Hay and Straw Lot				
	1965-66	1966-67	1967-68	1968-69	4-Yr Avg.
No. cows	56	48	42	40	
Avg. initial wt. (Dec)	1026.8	1042.5	994.4	1177.4	1060.3
Avg. (May) wt.	994.6	977.3	922.5	978.8	968.3
Winter wt. chcange	-32.2	-65.2	-71.9	-198.6	-92.0
Avg. Fall (Oct) wt.	1078.5	1115.8	1068.8	1138.8	1100.5
Avg. summer gain	83.9	138.5	146.3	160.0	132.2
Avg. wt. change (Dec-Oct)	51.7	73.3	74.4	-39.6	40.2
Feed cost/hd	$33.62	$30.28	$33.19	$28.24	31.3
Avg. lbs. straw fed.	13	8.3	10.1	10.5	10.5
Avg. calf birth wt.	67.2	69.8	73.5	74.7	71.3
Avg. calf weaning wt.	354.5	385.1	384.6	382.5	376.7
Cows and Heifers	1966	1967	1968	3-yr. Avg.	
1st Cycle	29	28	23	27	
2nd Cycle	11	4	14	10	
3 Cycle	3	7	1	5	

Summary:

Beef cows wintered on hay lost weight in two out of four years during the winter while those wintered on one-third hay and two-thirds straw lost weight every winter. The hay lot lost an average of -66.7 pounds with a range of from a +16.5 to -210.7 pounds. The straw lot lost an average of -92.0 pounds with a range of from -32.2 to -198.6 pounds.

On the average, the straw fed lots outgained the hay lots an average of 22.7 pounds during the summer grazing period. Both lots conceived and dropped their calves with equal regularity and there was little difference in weaning weights between lots.

When feeding cows straw, it is advisable to chop it to prevent waste and encourage a greater intake. First calf heifers and small young cows should be fed separately in order to give them an equal opportunity to feed.

Four year results show that up to two-thirds of the hay in a wintering ration can be replaced by wheat straw plus supplemental protein without loss of the cows is not detrimental if the cows are in good condition at the start of the wintering period.

SUPPLEMENTING COWS WITH BARLEY PELLETS TO IMPROVE REPRODUCTIVE PERFORMANCE

This trial was started in the spring of 1967 to evaluate the practice of supplementing grazing cows with pelleted barley for approximately thirty days prior to breeding. This evaluation includes both reproductive performance and milk production as measured by calf weight.

The station cow herd was equally divided into two groups. These Hereford cows and heifers were turned on fertilized (25¢ actual N) crested wheatgrass pasture on May 15th in 1969. On June 2nd, one group was supplemented with 3 pounds per head per day a 14% protein barley pellet. This supplementation wad continued at this rate until June 26, 1969, a period of 25 days. The pellets cost $68 per ton delivered or 3.4 dents per pound. Thus the cost per supplemented cow was $2.55 extra for feed. The cows and their calves were weighed May 15th, June 26th, and October 17th. The results of this year and the trial to date are shown in the following table.

Table 2. Breeding record of cows and heifers on spring pasture with and without supplemental feeding.

	1968		1969		
	Cows	Heifers	Cows	Heifers	Total
Cows and heifers without supplement					
Settled 1st cycle	15	5	15	4	39
Settled 2nd cycle	8	1	12	3	24
Settled after 2nd cycle	4	1	2	1	8
Cows and Heifers fed supplement					
Settled 1st cycle	24	6	17	5	52
Settled 2nd cycle	4	-	10	2	16
Settled after 2nd cycle	3	-	2	-	5

Table 3. Record of performance of cows and heifers on spring pasture with and without supplemental feeding.

	1967	1968	1969	3-Yr. Avg.
	Weights of animals without supplement			
Avg. initial cow wt.	991.2	955.7	941.2	962.7
Avg. cow wt. end of feeding	1070.2	1028.8	976.1	1025.0
Avg. cow wt. at weaning	1121.1	1092.1	1089.3	1100.8
Avg. cow wt. change	+129.9	+136.4	+148.0	138.1
Avg. calf initial wt.	182.8	128.4	115.2	142.1
Avg. calf wt. at weaning	389.0	391.6	393.3	391.3
Avg. calf wt. gain	206.2	263.2	278.1	249.2

Table 3. Record of performance of cows and heifers on spring pasture with and without supplemental feeding continued.

	1967	1968	1969	3-Yr. Avg.
		Weights of supplemented animals		
Avg. initial cow wt.	973.0	952.6	953.5	959.7
Avg. cow wt. end of feeding	1050.8	1042.8	1038.5	1044.0
Avg. cow wt. at weaning	1105.4	1095.3	1117.1	1105.9
Avg. cow wt. change	133.4	142.7	163.6	146.6
Avg. calf initial wt.	179.1	124.8	117.9	140.6
Avg. calf wt. at weaning	382.3	378.6	396.0	385.6
Avg. calf wt. gain	203.2	253.8	277.7	244.9

Summary:

The number of animals in this trial is limiting, the breeding record of cows receiving supplemental feed was better in both 1968 and 1969. Figured on a percentage basis for the two year period, 71 percent of the supplemented cows settled on the first cycle and 22 percent settled on the second cycle. This compares with 55 percent on the first cycle and 34 percent on the second cycle for those not getting supplemental feed.

The supplemented cows gained more weight during the spring and summer grazing period. However, this gain was not shown to produce any additional milk as shown by their calves weaning weights.

EFFECT OF IMPLEMENTING NURSING STEER CALVES WITH STILBESTROL

Previous work at this station and other stations has shown a definite advantage in weight gain and feed efficiency when using stilbestrol in beef steers from weaning to market. However, the effects of the use of stilbestrol with nursing calves has not been determined.

A trial to determine the value of stilbestrol implants with steer calves was initiated in June, 1967, and was continued in the summer of 1968 and 1969. Half of the steer calves born at the station were implanted with 12 mg. of stilbestrol in 1967 and 1968, and 15 mg. of stilbestrol in 1969. The calves were allotted so equal age and weight was maintained between treatments. All calves were individually weighed at the beginning of the trial in June, mid-August and at weaning in early October. The cows and calves grazed a western wheatgrass-needle and thread type native range typical to the area, with adequate water and minerals free choice. Three years results are tabulated in table 4.

Table 4. Three year results obtained by implanting steer calves with stilbestrol.

	Year	Avg. No. head	Avg. June wt.	Avg. October weaning wt.	Avg. Summer wt.	Days on trial	Avg. daily gain
No Stilbestrol	1967	27	185.9	396.9	211.0	119	1.77
	1968	23	173.7	382.2	208.5	110	1.90
	1969	21	179.8	383.6	203.8	113	1.80
3-Yr. Avg.		71	179.8	387.6	207.8	114	1.82
Stilbestrol implants	1967	27	182.2	390.2	208.0	119	1.75
	1968	23	173.7	385.7	212.2	110	1.93
	1969	19	180.0	399.7	219.7	113	1.94
3-Yr. Avg.		69	178.6	391.9	213.3	114	1.87

Summary:

There was no significant difference in gain for the calves implanted with 12 mg. stilbestrol in 1967 and in 1968. Calves implanted with 15 mg. stilbestrol in 1969 made gains that were significantly better than the calves not implanted. Difference in favor of implants in 1969 was .14 pounds per head per day.

This trial indicated that implanting nursing steer calves can increase gains.

Additional work will be needed to determine the best amount of stilbestrol, but this trial shows that the amount used not be less than 15 mg.

HIGH ENERGY RATIONS FOR CALVES

This trial was designed to measure the performance of calves fed a high energy ration for a three week period following weaning. Also an evaluation of vaccinating for Infectious Bovine Rhinotracheitis (Red Nose) was made by vaccinating every other calf 10 days before weaning.

The calves were weaned on October 16th in 1969 and on the 17th in 1969. They were then divided by sex into lots and started on a ration of three pounds of whole oats, one-half pound soybean meal and 300 mg. of terramycin crujmbles per head per day plus crested-bromegrass hay free choice. The oats and soybean oil meal were gradually increased so that at the end of the period each year the calves were receiving five pounds whole oats and one pound of soybean oil meal per head per day.

Table 5. Two year average performance of calves fed a high energy ration for a three week post-weaning period.

	Steers			Heifers		
	1968	1969	2-Yr. Avg.	1968	1969	2-Yr. Avg.
Days fed	20	17		20	17	
No. of head	48	39	87	49	54	103
Avg. Oct. wt.	381.6	386.0	383.8	370.5	382.5	376.5
Avg. Nov. wt.	403.2	414.4	408.8	387.6	404.4	396.0
Avg. wt. gain	21.6	28.4	25.0	17.0	21.9	19.5
Avg. daily gain	1.08	1.67	1.38	0.85	1.29	1.07
Avg. daily ration						
Brome-crested hay	4.2	7.1	5.7	4.2	6.2	5.2
Whole oats	3.8	4.0	3.9	3.8	4.1	4.0
Soybean oil meal	0.6	0.6	0.6	0.6	0.6	0.6
Terramycin crumbles	350 mg	250 mg	300 mg	350 mg	250 mg	300 mg
Feed cost/cwt gain	$15.07	$10.33	$12.70	$18.94	$13.32	$16.13
Feed cost/hd	$3.25	$2.99	$3.12	$3.23	$2.88	$3.05

Summary:

The calves responded well to the high energy rations gaining an average of 25 pounds for the steers and 19.5 pounds for the heifers in 1969. For the two years, the steers gained 1.38 pounds and the heifers 1.07 pounds per head per day.

Feed consumption was nearly equal for the steers and heifers with the cost of gai nearly 4 cents cheaper for the steers. The feed cost per head for the steers was $3.12 and for the heifers $3.06 per head.

During the three weeks feeding period there was no signs of shipping fever or other respiratory ailments. There appeared to be no advantage in this trial for vaccination for “red nose”.

When feeding a high energy ration, a vaccination for enterotoxemia would be a recommended practice.

SELF-FEEDING A MIXED RATION TO BEST STEERS FROM A WEANING TO MARKET

A trial was initiated in November, 1968 to determine the feasibility of self-feeding a mixed ration to steers from weaning to market. The ration fed was a mixture of grain and dry roughage 50:50 by weight with minerals fed at .2 pound per head per day. All feed was processed through a portable grinder-mixer using a one inch screen for the roughage and a three sixteenths inch screen for the grain. The roughage used was a mixture of crested wheatgrass hay, wheat straw and alfalfa. The grain was barley. No supplement was added to either ration. One ration fed was 50 per cent barley, 46 per cent tame hay, and 4 per cent alfalfa with a three part di calcium phosphate, one part trace mineral salt mixture added to the ration so each animal would get .2 pound per head per day.

The other ration fed contained 50 per cent barley, 21 per cent tame hay, 25 per cent wheat straw, and 4 per cent alfalfa by weight, plus the same amount of mineral mixture.

All feed was fed through a 2 ton capacity, straight sided self feeder, that allowed one foot of trough per head. The steers were Herefords, fed from approximately 350 to 1030 pounds. They were sold on grade and yield with an average grade of choice. The results are summarized in table 5.

Table 6. Gains, costs and rations in the self feeding trial on beef steers from weaning to market.

	Barley & tame hay	Barley-hay & straw
No. head	8	8
Avg. initial wt.	355.0	355.6
Avg. final wt.	1033.8 (Oct 1st)	1038.1 (Oct 29th)
Avg. gain	678.8	682.5
Days fed	330	358
Average daily gain	2.06	1.91
Cost/cwt gain	$13.26	$13.68
Cost/hd	$89.97	$93.36
Ration per day in pounds per head		
Alfalfa	0.68	0.70
Crested-brome hay	8.38	3.96
Wheat straw	-	4.62
Barley	9.06	9.29
Mineral mix	0.20	0.20
Total per head per day	18.32 lbs	18.77 lbs

Summary:

Both mixed rations gave good, economical gains with the barley-hay ration showing a 0.15 pound per head per day faster gain. These steers were more efficient with a saving of 42 cents per hundredweight gain. It required an extra 28 days feeding to get the straw-fed steers to the same slaughter weight.

There was very little health problem using this method of feeding, with no problems with bloat, founder or animals going off feed. The cost per hundredweight gain could be reduced in the lot containing straw if a lower value was placed on the straw.

COMPARING MGA AND STILBESTROL FOR FATTENING HEIFERS

MGA (Melengestrol Acetate) is a progesterone-like compound effective in suppressing estrus in beef cattle when administered at levels of 0.4 mg. per head per day. Recent experiments have also shown growth stimulation and increased feed efficiency using MGA.

Diethyl–stilbestrol (Stilbestrol) has also improved rate of gain and improved feed efficiency when used in feed lot steers. However, the results have been erratic when used with heifers.

This trial was initiated in January, 1969 to study the response of heifers treated with either 0.4 mg MGA or implanted with 15 mg stilbestrol from weaning to slaughter.

Twenty four head of Hereford heifers were randomly allotted to three lots and fed a similar ration. The MGA heifers received 0.4 mg of MGA per head per day mixed with their supplement.

One lot of heifers was implanted with 15 mg stilbestrol initially and reimplanted with 15 mg on May 5, 1969.

A control lot received netierh MGA or stilbestrol. All heifers were handled in the same manner and fed the same ration.

Results and rations fed are shown in the following tables. The heifers were sold on a grade and yield basis after 244 days feeding, with 87.5 per cent grading choice.

Table 7. Comparison of MGA and Stilbestrol for fattening heifers.

	MGA	15 mg. Stilbestrol	Check
No. head	8	8	8
Initial (Jan 30) wt.	434.4	435.8	434.4
Final (Oct 1) wt.	920.6	888.8	905.5
Total gain per hd.	486.2	453.2	468.1
Days fed	244	244	244
Avg. daily gain	1.99	1.86	1.92
Avg. daily ration (pounds)			
Corn silage	34.6	34.6	34.1
Barley	6.8	6.8	6.8
Minerals	0.2	0.2	0.2
Supplement	1.0	1.0	1.0
Cost/cwt gain	$13.11	$15.10	$14.54
Carcass Grade-24 head. (21 choice, 3 good			
Carcass Value-Average $214.49			

Summary:

The sMGA as fed was 100 per cent effective in controlling estrus in the heifers with no visible signs of heat observed. These heifers also gained 1.99 pounds per head per day the fastest of three lots. They were also more efficient, costing $1.45 per hundredweight gain less than the control heifers.

The heifers implanted with stilbestrol had the poorest gain and highest cost per hundred gain, $0.56 per hundredweight gain than the control heifers.

CHOPPED HAY VS. NATURAL UNCHOPPED HAY

A trial was started in November, 1966 to compare feeding two forms of hay to replacement heiders. The Hereford heifer calves used in this trial were randomly allotted into two lots in November of each year at an intital weight of about 400 pounds.

Both lots were fed crested wheatgrass-bromegrass hay on a free choice basis. In one lot the hay was feed in its natural long form, while in the other lot it was chopped through a one inch screen in a hammermill. In addition to the crested-brome hay, the ration for both lots included alfalfa hay, dry rolled barley and minerals.

In 1966-67, a small amount of corn silage and soybean oilmeal was also included in the ration.

Cost of chopping was figured against the one lot as $2 per ton.

Table 8. Rations and feed cost in the trial comparing chopped and unchopped hay.

	Natural Unchopped Hay Pounds per head per day			Chopped Hay Pounds per head per day		
	1966-67	1967-68	1968-69	1966-67	1967-68	1968-69
Crested brome hay	9.8	12.6	10.7	10.8	13.7	13.6
Rolled barley	2.9	2.0	2.76	2.9	2.0	2.0
Alfalfa hay	1.0	1.0	1.0	1.0	1.0	1.0
Silage	3.0	-	-	3.0	-	-
Soybean oil meal	0.69	-	-	0.69	-	-
Minerals	0.2	0.2	0.2	0.2	0.2	0.2
Feed cost/hd	$38.05	$28.78	$28.84	$42.51	$32.74	$33.21
Feed cost/cwt gain	$14.53	$14.23	$14.10	$15.99	$12.68	$13.89

Table 9. Summary of weights and gains in the trial comparing chopped and unchopped hay.

	Natural Unchopped Hay				Chopped Hay			
	1966-67	1967-68	1968-69	3-Yr Avg.	1966-67	1967-68	1968-69	3-Yr Avg.
Avg. initial wt.	385.9	388.6	416.4	397.0	374.5	394.5	413.6	394.2
Avg. final wt.	647.7	590.9	620.9	619.8	640.5	652.7	652.7	648.6
Avg. gain	261.8	202.3	204.5	222.8	266.0	258.2	239.1	254.4
Days fed	195	163	170	176	195	163	170	176
Avg. daily gain	1.34	1.24	1.20	1.27	1.36	1.58	1.41	1.45

Summary:

These data show that in two out of three years feeding chopped hay resulted in appreciably higher daily gains. Average daily gain for the animals fed chopped hay was .183 pounds per head higher over the entire three year period.

Chopped hay increased costs an additional $4.26 per head for the average wintering period of 176 days.

Cost per hundredweight gain was decreased by ten cents per hundredweight when chopped hay was fed.

Animals fed chopped hay ate more hay. The increased intake of chopped hay averaged .94 pound per head per day over the three year period.

When fed to replacement calves the additional cost per head would be difficult to justify. The heifers eating unchopped hay made an entirely adequate daily gain of 1.27 pounds.

Chopping hay does not change its quality. Advantage result in increased consumption and reduced waste. This shows up as increased gain and improved feed efficiency. However, it extremely poor quality hay is chopped and fed, digestive problems and lower gains can result because the animals cannot sort chopped hay.

FEEDING TRITICALE IN A FATTENING RATION TO BEEF CATTLE

This trial compares triticale with barley as a source of energy in a high roughage ration. Heifers used in this trial were fed from 375 to 900 pounds in 302 days.

Triticale was fed as a dry rolled feed in composition with dry rolled barley. The triticale and barley were analyzed as follows:

	Percent Dry Matter	Percent Ash	Percent Fiber	Percent Lignin	Percent Protein	Wt./bu
Triticale	89.63	2.46	6.05	2.40	16.75	48#
Barley	90.00	2.21	8.45	1.65	12.80	48#

Animals in both lots were sheltered in a slatted windbreak made of 1 X 6 inch boards 9 feet high spaced 1.5 inches apart. Each lot was provided with adequate summer shade. The average ration, gains and feed costs are summarized in the following tables.

Table 10. Average daily ration in pounds.

	Triticale	Barley
Average daily ration (lbs)		
Triticale	5.95	-
Barley	-	6.10
Soybean oil meal	0.50	0.50
Minerals	0.20	0.20
Corn silage	29.20	30.10
Alfalfa hay	1.60	1.60

Table 11. Summary of weight, gains, dressing percent and carcass comparison.

	BarleyTriticale	Triticale
No. head	7	8
Avg. initial wt.	374.3	372.6
Avg. final wt.	917.9	856.3
Days fed	302	302
Avg. daily gain	1.80	1.59
Avg. hot wt.	$47.0	$11.5
Avg. dressing percent	59.53	59.67
Avg. conformation	10.43	10.00
USDA grade	9.00	8.53
Loin eye sq. inches	11.86	11.21

Table 12. Feed cost per head per day.

	I Triticale			II Barley		
	Pounds	Cents		Pounds	Cents	
Triricale	(5.95)	(1.77)	=10.532			
Barley				(6.10)	(1.77)	=10.797
Soybean oil meal	(0.50)	(4.5)	=2.250	(0.50)	(4.5)	=2.250
Minerals	(0.20)	(3.67)	=0.734	(0.20)	(3.67)	=0.734
Corn silage	(29.2)	(0.36)	=10.512	(30.1)	(0.36)	=10.836
Alfalfa hay	(1.6)	(1.25)	=2.150	(1.6)	(1.25)	=2.150
Rolling	(5.95)	(0.1)	=0.595	(6.1)	(0.1)	=0.610
Total cost per head per day			26.773			27.377
Average daily gain			1.59			1.80
Average cost per lb. gain			16.84¢			15.21¢

Summary:

In this trial, triticale is not equal barley as a feed grain even though it had approximately 4 per cent more protein. Gains on barley were .21 pound per head per day faster, with a feed saving pf $1.63 per hundredweight gain, or about $8 per head for about $00 pounds gain.

The triticale fed contained ergot, which could explain the poor gains and lower feed efficiency. The triticale fed was definately lacking in palatability, withe the heifers not as interested in eating as compared to those fed barley.

SYSTEMS OF PRODUCING YEARLINGS

The beef cattle industry in western North Dakota is primarily a cow-calf operation with a high percentage of the calves sold out-of-state at weaning.

This trial was designed to study the economics and feasibility of producing yearlings for sale or to be finished for slaughter. The production of yearlings to be sold, or as finished cattle would increase the total income by utilizing local grains and roughage to good advantage.

This trial utilized 128 Hereford steer calves from the station herd. There were eight lots of eight steers in both years. The trial was divided into two phases, a wintering phase and a summer finishing phase.

In the wintering phase, the calves were wintered to gain either 0.75 pound per head per day (low level) or 1.25 pound per head per day (moderate level). The wintering phase lasted an average of 184 days.

During the wintering phase, the calves were fed about 20-25 pounds corn silage, 4 pounds crested wheatgrass hay, 0.2 pound minerals, with rolled barley, (approximately 2 pounds) for the lots wintered at a moderate level to give desired rate of gain.

The results of the wintering phases are shown in table 13.

Table 13. Producing Yearlings.

	Low Level			Moderate Level		
	1967-68	1968-69	2-Yr. Avg.	1967-68	1968-69	2-Yr. Avg.
Total hd.	32	32	64	32	32	64
Avg. initial wt.	395.2	415.8	405.5	398.4	415.8	407.1
Avg. May 9th wt.	499.7	537.8	518.8	640.9	636.6	638.8
Avg. winter gain/hd	104.5	122.0	113.3	242.5	220.8	231.8
Days fed	190	197	193	190	197	193
Avg. daily gain ration	0.550	0.619	0.585	1.276	1.122	1.197
Crested wheatgrass	4.0	4.0	4.0	4.0	4.0	4.0
Corn silage	18.7	21.8	20.3	21.6	22.9	22.2
Soybean oil meal	0.28	-	0.28 1/	0.28	-	0.28 1/
Rolled barley	-	0.57	0.57	2.0	2.2	2.1
Minerals	0.2	0.2	0.2	0.2	0.2	0.2
Avg. feed cost/hd/day	$0.125	$0.134		$0.175	$0.168	
Cost/cwt gain	$22.69	$21.68		$13.73	$14.95	
Combined avg. cost	$22.15			$14.31		

1/ one year average

From this table, we can clearly see the moderate level of wintering (1.2 pounds per head per day) was superior to the low level (0.6 pound per head per day), from an economic standpoint. It cost $22.15 per hundredweight gain at the moderate level. Thus a savings of $7.83 per hundredweight was realized by feeding for moderate gains. Calves wintered at low levels have the same maintenance requirements as those wintered at a moderate level. By increasing the feed per animal, this cost is spread over more pounds gain and hence reduces the average cost per hundredweight gain.

Following the wintering phase, half the calves (2 lots from each wintering level) were turned out an excellent crested wheatgrass pasture. The rest of the calves were kept in dry lot and fed with high silage or high barley rations. After about 90 days on pasture, half the steers with equal numbers from each of the wintering levels were returned to dry lot and finished on a full feed of rolled barley and limited corn silage. Those steers remaining on grass were supplemented with one pound rolled barley per hundredweight body weight until the grass was entirely utilized. They were then placed in dry lot and finished on barley and corn silage.

At the time the first steers came off grass, the two lots in dry lot getting a high silage ration were switched to a high barley-low silage ration and finished.

Table 14 shows the results of two years' of feeding.

From the table we see the number of days on feed varied from 350 days to 406 days. Average daily gains also varied a low 1.47 pounds to a high of 1.86 pounds per head per day.

Utilizing pasture the feed costs were very economical (under $13.00 per hundredweight) but the feeding time was extended from 11 to 66 days longer depending in wintering level in phase one.

Summary:

Wintering calves to gain less than 1.25 pounds per head per day is economical since cost pound of gain is greatly increased.

Good pasture will reduce the cost of feeding and not overly extend the feeding period when used for 60-90 days. Extending the use of pasture by supplementation with barley did not greatly affect the feed cost but this method did extend the feeding period to about two months.

In dry lot, the use of a high roughage ration early in the finishing phase did not reduce average daily gain but did reduce feed costs slightly.

Production of yearling cattle for sale or to be fed for market appears to have sound economic justification.

Table 14. Systems of producing yearlings.

	Full Feed In Dry Lot 2-Yr. Avg. Wintered		High Roughage Full Feed-Dru Lot 2-Yr. Avg. Wintered		90 Day Pasture + Full Feed 2-Yr. Avg. Wintered		Pasture + Grain + Full Feed 2-Yr. Avg Wintered	
	Low	Moderate	Low	Moderate	Low	Moderate	Low	Moderate
No. hd.	16	16	16	16	16	16	16	16
Avg. initial wt.	401.6	407.8	407.3	407.2	407.2	406.9	405.6	407.7
Avg. May wt.	515.3	630.6	515.3	632.2	526.9	652.5	517.5	641.0
Avg. final wt.	1029.1	1059.4	1028.1	1055.6	1047.8	1020.3	1000.0	1066.3
Avg. Gain/hd	627.5	651.6	620.6	646.4	640.6	613.4	594.4	658.6
Days fed	381	350	381	350	406	361	406	406
Avg. daily gain	1.65	1.86	1.63	1.85	1.58	1.70	1.47	1.63
Avg. feed cost/cwt gain	$14.41	$13.89	$14.90	$13.79	$12.81	$11.88	$12.61	$12.69
Feed/hd/day								
Crested wheatgrass	2.03	2.21	2.03	2.21	1.90	2.14	1.90	1.91
Corn silage	23.00	25.23	28.11	30.62	18.02	16.65	14.12	14.91
Rolled barley	5.70	5.35	4.99	5.14	4.15	3.80	3.52	4.47
Alfalfa hay	0.62	0.56	0.62	0.56	0.38	0.28	0.19	0.19
Minerals	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Soybean oil meal	0.28	0.28	0.28	0.28	0.14	0.15	0.09	0.09
Pasture	-	-	-	-	87	87	140	140

EFFECTS OF USING THIABENDAZOLE TO CONTROL CATTLE WORMS IN THE FEEDLOT

In May, 1969, a group of Hereford heifers were purchased from an area believed to be infested with cattle worms, for the purpose of evaluating worm control and its effects on feed lot performance.

The heifers were randomly allotted into two lots of 10 head. All heifers were implanted with 15 mg. of diethyl stilbestrol and each received a Triple Bacterin Injection. Both lots were started on a high roughage ration using corn silage, dry rolled barley, alfalfa hay and minerals.

At the start of the trial, both lots were examined for worms (Cooperia, Osterogia, and Haemonchus) by making individual worm-egg counts of fecal material on May 9th. This check indicated a high infestation in all animals. One lot, selected at random was then assigned for treatment using thiabendazole in a commercial (P.V.) Mix and fed at the recommended level of two pounds per head for one day. A repeat worm-egg count was made 37 days after feeding thiabendazole which showed a neat complete reduction in worm-egg numbers in the treated heifers, while the control heifers remained about the same as at the start.

Table 15 shows the results of the trial. Results-gains in both lots were good with no evidence of rejection or going off feed in the lots that was treated.

Table 15. Comparison of gains and rations fed to heifers dewormed with thisbendazole with untreated control heifers.

	Dewormed Lot	Control
No. Head	10	10
Avg. initial wt.	526.0	521.5
Avg. final wt.	898.0	915.5
Total gain	372.0	394.0
Days fed	213	213
Avg. daily gain	1.75	1.85
Avg. hot carcass wt.	527.0	545.4
Avg. dressing percent	58.7	559.6
Worm Egg-Count per head		
5/9/69	420 (18,480)	410 (18,040)
6/18/69	20 (880)	320 (14,080)
Ration		
Alfalfa	1.5	1.5
Corn silage	31.5	32.0
Dry rolled barley	9.3	9.3
Minerals	0.2	0.2
Cost/day	30.54¢	30.71¢
Cost/cwt gain	$17.45	$16.60

Gains were about as expected until mid-July when the dewormed heifers became infected with coccidiosis. (Eimeria zurmil, Eimeria bovis). After treatment with Sulfa Quinoxalin (5+ liquid oz. per animal in water over a 3-5 day period) gains were markedly improved.

The results show 22 lbs. greater gain and a 1.0% higher dressing percentage in the control lot. All heifers graded high good to low choice when sold. Due to the unexpected outbreak of coccidiosis, no fair comparisons can be made except to say that the thiabendazole treatment appeared to be very effective in removing worms based on the worm-egg sampling technique.

HOG FEEDING TRIALS 1968-1969

A trial was started in June, 1968 to compare three types of processing of a barley-soybean oilmeal ration. The processing consisted of (1) grinding through a 3/16 inch screen, (2) dry rolling and (3) pelleting (½ inch pellets). Cost of grinding or rolling was figured at $2 pe ton, while pelletting was figured at $10 per ton, which is the local rate charged. All feed was fed in wooden self-feeders set on a concrete platform. All pigs were fed on pasture (winter-wheat sown in the spring) and had access to automatic waterers and a portable house for shade and weather protection. All pigs were dewormed with diciovis (Atgaard) at the start of the trial. Each lots was one acre in size. The ratios were identical for all lots except for physical form, and were mixed as follows:

Barley	880 lbs
Soybean oilmeal	100 lbs
Di calcium phosphate	8 lbs
Limestone	5 lbs
Trace minerals salt	7 lbs
Zinc sulfate	113 grams

Table 16. Weight gains and feed costs in the 1968-1969 Hog-Feeding trials.

	Ground ration start to finish	Pellets to 125 lbs Ground feed to finish	Dry rolled start to finish	Pelleted start to finish
Initial wt. (pounds)	50.8	50.5	50.4	50.8
Final wt. (pounds)	197.9	210.6	191.7	218.8
Days fed	104	104	104	104
Gain/hd. (pounds)	147.1	160.1	141.3	168.0
Avg. daily gain (pounds)	1.41	1.54	1.36	1.62
Feed/cwt. gain (pounds)	357.2	353.8	387.8	339.3
Feed/hd/day (pounds)	5.1	5.4	5.3	5.5
Feed cost/cwt. gain	$7.04	$7.49	$7.64	$8.04

Summary:

There is a wide variation in rate of gain between lots. Pigs fed the pelleted ration gained 0.26 pound per head per day faster than did those fed the dry-rolled feed. When pigs were fed pellets to 125 pounds and then switched to ground feed hay still out-gained the pigs fed the dry rolled ration by 0.18 pounds per head per day. From an economic standpoint, the ground ration gave the cheapest gain, being $1 per hundredweight cheaper than the all pelleted ration.

These results indicate that dry-rolling hog feed is very costly because it produces slow gains and poor feed efficiency.

Pelleting hog feed will give maximum gain and feed efficiency. However, the present cost of pelleting makes ground feed the cheapest method of feeding.

EFFECT OF VARYING PROTEIN IN SWINE RATIONS

How important is it to provide adequate protein for growing-finishing pigs being fed a barley-oats ration? Just which level of protein is best justified from an economic standpoint? Should the level of protein change from weaning to market and if it does change, will these changes justify the expense, time and trouble?

In order to answer these questions, eight lots of Yorkshire pigs were randomly allotted in a trial beginning in November, 1968. Four lots averaged 58 pounds and four averaged 43 pounds. Each lot received a base ration of barley and oats, fortified with minerals and vitamins. Soybean oilmeal and fish meal were used to obtain levels of 16 percent, 14 percent, and 12 percent within each ration. Each lot was fed a pre-arranged ration schedule, with some lots changing and some remaining on a fixed level of protein for the entire trial. The rations fed along with cost per pound are shown in table 17. The "forta feed" is a commercial B-vitamin supplement.

Tables 18 and 19 summarize the trial results for the entire feeding period, either 119 or 140 days depending upon initial weight of pigs.

Table 17. Ration fed and cost per pound of ration.

Ingredient	16% Protein Ration	14% Protein Ration	12% Protein Ration	0% Protein Ration
Oats (lbs.)	285	310	320	325
Barley (lbs.)	575	610	650	650
Soybean meal (lbs.)	100	40	-	-
Fishmeal (lbs.)	20	20	6	-
Di calcium (lbs.)	2	3	5	19
Limestone (lbs.)	12	12	16	2
Trace mineral salt (lbs.)	5	5	5	5
Fortafeed (grams)	340	340	340	340
Vitamin A (grams)	30	30	30	30
Vitamin D (grams)	14	14	14	14
Zinc sulfate (grams)	45	45	45	45
	1000 lbs.	10001 lbs.	1003 lbs.	1002 lbs.
Calculated % protein	16.02	14.04	12.00	11.70
% Ca	0.68	0.69	0.67	0.67
% P	0.50	0.50	0.50	0.50
1968 Cost per pound	2.175¢	2.014¢	1.86¢	1.885¢

Table 18. Effect of varying protein levels in swine rations on gain and feed costs.

	14% Protein to 2-11-29 0 Protein to end	16% Protein to 2-7-69 12% to end	14% Protein entire total	12% Protein entire total	16% Protein to 2-7-69 12% to end
Initial wt. (lbs.)	57.5	59.0	57.7	58.0	43.0
Final wt. (lbs.)	200.1	206.2	198.1	185.1	192.9
Gain/hd/lbs.	146.4	147.2	140.4	127.3	149.9
Days fed	119	119	119	119	119
Avg. daily gain (lbs.)	1.23	1.24	1.18	1.07	1.26
Cost per pig	$12.03	$11.69	$11.71	$11.20	$12.18
Cost/cwt. gain	$8.23	$7.94	$8.34	$8.80	$8.13
FEED PER PIG					
16% ration (lbs.)		388.3			393.4
14% ration (lbs.)	423.3		581.4		
12% ration (lbs.)		174.2		602.1	194.7
Straight grain ration	186.6				
Total pounds	609.9	562.5	581.4	602.1	588.1
Feed/cwt. gain	416.6	382.1	414.1	473.0	392.3

Table 19. Effect of varying protein levels in swine rations on gain and feed costs.

	14% Protein entire trial	14% Protein 2-10-69 12% Protein 2-11 to 3-2-69 0 Protein 3-3 to 4-3-69	12% Protein entire trial
Initial wt. (lbs.)	42.4	43.0	42.5
Final wt. (lbs.)	205.5	209.6	198.2
Gain/hd/lbs.	163.1	166.6	155.7
Days fed	140	140	140
Avg. daily gain (lbs.)	1.17	1.19	1.11
Cost per pig	$13.09	$13.17	$12.42
Cost/cwt. gain	$8.03	$7.91	$7.98
FEED PER PIG			
14% ration (lbs.)	650.0	328.2	
12% ration (lbs.)		141.0	667.8
Straight grain ration		209.0	
Total pounds	650.0	678.2	667.0
Feed/cwt. gain	398.5	407.1	428.9

Results:

The 12 percent protein ration gave the lowest rate of gain and poorest feed efficiency at both starting weights. However, since this ration was cheap to formulate, cost per hundred pounds of gain was reasonable.

The fastest rate of gain was obtained by feeding a 16 percent start 12 percent finish ration. This combination also gave the highest feed efficiency with less than 3.9 pounds of feed needed per pound of gain. Cost of gain using this 16 percent protein ration was very good.

When feeding pigs, adequate protein must be provided during the growing phase if maximum and efficient gains are desired.

EFFECT OF SIRE LINES ON FEED EFFICIENCY AND RATE OF GAIN OF SWINE

Every saving in cost of production will increase the profit margin for the swine producer. Feed efficiency (measured in pounds of feed needed to produce a pound of pork) and rate of gain are two traits that can be improved by breeding and selection. Just as performance records are important to the cattle owner, accurate records will improve the hog farmers chances for success. With pigs, rate of gain and feed efficiency are closely correlated and about 30 percent inheritable. Hence, a boar that gains well will very likely be an efficient converter of grain to pork. Her will also be able to pass on this ability to produce efficiency to his offspring.

Over the years, this station has strived to improve the hog industry in western North Dakota by testing and improving techniques in feeding, breeding and management. In order to improve our breeding program, four different blood lines of Yorkshire pigs were evaluated in 1969. Eight lots of pigs were fed from weaning to market on concrete dry lot and two lots were fed on pasture. The ration fed in dry lot is shown in table 20. A similar ration was fed to pigs on pasture except the vitamins were not included.

The results of the trial are summarized in table 21.

Table 20. Ration fed to pigs on concrete dry lot May to September, 1969.

Barley	600 lbs.		0.177	=	$10.82
Oats	300 lbs.		0.171	=	5.13
Soybean oilmeal	70 lbs.		.045	=	3.15
Di calcium phosphate	13 lbs.		.045	=	.78
Limestone	10 lbs.		.06	=	.25
Trace mineral salt	5 lbs.		.025	=	.0125
Fortafeed	340 grams		.0005	=	.170
Vitamin A	30 grams	X	.0011	=	.033
Vitamin D	14 grams	X	.0053	=	.0742
Zinc sulfate	68 grams	X	.0052	=	.3536
					$20.8858
Plus $2.00 per ton grinding					1.00
					$21.89 per thousand lbs.

Table 21. Average weight gains and feed costs of barrows and gilts combined for 1969.

Sire	Drylot OAMC	Drylot Rebel	Drylot White Flame	Drylot DESS-2	Pasture DESS-2	Pasture Rebel
Initial wt. (lbs.)	52.7	48.3	48.9	42.9	74.6	69.7
Final wt. (lbs.)	201.5	199.9	189.3	208.9	192.2	185.8
Gain (lbs.)	148.8	151.6	140.4	166.0	117.6	116.1
Days fed	112	112	112	123	77	77
Avg. daily gain	1.33	1.35	1.25	1.35	1.53	1.51
Feed/cwt. gain	383.3	392.6	402.1	366.9	363.1	349.7
Cost/cwt. gain	$8.39	$8.60	$8.80	$8.03	$7.15	$6.89

Discussion

There was a spread from 1.25 pounds per head per day to 1.35 pounds per head per day in average daily gain. This difference shows up more clearly when we look at the feed efficiency. The slow gaining pigs ate almost 35 pounds more feed per hundred pounds of gain. When we place a dollar value on the feed, we find it cost almost 75 cents more per hundred pounds gain to feed the slowest gaining pigs.

With pigs on pasture, there was little difference in rate of gain with a small difference in feed efficiency between the sire lines.

MEETINGS AND TOURS, 1969

		Attendance
July 14	Variety Trials-Hettinger Field Day	30
July 21	Selecting Cattle for Efficient Production-Dr. Bonsma	
July 30	Variety Trials-Killdeer Field Day	1200
August 13	City Annexation-Dean Hazen	12
September 18	Dickinson Research and Breeding Herd Tour- ND Feed Manufacturer Meeting	40
Sep 29-30	Breeding Herd Tour-ND Hereford Tour	400
October 7	Preconditioning-Schnell Livestock Market	300
October 8	Haylage feeding (harvestor) at First National Bank	50
October 9	Tour of Station-Gordon Ridl and Agr. Business Students	24
October 1	Tour of Station-Jefferson Scholl 2nd and 3rd grade classes	25
December 3	Cattle and Hog Trials-Livestock Research Roundup	1200

RADIO, 1969

July 11	Field day report and discussion of steers on pasture
Sept 12	Winter wheat seeding and trials with Tom Conlon
Sept 26	Feeding triticale
Oct 3	Proven methods for weaning calves
Oct 31	Progress report on self-fed mixed rations
Nov 21	Current livestock trials
Dec 5	Self-feeding gestation sows and gilts

GENERAL SUMMARY, 1969

Date 1969	Farm visits	No. tours	Attendance at meetings	Station calls	Radio talks	News Articles	Meetings attended
July	1	0	1250	2	1	1	1
August	0	0	12	3	0	0	1
September	0	3	440	3	2	0	2
October	2	2	350	8	2	1	2
November	1	0	0	2	1	1	1
December	1	0	1200	2	1	1	1
Total	5	5	3252	20	7	4	8

REPORT OF

GRASS AND LEGUME INVESTIGATIONS

at the

DICKINSON EXPERIMENT STATION

DICKINSON, NORTH DAKOTA

1969 CROP SEASON

By

Harold Goetz and Warren C. Whitman

TABLE OF CONTENTS

ALFALFA MANAGEMENT TRIAL

A considerable amount of yield data with respect to different varieties of alfalfa are available. The performance of the alfalfa are available. The performance of the alfalfa has been measured in terms of yield, generally based on one to three cuttings during the growing season. Optimum time of cutting has been determined to be a time approximately 10 percent of the plants are in bloom. Cutting of the alfalfa at an inopportune stage in development can reduce yields as well as cause serious physiological impairment which may lead to a weakening and eventual death of the plants. This physiological weakening due to too frequent cutting or too late in the season will reduce carbohydrate reserves and may be the major reason for winter killing.

The alfalfa for thi9s trial was seeded in the spring of 1967 with oats as a cover crop. Due to a spotty and uneven stand in 1968, gathering of data was delayed until the 1969 season. The trial consists of 13 plots with a combination of 31 treatments, arranged in a random block design. Cutting dates were selected in a manner which would include various stages of maturity, regrowth, and bloom.

The data in table 1 show that the highest total yield of 9459 pounds of alfalfa was obtained in a combination of 3 cuttings consisting of June 20, August 10, and October 1. Slightly lower yields were obtained by carrying out the final clipping of the season 15 days earlier (September 15) or 15 days later (October 15) than the October 1 clipping.

Delaying of cutting dates from June 20 to June 30 and from August 10 to August 30 resulted in no regrowth for a third cutting. This was true for cutting dates of September 15, October 1, and October 15 (table 1). The average yield for this cutting combination (5452) was considerably less than the earlier starting date combination. Only slight differences in yield were observed between the June 30, August 10, and June 30 and August 30 cutting date combinations.

Cutting of alfalfa when in full bloom (approximately July 11) resulted in a yield of 2845 pounds. The combining of the full bloom cutting with a September 15 cutting resulted in a yield of 6460 pounds per acre of alfalfa, which was nearly equivalent to any combinations of cuttings made in June and August. It appears from these data that maximum yields are obtained with these combinations, although quality of hay would be considerably better with the earlier cuttings.

Relatively high alfalfa yields were observed from the second and third cuttings. Moisture conditions were conductive to good regrowth in the 1969 growing season which is generally not the normal selection. Prolonged dry periods in late summer may be experienced in the majority of years and would perhaps not allow more than a single

or perhaps a maximum of two cuttings. A relatively high weed growth was observed in some of the plots, although these will perhaps be considerably reduced after this season.

The management trial will have to be continued for a number of years to better assess the effect of date, stage of growth, and frequency of cutting of the optimum yield and survival of alfalfa in western North Dakota under dryland conditions.

Table 1. Yield and response to cutting of Ladak alfalfa at varying dates, frequency, and stages of bloom, 1969 season.

	Dry weight yields-lbs/acre			Total all clippings		
Treatments (cutting dates)	Alfalfa	Weeds	Total	Alfalfa	Weeds	Total
6-20	2334	28	2362	6004	38	6042
8-10	3670	10	3680			
6-20	2848	23	2871			
8-10	3803	0	3803	8054	23	8077
9-15	1403	0	1403			
6-20	3000	17	3017			
8-10	4462	12	4474	9459	29	9488
10-1	1997	0	1997			
6-20	2427	10	2437			
8-10	3678	0	3678	7660	10	7670
10-15	1555	0	1555			
6-30	2165	91	2256	5282	108	5390
8-30	3117	17	3134			
6-30	1920	15	1935			
8-30	2928	0	2928	4848	15	4863
9-15	No growth	No growth	No growth			
6-30	1963	29	1992			
8-30	3664	228	3892	5627	257	5884
10-1	No growth	No growth	No growth			
6-30	2561	4	2565			
8-30	3322	175	3497	5883	179	6062
10-15	No growth	No growth	No growth			
Full bloom 7-11	2845	554	3399	2845	554	3399
Full bloom 9-15	3179	88	3267	6460	94	6554
	3281	6	3287			
Full bloom 10-1	2265	725	2990	5357	725	6082
	3092	0	3092			
Full bloom 10-15	2134	357	2491	5433	395	5828
	3299	38	3337			

DRYLAND ALFALFA TRIAL

The dryland alfalfa trial was seeded in 1967 and harvested for yield and composition determinations in the 1968 and 1969 seasons. Growing conditions and plant performance were considerably less favorable in the 1968 season when compared with the performance of the legumes in 1969. Eski Sainfoin, which was not harvested in 1968 due to a poor stand, indicated a fairly good stand this season with an appreciable amount of production.

Improved stands and mid-summer precipitation in 1969 resulted in a better than average hay crop from the alfalfa plots with the second cutting contributing only slightly less hay production than was realized frpm the first production determination (table 1). Average total alfalfa and sainfoin production for all varieties in the 1969 season was 6188 pounds per acre. Weed production was extremely low with only 22 pounds per acre from all of the plots harvested. The highest producing alfalfa variety in 1969 was Roamer with 8173 pounds per acre followed by Ladak at 7794 pounds and Trovois at 7426 pounds of hay per acre. The lowest producing alfalfa variety was Fremont at 5223 pounds per acre, which was still slightly greater than 2½ tons of hay per acre which was considerably less production than was obtained from any other legumes of the trial.

Table 2 shows the 2-year average production and composition data for the legume trial. The 1968 yields were appreciably less than those observed in the 1969 season. Weed production was also substantially greater than in 1969 and accounted for a significant portion of the yields. The weed proportion was reduced to a nearly insignificant amount in the 1969 season.

Total production of all alfalfa varieties in 1968 was 1803 pounds of alfalfa per acre compared with 6188 pounds per acre in 1969. This is an increase in production of approximately 2 tons per acre for all alfalfa varieties and includes Eski Sainfoin not harvested in 1968.

The 2-year average data show tha Roamer alfalfa variety to be the highest yielding at 5012 pounds, Ladak at 4909, and Travois at 4894 pounds per acre. Stands of the alfalfa varieties have generally improved since 1968 and are now well established. The Eski Sainfoin stand remains quite thin and is considerably below what would be acceptable as an optimum or normal plant density. Emerald crown vetch, the only other legume of the trial, does not presently appear to be establishing a stand as only a few scattered plants were visible on the seeded plots in 1969.

Table 1. Composition and yields in 1969 from two cuttings of legume plots seeded in 1967.

	Lbs/acre-dry weight yield								
	First clipping			Second clipping			Total yield-lbs/acre		
Variety	Legume	Weeds	Total	Legume	Weeds	Total	Legume	Weeds	Total
Emerald crown vetch	-	-	-	No	Stand		-	-	1/
Roamer alfalfa	4536	0	4536	3637	0	3637	8173	0	8173
Ladak alfalfa	4296	9	4305	3498	0	3498	7794	9	7803
Travois alfalfa	4009	0	4009	3417	0	3417	7426	0	7426
Teton alfalfa	3618	0	3618	3243	0	3243	6861	0	6861
Norseman alfalfa	3277	12	3289	2925	0	2925	6202	12	6214
Vernal alfalfa	3042	0	3042	2840	0	2840	5882	0	5882
Ranger alfalfa	2788	34	2822	2779	0	2779	5567	34	5601
Dawson alfalfa	2918	0	2918	2593	0	2590	5511	0	5511
Fremont alfalfa	2701	128	2829	2522	0	2522	5223	128	5351
Eski alfalfa	1700	28	1728	1545	8	1553	3245	36	3281
AVERAGE	3289	21	3310	2900	1	2901	6188	22	6210

1/ Not included in average.

Table 2. Two-year average (1968-1969) hay yields and composition from legume plots seeded in 1967.

	Lbs/acre-dry weight yield								
	First clipping			Second clipping			Total yield-lbs/acre		
Variety	Legume	Weeds	Total lbs/acre	Legume	Weeds	Total lbs/acre	Legume	Weeds	Total lbs/acre
Emerald crown vetch		No stand			Poor stand			-------	
Roamer alfalfa	1851	471	2322	8173	0	8173	5012	236	5248
Ladak alfalfa	2024	569	2593	7794	9	7803	4909	289	5198
Travois alfalfa	2362	359	2721	7426	0	7426	4864	180	5074
Teton alfalfa	2034	461	2495	6861	0	6861	4448	230	4678
Norseman alfalfa	1631	468	2099	6202	12	6214	3917	240	4157
Vernal alfalfa	1639	279	1918	5882	0	5882	3761	139	3900
Ranger alfalfa	1656	350	2006	5567	34	5601	3612	192	3804
Fremont alfalfa	1585	503	2088	5223	128	5351	3404	316	3720
Dawson alfalfa	1444	466	1910	5511	0	5511	3478	233	3711
Eski alfalfa		No stand		3245	36	3281	3425	36	3218 2
AVERAGE	1803	436	2239	6188	22	6210	3996	229	4225

1/ Not included in average.
2/ One-year average.

NATIVE RANGE FERTILIZATION WITH NITROGEN AND PHOSPHORUS FERTILIZER

The natural productivity of native grassland in western North Dakota is generally considerably below the known potential. Productivity on much of this rangeland is low due to extended periods of overgrazing, too early grazing in the spring and higher than recommended stocking rates. The net result of this type of land use or management practice has been an increase in plant species which are less desirable than those originally in abundance, creation of a poor soil condition by way if trampling and erosion, and a general reduction in nutrient level in the soil. An improvement of the production of these grasslands by mean s of fertilization was initiated in 1964 and has been continued through the 1969 growing season at the Dickinson Experiment Station and on selected sites in the immediate vicinity.

Six-year average dry-weight yields from the four native range sites fertilized with different rates of nitrogen, nitrogen and phosphorus in combination, and phosphorus alone are shown in table 1. Yields for only the 1969 season are in table 2. Tables 3 and 4 show the percentage composition of the various types if grass and forb components and the annual total yields from each site over the 6-year trial period, respectively.

The fertilization trial consisted of four range sites selected on the basis of their importance in terms of the number of acres represented and the applicability of the results from the experimental trial to the rangeland of the area. The sites selected were designed by the soil series names and included a Vebar site (sandy hills), Havar site (sagebrush flat), Solonetz site (panspots), and Farland site (river terrace). The Vebar site is located at the Dickinson Experiment Station Headquarters, the Havre on Experiment Station land in the Badlands south of Fryburg, the Solenetz on United States Forest Service land south of Fruburg, and Farland site located on private land on the Heart River by Taylor, North Dakota. The trail consisted of check plots (no nitrogen), 33 lbs, N, 67 lbs, N, 100 lbs. N, 33 lbs. N + 48 lbs. P, and 48 lbs. P per acre. Plots were fertilized in the spring of each year and consisted of nitrogen and phosphorus in granular form. The plots and surrounding areas were grazed during the summer months. Steel-wire cages were placed on a portion of the fertilized areas to protect them from grazing in order to allow yield determinations to be made at the end of the growing season. Yield determinations consisted of clipping to ground level of all the vegetation inside of a designated plot size under the steel-wire cages, separation of the grasses and forbs into various components, and oven-drying the different plant species for weight determinations. Numerous other data were taken from the plots during the growing season which will not be included in this report.

The 6-year data show that the Havre range site was the highest producing of the sites studied (table 1). This site has a high inherent productive capacity because it is somewhat low lying and has better soil moisture retention capacity. The site has not been heavily grazed for many years. The data show that the 67-pound-nitrogen rate results in the highest producing rate per unit of applied nitrogen. The 100 pound rate showed a lower production than that observed with the 67-pounds of nitrogen. Nitrogen application at the 33-pound rate, in combination with phosphorus, and phosphorus alone did not show any appreciable increase in production over the observed on the check plots. Generally the same relationship was also observed on this site in the 1969 season (table 2).

The Vebar, Farland, and Solonetz sites showed a similar response to nitrogen and phosphorus fertilization as was observed on the Havre site. The highest increase in production above that of the check plots was found to be at the 67-pound nitrogen rate. Howeverm continued increases in production to the 100-pound nitrogen rate were noted, although the increment of increase in forage for each additional pound of applied nitrogen beyond the 67-pounds per acre rate was extremely small (table 1). Phosphorus in combination with nitrogen and phosphorus alone did not increase production on the Vebar site and only slightly above that of the check plots on the Solonetz site. The data for the 1969 growing season showed a similar annual response by the vegetation of the different sites to fertilization as was observed over the 6-year trial period (table 2).

The application of phosphorus fertilizer alone or in combination with nitrogen fertilizer does not appear feasible at this time. With the exception of the Havre site, where a slight response to the phosphorus was noted, the presence of the phosphorus has resulted in yields only slightly better or less than that of check plots. Indications are that the use of the phosphorus fertilizer are not needed by the native grasses and may even tend to inhibit proper development of some species, resulting in yields below that of plots with no fertilizer.

Table 1. Average dry weight yields on four native grass sites fertilized with nitrogen, nitrogen plus phosphorus, and phosphorus alone, 1964-1969 season.

Site	Treatment	Dry weight yield-lbs/acre						
		Mid grasses	Tall grasses	Short grasses	Total grasses	Perennial forbs	Annual forbs	Total yield
Vebar (Sandy hills)	0 lbs N	267	45	697	1008	246	77	1332
	33 lbs N	231	59	968	1258	367	41	1666
	67 lbs N	414	29	1232	1676	567	47	2290
	100 lbs N	436	81	1222	1733	570	22	2331
	**33 N + 48 P	209	35	550	794	428	25	1247
	*48 P	277	34	508	819	220	28	1067
Havre (Sagebrush flat)	0 lbs N	2069	-	17	2086	424	4	2514
	33 lbs N	2284	-	16	2300	351	4	2655
	67 lbs N	2954	-	5	2959	408	1	3368
	100 lbs N	2818	-	43	2861	215	3	3079**
	**33 N + 48 P	2326	-	2	2328	210	3	2540
	**48 P	2072	-	36	2108	413	12	2533
Solenetz* (Panspots)	0 lbs N	611	-	470	1081	67	123	1271
	33 lbs N	977	-	558	1535	63	52	1649
	67 lbs N	1026	-	604	1629	73	60	1762
	100 lbs N	1088	-	417	1504	114	90	1708
	33 N + 48 P	858	-	490	1348	104	58	1509
	48 P	602	-	548	1150	134	25	1309
Farland (River terrqance)	0 lbs N	306	-	947	1253	249	30	1532
	33 lbs N	337	-	1059	1395	317	32	1743
	67 lbs N	482	-	1452	1934	498	46	2477
	100 lbs N	602	-	1578	2180	688	42	2909

* 2 year average
** 3 year average

Table 2. Forage production on four native grass range sites fertilized with nitrogen plus phosphorus at different rates, 1969 season.

Site	Treatment	Dry weight yield-lbs/acre						
		Mid grasses	Tall grasses	Short grasses	Total grasses	Perennial forbs	Annual forbs	Total yield
Vebar (Sandy hills)	0 lbs N	426	51	525	1002	298	73	1373
	33 lbs N	337	110	843	1290	391	20	1701
	67 lbs N	688	72	1015	1775	478	45	2298
	100 lbs N	624	19	1082	1725	660	19	2404
	**33 N + 48 P	274	19	763	1056	494	11	1561
	*48 P	382	50	623	1055	259	12	1326
Havre (Sagebrush flat)	0 lbs N	2242	-	20	2267	491	16	2774
	33 lbs N	2720	-	60	2780	366	11	3157
	67 lbs N	3660	-	8	3668	501	3	4172
	100 lbs N	3288	-	27	3315	337	12	3664
	**33 N + 48 P	2737	-	1	2738	318	7	3063
	**48 P	2363	-	42	2405	343	11	2759
Solenetz* (Panspots)	0 lbs N	493	-	465	958	47	34	1039
	33 lbs N	947	-	620	1567	73	42	1682
	67 lbs N	927	-	693	1620	90	48	1758
	100 lbs N	986	-	461	1447	104	82	1633
	33 N + 48 P	1046	-	500	1546	87	60	1693
	48 P	722	-	442	1164	111	30	1305
Farland (River terrqance)	0 lbs N	315	-	851	1166	110	20	1296
	33 lbs N	426	-	1125	1551	71	32	1654
	67 lbs N	819	-	1559	2378	156	56	2590
	100 lbs N	910	-	1540	2450	233	42	2725

* 2 year average
** 3 year average

Table 3. Percentage composition of yields from native grass range sites fertilized with nitrogen, nitrogen plus phosphorus, and phosphorus alone, 1964-1969 season.

Site	Treatment	Dry weight yield-lbs/acre						
		Mid grasses	Tall grasses	Short grasses	Total grasses	Perennial forbs	Annual forbs	Total 1/ yield
Vebar (Sandy hills)	0 lbs N	20.0	3.4	52.3	75.7	18.5	5.8	1332
	33 lbs N	13.9	3.5	58.1	75.5	22.0	2.5	1666
	67 lbs N	18.0	1.3	53.8	73.1	24.8	2.1	2290
	100 lbs N	18.7	3.4	52.4	74.5	24.5	1.0	2331
	**33 N + 48 P	16.8	2.8	44.1	63.7	34.3	2.0	1247
	*48 P	26.0	3.2	47.6	76.8	20.6	2.6	1067
Havre (Sagebrush flat)	0 lbs N	82.3	-	0.7	83.0	16.9	0.1	2514
	33 lbs N	86.0	-	6.0	86.6	13.2	0.2	2655
	67 lbs N	87.7	-	1.0	87.8	12.1	0.1	3368
	100 lbs N	91.5	-	1.4	92.9	7.0	0.1	3079
	**33 N + 48 P	91.6	-	0.1	91.7	8.2	0.1	2540
	**48 P	81.8	-	1.4	83.2	16.3	0.5	2533
Solenetz* (Panspots)	0 lbs N	48.1	-	37.0	85.1	5.2	9.7	1271
	33 lbs N	59.2	-	33.8	93.0	3.8	3.2	1649
	67 lbs N	58.2	-	34.3	92.5	4.1	3.4	1762
	100 lbs N	63.7	-	24.4	88.1	6.7	5.2	1708
	33 N + 48 P	56.9	-	32.5	89.4	6.9	3.7	1509
	48 P	46.0	-	41.9	87.9	10.2	1.9	1309
Farland (River terrqance)	0 lbs N	20.0	-	61.8	81.8	16.2	2.0	15.32
	33 lbs N	19.2	-	60.8	80.0	18.2	1.8	1743
	67 lbs N	19.5	-	58.6	78.1	20.1	1.8	2477
	100 lbs N	20.7	-	54.2	74.9	23.7	1.4	2909

* 2 year average
** 3 year average

Data showing the percentage composition of yields for the 6-year period are given on table 3. In general, the relative proportions of the individual components of yield have remained relatively stable. However, it must be pointed out that the perennial forb component on the Vebar and Farland sites has increased over that observed on check plots by approximately 100 percent at the high levels of nitrogen fertilization. The concomitant increase in the grass component at the same high treatment levels has kept the percentage composition at a fairly constant proportion. The continuing increase in perennial forbs, especially the undesirable species, must be closely observed in the future and may require certain controls in order to maintain a proper balance of grasses and forbs in the grassland community. A desirable change of the plant community on all but the Havre site might be an increase in

Table 4. Annual total dry-weight yields on four native grass sites fertilized with nitrogen, nitrogen plus phosphorus, and phosphorus alone, 1964-1969 season.

		Dry weight yield-lbs/acre						
Site	Treatment	Mid grasses	Tall grasses	Short grasses	Total grasses	Perennial forbs	Annual forbs	Total 1/ yield
Vebar (Sandy hills)	0 lbs N	1283	2224	1296	839	975	1373	1332
	33 lbs N	1748	2791	1654	1040	1060	1701	1666
	67 lbs N	2375	3720	2413	1442	1493	2298	2290
	100 lbs N	2361	4110	2387	1409	1315	2404	2331
	**33 N + 48 P				905	1275	1561	1247
	*48 P					807	1326	1067
Havre (Sagebrush flat)	0 lbs N	1720	3320	2189	2699	2384	2774	2514
	33 lbs N	2265	3452	2132	2625	2300	3157	2655
	67 lbs N	2949	4307	2526	3356	2898	4172	3368
	100 lbs N	3250	4435	2055	2593	2477	3664	3079
	**33 N + 48 P				2546	2011	3063	2540
	**48 P				2649	2175	2759	2533
Solenetz* (Panspots)	0 lbs N					1415	1039	1271
	33 lbs N					1616	1682	1649
	67 lbs N					1765	1758	1762
	100 lbs N					1783	1633	1708
	33 N + 48 P					1324	1693	1509
	48 P					1312	1305	1309
Farland (River terrqance)	0 lbs N	1524	1722	1513	1511	1624	1296	1532
	33 lbs N	1873	2036	1806	1491	1599	1654	1743
	67 lbs N	2693	2935	2804	1837	2004	2590	2477
	100 lbs N	3324	3504	3148	2367	2387	2725	2909

* 2 year average
** 3 year average

the midgrass component at the expense of the shortgrasses. A much higher potential for production might be realized from this shift in the vegetation provided the species which are encouraged are of a desirable nature.

It appears from the results of the study thus far that native grassland production can be substantially increased by nitrogen fertilization. The amount of increase in productivity which can be expected is closely related to the site (soil, etc.) and prevailing climatic factors. The total dry-weight yields for any given season or site may fluctuate appreciably from one season to another (table 4). The response of the plants to the presence of the nitrogen, however, is still substantial despite the relatively poor conditions. The total amount of forage increase may be greatly reduced in a given year especially due to the lack of adequate moisture or other adverse growing conditions, although increases in forage production between treatments remains relatively stable.

Nitrogen fertilization of native rangelands may be economically feasible it carried out with some discretion. Application of nitrogen at rates which are too low or too high may be financially unsound. This study thus far has shown that the 67-pound rate may be near the optimum amount to apply. Certain range sites will not show a high enough increase in production to warrant fertilization, which will require selection of range sites with inherent high production for fertilization. The continued reduction in the price of nitrogen fertilizer will allow better economical returns for investment and may allow fertilization of sites with lower production potential. Caution and careful planning will be necessary for the most effective and efficient use of fertilizers for increasing native grassland productivity.

FERTILIZED SEEDED GRASSES

1. Hay fields from the fertilizer trial:

This trial has been referred to in previous reports as the "new fertilizer trial", but this term is not appropriate since hay fields have been taken from the plots for 12 consecutive years. The trial was given the name "new fertilizer trial", when it replaced a previous small plot trial. In this trial Nordan crested wheatgrass and Russian wildrye are compared under hay and pasture clipping in pure stand, in mixture with alfalfa, and with annual applications of nitrogen fertilizer at rates of 33, 67, and 100 pounds of nitrogen per acre. The trial was seeded in the spring of 1956, and hay clippings have been taken since 1958, although pasture clippings have been taken only since 1961. Fertilizer applications were made on the plots in late fall of 1957 and 1958, but all subsequent applications were made in early spring, usually in April.

Hay yields of Nordan crested wheatgrass for the period of the trial are given in table 5, and the hay yields for Russian wildrye in table 6. The 1969 hay yields of both grasses were below the average for the period under most treatments, with crested wheatgrass yields somewhat farther below average than were the Russian wildrye hay yields. The increase in yield from the fertilizer treatments in the 1969 season were reasonably good, but far from outstanding.

As shown by the date of tables 5 and 6, on the average over the period of the trial the fertilizer applications have resulted in appreciable increases in the hay yields of both grasses. With the 12-year average check yield of crested wheatgrass at 1647 pounds hay per acre (over-dry), the mixture with alfalfa has yielded 2828 pounds per acre more than the check; with 33 pounds N the yield has averaged 619 pounds more; with 67 pounds N, 1007 pounds more; and with 100 pounds N, 1231 pounds more. In the case of Russian wildrye with the check yield at 1087 pounds per acre, comparable hay yields have been: with alfalfa 273 pounds more than the check; with 33 pounds N, 526 pounds more; with 67 N, 951 pounds more; and with 100 N, 1317 pounds more.

If hay is valued at $1.00 per pound and nitrogen at 10¢ per pound, all rates of fertilization would have been profitable on the average for the whole period of the trial. However, the 33-pound rate would have produced the best returns in terms of pounds of extra grass produced per pound of applied nitrogen. The use of 33 pounds N on crested wheatgrass produced 19 pounds of extra grass per pound of nitrogen, the 67-pound rate produced 15 pounds extra hay per pound of N, and the 100-pound rate produced 12 pounds extra per pound of - a nearly marginal return. With Russian wildrye 33-pounds N produced 16 pounds of extra hay per pound of nitrogen, 67-pounds N produced

Table 5. Hay yields of Nordan crested wheatgrass in pure stands, in mixture with alfalfa, and fertilized at three different rates.

	Dry-weight yield - Lbs/acre				
Year	Grass alone	With alfalfa	33 lbs N	67 lbs N	100 lbs N
1958	1809	1647	1832	2491	2724
1959	1416	1827	2120	1737	2011
1960	2134	2485	2910	2713	2714
1961	1036	1012	1187	1120	1108
1962	1859	2136	3171	3242	3573
1963	3075	3268	4438	6030	6881
1964	905	1044	1016	1401	1458
1965	1786	2412	3140	4281	4781
1966	946	1619	1604	1658	1795
1967	2254	2813	2960	3344	3795
1968	1096	1335	1349	2094	1992
1969	1177	1548	1469	1736	1702
AVERAGE	1647	1929	2266	2654	2878

Table 6. Hay yields of Russian wildrye in pure stands, in mixture with alfalfa, and fertilized at three different rates.

	Dry-weight yield - Lbs/acre				
Year	Grass alone	With alfalfa	33 lbs N	67 lbs N	100 lbs N
1958	941	1111	1224	1613	1984
1959	778	841	975	971	1086
1960	1287	1312	1710	1823	1997
1961	643	616	821	761	777
1962	1338	1395	2041	2077	2746
1963	1661	2230	2345	3806	4388
1964	1425	1446	2132	2055	2694
1965	1083	1415	2147	3618	4477
1966	1360	1719	1884	2253	2319
1967	998	1640	1756	2823	2405
1968	526	1158	822	1017	2248
1969	1009	1438	1502	1639	1730
AVERAGE	1087	1360	1613	2038	2404

15 pounds grass per pound of N, and 100-pounds N produced 13 pounds extra grass per acre. In general, the use of 100 pounds of nitrogen does not seem to be economically justifiable on these grasses cut for hay.

2. Pasture yields from fertilized grasses:

Tables 7 and 8 give the pasture clipping yields for Nordan crested wheatgrass and Russian wildrye over the year period 1961-1969. Under the pasture-clipping treatment the grasses are allowed to grow to a height of 4 inches and are then cut back to a height of 2 inches. This treatment is repeated each time during the season that the grass reaches the 4-inch height. The clippings were made twice on each plot in the 1961, 1963, 1967, and 1968 seasons and three times on each plot in the 1962, 1965, 1966, and 1969 seasons. A comparison with the average pasture-clipping yields for the period of the trial with the average hay-clipping yields show that in the case of Nordan crested wheatgrass yields, while with Russian wildrye the pasture-clipping yields were slightly greater than the hay-clipping yields.

Under the pasture clipping treatment the crested-alfalfa plots produced an average of 533 pounds more grass per acre than did the check plots. With 33-pounds N on crested wheatgrass the pasture clipping yield produced 924 pounds more grass than the check plots, and the 100-pound N plots produced 1261 pounds more than the check. At these rates crested wheatgrass under pasture clipping with 33 pounds N produced only about 12 pounds of extra grass per pound of nitrogen. With 67-pounds N crested wheatgrass produced about 14 pounds of extra grass per pound N, and with 100-pounds N the production of extra grass averaged only about 12 pounds of grass per pound of nitrogen. Thus the 33- and 100-pound rates would have been marginal in terms of relative costs and values of grass produced, while the 67-pound N rate would have been profitable.

The pasture-clipped plots of Russian wildrye-alfalfa produced an average of only 219 pounds more grass per acre than the check plots over the 9-year period of the trial. With 33 pounds of nitrogen per acre production of Russian wildrye averaged 466 pounds per acre more than on the untreated check plots. The 67-pound rate of fertilization increased the average pasture-clipping yields of Russian wildrye by 952 pounds more than the check, and the 100-pound rate increased production to 1251 pounds more than the production on the check plots. In this case both the 33- and 67-pound rates of fertilization were about equally economical, producing 14 pounds of extra grass per pound of applied nitrogen. The 100-pound rate would be marginal with an average production of about 12½ pounds of extra grass per pound of nitrogen.

A point that should not be overlooked regarding the value of nitrogen fertilization is that not only is total dry weight production increased, but also the production of protein may be substantially increased. The increased quality of the grass as a forage, resulting from higher protein content, must be taken into account in evaluating fertilizer benefits. Since grazing animals can make direct use of this better quality of grass, there may be times when benefits will be greater from fertilizing pasture than from fertilizing haylands.

The stands of both grasses have shown substantial loss in vigor under the pasture clipping treatment. Deterioration of stands has been especially serious in the Russian wildrye plots, with many dead and low vigor plants evident under all treatments, including the check plots.

Table 7. Pasture clipping yields of Nordan crested wheatgrass in pure stand, in mixture with alfalfa, and fertilized at three different rates.

	Dry-weight yield - Lbs/acre				
Year	Grass alone	With alfalfa	33 lbs N	67 lbs N	100 lbs N
1961	938	982	1011	1171	1134
1962	2097	2284	2506	3098	3964
1963	1875	2223	2459	3738	4388
1964	1102	1100	1287	1338	1453
1965	1093	1483	1581	2091	2127
1966	1371	2970	1708	2179	2477
1967	836	1704	1403	2157	2269
1968	1136	1763	1519	1889	2250
1969	1613	2328	2113	2697	3332
AVERAGE	1338	1871	1732	2262	2599

Table 8. Pasture clipping yields of Russian wildrye in pure stand, in mixture with alfalfa, and fertilized at three different rates.

	Dry-weight yield - Lbs/acre				
Year	Grass alone	With alfalfa	33 lbs N	67 lbs N	100 lbs N
1961	656	679	793	836	912
1962	2105	2221	2577	3134	3354
1963	1372	1597	2126	3086	3506
1964	980	1115	1592	2093	1859
1965	1209	1574	1965	2812	3052
1966	1458	1452	1822	2048	2699
1967	1134	1386	1347	1870	2362
1968	835	1186	1261	1406	1995
1969	1364	1874	1826	2401	2632
AVERAGE	1235	1454	1701	2187	2486

STATION GRASS AND GRASS-ALFALFA MIXTURE TRIAL

The 1969 yields and composition of the grass-alfalfa mixtures in the station trial are given in table 1, and the 11-year average yields of the mixtures are given in table 2. Table 3 gives the composition and yields of the straight grass seedings in the 1969 season, and the 11-year average yields of the grasses are given in table 4. This trial was seeded in 1958, and as shown by the data of tables 1 and 3, many of the plots have become rather badly intermixed and invaded by both crested wheatgrass and alfalfa.

In the grass-alfalfa mixture trial 7 of the 12 mixtures remain fairly true to the mixture that was originally seeded on the plots. These include the mixture of (1) Nordan crested-Teton alfalfa; (2) Lincoln brome-Ladak alfalfa; (3) Manchar brome-Ladak alfalfa; (4) Lincoln brome-Nordan crested-Ladak alfalfa; (5) Lincoln brome-Teton alfalfa; (6) Russian wildrye-Ladak alfalfa; and (7) Russian wildrye-Teton alfalfa. This means that the mixture containing Nordan crested wheatgrass, Lincoln and Maznchar bromegrass, and Russian wildrye have been able to maintain relatively good stands over the 11-year period of the trial, while stands containing green stipagrass and Intermediate wheatgrass have shown serious deterioration. Even the bromegrass and Russian wildrye plots show some invasion by crested wheatgrass.

The amounts of alfalfa have remained relatively high in most of the mixtures, averaging 36.4 percent of all mixtures. The percentage of alfalfa has varied considerably from year to year in the plots, with a generally increasing trend over the last 3 years. Despite the invasion of many of the plots by crested wheatgrass, there has been little increase in general weediness in them, and throughout the trial the plots have been relatively weed-free.

The highest producing mixture over the period of the trial has been the Nordan crested-Teton alfalfa combination with an 11-year production of 3015 pounds per acre (over-dry weight). The Lincoln brome-Ladak alfalfa mixture has been the next highest producer at 2839 pounds per acre, followed closely by the Lincoln brome-Nordan crested-Ladak alfalfa mixture at 2693 pounds per acre. The intermediate wheatgrass-Ladak alfalfa mixture, which in table 2 shows a somewhat better average yield than the latter mixture, has had very little Intermediate wheatgrass in it since 1961. The green stipa-alfalfa mixtures showed very high yields in the years immediately after establishment, but there is very little green stipa left in them now, and the yields now being produced are mainly sue to the alfalfa component in combination with the invading crested wheatgrass.

The results of the trial show that there has been a substantial increase in yield in the grass-alfalfa mixtures as compared to the yields of the same grasses in the straight grass seedings. For the period of the trial as a whole the

Table 1. Composition of 1969 hay yields from Station grass-alfalfa mixture trial seeded in 1958.

Mixtures	Dry-weight yields-lbs/acre				
	Seeded Grass	Alfalfa	Other Grass*	Weed	Total Yield
Green stipa-Teton alfalfa	1087	1568	1226	-	3881
Nordan crested-Teton alfalfa	2207	1544	5	-	3756
Green stipa (new)-Ladak alfalfa	181	1813	1716	-	3710
Intermed. wheatgrqass-Ladak alfalfa	661	1273	1654	-	3588
Lincoln bromegrass-Ladak alfalfa	2296	831	446	-	3573
Manchar bromegrass-Ladak alfalfa	2028	1262	231	-	3521
Lincoln brome-Nordan crested-Ladak alfalfa	1947	1457	-	-	3406
Intermed. wheatgrass-Teton alfalfa	224	1609	1549	-	3382
Russian wildrye (23555)-Teton alfalfa	1025	1230	701	-	2956
Green stipa-Ladak alfalfa	704	626	1623	-	2953
Lincoln bromegrass-Ladak alfalfa	1928	743	223	-	2894
Russian wildrye (2355)-Ladak alfalfa	1553	561	150	-	2264
AVERAGE	1320	1210	794	-	3324

* Mainly crested wheatgrass.

Table 2. Average hay yields from Station grass-alfalfa mixture trial seeded in 1958.

	Dry-weight yields-lbs/acre											
Mixtures	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	11-year Avg. Yield
Nordan crested-Teton alfalfa	2359	3396	1360	2970	3959	1691	3961	3495	4232	1987	3756	3015
Lincoln brome-Ladak alfalfa	2171	3272	903	2824	4524	1534	4105	2661	3851	1808	3573	2839
Intermed. wheatgrqass-Ladak alfalfa	2818	3258	755	- 1/	4093	1440	3519	2418	3493	1648	3588	2703
Lincoln brome-Nordan crested-Ladak alfalfa	2447	3204	1195	2663	3642	1862	3410	2475	3672	1649	3406	2693
Lincoln brome-Teton alfalfa	2329	2765	943	2682	4441	1698	3984	2603	3585	1458	2894	2671
Intermed. wheatgrass-Teton alfalfa	3144	3381	647	2421	4182	1255	3075	1856	4173	1416	3382	2630
Manchar brome-Ladak alfalfa	2127	2764	692	2237	3654	1315	3259	2042	3531	1504	3521	2422
Russian wildrye (2355) Teton alfalfa	1449	2307	786	1825	2859	1307	2040	1690	2631	1543	2956	1945
Russian wildrye (2355) Ladak alfalfa	1653	1716	711	2201	2526	1220	2058	1286	1906	1309	2264	1714
Green stipa (new)-Ladak alfalfa	-	-	-	3006	5714	1365	2942	2647	3708	1755	3710	3106 2/
Green stipa-Teton alfalfa	-	-	642	2684	5579	1678	4781	3270	2955	1945	3881	3046 3/
Green stipa-Ladak alfalfa	-	-	1035	2344	4290	1406	3717	2555	3436	1461	2953	2577 3/
AVERAGE	2297	2897	879	2321	4123	1481	3404	2416	3431	1624	3324	2613

1/ No harvestable yield in 1962.
2/ 8-year average.
3/ 9-year average.

Table 3. Composition of 1969 hay yields from Station grass-alfalfa mixture trial seeded in 1958.

	Dry-weight yields-lbs/acre				
Mixtures	Seeded Grass	Alfalfa	Other Grass*	Weed	Total Yield
Nordan crested	1767	1695	-	-	3462
Summit crested	1874	1286	-	-	3160
Western wheatgrass	13	1353	1605	-	2871
Green stipa (com.)	114	754	1973	-	2841
Manchar brome	1896	822	50	-	2768
Intermediate wheatgrass (Neb. 50)	539	979	1230	-	2748
Southland brome	2106	530	-	-	2636
Lincoln brome	1864	222	183	-	2269
Northern brome	1805	438	-	-	2243
Green stipa (new)	6	421	1689	-	2116
Russian wildrye (com.)	1268	532	6	-	1806
Russian wildrye (2355)	1486	193	-	-	1679
AVERAGE	1228	760	562	-	2550

grass-alfalfa mixtures have yielded about 40 percent more than the straight grass seedings. The Nordan crested-Teton alfalfa mixture has yielded 40 percent more than the straight Nordan crested seeding, the Lincoln brome-Ladak mixture 46 percent more than the pure Lincoln brome, Manchar brome-Ladak 31 percent more than Manchar brome alone, and the Russian wildrye-Teton alfalfa mixture has averaged 44 percent more than the straight Russian wildrye seeding.

In the straight grass seedings (table 3 and 4) some stand deterioration has taken place and both alfalfa and crested wheatgrass have invaded nearly all plots. Surprisingly, substantial amounts of alfalfa have invaded all crested wheatgrass, bromegrass, and Russian wildrye plots, although crested wheatgrass has not been very successful in invading bromegrass or Russian wildrye plots. Most of the invasion of alfalfa into the plots has taken place in the last three years. For the period of the trial the average yields of the crested wheatgrass varieties have ben a little over a ton per acre. The southern type brome (Lincoln and Southland) have averaged about 100 to 150 pounds less than the southern bromes. As would be expected from the growth habits of the variety, Russian wildrye has averaged substantially lower in yield than the other grasses, producing slightly over 1300 pounds per acre over the trial period. Despite the relatively high average yield shown in table 4 for Intermediate wheatgrass, there has actually been very little Intermediate wheatgrass in these plots since 1961. The yield has been produced primarily by invading alfalfa and crested wheatgrass.

Since these plots have become so badly mixed, they have very little value left as the basis for a variety yield trial. They do indicate, however, that were these plots left to themselves they would probably end up dominated largely by crested wheatgrass and Ladak alfalfa.

Table 4. Average hay yields, 1959-1969, from Station grass trial seeded in 1958.

	Dry-weight yields-lbs/acre											
Mixtures	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	11-year Avg. Yield
Intermediate wheatgrass (Neb. 50)	2865	3440	743	1855	3167	1450	2439	2312	2272	1599	2748	2263
Summit crested	2653	3310	1272	2317	2339	1138	2390	1811	2245	1101	3160	2158
Nordan crested	2346	3203	1259	2032	2475	1117	2172	1972	2179	1388	3462	2146
Southland brome	2344	3293	750	2141	2442	703	2640	1594	2022	859	2636	1948
Lincoln brome	2559	3107	971	2185	2507	799	2572	1515	2018	845	2269	1941
Manchar brome	2332	2560	707	1937	2284	974	2391	1371	1856	1218	2768	1854
Northern brome	2324	2876	540	1818	2035	763	2075	1291	1800	845	2243	1692
Russian wildrye (2355)	1368	2086	686	1727	1929	913	1478	962	1394	672	1679	1354
Russian wildrye (com.)	1404	1913	756	1530	1574	1008	1522	792	1311	782	1806	1309
Slender wheatgrass	1937	2601	-	-	2531	-	-	-	-	-	-	-
Western wheatgrass	-	-	-	-	-	934	2609	1575	1794	1350	2871	1856*
Green stipa (com.)	-	-	608	1916	2912	1237	2613	1257	1819	1344	2841	1839
Green stipa (new)	-	-	755	2441	3118	1189	2354	1376	1679	1091	2116	1791*
AVERAGE	2215	2839	822	1991	2443	1019	2271	1486	1900	1107	2550	1852

REPORT OF

AGRONIMIC INVESTIGATIONS

at the

DICKINSON EXPERIMENT STATION

DICKINSON, NORTH DAKOTA

By

Thomas J. Conlon

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

VARIETY TRIALS WITH SMALL GRAIN

The variety trials with small grains are conducted to compare and evaluate the varieties of the several small grains that are available or are soon to become available for use on farms. These tests provide comparative data on yield, disease reaction in the field and data on other agronomic characteristics important to the commercial grower. Grain is also supplied from these trials for milling and baking tests, for tests on melting quality and other quality determinations.

Variety trials have been conducted at the Dickinson Experiment Station since 1908, and have provided much useful information on the vertical performance of the several small grains under western North Dakota conditions. New varieties are being developed periodically, and these need to be compared with the varieties currently in use and evaluated for possible future use in this region.

The variety trials are seeded on summerfallow. First tillage of the summerfallow is with the moldboard plow. Maintenance of the summerfallow is with the duckfoot cultivator. Tillage of the summerfallow before seeding is with the dickfoot cultivator. Seeding it done with a double disk press drill in a randomized block arrangement. Seeding rates are 1 bushel per acre for wheat, durum and rye, 1¼ bushel per acre for barley, and 1½ bushel per acre for oats.

Fertilizer application is uniform for all varieties and follow recommendations based on soil test. Present recommendations for this site are 5-10 lbs, nitrogen pre acre and 35-40 lbs. P_2O_5 per acre when soil moisture is low at seeding time. The nitrogen will be increased to 15-30 lbs per acre when the soil moisture at seeding time is medium, and 35-45 lbs per acre when soil moisture at seeding is high.

Uniform weed control follows the current recommendations of the North Dakota Agricultural Experiment Station.

In 1969 the wheat, durum, barley and oat variety trials were seeded at the station on April 17. Seed of several varieties being increased in the South, and mot available for the April 17 seeding were seeded along with several check varieties on May 8.

Off-station grain variety trials were seeded at Beach on April 23, at Bowman on April 22, at Hettinger on April 21, Killdeer on April 24 and at Glen Ullin on April 25.

Results of all spring seeded small grain variety trials conducted by the Dickinson Experiment Station in 1969 are summarized in the following tables.

The 1968-69 winter grain variety trials were seeded at Sickinson on September 11, at Beach on September 6, and at Bowman on September 9, 1968. Germination, was excellent, and fall growth was vigorous for all entries, the trials at Dickinson winter killed completely, with less than a 1% stand survival. The trials at Bowman survived the winter in good condition, but were hailed out in July.

Growing conditions at Beach were favorable and yields at the Beach site were exceptionally good.

Results of the fall seeded grain variety trials conducted by the Dickinson Experiment Station are summarized in tables 21 and 22.

Table 1. Hard red spring wheat variety trials-Dickinson.

Variety or treatment	Yield in bushel per acre					Test Weight	Heading date	Disease	Lodging %	Height inches
	Rep 1	Rep 2	Rep 3	Rep 4	Avg.					
Thatcher	38.5	39.6	42.9	48.4	42.4	58.5	7-2			31
Selkirk	44.0	41.8	44.0	46.2	44.0	58.0	7-1			31
Justin	44.0	40.7	42.9	48.4	44.0	60.0	7-4			32
Chris	42.9	36.9	38.5	40.7	39.8	57.5	7-3			33
Manitou	41.8	42.9	38.5	46.8	42.5	58.5	7-1			33
Polk	40.2	37.4	45.7	41.8	41.3	60.0	6-30			32
Waldron	39.6	39.6	45.1	46.2	42.6	59.5	6-30			30
Neepawa R.L. 4200	41.8	37.4	46.2	50.6	44.0	60.5	7-1			31
Ciano 67	37.4	30.8	33.0	37.4	34.7	59.0	6-24			22
Sheridan	41.3	38.5	39.6	44.0	40.9	61.0	7-4	None	None	35
Red River 68	35.2	36.3	38.5	42.9	38.2	59.0	6-25			24
Fortuna	30.8	30.8	34.1	34.1	32.5	57.5	6-29			29
Wisconsin 271	41.8	32.8	42.9	52.8	47.6	60.0	6-27			26
S 6694	36.3	38.5	39.6	44.0	39.6	60.0	7-1			28
S 6579	34.1	39.6	40.7	46.2	40.2	59.0	7-1			28
Minn. II-62-2	41.8	39.6	49.5	52.8	45.9	59.0	7-6			27
Minn. II-62-61	48.4	56.1	55.0	59.4	54.7	60.5	7-4			27
GWO 1809	38.0	33.0	38.5	47.3	39.2	57.5	6-25			23
GWO 1812	29.7	30.8	34.1	41.8	34.1	60.0	6-25			25

Standard error of treatment mean=1.4443
Standard error of a difference among treatment means=2.0425
The CV=6.97. The L.S.D. @ 5% is 4.09 bushels per acre

Table 1. Wheat variety trials-Late seeding-Dickinson.

Variety or treatment	Yield in bushel per acre					Test Weight	Heading date
	Rep 1	Rep 2	Rep 3	Rep 4	Avg.		
Polk	46.2	44.0	39.6	40.7	42.9	60.0	7-5
Waldron	46.2	41.8	41.8	44.0	43.5	59.5	7-5
Fortuna	37.4	39.6	46.3	37.4	37.7	57.5	7-3
Red River 68	39.6	33.0	37.4	37.4	36.9	59.0	7-3
N.D. 483	38.5	38.5	34.1	35.2	36.6	55.0	6-30
INIA 66	52.8	48.4	42.9	42.9	46.8	60.0	6-29
N.D. 486	44.0	41.8	42.9	40.7	42.4	56.0	7-5

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	75.84	0.00	5.40
Treatments	6.	365.26	60.88	13.02
Error	18.	84.19	4.68	
Total	27.	525.29		

Standard error of treatment mean=1.0814
Standard error of a difference among treatment means=1.5293
The CV=5.29. The L.S.D. @ 5% is 3.21 bushels per acre

Table 3. Off-Station hard red spring wheat varieties-Beach.

Variety or Treatment	Yield in bushel per acre			
	Rep 1	Rep 2	Rep 3	Avg.
Thatcher	21.8	34.8	37.8	31.5
Selkirk	23.2	36.3	34.8	31.4
Justin	31.9	37.8	43.6	37.8
Chris	26.1	30.5	37.8	31.5
Manitou	29.0	31.9	37.8	32.9
Polk	34.8	37.8	40.7	37.8
Waldron	34.8	33.4	36.3	34.8
Neepawa	37.8	36.3	37.8	37.3
Ciano 67	26.1	33.4	23.2	27.6
Sheridan	30.5	34.8	37.8	34.4
Red River 68	40.7	33.4	36.3	36.8
Fortuna	27.6	33.4	42.1	34.4
Wells	34.8	43.6	43.6	40.7
Leeds	34.8	39.2	40.7	38.2
Hercules	31.9	36.3	37.8	35.3
Triticale*	34.8	40.7	43.6	39.7

* Figured on the same basis as wheat

Analysis of Variance

Source	DF	SS	MS	F
Replication	2.	398.41	0.00	15.09
Treatments	15.	359.75	37.32	2.83
Error	30.	395.94	13.20	
Total	47.	1354.09		

Standard error of treatment mean=2.0975
Standard error of a difference among treatment means=2.9662
The CV=10.34 P.C. The L.S.D. @ 5% is 6.06 bushels per acre

Off-Station Hard Red Spring Wheat Varieties-Bowman (hailed out).

Table 4. Off-Station hard red spring wheat varieties-Glen Ullin.

Variety or Treatment	Yield in bushel per acre				
	Rep 1	Rep 2	Rep 3	Rep 4	Avg.
Thatcher	42.9	42.9	42.9	47.3	44.0
Selkirk	41.8	42.9	41.8	46.2	43.2
Justin	38.5	40.7	41.8	46.2	41.8
Chris	35.2	39.6	40.7	44.0	39.9
Manitou	39.6	44.0	41.8	46.2	42.8
Polk	38.5	41.8	44.0	41.8	41.5
Waldron	41.8	40.7	44.0	47.3	43.5
Neepawa	45.1	48.4	48.4	52.8	48.7
Ciano 67	34.1	35.2	39.5	39.6	37.1
Sheridan	38.5	37.4	37.4	46.2	39.9
Red River 68	47.3	44.0	40.7	48.4	45.1
Fortuna	37.4	40.7	42.9	44.0	41.3
Wells	39.6	42.9	44.0	48.4	43.7
Triticale*	37.4	40.7	40.7	48.4	41.8

* Figured on the same basis as wheat

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	304.44	0.00	29.41
Treatments	13.	385.31	29.64	8.59
Error	39.	134.56	3.45	
Total	55.	824.31		

Standard error of treatment mean=0.9288
Standard error of a difference among treatment means=1.3135
The CV=4.38 P.C. The L.S.D. @ 5% is 6.06 bushels per acre

Table 5. Off-Station hard red spring wheat varieties-Hettinger.

Variety or Treatment	Yield in bushel per acre				
	Rep 1	Rep 2	Rep 3	Rep 4	Avg.
Thatcher	35.2	45.1	46.2	45.7	43.1
Selkirk	33.6	42.9	40.2	41.8	39.6
Justin	38.5	48.4	47.3	45.1	44.8
Chris	29.7	36.3	34.1	37.4	34.4
Manitou	36.3	45.1	44.0	45.1	42.6
Polk	34.1	42.9	42.9	41.8	40.4
Waldron	36.3	46.2	44.6	42.9	42.5
Neepawa	39.6	48.4	45.1	49.5	45.7
Ciano 67	28.6	37.4	37.4	39.6	35.8
Sheridan	35.2	37.4	37.4	37.4	36.9
Red River 68	39.6	45.1	47.3	46.2	44.6
Fortuna	36.3	39.6	37.4	39.6	38.2
Wells	35.2	44.0	38.5	40.7	39.6
Leeds	41.8	47.3	49.5	45.1	45.9
Hercules	37.4	45.1	42.9	40.7	41.5

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	551.94	0.00	61.97
Treatments	14.	732.31	52.31	17.62
Error	42.	124.69	2.97	
Total	59.	1408.94		

Standard error of treatment mean=0.8615
Standard error of a difference among treatment means=1.2183
The CV=4.20 P.C. The L.S.D. @ 5% is 6.06 bushels per acre

Table 6. Off-Station hard red spring wheat varieties-Killdeer.

Variety or Treatment	Yield in bushel per acre				
	Rep 1	Rep 2	Rep 3	Rep 4	Avg.
Thatcher	26.4	33.0	35.2	29.7	31.1
Selkirk	31.9	35.2	37.4	29.7	33.6
Justin	35.2	39.6	31.9	29.7	34.1
Chris	34.1	29.7	33.0	27.5	31.1
Manitou	34.1	38.5	34.7	29.7	34.3
Polk	38.5	38.5	41.8	35.2	38.5
Waldron	38.5	36.3	27.0	33.0	33.7
Neepawa	38.0	42.9	34.1	31.9	36.7
Ciano	30.8	34.1	29.7	27.5	30.5
Sheridan	38.5	35.2	33.0	35.2	35.5
Red River 68	33.1	34.1	31.9	28.6	31.9
Fortuna	25.3	24.2	24.2	20.9	23.7
Wells	41.8	48.4	47.3	45.1	45.7
Leeds	39.6	47.3	48.4	42.9	44.6
Triticale*	36.3	41.8	39.6	40.7	39.6

* Figured on the same basis as wheat

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	172.50	0.00	6.82
Treatments	14.	1742.06	124.43	14.76
Error	42.	354.12	8.43	
Total	59.	2268.69		

Standard error of treatment mean=1.4519
Standard error of a difference among treatment means=2.0532
The CV=8.31 P.C. The L.S.D. @5% 4.14 bushels per acre

Table 7. Durum variety trials--Dickinson.

Variety or Treatment	Yield in bushel per acre Rep 1	Rep 2	Rep 3	Rep 4	Avg.	Test weight	Disease	Lodging %	Inches
Mindum	39.6	45.1	34.1	38.5	39.3	62.5			34
Wells	37.4	48.4	37.4	33.0	39.1	61.0			33
Leeds	30.8	38.5	36.3	29.7	33.8	61.5			34
Hercules	28.6	35.2	39.6	28.6	33.0	60.5			31
D6517	23.1	29.7	24.2	22.0	24.8	59.5			30
D6580	35.2	41.8	26.4	31.9	33.8	59.0			30
Triticle*	37.4	47.3	43.5	38.5	41.7	48.5			36

* Figured on same basis as wheat.

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	339.82	0.00	9.48
Treatments	6.	765.82	127.64	10.68
Error	18.	215.08	11.95	
Total	27.	1320.72		

Standard error of treatment mean=1.7284
Standard error of a difference among treatment means=2.4443
The CV=9.86. The L.S.D. @ 5% is 5.14 bushels per acre

Table 8. Wheat variety trials-off station sites.

	Yields in bushels per acre						
Variety	Dickinson	Beach	Bowman	Hettinger	Glen Ullin	Killdeer	5-Station average
Thatcher	42.4	31.5		43.1	44.0	31.1	38.4
Selkirk	44.0	31.4		39.6	43.2	33.6	38.4
Justin	44.0	37.8		44.8	41.8	34.1	40.5
Chris	39.8	31.5		34.4	39.9	31.1	35.3
Manitou	42.5	32.9		42.6	42.9	34.3	39.0
Polk	41.3	37.8		40.4	41.5	38.5	39.9
Waldron	42.6	34.8		42.5	43.5	33.7	39.4
Neepawa	44.0	37.3	Hailed Out	45.7	48.7	36.7	42.5
Ciano 67	34.7	27.6		35.8	37.1	30.5	33.1
Sheridan	40.9	34.4		36.9	39.9	35.5	37.5
Red River 68	38.2	36.8		44.6	45.1	31.9	39.3
Fortuna	32.5	34.4		38.2	41.3	23.7	34.0
Wells	39.1	40.7		39.6	43.7	45.7	41.8
Leeds	33.8	38.2		45.9	42.4	44.6	41.0
Triticale *	41.7	39.7		39.4	41.8	39.6	40.4
L.S.D. @ 5%	4.09	6.06		2.46	2.66	4.14	1.83

* Figured on same basis as wheat.

Table 9. Oat variety trials-Dickinson.

Variety or treatment	Yields in bushels per acre					Test Weight	Heading date	Height inches
	Rep 1	Rep 2	Rep 3	Rep 4	Avg.			
Garry	103.2	101.1	107.3	117.6	107.3	34.5	7-3	37
Holden	95.9	88.7	99.0	105.2	97.2	35.0	6-25	32
Kelzey	127.9	103.2	107.3	119.7	114.5	35.5	7-2	36
Burnett	103.2	103.2	107.3	113.5	106.8	36.5	6-26	36
Brave	99.0	92.8	90.8	105.2	97.0	35.5	6-23	35
Lodi	113.5	101.1	117.6	115.5	111.9	33.5	7-5	39
Portal	97.0	92.8	90.8	109.3	97.5	35.5	6-30	34
Harmon	103.2	105.2	88.7	107.3	101.1	35.0	7-5	39
Russell	90.8	97.0	103.2	103.2	98.6	34.5	7-3	36
Sioux	111.4	107.3	99.0	121.7	109.9	35.5	7-4	36
Kota	99.0	97.0	112.4	107.3	103.9	35.5	7-1	37
Cayuse	106.2	103.2	121.7	121.7	113.2	34.5	7-1	32
C.I. 8304	99.0	108.3	118.6	115.5	110.4	34.5	6-26	32

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	1064.56	0.00	8.77
Treatments	12.	2021.94	168.49	4.16
Error	36.	1456.75	40.47	
Total	51.	4543.25		

Standard error of treatment mean=3.1806
Standard error of a difference among treatment means=4.4981
The CV=6.04. The L.S.D. @ 5% is 9.12 bushels per acre

Table 10. Off-Station oat variety trials-Beach.

Variety or Treatment	Yield in bushel per acre				
	Rep 1	Rep 2	Rep 3	Rep 4	Avg.
Holden	141.6	114.3	103.5	103.5	115.7
Kelsey	144.3	138.8	147.0	117.1	136.8
Burnett	111.6	114.3	108.9	98.0	108.2
Brave	103.5	87.1	100.7	92.6	96.0
Lodi	114.3	106.2	100.7	68.1	97.3
Portal	98.0	100.7	95.3	76.2	92.6
Harmon	117.1	108.9	108.9	100.7	108.9
Russell	125.2	108.9	109.4	108.9	113.1
Sioux	103.5	122.5	119.8	114.3	115.0

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	1088.44	0.00	7.19
Treatments	8.	5790.19	723.77	8.26
Error	24.	2102.12	87.59	
Total	35.	9780.75		

Standard error of treatment mean=4.6794
Standard error of a difference among treatment means=6.6177
The CV=8.56 P.C. The L.S.D. @5% 13.66 bushels per acre

Off-Station Oat Variety Trials-Bowman (hailed out).

Table 11. Off-Station oat variety trials-Glen Ullin.

Variety or Treatment	Yield in bushel per acre				
	Rep 1	Rep 2	Rep 3	Rep 4	Avg.
Garry	84.6	84.6	70.1	80.5	80.0
Holden	72.2	78.4	72.2	72.2	73.8
Kelsey	101.1	94.9	97.0	107.3	100.1
Burnett	76.3	78.4	68.1	78.4	75.3
Brave	74.3	66.0	74.3	76.3	72.7
Lodi	80.5	90.8	92.8	82.5	86.7
Portal	72.2	72.2	72.2	64.0	70.2
Harmon	84.6	76.3	78.4	84.6	81.0
Russell	84.6	90.8	82.5	92.8	87.7
Sioux	86.6	97.0	82.5	92.8	89.7

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	108.44	0.00	1.40
Treatments	9.	3135.87	348.43	13.49
Error	27.	697.13	25.82	
Total	39.	3941.44		

Standard error of treatment mean=2.5406
Standard error of a difference among treatment means=3.5930
The CV=6.22 P.C. The L.S.D. @5% is 7.37 bushels per acre

Table 12. Off-Station oat variety trials-Hettinger.

Variety or Treatment	Yield in bushel per acre				
	Rep 1	Rep 2	Rep 3	Rep 4	Avg.
Garry	90.8	80.5	92.8	99.0	90.8
Holden	84.6	84.6	78.4	80.5	82.0
Kelsey	115.5	119.7	105.2	107.3	111.9
Burnett	90.8	92.8	82.5	86.6	88.2
Brave	84.6	80.5	81.5	78.4	81.3
Lodi	95.9	92.8	113.5	101.1	100.8
Portal	72.2	105.2	85.6	70.1	83.3
Harmon	94.9	92.8	88.7	97.0	93.4
Russell	115.5	101.1	99.0	101.1	104.2
Sioux	92.8	92.8	107.3	97.0	97.5

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	33.94	0.00	0.17
Treatments	9.	37783.44	419.83	6.37
Error	27.	1778.87	65.88	
Total	39.	3591.25		

Standard error of treatment mean=4.0585
Standard error of a difference among treatment means=5.7395
The CV=8.70 P.C. The L.S.D. @5% is 11.78 bushels per acre

Table 13. Off-Station oat variety trials-Killdeer.

Variety or Treatment	Yield in bushel per acre				
	Rep 1	Rep 2	Rep 3	Rep 4	Avg.
Garry	49.4	55.7	61.9	72.2	59.8
Holden	45.0	41.3	51.6	49.5	46.9
Kelsey	49.4	56.7	60.9	72.2	59.8
Burnett	31.9	36.1	43.3	42.3	38.4
Brave	29.0	28.9	33.0	35.1	31.5
Lodi	49.4	53.6	58.8	55.7	54.4
Portal	43.6	40.0	57.8	61.9	50.8
Harmon	49.4	48.5	51.6	59.8	52.3
Russell	40.7	37.1	55.7	45.4	44.7
Sioux	50.8	57.8	65.0	65.0	59.7

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	1078.06	0.00	21.21
Treatments	9.	3298.87	366.54	21.64
Error	27.	457.38	16.94	
Total	39.	4834.31		

Standard error of treatment mean=2.0579
Standard error of a difference among treatment means=2.9103
The CV=8.26 P.C. The L.S.D. @5% is 5.97 bushels per acre

Table 14. Oat variety trials-off station sites.

	Yields in bushels per acre						
Variety	Dickinson	Beach	Bowman	Hettinger	Glen Ullin	Killdeer	5-Station average
Holden	97.2	115.7		82.0	73.8	46.9	83.1
Kelsey	114.5	136.8		111.9	100.1	59.8	104.6
Burnett	106.8	108.2		88.2	75.3	38.4	83.4
Brave	97.0	96.0		81.3	72.7	31.5	75.7
Lodi	111.9	97.3		100.8	86.7	54.4	90.2
Portal	97.5	92.6	Hailed Out	83.3	70.2	50.8	78.9
Harmon	101.1	108.9		93.4	81.0	52.3	87.3
Russell	98.6	113.1		104.2	87.7	44.7	89.7
Sioux	109.9	115.0		97.5	89.7	59.7	94.4
Garry	107.3	108.0		90.8	80.0	59.8	89.2
L.S.D. @ 5%	9.12	13.66		11.78	7.37	5.97	4.47

Table 15. Barley variety trials-Dickinson.

Variety or treatment	Yields in bushels per acre					Test Weight	Heading date	Diseases	Lodging %	Height inches
	Rep 1	Rep 2	Rep 3	Rep 4	Avg.					
Larker	77.0	67.4	64.6	53.6	65.7	48.0	6-27			28
Dickson	79.8	79.8	66.0	60.5	71.5	47.5	6-30			30
Conquest	71.5	72.9	64.6	51.6	65.2	46.5	6-29			33
Keystone	63.3	80.4	59.1	63.3	66.5	48.0	7-2			32
Yukon	71.5	56.4	52.3	56.4	59.2	46.5	6-30			32
Paragon	72.9	66.0	74.2	69.4	70.6	47.0	7-4			31
Galt	59.1	60.5	55.0	55.0	57.4	45.0	7-2			29
Jubilee	75.6	75.6	57.8	66.0	68.8	46.0	7-5	None	None	30
Betzes	83.9	74.3	66.0	59.1	70.8	42.5	6-30			27
Primus II	63.3	61.9	56.4	45.4	56.8	48.5	6-25			29
B 133	82.5	74.3	70.1	55.0	70.5	52.0	7-2			28
B 134	65.3	52.3	52.3	55.0	56.2	51.0	7-3			30
B 139	75.6	60.5	63.3	53.6	63.3	52.5	7-2			29
B 140	70.1	51.6	45.4	52.3	54.9	48.0	6-30			29
Br. 6145-29-1	72.9	64.6	56.4	53.6	61.9	50.5	7-1			31

Analysi s of Variance

Source	DF	SS	MS	F
Replication	3.	2150.19	0.00	22.37
Treatments	14.	1965.06	140.36	4.38
Error	42.	1345.50	32.04	
Total	59.	5460.75		

Standard error of treatment mean=2.8300
Standard error of a difference among treatment means=4.0022
The CV=8.85. The L.S.D. @ 5% is 8.08 bushels per acre

Table 16. Off-Station barley variety trials-Beach.

Variety or Treatment	Yield in bushel per acre			
	Rep 1	Rep 2	Rep 3	Avg.
Larker	63.5	70.8	67.2	67.2
Dickson	63.5	79.9	94.4	79.3
Conquest	67.2	69.0	61.7	66.0
Keystone	65.3	63.5	67.2	65.3
Yukon	72.6	69.0	67.2	69.6
Paragon	70.8	65.3	70.8	69.0
Galt	63.5	70.8	59.9	64.7
Jubilee	59.9	65.3	52.6	59.3
Betzes	65.3	70.8	70.8	69.0

Analysis of Variance

Source	DF	SS	MS	F
Replication	2.	60.75	0.00	0.72
Treatments	8.	688.56	86.07	2.03
Error	16.	677.88	42.37	
Total	26.	1427.19		

Standard error of treatment mean=3.7580
Standard error of a difference among treatment means=5.3146
The CV=9.62 P.C. The L.S.D. @5% 11.27 bushels per acre

Off-Station Barley Variety Trials-Bowman (hailed out).

Table 17. Off-Station barley variety trials-Glen Ullin.

Variety or Treatment	Yield in bushel per acre				
	Rep 1	Rep 2	Rep 3	Rep 4	Avg.
Larker	67.4	33.0	39.9	59.1	49.9
Dickson	50.9	31.6	46.8	53.6	45.7
Conquest	45.4	33.0	42.6	39.9	40.2
Keystone	55.0	39.9	46.8	57.8	49.9
Yukon	49.5	35.8	41.3	46.8	43.4
Paragon	48.1	41.3	45.4	55.0	47.5
Galt	44.0	35.8	42.5	45.4	41.9
Jubilee	49.5	38.5	45.4	59.1	48.1
Betzes	38.5	37.1	41.3	50.9	42.0

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	1350.25	0.00	17.96
Treatments	8.	425.44	53.18	2.12
Error	24.	601.44	25.06	
Total	35.	2377.12		

Standard error of treatment mean=2.5030
Standard error of a difference among treatment means=3.5398
The CV=11.03 P.C. The L.S.D. @5% 7.31 bushels per acre

Table 18. Off-Station barley variety trials-Glen Ullin.

Variety or Treatment	Yield in bushel per acre				
	Rep 1	Rep 2	Rep 3	Rep 4	Avg.
Larker	59.1	63.3	66.0	61.9	62.6
Dickson	64.6	55.0	70.1	67.4	64.3
Conquest	52.3	63.9	61.9	59.1	59.3
Keystone	60.5	63.3	77.0	64.6	66.4
Yukon	60.5	61.9	57.8	49.5	57.4
Paragon	57.1	58.4	48.1	46.8	52.6
Galt	58.4	59.1	64.6	56.4	59.6
Jubilee	64.6	64.6	61.9	60.5	62.9
Betzes	75.6	67.4	71.5	72.9	71.9

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	90.88	0.00	1.24
Treatments	8.	977.63	122.20	5.01
Error	24.	584.88	24.37	
Total	35.	1653.37		

Standard error of treatment mean=3.7580
Standard error of a difference among treatment means=5.3146
The CV=9.62 P.C. The L.S.D. @5% 11.27 bushels per acre

Table 19. Off-Station oat variety trials-Killdeer.

Variety or Treatment	Yield in bushel per acre				
	Rep 1	Rep 2	Rep 3	Rep 4	Avg.
Larker	70.8	65.3	65.3	67.4	67.2
Dickaon	71.5	50.0	74.3	77.0	68.2
Conquest	66.0	71.5	78.4	70.8	71.7
Keysrtone	64.6	64.6	67.4	68.8	66.4
Yukon	67.4	71.5	68.8	66.0	68.4
Paragon	68.8	73.3	70.1	63.3	68.9
Galt	68.1	63.3	72.9	63.3	66.9
Jubilee	61.9	56.4	60.5	61.9	60.2
Betzes	59.1	49.5	57.8	68.8	58.8

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	160.81	0.00	1.72
Treatments	8.	554.50	69.31	2.23
Error	24.	747.38	31.14	
Total	35.	1462.69		

Standard error of treatment mean=2.7902
Standard error of a difference among treatment means=3.9459
The CV=8.42 P.C. The L.S.D. @5% is 8.14 bushels per acre

Table 20. Oat variety trials-off station sites.

	Yields in bushels per acre						
Variety	Dickinson	Beach	Bowman	Hettinger	Glen Ullin	Killdeer	5-Station average
Larker	65.7	67.2		62.6	49.9	67.2	62.5
Dickson	71.5	79.3		64.3	45.7	68.2	65.8
Conquest	65.2	66.0		59.3	40.2	71.7	60.5
Keystone	66.5	65.3		66.4	49.9	66.4	62.9
Yukon	59.2	69.6	Hailed Out	57.4	43.4	68.4	59.6
Paragon	70.7	69.0		52.6	47.5	68.9	61.7
Galt	57.4	64.7		59.6	42.0	66.9	58.1
Jubilee	68.8	59.3		62.9	48.1	60.2	59.9
Betzes	70.8	69.0		71.9	42.0	58.8	62.5
L.S.D. @ 5%	8.08	11.27		7.20	7.31	8.14	3.82

Table 21. Off-Station winter wheat variety trials-Beach.

Variety or Treatment	Yield in bushel per acre					
	Rep 1	Rep 2	Rep 3	Rep 4	Avg.	Test Weight
Minter	36.3	41.6	43.6	37.0	39.6	61.5
Hume	44.9	44.9	40.9	38.9	42.4	61.5
Lancer	43.6	52.8	45.5	43.6	46.4	62.5
Winalta	40.9	42.9	38.3	37.6	39.9	63.5
Trader	53.5	51.5	46.2	42.2	48.4	62.5
Trapper	52.8	51.5	44.2	44.2	48.2	62.5
Scout 66	48.8	49.5	40.3	39.6	44.6	66.0

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	224.27	0.00	9.36
Treatments	6.	321.34	53.56	6.71
Error	18.	143.74	7.99	
Total	27.	689.34		

Standard error of treatment mean=1.4129
Standard error of a difference among treatment means=1.9982
The CV=6.39 P.C. The L.S.D. 5% is 4.20 bushels per acre

Off-Station Winter Wheat Variety Trial-Bowman (hailed out).

Table 22. Winter wheat variety trials.

	Yield in bushels per acre					
	1969 Yields			1968 Yields		
	Dickinson	Bowman	Beach	Beach	Bowman	Average
Minter	Severely Damaged by birds. Date at harvest not considered reliable	Hailed Out	39.6	54.5	38.4	44.2
Hume			42.4	48.6	27.9	39.6
Lancer			46.4	55.3	32.4	44.7
Winalta			39.9	56.3	27.2	41.2
Trader			48.4			
Trapper			48.2			
Scout 66			44.6			

NURSERY TRIALS WITH SMALL GRAIN

Small grain nursery trials with small grain are grown each year at the Dickinson Station. Two types of nurseries are grown, the Cooperative Regional nurseries and plantings of material developed by the North Dakota Agricultural Experiment Station at Fargo or Dickinson.

In the regional trials the same varieties and newly developed strains of small grain are grown at many stations in the upper midwest. This permits a rapid evaluation of these varieties and potential varieties grown under a wide range of climatic and weather conditions. This work is most useful in the evaluation and development of new varieties. It is also means of getting an early look at a large number of varieties that have been developed in other states, and Canada.

Special nurseries of material developed at North Dakota State University are grown at Dickinson from time to time to aid in the evaluation of this material under western North Dakota climatic and weather conditions.

A limited amount of wheat breeding work is done at Dickinson, and six separate plantings are made with material produced from this work. Selections from the breedng work are grown in short rows for observation and further selection. Material advanced through the F-5 planting is tested in a yield nursery large enough to provide seed for quality tests.

Table 22. Uniform regional hard spring wheat nursery-Dickinson.

Entry No.	Variety or treatment	Yields in bushels per acre				Test Weight	Heading date	Diseases	Lodging %	Height inches
		Rep 1	Rep 2	Rep 3	Avg.					
1	C.I. 3461	23.8	31.4	27.6	27.6	58.0	7-3	None	None	31
2	C.I. 10003	24.2	29.0	25.0	26.1	54.0	6-30			31
3	C.I. 13100	24.8	36.4	25.0	28.7	59.5	7-4			30
4	C.I. 13462	22.0	27.0	23.4	24.1	59.5	7-4			32
5	C.I.13751	28.2	37.2	30.6	32.0	61.0	6-30			31
6	C.I. 13773	31.6	31.0	31.0	31.2	62.0	6-30			31
7	C.I.13958	18.6	26.2	25.6	23.5	59.5	6-29			30
8	R.I. 4200	30.6	33.6	29.4	31.2	60.0	6-30			32
9	R.I, 4220	30.4	31.0	29.6	30.3	60.5	7-1			34
10	S 6579	32.0	42.8	33.0	35.9	60.0	6-30			30
11	S 6694	28.4	35.4	28.2	30.7	59.0	6-30			31
12	ND 492	31.0	32.0	29.4	30.8	59.5	6-30			31
13	ND 493	27.6	20.4	35.0	27.7	59.0	6-30			29
14	ND 494	31.4	29.6	35.6	32.2	59.5	6-30			31
15	ND 495	23.0	23.6	24.2	23.6	60.0	6-30			28
16	Wisc. 271**	37.8	30.8	33.2	33.9	61.5	6-30			29
17	Sel. No 678-I-6-9	35.0	32.2	33.6	33.6	62.0	6-26			28
18	II-62-2**	38.0	35.0	36.0	36.3	60.0	7-7			29
19	II-62-61**	36.6	36.6	37.8	37.0	61.0	7-2			27
20	MT 677	33.8	25.8	27.6	29.1	59.0	7-2			30
21	MT 6723	30.8	25.0	28.4	28.1	56.5	7-3			30
22	C.I. 14193	35.4	23.0	27.0	28.5	61.0	6-26			29

** Semi dwarf types.

Table 24. Advanced Station hard spring wheat nursery-Dickinson.

Entry No.	Variety or Treatment	Yield in bushel per acre				Test Weight
		Rep 1	Rep 2	Rep 3	Avg.	
1	Conley x ND 45	30.0	29.2	34.0	31.1	60.0
2	"	34.0	29.2	28.6	30.6	60.5
3	RL 2937 x ND 45	27.0	30.8	31.2	29.7	61.0
4	"	29.6	34.6	29.2	31.1	60.0
5	ND 49 x PI Prem-II-44-22	33.6	36.6	35.2	35.1	59.5
6	Justin	30.4	44.4	27.2	34.0	61.0
7	ND 42-3-1-5 x 0.97	29.2	31.0	29.6	29.9	60.5
8	ND 476	29.2	29.0	32.4	30.2	60.0
9	Waldron	27.0	33.4	33.2	31.2	59.5
10	Polk	31.4	25.0	39.2	31.9	60.5
11	Fortuna	21.0	28.4	32.6	27.3	59.5
12	II-62-2	30.8	35.8	38.2	34.9	59.0
13	II 62-61	27.4	43.0	41.0	37.1	59.5
14	S-6579	24.0	30.0	31.4	28.5	59.0
15	S-659	28.6	37.6	34.2	33.5	60.5

Table 25. DeKalb-wheat planting-Dickinson.

Variety or treatment	Yields in bushels per acre				Test Weight	Heading date	Height inches
	Rep 1	Rep 2	Rep 3	Avg.			
Waldron	35.2	41.0	32.5	36.2	59.0	7-9	35
Polk	31.0	29.2	34.0	31.4	61.5	7-10	36
Fortuna	32.7	37.0	36.5	35.4	61.5	7-10	36
Red River 68	32.5	27.8	29.6	30.0	59.5	7-8	29
DeKalb Exp. 4114 A 28.2	28.2	29.6	33.4	30.4	59.5	7-11	28

Table 26. Yield in bushels per acre from the hard red dpring wheat nursery trials grown at North Dakota Stations.

	Yields in bushels per acre						
				Carrington			
Variety or Line	Dickinson	Williston	Minot	Dryland	Irrigated	Langdon	Fargo
Chris	--	25.3	42.0	53.5	43.8	44.7	36.1
Polk	31.4	26.6	--	56.0	51.6	--	40.7
Fortuna	35.4	26.6	--	--	--	--	--
Waldron	36.2	26.0	47.3	57.6	58.8	54.9	37.6
Neepawa	--	--	--	--	--	--	42.0
Red River 68	30.0	23.7	--	58.6	59.0	--	--
Ciano 67	--	--	--	53.3	61.3	--	41.5
Dekalb 4114A	30.4	27.4	53.9	56.9	55.7	56.5	44.4
L.S.D. @ 5%	6.0	3.0	7.6	5.3	8.6	--	7.8

Table 27. Summary of other agronomic data from the hard red spring wheat nursery trials at Noth Dakota Stations.

				Diseases			
Variety or Line	Date Headed	Height (inches)	Lodging Score [1/]	Leaf rust	Stem rust	Other leaf [2/]	Test Wt. (Lbs)
Chris	7-11	41	5.1	0	0	3.7	59.7
Waldron	7-8	37	1.8	TrR	0	5.7	59.2
Dekalb 4114A	7-9	30	1.5	TrR	0	5.1	58.3

1/ 1 is erect; 9 is completely lodged.
2/ Leaf spotting diseases, rated on a scale 1-10 most severe.

Table 28. Uniform regional durum nursery-Dickinson.

Entry No.	C.I. or Sel. No.	Variety or Treatment	Yield in bushels per acre				Test weight	Heading date	Height inches
			Rep 1	Rep 2	Rep 3	Avg.			
1	S296	Mindum	35.0	29.8	34.6	33.1	64.5	7-5	36
2	13333	Wells	35.0	32.0	34.6	33.9	62.0	7-5	34
3	13766	Leeds	27.0	27.0	23.0	25.7	61.5	7-4	35
4	DT191	Hercules	28.0	27.6	24.4	26.7	60.5	7-1	34
5	DT316	Lk*s/Pellssier	34.2	38.0	37.6	36.6	60.5	7-7	36
6	DT317	Lk*2/Pellssier	33.0	33.0	32.2	32.7	62.0	7-6	37
7	D6517	Lds/Ldn/St Complex	18.0	25.6	24.2	22.6	61.5	6-29	31
8	D6580	64-130-Lds	24.0	28.4	27.2	26.5	60.5	7-1	32
9	D6586	Lds/Ldn/Br134	24.8	26.2	30.8	27.3	62.5	7-1	33
10	D6674	60-62/61-42	27.6	30.6	33.6	30.6	62.0	7-1	33
11	D6676	60-62/61-42	25.4	30.6	35.8	30.6	62.0	7-1	31
12	D6678	60-62/61-42	23.0	30.4	39.2	30.9	61.0	6-30	31
13	D6687	61-130/61-42	33.0	27.0	27.2	29.1	61.5	7-2	33
14	D6688	61-130/61-42	23.0	25.4	23.8	24.1	61.5	6-30	29
15	D6690	61-130/61-42	20.2	34.0	25.6	26.6	62.0	6-30	28
16	D6647	61-130/Lds*	25.4	34.2	45.0	34.9	62.5	7-2	26
17	D6654	61-130/Lds*	26.0	31.0	25.2	27.4	62.5	7-2	28
18	D6655	61-130/Lds*	29.0	30.6	35.4	31.7	62.5	7-2	28
19	D6659	61-130/Lds*	23.4	33.0	27.0	27.8	62.5	7-2	26
20	D6660	61-130/Lds*	33.6	27.0	29.0	29.9	62.0	7-2	30

* Semidwarf types

Table 29. Uniform regional oats experiment#90.

Entry No.	Variety or Treatment	Yields in bushels per acre				Test weight	Heading date	Disease	Lodging %	Height inches
		Rep 1	Rep 2	Rep 3	Avg.					
1	ILL 30840	84.4	80.0	76.8	80.4	36.5	6-25			28
2	ILL 63-1062-2	104.0	72.4	88.8	88.4	36.0	6-25			33
3	ILL 63-1668-1	117.2	106.4	90.4	104.7	33.5	7-3			35
4	Minn. II-31-21	119.6	94.8	99.2	104.5	35.5	6-26			34
5	Minn. II-54-109	103.6	95.2	94.0	97.6	34.5	6-26			32
6	Minn. 674	95.2	90.4	122.0	102.5	35.5	6-30			34
7	MO 04205	94.8	103.6	112.0	103.5	35.0	6-29			36
8	NY S279A1B-3B-70	106.0	128.4	122.4	118.9	32.5	6-30			30
9	PUR 5328A3-4P-2	116.4	94.0	99.2	103.2	38.0	6-26			30
10	PUR 5877	80.8	83.6	73.2	79.2	36.5	6-25			32
11	PUR 5912RB1-3-2	91.2	76.0	89.2	85.5	35.0	6-25			34
12	PUR 6316A2-4	86.8	68.8	76.4	77.3	35.5	6-29	None	None	27
13	SD B64PROI-178	104.8	107.2	105.2	105.7	36.5	7-1			37
14	SD B65PROI-469	109.2	86.0	92.0	95.7	36.0	6-26			32
15	SD B65PROI-955	104.0	98.6	86.8	96.5	35.5	6-26			32
16	SD B65PROI-1541	85.6	74.4	91.2	83.7	35.5	6-26			32
17	SD B65PROI-1596	85.6	76.4	88.6	83.5	35.5	6-27			31
18	Wisc. X643-41	66.8	58.0	81.6	68.8	36.0	6-27			27
19	Wisc. X697-2	104.4	110.4	112.4	109.1	32.5	7-3			41
20	Wisc. X995-4-1	101.2	112.8	112.0	108.7	33.5	7-3			35
21	Wisc. X1181-2	88.4	92.0	107.2	95.9	36.0	7-1			34
22	Wisc. X1137-5	76.0	80.0	80.0	78.7	36.0	6-27			32
23	ILL 63-1105	89.6	87.2	82.4	86.4	34.5	6-26			34

Table 29. Uniform regional oats experiment#90 continued.

Entry No.	Variety or Treatment	Yields in bushels per acre				Test weight	Heading date	Disease	Lodging %	Height inches
		Rep 1	Rep 2	Rep 3	Avg.					
24	ILL 66-2345	85.2	88.0	100.0	91.1	36.0	6-26	None	None	31
25	PUR S939B1-3-9-3	106.4	88.0	91.2	95.2	34.5	6-27			30
26	Iowa M710	85.2	79.2	89.2	84.5	36.5	6-26			34
27	Mich. 60-101-1-20	120.0	112.4	112.8	115.1	34.5	7-3			38
28	Mich. 60-106-1-78	96.4	102.8	111.2	103.5	37.0	7-3			36
29	Mich. 64-132-20-2	100.0	103.2	118.0	107.1	31.5	7-8			37
30	Mich. 64-152-4-19	92.0	106.8	120.4	106.4	34.5	7-8			38
31	NY ML-5	105.2	94.8	117.2	105.7	32.5	7-3			37
32	NY 5279-105	130.4	121.2	110.0	120.5	32.0	7-2			31
33	NY 5832-4	131.6	118.0	140.0	129.9	37.0	7-4			32
34	NY 6083	114.8	120.0	110.0	114.9	32.5	7-2			32
35	Wisc. X1069-3-2	85.2	97.2	95.2	92.5	30.5	6-28			36

Table 30. Averages over all station for the indicated variables, in the uniform regional oat experiment #90.

Entry No.	C.I. or Sel. No.	Yield Bu/A	Test Wt. Lbs/bu	Height inches	Lodging %	Date head	Date ripe
1	ILL 30840	74.2	33.2	33.5	32.6	167.1	199.3
2	ILL 63-1062-2	75.8	33.0	38.3	22.0	169.7	203.3
3	ILL 63-1668-1	81.6	31.5	39.2	28.9	174.9	207.0
4	Minn. II-31-21	80.3	32.4	40.0	35.4	167.8	203.7
5	Minn. II-54-109	83.7	32.4	36.5	28.0	169.6	203.7
6	Minn. 674	74.3	31.3	38.8	48.1	171.6	201.7
7	MO 04205	77.5	33.3	40.9	41.8	169.9	203.7
8	NY S279A1B-3B-70	86.6	31.3	36.5	29.1	172.4	206.3
9	PUR 5328A3-4P-2	77.9	35.0	34.5	23.5	169.0	202.3
10	PUR 5877	75.1	33.0	38.4	30.3	170.4	203.7
11	PUR 5912RB1-3-2	69.9	32.2	36.8	22.6	167.6	201.7
12	PUR 6316A2-4	67.7	30.4	30.7	15.0	171.1	204.7
13	SD B64PROI-178	80.6	32.5	40.5	27.0	173.0	206.0
14	SD B65PROI-469	78.5	33.1	37.6	29.6	167.7	204.0
15	SD B65PROI-955	78.1	32.5	36.7	19.0	169.8	204.3
16	SD B65PROI-1541	75.7	32.4	37.0	23.5	170.3	205.3
17	SD B65PROI-1596	74.1	32.8	36.4	24.3	171.3	204.3
18	Wisc. X643-41	70.4	32.5	35.1	27.6	170.7	202.0
19	Wisc. X697-2	79.6	30.6	44.0	26.5	175.9	207.3
20	Wisc. X995-4-1	80.7	32.0	40.5	28.0	178.0	209.0
21	Wisc. X1181-2	81.6	33.0	39.6	20.9	174.9	208.3
22	Wisc. X1137-5	75.1	32.6	36.5	26.0	170.6	205.0
23	ILL 63-1105	79.1	33.5	37.9	20.8	169.8	204.0
24	ILL 66-2345	78.1	33.2	34.9	34.0	168.0	201.7
25	PUR S939B1-3-9-3	79.1	32.7	33.0	18.5	168.4	203.0
26	Iowa M710	72.3	33.5	39.3	33.7	170.6	205.0

Table 30. Averages over all station for the indicated variables, in the uniform regional oat experiment #90 continued.

Entry No.	C.I. or Sel. No.	Yield Bu/A	Test Wt. Lbs/bu	Height inches	Lodging %	Date head	Date ripe
27	Mich. 60-101-1-20	88.1	31.9	40.3	28.7	175.4	206.7
28	Mich. 60-106-1-78	82.3	33.1	40.0	36.7	174.8	204.7
29	Mich. 64-132-20-2	85.2	28.9	40.5	38.6	180.3	208.0
30	Mich. 64-152-4-19	83.3	29.8	39.6	37.1	179.2	207.3
31	NY ML-5	81.0	30.0	40.7	32.1	176.0	207.7
32	NY 5279-105	89.7	31.0	36.9	32.5	172.8	206.3
33	NY 5832-4	81.0	33.3	34.4	18.5	178.1	207.0
34	NY 6083	84.4	31.1	35.7	31.0	172.4	207.0
35	Wisc. X1069-3-2	79.9	30.1	39.1	33.4	171.0	147.0
	Average	78.9	32.2	37.7	28.7	172.0	203.2
	L.S.D. @ 5%	7.0	1.3	1.2	9.5	1.1	28.7
	CV PCT	13.7	6.0	4.3	42.2	0.9	8.7

Table 31. North Dakota State University Oat Nursery Experiment #92.

Entry No.	Variety or Treatment	Yields in bushels per acre				Test weight	Heading date	Disease	Lodging %	Height inches
		Rep 1	Rep 2	Rep 3	Avg.					
1	Brave	108.0	106.0	118.0	110.7	35.0	6-28			34
2	Burnett	108.0	88.0	108.8	101.6	3.0	6-30			36
3	C.I. 8304	119.2	92.0	104.4	105.2	34.0	6-30			32
4	Holden	90.8	76.4	90.0	85.7	36.0	6-30			34
5	Portal	103.2	117.2	87.2	102.5	35.5	7-2			35
6	Kota	102.0	94.4	90.0	95.5	37.0	7-2			36
7	Kelsey	98.0	96.8	106.0	100.3	32.0	7-3			36
8	Russell	122.4	124.0	104.4	116.9	32.0	7-3			35
9	Sioux	113.2	99.2	116.0	109.5	32.0	7-3			36
10	Garry	122.0	113.6	120.0	118.5	33.0	7-4	None	None	38
11	Lodi	118.4	111.6	106.0	112.0	31.0	7-4			38
12	Harmon	118.0	97.2	106.0	107.1	33.5	7-4			40
13	Cayuse	146.0	114.4	111.2	123.9	31.5	7-2			30
14	86-3-63	85.2	87.6	86.4	86.4	34.5	6-25			33
15	Wisc. 1181-2	120.0	82.0	97.6	99.9	33.5	7-2			35
16	Wisc. 995-4-1	121.2	105.2	110.4	112.3	31.5	7-4			36
17	B65 PROI-469	114.4	92.8	106.0	104.4	35.0	6-25			32
18	Mich 64-152-4-195	118.0	119.2	123.2	120.1	34.5	7-4			35
19	Mich 152-1-121	118.4	101.2	124.8	114.8	34.5	7-8			38
20	Wyndmere	101.6	117.2	71.6	96.8	34.0	6-28			33

Table 32. Great Plains Barley Nursery.

Entry No.	Variety or Treatment	Yields in bushels per acre				Test weight	Heading date	Disease	Lodging %	Height inches
		Rep 1	Rep 2	Rep 3	Avg.					
1	Munsing	55.8	58.0	47.5	53.8	47.0	6-25			27
2	Unitan	52.0	55.8	56.0	54.6	45.5	6-25			26
3	Larker	60.3	56.3	53.5	56.7	48.0	6-28			28
4	62 Ab 3786	45.0	50.8	48.3	48.0	50.0	7-2			26
5	Galt	55.8	51.3	66.8	58.0	47.5	7-2			25
6	Primus	55.5	48.3	52.3	52.0	48.5	6-24			26
7	62 Ab 3722	42.0	46.0	42.3	43.4	49.0	7-2			21
8	63 Ab 1434	50.3	43.3	57.8	50.5	48.5	7-1			25
9	Neb. 591035	51.3	42.5	50.0	47.9	46.5	6-25			27
10	S.D. 67278	64.0	87.0	63.8	71.6	47.5	7-2			28
11	S.D. 67535	63.3	62.8	63.3	63.1	46.5	6-25	None	None	28
12	S.D. 67640	57.0	52.5	62.0	57.2	48.0	6-28			30
13	Betzes	60.5	54.5	62.5	59.2	49.0	7-1			27
14	Ebert	46.8	36.3	45.0	42.7	49.5	6-26			21
15	Shabet	53.8	50.0	68.8	57.5	47.5	7-2			28
16	Titan	49.0	46.8	43.3	46.4	46.5	6-29			29
17	Bullless Titan	45.5	40.8	41.3	42.5	45.0	6-28			29
18	Red Lemme Titan	44.0	43.3	39.5	42.3	46.5	6-28			30
19	Rolled Leaf Titan	49.0	36.5	38.5	41.3	47.5	6-27			30
20	63 Ab 2961	58.0	66.8	56.0	60.3	43.5	7-1			25
21	63 Ab 2987	43.8	53.8	47.8	48.5	46.5	6-30			25
22	Primus II	59.5	59.5	54.3	57.8	48.5	6-24			28

Table 33. 1969 Summary-Great Plains Barley Nursery.

Entry No.	C.I. No.	Variety	Average ** Acre Yield Bu.	Average Test Weight Lbs.	Average Date Headed June	Average Plant Height
1	6009	Munsing	41.6	48.8	24.3	22.4
2	10421	Unitan	43.5	46.5	25.1	26.9
3	10648	Larker	42.0	48.9	24.5	28.9
4	-------	62 Ab 3786	43.5	49.1	29.0	25.5
5	11770	Galt	46.8	47.2	27.8	26.8
6	13109	Primus	41.0	49.0	20.8	27.8
7	-------	62 Ab 3722	42.0	49.3	23.0	22.7
8	-------	63 Ab 1434	44.3	50.0	26.4	24
9	-------	Neb. 591035	40.6	47.7	23.5	27.6
10	-------	S.D. 67278	47.3	48.6	27.7	28.6
11	-------	S.D. 67535	44.0	48.7	21.0	27.9
12	-------	S.D. 67640	44.1	48.9	25.0	30.1
13	6398	Betzes	43.9	49.8	28.4	26.1
14	-------	Ebert	41.2	51.0	22.5	23.1
15	-------	Shabet	45.4	49.4	28.6	27.2
16	7055	Titan	41.4	47.9	25.2	28.7
17	-------	Bullless Titan	35.3	51.7	25.2	28.9
18	-------	Red Lemme Titan	35.8	47.0	24.2	27.8
19	-------	Rolled Leaf Titan	35.3	48.6	26.0	28.8
20	-------	63 Ab 2961	41.2	45.5	27.5	25.6
21	-------	63 Ab 2987	40.8	48.4	27.1	25.9
22	13796	Primus II	41.5	49.1	20.6	28.3
		Grand Average	42.0	48.7	25.2	26.8
		No. Of stations	13.0	14.0	11.0	11

** Average value for all stations reporting.

Table 34. Uniform Regional Flax Nursery.

Entry No.	C.I. No.	Variety or Treatment	Yields in bushels per acre				Test weight	Heading date	Disease	Lodging %	Height inches
			Rep 1	Rep 2	Rep 3	Avg.					
1	389	Bison	17.0	25.6	19.1	20.6	56.0	7-15	None	None	24
2	1130	Redwood	22.4	13.2	13.0	16.2	56.5	7-13			25
3	1478	Bolley	22.6	22.2	19.0	21.3	57.0	7-10			23
4	1823	Windom	27.6	24.0	23.2	24.9	57.0	7-11			22
5	1914	Summit	9.0	19.4	18.2	15.5	56.0	7-11			20
6	2444	Rwd x Birio	24.8	21.6	25.2	23.9	56.5	7-12			21
7	2537	Sel. of 2444	21.2	24.6	23.0	22.9	56.0	7-13			23
8	2522	Linott	23.0	32.0	29.6	28.2	56.5	7-10			20
9	2523	Foster	26.2	22.2	25.0	24.5	56.5	7-13			22
10	2525	RWD x Mar	16.0	11.0	9.0	12.0	56.5	7-11			23
11	2534	Sel. of Norland	26.0	20.0	23.4	23.1	56.0	7-14			29
12	2535	Valuta x Raja	27.0	18.0	20.6	21.9	56.5	7-15			28
13	2538	Wdm x 2318	38.6	38.2	47.0	41.3	56.5	7-13			27
14	2539		22.4	18.0	27.2	22.5	56.5	7-15			28
15	2540		27.0	22.2	20.8	23.3	56.0	7-10			20
16	2541		25.4	24.6	21.6	23.9	57.0	7-12			22
17	2542		27.0	21.0	24.0	24.0	56.5	7-9			22
18	2543		25.6	25.8	25.7	25.7	56.0	7-10			23
19	2544		25.2	25.0	25.1	25.1	55.5	7-9			21
20	2545		25.0	21.0	23.0	23.0	56.0	7-9			22
21	2546		24.4	21.8	23.1	23.1	56.0	7-15			24

NORTHERN REGIONAL HARD RED WINTER WHEAT PERFORMANCE NURSERY 1969

The largest winter wheat nursery of recent years was seeded in September of 1969 and made excellent fall growth. Survival through the winter was also excellent. The entire winter wheat nursery as well as the entire winter rye planting was completely destroyed by birds when the grain was in the soft dough stage, and before it could be harvested.

While it was disappointing to lose the winter grain plantings, these plantings, did attract birds and keep them away from nearby spring grain nurseries. The spring sown grains escaped practically untouched.

Hard Red Winter Wheat
Northern Regional Performance Nursery
1969

Table 35.

Entry No.	Variety or Pedigree	C.I. or Sel. No.	Source
1	Kharkof	1442	Check
2	Warrior	13190	Check
3	Winalta	13670	Check
4	Trader	13998	Nebr.
5	Trapper	13999	"
6	Selkirk x Cheyenne^2	NVB64365	"
7	Ky58-Nth-Cnn-Tm-Mi-Hope-Pn-Cnn x Wrr	NB66490	"
8	Selkirk x Cheyenne^2	NB64334	"
9	Selkirk x Cheyenne^3	NB64308	"
10	Winalta Selection	14000	S. Dak.
11*	NB60258 x NB61983	SD6687	"
12*	do.	SD6689	"
13*	Warrior^2 x III-54-12	SD66117	"
14*	SD56-497-3-0-0	SD66166	"
15*	SD56-497-6-0-0	SD66167	"
16*	SD56-497-7-0-0	SD66168	"
17*	Pnc-Cnn^3 x NB61981	SD66169	"
18*	do.	SD66171	"
19*	Pnc-Cnn^3 x NB61977	SD66173	"
20*	do.	SD66174	"
21*	do.	SD66176	"
22	BWH1904-7	MT639	Mont.
23	NT-2 x Cnn-2 8-9-3	MT6326	"
24	Yogo x Cnn 12-4-2	MT6320	"
25	Selected Bulk 2-77	MT6319	"

Hard Red Winter Wheat
Northern Regional Performance Nursery
1969

Table 35. Continued

Entry No.	Variety or Pedigree	C.I. or Sel. No.	Source
26*	Dekalb Hybrid	A220	Dekalb
27*	do.	A222	Dekalb
28*	do.	A225	Dekalb
29*	do.	A226	Dekalb
30*	do.	A229	Dekalb
31*	do.	A233	Dekalb
32*	Pnn-Cnn-Pn-Ky58 x Cnn	NB66403	Nebr.
33*	do.	NB66404	"
34*	do.	NB66408	"

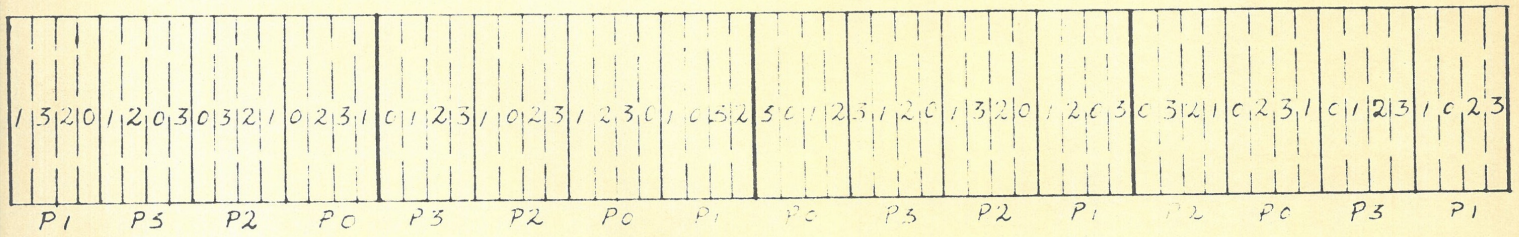
*new entries in 1969.

FERTILIZER FORMULATION, RATES OF APPLICATION AND METHODS OF TREATMENT ON SUMMERFALLOW

In this trial, broadcast application, drill row applications and a combination of broadcast and drill row applications are compared, using three different rates for each application method. Tables 36 and 37 show the planting plan used, and also includes the formulations used and the key to rates used for both broadcast and drill row applications.

Tables 38 and 39 summerize the yield data for 1969. Recorded yield data for this trial in 1967 and 1968 show no conclusive trend for method of application of rate of application. There is little indication that the 18-46-0 formulation is superior to the 0-46-0 formulation on summerfallow in western North Dakota in 1969.

Table 36. Planting Plan, Formulations and Key to Rates Used in the Trial Comparing Fertilizer Formulations, Rates of Application and Methods of Treatment on Summerfallow, 1969.



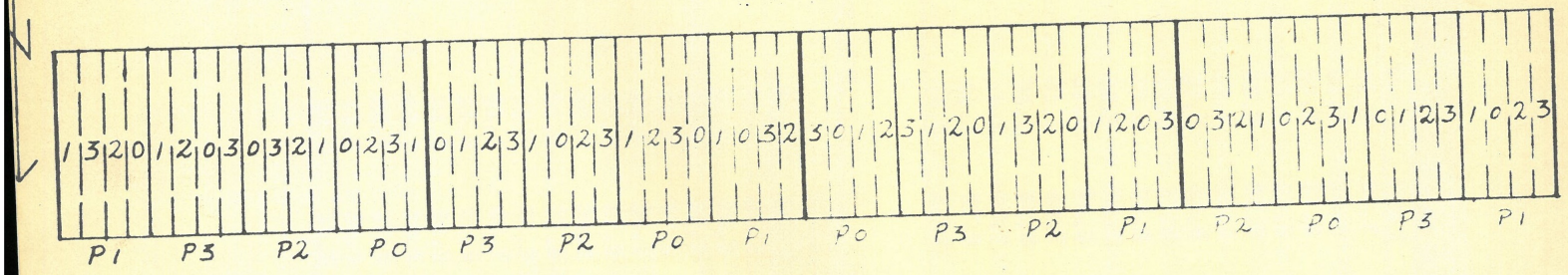
Broadcast treatment, incorporated with the disk

P_0	-	0 pounds	0-46-0
P_1	-	66 "	"
P_2	-	132 "	"
P_3	-	264 "	"

Drill row application

0	-	0 pounds	0-46-0
1	-	33 "	"
2	-	66 "	"
3	-	132 "	"

Table 37. Planting Plan, Formulations and Key to Rates Used in the Trial Comparing Fertilizer Formulations, Rates of Application and Methods of Treatment on Summerfallow, 1969.



REP. 1 REP. 2 REP. 3 REP. 4

Broadcast treatment, incorporated with the disk

P_0	-	0 pounds	18-46-0
P_1	-	66 "	"
P_2	-	132 "	"
P_3	-	264 "	"

Drill row application

0	-	0 pounds	18-46-0
1	-	33 "	"
2	-	66 "	"
3	-	132 "	"

40

Table 38. Vasey Fertilizer Trial.

Variety or treatment		Yields in bushels per acre				
		Rep 1	Rep 2	Rep 3	Rep 4	Avg.
18-46-0	PO-O	31.9	24.7	33.4	33.4	30.9
18-46-0	PO-1	36.3	34.8	36.3	43.6	37.8
18-46-0	PO-2	37.8	37.8	37.8	40.7	38.5
18-46-0	PO-3	37.8	37.8	45.0	37.8	39.6
18-46-0	PO-O	40.7	34.8	31.9	27.6	33.8
18-46-0	PO-1	43.6	30.5	43.6	42.1	40.0
18-46-0	PO-2	37.8	43.6	36.3	37.8	38.9
18-46-0	PO-3	34.8	37.8	37.8	33.4	36.0
18-46-0	PO-O	37.8	34.8	30.5	34.8	34.5
18-46-0	PO-1	34.8	34.8	40.7	42.1	38.1
18-46-0	PO-2	37.8	34.8	39.2	40.7	38.1
18-46-0	PO-3	31.9	40.7	37.8	39.2	37.4
18-46-0	PO-O	34.8	34.8	39.2	29	34.5
18-46-0	PO-1	37.8	40.7	37.8	40.7	39.3
18-46-0	PO-2	34.8	37.8	37.8	37.8	37.1
18-46-0	PO-3	43.6	37.8	34.8	31.9	37.0

Table 39. Vasey Fertilizer Trial.

Variety or treatment		Yields in bushels per acre				
		Rep 1	Rep 2	Rep 3	Rep 4	Avg.
18-46-0	PO-O	36.3	36.3	39.2	45.0	39.2
18-46-0	PO-1	34.8	36.3	37.8	46.5	38.9
18-46-0	PO-2	33.4	39.2	40.7	43.6	39.2
18-46-0	PO-3	31.9	39.2	36.3	42.1	37.4
18-46-0	PO-O	40.7	34.8	37.8	43.6	39.2
18-46-0	PO-1	37.8	37.8	37.8	43.6	39.3
18-46-0	PO-2	40.7	36.3	39.2	43.6	40.0
18-46-0	PO-3	34.8	37.8	43.6	46.5	40.7
18-46-0	PO-O	40.7	34.8	37.8	45.0	39.6
18-46-0	PO-1	31.9	40.7	36.3	46.5	38.9
18-46-0	PO-2	33.4	31.9	39.2	49.4	38.5
18-46-0	PO-3	34.8	34.8	42.1	43.6	38.8
18-46-0	PO-O	40.7	39.2	37.8	45.0	40.7
18-46-0	PO-1	40.7	37.8	40.7	43.6	40.7
18-46-0	PO-2	43.6	36.3	40.7	43.6	41.1
18-46-0	PO-3	34.8	39.2	40.7	40.7	38.9

A COMPARISON OF WHEAT YIELDS ON CONTINUOUS CROPPING, CORNLAND, AND FALLOW, FERTILIZED AND UNFERTILIZED

This trial was begun in 1959 to compare the results of commercial fertilizer application on three different cropping systems over a long period of years. While there is considerable information available on work with commercial fertilizer application on wheat in North Dakota, not very much of it is on sites such as these where data are kept on cropping history and fertilization over a long period of years.

Data from the 1969 trial are given in table 10. Table 41 summarizes yields from this trial for the period 1959-1969.

Table 40. Yields from Continuous Cropping, Cornland and Fallow, Fertilized and Unfertilized-1969.

	Yields in bushels per acre			
	Rep 1	Rep 2	Rep 3	Avg.
Continuous cropping	17.7	18.9	17.7	18.1
Continuous cropping-fertilized	23.6	21.2	23.6	22.8
Cornland	16.5	16.5	15.7	16.2
Cornland-fertilized	24.4	22.0	24.4	23.6
Summerfallow	35.4	33.0	32.6	33.7
Summerfallow-fertilized	44.0	46.4	44.8	45.1

Table 41. Summary of wheat yields on continuous cropping, cronland and fallow, fertilized and unfertilized, for the period 1959-1969.

	Yield in bushel per acre											
Treatment	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	11 yr. Avg.
Spring plowed continuous cropping	6.7	10.8	43.8	--	17.8	8.6	17.3	--	15.4	11.6	18.1	12.3
Spring plowed-continuous cropping, fertilized	8.1	12.5	3.9	--	19.4	10.7	22.3	--	14.0	10.0	22.8	13.7
Summerfallow	11.1	15.3	6.2	--	28.1	13.0	31.4	--	25.8	22.8	33.7	20.8
Summerfalllow, fertilized	12.9	22.0	8.1	--	33.8	16.1	34.0	--	23.6	33.6	45.1	25.5
Disked cronland	7.3	10.6	0.0	--	18.7	10.6	24.6	--	17.2	20.7	16.2	14.0
Disked cornland, fertilized	8.6	13.6	0.0	--	25.7	11.8	31.4	--	21.4	24.5	23.6	17.8

Crop destroyed by hail in 1962 and 1966.

COMPARISON OF RATES AND FORMULATION OF COMMERCIAL FERTILIZER APPLICATION ON SUMMERFALLOW IN WESTERN NORTH DAKOTA

The objective of this trial is to provide additional information on use of fertilizer on summerfalllow in western North Dakota.

A considerable amount of work has been done in past years and is presently in progress on the use of commercial fertilizer in western North Dakota. We have only scratched the surface of this important subject, and because of the variability of land, climate and other environmental factors, and the various fertilizer formulation available, all of the information that can be gathered will eventually help to answer the main question in the minds of farmers, that being: "How can commercial fertilizer contribute to increasing the income for the farmers and ranchers in North Dakota."

The trial is a companion trial designed to make duel use of the plot layout involved in the Maintenance of Summerfallow trial. Fertilizer is applied at planting time by drill attachment to the plot layout shown in table 42.

The 1969 yield record is summerized in table 43, 44, and 45.

ODD NUMBERED YEARS

Table 42.

Rep. 4 / Rep. 3

Plot	Weeks	Subplots
[illegible]	5 wK.	18, 17, 16
166	4 wK.	20, 19, 18, 17, 16
165	6 wK.	20, 19, 18, 17, 16
164	7 wK.	20, 19, 18, 17, 16
163	4 wK.	15, 14, 13, 12, 11
162	6 wK.	15, 14, 13, 12, 11
161	5 wK.	15, 14, 13, 12, 11
160	7 wK	15, 14, 13, 12, 11

Plot	Weeks	Subplot	Treatment
[illegible]	5 wK.	18	50# 18-46-0
		17	100# 18-46-0
		16	50# 11-48-0
139	4 wK.	20	100# 0-46-0
		19	check
		18	50# 18-46-0
		17	100# 18-46-0
		16	50# 0-46-0
140	6 wK.	20	100# 23-23-0
		19	check
		18	50# 18-46-0
		17	100# 18-46-0
		16	50# 23-23-0
141	7 wK.	20	150# 10-30-10
		19	check
		18	50# 18-46-0
		17	100# 18-46-0
		16	75# 10-30-10
142	4 wK.	15	50# 0-46-0
		14	100# 0-46-0
		13	check
		12	100# 18-46-0
		11	50# 18-46-0
143	6 wK.	15	50# 23-23-0
		14	100# 23-23-0
		13	check
		12	100# 18-46-0
		11	50# 18-46-0
144	5 wK.	15	50# 11-48-0
		14	100# 11-48-0
		13	check
		12	100# 18-46-0
		11	50# 18-46-0
145	7 wK.	15	75# 10-30-10
		14	150# 10-30-10
		13	check
		12	100# 18-46-0
		11	50# 18-46-0

Rep. 2 / Rep. 1

Plot	Weeks	Subplots
[illegible]	6 wK.	8, 7, 6
136	4 wK.	10, 9, 8, 7, 6
135	7 wK.	10, 9, 8, 7, 6
134	5 wK.	10, 9, 8, 7, 6
133	4 wK.	5, 4, 3, 2, 1
132	7 wK.	5, 4, 3, 2, 1
131	5 wK.	5, 4, 3, 2, 1
130	6 wK.	5, 4, 3, 2, 1

Plot	Weeks	Subplot	Treatment
[illegible]	6 wK.	8	[illegible] 23-23-0
		7	check
		6	50# 18-46-0
109	4 wK.	10	100# 18-46-0
		9	50# 0-46-0
		8	100# 0-46-0
		7	check
		6	50# 18-46-0
110	7 wK.	10	100# 18-46-0
		9	75# 10-30-10
		8	150# 10-30-10
		7	check
		6	50# 18-46-0
111	5 wK.	10	100# 18-46-0
		9	50# 11-48-0
		8	100# 11-48-0
		7	check
		6	50# 18-46-0
112	4 wK.	5	100# 0-46-0
		4	50# 0-46-0
		3	check
		2	100# 18-46-0
		1	50# 18-46-0
113	7 wK.	5	150# 10-30-10
		4	75# 10-30-10
		3	check
		2	100# 18-46-0
		1	50# 18-46-0
114	5 wK.	5	100# 11-48-0
		4	50# 11-48-0
		3	check
		2	100# 18-46-0
		1	50# 18-46-0
115	6 wK.	5	100# 23-23-0
		4	50# 23-23-0
		3	check
		2	100# 18-46-0
		1	50# 18-46-0

Table 43. Grain yields recorded in the trial comparing rates and fertilizer formulations on the summerfallow management trial-1969.

		Yields in bushels per acre				
Treatment		1	2	3	4	Avg.
Check		44.0	39.0	42.0	47.0	43.0
50 lbs	0-46-0	46.0	39.0	46.0	46.0	44.3
100 lbs	0-46-0	46.0	40.0	44.0	49.0	44.8
50 lbs	18-46-0	44.0	42.0	46.0	49.0	45.3
100 lbs	18-46-0	53.0	45.0	46.0	49.0	48.3
The above yields are from the 4-week cultivation interval.						
Check		46.3	45.0	43.0	39.0	43.3
50 lbs	11-48-0	41.0	43.0	44.0	47.0	43.8
100 lbs	11-48-0	44.0	46.0	50.0	44.0	46.0
50 lbs	18-46-0	47.0	45.0	42.0	43.0	44.3
100 lbs	18-46-0	46.0	48.0	44.0	44.0	45.5
The above yields are from the 5-week cultivation interval.						

Table 43. Grain yields recorded in the trial comparing rates and fertilizer formulations on the summerfallow management trial-1969.

		Yields in bushels per acre				
Treatment		1	2	3	4	Avg.
Check		44.0	34.0	42.0	41.0	40.3
50 lbs	0-46-0	46.0	36.0	47.0	44.0	43.3
100 lbs	0-46-0	43.0	40.0	45.0	46.0	43.5
50 lbs	18-46-0	46.0	41.0	44.0	44.0	43.8
100 lbs	18-46-0	48.0	44.0	51.0	46.0	47.3
The above yields are from the 6-week cultivation interval.						
Check		37.0	41.0	37.0	37.0	38.0
50 lbs	11-48-0	42.0	40.0	31.0	39.0	38.0
100 lbs	11-48-0	44.0	44.0	34.0	39.0	40.3
50 lbs	18-46-0	40.0	46.0	35.0	39.0	40.0
100 lbs	18-46-0	41.0	43.0	35.0	44.0	40.8
The above yields are from the 7-week cultivation interval.						

Table 45. Record of grain yields from check plots compared to the 18-46 -0 formulation in the fertilizer use of summerfallow management trial-1969.

Treatment	Grain yields in bushels per acre								Avg.	1968 Avg.	2-yr. Avg.
Check	46.0	45.0	43.0	39.0	44.0	34.0	42.0	41.0			
Check	44.0	39.0	42.0	47.0	37.0	41.0	37.0	37.0	41.1	38.6	39.9
50 lbs 18-46-0	47.0	45.0	42.0	43.0	46.0	41.0	44.0	44.0			
50 lbs 18-46-0	44.0	42.0	46.0	49.0	40.0	46.0	35.0	39.0	43.3	42.1	42.7
100 lbs 18-46-0	46.0	48.0	44.0	44.0	48.0	44.0	51.0	46.0			
100 lbs 18-46-0	53.0	45.0	46.0	49.0	41.0	43.0	35.0	44.0	45.4	39.6	42.5

EFFECT OF LIGHT, MODERATE AND HEAVY RATES OF NITROGEN ON THE YIELD OF WHEAT

The Soils Department, North Dakota State University, seeded Waldron, Polk, Red River 68 and Inia 66 in a trial designed to compare the effect of three rates of nitrogen application on the yield of these four wheats.

The trial was seeded on April 23rd. Seeding, harvesting and data collection was done by Soils Department personnel.

Results are recorded below.

Table 46. Yield in bushels per acre at indicated rate of application.

Variety	0	25% N	50% N	100% N
Waldron	16.3	18.0	17.8	20.1
Polk	21.8	20.6	26.2	24.7
Red River 68	20.1	17.5	20.6	19.4
Inia 66	20.1	22.4	23.3	28.2

Table 47. Fertilizer rate and formulation trial-Beach site.

Variety or treatment		Yields in bushels per acre				
		Rep 1	Rep 2	Rep 3	Rep 4	Avg.
18-46-0	200#	35.3	41.5	42.4	47.3	41.6
18-46-0	100#	31.3	44.2	41.1	36.2	38.2
18-46-0	50#	26.4	37.5	41.5	40.6	36.5
11-48-0	100#	32.2	42.0	38.0	37.1	37.3
11-48-0	50#	34.8	36.6	41.5	33.9	36.7
0-46-0	100#	34.8	41.1	36.2	45.8	39.5
0-46-0	50#	35.7	32.6	43.8	33.9	36.5
23-23-0	200#	36.6	42.9	35.7	47.8	40.8
23-23-0	100#	35.3	37.5	36.6	33.9	35.8
10-30-10	200#	30.8	41.1	36.6	44.2	38.2
10-30-10	100#	38.4	35.7	38.0	28.4	35.1
Check		27.2	28.6	30.4	27.9	28.5

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	235.50	0.00	4.40
Treatments	11.	487.13	44.28	2.48
Error	33.	588.81	17.84	
Total	47.	1311.44		

Standard error of treatment mean=2.1120
Standard error of a difference among treatment means=2.9869
The CV=11.40 The L.S.D. 5% is 6.08 bushels per acre

Table 48. Fertilizer rate and formulation trial-Glen Ullin site.

Variety or treatment		Yields in bushels per acre				
		Rep 1	Rep 2	Rep 3	Rep 4	Avg.
18-46-0	200#	51.7	56.7	45.0	43.3	49.2
18-46-0	100#	45.0	50.0	35.0	45.0	43.8
18-46-0	50#	36.7	46.7	33.3	45.0	40.4
11-48-0	100#	40.0	48.3	38.3	43.3	42.5
11-48-0	50#	41.7	43.3	33.3	33.0	37.8
0-46-0	100#	38.3	43.3	30.0	38.3	37.5
0-46-0	50#	38.3	38.3	33.3	40.0	37.5
23-23-0	200#	35.0	41.7	31.7	36.7	36.3
23-23-0	100#	35.0	33.3	26.3	35.0	32.4
10-30-10	200#	36.7	43.3	36.7	40.0	39.2
10-30-10	100#	35.0	35.0	31.7	36.7	34.6
Check		26.7	26.7	21.7	21.7	24.2

Table 48. Fertilizer rate and formulation trial-Geln Ullin site (continued).

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	506.00	0.00	16.70
Treatments	11.	1655.50	150.50	14.90
Error	33.	333.38	10.10	
Total	47.	2494.87		

Standard error of treatment mean=1.5892
Standard error of a difference among treatment means=2.2475
The CV=8.31 The L.S.D. 5% is 4.57 bushels per acre

Table 49. Fertilizer rate and formulation trial-Killdeer site.

Variety or treatment		Yields in bushels per acre				
		Rep 1	Rep 2	Rep 3	Rep 4	Avg.
18-46-0	200#	20.9	30.8	22.0	27.5	25.3
18-46-0	100#	24.2	22.0	19.8	27.5	23.4
18-46-0	50#	22.0	29.7	22.0	30.8	26.1
11-48-0	100#	25.2	27.5	22.0	31.9	26.7
11-48-0	50#	22.0	22.0	22.0	28.6	23.7
0-46-0	100#	24.2	24.2	19.8	29.7	24.5
0-46-0	50#	23.1	20.9	24.2	27.5	23.9
23-23-0	200#	24.2	23.1	19.8	31.9	24.8
23-23-0	100#	25.3	20.9	22.0	28.6	24.2
10-30-10	200#	25.3	20.9	19.8	26.4	23.1
10-30-10	100#	25.3	20.9	24.2	30.8	25.3
Check		20.9	23.1	18.7	27.5	22.6

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	383.83	0.00	23.61
Treatments	11.	67.00	6.09	1.12
Error	33.	178.80	5.42	
Total	47.	629.63		

Standard error of treatment mean=1.1639
Standard error of a difference among treatment means=1.6459
The CV=9.52 The L.S.D. 5% is 3.35 bushels per acre

Table 50. Fertilizer rate and formulation trial-Off-Station sites.

Variety or treatment		Yields in bushels per acre			
		Beach	Glen Ullin	Killdeer	3-station Avg.
18-46-0	200#	41.6	49.2	25.3	38.7
18-46-0	100#	38.2	43.8	23.4	35.1
18-46-0	50#	36.5	40.4	26.1	34.3
11-48-0	100#	37.3	42.5	26.7	35.5
11-48-0	50#	36.7	38.3	23.7	32.9
0-46-0	100#	39.5	37.5	24.5	33.8
0-46-0	50#	36.5	37.5	23.9	32.6
23-23-0	200#	40.8	38.9	24.8	34.8
23-23-0	100#	35.8	32.9	24.2	31.0
10-30-10	200#	38.2	39.2	23.1	33.5
10-30-10	100#	35.1	34.6	25.3	31.7
Check		28.5	24.2	22.6	25.1
L.S.D. @ 5%		6.08	4.57	3.35	2.77

MAINTENANCE OF SUMMERFALLOW IN WESTERN NORTH DAKOTA

The principle objective of this trial is to determine the optimum number of cultivations required on sumerfallow in western North Dakota, as related to yield and to the cost of operation.

Work on summerfallow at this station previously, has determined the best date for first tillage of fallow, and has compared the production of wheat on plowed fallow and on trashy fallow. Work is presently in progress comparing production on roto-tilleed fallow and plowed fallow. Generally, the previous work has aimed at keeping the fallow clean, but has not specified the number of cultivations. The idea has been that whatever number of cultivations were required to keep the fallow clean in nay given year would be applied.

Tillage operations in this trial begin as close to May 15 as possible, this date previously determined as the best date for the first tillage of fallow at this station, with the first operation being moldboard plowing. Subsequent tillage operations are with the sweep cultivator at 4 week, 5 week, 6 week and 7 week intervals. The approximate dates of cultivation and the number of operations for each interval are as follows:

4 week-June 15, July 15, August 15, September 15, and October 15.

5 week- June 22, August 1, September 7, and October 21.

6 week-July 1, August 15, and October 1.

7 week-July 7, September 1, and October 21.

Yield data from the first year of cropping are summarized in table 51.

Table 51. Grain yields recorded in the summerfallow management study 1969.

	Yields in bushels per acre				
Treatment	1	2	3	4	Average
4 week check	39.0	44.0	47.0	42.0	43.0
5 week check	46.0	45.0	43.0	39.0	43.3
6 week check	34.0	44.0	41.0	42.0	40.3
7 week check	37.0	41.0	37.0	37.0	38.0

A COMPARISON OF THE HOE DRILL AND THE DOUBLE DISK PRESS DRILL FOR SEEDING SPRING WHEAT ON SUMMERFALLOW IN WESTERN NORTH DAKOTA

This trial, designed to compare the hoe drill and the double disk press drill for the production of spring wheat on summerfallow in western North Dakota has been in progress since 1963.

In two separate trials conducted during the three year period 1963-1965, the double disk press drill produced the higher yields, as was the case in the single trial continued in 1968.

Data from the trial are summarized in table 52. There are no yields from this trial for 1966 because the crop was destroyed by a severe hailstorm in July of that year.

Table 52. A comparison of yields of spring wheat seeded on summerfallow with the hoe drill and with the press drill.

	Yields in bushels per acre							
Drill used	1963	1964	1965	1966	1967	1968	1969	Avg.
Hoe drill with 10 inch spacing	18.3	15.6	39.5	--	18.1	21.0	26.0	22.9
Double disk press drill with 6 inch spacing	25.3	24.7	41.3	--	19.7	34.9	37.1	30.5

CONTINUOUS CROPPING TRIALS WITH WHEAT, OATS, BARLEY AND CORN

This trial was begun in 1908 as part of the work with crop rotations and tillage on what was then the newly established Dickinson Experiment Station. It was designed to determine yields of the four crops, wheat, oats, barley, and corn when grown year after year on the same land. This trial also included a comparison of spring plowing and fall plowing as well as a comparison of continuous cropping with alternate cropping and summerfallow.

The 1969 yields, and the average yields for the first 55 years of the trial are summarized in the following table.

Table 53. Crop yields in the continuous cropping trial.

	Spring plowed		Fall plowed		Summerfallow	
Crop	1969	55 Yr. Avg.	1969	55 Yr. Avg.	1969	55 Yr. Avg.
			Grain yields in bushels per acre			
Wheat	15.7	11.2	17.7	10.2	35.4	18.5
Oats	44.2	25.7	50.1	23.4	64.8	43.1
Barley	23.6	16.7	29.5	15.3	42.2	23.7
Corn		18.9		18.7		22.5
			Silage yields in tons per acre @ 70% moisture			
Corn	3.3	3.14	3.0	3.05	3.9	3.63

PROPOSED WILLISTON BRANCH STATION WHEAT SEEDING RATE

Feb. 1, 1969

Scope of the Trial:

There is need for information concerning rate of seeding irregardless of kernel size in wheat. The different seeding rates for different types of wheat (semi-dwarf, common, and durum) need to be more carefully defined as does the influence of fertilizer on seeding rates. The trial will be conducted for three years.

Variables:

F-Fertility-broadcast applied and worked in prior to seeding
- F1-no effect
- F2-normal rate
- F3-high rate

R-Rate of seeding based on pure live seed
- R1-1/3 million plants per acre
- R2-2/3 million plants per acre
- R3-1.0 million plants per acre
- R4-1 1/3 million plants per acre

V-Variety
- V1-Fortuna HRS (large kerneled variety)
- V2-Manitou HRS (small kerneled variety)
- V3-Semi-dwarf HRS
- V4-Leeds durum

Objectives:

1. To collect yield data as influenced by the variable listed above.
2. To collect data with regard to plant response tot he variables.
3. To compare the effect of soil moisture and temperature on the variables and the effect of the variables on soil moisture.

Weed Control:

To be determined by individual stations depending upon local conditions.

Data to be Collected:

1. Wheat protein.
2. 1000 kernel weight.
*3. Kernels per head. Determined by thrashed a given number of head and counting the thrashed kernels.
*4. Stand count. Tillering as influenced by each variable can easily be determined as the seeding population will be known. Stand count should consist of the number of productive heads within a specified distance. Two readings per plot should be made.
5. Plant height.
6. Date 90%/headed and date ripe.
7. Grain yield in bushels per acre.
8. Grain test weight in pounds per bushel.
9. Percentage of plants lodged.

10. Weed population at heading time and at harvest time. Rated 1-5 where
    1-no weeds and 5-severe infestation.
11. Plant diseases using standard rating system.
12. Soil moisture and soil temperature at seeding time and periodically thereafter.
13. Miscellaneous notes on any other factors which may be important.

Planting Instructions:

This trial is to be laid out as a split-split plot design and sown by a disc drill with a 6 inch row spacing. The trial should be sown when the average soil temperature is 45° F. At six inches depth. The treated seed will be from a single source for all stations and all three years of the trial. Fertilizer, equipment, and labor will be provided by the individual stations.

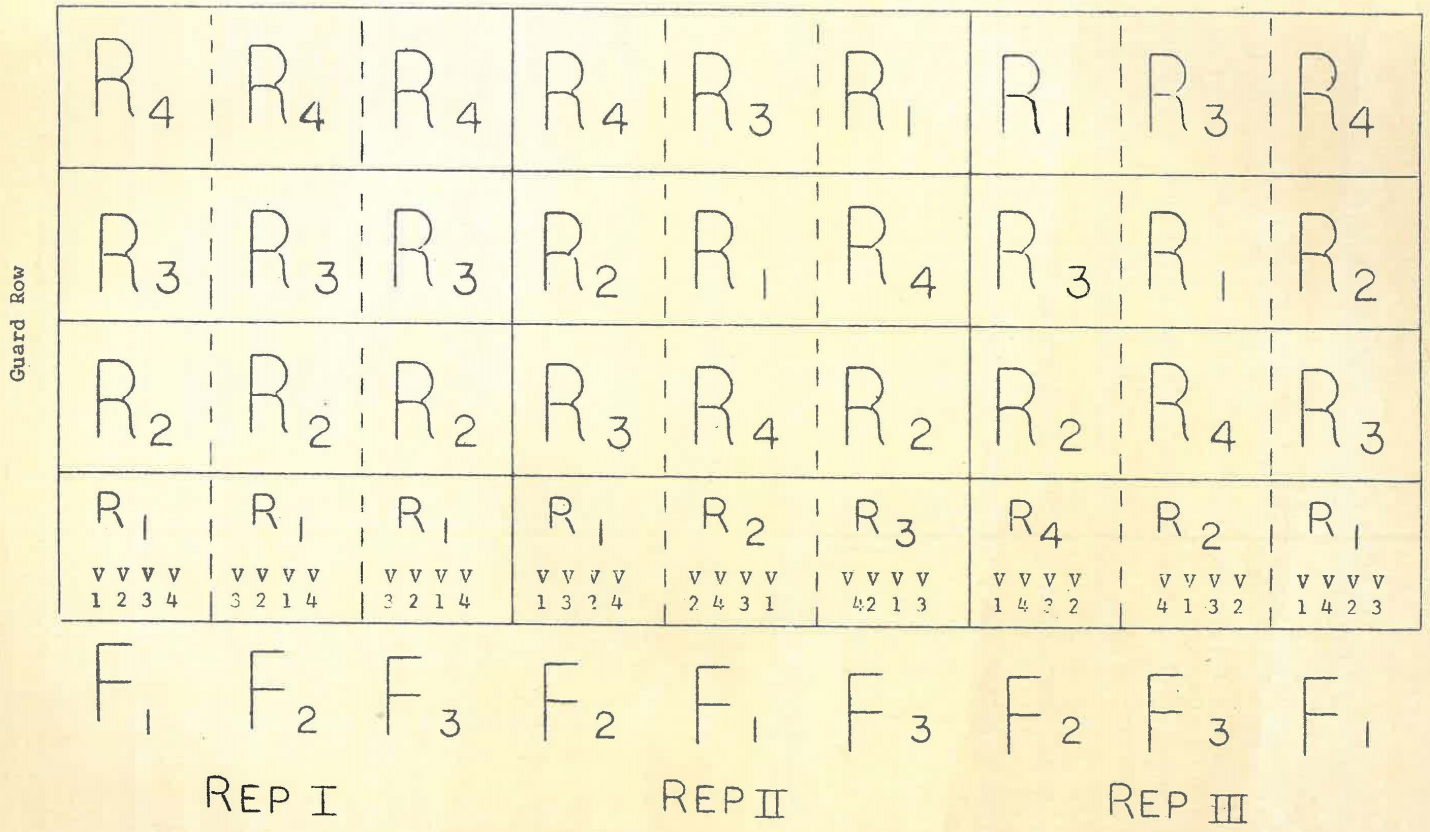
Experiment Design:

The trials has a split-split plot design with fertilizer (F) as the whole plot, variety (V) as the split plot and rate of seeding ® as the split-split plot. Three replications of each treatment will be sown. A breakdown of the analysis of variance is given below.

Rate of Seeding Variety x Fertility Study-Anova Table.

Source	DF.
Reps	2
Fertility	2
Error a	4
Variety	3
Variety x Fertility	6
Error b	24
Rate	3
Variety x Rate	9
Variety x Fertility	18
Error c	72
Total	143

RATE OF SEEDING X VARIETY X FERTILITY STUDY



The individual passes can be of any width depending upon the equipment used. This design is almost impossible to use unless rates of seeding can be easily adjusted. Guard rows may be necessary between fertility plots.

RATE OF SEEDING TRIALS

The main objective of this trial is to obtain information on how yields of common wheat, semi-dwarf wheat and durum wheat are affected by various seeding rates. A secondary objective attempts to measure the interaction of fertilizer application and seeding rate.

No firm conclusions are possible from a single years' date. Evaluation of the trial may be possible after three years' data are complete.

Table 54. Rate of seeding trial.

		Seeding Rate		Yields in bushels per acre			
	Fertilizer	Million Plants/acre	Pounds/ acre	1	2	3	Avg.
Fortuna	None	1/3	25.0	28.6	24.3	32.8	28.6
Fortuna		2/3	50.0	35.5	37.4	33.2	35.4
Fortuna		3/3	75.0	40.8	34.5	38.3	37.9
Fortuna		4/3	100.0	32.7	35.9	41.0	36.5
Wisc. 271		1/3	24.0	39.5	39.4	35.9	38.3
Wisc. 271		2/3	48.5	34.6	55.8	41.7	44.0
Wisc. 271		3/3	72.5	29.7	60.5	49.5	46.6
Wisc. 271		4/3	97.0	46.8	55.4	73.9	58.7
Waldron		1/3	27.5	31.7	35.0	33.3	33.3
Waldron		2/3	55.0	43.7	43.7	38.1	41.8
Waldron		3/3	82.5	42.6	39.4	35.3	39.1
Waldron		4/3	110.0	35.6	38.3	46.9	40.3
Leeds		1/3	31.5	34.4	52.7	43.1	43.4
Leeds		2/3	63.0	40.7	48.9	51.3	47.0
Leeds		3/3	94.5	55.2	56.2	55.3	55.6
Leeds		4/3	126.0	53.4	53.3	43.3	50.0

Table 55. Rate of seeding trial.

		Seeding Rate		Yields in bushels per acre			
	Fertilizer	Million Plants/acre	Pounds/ acre	1	2	3	Avg.
	55 lbs.						
Fortuna	18-46-0	1/3	25.0	30.3	30.5	18.5	26.4
Fortuna	18-46-0	2/3	50.0	32.0	36.0	38.1	35.4
Fortuna	18-46-0	3/3	75.0	31.4	34.4	26.4	30.7
Fortuna	18-46-0	4/3	100.0	29.5	36.8	44.1	36.8
Wisc. 271	18-46-0	1/3	24.0	34.5	36.3	26.4	32.4
Wisc. 271	18-46-0	2/3	48.5	43.5	42.1	40.1	41.9
Wisc. 271	18-46-0	3/3	72.5	39.9	48.6	61.0	49.8
Wisc. 271	18-46-0	4/3	97.0	44.3	53.9	64.9	54.4
Waldron	18-46-0	1/3	27.5	34.1	40.6	26.1	33.6
Waldron	18-46-0	2/3	55.0	34.3	34.9	44.4	37.9
Waldron	18-46-0	3/3	92.5	29.6	39.7	46.8	38.7
Waldron	18-46-0	4/3	110.0	33.1	38.7	36.8	36.2
Leeds	18-46-0	1/3	31.5	42.1	34.6	30.3	35.7
Leeds	18-46-0	2/3	63.0	39.2	52.4	49.9	47.2
Leeds	18-46-0	3/3	94.5	46.9	52.9	41.6	47.1
Leeds	18-46-0	4/3	126.0	48.9	49.9	49.7	49.5

Table 56. Rate of seeding trial.

		Seeding Rate		Yields in bushels per acre			
	Fertilizer	Million Plants/acre	Pounds/ acre	1	2	3	Avg.
	105 lbs						
Fortuna	18-46-0.	1/3	25.0	36.1	14.1	40.2	30.1
Fortuna	18-46-0	2/3	50.0	36.8	28.0	31.3	32.0
Fortuna	18-46-0	3/3	75.0	42.6	19.5	40.1	34.1
Fortuna	18-46-0	4/3	100.0	37.6	36.3	37.6	37.2
Wisc. 271	18-46-0	1/3	24.0	28.7	43.7	40.1	37.5
Wisc. 271	18-46-0	2/3	48.5	31.4	46.0	50.4	42.6
Wisc. 271	18-46-0	3/3	72.5	49.7	50.6	52.2	50.8
Wisc. 271	18-46-0	4/3	97.0	44.0	43.6	47.4	45.0
Waldron	18-46-0	1/3	27.5	16.0	38.9	39.5	31.5
Waldron	18-46-0	2/3	55.0	30.7	38.5	39.9	36.4
Waldron	18-46-0	3/3	82.5	28.7	36.8	38.5	34.7
Waldron	18-46-0	4/3	110.0	44.4	43.0	23.5	37.0
Leeds	18-46-0	1/3	31.5	32.2	43.4	43.9	39.8
Leeds	18-46-0	2/3	63.0	32.9	49.1	34.3	38.8
Leeds	18-46-0	3/3	94.5	40.7	47.4	53.8	47.3
Leeds	18-46-0	4/3	125.0	52.0	45.5	53.1	50.2

Table 57. Rate of seeding trial 1969.

	Seeding Rate		Average Yield			
	Million Plants/acre	Pounds/ acre	Check	55 lbs 18-46-0	105 lbs 18-46-0	All Treatments.
Fortuna	1/3	25.0	28.6	26.4	30.1	28.4
Fortuna	2/3	50.0	35.4	35.4	32.0	34.3
Fortuna	3/3	75.0	37.6	30.7	34.1	34.2
Fortuna	4/3	100.0	36.5	36.8	37.2	36.8
Wisc. 271	1/3	24.0	38.3	32.4	37.5	36.1
Wisc. 271	2/3	48.5	44.0	41.9	42.6	42.8
Wisc. 271	3/3	72.5	46.0	49.8	50.8	48.9
Wisc. 271	4/3	97.0	58.7	54.4	45.0	52.7
Waldron	1/3	27.5	33.3	33.6	31.5	32.8
Waldron	2/3	55.0	41.8	37.9	36.4	38.7
Waldron	3/3	82.5	39.1	38.7	34.7	37.5
Waldron	4/3	110.0	40.3	36.2	37.0	37.8
Leeds	1/3	31.5	43.4	35.7	39.8	39.6
Leeds	2/3	63.0	47.0	47.2	38.8	44.3
Leeds	3/3	94.5	55.6	47.8	47.3	50.2
Leeds	4/3	126.0	50.0	49.5	50.2	49.9

Table 58. Summary of Analysis of the Seeding Rate Trials-1969.

		Dickinson		Williston		Minot	
Variable	DF	F Value	Significance	F Value	Significance	F Value	Significance
Reps	2	13.15	**	1.76		1.34	
Fertility	2	7.00	*	15.29	**	4.21	
Variety	3	19.75	**	21.77	**	2.96	
Fertility vs Vriety	6	0.13		2.62		0.44	
Seeding Rate	3	15.66	**	2.41		22.95	
Fertility vs Seeding Rate	6	0.43		0.57		0.13	
Variety vs Seeding Rate	9	1.31		2.87	*	1.05	
Fertility vs Variety vs Seeding Rate	18	0.55		0.86		0.43	
Total	143						

* Significant @ 0.050
** Significant @ 0.025

UNIFORM CORM PRODUCTION TRIAL

This trial is designed to compare corn grain and corn silage production. And how production is influenced by commercial fertilizer application, previous land use, row width, and plant population under North Dakota environments conditions.

Row spacing of 20 inches, 30 inches, and 40 inches are used on both summrfallow and on stubbleland, and all treatments are planted both with and without commercial fertilizer.

The trial began in 1966 but was hailed out that year at Dickinson.

Table 59. Yields from the Uniform Corn Production Trial as Influenced by Commercial Fertilizer Application and Previous Land Use.

Treatment	1967	1968
Grain yield on fallow-bushels per acre		
With commercial fertilizer	39.1	61.3
No commercial fertilizer	35.3	61.0
Grain yield on stubbleland-bushels per acre		
With commercial fertilizer	29.4	25.9
No commercial fertilizer	32.3	26.0
Silage yield on fallow-tons per acre		
With commercial fertilizer	6.4	5.0
No commercial fertilizer	5.7	4.9
Silage yield on stubbleland-tons per acre		
With commercial fertilizer	6.7	2.9
No commercial fertilizer	7.0	2.5

Table 60. Yields from the Uniform Corn Production Trial as Influenced by Row Spacing.

Treatment	1967	1968
Grain yields on fallow-bushels per acre		
20 inch row spacing	39.5	67.5
30 inch row spacing	37.4	62.2
40 inch row spacing	34.8	54.0
Grain yields on stubbleland-bushels per acre		
20 inch row spacing	33.6	26.5
30 inch row spacing	31.4	24.8
40 inch row spacing	27.7	26.8
Silage yields on fallow-tons per acre		
20 inch row spacing	6.1	5.2
30 inch row spacing	6.1	5.5
40 inch row spacing	6.0	4.3
Silage yields on stubbleland-tons per acre		
20 inch row spacing	7.1	2.9
30 inch row spacing	7.1	2.4
40 inch row spacing	6.6	2.7

Appreciable damage occurred to the corn in this trial when the temperatures dropped to 27° F on June 20th. Dry weather in August and September hastened the maturity of the crop. The late first call frost date of October 4 was of no special benefit to the crop because the moisture supply was used up and the crop ripened by the middle of September.

Table 61. Corn variety trial-1969.

Variety	Days R.M.	% Moisture	Silage yield tons/acre @ 70% moisture
Trojan Txs-85-F-6	84	70.0	6.49
Agsco 3 x AA	80	68.1	5.60
Agasco 3 x AAA	70	62.0	4.24
De kalb 22	70	64.5	5.19
De kalb 29	75	66.8	4.97

Table 62. UNIFORM CORN PRODUCTION TRIAL DATA

Station Dickinson Year 1969 Date Planted: 5-19 Harvested: Silage 9-10 Grain 9-15

Population: P_1 12,000 P_2 18,000 Fertilizer 210 lbs. 0-46-0 Frost Date 10 - 4

Cols.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Plot No.	Trt. code LRFWP	Date of silk	Height Plant in.	Height Ear in.	Plant lodge %	Weight of Silage Plot Wet	Weight of Silage Sample Wet	Weight of Silage Sample Dry	Weight of Silage Ears Wet	Weight of Silage Ears Dry	No. of stalks	Weight of Grain per plot Wet	Weight of Grain per plot Dry	Weight of Grain per plot Shell	No. of Ears
1	I I 111	8-9	55	14	0	5.0	410	146	1000	551	8	1000	551	451	7
2	II 112	8-8	60	16	0	5.8	330	160	348	187	11	348	187	168	6
3	II 121	8-9	59	16	0	7.5	738	286	666	397	8	666	397	322	4
4	II 122	8-8	55	15	0	4.3	580	157	890	405	6	890	405	371	5
5	II 131	8-9	55	15	0	7.8	666	214	940	535	6	940	535	425	5
6	II 132	8-7	56	15	0	4.3	610	170	860	516	6	860	516	416	6
7	II 211	8-8	58	16	0	7.8	428	125	1212	611	8	1212	611	546	8
8	II 212	8-7	57	16	0	3.5	366	214	616	410	6	616	410	318	6
9	II 221	8-8	53	13	0	7.5	322	166	862	402	12	862	402	296	6
10	II 222	8-7	59	15	0	6.0	454	273	300	163	7	300	163	142	3
11	II 231	8-8	60	16	0	6.0	608	211	578	303	6	578	303	216	3
12	II 232	8-7	57	15	0	3.8	516	182	542	321	5	542	321	264	4
13	I II 221	8-9	58	14	0	8.5	642	250	410	225	9	410	225	182	2
14	I II 222	8-9	58	15	0	5.8	680	202	686	351	7	686	351	287	5
15	I II 232	8-9	56	14	0	5.0	1032	211	350	196	6	350	196	148	2
16	I II 231	8-9	53	14	0	4.0	510	160	788	435	7	788	435	351	6
17	I II 211	8-7	55	14	0	4.5	290	111	882	530	8	882	530	436	6
18	I II 212	8-7	52	13	0	6.3	390	165	510	268	11	510	268	217	6
19	I II 131	8-8	55	15	0	4.5	454	201	1225	719	4	1225	719	602	6
20	I II 132	8-9	52	14	0	5.3	786	256	686	420	7	686	420	321	5
21	I II 112	8-9	55	15	0	6.0	310	165	830	494	8	830	494	391	6
22	I II 111	8-8	56	16	0	7.5	980	324	1141	569	9	1141	569	522	7
23	I II 122	8-9	59	17	0	5.8	630	265	748	414	5	748	414	327	4
24	I II 121	8-8	55	15	0	3.5	398	217	768	412	7	768	412	323	3

UNIFORM CORN PRODUCTION TRIAL DATA

Station_____ Year_____ Date Planted:_____ Harvested: Silage_____ Grain_____

Population: P_1_____ P_2_____ Fertilizer_____ Frost Date_____

Cols.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Plot	Trt. code LRFWP	Date of silk	Height Plant in.	Height Ear in.	Plant lodge %	Weight of Silage Plot Wet	Sample Wet	Sample Dry	Ears Wet	Ears Dry	No. of stalks	Weight of Grain per plot Wet	Dry	Shell	No. of Ears
25	I III 231	8-9	54	14	0	5.0	452	216	780	474	6	780	474	382	5
26	I III 232	8-7	52	13	0	5.5	292	147	434	248	8	434	248	211	4
27	I III 212	8-7	55	15	0	8.5	382	147	700	453	10	700	453	365	5
28	I III 211	8-7	52	14	0	4.0	374	122	516	278	8	516	278	227	5
29	I III 221	8-7	52	13	0	6.5	300	88	768	483	8	768	483	389	5
30	I III 222	8-8	59	16	0	5.3	338	177	564	332	6	564	332	265	3
31	I III 132	8-9	58	15	0	4.5	526	225	646	388	7	646	388	304	5
32	I III 131	8-8	56	15	0	7.5	554	203	542	342	8	542	342	272	4
33	I III 111	8-8	55	14	0	6.8	338	153	1236	605	8	1236	605	553	8
34	I III 112	8-9	59	14	0	4.0	454	186	1090	521	7	1090	521	496	6
35	I III 121	8-9	52	13	0	4.0	624	248	720	426	6	720	426	338	4
36	I III 122	8-9	51	13	0	3.5	570	233	1114	495	5	1114	495	468	7
37	I IV 122	8-10	52	13	0	5.0	492	173	532	306	9	532	306	234	6
38	I IV 121	8-8	58	16	0	5.5	590	237	1006	584	6	1006	584	476	5
39	I IV 112	8-10	54	14	0	5.8	456	200	950	515	13	950	515	405	8
40	I IV 111	8-6	52	13	0	4.3	430	205	1020	601	8	1020	601	497	7
41	I IV 131	8-9	54	14	0	4.0	344	152	964	567	8	964	567	462	7
42	I IV 132	8-7	54	15	0	7.5	634	222	1050	631	6	1050	631	502	5
43	I IV 231	8-7	57	16	0	3.8	330	156	410	225	8	410	225	173	3
44	I IV 232	8-7	60	17	0	5.0	574	195	1382	845	7	1382	845	763	7
45	I IV 222	8-8	59	16	0	3.8	322	131	434	291	9	434	291	241	4
46	I IV 221	8-7	53	15	0	5.3	604	265	670	409	7	670	409	328	4
47	I IV 211	8-8	52	12	0	3.5	284	142	530	341	7	530	341	275	6
48	I IV 212	8-7	57	14	0	4.8	330	186	648	367	9	648	367	326	7

UNIFORM CORN PRODUCTION TRIAL DATA

Station Dickinson Year 1969 Date Planted: 5-19 Harvested: Silage 9-10 Grain 9-15

Population: P_1 12,000 P_2 18,000 Fertilizer 200 lbs. 11-48-0 Frost Date 10-4

Cols.		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Plot No.	Trt. code LRFWP	Date of silk	Height Plant in.	Height Ear in.	Plant lodge %	Weight of Silage Plot Wet	Sample Wet	Sample Dry	Ears Wet	Ears Dry	No. of stalks	Weight of Grain per plot Wet	Dry	Shell	No. of Ears
49	21 111	8-10	55	15	0	4.7	466	167	720	387	9	720	387	309	5
50	21 112	8-10	56	12	0	6.0	352	137	526	294	10	526	294	233	5
51	21 121	8-12	52	14	0	6.4	468	183	1034	504	9	1034	504	371	7
52	21 122	8-10	56	16	0	5.7	484	185	526	246	8	526	246	188	6
53	21 131	8-12	51	14	0	6.0	716	186	780	326	10	780	326	252	4
54	21 132	8-9	58	16	0	5.5	490	180	670	293	8	670	293	208	4
55	21 211	8-8	52	15	0	5.4	584	185	670	393	5	670	393	301	4
56	21 212	8-8	58	16	0	7.3	420	111	860	477	11	860	477	355	5
57	21 221	8-10	54	15	0	9.7	418	173	842	417	12	842	417	308	5
58	21 222	8-10	59	15	0	7.2	690	224	1212	508	11	1212	508	460	7
59	21 231	8-10	60	17	0	6.7	710	198	840	438	6	840	438	352	6
60	21 232	8-10	59	16	0	5.7	696	257	1095	555	7	1095	555	422	6
61	2 II 232	8-10	59	16	0	6.1	652	230	920	516	10	920	516	407	6
62	2 II 231	8-10	51	13	0	7.3	710	195	926	456	11	926	456	328	7
63	2 II 212	8-10	54	14	0	8.2	622	217	1272	516	8	1272	516	496	8
64	2 II 211	8-9	54	14	0	7.2	506	156	814	414	9	814	414	302	5
65	2 II 221	8-9	50	13	0	7.7	746	202	414	234	8	414	234	184	2
66	2 II 222	8-9	51	13	0	7.7	762	237	840	417	12	840	417	326	6
67	2 II 131	8-12	48	12	0	5.8	718	240	930	430	7	930	430	309	6
68	2 II 132	8-12	52	14	0	7.0	910	295	728	330	8	728	330	240	4
69	2 II 122	8-12	50	12	0	6.7	532	132	610	282	16	610	282	205	5
70	2 II 121	8-11	52	13	0	5.5	584	161	694	343	10	694	343	272	5
71	2 II 111	8-10	54	15	0	9.5	550	200	1190	471	12	1190	471	412	6
72	2 II 112	8-11	50	12	0	5.5	584	244	552	257	13	552	257	191	4

UNIFORM CORN PRODUCTION TRIAL DATA

Station_____ Year_____ Date Planted:_____ Harvested: Silage_____ Grain_____

Population: P_1_____ P_2_____ Fertilizer_____ Frost Date_____

Plot	Trt. code LRFWP	Date of silk	(1) Height Plant in.	(2) Height Ear in.	(3) Plant lodge %	(4) Weight of Silage Plot Wet	(5) Sample Wet	(6) Sample Dry	(7) Ears Wet	(8) Ears Dry	(9) No. of stalks	(10) Weight of Grain per plot Wet	(11) Dry	(12) Shell	(13) No. of Ears
73	2 III 111	8-12	52	13	0	10.0	690	241	1000	403	8	1000	403	394	7
74	2 III 112	8-10	53	12	0	4.9	262	140	810	423	7	810	423	326	5
75	2 III 132	8-10	52	13	0	8.6	658	231	1032	556	8	1032	556	437	5
76	2 III 131	8-9	53	13	0	6.0	326	171	466	252	8	466	252	198	4
77	2 III 121	8-10	51	13	0	7.7	442	213	900	469	7	900	469	346	4
78	2 III 122	8-10	50	12	0	3.3	480	163	512	283	8	512	283	224	5
79	2 III 212	8-12	52	13	0	5.9	650	222	892	434	6	892	434	327	5
80	2 III 211	8-8	50	13	0	3.5	498	182	710	363	7	710	363	281	5
81	2 III 232	8-12	52	14	0	7.2	550	182	318	137	15	318	137	102	4
82	2 III 231	8-8	50	12	0	6.0	278	172	1164	514	10	1164	514	491	8
83	2 III 222	8-10	50	12	0	5.5	724	281	950	501	6	950	501	377	5
84	2 III 221	8-10	54	14	0	6.0	690	216	578	358	10	578	358	282	4
85	2 IV 111	8-10	55	15	0	6.2	452	146	1152	602	8	1152	602	482	6
86	2 IV 112	8-10	50	13	0	6.6	450	233	976	511	11	976	511	395	5
87	2 IV 131	8-10	51	12	0	4.5	286	168	1140	651	7	1140	651	516	7
88	2 IV 132	8-8	52	13	0	6.5	630	250	1090	577	8	1090	577	455	6
89	2 IV 122	8-10	52	13	0	4.9	616	245	696	407	6	696	407	315	4
90	2 IV 121	8-10	52	14	0	5.2	720	227	1058	518	6	1058	518	387	5
91	2 IV 221	8-8	51	12	0	6.5	710	220	1094	663	7	1094	663	507	5
92	2 IV 222	8-8	53	15	0	3.8	310	136	786	464	6	786	464	360	5
93	2 IV 231	8-8	52	12	0	5.5	568	141	458	308	10	458	308	247	2
94	2 IV 232	8-8	54	14	0	7.0	576	172	550	302	12	550	302	223	3
95	2 IV 211	8-8	50	13	0	4.2	534	200	906	578	7	906	578	477	7
96	2 IV 212	8-8	51	14	0	5.7	358	182	646	414	12	646	414	326	6

SORGHUM MANAGEMENT TRIAL

Yields in the sorghum management trial where the crop was cut at different heights, and at two dates of cutting, are summarized in table 63.

Included also in this management trial was a rate of seeding study, with the variety NK 145 used throughout. Data from this trial for 1967-1969 are given in table 64.

Data from the yield trial which compares several varieties of sorghum, Sudan grass, sorghum and Sudan grass hybrids and corn, are summarized in table 65 from the 1967-1969 seasons. This trial as well as the two proceeding trials reported in tables 63 and 64, were grown on land that was summer-falllowed in the season of 1968.

Table 63. Sorghum Management Trial 1967-1969.

		Dry weight yields-lbs/acre											
		August 1 cutting				September 6 cutting				Total-yield			
Variety	Cutting height	1967	1968	1969	Avg.	1967	1968	1969	Avg.	1967	1968	1969	Avg.
Sweet	2"	693	718	191	534	1472	2690	3634	2599	2165	3408	3825	3133
Sioux	6"	539	176	142	286	1459	2325	4144	2643	2098	2501	4286	2962
(maturity)	10”	125	59	31	72	1403	3161	4305	2956	1528	3220	4336	3028
	2" (maturity)	-	-	-	-	3081	3608	4869	3853	3081	3608	4889	3859
	2"	607	679	151	479	2170	2002	3565	2579	2777	2681	3716	3058
	6"	265	116	68	150	2286	1988	3717	2664	2553	2104	3785	2814
DeKalb	10"	128	22	19	56	2321	2540	3558	2806	2449	2562	3577	2863
	2" (maturity)	-	-	-	-	3450	2984	4743	3726	3450	2984	4743	3726

Table 64. Rate of seeing trial with sorghum 1967-1969.

Rate of Planting-lbs/Acre-Seed	Dry-weight yields-lbs./acre			
	1967	1968	1969	Avg.
2	1022	3394	3998	2805
4	1809	5090	4495	3798
6	2725	3950	4605	3760
9	2274	4528	5239	4014
12	2441	4720	5881	4347
15	2801	4636	5431	4289
18	2477	4703	5404	4195
21	3171	4993	6289	4818

Table 65. Yield trial of several varieties of corn, sorghum, and Sudan grass and sorghum and Sudan grass hybrids-1967-1969.

Variety	Dry-weight yields-lbs./acre			
	1967	1968	1969	Avg.
Piper Sudan	2240	2286	3158	2561
Nk-78 Corn	2678	2111	- 1/	1597
HS-50 Corn (high sugar)	2871	2849	3456	3059
Sokota 250 Corn (95 day)	2108	2196	3750	2685
NK-145 (Sudan grass cross)	2283	2981	4841	3368
Pioneer 936 (sorghum hybrid)	2523	3435	5377	3778
DeKalb SX-11 (Sorghum x Sudan)	2536	2572	4140	3083
Trudan I (hybrid Sudan grass)	2465	2340	2707	2504
KE-411	-	-	4121 2/	1374

1/ Not included in 1969 trial.
2/ Not included in trial previous to 1969.

MEETINGS AND TOURS
1969

Date		Attendance
January 10	Stark County Crop Improvement Assn.	350
January 14	Jaycees-Dickinson-Selection of Outstanding Young Farmer	
January 15	Frontier Farming Days-Dickinson Variety Recommendation	300
January 21	Frontier Farming Days-Beach Variety Recommendation	125
January 22	McKenzie Co. Crop Improvement Assn. Grass and Forage Trials at DES	25
January 31	Frontier Farming Days-Hettinger Variety Recommendation	40
February 5	SCS Country Agent Planning & Review-Beach	12
February 12	Hettinger Station-Sheep Day	attended
February 17	Dunn Country Vocational Agricultural Group Tour Livestock Trials	42
February 18	Burleigh Country Agricultural Imp. Assn.	40
February 19-20	Branch Station Conference	attended
March 4	NGPFS-Mandan-Research Review and Planning Conference	attended
March 7	Valley City Winter Show	Judge
March 14	Hettinger County Crop Imp.-Association-Regent	35
March 25-26	Nitrogen Fertilizer Conference-Bismarck	attended
May 16	St Patrick's Fifth Graders-Tour of Station	69
July 14	Hettinger Off-Station Crops Day	30
July 16	Crops Day at Dickinson Experiment Station	250
July 23	Distriict Livestock Judging Contest	80
July 27	Crops Day at Beach Off-Station Trials-Fertilizer Work	20
August 5	Glen Ullin Field Day-Off-Station Site	75
August 13	Dean Hazen-City of Annexation	12
August 18	Stark County-4-H Achievement Day	Crops Judge
August 25	Cornell University-Agronomy Tour	30
August 27	SCS Personnel from Bismarck and Lincoln, Nebraska-Tour of Station	4
September 13	Golden Valley 4-H Achievement Day	Grains Judge
September 29-30	North Dakota Hereford Tour	attended
October 1	Grant County Crop Investment Assn.	30
October 8	Dickinson High School Vocational Classes	75
October 9	Dickinson High School Agri-BusinessClass-Tour Station	24
October 10	4th Grade Public School Students-Tour Livestock Farm	25
October 17	Elgin 4-H Achievement Day & Fall Festival	Judge
October 31	Hereford Association Type & Carcass Evaluation Program-Bismarck	attended
November 5	Slope Seed Dealers Association	60
November 8	PGA Meeting-Lemmon, South Dakota	250
November 19	John Deere Day-Dickinson	300
December 3	Livestock Research Roundup	1100
December 9	Slope County Crop Improvement Assn. Meeting	45
December 17	Seed Trade Short Course Program	200
December 18	Fertilizer Dealer Conference	attended

RADIO-1969

Date	Programs
January 3	Comparison of Shoe Drills and Disk Drill in Western North Dakota.
January 17	Report of Release of Waldron Wheat and Performance in Western North Dakota
January 31	Progress Report on Summerfallow Management Trials
February 14	Management of Summerfallow
February 18	Management of Summerfallow
March 14	Use of Commercial Fertilizer
March 21	Use of Commercial Fertilizer (continued)
April 11	Depth of Seeding
April 25	Prograss with Off-Station Trials
May 9	Results of Uniform Corn Production Trials
May 30	Weed Control Recommendations-1969
June 13	Rust Situation and Vrops Field Day
July 18	Crops Field Day at Dickinson Experiment Station
August 15	Guidelines of Swathing
September 19	Results of Winter Wheat Trials and New Winter Wheat Trials for 1969-1970
October 17	Livestock Research Roundup Program
November 14	Livestock Research Roundup Program
December 12	Report of Small Grain Variety Yields-1969
December 26	Plans for New Research Work in 1970

GENERAL SUMMARY

	Farm Visits	No. Tours	Attendance at Meetings	Station Calls	Radio Talks	News Articles	Meetings Attended
January	0	0	840	3	3	0	6
February	0	1	94	3	2	0	4
March	0	0	0	4	2	0	4
April	0	0	0	5	2	1	0
May	0	1	77	8	1	1	2
June	2	0	0	6	1	1	0
July	9	0	440	19	1	0	5
August	0	2	120	11	1	0	5
September	0	0	0	14	1	0	2
October	0	2	155	12	1	0	6
November	0	0	690	15	1	0	4
December	0	0	1345	18	1	2	4
Totals	**11**	**6**	**3761**	**118**	**17**	**5**	**42**