1967

Annual Report

Dickinson Experiment Station

Dickinson, North Dakota

***

Raymond J. Douglas

Superintendent

Table of Contents

Annual Report

Of The

Dickinson Experiment Station

A fair return to the farmer and rancher is essential to a thriving agriculture, and with North Dakota more wholly agricultural than any other stat, it is necessary for our entire economy. In this critical period with and ever increasing overhead and low prices which in many cases are below parity we must take a carful look at our over-all farming and ranch programs.

These factors have brought about a station requiring the best possible type of operation for both the farm and ranch. We not only need to have the most up to date knowledge in crop production, range management, and the livestock enterprises but we must use the information to the best advantage in our programs and the various situations as they arise.

Personal desires or tradition must no longer be in our program unless it still marks the most profitable type of production. Our agricultural enterprises must be developed to the highest degree. Examples of this would be growing the best in small grain varieties, proven tillage practices, the most profitable fertilizer amounts and application along with our best “know how” for “ more roughage from less acres “. This type of operations helps our income remain stable in the face of increasing overhead and in many cases lower prices for farm and ranch commodities.

In all agricultural enterprises management is of the utmost importance in keeping up the income. Examples for livestock would be low cost housing, efficient use of roughage and grain raised on the unit along with handling the cow and calf herd for the greatest possible income. The same management and feeding consideration must also be given in a swine enterprise.

The value of this Station is vested in pointing the way for these changes in a well balanced program of expansion. The result will be a strong agriculture and a greater income for not only the farmers and ranchers but the other large segment of out population dependent upon a thriving agriculture.

Changing trends in crop production in the United States pose many questions for the farmer and rancher. In recent months our National Agricultural policy has placed less effort on reducing farm output by retiring land from cultivation and has given more emphasis to encouraging increased production of many crops.

Increased requirements for food to meet domestic needs, supply foreign markets and provide aid to undeveloped nations have reduced stocks of surplus crops to the point that there must be concern with assuring adequate supplies in the future.

The prevention of water and wind erosion is an ever present problem which must be met for maintenance of maximum soil fertility and production. This demands constant effort in the conversation

of all our natural resources. Extensive and proper use of land and water are a must in a sound program geared to the agriculture of the west river area.

The seasons of short rainfall are the greatest single hazards to crop production in the west river area. The fact requires an agricultural improvement program built upon a foundation of sound dry land farming and ranching operations. There is the occasional season of too scanty rainfall for even dry land farming methods to pay out.

Acreage control is encouraging farmers to devote time and land to new crops, which have promise of potential in our agricultural program. Emphasis is being placed more and more on increasing yields through better crop varieties, the best use of fertilizer, and improved practices in tillage and crop rotations along with improved insect and weed control measures.

We can help in this over-all change or "Agricultural Revolution" by pointing the way towards new findings which when taken together even under the most adverse conditions will tend to stabilize our farm and ranch income.

We must also fit these changes in our agricultural programs into the over-all picture to insure:

1. Conservation of our natural resources.
2. Increase both the ranch and farm income to provide a better way of life in the face of increased cots.
3. Maintain our soil in such a condition that it will retain or even improve productivity for future generations.

Needs of
The
Dickinson Experiment Station

The public looks towards an experiment station as a place that has "eye appeal" which in some cases carries beyond the experimental work being done. This embodies constant repairs, renovation and "dressing up" during every week of the year. Our equipment, and methods must in every sense of the word be up-to-date. In our projects whenever possible the method of operation must point the way for the agriculture of tomorrow.

To do this job and meet the approval of those interested in and dependent upon our work requires that our programs lead the way in agriculture and be far reaching and comprehensive in scope.

I. LAND

1. The Dickinson State College received 20 acres of our land described as S ¼ of N ¾ W ½ W ½ of Section 4-139-96 through Legislative action in 1967 for a consideration of $500.00 per acre.
2. Up to the present time we have not been able to acquire more land for the Station to replace the land lost to the Highway Department, Dickinson school system and Dickinson State College.

   We have $79,726.00 at the present time, to be used for the purchase of additional land for the use of the Dickinson Experiment Station. It is our hope that the land be purchased in 1968.

3. We are anxious to increase our range land in the Badlands from 400 to 640 acres. This is being worked on with the Forest Service and the Bureau of Land Management. It is hoped that arrangements can be made to secure an acreage adjacent to the grazing land we already have known as Pyramid Park. If some land could be obtained from the Federal government as indicated, one or more small tracts are probably available from private owners. This land is necessary in order to give our cow herd an acreage of sufficient size to provide grazing for the whole herd in the Badlands from about June 20 to October 15 without over-grazing our range. We are in need of three separate pastures for this purpose, with present acreage providing only two grazing areas.

II. IMPROVEMENTS MADE IN 1967.

1. The buildings on the Agronomy farm were all painted in 1967 except the mess house. The major portion of the cattle lots on the Livestock farm not painted in 1966 were painted in 1967.
2. The "off-station" sites for crops work were selected in 1967. These sites are located in Dunn, Golden Valley, Bowman, Adams and Morton counties.

   Contracts for these sites for 1968 have already been signed. This will be the first year of the trials on these sites which in most cases consist of 10 acres, with 5 acres in trials and 5 acre in fallow each year.
3. Renovation of the shelter belts on both frame were continued.
4. Pruning and removing of dead trees was continued in 1967.
5. The land was prepared for the sainfoin pasture trials to be planted in the spring of 1968.

6. The SW ¼ SW ¼ of Section 5 was prepared for planting to a grass and alfalfa mixture in 1968.
7. A grass mixture was planted in the diversion ditch, constructed on the NW ¼ of Section 32 in 1966.
8. New iron gates were put on the boar lots.
9. New gates were constructed and much repairing done on lot and fences.
10. The shop on the Agronomy farm was improved to make for satisfactory working conditions during the winter months. This included a new cement floor on a insulated base. Additional insulation on the walls and ceiling, a new heating plant, an overhead door and a complete paint job.

III. IMPROVEMENTS TO BE MADE IN 1968.

1. Painting of the mess house on the Agronomy farm, and the building, lots and gates on the Livestock farm not painted in 1967.
2. Replace both spruce and broad leaf trees in our shelter belts where needed.
3. Replace dead apple and plum trees in our new orchard planting.
4. Continue renovation of our shelter belts on both farms in 1968.
5. Prune and properly keep up shelter belts.
6. Make sainfoin planting for pasture trials in 1968.
7. Re-seed SW ¼ SW ¼ of Section 5 with a grass mixture of western wheatgrass, Russian wild rye, Lincoln brome and Ladak alfalfa.
8. Build a new entrance to the root cellar.
9. Build a new machine shed on the Agronomy farm. This project should have been completed before, but was not started due to the lack of time to get the job done.

IV. OTHER PROJECTS

1. The poultry project was discontinued in 1967.
2. The garden project will be continued in 1968 in cooperation with the Extension Service and Horticulture Department at North Dakota State University. Adequate water is provided for the irrigation of the garden project.

V. INFORMATION

1. Our program included releasing information as available for improving farming and ranching operations. Such information is released through the Crops Day, Livestock Research Roundup, tours, meetings, publications, news releases, radio and TV programs, along with both office and farm calls.
2. Two thousand copies of our 1967 Livestock Research Roundup bulletin were released to farmers and ranchers.

Dickinson Experiment Station
Weather Station

We make a daily weather record which is sent to the National Weather Records Center, Arcade Building, Asheville, North Carolina which consists of the following:

1. Maximum, minimum and 7:00 a.m. temperature readings.
2. Wind velocity over each 24 hour period.
3. Free surface evaporation from April 1 to October 1.
4. Daily precipitation.
5. Snow fall each day and amount on the ground each day

The daily reports are summarized for each month and at the end of each year.

Month	1967	Accum.	1892-1967 Summary*	Avg.	Accum.	Last 10 Years Year	April-July	Annual
Jan.	.51	.51	32.97	.43	.43	1958	8.14	12.18
Feb.	.48	.99	32.61	.43	.86	1959	6.15	13.45
March	.27	1.26	56.37	.74	1.60	1960	6.22	10.23
April	3.87	5.13	101.92	1.34	2.94	1961	7.81	13.90
May	2.79	7.92	176.08	2.32	5.26	1962	12.59	18.34
June	1.63	9.55	267.08	3.51	8.77	1963	13.58	18.94
July	.72	10.27	166.71	2.19	10.96	1964	13.78	18.68
Aug.	.41	10.68	136.36	1.79	12.75	1965	16.81	21.63
Sept.	2.48	13.16	93.05	1.22	13.97	1966	10.11	16.69
Oct.	.61	13.77	61.16	.80	14.77	1967	9.01	14.24
Nov.	.15	13.92	39.54	.52	15.29	1944**	21.20	31.16
Dec.	.32	14.24	29.56	.39	15.68	1936**	2.03	6.72

76- Year Average Precipitation = 15.68; 76-Year Average Precipitation, April-July = 9.37; *Total Precipitation in inches per month for 76 years; **Greatest of Record; ***Least of Record; 1967 Greatest 24-hour precipitation, April 16, 1.70 inches. Under Normal for 1967 -1.44 inches.

Temperature
General Information

Latest Killing Frost in Spring

1915	June 16	30°F
1967	May 13	28°F

Earliest Killing Frost In Fall

1917	Aug. 9	30°F
1967	Sept. 10	29°F

Frost-Free Season

1967 124 days

Shortest of Record

69 days-in 1915-1917

Longest of Record

175 days -1962

Lowest of Record

1936	Feb. 16	-47°F
1967	Dec. 31	-31°F

Highest of Record

1936	July 6	114°F
1967	Aug. 1	100°F

LIGHTING SAFETY RULES

THESE SAFETY RULES WILL HELP YOU SAVE YOUR LIFE WHEN LIGHTNING THREATENS:

(1) Stay indoors, and don't venture outside, unless absolutely necessary.
(2) Stay away from open doors and windows, fireplaces, radiators, stoves, metal pipes, sinks, and plug-in electrical equipment like radios, television sets, lamps, and refrigerators.
(3) DO not use plug-in electrical equipment like hair dryers, electric tooth brushes, or electric razors during an electrical storm.
(4) DO not use the telephone- lighting may strike telephone lines outside.

IF LIGHTINIG CATCHES YOU OUR OF DOORS:

(1) Don't work on fences, telephone or power lines, pipelines, or structural steel fabrication.
(2) Don't use metal objects like fishing rods and golf clubs.
(3) Don't handle flammable materials in open containers.
(4) Stop tractor work, especially when the tractor is pulling metal equipment, and dismount. Tractors in open fields are often struck by lightning.
(5) Get out of the water and off small boats.
(6) Stay in your automobile if you are traveling. Automobiles offer excellent lightning protection.
(7) Seek shelter in buildings. If no buildings are available, your best protection is a cave, ditch, canyon, or under head-high clumps of trees in open forest glades.
(8) When there is no shelter avoid the highest object in the area. If only isolated trees are nearby, your best protection is to crouch in the open, keeping as far away from isolated trees as the trees are high.
(9) Avoid hill tops, open spaces, wire fences, metal clothes lines, exposed sheds, and any electrically conductive elevated objects.
(10) When you feel the electrical charge – if your hair stand on end or your skin tingles – lightning may be about to strike you. Drop to the ground immediately.

VI. BEEF CATTLE

A. Improving the cow herd.

1. We are making a special effort over the years to improve the production of our cow herd. The heifer calves selected as replacement animals are the best ones raised each year on the basis of pounds over the scale at weaning, good growth rates, economy of gains, carcass quality and against such defects as dwarfism.
2. Each year heifers equal to about on fifth of the cow herd are saved for replacements. After culling out the cows with defects like lump jaw, cancer eye, bad feet, cows over 10 years old, etc., the poor producing cows still remaining in the herd are replaced. This program results in weeding out a little less than the bottom one fifth of the herd each year.
3. We believe that the life of a cow in the breeding herd should not be over ten years unless she is an exceptionally good cow and sound.
4. If under normal conditions a heifer weans a light calf she probably always will and should be culled.

5. One important factor in producing a heavy calf at weaning is the mother's ability to be a good milker.
6. Dry cows and a cow that losses her calf during the pregnancy period are not profitable an should be removed from the herd at once. In either case the physiology of the cow's reproductive tract or disease may be the reason for the cow being dry or the abortion.
7. A cow with a high-strung temperament, a fence crawler, or one with a mean disposition, will never change and should be removed from the herd.
8. Cows with poor color markings may be culled, but in doing so we must remember, that color is not weighed over the scale.
9. The heifers selected for replacements are a most important consideration. Our replacement heifers are selected from the top 50% by weight of the current year's heifer crop. The heifers falling into this weight group are selected on the basis of type, thickness, bone, quality and breed character.

B. Bull selection:
   1. At the present time the bulls listed below are being used in the Dickinson Experiment Station herd.
      a. TTT Lodge Heir 8, Number 11,643,726
         Calved, April 3, 1961
         Bred by Thor Tagestad, Towner, North Dakota
      b. TTT Anxiety , Number 11,643,725
         Calved, April 3, 1961
         Bred by Thor Tagestad, Towner, North Dakota
      c. Husky Pioneer 314, Number 12,322,508
         Calved, April 3, 1962
         Bred by Tony Stroh, Killdeer, North Dakota
      d. Husky Pioneer 314, Number 12,874,433
         Calved, April 15, 1963
         Bred by Tony Stroh, Killdeer, North Dakota
      e. Husky Pioneer 402, Number 13,351,427
         Calved, April 13, 1964
         Bred by Tony Stroh, Killdeer, North Dakota
      f. TTT Silver Beau, Number 12,799,402
         Calved, April 13, 1965
         Bred by Thor Tagestad, Towner, North Dakota
      g. TTT Lad, Number 13,799,391
         Calved, April 13, 1965
         Bred by Thor Tagestad, Towner, North Dakota
   2. For two years no new bulls have been added to the herd. One or two bulls will be purchased in 1968 for use in our herd. Only bulls with a good record of growth rate through production testing records will be selected. We have made an effort to increase the size and fleshing qualities of our cows by the bulls used. We have made some progress but have not made the desired progress in weight over the scale at weaning. The new bulls selected will be in an effort to increase size, fleshing qualities and weaning weight. The essentials any breeder must consider in building his herd with the increasing overhead and narrow margins we face at present.

C. Trials with the cow herd.

1. This is our second year with a trial determine the value of straw in the ration for wintering breeding cows. Since there was quite a lot of waste the first year straw fed, during the last winter the straw was chopped in lengths not longer than about one inch.

    a. The cow herd is divided into two nearly equal lots.
    aa. One lot receives 20 pounds of hay. This would be even more satisfactory if part of the hay was replaced with silage.
    bb. The other lot receives 7 pounds hay, about 13 pounds of (chopped) straw, and one pound of soybean oil meal.
    cc. After about February 1 each cow in both lots receives 2 pounds of ground barley with 5,000 International Units of vitamin A per pound.
    dd. About 6 weeks before calving half the cows in both lots were injected with 2 cc of recavit, each cc containing 500,000 I.U. of vitamin A, 75,000 I. U. of vitamin D and 50 I.U. of vitamin E.
    ee. In this trial the following determinations are mage:
        1. Vigor of calf at birth
        2. Loss of calves at birth
        3. Weight of calves at birth
        4. Weight of calves at weaning
        5. Weight of cows at beginning of the trial, at calving and when the calf is weaned.
2. For the first two months of spring grazing about one half the cow-calf herd is fed 3 pounds of a 15% protein supplement with the remaining one half of the herd receiving no supplement. This is to determine:

    a. If this supplement would increase the weight of the calf at weaning because of increased milk flow.
    b. Would a higher percentage of the cows receiving the supplement breed on the first heat cycle after the bull is turned into the herd.

D. Trials in lots with animals being fed out for slaughter.

1. Realizing that there is no one best way to “feed out” cattle we feed mostly high roughage and low grain rations. In some cases we have fed high grain and low roughage rations. In either case the cost of gains are about the same with the gains just a little faster with high grain and low roughage ration.
2. The main purpose of our feeding program is to use as the major part of the ration, home grown feeds. This applies especially to roughage which might be wasted or sold at a price below what it will bring as beef when fed in the ration.
3. No feeder can afford not to feed a balanced ration which besides the grain and roughage must have adequate protein and minerals. We are also giving consideration to management and housing problems.
4. In our feeding program we are searching for reliable information on the following:
    a. Most economical shelters for beef cattle in North Dakota that result in fast and economical gains.
    b. Wheat, barley and oats in fattening rations for beef cattle.
    c. Comparison of supplements in high roughage fattening ration.

d. Long hay or chopped hay in rations for wintering heifers.
e. Low level and medium growth rations for wintering steers to be finished out by one of the following ways:
   aa. Finishing in dry lot
   bb. Grazed in spring followed by dry lot feeding.
   cc. Grazed and fed grain on pasture followed by dry lot finishing.
f. Feed lot performance of creep-fed steers.
g. Long hay or chopped hay in a fattening ration for feeding out beef steers.

VII. Swine Program.

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 65-283296 PR
   Dam: OAMC1 Miss Capre 18-324583
   Bred by: Oklahoma State University

b. DES5 Two hundred Forty Five Fall 5 438683
   Farrowed Sept. 10, 1965
   Sire: OAMC4 Model 297-404802
   Dam: DES4 Forty Four 5 400136
   Bred by : Dickinson Experiment Station

c. DES5 Two hundred Forty Five Fall 5 438683
   Farrowed April 12, 1966
   Sire: OAMC4 Model 297 25 8 404802
   Dam: DES4 One hundred Fourteen 400122
   Bred by: Dickinson Experiment Station

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

e. ISU7 Rebel 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

2. Trials in swine production.

    a. A lot with the hog house insulated and providing a windbreak; a lot insulating the house without a windbreak; a lot with a windbreak and no insulation and a lot with the standard type house without insulation or windbreak as the control.
    b. Pasturing pigs with a barley ration and no supplement, compared to a supplemented ration.
    c. Pasturing pigs with a supplemented ration up to 125 pounds, followed by no supplement in the ration to a market weight of about 210 pounds.
    d. Comparing rolled, and ground barley in separate rations to rations of 1/3 oats and 2/3 barley, and a fourth ration of 1/3 barley and 2/3 oats.
    e. Comparison of pigs fed on pasture to those fed in dry lot with a cement floor.
    f. New programs to be considered.
        aa. Economy of the 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.

VIII. <u>Grass and Legume Investigations</u>

A. The improving of both pasture and hay in western North Dakota is the highly important part of these investigations.
    1. Uniform bromegrass trial, including hay yields.
    2. Crested wheatgrass trial, including hay yields, and composition of hay yields.
    3. Grass and legume mixtures seeded in 1968 including grass, legume and weed content of the hay.
    4. Dry land alfalfa variety plots seeded in 1960 for a determination of total yield of alfalfa and weeds.
    5. Yields of alfalfa varieties and weeds from plots seeded in 1964.
    6. Hay yields from alfalfa plots.
B. New fertilizer trial.
    1. Hay yields from new fertilizer trials with three rates of nitrogen fertilizer.
        a. Nordan crested wheatgrass in pure stand.
        b. Nordan crested wheatgrass with alfalfa
        c. Russian wildrye in pure stands.
        d. Russian wildrye with alfalfa.
    2. Pasture yields from new fertilizer trials, fertilized at three rates.
        a. Russian wildrye and crested wheatgrass in pure stands.
        b. Russian wildrye and crested wheatgrass each seeded with alfalfa.

IX. <u>Native Grassland Fertilization</u>

A. Fertilization on four different soil series, including Vebar, Havre, Manning and Rhodes, with the most comprehensive work being done with the first three soil series mentioned.

1. Fertilization with different rates of nitrogen, phosphorus and a nitrogen-phosphorus combination using a spring application.
2. Yields from the check and each fertilized application to be separated into tallgrasses, midgrasses, shortgrasses, annual forbs, perennial forbs, total grass yield and total yield including forbs.

X. Agronomy Investigations.

A. The work in agronomy is directed along the following lines:
   1. One of the important trial and one which creates perhaps the greatest interest especially in the west river area is our work at Dickinson Experiment Station with small grain varieties. It is that the part of our over-all program that keeps west river farmers and ranchers up to date with the most promising of small grain varieties for our area.
   2. Nursery trials are carried on in cooperation with the North Dakota State University, and Uniform Regional Nurseries with spring wheat, winter wheat, barley oats and flax. Besides this trials are carried on with other Branch Stations when this cooperation is desired to make a trial applicable on a state wide basis.
   3. Comprehensive trials with fertilizer on continuous cropping, cornland, and fallow.
   4. A comparison of different seeding and tillage implements like the hoe drill, double disc press drill, moldboard plow and roto tiller.
   5. Roughage trials comparing corn, sorghum and sudan.
   6. Trials in the production of grain sorghum in western North Dakota.
   7. Corn production trials, and early maturing hybrids corn production trials.
   8. Winter wheat on stubble and fallow with ten and twenty inch row spacing.
   9. Seeding rate trials with both wheat and oats.
   10. "Off-station" trial at Hettinger in Adams county with small grain varieties. These trials will also conducted in Dunn, Golden Valley, Morton and Bowman counties in 1968.

XI. General Farming Operation

A. Feed on hand December 31, 1967.

1.	200 ton of hay @ $18.00	$3,600.00
2.	75 ton of straw @ $10.00	$750.00
3.	1650 ton of corn silage @ $7.24	$11,946.00
4.	5000 bushels of barley @ .90	$4,500.00
5.	400 bushels of oats @ .60	$240.00

XII. Equipment and Livestock Purchased in 1967.

1. Lumber for 10 hog houses
2. 1-Morse Pump
3. 1-Victor Adding machine
4. 1-Hydraulic Soil Coring and Sampling machine
5. 2-Stenographers Posture chairs
6. 1-Vacum pump

7. 1-Arpo Snow Blower
8. 1-Donahue Implement Carrier
9. 1-Ritchie Hot Scot Heater
10. 1-Pressure Pump for cleaning barns & stalls
11. 1-Electric Branding Iron
12. 1-Mechanical Endgate for Spreader
13. 2-Axillary gas tanks for G.M.C. Truck
14. 1-Massey Ferguson 3 bottom 14" Plow
15. 1-Electric Range
16. 1-Submersible Pump
17. 1-Mistblower
18. 1-Bear Cat Hammermill
19. 1-Rotary Cutter
20. 1-Heavy Duty 6 cylinder ½ ton Pickup
21. 1-Spring Tine Cultivator
22. 1-Radiator & Bricks installed in Mess House
23. 1-Lister P.I. Drill with shovels
24. 1-Adding Machine
25. 1-Yorkshire Boar
26. 24-Hot Rod Pipe Heaters
27. 2-Hot Scot Heaters
28. 1-Electric stove
29. 2-Cattle quards
30. 1-Radio for ½ ton Chev. Pickup
31. 30-red white faced steers
32. 45-red white faced steer calves
33. 22-red white faced heifer calves
34. 1-Hydrotherm cast iron Boiler
35. 1-Laboratory scale
36. 1-Toastmaster heater

Meeting and Tours
1967

Date		Attendance
January 3	McHenry County Agricultural Improvement Ass'n "Livestock Improvement & Health"	60
January 9	Organize Beef Cattle Improvement Ass'n "Annual Meeting"	20
February 1	Glen Ullin "Projects at Dickinson Experiment Station"	80
February 2	Taylor "A Livestock Program"	70
February 2	Station Tour "Fifth and Sixth grades of Dickinson Public Schools"	10
February 14	Watford City "Agricultural Improvements Ass'n."	60
February 18	Bottineau "Bottineau County Winter Show"	200
March 4-6	Valley City "North Dakota Winter Show"	attended
March 15	Dickinson Experiment Station "Freeze Branding Demonstration"	40
March 30	Devils Lake "The Future of Beef Production"	73
April 14	Wm. Dinusson "Planning Spring Trials"	attended
April 24	Station Tour "Boy Scout Troop"	11
April 26	Station Tour "Lefor Rural School"	11
April 28	Station Tour "St. Patrick's Grade School"	68

Date	Meetings (continued)	attendance
June 8	North Dakota State University "Memorial Foundation Meeting"	10
June 9	Experiment Station "Tri-County Judging Contest"	attended
June 12-13	Valley City "North Dakota Stockmen's Meeting"	300
June 26	Bottineau County Fair "Judge"	
July 19	Station Tour "Crops Field Day"	250
July 21	4-H Southwest Stock Judging Contest "Assisted"	85
August 30	Schnell's Livestock Auction "Pre-conditioning calves"	100
Sept. 10-13	Austin, Minnesota "National Barrow Show"	attended
September 15	Drake, North Dakota "McHenry County 4-H & F.F.A. Fair"	300
September 26	Rotary Meeting "Meat vs. Lard Hog Demonstration"	60
September 29	Station Tour and visit "State ASC Committee Fieldmen"	
September 30	Hettinger Experiment Station	attended
October 3	Halliday "Pre-conditioning of calves"	60
October 4	Potato Day "Potato Demonstration of calves"	30
October 6	Watford City "Pre-conditioning of calves"	70

Date	Meetings (continued)	attendance
October 9	Legislative Research Committees "Sub-Committee on Budget"	attended
October 20	North Dakota State University "Extension Conference"	attended
October 24	Interstate Seed Dealers "Red River 68"	attended
November 2	Dr. Wm. Dinusson "Trials for 1967-68	attended
November 16	Reseglen "McLean County Agricultural Imp. Ass'n."	78
December 7	Jacques Seed Company "Dealers Meeting"	50
December 8	North Dakota Banker's Credit Conference "Beef Cattle in our Economy Today"	150
December 13	Livestock Research Roundup	950

Radio
1967

Date	Programs
January 6	Wintering Sows & Gilts
January 27	The weather for 1966
February 17	Preparation for Early Farrowing
March 10	Stilbestrol Implants
March 31	Spring grazing of Crested Wheatgrass
April 7	Corn – A Feed Crop for western North Dakota
May 12	Improving Beef Gains
June 2	Grazing Beef Cattle
June 30	Crops Field Day
July 7	Crops Field Day
August 25	Fall Seeding of Grass
September 8	Potato Day, October 4
September 29	Potato Day program
October 27	Livestock Research Roundup
November 10	Livestock Research Roundup Program
December 1	Livestock Research Roundup
December 22	Wintering Beef Cows – Hay vs. Straw

General Summary

Date 1967	Farm visits	No. tours	Attendance at meetings	Station calls	Radio talks	News Articles	Meetings attended
January	0	0	80	14	2	0	2
February	0	1	420	22	1	0	4
March	2	0	113	13	2	0	3
April	1	3	90	14	1	0	4
May	0	0	0	13	1	0	0
June	0	0	310	15	2	0	4
July	8	1	335	10	1	0	2
August	0	0	100	12	1	0	1
September	1	1	360	13	2	0	5
October	2	0	160	12	1	0	6
November	0	0	78	10	1	0	2
December	0	0	1150	14	2	0	3
Total	14	6	3196	162	17	0	36

1967
Annual Report Of
Livestock Investigations
Dickinson Experiment Station

By

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Table of Contents

Long Or Chopped Hay
In A High Roughage Fattening Ration For Beef Cattle

Feeding chopped crested wheatgrass hay or feeding it in its natural form has been the object of a feeding trial conducted during the last two years. Ten and eight Hereford steer calves were randomly allotted to each lot in November and fed for 325 and 279 days in 1965 and 1966 respectively. They were fed a ration of 4 pounds rolled barley in 1965 and 3 pounds in 1966, 3 pounds corn silage, 1 pound soybean meal and 0.2 pound mineral. In addition to this, one lot received chopped crested wheatgrass-brome hay of good quality free-choice and the other lot received the same kind of hay only in its natural form. The Hay was chopped into approximately ¾- 1 inch lengths. Average daily rations for the entire trial are shown in table 1 for 1966-1967 and table 2 shows the average feed intake for both years of the trial. Stilbestol implants were used both years. A low level of grain was fed in order to make maximum use of the hay in the ration.

Table 1. Results From 1966-1967 Trial Comparing Long or Chopped Hay.

	Long Hay	Chopped Hay
Initial weight	316.2	313.1
Final weight	823.1	866.9
Average daily gain	1.82	2.06
Average daily ration		
Crested-brome hay	13.7	13.8
Corn Silage	3.0	3.0
Rolled Barley	2.9	2.9
Soybean meal	0.9	0.9
Minerals	0.2	0.2

Chopping the hay that was fed to cattle on a ration low in grain has produced a significant increase in rate of gain. The lot on chopped hay outgained the long day by 0.24 pounds per head per day in each of the two years the trail was conducted. The difference in daily gain between the two lots was the same for both years; however, as shown in table2, the gains were much better the second year than the first. Once pound less grain was fed the second year but the amount of hay fed was much greater. An average of 8.6 pounds of hay was fed the first year compared to 13.8 pounds the second year. The use of stilbestol implants also may have contributed to the better gains the second year since the cattle were only implanted near the midpoint of the trial year and near the beginning and midpoint the second year.

Table 2. Two year Summary of Results Comparing Chopped or Long Hay.

	Long Hay	Chopped Hay
Initial weight	319.8	318.6
Final weight	817.0	889.0
Daily gain, 1965-1966	1.50	1.74
1966-1967	1.82	2.06
Average	1.66	1.90
Average daily ration		
Crested-brome hay	11.0	11.4
Corn silage	2.8	2.8
Rolled barley	3.0	3.0
Soybean meal	0.8	0.8
Minerals	0.2	0.2
Feed cost/cwt gain	$13.14	$12.27

The average amount of hay fed to the two lots is very interesting in light of the large difference in average daily gains between the two lots and the fact that equal amounts of all the other feeds were fed to both groups. The average amount of hay fed to the long hay lot and chopped hay lot was 8.2 and 9.0 pounds the first year and 13.7 and 13.8 pounds the second year. At least two factors are responsible for the large difference in gain within each year on a fairly similar amount of feed. First, hay in the chopped form may ne more easily digested or may be in a form where it can pass through the digestive tract more readily or it can be used more efficiently. Second, the figures presented are amounts of hay fed, and especially in the case of long hay, does not indicate the actual amount consumed. With chopped hay there was almost no waste but the long hay was fed in a bunk so some of it was wasted. The cattle were also able to sort; therefore, the undesirable material was left.

The cost of the feed to produce one hundred pounds of gain was not significantly different between the two groups. It was slightly more economical to chop the hay to feed it in its natural form.

Results similar to these may or may not be obtained if the hay used is of poorer or better quality of if there is a different level of grain in the ration. Whether or not it pays to chop hay depends on if you own a suitable piece of equipment or if you must buy or rent a chopper. It will also depend on the quality of hay being fed. The poorer the hay quality, the more waste there will be when it is fed in the long form. If poor quality hay is chopped, the animals will be forced to eat all of it and because of its poor quality, they will have to be fed more hay or a supplement to provide the required nutrients.

High Levels Of Oats or Oats And Barley For Fattening Beef Cattle

Two lots of eight Hereford steers each were started on a trial on October 15, 19696, to compare oats with oats and barley when fed at fairly high levels. Half of the steers in each lot were creep-fed during the summer of 1966 and half were not. The steers averaged 403 pounds when the trial started and they were on feed for 332 days.

The rations for this trial consisted of 1 pound alfalfa hay, corn silage free-choice, 3 pounds of oats or half oats and half barley, 1 pound soybean meal and 0.2 pound minerals. The amount of gain was increased to 6 pounds when they averaged about 550 pounds and to 12 pounds at an average weight of about 900 pounds. The steers were implanted with stilbestrol at the beginning of the trial and again about midway through the trial.

Table 3. Results from Feeding High Levels of Oats or Oats and Barley.

	Oats	Oats & barley
Average initial weight	402	404
Average final weight	1069	1071
Average daily gain	2.01	2.01
Average daily ration		
Alfalfa hay	1.0	1.0
Corn silage	29.7	30.0
Rolled barley		3.0
Rolled oats	6.0	3.0
Supplement	0.9	0.9
Minerals	0.2	0.2
Feed cost/cwt gain	$13.92	$14.78

Results from the first year of this trial show no difference in average daily gain between the two treatments. Both lots gained an average of 2.01 pounds per day for the entire 332 day trial. Feed consumption was also nearly identical for both lots. The only difference was the additional 0.3 pounds of silage consumed by the oats and barley lot.

The largest variable in the trial to date is feed cost per unit of gain. This difference was due entirely to the cost of the feed used since weight gains were the same for both lots. Cost of gains for the oats and barley lot was 86 cents more per hundred pounds of gain due to the higher price of barley. For this trial, oats was valued at 60 cents per bushel and barley at $1.00 per bushel. Oats used in this trial was of good quality. Due to the rather small differences between treatments and the fact that this trial has been conducted for only one year, it will be necessary to collect more data before any conclusive statements can be made.

Wheat, Barley And Oats In Fattening Rations For Beef Cattle

Barley and oats are the most common feed grains grown in western North Dakota. Barley had the role in the cattle feeding program of western North Dakota that corn had in the corn belt; whereas, oats has been used to supplement the winter ration for young livestock and also to grow out breeding stock. Extensive acreages of wheat are also grown and usually sold as a cash grain crop. However, due to weather, disease or insect conditions or low prices, there may be years when is may be economically advantageous to feed what to livestock rather than sell it.

An experiment was started on November 6, 1965 to compare wheat, barley, oats, 50% wheat 50% barley 50% oats when they were used in high-roughage, fattening ration for beef cattle. This experiment was conducted for 325 days the first year and for 314 days the second year. Eight Herford steers were randomly allotted to each treatment and initially fed a ration of 1 pound alfalfa hay, corn silage free-choice, 3 pounds rolled grain, 1 pound soybean meal and 0.2 pound of minerals. The grain was increased to 6 pounds in May. All steers were implanted with stilbestrol in the spring of 1966 and in the fall and spring of the second trial year. The average daily rations for the entire trial are shown in table 4. Average daily rations for the second year of the trial are shown in table 5.

Average daily gains over the two years as shown in table 4 are not widely different from one treatment to the next. The better gains have been made by the groups receiving a mixture of grains and the lots on the single grain ration have made the poorer gains. These results show that average daily gains were the same when wheat, barley or oats was fed as the only grain in a high roughage, fattening ration. Gains were slightly better when a mixture of two grains was fed with the wheat-barley mixture being slightly better than the barley-oats mixture.

Average daily gains for the second year of the trial (table 5) show the mixed grains were as good, and in the case of the half wheat-half barley ration, appreciably better than gains form the single grain rations.

This trial points out that energy is energy, whether it's source is from wheat, barley or oats, when grain is fed at the rate used in this trial. Since there was very little difference in the average daily gain from on lot to the next, the determining factor in deciding which grain to feed would be what each grain cost.

Table 4. Two Year Summary of Performance when Fed Different Grains.

	Wheat	Wheat & barley	Barley	Barley & oats	Oats
Total number head	16	15	16	16	16
Average initial weight	389	388	389	389	389
Average final weight	1011	1031	1008	1021	1017
Average daily gain	1.94	2.02	1.94	1.98	1.96
Average daily ration					
Alfalfa hay	1.0	1.0	1.0	1.0	1.0
Corn silage	31.6	32.2	31.8	31.1	32.0
Grain	4.45	4.45	4.45	4.45	4.45
Soybean meal	0.8	0.8	0.8	0.8	0.8
Minerals	0.2	0.2	0.2	0.2	0.2
Feed cost/cwt gain	$15.59	$14.21	$13.69	$13.16	$13.38

Table 5. Performance and Feed Intake of Steers Fed Wheat, Oats or Barley For the Year 1966-1967.

	Wheat	Wheat & barley	Barley	Barkey & oats	Oats
Number of head	8	7	8	8	8
Average initial weight	385.0	383.6	385.0	385.6	385.0
Average final weight	1010.6	1042.9	985.0	1010.6	978.1
Average daily gain	1.99	2.10	1.91	1.99	1.89
Average daily ration					
Alfalfa hay	1.0	1.0	1.0	1.0	1.0
Corn silage	34.0	35.3	34.3	34.5	34.6
Grain	4.3	4.3	4.3	4.3	4.3
Soybean meal	0.9	0.9	0.9	0.9	0.9
Minerals	0.2	0.2	0.2	0.2	0.2
Feed cost/cwt gain	$15.69	$14.41	$14.82	$14.02	$14.60

Supplements For A High Roughage, Fattening Ration

Is it beneficial to include alfalfa in a high roughage fattening ration? If corn silage and grain are being fed to fattening steers, is it economically advantageous to also feed a protein supplement? A feeding trial was started in July, 1965, and again in 1966, extending for 245 and 235 days respectively, to compare three different supplements each year. There were eight yearling steers averaging 609 pounds assigned to each lot in 1965 and nine steers averaging 574 pounds in 1966. The steers were marketed in March at an average weight of 1040 pounds in 1966 and 998 pounds in 1967.

All four lots were fed corn silage fee-choice, 6 pounds rolled barley and 0.2 pounds minerals. This was the complete ration for the check or control lot. In addition to this, one lot was fed 1 pound alfalfa hay and another lot was fed 1 pound alfalfa hay and 1 pound soybean meal. In the 1965 trial, a lot was included that received 1 pound alfalfa hay plus 1 pound of a mixed supplement. The mixed supplement consisted of 25% alfalfa meal, 15% dehydrated alfalfa meal, 8% trace mineral salt, 10% wheat bran, 12% di calcium phosphate, 4% limestone and 26% soybean meal with 10,000 International Units vitamin A and 1000 I.U. vitamin D added per pound of supplement. In 1966, the mixed supplement was replaced with 1.3 pounds linseed meal. The additional 0.3 pound was fed to total protein intake would be the same as for the soybean meal lot. To compensate for the additional energy in the additional 0.3 pound of linseed meal, 0.3 pound more barley was fed to the soybean meal lot.

Half of the steers in each lot were given a vitamin injection every other 28 days weigh period. A 2 cc injection was given with each cc containing 500,000 International Units of vitamin A, 75,000 I.U. of vitamin D and 50 I.U. of vitamin E.

Table 6. Rate of Gain as Affected by the Supplement Fed.

	Control	Alfalfa only	Soybean meal	Mixed supplement	Linseed meal
1965-1966	1.68	1.76	1.90	1.69	
1966-1967	1.76	1.72	1.88		1.85
Average	1.73	1.74	1.89		

The results in table 6 show average daily gains were affected by the different supplements fed. Over the two year period, the addition of 1 pound alfalfa hay and 1 pound soybean meal increased average daily gains; however, the addition of 1 pound alfalfa hay by itself did not affect rate of gain. Feeding 1 pound alfalfa hay and 1 pound of the mixed supplement had no effect on daily gain during the first year. Linseed meal fed the following year instead of the mixed supplement improved daily gains as much as did soybean meal. In this case, both energy and protein were held constant for both the soybean meal and linseed meal lots and there was no significant difference in daily gain between the lots.

Table 7. Gains for 1966-1967 as Affected by Supplement Fed and Vitamin Injections.

	Control	Alfalfa only	Soybean meal	Linseed meal	Average
No vitamin injection	1.87	1.65	1.95	1.86	1.83
Vitamin Injection	1.68	1.77	1.83	1.85	1.78
Average	1.76	1.72	1.88	1.86	

Average daily gain for the steers in each lot that received the vitamin injection were no different than the daily gains of the steers that did not receive the injection. This was true for 1966-1967 as is shown in table 7 and also for the previous year.

Table 8. Silage Consumption of Steers Fed Different Supplements.

	Check	Alfalfa only	Soybean meal	Mixed supplement	Linseed meal
1966	33.3	32.2	32.2	32.2	
1967	41.8	40.8	39.6		40.3
Average	37.6	36.6	35.9		

Corn silage was the only ration ingredient fed free-choice and thus was the only feed with variable consumption rates from lot to lot. The amount of linseed meal and barley was different in the linseed and soybean meal lots from the other lots as previously pointed out, but this was done to equalize the protein and energy intake from these two feeds. Table 8 shows the amount of silage fed each year. Differences in daily silage consumption were small from lot to lot within each year; however the check lot did consume slightly more silage each year than did any of the other lots. Average daily feed intake for all lots is shown in table 9.

Table 9. Weights and Daily Feed Intake of Steers Fed Different Supplements During 1966-1967.

	Check	Alfalfa only	Soybean meal	Linseed meal
Average initial weight	573.9	570.0	575.6	576.9
Average final weight	987.8	974.4	1018.3	1011.9
Average daily gain	1.76	1.72	1.88	1.85
Average daily ration				
Alfalfa hay		1.0	1.0	1.0
Corn silage	41.8	40.8	39.6	40.3
Rolled barley	5.8	5.8	6.1	5.7
Soybean meal			0.9	
Linseed meal				
Minerals	0.2	0.2	0.2	0.2
Average slaughter grade score[a]				
	4.3	4.9	4.3	4.5
Average dressing %	54.93	54.28	52.87	55.73

[a] Average slaughter grade scores: choice, 6; low choice, 5; high good, 4; average good, 3.

Slaughter data on grade and yield was collected in both years but there was no difference due either to the kind of supplement fed or the injection of vitamins. Small differences in average grade score and dressing percent did occur within each year as is shown in table 9; however, they were not large enough to be meaningful.

Feed cost figures shown in table 10 should be considered in conjunction with daily gain figures in table 6. Generally speaking, as the average daily gains increased from lot to lot, feed cost per hundred weight gain also increased. In such case, it is necessary to determine if the additional feed cost in compensated for by the additional gain. An answer to this will depend on the value placed on the additional gain and the value on the feed. Using the feed costs of the last two years and valuing the beef at 25 cents per pound, the additional gain has not paid for the additional feed in any of the lots when compared to the check lot. By adding supplements to the ration, average daily gains have increased, but feed costs have increased and at a slightly higher rate. The fact that feed efficiency was not improved when a protein supplement was added, may mean the particular ration was meeting the protein requirements of the individual animal.

The addition of a protein supplement to a ration usually results in a more efficient use of all the nutrients consumed which produces an increase in daily gain with a rather small increase in food costs. However, this may not always happen as was the case in this trial. One economic advantage of adding supplements to a ration and the resulting increase in daily gain is fixed cost for facilities, equipment, etc., can be spread out over a larger number of livestock since more animals will be handled in a given period of time.

Table 10. Feed Cost of Rations Using Different Supplements.

	Control	Alfalfa only	Soybean meal	Mixed supplement	Linseed Meal
1966	$14.12	$13.83	$15.08	$16.06	
1967	$16.31	$17.14	$17.96		$18.98
Average	$15.22	$15.48	$16.52		

Comparison Of Shelters For Beef Cattle

A trial was started in the fall of 1964 to compare a pole shed to a solid board windbreak as shelter for beef cattle in a feedlot under conditions common to western North Dakota. A lot with a slatted windbreak was added to the comparison in the spring of 1966 and a lot with slatted windbreak plus summer shade was added in the fall of 1966. This trial has been divided into a winter phase and a summer phase. The winter phase starts with the beginning of the trial in November and ends in May. The summer phase had covered periods of 175, 181 and 195 days and the summer phase has extended over periods of 147, 144 and 119 days during the last three years.

The windbreaks enclose the lots on the west and north side. The solid windbreak is 8 feet high and the slatted windbreak is 9 feet high. The slatted windbreak is made of 1 x 6 inch boards spaced 1.5 inches apart, which makes a windbreak that is 20% open.

Eight Hereford heifers have been randomly allotted to each lot each year. All lots have been fed the same ration within each year. This has been a high roughage, fattening ration made up of 1 pound alfalfa hay, corn silage free-choice, 3 pounds rolled barley, 1 pound supplement and 0.2 pound minerals with the barley being increased to 6 pounds in May. The heifers were implanted with stilbestrol.

Results are now available for a period of three years for parts of the trial and for only one year for other portions of the trial as indicated in the footnotes to table 11. The results should be viewed with this fact in mind. Average daily gains shown in table 11 indicate very little differences in gain through the winter except for the poorer performance of the cattle with the slatted windbreak. Actually, through the winter months, there was no difference in the two slatted windbreak lots since the shade was not provided until the summer phase so the rather large difference in daily gain between the two lots is due to something other than the winter shelter provided.

Daily gains during the summer phase showed a greater difference between lots. The most rapid gains were made by the slatted windbreak lot with summer shade followed by the shed lot with the other lots gaining about the same. Daily gains to date indicate summer shade was of some benefit since both the shed lot and the slatted windbreak lot gained better than the lots without any shade.

A benefit from the shade provided is also evident when the results of the winter and summer phase are combined. Daily gains of 1.75 pounds per day for the shed and slatted windbreak plus summer shade lot compare with 1.67 pounds for the slatted and 1.64 for the solid windbreak lot.

Table 11. Three Year Summary of Performance as Affected by Type of Shelter.

	Shed[a]	Solid[a]	Slatt[b]	Slatt & Shade[c]
	Winter phase (November – May)			
Av. initial weight	319	318	312	311
Av. daily gain	1.68	1.60	1.49	1.61
Av. daily ration				
Alfalfa hay	1.1	1.1	1.0	1.0
Corn silage	22.3	21.8	26.8	26.7
Rolled barley	3.8	3.9	3.3	3.3
Supplement	0.8	0.8	0.9	0.9
Minerals	0.2	0.2	0.2	0.2
Feed cost/cwt gain	$12.46	$13.10	$15.60	$14.41
	Summer phase (May – October)			
Av. initial weight	626	644	611	624
Av. final weight	880	843	839	861
Av. daily gain	1.87	1.71	1.76	1.99
Av. daily ration				
Alfalfa hay	1.0	1.0	1.0	1.0
Corn silage	34.5	32.0	34.5	32.6
Rolled barley	6.0	6.0	6.0	6.0
Supplement	.98	.98	1.0	1.0
Minerals	0.2	0.2	0.2	0.2
Feed cost/cwt gain	$16.19	$17.24	$18.10	$15.89
	Entire trial			
Av. daily gain	1.75	1.64	1.67	1.75
Av. daily ration				
Alfalfa hay	1.0	1.0	1.0	1.0
Corn silage	27.5	26.2	29.0	28.9
Rolled barley	4.7	4.8	4.3	4.3
Supplement	.88	.88	.94	.94
Minerals	0.2	0.2	0.2	0.2
Feed cost/cwt gain	$14.16	$14.94	$15.77	$15.05

[a] 3 years' results

[b] 1 year's results except for 2 years' results for the summer phase

[c] 1 year's results – 1966-1967

Table 12. 1966-1967 Results of a Trial Comparing Shelters of Beef Cattle.

	Winter phase (November – May)			
	Shed	Solid	Slatt	Slatt & Shade
Number head	8	8	8	8
Av. initial weight	311.2	313.1	310.6	311.9
Av. daily gain	1.61	1.53	1.61	1.49
Av. daily ration				
Alfalfa hay	1.0	1.0	1.0	1.0
Corn silage	26.5	26.1	26.7	26.8
Rolled barley	3.3	3.3	3.3	3.3
Soybean meal	0.9	0.9	0.9	0.9
Minerals	0.2	0.2	0.2	0.2
Feed cost/cwt gain	$14.39	$15.05	$14.41	$15.60
	Summer phase (May – September)			
Av. initial weight	624.4	610.6	624.4	601.9
Av. final weight	866.2	840.0	861.2	837.5
Av. daily gain	2.03	1.93	1.99	1.98
Av. daily ration				
Alfalfa hay	1.0	1.0	1.0	1.0
Corn silage	37.7	32.3	32.6	32.6
Rolled barley	6.0	6.0	6.0	6.0
Soybean meal	1.0	1.0	1.0	1.0
Minerals	0.2	0.2	0.2	0.2
Feed cost/cwt gain	$16.47	$16.37	$15.89	$15.98

Corn silage has been fed free-choice throughout the trial and the amount of grain fed has always been constant for all lots within a given year, but did vary from one year to the next. The amount of feed consumed appears to be somewhat different between the first two lots and the second two lots in the winter phase but this difference is due to the feed consumption for the two previous years that is averaged into the first two figures. Corn silage fed to the four lots in the winter phase, 1966-1967, ranged from 26.1 to 26.8 pounds per head per day (table 12). This shows there was no measurable difference in the amount of silage consumed due to the treatments involved for that one year. Corn silage consumption for the summer phase varies some among lots; however, this difference is not significant and is not large enough to account for all the difference in daily gain. Differences in the amounts of silage consumed by the four lots over the entire length of the trial are also small and insignificant.

Feed costs per hundred weight gain are not widely different where a similar number of years are involved. The big difference between the slatted lot and the slatted lot with summer shade for the summer phase is due to high feed cost for the slatted lot during the previous summer.

Slaughter grade and dressing percent results to date show no difference from one lot to the next within each year.

After three years of results on portions of this trial, there are indications that the type of winter protection used in the trial has less effect on average daily gains than does the presence or absence of summer shade. However, it should be recognized that results in this trial are in response to a highly variable element, weather, as it is modified by different types of shelter; therefore, several years results will be required to arrive at any conclusions.

Table 13. Feed Prices for all 1966-1967 Trials.

Alfalfa hay	$25.00 per ton	Trace mineral salt	$50.00 per ton
Crested wheatgrass		Limestone	$50.00 per ton
Brome hay	$18.00 per ton	Grinding, rolling or	
Wheat straw	$10.00 per ton	chopping	$2.00 per ton
Corn silage	$7.20 per ton	Wheat	$1.70 per bushel
Soybean oil meal	$90.00 per ton	Barley	$1.00 per bushel
Linseed meal	$100.00 per ton	Oats	$ .60 per bushel
Di calcium phosphate	$120.00 per ton	Vitamin A	$ .20 per million units

Chopped Hay In a Wintering Ration For Replacement Heifers

Twenty two replacement Hereford heifers were randomly allotted into two lots and placed on trial November 2, 1966, for the purpose of comparing crested wheatgrass-brome hay fed in its natural form or as chopped hay. A ration composed of 3 pounds corn silage, 3 pounds barley, 0.2 pound minerals and crested-brome hay free-choice was fed for a period of 195 days. The chopped hay was fed trough a self-feeder. Near the beginning of the trial, 1 pounds of soybean meal was fed; however, this was changed to 1 pound alfalfa hay after 93 days.

Table 14. Effect of Chopping the Hay in a Wintering Ration.

	Long hay	Chopped hay
Average initial weight	386	374
Average final weight	648	640
Average wintering gain per head	262	266
Average daily gain	1.34	1.36
Average daily ration		
Crested-brome hay	9.8	11.1
Alfalfa hay	1.0	1.0
Corn silage	3.0	3.0
Barley	2.9	2.9
Soybean meal	0.7	0.7
Minerals	0.2	0.2
Feed cost/cwt gain	$14.53	$15.99
Feed cost/hd.	$38.05	$42.51

Average daily gains were very similar between the two treatments at the end of the trial. The heifers fed the chopped hay gained 0.02 pound more per day which is not a significant difference.

The amount of feed fed was also very similar between the two lots; however, in this case this is not an accurate picture of the amount of hay actually consumed. There is almost no waste when the hay is chopped, but there may be very little or a lot of hay wasted when fed in its natural form, depending on the quality of the hay. In this trial, the heifers consumed 11.1 pounds of chopped hay per day, but they actually consumed somewhat less than the 9.8 pounds of long hay per day as shown.

Feed costs were higher for the chopped hay lot, both on a per hundred weight gain basis and per head basis. A charge for chopping the hay was included in arriving at the feed cost figures cited. There feed costs may be somewhat high for wintering replacement heifers. To reduce the feed cost per head, these heifers could be wintered to gain 1.10 to 1.25 pounds per day without adversely affecting subsequent reproductive performance. This would lower the wintering costs somewhat and still provide for adequate growth.

Chopping the hay that was fed in this trial was of no benefit in terms of rate of gain or wintering costs. The value of chopping hay may vary with the quality of hay available and equipment available. It

will reduce the amount of waste and will also force the cattle to eat the poorer quality material they usually would sort out. This means the quality of hay the cattle actually consume is lowered because of the poor quality material that is incorporated by chopping. The practice of chopping hay does not by itself improve the quality of the hay or the value of hay as a feed.

Wintering Beef Cows on Hay or Straw

Two years results are now available on feeding hay or straw to pregnant beef cows during the wintering period. In December, 1965, the cow herd was split by age into a lot receiving 20 pounds of crested-brome hay per head per day and the other lot was fed 7 pounds hay and 13 pounds wheat straw and 1 pound soybean meal per day. IN the fall of 1966, the cow herd was divided into the same lots only the wheat straw was wasted during the previous winter. Beginning the first of February, both lots were fed 32 pounds barley plus 10,000 I.U. of vitamin A per head per day. On March 11, 1967, the straw and soybean meal was eliminated and hay was increased to 20 pounds. An average of 8.3 pounds of straw was consumed during this 89 day period. Included with these cows are heifers that will calve in the spring as two-year-old's.

The effect of including straw in the wintering ration for beef cows has been a loss in weight during the wintering period of 48 pounds in 1966 and 29 pounds in 1967 when compared to the lot receiving hay. Table 10 shows this is an average difference in weight lost of 39 pounds. In 1966, the cows receiving hay gained 16 pounds but they lost 36 pounds during the 1966-1967 winter, which means the cows on straw lost a total of 65 pounds during the second winter. This weight loss may or may not be important, depending on the condition of the cows when they enter the wintering period. Cows in good condition can lose this much weight through the winter without any ill effects.

While on summer pasture, the cows wintered on straw gained an average of 23 pounds more weight than the cows wintered on hay alone. Results in table 15 show an overall gain in weight of 78 pounds for cows wintered on hay and 62 pounds for cows wintered on straw for the entire trial. The gain in weight is due in part to the fact there were a rather large number of young cows that had not reached their mature size.

The cost of wintering cow on these two feeding program was nearly the same. The comparative costs would depend on the value placed on the straw. In the straw is a by-product of the farming operation, it can be valued at or near the cost of bailing and hauling it. This would probably be a lower value than for straw that would have to be purchased and hauled to the farm or ranch.

Birth weight and growth rate of the calves was not affected by the level of winter nutrition of their dams. This may mean milk production was not affected by the additional winter weight loss in the straw lot since weaning weights were not affected.

Table 15. Two Years Results of Wintering Beef Cows on Hay or Hay and Straw.

	Hay			Straw		
	1965-66	1966-67	Av.	1965-66	1966-67	Av.
No. of cows	52	49	101	56	48	104
Av. initial wt.(Dec.)	1016.1	1045.7	1030.9	1026.8	1042.5	1034.6
Av. May wt.	1032.6	1009.8	1021.2	994.6	977.3	985.9
Av. winter wt. change	+16.5	-35.9	-9.7	-32.2	-65.2	-48.7
Av. final wt. (Oct.)	1101.8	1116.8	1109.3	1078.5	1115.8	1097.1
Av. summer wt. change	+69.2	+107.0	-88.1	+83.9	+138.5	+111.2
Av. wt. change, Entire trial	+85.7	+71.1	+78.4	+51.7	+73.3	+62.5
Feed cost per head	$32.28	$33.13	$32.70	$33.62	$30.26	$31.95
Av. calf birth wt.	69.5	69.6	69.6	67.2	69.8	68.5
Av. weaning wt.	349.0	380.9	365.0	354.5	385.1	369.8
Lb. straw consumed				13.0*	8.3	

*Fed without chopping and there was a fairly large amount wasted.

A check of the calving records for the cows used in the 1965-1966 trial showed there was no difference in subsequent conception dates due to the two levels of nutrition during the winter. About the same number of cows from both lots settled during the first heat period. If the cows would have been in poorer condition when they entered the wintering period or if they would have been wintered at a lower level of nutrition, subsequent conception dates may have been delayed.

To date, this trial indicates up to two-thirds of the hay in a beef cow wintering ration can be replaced with straw plus supplemental protein with-out adversely affecting the cow's ability to wean a good calf if she is in good condition upon entering the wintering period. Replacing hay with straw and a supplement to this extent does not result in a reduced wintering feed bill per cow but it can be done to stretch a short hay supple and to make use of another product raised on the farm that generally has been discarded.

Vitamin Injection For Cows

What effect does a low vitamin A wintering ration or a vitamin injection have on the reproductive performance of a beef cow? A trial was started in the fall of 1963 and has continued for a period of four winters to compare the weight changes and calving records of cows given vitamin injections with those not given an injection. A 2 cc injection containing 500,000 I.U. of vitamin A, 75,000 I.U. of vitamin D and 50 I.U. of vitamin E per cc was given to half the cow herd at the Experiment Station. The average date of the injection has been February 26 with the first calves being born the last week in March. To date there have been 198 cows that received the injection and 205 cows used as controls. The cows were divided on the basis of their age.

The ration for the first two years was 22 pounds crested wheatgrass hay per day to January 1, at which time they were fed 22.5 pounds corn silage and 12 pounds hay. During the remaining two winters, half or the vitamin injected cows and half of the control cows were in the straw ration discussed in the previous article on wintering cows. The other half of each lot was on the hay ration in the same previous trial. During al four winters, all the cows were fed 2 pounds barley and 10,000 I.U. of vitamin A per day starting about two months before calving and continuing until they were turned out on pasture the first part of May.

Table 16. Four Years Results of Injecting Beef Cows with Vitamins.

	No vitamin injection		Vitamin injection	
	1966-67	4-year average	1966-67	4-year average
Number of cows	49	205	48	198
Av. Feb. cow wt.	1054	1054	1033	1049
Av. Oct. cow wt.	1115	1104	1118	1103
Av. lbs. gain	61	50	85	54
Av. birth wt.	71	70	69	71
Av. weaning wt.	379	365	387	367
Av. lbs. gain	308	295	318	296

The lot referred to as the no vitamin injection lot did receive vitamins in the amount of 10,000 I.U. of vitamin A per day fed with the grain beginning about February 1 each year. All the cows were fed vitamin A at this time and half of them were given the additional multi-vitamin injection.

An average of four years results show that cow weight gains, calf birth weight and calf gains to weaning were not affected by injecting the pregnant cows with a multi-vitamin solution approximately one month before calving. The difference shown in table 16 between the two lots are small and may be entirely due to chance variation.

As a general conclusion, the injection of vitamins to pregnant beef cows that were on the feeding program as outlined previously in this article, was of no measurable benefit. This would indicate the ration fed to these cows was providing the required amounts of vitamins needed for normal reproduction and growth. Results under a different feeding program may or may not vary depending on the quantity and quality of feed used.

Creep Feeding Calves And Subsequent Drylot Performance

Pounds of beef over the scale is the basis on which a feeder cattle producer is paid for his labor and investment. Over the years, practices such as performance testing, pasture fertilization, sire selection on the basis of records, pasture rotation, brush spraying, interseeding, etc., have been developed and used to increase beef production. A trial was started in 1961 and conducted for six years to (1) see if creep-feeding outs to nursing calves on pastures would improve their rate of gain to

weaning and (2) to see if creep-feeding had any effect on the subsequent gains made when the calves were finished out in the feedlot.

During the first four years, two-thirds of the cow herd was used for the non-creep portion and one-third for the creep portion of the trial. Approximately thirty Hereford cow and calf pairs have been used for each portion of the trial during the last two years. A total of 288 pairs were used for the non-creep part and 174 pairs for the creep part of the trial. A portion of the cow herd was pastured on summer range in the Badlands with the pastures used on a planned rotation basis.

Average starting and finishing dates for the creep-feeding phase have been June 24 and October 21. About the end of June, whole oats was made available in a self-feeder. Minerals were also provided free-choice for the cows and calves.

Table 17. Average Performance of Creep-fed Calves over a Six Year Period.

	Non-creep	Creep
Average initial calf weight	163.7	166.4
Average final calf weight	358.7	381.1
Average total lbs. gain per head	195.0	214.7
Lbs. gain from creep-feeding		19.7
Average lbs. oats per calf		187
Lbs. oats per lb. gain		9.2
Average initial cow weight	1044.4	1053.3
Average final cow weight	1090.8	1092.8
Average total lb. gain	46.4	39.5

Creep-feeding calves has resulted in an average increase in gain of 19.7 pounds per calf over a six year period (table 17). Creep-feeding has increased gains every year with increases ranging form 3.7 pounds in 1964 to 33.5 pounds in 1963. Gains in 1965 were also small, averaging 5.3 pounds per calf. However, creep-feeding boosted gains by at least 20 pounds per head in four of the six years.

Oats consumption per head also varied greatly from year to year. In 1965, the calves ate 114 pounds of oats per head compared to 324 pounds in 1963.

Pounds of oats per pound of additional gain is a figure that will give a good picture of whether or not the additional gain was sufficient to pay for the additional feed required. A range from 5.0 to 34.9 existed in the pounds of oats required to produce one additional pound of gain with an average of 14.6 for the six year involved. This is an average of the pounds oats required per pound of additional gain for each year of the trial. Table 17 shows 9.2 pounds of oats was required per pound of additional gain. This figure is equal to the total amount of oats fed during the six years divided by the total additional gain over the six years. This procedure takes into account the uneven number of animals used each year and it also tends to even out a value that differs greatly from the other yearly values. In a majority of the

years involved, the feed required was more than paid for by the additional gains made. Some of the variability from one year to the next may be due to different pastures and also to the seasonal variation in precipitation, forage production, ect.

Whether the calves were creep-fed or not had almost no effect on the amount of weight the cows gained through the summer. The cows whose calves were creep-fed gained an average of 6.9 pounds less, but this is not a significant difference.

As soon as the calves were weaned, a group of about eight head from each treatment were brought into the feedlot and immediately started on a high roughage, fattening ration. They were on feed for an average of 343 days.

Six years results of this phase of the trial (table 18) indicate there is no difference in average daily gain due to whether or not the calves were creep-fed before they were put into the feedlot. The two groups differed by 0.02 pound per day but this is a very insignificant difference. This amounts to seven pounds per head over the entire feedlot period compared to an average gain from creep- feeding of nearly 20 pounds. Average daily gains for 1966-1967 were contrary to the results over the six year period (table 18). The creep-fed calves out-gained the non-creep calves by 0.06 pound per day for this one year.

Table 18. Feedlot Performance of Steers After Being Creep-fed.

	Non-creep		Creep	
	1966-67	Six year average	1966-67	Six year average
Av. initial weight	402	380	404	387
Av. daily gain	1.98	1.93	2.04	1.91
Gain in lbs. , non-creep				
Over creep	-21	7		

Feed cost per hundred weight gain figures for the feedlot phase are available for only two years but are very similar for both lots. Carcass grade and dressing percent have also been veery similar for both groups during the five years when this information was available.

In conclusion, creep-feeding calves has produced an average of 19.7 pounds additional gain per calf over a six year period (table 17). On al individual year basis, gains were boosted by at least 20 pounds in four of the six years. Results from this trial show one pound of additional gain from creep-feeding oats was produce for less than 20 cents in four year out of six when oats was valued at 60 cents per bushel. Weight gains of the cows were not affected by creep-feeding the calves. When creep-fed calves were fed out in the feedlot, they gained weight equally as rapidly as did calves that were not creep-fed. An added benefit due to creep-feeding that was not measured by this trial is that calves may go on feed faster when they are weaned if they are used to eating grain.

Supplementing Nursing Cows on Spring Pasture

The purpose of this trial is to determine the value of feeding grain to beef cows nursing calves on pasture during the spring grazing season. Hereford cows ranging in age from two to eleven years with calves at their sides were randomly allotted to a lot that received three pounds of a barley pellet per head per day and to another lot that received no pellets. These cattle were turned into two crested wheatgrass pastures on May 18th. These pastures had been fertilized with approximately 25 pounds of nitrogen per acre. Calving dates ranged from March 27 to May 12 with the average birth date being April 15.

Table 19. Response Due to Supplementing Nursing Beef Cows on Spring Pasture – 1967.

	No supplement	Supplement	Added gain from supplement
No. of head	44	46	
Initial cow wt. 5/18	991.2	973.0	
Cow wt.-end of feeding Period- 6/29	1070.2	1050.8	
Wt. gain while on feed	79.0	77.8	-1.2
Cow wt. at weaning 10/25&27	1121.1	1106.4	
Wt. gain, 6/29-10/25&27	50.9	55.6	+4.7
Wt. gain, 5/18-10/25&27	129.9	133.4	+3.5
No. of heifer calves	19	22	
Wt., 6/29	170.8	174.1	
Weaning wt., 10/25&27	370.0	374.5	
Wt. gain	199.2	200.4	+1.2
No. of steer calves	25	24	
Wt., 6/29	194.8	184.0	
Weaning wt., 10/25&27	408.0	390.0	
Wt. gain	213.2	206.0	-7.2

The results to date, as measured by weight gains for both the cows and the calves, indicate feeding three pounds of barley pellets per head per day was of no beneficial value. However, to fully determine whether or not the additional feed was of any value, other measures of production or condition must ne evaluated. One such measure is the effect the additional feed may have had on getting the cows back into good breeding condition so they would settle on first service. This information will be available at a later date.

Implanting Nursing Steer Calves with Stilbestrol – 1967

A random half of the steer calves at the Experiment Station were implanted with 15mg. of stilbestrol on June 29. Then about two thirds of all the calves were hauled out to two summer pastures in the Badlands and the remainder were kept at the Station on a native pasture. These calves were from cows ranging form two to eleven years of age. Birth dates of the calves ranged from March 25 to June 19. They were all weaned the 25th or 27th of October. Table 20 gives a summary of the results.

Table 20. The Response of Nursing Steer Calves Implanted with Stilbestrol.

	No Stilbestrol	Stilbestrol	Boost from Stilbestrol
No. calves	27	27	
Initial wt. – 6/29	185.9	182.2	
Intermediate wt. – 8/30&31	302.8	307.6	
Early summer wt. gain	116.9	125.4	+8.5
Weaning wt. – 10/25&27	396.9	390.2	
Wt. gain – 8/30&31 – 10/25&27	94.1	82.6	-11.5
Wt. gain entire period	211.0	208.0	-3.0

Results of the first year of this trial show the implants administered had no beneficial effect on growth rate. This trial will be repeated to determine the response during different years.

Facilities For Wintering Market Hogs

Insulating the hog house and providing a windbreak for the feeding area were two practices incorporated into a trial that started in the fall of 1966. The four treatments in this trial were a control lot that had an uninsulated house and no windbreak for the feeding area, a lot with an insulated house, a lot with a feeding area windbreak and a lot with both an insulated house and a windbreak. The portable 8x10 foot houses were insulated by covering them with straw bales. A four foot high windbreak was extended from the hog house so it provided protection on the north and west side of the self-feeder.

Four lots of six barrows and six gilts with an average weight of 60.2 pounds were assigned to each treatment as were four lots of five barrows and seven gilts that averaged 43.0 pounds. The heavier pigs were on trial for 99 days and the lighter pigs for 126 days. The pigs averaged 197.6 pounds when they were marketed.

The ration fed to these pigs is shown in table 21.

Differences among all the lots for average daily gain were very small. The windbreak improved gains by 0.06 pound per day; whereas, adding insulation improved gains by only 0.02 pound per day. The best gaining group was the insulation and windbreak lot with an average daily gain of 1.36 pounds. The pigs with the wind protection ate slightly more feed per day, but not enough to entirely account for

the 0.06 pound advantage in daily gain. Several other factors contributed to the better gains or it may be due to just chance variation.

Table 21. Ration for Swine in Insulation and Windbreak Trial.

Barley	88.5 lbs.	Trace mineral salt	0.6 lb.
Soybean meal	4.5 lbs.	Zing sulfate	0.02 lb.
Meat scraps	4.5 lbs.	Fortafeed	0.075 lb.
Di calcium phosphate	0.8 lbs.	Vitamin B_{12}	0.05 lb.
Limestone	0.5 lb.	Vitamin A	2.8 gm.
		Vitamin D_2	1.4 gm.

Table 22. Daily Gain and Feed Efficiency for Insulation and windbreak Trial.

	Average daily gain			Feed per hundred weight gain		
	No Insulation	insulation	Average	No insulation	Insulation	Average
No windbreak	1.28	1.28	1.28	418.9	404.4	411.6
Windbreak	1.32	1.36	1.34	397.9	397.2	397.6
Average	1.30	1.32		408.4	400.8	

Feed efficiency was improved by insulating the houses and by providing protection from the wind. The greatest improvement was again due to the wind protection provided.

Insulating the houses in the manner previously described resulted in only a slight rise in temperature inside the houses. However, it was noticed that the insulated houses were much dryer inside than the uninsulated houses. All of the houses used had metal roofs and moisture would condense on the roof and the walls if the house was not insulated. This trial will be conducted again to gather additional information.

Pasturing Market Pigs with a Barley or a Supplemented Barley Ration

In June, 1967, a trial was started to compare a supplemented barley ration, a supplemented barley ration to 125 pounds and then a barley plus salt ration and also a barley plus salt ration fed throughout the entire trial. These rations were fed to pigs in one acre pasture lots that were seeded to winter wheat in the spring. These rations are shown in table 23.

Each lot was replicated with two weight groups. On group started at an average weight of 62.1 pounds with 4 barrows and 4 gilts per lot and the other replication started with 5 barrows and 4 gilts as an average weight of 32.5 pounds. The heavy lots of pigs were on trial for 105 days and the light lots for 147 days.

Table 23. Composition of Rations.

	Supplemented barley ration	Barley plus salt
Ground barley	645	696
Soybean meal	35	
Di calcium phosphate	6	
Ground limestone	7	
Trace mineral salt	4	4
Zinc plus vitamins	1[a]	

[a] Includes 8.4 oz. fortafeed; 9.8 gm. Vitamin D; 21.0 gm. Vitamin A and 47.6 gm. Zinc sulfate.

The purpose of this trial was to determine whether or not feeder pigs can obtain the additional protein and minerals required for growth from the pasture on which they are grazing over that furnished in the grain. One ration provides all the needed nutrients and was used as a control. Another ration provides all the needed nutrients until they reach a weight of 120-125 pounds and the third ration relies entirely on pasture for the additional protein and minerals from the beginning to the end of the trial.

Table 24. Effect of Feeding a Supplemented or Unsupplemented Ration on Performance.

	Supplemented Ration	Supplemented to 125lbs.	Unsupplemented ration
Av. initial weight	46.4	48.0	47.7
Av. final weight	193.8	198.4	174.6
Av. daily gain	1.18	1.20	1.03
Av. feed per day	4.6	4.7	4.4
Feed/cwt gain	389.6	385.0	426.5
Feed cost/cwt gain	$9.28	$9.09	$9.94

Results shown in table 24 do not show any difference in the performance of pigs on a supplemented ration to market weight compared to pigs receiving a supplemented ration until they reached 125 pounds. There was no difference in rate of gain or feed efficiency and a slight but insignificant difference in feed cost per unit gain.

The unsupplemented lots gained much slower and required substantially more feed per unit gain which resulted in a higher feed cost per unit gain. The difference in feed required per unit gain may have been even greater if the pigs would have been carried to a weight comparable to the other two lots. Due to the poorer quality, that is, the lower protein content of the unsupplemented ration, these pigs made poorer use of the feed they ate and thus took a longer time to reach market weight.

The average daily gains in this trial are somewhat poorer than normal. This is due to the light weight replication of pigs. The same ration was used for all lots of pigs; however, for lighter pigs which have a higher protein requirement, this ration was probably a little low in total protein. Also pigs fed on pasture usually do not quite as well as pigs under confinement.

Comparing Rolled or Ground Barley with Barley and Oats in a Swine Ration

A feeding trial was conducted during the summer of 1966 and 1967 to compare ground barley, rolled barley, and a ration of two-thirds barley and one-third oats. A ration of one-third barley ad two-thirds oats was added in 1967. The complete rations are shown in table 25. In 1966, each ration was self-fed to a lot of four barrows and five gilts with an average initial weight of 33 pounds and also to a lot of four barrows and two gilts averaging 72 pounds. A lot of nine barrows averaging 70 pounds and a lot of 8 gilts averaging 69 pounds were self-fed each ration in 1967. These pigs were confined to an 8’ x 19’ concrete lot that provided both shade and water.

Table 25. Composition of Individual Ration.

Ingredient	Ground barley	Rolled barley	2/3 barley	1/3 barley
Barley, ground	645		435	210
Barley, rolled		645		
Oats, ground			210	435
Soybean meal	35	35	35	35
Di calcium phosphate	6	6	6	6
Limestone	7	7	7	7
Trace mineral salt	4	4	4	4
Zinc and vitamins [a]	1	1	1	1

[a] Includes: Fortaseed, 8.4 oz; vitamin A, 21 gm,; vitamin D, 9.8 gm.; zinc sulfate, 47.6 gm.

Average daily gains, as shown in table 26, show no difference between the two forms in which barley was fed. However, 32.4 pounds less feed was required to produce one hundred pounds of pork when the barley was dry rolled. The cheapest gains were made by the lot being fed rolled barley.

Results over the two year period show rate of gain was increased when one-third of the barley was replaced with high quality oats. The increase in rate of gain of the two-thirds barley ration plus the slight improvement in feed efficiency resulted in the most pork being produced for the least amount of money.

Average daily gain and feed efficiency for the one-third barley ration should be compared to 1.43, 1.39, 1.47, 435.9, 411.7 and 423.6, which are the 1967 average daily gain and feed required per one hundred pounds of gain figures for the other three rations in the order shown in table 26. Compared to the other results for 1967, the one-third barley ration had a very good average daily gain, fair feed efficiency and the cheapest gains of all the rations used for that year.

Table 26. Two Year Average of Results When Fed Ground or Rolled Barley or Two Different Ratios of Barley to Oats.

	Ground barley	Rolled barley	2/3 barley	1/3 barley *
Days on trial	96.5	96.5	96.5	95.0
Av. initial weight	60.1	62.2	60.1	69.0
Av. final weight	202.1	202.6	210.9	207.0
Av. daily gain	1.47	1.47	1.57	1.46
Feed/cwt gain	426.3	393.9	422.3	425.9
Feed cost/cwt gain	$9.73	$9.00	$9.48	$9.54

*1967 only

This trial indicates rolled or ground barley produced the same rate of gain but feed efficiency was better with rolled barley. The ground barley, which was of a medium grind in this trial, may have had a better feed efficiency value if it would have been ground fine. It also indicates average daily gains were not lowered when one-third of the barley was replaced with high quality oats and feed cost were affected very little.

In comparing the barrows and gilts in the 1967 trial, the barrows outgained the gilts by 0.1 pound per day with no difference in feed efficiency. Results for each ration for 1967 only are shown in table 27.

Table 27. Results of Feeding Ground or Rolled Barley or Two Different Ratios of Barley to Oats in a Fattening Swine Ration During 1967.

	Ground barley	Rolled barley	2/3 barley	1/3 barley
Av. initial wt.	69.4	69.4	69.2	69.0
Av. final wt.	205.2	201.6	208.8	207.0
Av. daily gain	1.43	1.39	1.47	1.46
Feed/head/day, lbs.	6.2	5.7	6.2	6.2
Feed/cwt gain	435.9	411.7	423.6	425.9
Feed cost/cwt gain	$10.37	$9.80	$9.78	$9.54

Limited or Free-choice Feeding of Gilts During Gestation

A trial was started May 31, 1967 which involved one lot of gilts that were fed all they would eat from self-feeders and another lot that were fed four pounds per head per day initially and six pounds starting three weeks before the average farrowing date. These gilts were in a one a day individual stalls. The gilts used were purebred Yorkshire gilts that were farrowed the previous fall. They were used in a winter shelter trial where all the pigs were self-fed the same ration. When the trial was closed, they were left on self-feeders through the breeding season until this trial started. The ingredients in the ration fed are shown in table28. Both lots were fed the same ration.

Table 28. Ration Used for the Limited Feeding of Gilts Trial.

Oats	1315	Limestone	25
Barley	400	Di calcium phosphate	25
Soybean meal	215	Trace mineral salt	20

The gilts were weighed at the beginning of the trial, about seven weeks before the average farrowing date and again when each gilt was put in the farrowing barn, which averaged five days before farrowing. The gilts were moved to the farrowing barn two to three days before they were due to farrow, but the interval from the pre-farrowing weight to the date of farrowing still varied from zero to

seven days. Within 24 hours of farrowing, the gilts were weighed and the little pigs were weighed, ear notched and their needle teeth were clipped. The pigs were weaned when they averaged 62 days of age.

Several problems were encountered during the course of this trial and as result, some of the gilts were not included in the summary and the remaining data in some cases may be biased. For example, some of the pigs from the very large litters were transferred to a gilt with a small litter. This reduced the number of pigs weaned in the big litter and reduced the average weaning weight of the pigs in the litter to which they were transferred.

Table 29. Results of Limit Feeding or Self-feeding Pregnant Gilts.

	Limit-fed	Full-fed
No. head	5	4
Initial wt.	322.0	342.8
Wt. near farrowing	411.2	458.5
Wt. gain during gestation	89.2	115.8
Wt. loss during farrowing	23.6	45.2
No. of pigs born	8.83	12.43
No. of pigs born alive	8.17	12.29
Av. birth wt. of living pigs	2.73	2.41
Av. total birth wt. of pigs born alive	20.9	28.4
No. of pigs weaned	5.0	8.0
Av. weaning wt.	48.03	44.10
Lbs. feed/hd/day	4.39	8.95
Feed cost/hd – 76 days	$7.56	$15.35

The results in table 29 indicate the full-fed gilts gained 26.6 pounds more weight during gestation and lost 21.6 pounds more during farrowing. They also farrowed 3.6 more live pigs per litter and weaned an average of 3 extra pigs. The pigs from the full-fed gilts weighed 0.32 pound less at birth and 3.93 pound less at weaning. However, an average litter from the self-fed gilt weighed 7.5 pounds more at birth and 20.5 pounds more at weaning.

Results from this trial appear to be contrary to much of the work done at other stations in that limiting the feed intake usually results in very satisfactory performance of both gravid gilts and sows. A continuation of this trial would be of interest to determine whether or not the performance of pregnant gilts would be satisfactory when feed intake is restricted.

Radio Programs, 1967

Date	Subject
January 20	Feeding a Balanced Ration
February 10	North Dakota Beef Cattle Improvement Ass'n. Meeting and Performance Testing
March 3	Cattle and Hog Trials at Dickinson Experiment Station
March 24	Energy Needs of Beef Cows Nursing Calves
April 14	Winter, 1966-1967 Swine Trials
May 5	Supplementing Cows on Pasture
June 23	Livestock Portion of Crops Field Day
August 11	Feeding For Leanness in a Market Hog
September 22	National Barrow Show and Selecting a Hard Boar
October 13	Different Ways of Feeding and Handling Hay
November 3	New Cattle Trials at Dickinson Experiment Station
November 24	Livestock Research Roundup
December 15	Selection and Selection Pressure in a Beef Cattle Improvement Program
December 29	Feeding Steers Grain While on Pasture

Date	Meeting and Tours, 1967	Attendance
January 9	North Dakota Beef Cattle Improvement Ass'n Committee Meeting, Dickinson	6
January 19	Adult Education Class, Halliday "Balancing a Ration"	22
January 19	Adult Education Class, Killdeer "Balancing a Ration"	50
February 1	Tour of Livestock Farm by Dickinson grade school Children	9
February 8	Tour of Cattle Trials for North Dakota Beef Cattle Improvement Ass'n – Annual Meeting	100
February 13	Slope County Crop & Livestock Improvement Ass'n "Protein and Energy Requirements for Wintering Beef Cattle"	60
February 14	Annual Sheep Field Day, Hettinger "Attended"	
March 4-7	North Dakota Winter Show, Valley City Showed Swine	
March 15	Demonstration at Station on Freeze Branding	40
April 12	Agricultural Committee, Chamber of Commerce	7
April 14	Meeting with Dr. W.E. DInusson on Summer Cattle and Hog Trials	3
April 24	Tour of Station by Cub Scout Den	11
April 26	Tour of Station by Lefor Rural School	11
April 28	Tour of Station by 5th grade at St. Patrick's Grade School	68
June	Tri-County 4-H Livestock Judging Contest at Station	50
July 19	Dickinson Experiment Station Crops Field Day " Pasture Grazing & Grain Trial"	250
July 21	Southwest District Livestock Judging Contest At Station	100

Date	Meeting and Tours continues	Attended
July 27-28	Annual Meeting and Tour of Great Plains Section of American Society of Range Management Bowman	100
August 16	Preconditioning Calves, Bismarck	100
August 30	Preconditioning Calves, Dickinson	100
September 8	Golden Valley County Fair, Beach Judge Livestock	
September 10-14	Attend National Barrow Shoe, Austin, Minn.	
September 20	Preconditioning and Marketing Meeting Richardton " Value of Preconditioning Calves "	65
September 22	Preconditioning and Marketing Meeting, Mott "Value of Preconditioning Calves"	60
September 25-26	North Dakota Hereford Tour, Flasher to Lemmon S. Dak. Area	
October 4	Potato Day Demonstration Trials at Dickinson Experiment Station	30
October 9	Legislative Research Committee, Sub-committee On budgets	8
October 19-20	Attend Extension Conference at Fargo – Red River 68 Wheat	
November 2	Meeting with Dr. W.E. Dinusson on Fall Cattle Trials	3
November 30	Feed Company Nutrition Meeting, Dickinson	60
December 13	18th Annual Livestock Research Roundup at Dickinson Experiment Station	950

General Summary

Month	Farm Visits	No. Tours	Attendance at meetings	Station Calls	Radion Talks	News Articles	Meetings Attended
January			78	8	1		3
February		2	169	1	1		3
March	4		40	3	2		
April	1	3	100	1	1		2
May				1	1		
June			50	3	1		
July		1	450	3		1	3
August		1	200	3	1		2
September		1	125	1	1		2
October	1		38	7	1		3
November	1		63	6	2	1	2
December			950	3	2		1
Total	7	8	2713	40	14	2	21

Report Of
Grass and Legume Investigations
At The
Dickinson Experiment Station
1967 Crop Season
By

Warren C. Whitman and Harold Goetz

Table Of Contents

Hay Yields From Grass And Grass-Alfalfa Mixture Plots

1. Uniform bromegrass trial:

The 1967 hay yields for the 14 strains of bromegrass in the uniform bromegrass trial are given in table 1. The 12-year average yields are given in table 2. This trial was seeded in 1953, with the first harvest year being 1954. In general the trial can be considered as being beyond its major period of usefulness, but the stands of the different varieties have continued to produce well and yield clippings have been made on all plots in all years of the trial except 1956 and 1964. The 1967 average yield for all varieties of 1733 lbs. per acre (dry-weight) was not outstanding, but it was greater than the 12-year average yield for all varieties. As in the past, the best yields were made by the southern-type varieties rather than the northern types. However, Canadian common and Homesteader yielded slightly better than some of the southern types; such as Achenbach, Elsberry, Kuhl, and Fisher. Lincoln, at 1929 lbs. per acre, was the best yielding variety, followed closely by Lyon and Lancaster.

The data of table 2 show that for the period of the trial Lincoln, Achenbach, Fisher, and Oklahoma synthetic have made the best production, all averaging over 1400 lbs. per acre (dry weight). Lincoln has been slightly better than the other varieties. The northern-type varieties, Manchar, Mandan 404, and Canadian common have been the lowest producers for the period of the trial, with 12-year average yields of 1244, 1241, and 1199 lbs. per acre, respectively.

The general differences between varieties in the trial have been rather small, but the overall excellent performance of Lincoln brome has marked it clearly as the outstanding variety of the trial. In stand maintenance and leafiness Manchar brome has been the best of the norther-type bromes.

2. Crested Wheatgrass trial:

The 1967 hay yields from the crested wheatgrass variety plots seeded in 1958 are given in table 3, and the 9-year average yields (1959-1967) for the crested wheatgrass varieties are given in table 4. As shown by the data of table 3, the 1967 yields of the crested wheatgrass plots are misleading. The plots have been heavily invaded by volunteer alfalfa, and, as the result of this invasion, the plots which contained the most alfalfa were generally the best producers in the 1967 season. The varieties in which little varieties, even though the grass stands were generally lower in yields than the other varieties, even though the grass stands were actually better in these plots than in most of the others. The best yields of actual grass were made by commercial crested, common Fairway, Neb. 3576 Fairway, Nebraska 10 (standard derivative).

The average production of all varieties in the 1967 season, 1941 lbs. per acre, was the highest yield for any of the 9 years of the trial (Table 4). The production of grass alone, however, (Table 3) was only 1264 lbs. per acre, a yield which was exceeded in 4 of the 9 years of the trial. The data in table 4 show that in general the standard-type varieties, Summit, Mandan 2359, Nebraska 10, commercial crested, and Nordan, continue to be somewhat better producing than

the Fairway-derived varieties. Most of the yield from the Turkish Fairway plots is provided by other varieties that have invaded these plots, as well as by the volunteer alfalfa.

Table 3. Composition of Hay Yields in 1967 from Crested Wheatgrass Plots Seeded in 1958.

Variety	Grass	Weeds*	Total
Mandan 2359	1191	1291	2482
South Dakota 15	1149	1285	2434
Summit crested	1202	937	2139
Nebraska 10	1358	684	2042
Commercial crested	1465	346	1811
Turkish Fairway	911	882	1793
Neb. 3576 Fairway	1372	305	1677
Nordan crested	1317	275	1592
Common Fairway	1407	92	1499
Average	1264	92	1499

*Most of material listed as “weeds” is volunteer alfalfa.

Table 4. Hay Yields from Crested Wheatgrass Varieties Seeded in 1958.

	Dry – weight yield – lbs./acre									9-yr. average
Variety	1959	1960	1961	1962	1963	1964	1965	1966	1967	yield
Summit crested	1328	1614	856	2023	1995	889	2011	903	2139	1529
Mandan 2359	1157	1687	833	1768	2119	864	1808	871	2482	1510
Nebraska 10	1137	1791	864	1890	2109	871	1784	864	2042	1484
Commercial crested	1452	1815	824	2080	1978	818	1538	758	1811	1453
Nordan crested	1427	1461	806	2006	2069	910	1669	687	1592	1403
Neb. 3576 Fairway	1371	1605	905	1680	1846	715	1650	962	1677	1379
South Dakota 15	1164	1546	770	1566	1788	712	1523	781	2434	1363
Commercial Fairway	1425	1819	873	1759	1734	887	1435	862	1499	1344
Turkish Fairway	753	930	562	1338	1558	747	1308	669	1793	1073
Average	1246	1563	810	1790	1911	824	1647	817	1941	1394

3. Station grass and grass and mixture trial:

Yields of the grass- alfalfa mixtures and the straight grass seedings in this trial are given in table 5, 6, and 7. The 1967 yields of the grass-alfalfa mixtures are given in table 5, and the 9-year average yields of the mixtures are given in table 6. The average yields for the grass varieties are given in table 7.

The 1967 average yield of all mixtures at 3431 lbs. per acre was appreciably greater than the 9-year average yield for all mixtures at 2625 lbs. per acre. The highest producing mixture in the 1967 season was the Nordan crested-Teton alfalfa mixture at 4232 lbs. per acre (dry-weight). Intermediate wheatgrass and Teton alfalfa was also a high-yielding mixture at 4173 lbs. per acre. In both of these mixtures alfalfa provided most of the yield, averaging 76.8 percent of the yield in the Nordan-Teton mixture and 67.3 percent in the Intermediate-Teton mixture. Weeds were of appreciable significance in both sets of mixtures. Alfalfa made up the highest percentage of the yield on the average of all mixtures, 53.4 percent, but in some of the mixtures, notably Lincoln bome-Ladak, Manchar brome-Ladak, and Russian wildrye-Ladak the alfalfa component made up substantially less of the yield than did the grass component. However, the relative amounts of alfalfa in the mixtures are surprisingly high.

Table 5. Composition of 1967 Hay Yields from Station Grass-Alfalfa Mixture Trial Seeded in 1958.

	Dry – Weight yields – lbs./acre				
Mixtures	Grass	Alfalfa	Other Grass	Weeds	Total yield
Nordan crested – Teton alfalfa	841	3251	--	140	4232
Intermed. Wheatgrass – Teton alfalfa	633	2809	--	731	4173
Lincoln brome- Ladak alfalfa	2353	1445	--	53	3851
Green stipa (new)- Ladak alfalfa	200	2433	--	1075	3708
Lincoln brome-Nordan Crested-Ladak alfalfa	1802	1870	--	--	3672
Lincoln brome- Teton alfalfa	1742	1792	--	51	3585
Manchar brome- Ladak alfalfa	2261	1253	--	17	3531
Intermed. Wheatgrass- Ladak alfalfa	945	1599	--	949	3493
Green stipa- Ladak alfalfa	87	1635	--	1714	3436
Green stipa- Teton alfalfa	--	2091	--	864	2955
Russian wildrye-(2355)- Teton alfalfa	1301	1284	21	25	2631
Russian wildrye (2355)- Ladak alfalfa	1111	547	--	248	1906
Average	1106	1834	2	489	3431

Table 6. Average Hay Yields from Station Grass-Alfalfa mixture Trial Seeded in 1958.

Mixtures	Dry – weight yields – lbs./acre									9-year average yeild
	1959	1960	1961	1962	1963	1964	1965	1966	1967	
Nordan crested-Teton alfalfa	2359	3396	1360	2970	3959	1691	3961	3495	4232	3047
Lincoln brome-Ladak alfalfa	2171	3272	903	2824	4527	1534	4105	2661	3851	2872
Lincoln brome-Teton alfalfa	2329	2765	943	2682	4441	1698	3984	2603	3585	2781
Lincoln brome-Nordan Crested-Ladak alfalfa	2447	3204	1195	2663	3642	1862	3410	2475	3672	2730
Intermed. wheatgrass-Teton alfalfa	3144	3381	647	2421	4182	1255	3075	1856	4173	2682
Intermed. wheatgrass-Ladak alfalfa	2818	3258	755	--[1/]	4093	1440	3519	2418	3493	2421
Manchar brome-Lakak alfalfa	2127	2764	692	2237	3654	1315	3259	2042	3531	2402
Russian wildrye (2355)-Teton alfalfa	1449	2307	786	1825	2859	1307	2040	1690	2631	1877
Russian wildrye (2355)-Ladak alfalfa	1653	1716	711	2201	2526	1220	2058	1286	1906	1697
Green stipa (new)-Ladak alfalfa	--	--	--	3006	5714	1365	2942	2647	3708	3230
Green stipa-Teton alfalfa	--	--	642	2684	5579	1678	4781	3270	2955	3084
Green stipa – Ladak alfalfa	--	--	1035	2344	4290	1406	3717	2555	3436	2683
Average	2297	2897	879	2321	4123	1481	3404	2416	3431	2625

[1/] No harvestable yield in 1962.

Table 7. Average Hay Yields, 1959-1967, from Station Grass Trial Seeded in 1958.

Grasses	Dry – weight yield – lbs./acre 1959	1960	1961	1962	1963	1964	1965	1966	1967	9-year average yield
Intermediate wheat-Grass (Neb. 50)	2865	3440	743	1855	3167	1450	2439	2312	2272	2283
Summit crested	2653	3310	1272	2317	2339	1138	2390	1811	2245	2164
Nordan crested	2364	3203	1259	2032	2475	1117	2172	1972	2179	2086
Lincoln bromegrass	2559	3107	971	2185	2507	799	2572	1515	2018	2026
Southland brome	2344	3293	750	2141	2442	703	2640	1594	2022	1992
Manchar brome	2332	2560	707	1937	2284	974	2391	1371	1856	1824
Northern brome	2324	2876	540	1818	2035	763	2075	1291	1800	1725
Russian wildrye (2355)	1368	2086	686	1727	1929	913	1478	962	1394	1394
Russian wildrye (Com,)	1404	1913	756	1530	1574	1008	1522	792	1311	1312
Slender wheatgrass	1937	2601	--	--	2531	--	--	--	--	--
Green stipa (new)	--	--	755	2441	3118	1189	2354	1376	1679	(1845)*
Green stipa (com.)	--	--	608	1916	2912	1237	2613	1257	1819	(1766)*
Western wheatgrass	--	--	--	--	--	934	2609	1575	1794	(1728)*
Average	2215	2839	822	1991	2443	1019	2271	1486	1900	1867

*Not included in average yield of all grasses

A comparison of the average grass-alfalfa mixture yields with the straight grass yields (table 6 and 7) shows that on the average for the period of the trial the mixture plots have produced about 40.6 percent more hay then the straight grass plots. Some individual comparisons show that Nordan crested and Teton alfalfa produced 46.1 percent more than straight Nordan crested, Lincoln brome and Ladak alfalfa produced 41.7 percent more than straight Lincoln brome, and Russian wildrye-Teton alfalfa produced 34.6 percent more than straight Russian wildrye.

In The straight grass seedings Neb. 50 Intermediate wheatgrass shows the highest average yield for the period of the trial, 2283 lbs. per acre. However, a substantial portion of the yield of the Intermediate wheatgrass plots is produced by crested wheatgrass, which had invaded the somewhat deteriorated plots of Intermediate. Summit crested, Nordan crested, and Lincoln brome-grass have all maintained average yields of a little over 1 ton per acre, and the average yield of Southland brome is very close to a ton per acre. Manchar brome and northern brome have average yields in the vicinity of 1700 to 1800 lbs. per acre, and the two Russian wildrye varieties show yields between 1300 and 1400 lbs. per acre.

Some stand deterioration has taken place in both the mixture plots and the straight grass seedings. In the straight grass plots the Intermediate stands, the green stipa stands, and the common northern brome stands show the most serious deterioration, with substantial amounts of crested wheatgrass having invaded the plots of these varieties. The intermediate wheatgrass-alfalfa plots and the green stipa- alfalfa plots have been seriously invaded by crested wheatgrass. As shown in table 5, the amount of grass remaining in the Intermediat-Ladak, and green stipa-Ladak mixtures is very low.

4. Dryland alfalfa plots:

The yields for the 1967 season from the alfalfa variety plots seeded in 1960 are given in table 8, and the 7-year average yields for the varieties are given in table 9. Two cuttings were made from the plots in the 1967 season with the average total yield of all varieties being 3984 lbs. per acre (dry-weight). This yield is surprisingly good considering that the 1967 season was appreciably dryer than usual. The relative dryness of the summer period was reflected in the fact that only 17.5 percent of the average total yield for all varieties was produced from the second clipping.

The highest yielding variety in the 1967 season was Narragansett, with a total production of 4627 lbs. per acre. S. Dak. (H-2157), Rambler, Rhizoma, and Ladak were next in order of production with yields of 4597, 4580, 4494, and 4422 lbs. per acre, respectively. Ranger and Teton both produced over 2 tons per acre, while Grimm and Vernal produced well over 3500 lbs. per acre. Only Pfister produced less than 3000 lbs. per acre.

The 7- year average yields (table 9) show that Ladak and Rambler have been the highest producers over the period of the trial, followed closely by Rhizoma, S. Dak. H-2157, Narrangasett, Vernal, Teton, and Grimm. All of these varieties show an average yield of over 3700 lbs. per acre, while Ladak and Rambler show average yields of over 2 tons per acre. The 7-year average yield for all varieties of 3614 lbs. per acre is very good. The yields of Scandia, DuPuits, and Pfister have been substantially lower than the yields of the other varieties.

Table 8. Yields of Alfalfa and Weeds in the 1967 Season from Dryland Alfalfa Plots Seeded in 1960.

Variety	Dry – weight yield – lbs./acre				Total Yield lbs./acre	
	1st clipping		2nd clipping			
	Alfalfa	Weeds	Alfalfa	Weeds	Alfalfa	Weeds
Narragansett	3769	122	858	4	4627	126
S. Dak. (H-2157)	4086	96	511	--	4597	96
Rambler	3802	258	778	--	4580	258
Rhizoma	3648	56	846	--	4494	56
Ladak	3612	5	810	--	4422	5
Ranger	3149	112	939	--	4088	112
Teton	3554	170	472	--	4026	170
Grimm	3217	152	768	3	3985	155
Vernal	3179	898	517	11	3696	909
Scandia 1/	2520	384	570	9	3090	393
DuPuits	2412	249	674	--	3086	249
Pfister	2118	299	574	--	2692	299
Average	3255	233	693	2	3948	235

1/ Yield data from 3 plots.
Yield data on all others from 4 plots.

Table 9. Summary of 1961-1967 Hay Yields from Dryland Alfalfa Plots Seeded in 1960.

	Dry-weight yield – lbs./acre							7-year Average
Variety	1961	1962	1963	1964[1/]	1965[1/]	1966[1/]	1967[1/]	Yield
Ladak	963	5851	4504	3209	5887	3927	4422	4109
Rambler	1124	5947	4439	2840	5556	3960	4580	4064
Rhizoma	827	5923	4244	2165	5792	4042	4494	3927
S.Dak. H-2157	900	5008	4302	2910	6026	3432	4597	3882
Narragansett	1023	5658	4469	2625	5365	3392	4267	3828
Vernal	1099	5545	4345	3051	5152	3660	3696	3793
Teton	841	4960	4480	2796	5696	3615	4026	3765
Grimm	1059	5354	4113	3124	5035	3655	3985	3761
Ranger	869	4842	4100	2750	4824	3169	4088	3520
Scandia	907	5312	3793	2349	3609	2612	3090	3096
DuPuits	974	5789	3984	1091	--	2007	3086	3822[2/]
Pfister	904	5093	3701	1267	3141	2925	2692	2803
Average	958	5274	4206	2515	5378[3/]	3358	3948	3614

[1/] Yields for 1964, 1965, 1966, and 1967 do not include weeds.
[2/] Six-year average yield – no yield in 1965.
[3/] Does not include DuPuits in 1965.

Table 10 gives the 1967 yields from the new alfalfa trial plots seeded in 1964. The average yield for all varieties for all varieties in the 1967 season was 4705 lbs. per acre, the highest yield in any of the 3 years that this trial had been harvested (table 11). There were very few weeds in the plots, as shown in Table 10. None of the varieties produced more from the second clipping than from the first. In fact, the bulk of the yield of all varieties being 85.6 percent of the total seasonal yield produced from the first clipping. The top yielding variety in the 1967 season was Ladak with a production of 5336 lbs. per acre (dry weight). All varieties yielded over 2 tons per acre, with Ranger, Unita, and Norseman all producing over 4900 lbs. per acre. Lahontan was the lowest producer with a yield of 4128 lbs. per acre.

The average yields for the 3 years of this trial are given in Table 11. On the basis of the 3-year average Vernal has shown the highest production at 4563 lbs. per acre. Range and Ladak have shown yields nearly equal to that of Vernal. All varieties except DuPuits, Cody, and Lahontan have a 3-year average production of over 4000 lbs. per acre.

Table 10. Yields of Alfalfa and Weeds in 1967 Season from Alfalfa Trial Plots Seeded in 1964.

Variety	Dry-weight yield – lbs./acre				Total Yield Lbs./Acre	
	1st clipping		2nd clipping			
	Alfalfa	Weeds	Alfalfa	Weeds	Alfalfa	Weeds
Ladak	4418	--	918	--	5336	--
Ranger	4238	20	756	--	4994	20
Uinta	4163	39	772	--	4935	39
Norseman	4324	--	588	--	4912	--
Vernal	4082	--	733	--	4815	--
Travois	4640	--	161	--	4801	--
Warrior	3958	--	696	--	4654	--
Culver	4027	--	611	--	4638	--
Cody	3752	14	713	--	4465	14
DuPuits	3560	32	863	--	4423	32
Teton	3820	--	543	--	4363	--
Lahontan	3330	29	798	--	4128	29
Average	4026	11	679	--	4705	11

Table 11. Hay Yields from Alfalfa Plots Seeded in 1964. 1/

Variety	Dry – weight yield – lbs./acre 1965	1966	1967	3- Year average lbs./acre
Vernal	4535	4338	4815	4563
Ranger	4423	4225	4994	4547
Ladak	4002	4160	5336	4499
Warrior	4096	4413	4654	4388
Uinta	3704	4428	4935	4356
Travois	3819	4273	4801	4298
Norseman	4086	3815	4912	4271
Culver	4687	3115	4638	4147
Teton	4472	3477	4363	4104
DuPuits	3550	3544	4423	3839
Cody	3502	3521	4465	3829
Lahontan	2843	3267	4128	3413
Average	3977	3881	4705	4188

1/ Yields include alfalfa only – no weeds.

New Fertilizer Trial

1. Hay yields from new fertilizer trials:

In this trial Nordan crested wheatgrass and Russian wildrye are compared under hay clipping and pasture clipping in pure stands, in mixture and alfalfa, and 33, 67, and 100 lbs. 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 the 1961 season. Fertilizer applications were made on the plots in late fall in 1967 and 1958. All applications in subsequent years made in early spring, usually in April.

Hay yields of Nordan crested wheatgrass for the period of the trial are given in Table 12., and for Russian wildrye in Table 13. The hay yields of Nordan crested wheatgrass in the 1967 season were substantially above the 10- year average yields for this variety, while the 1967 hay yields of Russian wildrye were variable, with only the 67-bls. -N treatment being substantially above the 10-year average yield for this treatment. As would be expected, the hay yields of Nordan crested wheatgrass in the 1967 season were substantially greater than the hay yields of Russian wildrye. Check plots of Nordan produced 1526 lbs. per acre more than the Russian wildrye checks; in mixture with alfalfa Nordan produced 1173 lbs. more per acre than the Russian wildrye mixture; while under the fertilizer treatments hay production by Nordan was 1204 lbs. more at the 33-lbs,-N level, 521 lbs. more at 67-lbs.-N, and 1390 lbs. more than the Russian wildrye at the 100-lbs.-N level.

Table 12. Hay Yields of Nordan Crested Wheatgrass in Pure Stand, in Mixture with Alfalfa, and Fertilized at Three Different Rates.

Year	Dry – weight yields – lbs./acre				
	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	2524	2813	2960	3344	3795
Average	1749	2026	2438	2802	3084

Table 13. Hay Yields of Russian Wildrye in Pure Stands, in Mixture with Alfalfa, and Fertilized at Three Different Rates.

Year	Dry – weight yield – lbs./acre				
	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
Average	1151	1373	1704	2180	2487

On the basis of the 10-year average of crested wheatgrass hay clipping the grass-alfalfa plots averaged 277 lbs. more yield than the check plots. With 33 lbs. nitrogen per acre the hay yields were 689 lbs. per acre more than the check plot yields. The 67-lbs.-N treatment has produced 1053 lbs. more, and the 100-lbs.-N plots have produced 1335 lbs. more hay per acre than the untreated plots. If hay were valued at one cent per lb. and nitrogen at 10 cents per lb., all rates of fertilization would have been economically profitable on crested wheatgrass.

The Russian wildrye hay- clipping yields have been surprisingly good. The mixture of Russian wildrye and alfalfa produced an average of 222 lbs. per acre more hay than the unfertilized check plots of this grass over the 10-year period of the trial. Plots fertilized with 33 lbs. nitrogen produced 553 lbs. more than the checks; with 67 lbs. nitrogen, 1029 lbs. more; and with 100 lbs. nitrogen, 1336 lbs. more. All rates of fertilization on the Russian wildrye plots were also economically profitable. Increases in yield of the grass-alfalfa mixtures over the straight grass plots have been relatively low for the period as a whole averaging 19.3 percent for crested wheatgrass and 15.8 percent for Russian wildrye. However, in the past three seasons alfalfa has shown some increase in production on both the crested wheatgrass and the Russian wildrye plots.

2. Pasture yields from new fertilizer trial:

Table 14 gives the pasture-clipping yields for Nordan crested wheatgrass and Russian wildrye over the 7-year period 1961-1967. The clippings were made twice on each plot in the 1961, 1963, and 1967 seasons and three times on each plot in the 1962, 1964, 1965 and 1966 season. A comparison of the average pasture-clipping yields of Nordan crested with the average hay-clipping yields for this grass (Table 12) shows that the pasture-clipping yields are appreciably lower than the hay-clipping yields average slightly greater than the hay-clipping yields (Table 14 and 13).

Under pasture clipping the Nordan crested-alfalfa mixture plots produced an average of 491 lbs. more grass per acre than the check plots. On the plots fertilized with 33 lbs. nitrogen per acre the average production was 235 lbs. per acre than on the checks; with 67lbs. N the increase in yield was 923 lbs.; and with 100 lbs. N the increased yield averaged 1215 lbs. per acre. On the basis of increased amounts of grass and relative cost of nitrogen the 67-lb. rate of fertilization was the most economical. The 33-lb. rate would distinctly uneconomical on the basis of this type of evaluation. The grass-alfalfa plots showed an average increase in yield of about 37 percent over the check plots, appreciably better than the increase obtained with the first 33 lbs. of nitrogen.

The pasture-clipping plots of Russian wildrye-alfalfa produced only 159 lbs. per acre more than the pure grass check plots over the 7-year period of the trial. With 33 lbs. nitrogen production was increased by an average of 473 lbs. of grass per acre. The 67-lb. rate of nitrogen fertilization increased the pasture clipping yields of Russian wildrye by 995 lbs. per acre, and the 100-lb. rate increased production by 1262 lbs. per acre over the production of the check. All rates of fertilization were thus economically profitable on Russian wildrye under pasture clipping. The 67-and the 100-lb. rates were apparently the most economical.

The stands of both grasses have shown some loss of vigor under the pasture clipping treatment, and a number of dead and very low-vigor plants have been observed in the Russian wildrye plots. Weeds have increased somewhat in these plots, but the plots are still in fairly good shape. The clipping treatment consists of allowing the grass to grow to a height of 4 inched and then cutting it back 2 inched. This treatment is repeated each time during the season that the grass reached the 4-inch height.

Table 14. Pasture Clipping Yields of Two Grasses in Pure Stands, in Mixture with Alfalfa, and Fertilized at Three Different Rates.

Grass	Year	Dry – Weight yield – lbs./acre				
		Grass Alone	With alfalfa	33lbs. N	67lbs. N	100lbs. N
Nordan Crested	1961	938	982	1011	1171	1134
	1962	2097	2284	2506	3098	3964
	1963	1875	2223	2459	3738	4322
	1964	1102	1100	1287	1338	1453
	1965	1093	1483	1581	2091	2127
	1966	1371	2970	1708	2179	2477
	1967	836	1704	1403	2157	2269
Average		1330	1821	1565	2253	2545
Russian Wildrye	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
Average		1273	1432	1746	2268	2535

Native Grassland Fertilization

A native grassland nitrogen fertilization trial started in the spring of 1964 was continued in the 1967 growing season with some slight modifications. The trial was started in 1964 and included four range sites consisting of some of the major sites found in western North Dakota. The range sites were selected because of the extreme range in conditions, as well as the substantially large acreages of grazing land represented by each site. The sites were designated by a soil series name and originally included a sandy hills site (Vebar series), a sagebrush-flat site (Havre series), a Solonetz or panspot site (Rhodes series) and a high river terrace site (Manning series).

In the 1967 growing season the Solonetz site was not included in the fertilizer experiment. Another Solonetz soil type will, however, again be included in the fertilizer trial in the 1968 season. In addition to the three rates of nitrogen fertilizer, plots fertilized with phosphorus and plots with phosphorus-plus-nitrogen in combination were added to the Harve range site in the 1967 season. Plots fertilized with nitrogen-and -phosphorus in combination only were added to the fertilizer trial on the Vebar range site. The Manning range site remained essentially the same as initially setup with three rates of nitrogen fertilizer.

The fertilizer treatments were applied in the spring by approximately the 10th of May. This was considerably later then the time of application in the previous growing season. The late applications were due to the relatively late snowstorms experienced in this areas in the spring of 1967. Yields in general, however, were higher in the 1967 season than those observed in the 1966 growing season, but well below the production obtained in the 1964 and 1965 growing season. Small areas of the fertilized plots were protected by steel-wire cages and the plots were hand-clipped and oven-dried for yield determinations at the end of the growing season. The total yields were separated into various components consisting of: (1) tall-grasses, (2) midgrasses, (3) shortgrasses, (4) annual forbs, and (5) perennial forbs (Table 1).

The data on Table 1 shows the yields from the three range sites in the 1967 season. The total yields were highest from the Havre site on check plots and at all rates of nitrogen fertilization when compared to the other sites. The highest increase in yield was observed at the 67-pound-nitrogen application with and increase in yield of 903 pounds of grass per acre over the yield from the check plots. The 100-pound-nitrogen application yielded an increase of 855 pounds per acre while the 33-pound rate increase 234 pounds above the yield from the check plots. Total yields were appreciably greater at all levels of fertilizer treatments with the inclusion of the forb component. The plots fertilized with the 48-pounds of phosphorus fertilizer showed an increase in total yields of all components to be greater than that observed at the 33-pound-nitrogen rate. The combination of 33-pounds-nitrogen and 48-pounds-phosphorus treatment showed a substantial increase in total grass yield but a marked decrease in the yield of the forb component.

Yields from the Manning range site in the 1967 season are given in Table 1. The Manning site was fertilized at three different rates of nitrogen fertilizer but no plots were added with phosphorus applications. The data show substantial increases in total yields of grass with each added increment of nitrogen fertilizer. The largest increases in yield were observed at the 67-and at the 100-pound-nitrogen applications. Increases in yield of 346 pounds per acre of grass above the yield from check plots was observed at the 67-pound-rate and 856 pounds increase a the 100-pound-nitrogen rate. The perennial

forb species did not show an increase in total yields with increase in fertilizer rates this season, due mainly to the elimination of the fringed sage form the site.

The Vebar range site was the lowest producing site in the 1967 growing season (Table 1). Highest yields of forage were observed with the 67-pound-nitrogen fertilizer application a 1442 pounds per acre. This was a total increase in yield over check plots of 603 pounds per acre. The 100-pound-nitrogen rate did not increase the yield above the yields obtained from the 67-pound-nitrogen application. Yields from the plots with phosphorus-and-nitrogen in combination showed yields only slightly greater than those obtained form the check plots. A substantial percentage of the total yield form this site was due to the perennial forb component, averaging approximately 36 percent of most of the fertilizer treatments (Table 2).

The 4- year average yield data are given in Table 3. The average percent composition of the yields for the yields for the 4-year study are given in Table 4. Data from the 4-year period showed that the Harve range site was the highest yielding site in total pounds per acre produced and in amount of usable forage at the different rates of nitrogen fertilization. In terms of increase of the grass component, the 67-pound-nitrogen rate has produced the highest returns with an average of 2944 pounds per acre. This is an increase over the average yield from check plots of 903 pounds per acre. The 33-pound rate increased the average grass yield over the check plots by 234 pounds, while the 100-pound-nitrogen rate increased yields by 855 pounds per acre. The forb production has remained less with the applied nitrogen than was observed on the check plots on the Harve site (table 4).

The Manning site was the next highest yielding site showing lower total yields than those from the Havre site but higher production than was found on the Vebar range site. The 4-year average yield data (Table 3) show that the highest increase in grass production was at the 67-pound-nitrogen rate on this site. Additional increases were observed at the 100-pound-nitrogen rate, although the additional increases were comparatively less than those at the 67-pound-rate. In terms of actual pounds per acre of forage produced beyond that from the check plots, the 67-pound-nitrogen application produced 614 pounds per acre with 875 pounds produced with the 100-pound-nitrogen rate. The 33-pound-nitrogen rate showed a 4-year average increase of only 129 pounds of grass per acre. Substantial increases in yield of the forb component over the 4-year period were evident with each increase in added increment of fertilizer (Table 3). The data reflect mainly the results of the 3-year period previous to the 1967 growing season. Table 4 shows that approximately 25 percent of the total yields have been due to the forb component, increasing with the amount of applies nitrogen. The actual average increase in total yield due to the forbs will probably be considerably less in the future with increased rates of applied nitrogen due to decrease in the fringed sage population on this site.

Four-year average yields form the Vebar site show this site to be the lowest yielding of the three sites studied (Table 3). The highest yields were observed at the 67-pound-nitrogen rate which was similar to the observations from the Havre and Manning sites. A 750 pound increase in grass was observed on the Vebar site at the 67-pound rate with only an additional increase of 109 pounds at the 100-pound-nitrogen treatments. In terms of percentage composition of yield of the different forage components, the relative pro-portions of each has increased in nearly equal amounts. The forb component has increased slowly and accounts for about 25 percent of the total yield of the Vebar site.

In genera, the 4-year data thus far show that the highest grass yields may be realized with the 67-pound-nitrogen treatment on the three sites. A preliminary economic analysis of the data indicate

that a profitable return on the investment of the cost of the fertilizer and its application would be limited to the 67-pound-nitrogen rate and possibly only on the better range sites. When considering the total yield from each of the sites at the 67-pound-nitrogen rate, a profitable return could be ecpected from all of the sites. When considering the total yield from each of the sites at the 67-pound-nitrogen rate, a profitable return could be expected form all the sites. The total yields does, however, include an appreciable percentage of undesirable forbs normally not eaten by the grazing livestock. Other additional data also indicate, however, that the protein content of the vegetation of the poorer sites may be considerably higher than that of the better sites and may partially compensate for the lower overall production.

The perennial forb species, mainly the sage species, showed appreciable stimulation due to the applied nitrogen at the higher rates on most sites. The Manning site has a high sage plant population in the 3 previous years on the study, but nearly all of the plants of this species died during the 1967 growing season. The heavy use of the nitrogen fertilizer may have contributed to the elimination of the sage species.

I may become necessary to use herbicides as a control measure in conjunction with the fertilizer in order to avoid complete dominance of certain range sites with undesirable forb species. The use of fertilizer to improve the forage production of native grasslands, however, may become a valuable tool for attaining maximum native range production in the future if used with a through knowledge of plant responses on different range sites.

Table 15. Forage Production on Three Native Grass Range Sites Fertilized with Nitrogen, Nitrogen-Plus Phosphorus, and Phosphorus Alone, in the 1967 Season.

Site	Treatment	Dry- weight yield – lbs./acre						
		Mid Grasses	Tall Grasses	Short Grasses	Total Grasses	Perennial Forbs	Annual Forbs	Total Yield
Havre	Check	1966	--	21	1987	711	0.4	2699
	33 lbs. N	2090	--	10	2100	525	--	2625
	67 lbs. N	2934	--	1	2935	421	--	3356
	100 lbs. N	2251	--	49	2300	293	--	2593
	33 lbs. N+ 48 lbs. P	2358	--	1	2359	187	--	2546
	48 lbs. P	2159	--	7	2166	483	--	2649
Manning	Check	377	--	892	1230	260	21	1511
	33 lbs. N	346	--	1021	1366	111	15	1491
	37 lbs. N	426	--	1307	1733	83	21	1837
	100 lbs. N	467	--	1789	2256	101	11	2367
Vebar	Check	169	20	379	567	245	28	839
	33 lbs. N	137	91	468	697	323	22	1040
	67 lbs. N	292	42	485	819	601	22	1422
	100 lbs. N	272	81	514	866	535	8	1409
	33 lbs. N+ 48 lbs. P	127	25	349	502	393	9	905

Table 16. Percentage Composition of Yields from Native Grass Range Sites Fertilized with Nitrogen at Three Different Rates – 1967.

Site	Treatment	Percent composition of yield		
		Mid and Tall Grasses	Short grasses	Forbs
Havre	Check	72.8	0.8	26.4
	33 lbs. N	79.6	0.4	20.0
	67 lbs. N	87.5	T	12.5
	100 lbs. N	86.8	1.9	11.3
	33 lbs. N+ 48 lbs. P	92.6	T	7.4
	48 lbs. P	81.5	0.3	18.2
Manning	Check	22.3	59.1	18.6
	33 lbs. N	23.2	68.4	8.4
	67 lbs. N	23.2	71.1	5.7
	100 lbs. N	19.7	75.6	4.7
Vebar	Check	22.4	45.2	32.4
	33 lbs. N	21.9	45.0	33.1
	67 lbs. N	23.2	33.6	43.2
	100 lbs. N	25.0	36.5	38.5
	33 lbs. N+ 48 lbs. P	16.8	38.6	44.4

Table 17. Average dry weight yields on three Native Grass Sites Fertilized with Nitrogen, Nitrogen-Plus-Phosphorus, and Phosphorus Alone, 1964-1967 seasons.

Site	Treatment	Dry weight yield – lbs./acre					
		Mid Grasses	Tall Grasses	Short Grasses	Total Grasses	Total Forbs	Total Yield
	Check	2029		122	2041	441	2482
	33 lbs. N	2269		6	2275	344	2619
	67 lbs. N	2940		4	2944	340	3285
Havre	100 lbs. N	2848		48	2896	188	3084
(Sagebrush flat)	33 lbs. N+						
	48 lbs. P	*2358		1	2359	187	2546
	48 lbs. P	*2159		7	2166	483	2649
	Check	284		971	1255	315	1570
Manning	33 lbs. N	281		1103	1384	418	1802
(River terrace)	67 lbs. N	364		1506	1869	699	2568
	100 lbs. N	425		1703	2128	959	3087
	Check	275		813	1088	323	1411
	33 lbs. N	268		1110	1378	431	1809
Vebar	67 lbs. N	398		1440	1838	650	2488
(Sandy hills)	100 lbs. N	538		1409	1947	620	2567
	33 lbs. N+						
	48 lbs. P *	152		349	502	402	905

*1-year average.

Table 18. Average Percentage Composition of Yields from Native Grass Range Sites Fertilized with Nitrogen, Nitrogen-Plus-Phosphorus, and Phosphorus Alone – 1964-1967 Seasons.

Site	Treatment	Percent composition of yield		
		Mid and Tall Grasses	Short grasses	Forbs
Havre	Check	81.7	0.5	17.8
	33 lbs. N	86.7	0.2	13.1
	67 lbs. N	89.5	0.1	10.4
	100 lbs. N	92.3	1.6	6.1
	33 lbs. N+ * 48 lbs. P	92.7	T	7.3
	* 48 lbs. P	81.5	0.3	18.2
Manning	Check	18.1	61.8	20.1
	33 lbs. N	15.6	61.2	23.2
	67 lbs. N	14.2	58.6	27.2
	100 lbs. N	13.8	55.2	31.0
Vebar	Check	19.5	57.6	22.9
	33 lbs. N	14.8	61.4	23.8
	67 lbs. N	16.0	57.9	26.1
	100 lbs. N	21.0	54.9	24.1
	33 lbs. N+ * 48 lbs. P	16.8	38.6	44.4

* 1-year average.

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

1967

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 plants 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 test on malting quality and for other quality determinations.

Variety trials have been conducted at the Dickinson Experiment Station since 1908, and have provided much useful information on the varietal 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 randomized block arrangement. Seeding rates are 1 bushel per acre for wheat, durum and rye, 1 ¼ bushel per acre for barley, 1 ½ bushel per acre for oats and ½ bushel per acre for flax.

Fertilizer application is uniform for all varieties and follows recommendations based on soil test. Present recommendations for this site are 5-10 lbs. nitrogen per acre and 33-40 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 1967 the wheat and durum variety trials were seeded on April 15. Heavy snowfall, and cold weather following this seeding prompted an additional seeding of the complete wheat and durum variety series on May 15. Results of both seedings are reported in the following tables, as are the results of the oat variety trials, seeded May 9, the barley variety trials, seeded May 9, and the winter wheat and winter rye variety trials, seeded on September 9, 1966.

Table 1. Wheat Variety Trial.

Variety or Treatment	Entry No.	Yield - bushels per acre				Average	Test weight	Heading date	Diseases	Lodging %	Height inches
		Rep 1	Rep 2	Rep 3	Rep 4						
Thatcher	1	8	18	14.2	22.3	15.62	56	8-Jul			25
Selkirk	7	9.6	9.4	13.8	23	13.95	55	8-Jul			25
Justin	8	13.8	11.6	14.2	22.2	15.45	57.5	9-Jul			25
Pembina	9	9.5	14	18.5	20	15.5	57.5	5-Jul			25
Crim	14	12.3	16.4	18.8	22.1	17.4	57.5	5-Jul			28
Chris	15	10.2	11.3	19.1	24	16.15	57	8-Jul			28
Manitou	34	9.9	18.7	16.8	21.1	16.62	56	8-Jul			26
Valley	41	8.1	14.7	17.9	20.6	15.32	58.5	5-Jul			24
Fortuna	54	10.9	13.5	19.1	28.7	18.05	59.5	5-Jul			26
Sheridan	35	11.4	15.7	16.9	21.1	16.27	60.5	5-Jul			27
II-55-11	38	13.1	12	16.7	26.4	17.05	60	6-Jul			23
Wisc. 255	39	10	11.6	12.4	19.3	13.32	56.5	6-Jul			25
ND 363-1	45	14.1	13.1	21.6	24.9	18.42	55.5	6-Jul			26
ND 61-107	36	13.9	18	14.9	20.7	16.87	58.5	5-Jul			25
Canthatch	10	17.6	17.2	20.5	27	20.57	57	7-Jul			28

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	1062.62	354.21	61.73
Treatments	14.	179.73	12.84	2.24
Error	42.	241.01	5.74	
Total	59.	1483.36		

Standard error of a treatment mean = 1.1977
Standard error of a difference among treatment means = 1.6939
The C.V. = 14.57 P.C.
The L.S.D. @ 5% is 3.40 bushels per acre

Table 2. Late Seeded Wheat Variety Trial.

Varitey or Treatment	Entry No.	Rep 1	Yield - Rep 2	Bushels Rep 3	per acre Rep 4	Average	Test weight	Heading date	Disease	Lodging %	Height inches
ND 363-1	45	18.4	23.1	25.9	24.9	23.08	58	9-Jul			28
Pembina	9	14.1	18.8	24.4	23.1	20.1	58	9-Jul			26
Valley	41	16.9	21.6	24.3	25.6	22.1	57	10-Jul			26
Canthatch	10	18.8	22	22.3	21.6	21.18	56	12-Jul			30
Crim	14	21.6	25.7	23.7	21.3	23.08	58	10-Jul			28
Manitou	34	17.3	27.2	23.5	25.6	23.4	55.5	11-Jul			26
Fortuna	54	17.3	23.4	21.2	25.1	21.75	59	10-Jul			29
Tobari 66		17.6	23.3	27.1	23.3	22.83	58	9-Jul			23
Selkirk	7	15	17.1	16.8	19	16.98	56	12-Jul			24
Thatcher	1	14.7	23.5	19.9	22.1	20.05	57	11-Jul			25
II-55-11	38	18.7	23.3	23.1	23.7	22.2	60	11-Jul			27
ND 61-107	36	19.9	18.5	22.1	25.6	21.53	57	10-Jul			26
Justin	8	12.8	20.5	20.9	25.1	19.83	56.5	13-Jul			26
Wisc. 255	39	16.8	22.1	20.8	22.4	20.53	58	12-Jul			27
Chris	15	14.3	21.3	19.5	19.9	18.75	57	12-Jul			28

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	364.84	121.61	31.96
Treatments	14.	181.74	12.98	3.41
Error	42.	159.81	3.80	
Total	59.	706.39		

Standard error of a treatment mean = .9753
Standard error of a difference among treatment means = 1.3793
The C.V. = 9.22 P.C.
The L.S.D. @ 5% is 2.78 bushels per acre

Table 3. Durum Variety Trials

Variety or Treatment	Entry No.	Rep 1	Yield - bushels per acre Rep 2	Rep 3	Rep 4	Average	Test weight	Heading date	Diseases	Lodging %	Height inches
Mindum	102	15.6	20.6	18	18.1	18.07	60	12-Jul			33
Wells	106	14.5	18.8	19.8	17.7	17.7	58	10-Jul			30
Stewart 63	101	18.5	19.5	22.9	23.8	21.17	61.5	12-Jul			34
Leeds	108	18.2	18.7	20	19	18.97	61.5	5-Jul			28
Sel. 61-73	113	21	21.3	24.6	22.3	22.3	60.5	6-Jul			28
63-51	126	21	18.2	22.2	20.5	20.47	59	5-Jul			29

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	30.88	10.29	4.36
Treatments	5.	66.64	13.33	5.64
Error	15.	35.45	2.36	
Total	23.	132.97		

Standard error of a treatment mean = .7688
Standard error of a difference among treatment means = 1.0870
The C.V. = 7.77 P.C.
The L.S.D.@ 5% if 2.32 bushels per acre.

Table 4. Late Seeded Durum Wheat Variety Trial.

Variety or Treatment	Entry No.	Rep 1	Yield- Rep 2	buschels Rep 3	per acre Rep 4	Average	Test weight	Heading date	Diseases	Lodging %	Height inches
Mindum	102	18	18.9	25.3	20.8	20.75	60				
Wells	106	17.2	17.3	26.6	18.5	19.9	63				
Stewart 63	101	19.6	20	26.1	19.9	21.4	60				
Leeds	108	16.8	22.2	24.5	19.3	20.7	63				
Exp. 62-73	113	17.9	22.3	22.2	18.9	20.33	62				
Exp. 63-51	126	17.7	19	29.2	20	21.48	62.5				

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	206.18	68.73	21.77
Treatments	5.	7.41	1.48	.47
Error	15.	47.36	3.16	
Total	23.	260.96		

Standard error of a treatment mean = .8885
Standard error of a difference among treatment means = 1.2565
The C.V. = 8.56 P.C.
The L.S.D. @ 5% is 2.68 bushels per acre

Table 5. Oat Variety Trials.

Variety or Treatment	Entry No.	Yields - bushels per acre Rep 1	Rep 2	Rep 3	Rep 4	Average	Test weight	Heading date	Diseases	Lodging %	Height inches
Burnett	3	31.2	41.7	42.5	38.5	38.47	34.5	5-Jul			26
Russell	5	29.7	38.8	38.6	35.7	35.7	33.5	10-Jul			25
Minton	6	31.4	38.2	39.4	36.3	36.32	35	10-Jul			23
Garry	9	31.2	36.9	35.1	34.4	34.4	34	11-Jul			28
Rodney	10	35.1	38.8	32.2	35.4	35.37	34	11-Jul			25
Ortley	13	42.1	38.8	40.8	40.6	40.57	33.5	12-Jul			27
Lodi	14	42.9	40.6	42.7	42.1	42.07	35	11-Jul			28
Wyndmere	21	42.1	38.2	38.4	39.6	39.57	35	30-Jun			26
Brave	27	38.4	24.5	33.2	32	32.02	33	2-Jul			26
Dawn	28	37.3	36.3	37.8	37.1	37.12	33	30-Jun			29
Harmon	30	35.7	35.5	39.8	37	37	34	12-Jul			28
Orbit	31	45.4	34.9	44.1	41.5	41.47	31.5	12-Jul			22
Tyler	32	38.2	43.9	30.1	37.4	37.4	33	1-Jul			22
Kelsey	33	47.4	43.9	46.6	46	45.97	33.5	9-Jul			27
Sioux	34	55.1	45.4	56.1	52.2	52.2	33	11-Jul			25
Portal	35	39.4	27.9	32.6	33.3	33.3	35.5	5-Jul			27
Holden	36	52.4	38.8	54.1	48.4	48.42	35.5	5-Jul			25

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	54.54	18.18	1.19
Treatments	16.	1891.20	118.20	7.76
Error	48.	730.93	15.23	
Total	67.	2676.67		

Standard error of a treatment mean = 1.9511
Standard error of a difference among treatment means = 2.7593
The C.V. = 9.94 P.C.
The L.S.D. @ 5% is 5.55 bushels per acre

Table 6. Barley Variety Trials.

Variety or Treatment	Entry No.	Rep 1	Yield - bushesls per acre Rep 2	Rep 3	Rep 4	Average	Test weight	Heading date	Diseases	Lodging %	Height inches
Traill	3	29.6	34	28.3	27.5	29.85	43.5	12-Jul			21
Trophy	5	29.7	28.3	32	23.9	28.47	41.5	10-Jul			20
Larker	6	23	34.8	32.3	26.1	29.05	44	10-Jul			19
Dickson	15	28.9	33.3	27.5	28.3	29.5	44	10-Jul			19
Conquest	33	34.4	42.1	37.1	35.3	37.22	43.5	8-Jul			22
Keystone	9	30	42.9	35.8	31.4	35.02	40.5	12-Jul			21
Yukon	18	34	38.2	30	32.7	33.72	42.5	12-Jul			23
B129	30	26.8	38.1	30.3	30.4	31.4	43.5	12-Jul			19
B130	31	34.1	38	32.2	29	33.32	40.5	12-Jul			19
Primus	58	33.4	42.9	30.3	29.7	34.07	46	4-Jul			20
Tregal	7	35.9	39.7	35.3	35.6	36.62	42.5	12-Jul			19
Unitan	11	23.7	38.9	34.1	25.6	30.57	41.5	12-Jul			21
Hypana	35	33.3	32.6	30.5	28.2	31.15	43.5	13-Jul			22
Galt	36	36.6	41.3	31.6	33	35.62	39.5	13-Jul			19
Jubilee	10	30.9	35.2	27.5	25.4	29.75	40	15-Jul			20
Betzes	12	41.8	37.8	32.3	28.7	35.15	43	13-Jul			22

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	554.92	184.97	20.66
Treatments	15.	50.230	33.49	3.74
Error	45.	402.87	8.95	
Total	63.	1460.10		

Standard error of a treatment mean = 1.4961
Standard error of a difference among treatment means = 2.1157
The C.V. = 9.20 P.C.
The L.S.D. @ 5% is 4.26 bushels per acre

Table 7. Winter Rye Variety Trial.

Variety or Treatment	Entry No.	Rep 1	Yield - bushels per acre Rep 2	Rep 3	Rep 4	Average	Test weight	Heading date	Diseases	Lodging %	Height inches
Von Lochow	1	56.4	53	52.2	44.6	51.55	55	28-Jun			47
Frontier	2	45.5	48.8	45.5	38.7	44.62	57	28-Jun			49
Antelope	3	43.8	41.2	37	30.3	38.07	54.5	28-Jun			48
Cariboue	4	35.4	36.2	33.7	30.3	33.9	55.5	28-Jun			48

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	219.48	73.16	19.58
Treatments	3.	716.41	238.80	63.92
Error	9.	33.62	3.74	
Total	15.	969.52		

Standard error of a treatment mean = .9664
Standard error of a difference among treatment means = 1.3667
The C.V. = 4.60 P.C.
The L.S.D. @ 5% is 3.09 bushels per acre

Table 8. Winter Wheat Variety Trial #1.

Variety or	Entry		Yield -	Bushels	per acre		Test	Heading	Diseases	Lodging	Height
Treatment	No.	Rep 1	Rep 2	Rep 3	Rep 4	Average	weight	date		%	inches
Hume	1	25.1	33.7	35	39.6	33.35	59	26-Jun			35
Lancer	2	32.3	37	35	30.4	33.68	61.5	27-Jun			32
Cheyenne	3	31	35.6	39.6	37	35.8	58	29-Jun			34
Minter	4	36.3	35.6	39.6	40.3	37.95	60	29-Jun			39

Seeded September 9, 1966 on Summerfallow. Harvested August 1, 1967.
Land tilled with the rod-weeder prior to seeding.

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	93.31	31.10	2.87
Treatments	3.	54.68	18.23	1.68
Error	9.	97.54	10.84	
Total	15.	245.53		

Standard error of a treatment mean = 1.6460
Standard error of a difference among treatment means = 2.3279
The C.V. = 9.35 P.C.
The L.S.D. @ 5% is 5.27 bushels per acre.

Table 9. Winter Wheat Variety Trial #2

Variety or Treatment	Entry No.	Yield - bushels per acre Rep 1	Rep 2	Rep 3	Rep 4	Average	Test weight	Heading date	Diseases	Lodging %	Height inches
Hume	1	38.9	42.2	37	43.6	40.43	59	26-Jun			35
Lancer	2	39.6	39.6	33	35.6	36.95	61.5	27-Jun			32
Cheyenne	3	39.6	37.6	35.6	36.3	37.28	58	29-Jun			34
Minter	4	42.2	40.3	42.9	37	40.6	60	28-Jun			39

Seeded September 9, 1966 on Summerfallow. Harvested August 1, 1967.
Land tilled with the double disk prior to seeding.

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	24.61	8.20	1.15
Treatments	3.	46.51	15.50	2.17
Error	9.	64.32	7.15	
Total	15.	135.44		

Standard error of a treatment mean = 1.3366
Standard error of a difference among treatment means = 1.8903
The C.V. = 6.89 P.C.
The L.S.D. @ 5% id 4.28 bushels per acre

Nursery Trials With Small Grain

Small scale nursery trials with small grains are grown each year at the Dickinson Station. Two types of nurseries are grown, the Cooperative Regional nurseries and planting 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 one 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 breeding 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 see for quality tests.

Table 10. Uniform Great Plains Barley Nursery – 1967.

Entry No.	Description	C.I. or Sel.No.	Yield - Bushels per acre 1	2	3	Av.	Test weight	Date head	Date ripe	Height inches
1	Flynn 1	5911	34.5	33	29.3	32.3	46	1-Jul	29-Jul	20
2	Munsing	6009	40.1	30.5	40.3	37	47	1-Jul	31-Jul	21
3	Unitan	10421	40.5	46.8	46.5	44.6	45	1-Jul	2-Aug	23
4	Larker	10648	29.8	39	38	35.6	48	6-Jul	5-Aug	22
5	Leth. 5528-70	11773	40.5	49.3	45	44.9	49.5	1-Jul	3-Aug	22
6	Glacier x Mars	13101	27	34.3	40	33.8	45	30-Jun	31-Jul	18
7	C.C.CI 4116	4116	27.8	37	32	32.3	43	2-Jul	2-Aug	24
8	Betzer x Munsing	62Ab3786	30.5	49	29.3	36.3	49	7-Jul	8-Aug	23
9	Galt	11770	40.5	48.8	57	48.6	46	7-Jul	7-Aug	23
10	Primus	13109	37.5	38.5	38	38	47	1-Jul	31-Jul	24
11	S.D. 64-1709	13110	36.5	40.8	42	39.8	46	5-Jul	31-Jul	23
12	Piroline x Munsing	62Ab3722	28.3	24.8	29.8	27.6	44	1-Jul	28-Jul	21
13	Piroline x Vance Smyrna	63Ab1434	43.5	42	46.5	44	44	1-Jul	28-Jul	23
14	Firlecks III x Vance Smyrna	63Ab1405	38	37.3	33.5	36.3	49.5	1-Jul	27-Jul	24
15	Piroline x Breuns Volla	63Ab1417	42.5	45	44	43.8	48.5	1-Jul	27-Jul	24
16	Glacier x 7 Titan	Mt. 65x8914	49.5	49.5	44	47.7	49	1-Jul	25-Jul	25
17	Glacier x 7 Titan	MTt. 65x891(	41.3	52.5	48.3	47.4	48	1-Jul	25-Jul	25
18	Stamm x 7 Titan	Mt. 65x5795	43.3	45.3	36.8	41.8	47	1-Jul	24-Jul	26
19	Stamm x 7 Ttian	Mt. 65x5796	41	40	39.5	40.2	47	1-Jul	24-Jul	24
20	Titan	7055	52.3	49.5	43.5	48.4	45	1-Jul	29-Jul	24

Table 11. Peterson's Barley Nursery – 1967.

Entry		Yield – Bushels per acre				Test	Dates		Height
No.	Description	1	2	3	Av.	weight	head	ripe	inches
1	Trophy	39.0	22.5	38.3	33.3	45.0	7-10	8-7	21
2	Larket	38.3	48.3	37.6	41.4	49.0	7-6	8-4	22
3	Dickson	33.5	43.3	30.5	35.8	45.0	7-10	8-9	21
4	Conquest	41.5	45.1	36.0	40.9	46.0	7-6	8-7	25
5	B 129	53.8	44.0	54.8	50.9	48.5	7-5	8-8	24
6	B 129 RSF	43.5	39.3	46.8	43.2	48.0	7-10	8-9	23
7	B 129 rSf	34.0	38.0	50.8	40.9	46.0	7-10	8-9	23
8	B 130	64.0	50.0	54.3	56.1	47.0	7-9	8-4	23
9	B 130 RSF	48.5	42.0	42.5	44.3	46.0	7-5	8-7	23
10	B 133	35.5	44.0	51.3	43.6	46.0	7-10	8-9	24
11	B 134	48.0	40.1	41.0	43.0	48.5	7-8	8-5	23
12	B 135	48.5	31.3	43.5	41.1	44.5	7-10	8-9	23
13	B 136	42.0	44.3	37.0	41.1	47.5	7-5	8-8	23
14	B 137	36.5	40.0	53.8	43.4	48.0	7-2	8-2	22
15	B 138	37.6	49.5	42.8	43.3	49.0	7-5	8-5	23
16	Br. 7440-1-1	48.3	44.0	48.5	46.9	46.0	7-9	8-3	23
17	Primus	32.0	36.0	33.3	33.8	48.5	6-29	8-1	24
18	M 4	40.0	36.8	29.5	35.4	44.5	7-12	8-4	24
19	Wpg 62-528	32.5	32.5	45.0	36.7	45.0	7-2	7-29	25
20	Wpg 62-532	38.3	35.8	48.8	41.0	45.5	7-2	7-29	25

Table 12. Uniform Regional Flax Nursery 1967.

Entry No.	Description	C.I. No.	Yields – bushels per acre 1	2	3	Av.	Test weight	Days from sowing	Height inches
1	Bison	389	10.0	8.4	5.6	8.0	53.5	49	16
2	Redwood	1130	6.4	10.4	6.8	7.9	51.9	49	16
3	Bolley	1478	7.2	10.8	6.4	8.1	52.4	45	16
4	Windom	1823	8.4	6.8	8.4	7.9	54.6	44	18
5	Summit	1914	10.0	10.0	9.6	9.9	54.6	44	13
6	Rwd. Birio	2444	7.6	12.8	7.6	9.3	54.6	44	14
7	Rwd. X Mar. 79	2445	8.4	8.8	6.0	7.7	53.0	47	16
8	Rwd. X Mar. 79	2446	6.0	6.8	6.8	6.5	51.9	44	17
9	Rwd. X Valuta-Raja	2480	8.0	5.2	8.4	7.2	52.4	49	19
10	Bison $L^6M^3N^1$	2481	9.6	8.4	6.0	8.0	54.1	47	17
11	1085 x Rwd.	2482	8.8	8.8	5.2	7.6	55.2	49	15
12	1082 x Bolley	2483	5.2	6.8	4.4	5.5	51.9	45	15
13	Linnot	2522	9.6	10.0	5.2	8.3	54.1	45	16
14	1605 x Minerva	2523	4.4	7.6	4.8	5.6	54.6	47	16

Table 13. Uniform Midseason Oat Performance Nursery Experiment 90 – 1967.

Entry No.	Description	C.I. No.	Yield – Bushels per acre 1	2	3	Av.	Test weight	Head ripe	Height inches
1	I11. 30840	7971	47.6	50.4	57.6	51.9	37.5	7-6	26
2	Iowa M68		69.2	61.6	45.6	58.8	35.0	7-6	28
3	Mass. C-2-1-60		76.4	74.8	82.8	78.0	33.0	7-11	34
4	Minn II-31-21	4170	85.6	66.0	59.6	70.4	34.5	7-10	32
5	Minn II-54-106	8304	100.8	81.6	67.2	83.2	33.5	7-10	27
6	Minn. II-54-120	8305	74.5	72.0	57.6	68.0	35.0	7-10	28
7	Minn. 674	2027	74.0	72.8	60.8	69.2	33.5	7-12	29
8	Mo. 04205	4988	83.6	53.2	53.6	63.4	33.5	7-9	31
9	N.Y. 5427alB-3B-70	7811	82.4	74.4	65.6	74.1	29.5	7-13	26
10	N.D. 0-64-11	8048	83.6	72.8	68.8	75.1	31.0	7-12	34
11	N.D. 0-64-17	8151	58.4	70.4	56.4	61.7	34.0	7-5	30
12	Purdue 5328A3-4P-2	7463	60.0	58.4	54.4	57.6	39.0	7-7	28
13	Purdue 5842A4-14-3	8152	70.8	56.0	56.8	61.2	34.5	7-13	30
14	Purdue 5877	7639	59.2	62.4	68.0	63.2	36.0	7-7	31
15	Purdue 6316A0-2-1		53.6	52.8	45.6	50.7	34.0	7-11	24
16	Purdue 6316A2-3		45.2	44.0	46.0	45.1	34.5	7-11	24
17	Purdue 6316A2-4		43.2	36.8	50.8	43.6	33.5	7-11	24
18	Purdue 6316A2-6		44.4	43.6	47.2	45.1	34.5	7-11	26
19	Purdue 6316A2-10		60.0	58.8	50.0	56.3	34.5	7-11	25
20	S.D. RROII-B-60-2-149	8178	63.2	85.2	57.2	68.5	35.0	7-11	32
21	Wisc. X643-41	7453	65.6	66.0	57.6	63.1	36.0	7-10	29
22	Wisc. X64375	7978	66.8	66.4	49.2	60.8	36.0	7-10	31
23	Wisc. X697-2	7561	73.6	60.8	73.6	69.3	29.5	7-13	34
24	Wisc. X957-2	8040	59.2	78.0	60.4	65.9	35.0	7-11	30
25	Wisc. X1144-3		63.6	68.0	71.6	67.7	31.0	7-11	28
26	Wisc. X1137-2		68.4	63.6	56.8	62.9	36.5	7-10	28

Table 14. Experiment 92 Oats – 1967.

Entry No.	Description	Yield – Bushels per acre 1	2	3	Av.	Test weight	Head ripe	Height inches
1	Dawn	67.6	73.6	92.8	78.0	35.0	7-8	32
2	Brave	68.0	69.6	63.2	66.9	37.0	7-9	29
3	Wyndmere	45.6	62.4	62.4	56.8	34.5	7-9	30
4	Burnett	69.6	76.8	72.4	72.9	35.0	7-11	30
5	Tyler	68.0	69.2	84.0	73.7	35.5	7-11	27
6	Tippecanoe	63.2	38.8	72.8	58.3	37.5	7-10	28
7	Clintland 64	82.4	65.6	66.8	71.6	35.5	7-11	30
8	C.I 7784	106.4	79.2	84.0	89.9	33.0	7-12	33
9	Russell	91.6	76.4	61.6	76.5	32.0	7-14	32
10	Ajax	71.2	76.8	72.4	73.5	31.5	7-13	29
11	Minhafer	67.6	49.2	48.8	55.2	34.0	7-9	30
12	Gopher	78.4	60.4	56.8	65.2	33.0	7-12	30
13	Minton	72.0	68.8	58.4	66.4	34.5	7-13	31
14	Orbit	84.0	66.4	59.6	70.0	31.0	7-13	28
15	Lodi	96.0	60.8	60.8	72.5	32.0	7-15	34
16	Portal	76.8	54.4	46.8	59.3	35.0	7-11	32
17	C.I. 8048	82.4	76.4	72.0	76.9	30.0	7-12	31
18	C.I. 7814	75.2	71.6	70.4	72.4	35.5	7-11	30
19	C.I. 8151	69.6	56.0	57.2	60.9	35.0	7-8	31
20	Rodney	69.2	56.0	66.4	63.9	33.0	7-14	30
21	C.I. 8178	68.4	74.0	66.0	69.5	34.0	7-13	30
22	Holden	65.6	64.0	73.6	67.7	35.0	7-11	32
23	Storemont	60.8	75.2	66.8	67.6	32.0	7-12	30
24	C.I. 7670	46.4	58.8	84.8	63.3	35.0	7-14	30
25	Kelsey	62.8	60.8	64.4	62.7	33.0	7-14	28
26	Sioux	60.0	68.0	79.2	69.1	32.5	7-14	24
27	Harmon	61.2	62.0	78.4	67.2	33.0	7-14	30
28	Ortley	64.0	90.8	100.4	85.1	33.5	7-14	31
29	Minhafer x Mo. 0-205	60.0	60.4	72.4	64.3	32.5	7-14	27
30	Garry	67.6	70.8	52.0	63.5	30.0	7-10	29
31	C.I. 8151	44.4	59.2	71.2	58.3	33.5	7-12	25
32	C.I. 8151	56.8	64.4	58.4	59.9	34.5	7-9	25
33	C.I. 8151	42.8	54.0	63.2	53.3	32.0	7-14	25

Table 15. Uniform Regional Spring Wheat – 1967.

Entry No.	Description	Yield – Bushels per acre 1	2	3	Av.	Test weight	Dates head	ripe	Height inches
1	C.I. 3641	21.0	22.6	26.8	23.5	57.4	7-8	8-12	27
2	C.I. 10003	21.8	23.6	32.6	26.0	60.7	7-8	8-10	26
3	C.I. 13100	26.8	19.2	24.4	23.5	57.5	7-8	8-10	29
4	C.I. 13462	15.0	18.0	22.8	18.6	60.5	7-9	8.13	30
5	C.I 13751	18.2	20.0	25.2	21.1	58.8	7-8	8-10	27
6	C.I. 13775	22.0	22.6	29.4	24.7	59.0	7-8	8-11	26
7	C.I. 13773	19.0	24.8	23.4	22.4	62.5	7-9	8-13	26
8	II-55-16	19.6	26.8	29.0	23.3	60.0	7-10	8-14	26
9	II-56-40	22.2	26.0	28.8	25.7	60.5	7-9	8-11	30
10	II-59-91	22.4	24.8	27.8	25.0	59.0	7-9	8-12	29
11	C.I. 13937	17.2	22.8	29.2	23.1	59.0	7-8	8-10	26
12	Wisc. 261	18.4	23.6	20.8	20.9	55.8	7-6	8-5	23
13	Wisc. 270	23.8	28.0	27.2	26.3	56.5	7-1	8-4	24
14	Wisc. 271	27.6	21.6	27.0	25.4	57.4	7-2	8-5	24
15	RL4200	24.2	14.0	26.0	21.4	57.4	7-3	8-5	30
16	N.D. 363-1	21.4	19.8	26.0	22.4	57.7	7-3	8-5	30
17	N.D. 478	18.2	14.0	18.6	16.9	57.8	7-6	8-7	31
18	N.D. 479	22.1	21.6	20.8	21.5	59.5	7-9	8-10	29
19	WS-J	23.8	20.8	21.4	22.0	60.0	6-30	8-4	26

Table 16. Advanced Station Spring Wheat Nursery – 1967.

Entry No.	Description	Average yield	Test weight
1	Conley x ND 45	20.2	58.8
2	Conley x ND 45	22.4	56.7
3	Conley x ND 45	20.2	56.7
4	Conley x ND 45	23.8	55.7
5	RL 2937 x ND 45	16.0	57.1
6	RL 2937 x ND 45	20.4	57.4
7	RL 2937 x ND 45	24.2	59.2
8	RL 2937 x ND 45	17.0	59.2
9	ND 49 x (Pilot Premier-II-44-22)	22.4	55.8
10	ND 49 x (Pilot Premier-II- 44-22)	27.4	56.7
11	ND 49 x (Pilot Premier-II-44-22)	17.0	56.0
12	Crim	16.4	56.4
13	Justin	14.2	56.0
14	Chris	14.6	56.4

Table 17. F-6 Hard Spring Wheat Nursery – 1967.

Entry No.	Description	1967 row no.	Average yield	Test weight
1	N.D. 152	1	18.2	54.7
2	Dix 0.97	2	17.8	59.6
3	N.D. 152 x Dix 0.97	3	18.6	58.9
4	N.D. 152 x Dix 0.97	4	18.8	58.1
5	N.D. 42-3-1-5 x Dix 0.97	13	23.8	57.5
6	Conley x 0.97	16	26.8	56.5
7	N.D. 137-2	31	23.2	58.0
8	N.D. 137-2 x Dix 0.97	35	23.6	55.5
9	N.D. 137-2 x Dix 0.97	36	15.8	56.6
10	Dix 0.97 x Justin	43	23.0	54.5
11	Dix 0.97 x Justin	44	24.0	55.5
12	Dix 0.97 x Justin	46	19.0	55.1
13	Justin x Dix 0.97	55	27.8	55.0
14	Justin x Dix 0.97	62	24.2	56.5
15	Pi Prem-II-44-22x N.D. 102	67	22.4	57.5
16	N.D. 102 x Pi Prem-II-44-22	71	32.4	58.0
17	N.D. 102 x Pi Prem-II-44-22	74	25.8	56.5
18	Pi Prem-II-44-22 x II-53-541	78	22.6	57.0
19	Pi Prem-II-44-22 x II-53-541	83	20.8	54.0
20	II-53-541 x Pi Prem-II-44-22	86	26.4	56.5
21	Pi Prem-II-44-22 x N.D. 102 Sib	94	23.2	56.5
22	Pi Prem-II-44-22 x N.D. 102 Sib	96	20.8	59.3
23	Pi Prem-II-44-22 x N.D. 102 Sib	100	23.4	55.5
24	1552-Mida-H44-1018-Merc x N.D. Sib	114	14.4	55.1
25	1552-Mida-H44-1018-Merc x II-53-541	123	13.8	57.4
26	1552-Mida-H44-1018-Merc x II-53-541	128	20.8	53.5
27	(2083-2247) x N.D. 102 Sib	137	26.8	57.5
28	(2083-2247) x N.D. 102 Sib	141	26.0	58.0
29	(2083-2247) x II-53-541	151	30.0	58.0
30	II-53-541 x (2083-2247)	159	19.6	59.6

Table 18. Uniform Regional Winter Wheat – 1967.

Entry No.	Description	C.I. or Sel. No.	Yield-Bushels per acre 1	2	3	Av.	Test weight	Dates head	ripe	Height inches
1	Kharkof	1442	32.5	34.8	29.0	32.1	63.0	6-29	7-31	36
2	Warrior	13190	27.7	35.5	34.0	32.4	64.5	6-29	7-31	32
3	Winalta	13670	32.3	33.0	30.0	31.8	64.5	6-29	7-30	39
4	Wrr x Sk-Cnn^2	NB64322	28.3	35.3	24.8	29.5	63.0	6-29	7-30	37
5	Wrr x Sk-Cnn^2	NB64323	38.2	40.4	44.5	41.0	63.5	6-29	7-30	39
6	Minn III-54-12 X Cnn)	NB61355	33.1	33.0	30.8	32.3	62.5	6-29	7-30	35
7	S.Dak.Sel.	SD56-497	27.6	31.2	35.2	31.3	62.5	6-29	7-31	37
8	S.Dak.Sel.	SD56-758	34.8	39.2	35.5	36.5	64.0	7-2	8-1	39
9*	Winalta Resel.	--	37.9	29.5	44.5	37.3	64.5	6-29	7-30	38
10	Selkirk x Cheyenne^2	NB64365	33.0	31.4	42.0	35.5	63.5	6-29	7-31	37
11*	Selkirk x Cheyenne^2	NB64334	30.0	31.0	37.7	32.9	64.0	7-3	8-2	38
12*	Selkirk x Cheyenne^3	NB64312	31.3	35.4	32.3	33.0	63.5	7-3	8-3	38
13*	BWH 1904-7	MT639	28.4	29.0	35.5	31.0	62.0	7-3	8-3	39
14	H44-Minturki^2 x Minter	13858	27.1	35.8	34.6	32.5	63.5	7-3	8-4	39
15	Mtr-M2825x H255-Bkk	13994	23.8	28.7	36.0	29.5	62.0	7-3	8-4	38
16	II-36-3 x III-51-31	13995	32.5	32.2	34.7	33.1	60.5	6-29	7-31	39

*New entry in 1967.

Trials with Fertilizer

Trace element fertilizer trial – 1967

A Premium fertilizer with secondary and trace elements was compared with a standard commercial fertilizer in a special trial on wheat in 1967.

The formulation on the Premium fertilizer was 8-34-12 with secondary and trace elements as follows: Ca, 7%; S, 2%; Zn, 0.5%; Mg, 0.5%; Fe, 0.10%; Mn, 0.10%; Cv, 0.05%; B, 0.02%; and Mo, 0.0005%.

Formulation of the standard commercial product was 11-48-0.

Rate of application of the Premium fertilizer was 100 lbs. per acre and for the standard fertilizer 75 lbs. per acre.

Application was made on wheat with a drill row attachment at planting time. Seeding were on summerfallow.

Analysis of these data, presented in table 19, shows no significant difference in yield for either treatment.

Table 19. Trace Element Fertilizer Trial – 1967.

	Yields – Bushels per acre					
Treatment	1	2	3	4	5	Av.
Check	16.1	21.0	22.1	16.5	21.7	19.5
Cenex Premium 8-34-12 with secondary and trace elements	19.6	22.1	24.5	21.7	21.7	21.9
Armour 11-48-0	19.6	22.4	24.5	16.5	23.1	21.2

Analysis of Variance Summary

Source	DF	Sums of Squares	Mean Square	F Value
Total	14	103.3	7.37	
Replication	4	70.6	17.65	8.37
Treatment	2	15.8	7.90	3.74
Error	8	16.9	2.111	

F value needed for significance @5% level =4.46

Fertilizer Formulations, Rated Of Application And Methods Of Treatment On Summerfallow

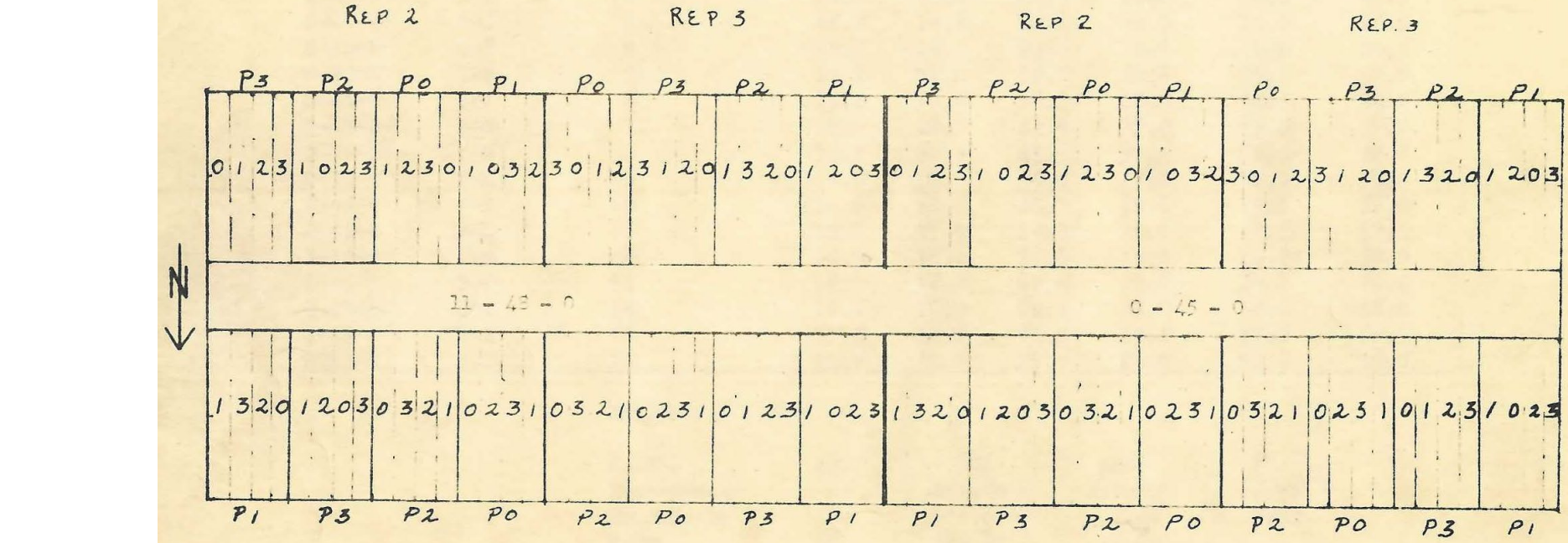
In this trial, broadcast applications, drill row applications and a combination of broadcast and drill row applications are compared, using three different rates for each application method. Table 20 shows the planting plan used, and also includes the formulations used and the key to rates used for both broadcast and drill row applications.

Table 21 and table 22 summarize the yield data for 1967.

Highest yields were produced in the trial where the 11-48-0 formulation was used, with the 60 pound per acre rate proving to be the best application rate. Considerably higher rates of application failed to produce higher yields.

The difference in yield between the 0-45-0 and 11-48-0 trials is also noteworthy, with the formulation containing nitrogen producing appreciably better then the straight phosphate formulation.

Table 20 Planting plan, formulations, and key to rates used in the trial comparing fertilizer formulations, rates of application and methods of treatment on summerfallow, 1967.



Broadcast treatments, incorporated with the disk

P_0	-	0 pounds	0-46-0	11-48-0
P_1	-	66 "	"	"
P_2	-	132 "	"	"
P_3	-	264 "	"	"

Drill row application

0	-	0 pounds	0-46-0	11-48-0
1	-	33 "	"	"
2	-	66 "	"	"
3	-	132 "	"	"

Table 21. Fertilizer Formulations, Rates of Application and Methods of Treatment on Summerfallow.

Variety or Treatment		Entry No.	Yield – Bushels per acre					Test weight
			Rep1	Rep2	Rep3	Rep4	Av.	
Fertilizer treatment								
0-45-0	0-0	1	14.6	17.5	22.8	19.0	18.5	56.5
0-45-0	0-1	2	19.0	18.4	21.9	22.8	20.5	57.0
0-45-0	0-2	3	15.8	16.9	21.6	19.0	18.3	55.0
0-45-0	0-3	4	15.2	18.1	22.8	19.8	19.0	56.0
0-45-0	1-0	5	15.2	21.0	25.7	18.4	20.1	57.0
0-45-0	1-1	6	15.2	19.8	24.5	22.2	20.4	58.0
0-45-0	1-2	7	16.9	22.2	24.5	21.0	21.2	57.0
0-45-0	1-3	8	16.3	22.2	25.1	31.5	23.8	57.0
0-45-0	2-0	9	14.6	19.3	26.0	17.5	19.4	58.0
0-45-0	2-1	10	14.6	19.0	25.7	19.0	19.6	57.0
0-45-0	2-2	11	15.2	21.0	26.3	21.6	18.5	57.0
0-45-0	2-3	12	16.9	18.1	25.1	19.8	20.0	57.0
0-45-0	3-0	13	16.9	18.4	21.9	23.6	20.2	58.0
0-45-0	3-1	14	16.3	19.8	15.2	23.9	18.8	56.0
0-45-0	3-2	15	15.8	19.3	15.2	24.5	18.7	57.0
0-45-0	3-3	16	16.9	18.7	21.6	24.5	20.4	57.0

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	395.50	131.83	18.15
Treatments	15.	111.53	7.44	1.02
Error	45.	326.82	7.26	
Total	63.	833.85		

Standard error of a treatment mean = 1.3475
Standard error of a difference among treatment means = 1.9056
The C.V. = 13.59 P.C.
The L.S.D. @ 5% is 3.84 bushels per acre.

Table 22. Fertilizer Formulations, Rates of Application and Methods of Treatment on Summerfallow.

Variety or Treatment		Entry No.	Yield – Bushels per acre					Test weight
			Rep1	Rep2	Rep3	Rep4	Av.	
Fertilizer treatment								
11-48-0	0-0	1	16.9	27.4	10.2	14.9	17.4	53.0
11-48-0	0-1	2	15.5	30.6	18.4	14.3	19.7	52.0
11-48-0	0-2	3	19.0	31.2	28.0	15.2	23.4	53.0
11-48-0	0-3	4	16.9	30.0	28.3	14.9	22.5	54.0
11-48-0	1-0	5	28.0	28.9	18.1	16.3	22.8	52.0
11-48-0	1-1	6	27.4	27.4	29.8	14.9	24.9	51.0
11-48-0	1-2	7	27.1	29.5	30.9	26.8	28.6	50.0
11-48-0	1-3	8	25.1	29.2	25.1	17.2	24.2	52.0
11-48-0	2-0	9	23.9	29.8	29.5	31.8	28.8	51.0
11-48-0	2-1	10	20.1	33.5	30.6	16.0	25.1	53.0
11-48-0	2-2	11	20.4	33.0	30.9	16.9	25.3	52.0
11-48-0	2-3	12	22.8	32.7	29.2	12.3	24.3	52.0
11-48-0	3-0	13	26.0	26.3	29.2	14.3	24.0	52.0
11-48-0	3-1	14	27.4	30.9	30.3	19.0	26.9	52.0
11-48-0	3-2	15	29.8	32.7	29.5	14.3	26.6	52.0
11-48-0	3-3	16	31.5	34.4	28.0	16.0	27.5	53.0

Analysis of Variance

Source	DF	SS	MS	F
Replication	3.	1508.93	502.98	27.96
Treatments	15.	549.34	36.32	2.04
Errors	45	809.61	17.99	
Total	63.	2867.88		

Standard error of a treatment mean = 2.1208
Standard error of a difference among treatment means=2.9993
The C.V. = 17.33 P.C.
The L.S.D. @5% is 6.04 bushels per acre

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 1967 trial are given in table 23. Table 24 summarizes yields form this trial for the period 1959-1967.

Corn yields in this trial are of interest also because of the possible effect of residual fertilizer on the corn planted on the wheat stubble land the year after the fertilizer was applied to the wheat. Both silage yields and shelled corn yields are summarized in table 25.

Table 23. Yields form Continuous Cropping, Cornland and Fallow, Fertilized and Unfertilized – 1967.

	Yields – Bushels per acre			
Treatment	1	2	3	Av.
Continuous Cropping	21.1	14.0	11.2	15.4
Continuous cropping – Fertilized	17.1	11.6	13.2	14.0
Cornland	18.9	18.6	14.2	17.2
Cornland – Fertilized	22.3	25.0	17.0	21.4
Summerfallow	27.3	26.2	23.8	25.8
Summerfallow – Fertilized	23.5	22.1	25.1	23.6

Table 24. Summary of Wheat Yields on Continuous Cropping, Cornland and Fallow, Fertilized and Unfertilized, for the period 1959-1967.

	Yields in bushels per acre										
Treatment	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	Av.
Spring plowed Continuous Cropping	6.7	10.8	4.8	--	17.8	8.6	17.3	--	15.4	11.6	11.6
Spring plowed Continuous Cropping, fertilized	8.1	12.5	3.9	--	19.4	10.7	22.3	--	14.0	10.0	12.6
Summerfallow	11.1	15.3	6.2	--	28.1	13.0	31.4	--	25.8	22.8	19.2
Summerfallow, Fertilized	12.9	22.0	8.1	--	33.8	16.1	34.0	--	23.6	33.6	23.0
Disked Cornland	7.3	10.6	0.0	--	18.7	10.6	24.6	--	17.2	20.7	13.7
Disked Cornland, Fertilized	8.6	13.6	0.0	--	25.7	11.8	31.4	--	21.4	24.5	17.1

Crop destroyed by hail in 1962 and 1966.

Table 25. Yields of Corn Silage and Shelled Corn on Fertilized and Unfertilized Wheat Stubble Land in 1967.

Treatment	Average Silage yield tons/acre	Average grain yield bushels/acre
Corn planted on wheat stubble land, Fertilized the previous year.	5.11	29.8
Corn planted on wheat stubble land, Unfertilized.	4.78	30.4

Test weights of shelled corn for both treatments was 52.0 pounds per bushel.

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 1967.

A summary of the two trials conducted from 1963-1965 is found in the annual report of the Dickinson Station for 1965. Data from the trials continued in 1967 are summarized in table 26. There are no yields from this trial for 1966 because the crop was destroyed by a severe hailstorm in July of that year.

Table 26. A Comparison of Yields of Spring Wheat Seeded on Summerfallow with the Hoe Drill and with the Press Drill.

	Yield in bushels per acre						
Drill used	1963	1964	1965	1966	1967	1968	Average
Hoe drill With 10 inch spacing	18.3	15.6	38.5	--	18.1	21.0	22.3
Double disk press drill With 6 inch spacing	25.3	24.7	41.3	--	19.7	34.9	29.2

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 1967 yields, and the average yields for the first 55 years of the trial are summarized in the following table.

Table 27. Crop Yields in the Continuous Cropping Trial.

	Spring plowed		Fall plowed		Summerfallow	
Crop	1967	55 Yr. Av.	1967	55 Yr. Av.	1967	55 Yr. Av.
			Grain yields in bushels per acre			
Wheat	11.5	11.2	11.9	10.2	29.4	18.5
Oats	23.6	25.7	26.5	23.4	36.8	43.1
Barley	10.8	16.7	8.8	15.3	28.5	23.7
Corn	29.2	18.9	31.6	18.7	29.7	22.5
			Silage yields in tons per acre @ 70% moisture			
Corn	4.32	3.14	5.60	3.05	4.10	3.63

A Comparison Of The Moldboard Plow And The Roto Tiller When Used As Spring Tillage Implements For The Production Of Corn And Wheat In A Two Year Rotation

This trial compares the production of corn and wheat in a two year rotation planted following spring tillage with the roto tiller, and production of corn and wheat planted following spring tillage with the moldboard plow. Yields for the four year period 1964-1967 are summarized in table 28. While yield differences are small, and probably not significant, the plow maintains a slight advantage in both the production of wheat on cornland, and the production of corn on wheat stubble land.

Table 28. Yields of Wheat and Corn on Roto Tilled Land and on Spring Plowed Land.

	Yield (see below)				
Treatment	1964	1965	1966	1967	Average
Wheat on roto tilled cornland	7.9	22.3	--	16.8	15.7
Wheat on spring plowed cornland	8.2	24.9	--	17.2	16.8
Corn on roto tilled stubbleland	5.2	5.6	--	3.2	4.7
Corn on spring plowed stubbleland	4.4	6.4	--	4.8	5.2

Yield of wheat in bushels per acre. Yield on silage in tons per acre at 70% moisture. Crop destroyed by hail in 1966.

A Comparison Of The Roto Tiller And The Moldboard Plow Duckfoot Cultivator Combination For The Maintenance Of Summerfallow

The roto tiller and the moldboard plow have also been used in this trial which compares them as summerfallowing implements. There was no difference in the yield of wheat following either treatment, with the actual average yields being 18.7 bushels per acre on the plowed fallow and 19.1 bushels per acre on the roto tilled fallow. The roto tilled fallow required two more cultivations than was needed for the plowed fallow to maintain it in a satisfactory condition.

Comparison of Silage Production from Corn, Forage Sorghum and Sudan Grass when Grown in a Two Year Rotation with Wheat

Corn has been a most dependable producer over the years in western North Dakota, and has produced more feed per acre than any other silage crop tried. The following table shows the relative production of corn as compared to forage sorghum and sudan grass, in Dickinson Experiment Station trials since 1960.

Table 29. Comparison of the Production of Forage Sorghum, Sudan Grass and Corn when Grown in a Two Year Rotation with Wheat.

	Silage yield in tons per acre at 70% moisture								
Crop	1960	1961	1962	1963	1964	1965	1966	1967	Average
Corn	2.0	4.3	6.0	5.3	4.4	6.4	--	4.8	4.7
Forage sorghum	2.5	1.5	4.5	2.0	3.1	4.5	--	3.2	3.0
Sudan grass	2.4	.6	3.2	3.2	1.3	4.5	--	3.1	2.6

Table 30. Yield Trial of Several Varieties of Corn, Sorghum and Sudan Grass, and Sorghum and Sudan Grass Hybrids – 1967.

	Dry-weight yields-lbs./acre	
Variety		Average Yield
Piper sudan	(7)	2240
NK-78 corn	(2)	2678
HS-50 corn	(1)	2871
NK-145 (sudan grass cross)	(6)	2283
Pioneer 936 (sorghum hybrid)	(4)	2523
DeKalb SX-11	(3)	2536
SoKota 250 corn	(8)	2108
Trudan I (hybrid sudan grass)	(5)	2465

Sorghum Management Trial – 1967

Yields in the sorghum management trial conducted in 1967 where the crop was cut at different heights, and at two dates of cutting, at summarized in the following table.

Table 31. Sorghum Management Trial – 1967.

Variety	Cutting height	Dry weight yields – lbs./acr August 1 cutting	September 6 cutting	Total-yield
	2”	693	1472	2165
Sweet	6”	539	1459	2098
Sioux	10”	125	1403	1528
(maturity)	2’	-	3450	3450
	2”	607	2170	2777
DeKalb	6”	265	2288	2553
SX-11	10”	128	2321	2449
(maturity)	2’	-	3450	3450

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

Table 32. Rate of Seeding Trial with Sorghum – 1967.

Rate of Planting – lbs./acre – seed	Dry – weight yields – lbs./acre Average yield
2	1022
4	1809
6	2725
9	2274
12	2441
15	2801
18	2477
21	3171

Production Of Grain Sorghum At The Dickinson Experiment Station

Grain sorghum has been included in the trials at the Dickinson Station for many years, but has not been very successful because the varieties presently available require a growing season that is longer than what is normal for this area. In 1967, grain sorghum produced an average yield of 13.6 bushels per acre. The test weight of this grain was 33.8 pounds per bushel, and reflects the fact that the crop was killed by frost before it was fully mature.

A grain sorghum variety that would be a high producer, and early enough to mature in a short growing season would be a valuable crop for this area, and plans are to continue the search for an early grain sorghum.

Uniform Corn Production Trial – 1967

There is a demand for data concerning corn grain and silage production under the environmental conditions found in North Dakota, and as influenced by commercial fertilizer application, prior crops, row width and plant population. A cooperative trial involving the main station at Fargo, and branch stations at Edgeley, Williston, Dickinson, Minot and Carrington, was begun in 1966 with the following objectives:

1. To collect yield data as influenced by the experimental variables as listed in the following paragraph.
2. To collect agronomic data which will reflect plant response to these experimental variables.
3. To compare water use efficiency in the corn plant when grown under extreme experimental variables.
4. To measure the effect of plant distribution and population density upon soil temperature.

The experimental variables included in this study are:

1. L = Land usage (independent test areas)
   - L_1 = summer fallow the previous season
   - L_2 = stubble land, spring plowed at Dickinson

2. F = Fertilizer application
   - F_1 = Control (no fertilizer)
   - F_2 = Recommended rates of NPK

3. W = Width between rows in inches (sub plot)
   - W_1 = 20 inches between rows
   - W_2 = 30 inches between rows
   - W_3 = 40 inches between rows

4. P = Plant population per acre (sub – sub – plot)
   - P_1 = Normal population (12000 plants per acre for Dickinson)
   - P_2 = Normal population plus 6000 plants per acre

The experimental design is a split-split-plot, with fertilizer variables as the whole plot, row width variables as the split plot and population variables as the split-split plot. Analysis of data is done on the IBM computer at NDSU.

The trial at Dickinson in 1966 was destroyed by hail. Data from the 1967 planting are summarized in the following tables 33 through 36. The following comments are not to be considered conclusions, but are offered as observations only.

1. The 1967 trial at Dickinson, grain yields were highest from the 20 inch row spacing, and lowest from the 40 inch row spacing on both stubble land and summerfallow.
2. Silage yields were not affected appreciably by row spacing on either stubble land or summerfallow.

3. Grain yields were not increased on stubble land by applications of commercial fertilizer, but were increased by application of commercial fertilizer on fallow.
4. Silage yields on stubble land were not increased by application of commercial fertilizer, supporting previous work done with commercial fertilizer on corn at the Dickinson Station.

Table 33. **UNIFORM CORN PRODUCTION TRIAL DATA** -40-

Station Dickinson Year 1967 Date Planted: 6-3 Harvested: Silage 9-7 Grain 10-3

Population: P_1 12000 P_2 18000 Fertilizer 210 lbs 0-46-0 Frost Date

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
1	I 111	8-12	50	24	none	5.5	287.6	61.6	312.2	70.9	9	576	486	376	7
2	I 112	8-12	54	19	none	6.7	352.6	80.3	615.4	146.0	9	1028	750	592	14
3	I 121	8-11	59	23	none	8.2	588.6	143.0	977.0	267.3	8	1240	992	745	12
4	I 122	8-11	58	19	none	7.5	390.1	90.1	967.7	258.4	10	880	840	674	13
5	I 131	8-12	61	20	none	7.6	438.5	83.5	640.8	139.4	10	920	756	574	10
6	I 132	8-13	57	20	none	7.8	411.2	87.0	777.2	192.6	12	654	562	410	8
7	I 211	8-10	61	21	none	7.2	470.9	108.0	948.4	295.5	9	1257	1039	812	14
8	I 212	8-9	53	19	none	8.2	416.9	116.0	1150.1	402.4	10	1613	1332	1018	17
9	I 221	8-12	61	23	none	6.2	562.8	122.5	1176.6	341.8	8	1359	1130	904	15
10	I 222	8-11	57	19	none	7.8	401.4	87.7	1263.4	447.0	10	1316	1137	858	15
11	I 231	8-12	63	23	none	6.4	335.8	84.8	553.6	272.8	8	842	730	550	9
12	I 232	8-12	55	19	none	6.8	416.0	99.6	945.6	304.6	9	1266	1064	840	12
13	II 221	8-11	57	22	none	7.2	394.6	73.5	822.7	224.2	11	1053	866	674	11
14	II 222	8-11	57	18	none	7.1	369.5	75.7	993.0	325.3	9	1323	1036	792	15
15	II 232	8-11	57	19	none	6.6	437.2	95.7	821.6	264.4	8	710	634	490	11
16	II 231	8-11	56	19	none	6.7	727.5	165.7	1035.0	387.0	8	1120	990	760	12
17	II 211	8-12	55	19	none	6.2	529.8	148.9	529.8	139.0	11	992	870	654	9
18	II 212	8-12	55	15	none	8.0	378.9	96.5	812.0	157.5	15	950	824	618	10
19	II 131	8-15	55	19	none	7.7	379.9	54.5	682.8	116.8	10	1412	1078	772	12
20	II 132	8-15	57	20	none	5.6	401.2	104.3	839.8	176.5	9	770	558	438	10
21	II 112	8-14	54	19	none	6.0	366.6	69.1	803.1	148.2	12	1314	1020	750	16
22	II 111	8-15	52	19	none	6.2	516.6	99.9	680.4	158.9	8	1138	780	580	10
23	II 122	8-14	53	19	none	6.0	533.0	106.5	716.5	142.6	11	1495	1205	840	14
24	II 121	8-15	52	20	none	6.1	432.4	88.2	602.2	127.0	8	1060	878	656	12

Table 33.(cont.) **UNIFORM CORN PRODUCTION TRIAL DATA** Sheet 2

Station Dickinson **Year** 1967 **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	Weight of Silage Sample Wet	Weight of Silage Sample Dry	Weight of Silage Ears Wet	Weight of Silage Ears Dry	No. of stalks	No. Weight of Grain per plot Wet	Weight of Grain per plot Dry	No. of Shell	Ears
25	I III 231	8-11	57	18	none	6.0	525.4	139.9	947.5	234.3	8	1146	916	686	10
26	I III 232	8-12	57	20	none	7.4	345.1	77.0	709.9	181.5	8	946	818	626	10
27	I III 212	8-12	54	19	none	6.8	593.0	143.7	1074.9	220.1	9	1854	509	1100	15
28	I III 211	8-11	54	18	none	7.2	494.8	104.0	925.1	346.5	8	1299	1130	882	13
29	I III 221	8-11	57	20	none	5.7	614.5	145.3	1020.4	309.9	6	1235	1089	816	13
30	I III 222	8-11	55	19	none	7.0	426.1	95.5	749.5	133.0	10	890	634	510	9
31	I III 192	8-15	57	17	none	7.7	348.8	84.1	1227.9	273.7	11	1474	1089	804	14
32	I III 131	8-13	57	21	none	6.5	392.5	71.2	510.4	126.5	8	840	686	522	9
33	I III 111	8-15	58	20	none	6.6	491.9	132.9	851.2	201.4	7	1253	968	730	15
34	I III 112	8-16	54	18	none	6.1	426.6	69.2	579.0	137.5	7	956	750	556	12
35	I III 121	8-15	57	19	none	6.5	594.1	143.9	880.8	257.8	7	1374	1057	794	13
36	I III 122	8-14	56	20	none	5.8	331.1	79.8	467.9	119.5	10	604	518	408	11
37	I IV 122	8-16	58	18	none	7.8	591.0	134.9	847.2	185.0	8	1529	1249	934	19
38	I IV 121	8-13	58	20	none	7.8	615.7	133.0	998.1	245.4	7	970	820	588	12
39	I IV 112	8-15	56	20	none	6.5	403.3	90.3	942.6	242.5	8	1632	1465	1084	16
40	I IV 111	8-15	55	18	none	8.6	431.9	103.0	976.4	240.4	7	1317	1040	786	18
41	I IV 131	8-14	55	20	none	8.4	388.4	79.2	946.0	214.5	10	1757	1547	1174	11
42	I IV 132	8-15	54	20	none	6.7	475.3	115.5	652.7	109.1	10	1203	862	650	19
43	I IV 231	8-10	58	21	none	6.2	650.0	163.3	680.7	272.2	5	1342	1066	812	14
44	I IV 232	8-11	55	18	none	6.7	314.7	61.6	730.3	219.7	11	1227	1022	780	16
45	I IV 222	8-11	54	19	none	7.8	556.4	129.1	964.4	298.7	10	1078	924	718	9
46	I IV 221	8-11	56	20	none	8.0	456.8	109.0	1207.5	289.6	8	1440	1143	846	12
47	I IV 211	8-11	53	19	none	6.8	426.4	100.2	860.4	308.4	8	1664	1468	1012	16
48	I IV 212	8-10	54	19	none	6.9	529.5	128.8	891.5	313.7	11	1030	886	670	13

Table 33. (cont.) **UNIFORM CORN PRODUCTION TRIAL DATA** Sheet 3

Station Dickinson **Year** 1967 **Date Planted:** ____ **Harvested: Silage** ____ **Grain** ____

Population: P_1 ____ **P_2** ____ **Fertilizer** 200 lbs 11-48-0 **Frost Date** ____

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 %	Plot Weight of Silage Wet	Sample Wet	Sample Dry	Ears Wet	Ears Dry	No. of stalks	Weight of Grain per plot Wet	Dry	No. Shell	No. of Ears
49	2 I 111	8-11	61	22	none	8.2	432.6	150.4	1090.4	378.4	9	1481	1225	936	15
50	2 I 112	8-12	53	18	none	6.4	305.6	76.8	684.4	204.0	9	980	840	630	16
51	2 I 121	8-12	60	22	none	7.0	551.0	171.9	886.3	247.6	8	1120	960	740	13
52	2 I 122	8-12	58	20	none	6.5	450.0	119.4	919.0	305.2	9	964	866	670	14
53	2 I 131	8-12	59	20	none	7.2	352.8	82.6	951.7	311.9	11	866	734	536	10
54	2 I 132	8-14	56	19	none	5.0	320.1	77.5	522.2	107.2	9	360	330	246	7
55	2 I 211	8-12	61	19	none	5.8	360.2	92.7	557.8	191.5	9	626	530	410	10
56	2 I 212	8-11	51	20	none	6.0	318.3	74.3	675.5	223.4	8	552	554	428	9
57	2 I 221	8-11	61	22	none	6.0	404.3	110.8	619.9	243.5	8	902	796	634	11
58	2 I 222	8-12	56	20	none	6.3	323.0	70.1	596.7	143.2	11	524	428	336	9
59	2 I 231	8-11	60	22	none	6.0	459.3	128.5	779.1	288.2	8	682	600	476	9
60	2 I 232	8-11	59	20	none	4.3	395.4	109.0	435.4	125.6	7	430	358	266	5
61	2 II 232	8-11	59	22	none	7.6	384.0	97.0	769.3	268.5	10	902	838	650	14
62	2 II 231	8-11	62	23	none	5.9	407.4	98.4	806.9	296.1	7	785	710	546	11
63	2 II 212	8-10	56	20	none	8.8	299.0	108.7	1203.0	434.9	12	1147	974	756	14
64	2 II 211	8-11	54	22	none	5.6	398.7	110.9	446.3	135.9	5	565	820	646	11
65	2 II 221	8-9	55	21	none	6.3	442.4	118.8	956.0	395.0	9	1587	1360	1048	15
66	2 II 222	8-10	56	22	none	4.5	364.3	116.1	529.5	166.8	5	656	618	482	12
67	2 II 131	8-12	60	22	none	8.0	393.8	90.8	1069.0	389.0	9	1232	1034	796	15
68	2 II 132	8-12	57	21	none	4.6	243.5	51.2	487.8	115.9	5	498	402	302	7
69	2 II 122	8-11	57	21	none	6.4	376.3	107.2	867.7	290.6	9	998	806	562	13
70	2 II 121	8-11	56	20	none	6.3	489.4	128.1	822.2	260.4	8	780	710	542	11
71	2 II 111	8-11	56	19	none	6.6	270.2	64.9	875.9	326.2	10	1024	874	656	12
72	2 II 112	8-12	56	18	none	6.4	367.2	79.4	829.7	261.0	8	896	720	614	14

Table 33. (cont.) **UNIFORM CORN PRODUCTION TRIAL DATA** Sheet 4 -43-

Station Dickinson **Year** 1967 **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 No.	Trt. code LRFWP	Date of silk	Height Plant in.	Ear in.	lodge %	Weight of Silage Plot Wet	Sample Wet	Sample Dry	Ears Wet	Ears Dry	No. of stalks	Weight of Grain per plot Wet	Dry	No. of Shell Ears
73	2 III 111	8-12	57	21	none	7.4	422.3	114.7	1051.6	258.9	10	837	768	576	12
74	2 III 112	8-11	57	20	none	7.2	333.9	89.4	467.9	329.6	10	1193	968	740	15
75	2 III 132	8-11	63	21	none	8.3	532.3	147.3	1080.7	342.3	11	1540	1318	1000	18
76	2 III 131	8-12	61	21	none	5.1	447.6	104.4	731.4	250.8	8	570	744	566	13
77	2 III 121	8-12	58	21	none	8.0	390.2	120.3	1005.5	378.9	8	984	892	694	14
78	2 III 122	8-12	56	20	none	7.1	333.6	90.7	839.2	255.6	11	1224	962	748	15
79	2 III 212	8-9	60	22	none	8.4	393.2	115.1	799.9	256.0	11	1460	1315	996	14
80	2 III 211	8-8	56	22	none	4.5	241.1	52.7	629.7	209.4	6	1462	1258	976	14
81	2 III 232	8-11	61	22	none	7.0	328.0	78.2	597.4	180.5	12	1220	678	522	11
82	2 III 231	8-11	59	21	none	9.3	376.5	93.3	1009.0	367.1	9	1462	844	644	12
83	2 III 222	8-12	56	21	none	5.9	436.5	132.5	873.3	404.9	8	1322	922	714	15
84	2 III 221	8-10	61	25	none	10.2	403.5	104.1	1462.4	576.8	8	1865	1417	1056	11
85	2 IV 111	8-12	57	19	none	6.4	249.4	71.3	784.4	299.1	9	1262	804	620	13
86	2 IV 112	8-12	58	20	none	7.5	519.1	137.6	1421.4	419.0	9	1377	1208	905	14
87	2 IV 131	8-11	61	20	none	7.8	401.1	120.0	991.0	296.4	9	963	806	614	11
88	2 IV 132	8-11	58	19	none	8.1	337.1	87.4	1020.7	302.6	12	1173	1060	798	18
89	2 IV 122	8-10	47	18	none	4.0	190.8	47.2	364.1	80.3	7	822	364	274	7
90	2 IV 121	8-12	61	19	none	7.3	526.1	132.4	830.5	260.5	11	868	792	612	9
91	2 IV 221	8-10	53	18	none	6.0	373.9	104.7	792.9	297.3	8	894	526	404	12
92	2 IV 222	8-10	55	19	none	6.6	365.6	119.5	551.5	165.9	10	690	626	478	12
93	2 IV 231	8-11	59	20	none	5.4	216.9	52.3	424.9	127.2	9	524	472	372	9
94	2 IV 232	8-10	56	19	none	6.6	351.9	90.6	617.3	221.2	12	618	544	416	10
95	2 IV 211	8-11	57	17	none	4.1	292.0	80.1	261.4	83.7	8	486	460	370	9
96	2 IV 212	8-11	55	18	none	5.4	178.0	44.0	660.9	241.8	10	610	558	414	9

Table 34. Uniform Corn Production Trial on Summerfallow – 1967.

ST	YR	IDENT LRFWP	S	HT PLT	HT EAR	LODG 0/0	DMST 0/0	DMER 0/0	SIL. T/A	EARS 0/0	DM 0/0	WT/GRAIN PLT	WT/GRAIN BU/A	MOIST 0/0	SHELL 0/0	WT/EAR
DCT	67	4014111	14	54	20	0	23.0	24.1	5.7	23.3	23.1	.9	31.7	21.7	75.7	.7
DCT	67	4714211	11	56	19	0	23.9	32.7	6.6	33.0	26.4	.9	43.6	13.6	75.1	.9
DCT	67	3814121	14	57	21	0	22.6	25.4	6.3	28.2	23.4	1.1	36.3	19.2	74.2	.8
DCT	67	4614221	11	58	21	0	19.9	31.6	5.6	45.3	23.2	.9	40.9	16.7	76.7	.8
DCT	67	4114131	14	57	20	0	19.2	21.5	5.4	21.7	19.6	.7	39.3	17.9	74.9	1.0
DCT	67	4314231	11	59	20	0	25.0	33.6	6.3	36.8	27.4	1.1	35.8	13.5	74.3	.8
DCT	67	3914112	14	55	19	0	20.0	22.9	4.9	27.2	20.7	.7	38.6	20.3	76.1	.7
DCT	67	4814212	11	54	19	0	25.5	27.5	7.1	30.3	26.1	.8	44.0	15.8	75.0	.8
DCT	67	3714122	14	56	19	0	22.5	23.5	5.6	24.9	22.8	.7	36.1	15.5	77.2	.6
DCT	67	4514222	11	56	19	0	22.0	31.5	6.7	35.1	24.8	.9	36.1	19.6	78.0	.8
DCT	67	4214132	15	56	19	0	22.6	22.1	6.2	23.9	22.4	.8	29.7	24.2	75.2	.6
DCT	67	4414232	12	57	19	0	22.0	30.0	6.0	32.2	24.1	.9	34.2	14.2	77.3	.7

AOV DICKINSON CORN TRIAL 67 SILAGE SUMMERFALLOW L1

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F
BLOCKS	3.	9.59	3.20	22.09
TRT A	1.	5.74	5.74	39.67
ERROR A	3.	.43	.14	
TRT B	2.	.04	.02	.02
AB INT	2.	4.17	2.09	2.07
ERROR B	12.	12.10	1.01	
TRT C	1.	.21	.21	.24
AC INT	1.	1.27	1.27	1.39
BC INT	2.	.21	.10	.12
ABC INT	2.	4.94	2.47	2.71
ERROR C	18.	16.44	.91	
TOTAL	47.	55.14		

TABLE OF MEANS

	1B	2B	3B
A1	5.32	5.94	5.87
A2	6.84	6.19	6.17
	6.08	6.07	6.02

	1A	2A
C1	5.81	6.17
C2	5.61	6.63
	5.71	6.40

	1C	2C
B1	6.11	6.06
B2	5.97	6.17
B3	5.89	6.14
	5.99	6.12

1R	2R	3R	4R
6.45	5.50	5.74	6.54

EXP. MEAN = 6.06

AOV DICKINSON CORN TRIAL 67 GRAIN SUMMERFALLOW L1

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F
BLOCKS	3.	657.86	219.29	1.30
TRT A	1.	178.25	178.25	1.05
ERROR A	3.	509.81	169.94	
TRT B	2.	175.70	87.85	1.76
AN INK	2.	147.65	73.82	1.48
ERROR B	12.	601.19		
TRT C	1.	26.55	26.55	.26
AC INT	1.	2.85	2.85	.03
BC INT	2.	177.74	88.87	.86
ABC INT	2.	124.66	62.33	.60
ERROR C	18.	1881.57	104.53	
TOTAL	47.	4483.84		

TABLE OF MEANS

	1B	2B	3B
A1	35.12	36.14	34.53
A2	43.82	38.49	35.04
	39.47	37.32	34.79

	1A	2A
C1	35.76	40.11
C2	34.76	38.13
	35.26	39.12

	1C	2C
B1	37.64	41.29
B2	38.57	36.07
B3	37.59	31.98
	37.93	36.45

1R	2R	3R	4R
34.89	34.36	35.99	43.52

EXP. MEAN = 37.19

Table 36. Uniform Corn Production Trial on Stubbleland – 1967.

ST	YR	IDENT LRFWP	S	HT PLT	LODG EAR	DMST 0/0		DMER 0/0	SIL. T/A	EARS 0/0	DM 0/0	WT/ PLT	GRAIN BU/A	MOIST 0/0	SHELL 0/0	WT/EAR
DCT	67	85241	11	58	20	0	27.6	35.8	7.9	35.1	30.0	1.1	35.5	11.8	75.9	.7
DCT	67	95242	11	57	20	0	25.6	32.5	5.0	25.0	27.1	.8	29.6	11.6	78.7	.7
DCT	67	90241	21	59	21	0	28.3	31.9	7.6	29.8	29.3	1.1	32.4	10.3	77.1	.7
DCT	67	91242	21	58	22	0	27.0	39.4	7.9	37.6	30.6	1.2	39.7	11.6	77.5	.8
DCT	67	87241	31	60	21	0	24.9	33.3	7.0	36.2	27.4	1.0	32.1	14.1	75.6	.7
DCT	67	93242	31	60	22	0	25.2	35.0	6.7	31.7	27.7	1.0	25.4	11.0	77.8	.6
DCT	67	86241	12	56	19	0	25.0	31.2	7.3	33.2	26.7	1.0	36.1	16.3	78.0	.6
DCT	67	96242	12	56	20	0	28.4	34.4	7.9	29.9	29.9	1.0	32.9	9.6	76.2	.7
DCT	67	89241	22	55	20	0	26.7	31.4	6.1	29.2	28.0	.8	28.2	15.7	75.1	.6
DCT	67	92242	22	56	21	0	29.1	33.0	6.5	26.7	30.4	.9	25.1	10.9	77.6	.5
DCT	67	88241	32	59	20	0	24.6	26.4	6.1	27.1	25.1	.7	29.5	14.2	75.6	.6
DCT	67	94242	32	59	21	0	25.6	32.7	6.2	25.3	27.1	.8	23.6	10.7	75.8	.6

AOV DICKINSON CORN TRIAL 67 SILAGE NON FALLOW L2

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F
BLOCKS	3.	15.80	5.27	1.12
TRT A	1.	1.08	1.08	.23
ERROR A	3.	14.23	4.74	
TRT B	2.	2.98	1.49	.53
AB INT	2.	4.47	2.24	.79
ERROR B	12.	34.00	2.83	
TRT C	1.	1.33	1.33	.40
AC INT	1.	5.74	5.74	1.70
BC INT	2.	14.30	7.15	2.12
ABC INT	2.	7.63	3.81	1.13
ERROR C	18.	60.82	3.38	
TOTAL	47.	162.38		

TABLE OF MEANS

	1B	2B	3B
A1	7.62	6.91	6.59
A2	6.48	7.21	6.49
	7.05	7.06	6.52

	1A	2A
C1	7.54	6.55
C2	6.51	6.91
	7.03	6.73

	1C	2C
B1	6.48	7.62
B2	7.79	6.32
B3	6.86	6.19
	7.04	6.71

1R	2R	3R	4R
6.32	6.68	7.84	6.66

EXP. MEAN = 6.88

AOV DICKINSON CORN TRIAL 67 GRAIN NON FALLOW L2

ANALYSIS OF VARIANCE

SOURCE	DF	SS	MS	F
BLOCKS	3.	1311.44	437.15	1.71
TRT A	1.	104.43	104.43	.41
FRROR A	3.	768.06	256.02	
TRT B	2.	282.33	141.16	1.85
AB INT	2.	154.46	77.23	1.01
ERROR B	12.	919.52	76.63	
TRT C	1.	126.52	123.52	1.50
AC INT	1.	15.87	15.87	.20
BC INT	2.	264.88	132.44	1.60
ABC INT	2.	97.80	48.90	.60
ERROR C	18.	1490.17	82.79	
TOTAL	47.	5532.48		

TABLE OF MEANS

	1B	2B	3B
A1	35.83	30.36	30.82
A2	31.26	32.38	24.52
	33.54	31.37	27.67

	1A	2A
C1	33.36	31.56
C2	31.31	27.21
	32.33	29.38

	1C	2C
B1	32.56	34.53
B2	36.07	26.67
B3	28.77	26.57
	32.46	29.26

1R	2R	3R	4R
26.52	31.82	39.02	26.07

EXP. MEAN = 30.86

Early Maturing Hybrid Corn Trials – 1967

Several commercial hybrid seed corn producers have developed hybrid strains that are early maturing, and should be useful in this area where the growing season often is extremely short for the production of mature grain from corn. The following table summaries the data from a trial which included several early strains of hybrid corn. The relatively low yields of both silage and grain in this trial is attributable to the late seeding date of May 25 for this material.

Table 37. Silage and Shelled Corn Yields in the Early Maturing Corn Hybrid Trial – 1967.

	Silage yields in tons per acre @ 70% moisture				
Description	1	2	3	4	Average
J 750 J	2.94	3.45	3.14	3.86	3.35
Nodak 307	3.02	4.69	5.10	4.17	4.25
A.E.S. 101	2.13	4.46	5.00	3.75	3.84
PXE – 1	2.68	3.79	5.23	3.23	3.73
	Shelled corn yields in bushels per acre				
	1	2	3	4	Average
J 750 J	10.0	15.7	22.9	24.0	18.2
Nodak 307	11.4	18.8	27.0	17.3	18.6
A.E.S. 101	13.8	21.7	25.6	14.6	18.9
PXE – 1	13.0	21.6	23.9	17.0	18.9

Winter Wheat Seeded on Summerfallow and on Stubble Land in Ten Inch and Twenty Inch Row Spacing.

Hume winter wheat was seeded on September 9, 1966 on both summerfallow and wheat stubble land, in a trial that also compares ten inch row spacing with twenty inch row spacing.

Good germination and fall growth, and practically no loss during the winter resulted in excellent stands on all treatments.

Helminthosporium leaf blotch was present but not sever, and stem and leaf rust were of no consequence on the winter wheat this year, with only an occasional pustule being found.

A heavy growth of wild oats reduced the yields on the stubble plantings. Wild oats was not a problem in the planting made on summerfallow, and yields on summerfallow were very good.

Yield data for this trial are summarized in table 38.

The spacing trial was suggested by local winter wheat growers who felt that the hoe drill spacing of 10 inches between rows used by the Station was not a wide enough spacing for best production of winter wheat. The results of this trial show that the 10 inch spacing is far better than the 20 inch spacing in both summerfallow and on stubble land.

The question of top dressing winter wheat with an application of nitrogen fertilizer was also posed by local winter wheat producers, and this was given consideration in 1967. An application of 150 lbs. per acre of 33.5-0-0 commercial fertilizer applied as a top dressing the middle of April on both summerfallow and stubble seedings of winter wheat produced no additional yield on fallow and only a very moderate increase on stubble land in 1967.

Table 38. Winter Wheat Planted with the Hoe Drill on 10 Inch and 20 Inch Spacing.

Variety or Treatment	Yield			
	Rep1	Rep2	Rep3	Average
Hume, 10 inch spacing Top dressed, fallow	30.8	33.6	34.1	32.8
Hume, 10 inch spacing No top dressing, fallow	30.3	35.2	38.5	34.7
Hume, 20 inch spacing Top dressed, fallow	19.2	12.6	14.3	15.4
Hume, 20 inch spacing No top dressing, fallow	12.6	10.4	13.8	12.3
Hume, 10 inch spacing Top dressed, stubble	6.3	9.1	9.1	8.2
Hume, 10 inch spacing No top dressing, stubble	5.5	7.4	7.2	6.7
Hume, 20 inch spacing Top dressed, stubble	4.1	4.3	4.4	4.3
Hume, 20 inch spacing No top dressing, stubble	3.4	2.5	3.3	3.1

Seeding Rate Trials With Wheat And Oats

Numerous seeding rate trials have been conducted with small grains by many experiment stations in past years, and these trials, combined with local farm experience have served in a general way to establish the approximate rates best suited to specific localities. Generally, however, these experiences and the recommendations resulting from them have as their basis total weight or total volume of seeds sown, with the germination and purity of the seed coming into consideration only in a general way. The assumption has been proven faulty by numerous drill box surveys made in recent years which have shown that far to much poor quality see is actually used. In addition, the term “good” seed is a general term, which perhaps could well be refined in terms of germination and purity, and from which can be calculated the “ pure live seed” percentage. The amount of “pure live seed” used per acre is actually the only meaningful way to measure seeding rates, and is also the basis which should be used to determine the comparative value of seed of different lots. For example, a seed lot testing 95% pure and with a germination of 95% has a pure live seed percentage of 90.25%. A 60 lb. bushel of this seed lot will contain 54.15 lbs. of pure live seed. Another lot of seed testing 90% pure and with a germination of 90% would have a pure live seed percentage of 81%. This is considered to be good seed by present standards, but this second lot would have to be seeded at a rate of 66.7 lbs. per acre to equal the pure live seed percentage in a 60 lb. bushel of the seed testing 95% pure and with a 95% germination. Perhaps the traditional tendency to seed fairly heavy rates of small grain has been necessary to make up for lack of high purity and germination, and has been the only way to get satisfactory stans. It is rather fortunate that the small grains are adaptable enough to be able to adjust themselves to rather wide variations in seeding rate with no sacrifice to yield.

This subject is perhaps only of moderate importance at present because of the relatively low price of seed of most of the small grains. However, it will become increasingly important if the development of hybrid wheat becomes a reality for the commercial producer. Hybrid seed wheat will undoubtedly cost a great deal more than common seed wheat, and in addition, new hybrid seed will have to be bought each year.

Table 39. Rate of Seeding Trial with Oats – 1967.

Rate of seeding	Yields bushels per acre				
Pounds per acre	1	2	3	4	Average
40 pounds	43.1	38.5	38.5	30.8	37.7
48 pounds	43.8	39.2	37.8	35.0	39.0
64 pounds	43.1	42.0	38.5	28.0	37.9

Analysis of Variance Summary

Source	df	Sums of squares	Mean square	F-value
Total	11	264.3	24.0	--
Replication	3	232.0	77.3	16.1
Treatment	2	3.5	1.75	.365
Error	6	28.8	4.8	

F-Value required for significance @ 5% level is 5.14
L.S.D. @ 5% is 5.35 bushels per acre

Table 40. Rate of Seeding Trial with Wheat – 1967

Rate of seeding	Yield bushels per acre				
Pounds per acre	1	2	3	4	Average
45 lbs. per acre	20.8	22.0	27.0	33.3	25.8
60 lbs. per acre	20.8	24.5	28.3	31.5	26.3
75 lbs. per acre	21.3	26.8	30.3	30.5	27.2

Analysis of Variance Summary

Source	df	Sums of squares	Mean square	F-value
Total	11	221.6	20.15	
Replication	3	200.3	66.77	23.68
Treatment	2	4.4	2.20	.78
Error	6	16.9	2.82	

F-Value required for significance at 5% level is 5.14
L.S.D. @ 5% is 4.10 bushels per acre.

Table 41. Summary of the Seeding Rate Trials with Wheat and Oats.

Crop	Rate of seeding	Average yield bushels per acre 1964	1965	1966*	1967	1968	4 Yr Av.
Wheat	45 lbs. per acre	10.4	25.2	--	25.8	39.2	25.2
	60 lbs. per acre	12.8	25.9	--	26.3	37.1	25.5
	75 lbs. per acre	12.9	26.2	--	27.2	38.0	26.1
	L.S.D. @ 5%	2.75	4.80	--	4.10	2.5	1.8
% germination		90.0	92.0	--	93.0		
% purity		99.3	96.0	--	96.0		
% pure live seed		89.4	88.3	--	89.3		
Oats	40 lbs. per acre	36.5	76.7	--	37.7	80.9	58.0
	48 lbs. per acre	34.9	82.4	--	39.0	82.7	59.8
	64 lbs. per acre	39.8	73.6	--	37.9	85.5	59.2
	L.S.D. @ 5%	4.34	5.90	--	5.35	7.6	2.96
% germination		96.0	98.0	--	96.0		
% purity		99.3	99.9	--	99.5		
% pure live seed		95.3	98.0	--	95.5		

*Hailed out in 1966.

Off Station Variety Trials

In 1967 the Dickinson Station made arrangements for land at five off-station locations within a radius of 70 miles from the Station. The major purpose for these off-station locations will be to conduct variety trials with small grains in the areas for enough away from the Dickinson Station so that the soil and other environmental factors are not well represented at the Station.

The only location selected having summerfallow available for the 1967 seeding was Hettinger. All other locations were fallowed in 1967 in preparation for trials beginning in 1968.

The data from the Hettinger trials are summarized in the following three tables.

Table 42. Wheat Variety Trial – Hettinger – 1967

Variety or Treatment	Entry No.	Yield bushels per acre Rep1	Rep2	Rep3	Average	Test weight
Justin	08	25.5	29.4	29.4	28.1	58.0
Chris	15	27.9	32.7	24.3	28.3	56.5
Crim	14	32.1	36.9	29.3	32.8	57.5
Selkirk	07	25.4	27.8	24.6	25.9	56.0
Manitou	34	39.6	37.2	30.9	35.9	59.0
Canthatch	10	33.5	26.9	27.0	29.1	57.0
Valley	41	40.1	30.3	31.4	33.9	60.0
Pembina	09	30.8	32.6	31.1	31.5	58.0
ND 363-1	45	38.4	29.6	29.1	32.4	56.5
Wisc. 255	39	37.4	29.6	25.4	30.8	58.5
Fortuna	54	43.7	37.2	28.8	36.6	62.0
M II-55-11	38	29.1	33.2	27.6	30.0	61.5
ND 61-107	36	43.8	40.1	28.4	37.4	61.0
Wells	106	30.9	28.1	27.5	28.8	60.5

Analysis of Variance

Source	DF	SS	MS	F
Replication	2.	259.27	129.63	9.82
Treatments	13.	470.50	36.19	2.74
Error	26.	343.11		
Total	41.	10272.88		

Standard error of a treatment mean = 2.0973
Standard error of a difference among treatment means = 2.9661
The CV = 11.52 P.C.
The L.S.D. @ 5 % is 6.10 bushels per acre

Table 43. Oat Variety Trials – Hettinger – 1967.

Variety or Treatment	Entry No.	Yield bushels per acre Rep1	Rep2	Rep3	Average	Test weight
Burnett	3	72.9	63.6	65.0	67.2	34.5
Russell	5	86.4	64.8	61.2	70.8	33.5
Minton	6	107.4	59.4	111.3	92.7	35.0
Rodney	10	87.0	49.8	70.8	69.2	34.0
Ortley	13	73.2	58.8	89.1	73.7	33.5
Lodi	14	85.2	69.0	63.9	72.7	35.0
Wyndmere	21	80.1	49.8	93.0	74.3	35.0
Brave	27	82.2	74.4	66.9	74.5	33.0
Harmon	30	77.7	58.5	64.2	66.8	34.0
Tyler	32	57.0	58.8	83.7	66.5	33.0

Analysis of Variance

Source	DF	SS	MS	F
Replication	2.	2293.12	1146.56	7.01
Treatments	9.	1579.02	175.45	1.07
Error	18.	2942.67	163.48	
Total	29.	6814.81		

Standard error of a treatment mean = 7.3820
Standard error of a difference among treatment means = 10.4397
The CV = 17.55 P.C.
The L.S.D. @ 5% is 21.93 bushels per acre

Table 44. Barley Variety Trial – Hettinger – 1967.

Variety or Treatment	Entry No.	Yield bushels per acre Rep1	Rep2	Rep3	Average	Test weight
Traill	03	53.9	25.9	51.1	43.6	46.0
Trophy	05	38.8	45.5	53.4	45.9	48.0
Larker	06	44.4	42.8	52.5	46.6	48.0
Dickson	15	38.3	39.6	44.3	40.7	47.0
Conquest	33	43.9	35.4	40.3	39.9	45.0
Keystone	09	50.1	38.5	55.3	48.0	42.0
Yukon	18	48.5	47.5	44.8	46.9	45.0
B 129	30	54.8	48.0	48.6	50.5	45.0
B 130	31	62.9	38.4	40.4	47.2	45.0
Jubilee	10	50.4	33.9	38.6	41.0	44.5
Betzes	12	52.1	38.9	52.4	47.8	49.5

Analysis of Variance

Source	DF	SS	MS	F
Replication	2.	564.97	282.48	5.98
Treatments	10.	361.06	36.11	.76
Error	20.	945.07	47.25	
Total	32.	1871.10		

Standard error of a treatment mean = 3.9688
Standard error of a difference among treatment means = 5.6127
The CV = 15.18 P.C.
The L.S.D. @ 5% is 11.71 bushels per acre

Meetings and Tours
1967

Date	Meeting	Attendance
January 24	Stark County A.S.C.S	100
February 2	Taylor Lions Farm Forum	65
February 14	7th Annual Sheep Day – Hettinger	Attended
February 15	1st. National Crop Clinic	600
February 22	Lincoln Elementary School 5th Grade	50
February 23	Central Elementary School 5th Grade	30
March 2	O&M Elevator Agricultural Day – New England	125
March 3	Judging Crops – Valley City Winter Show	
April 24	Cub Scout Pack – Tour of Dickinson Experiment Station	11
April 28	St. Patrick's Grade School Classes	
	Tour of Dickinson Experiment Station	68
June 26	Dickinson Chamber of Commerce	10
July 13	Hettinger Station Field Day	25
July 19	Crops Field Day – Dickinson Branch Station	250
July 20	Fargo Station Field Day	Attended
August 19	Fallon County Fair	Crops Judge
August 25	4-H Achievement Day – Stark County	Judge
September 8	4-H Achievement Day – Golden Valley County	Judge
September 9	Richardton Harvest Dealers	Judge
October 4	Potato Day – Demonstration Trials	30
October 20	NDUS Conference – Red River 68	
October 20	Interstate Seed Dealers	40
November 20-21	North Dakota Crop Improvement Ass. Conference	Attended
November 28	Special Meeting on Septoria at N.G.P.F.S. – Mandan	Attended
November 30	North Dakota Fertilizer Conference – Minot	Attended
December 7	Southwest District A.S.C. County Committeemen	50
December 7	Jacques Seed Co. – Dealers meeting	15
December 13	18th Annual Livestock Research Roundup	950
December 15	Seed Trade Short Course	

Radio – 1967

Date	Program
January 13	New Summerfallow Trial and Triticales a New Crop
February 24	"Out Station" Crops Trials Planned for the Future
March 17	Soil Fertility and Fertilizers, Some of the Finer Points Involved in Fertilizer Use
April 21 &28	Fertilizer Use, Including Methods, Rates, and Some of the Soil and Fertilizer Chemistry Involved in Fertilizer Use.
May 19	New Off-Station Trials at Dickinson Experiment Station, Their Purpose and Value
June 16	Rust Development on Small Grain in the Midwest, and Field Day at Dickinson Experiment Station
July 14	Crop Field Day Plans at Dickinson Experiment Station – 1967
August 4	Results of Trials with Winter Grain at Dickinson Experiment Station in 1967
September 15	Results of Early Seedings and Late Seedings of Small Grain in 1967
October 6	Potato Day at Dickinson Experiment Station
October 20	Wheat Variety Trial Results in 1967 at Dickinson and Hettinger
November 17	Rate of Seeding Trial Results at Dickinson Experiment Station 1964-1967
December 8	Plans for 18th Annual Livestock Research Roundup

General Summary

	Farm Visits	No. Tours	Attendance at meetings	Station calls	Radio talks	News articles	Meetings attended
January	0	0	100	3	1	0	1
February	3	0	745	0	1	0	5
March	1	0	125	7	1	0	2
April	4	2	79	10	2	0	2
May	0	0	0	4	1	0	1
June	0	0	10	3	1	0	1
July	9	0	275	1	1	0	3
August	0	0	0	0	1	0	2
September	0	0	0	3	1	1	2
October	0	0	70	2	2	0	3
November	7	0	0	7	1	0	3
December	0	0	1150	3	1	0	4
Total	24	2	2554	43	14	1	28