SECTION I

CROP PRODUCTION TRIALS

AGRONOMIC INVESTIGATIONS

at the

DICKINSON RESEARCH CENTER

1989

by

Mr. Thomas J. Conlon
Superintendent and Agronomist

Mr. David A. Claypool
Research Specialist I

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DICKINSON BRANCH STATION
Dickinson, North Dakota

Production of Cereal Cultivars, Corn Sunflower, Safflower and Miscellaneous Minor and New Crops in Southwestern North Dakota

New crop cultivars and advanced experimentals from public and private agencies must be evaluated for their agronomic merit and usefulness in processed products as compared to varieties now grown. The North Dakota Agricultural Experiment Station is obligated to obtain information and make recommendations based on unbiased data and interpretations which the producer may use to choose cultivars for farm production. This project collects the necessary information on comparative performance of cultivars of cereals in southwestern North Dakota (1) to assist in evaluation of unnamed cultivars for possible release to North Dakota farmers; (2) to provide grain and quality analysis; and, (3) to provide production recommendations of varieties released by both public and private sources.

The project includes three separate experimental categories for cereal cultivars, including (1) regional nursery trials to evaluate advanced experimental genotypes of cereal grains; (2) comparison trials of named cereal cultivars and advanced experimentals in the final testing stages preparatory to release as named varieties; and, (3) off-station testing of newly released varieties from both public and private sources.

Regional Nursery Trials

Each year the regional nursery testing is done by agronomists in the U. S. and Canada cooperating with regional project leaders in North Dakota, South Dakota, Montana, and Minnesota. Nurseries presently under test include:

The Uniform Regional Hard Red Spring Wheat Nursery

The Uniform Regional Durum Nursery

The Elite Hard Red Winter Wheat Nursery

The Intermediate Hard Red Winter Wheat Nursery

The Western Spring Barley Nursery

The Western Dryland Barley Nursery

The Advanced Two Row Barley Nursery

The Early Oat Nursery

The Midseason Oat Nursery

Variety Comparison Trials

This project provided much of the early yield, quality and agronomic evaluation of crop varieties in North Dakota. Each year this project evaluates approximately 40 or more hard red spring wheat (Triticum aestivum L.), 25 to 30 durum wheat (Triticum turgidum L.), 10 to 15 oat (Avena sativa L.), 10 to 15 six-rowed barley (Hordeum vulgare L.), 10 to 15 two-rowed barley (Hordeum distichon L.), 8 to 12 winter wheat (Triticum aestivum L.) and 6 to 10 winter rye (Secale cereale L.) cultivars. Genotypes evaluated include both named cultivars and experimental lines from NDSU, and other public and private breeding programs in the United States and Canada. Evaluations are used to make varietal recommendations. The grain produced from the hard red spring wheat, durum wheat and both two and six rowed barley plots is important because it is used in quality evaluations. Quality evaluations of experimental lines are compared to cultivars now grown by producers. The quality and agronomic performance of a genotype at various locations are the major bases for the recommended release of that line as a named variety or its removal from consideration for further testing. Data from this project in part determine which cultivars of these major crops will be released by the experiment station for commercial production. Experimental lines from other state universities and private plant breeding companies also are evaluated for quality. Although data from this project are not instrumental in the eventual release or rejection of private varieties they provide information on genotype and agronomic characteristics prior to release and assist in making cultivar recommendations.

Off Station Testing

The principal objective of off-station trials is to provide a wider base for interpretation of yield data as it relates to varied soil types and growing conditions over the 14 counties of the Missouri Slope area. While the soils at the Dickinson Branch Station are representative of a large percent of those of southwestern North Dakota they are not representative of all soil types being used for crop production in the region. Five different soil types are represented in the off-station trials. Local climatic differences also influence crop growth response. Data from these trials are combined with data from the off-station trials of the Hettinger Branch Station to provide a diverse test of crop performance at eleven locations in southwestern North Dakota.

Demonstration Plots

The same field plots used for yield and quality evaluations also serve as demonstration plots. This allows producers and scientists to observe the varieties and experimental lines of cereal crops grown in comparison trials for reaction to disease and insect pests.

Corn and Sunflower

Corn and sunflower are major crops in southwestern North Dakota.

Corn acreage in the three southwestern crop reporting districts increased from 166,000 acres in 1980 to 207,000 acres in 1984, and averaged 194,500 acres for that five year period. Acreage in 1985 was 233,000 and in 1986, 215,000 acres.

Average annual value of the corn crop in these districts for the five year period 1980-84 was $21,750,000.00, making the average per acre value $111.85. Using this value as a base, the value of the 1986 crop would be $24,041,300.00

Sunflower acreage increased from 160,000 acres in 1980 to 460,000 acres in 1984, and averaged 307,600 acres annually in the three southwestern districts during that five year period. During that time the average annual value of the sunflower crop in those districts was approximately $32,000,000.00, with the per acre value being $104.03. Sunflower acreage dropped to 371,000 acres in these three districts in 1985. Production and marketing problems combined to further reduce the acreage in 1986 to 189,500 acres. Without some form of price stabilization, acreage of sunflower will no doubt continue to decline.

Modern production technology demands new types of hybrids of both corn and sunflower which will withstand high plant densities, be adapted to narrow row spacing, use fertilizers effectively, be adapted to combine harvesting and capable of economical and consistent grain production.

New hybrids of both crops are being developed by private seed companies and are evaluated for adaptation to southwestern North Dakota growing conditions. Production practices are also evaluated.

Farmers of this area use the data collected from these trials to decide which hybrids to grow.

Miscellaneous Minor and New Crops

Safflower, sorghum, proso millet, buckwheat and dry beans are minor crops in southwestern North Dakota. Agronomic evaluation of new varieties and experimental lines of these and other miscellaneous crops is needed. Producers and potential processors require information on these crops to assist in making management decisions. New and improved production techniques for use by producers need to be discovered and their impact determined.

EXPERIMENTAL PROCEDURE

Seeding rates are calculated from 1000 kernel weights and germination percentages are adjusted to provide a seeding rate of 1,000,000 live seeds per acre for hard red spring wheat and durum and 750,000 live seeds per acre for oats and barley. These rates are approximately equivalent to 60 pounds of wheat and durum (1 bushel, 65 pounds of barley (1.3 bushels), and 48 pounds of oats (1.5 bushel) per acre.

All variety comparison trials and uniform regional nursery trials are seeded on summer fallow. Rotation and tillage trials follow appropriate cropping sequence. Soil tests are used to determine proper fertilizer application. Herbicide application follows current procedure as outlined in the NDSU agricultural weed control guide circular W253 as revised annually. All trials are machine-planted with a K. E. M. four-row double disk cone seeder at appropriate rates for each species being tested. Trials are seeded in randomized complete block design in either three or four replications as requested by respective project leaders. Plot size for all regional tests are four by fourteen feet. Plant growth is monitored and agronomic information on planting date, time of emergence, seeding vigor, stand percent, heading date, height, disease and insect phenomena is recorded by Station personnel as required by respective project leaders throughout the growing season. Grain yields are determined from hand-harvested plots. Grain samples for quality tests are supplied as requested by respective project leaders.

Variety comparison trials are seeded at the Dickinson Branch Station each year. Trials consist of named cereal cultivars and advanced experimentals in the final testing stages preparatory to release. All trials are seeded on summerfallow. Soil tests are used to determine proper fertilizer application for selected yield goals. Herbicide application follows current procedure as outlined in the NDSU agricultural weed control guide, circular W253 as revised annually. All trials are machine-planted with a Melroe double disk drill at appropriate rates for each species. Drill row spacing is six inches. Plot size is five feet by one hundred thirty-two feet. Trials are seeded in randomized complete block design using four replications. Plant growth is monitored as necessary to record agronomic, disease and insect phenomena occurring during the growing season. Grain yields are determined from combine harvest of the entire plot. Grain samples for quality tests are supplied as requested by the chairman of the Department of Agronomy, NDSU.

Off-station variety comparison trials of newly released varieties from both public and private sources are seeded on selected off-station sites in Golden Valley, Dunn, Morton, Oliver and Mercer Counties. Procedure described for the variety comparison trials will be followed for off-station trials also.

All row crops to include corn, sunflower, dry beans and grain sorghum, are planted with an Allis row crop planter equipped with double disk furrow openers spaced 36 inches apart. Trials are planted at an excessive rate and thinned to the desired uniform stand.

Plot size for all row crops are one-fiftieth acre with yield determined from hand-harvested samples of a one-hundredth acre portion of the plot. Grain or seed is weighed at harvest and moisture percentage determined. Yield is determined on a uniform moisure basis for the species being tested. Corn silage yields are determined on a 70% moisure basis.

All small seeded crops are machine planted with a Melroe double disk drill set at 6 inch row spacing or a K. E. M. double disk cone seeder designed to plant from 3 to 7 rows set at 6 inch row spacing, depending on amount of available seed and plot size.

Plot size for all small seeded crops is one-hundredth acre, seed supplies permitting. Yield determinations are from combine harvest. Grain samples for quality tests are supplied as required to the Department of Cereal Science and Food Technology, NDSU.

Data are analyzed using statistical procedure for analysis of variance.

DICKINSON RESEARCH CENTER

Growing Conditions - 1989

Severe drought prevailed during the year of 1988. Precipitation during the fall of 1988, September through December, was nearly an inch and a half below average and continued the deficit experienced throughout the summer. The well above average precipitation in April, 1989 provided adequate soil water for germination and early season crop growth. Temperatures were moderate, and crop development was fairly good through May and June, even though precipitation was below average for both months. However, well above average temperatures in July (see weather data summary) coupled with well below average precipitation of .68 inch combined to create very poor growing conditions for the remainder of the growing season.

Once again, effects of the droughty growing conditions masked development of leaf diseases. Common root rot was once again a problem of consequence.

Weather Data Summary
Dickinson 1988-89

Precipitation	1987-88	1988-89	95 Year Average
Sept. – Dec.	1.16	1.74	3.14
Jan. – Mar.	1.96	1.17	1.53
April – June	3.64	6.69	7.29
July – Aug.	1.87	1.92	3.89
Total	8.63	11.52	15.84

Average Temperature °F	1988	1989	95 Year Average
April	42	42	41
May	59	53	54
June	75	60	61
July	71	74	69
August	68	69	67

Table 1. 1989 Dickinson Hard Red Spring Wheat Variety Trial

Variety	Bu/A Avg.	Test Wt lbs.	Heading Date	Height in.
ND 652	21.7	59.5	29-Jun	21
Leif *	21.7	58.5	26-Jun	22
Prospect *	20.4	60.5	27-Jun	24
Norak *	20.1	60.0	27-Jun	20
Pioneer 2375 *	19.5	61.0	27-Jun	20
Marshall *	19.3	59.0	27-Jun	20
Gus * (ND 618)	18.2	59.0	27-Jun	25
ND 657 *	17.3	59.5	27-Jun	19
Len *	17.1	60.0	28-Jun	22
Columbus	17.1	59.5	04-Jul	22
ND 650 *	16.8	61.5	29-Jun	20
Fjeld * (HS84-873)	16.5	58.5	27-Jun	19
Pioneer 2369 *	16.2	61.5	27-Jun	21
Amidon	16.0	59.5	26-Jun	22
Rambo *	15.7	61.0	28-Jun	20
Celtic *	15.4	60.5	26-Jun	20
Nordic *	15.1	62.0	28-Jun	21
W 2501	15.1	58.5	26-Jun	21
Norseman *	14.9	60.0	28-Jun	16
Telemark *	14.9	59.5	27-Jun	19
Minnpro * (MN 81110)	14.6	59.0	28-Jun	25
ND 653 *	14.6	60.0	26-Jun	19
W 2502 *	14.3	56.0	26-Jun	18
Stoa	14.0	58.5	27-Jun	25
Grandin * (ND 626)	13.8	60.5	26-Jun	27
ND 654	13.8	59.0	27-Jun	22
Vance * (MN 82354)	13.8	58.5	29-Jun	20
ND 655 *	13.2	60.5	26-Jun	17
ND 658	12.9	62.0	25-Jun	20
Cutless *	12.9	61.0	27-Jun	20
Roblin	12.9	58.0	24-Jun	26
Pioneer 2385 *	12.7	59.5	25-Jun	19
ND 656	12.1	60.0	27-Jun	21
Butte 86	11.3	61.5	25-Jun	24
ND 643	10.7	57.0	29-Jun	18
Laura	7.7	58.0	28-Jun	21
* semidwarf				
Seeding Rate: 1,000,000 live seeds per acre				
Seeding Date: April 25 Harvest Date: Aug. 12				
Fertilizer Applied: 50 lbs./A 18-46-0				
Herbicide Applied: Hoelon/Buctril tank mix				
L.S.D. 5% = 6.1 Bu/A C.V. = 28.4%				

Table 2. Long Term Yields – Hard Red Spring Wheat, Dickinson

Variety	1985	1986	1987	1988	1989	Average
Alex	43.6	45.4	34.7	12.8	16.4	37.0
Norak	52.4	54.2	28.9	9.5	17.8	37.4
Len	52.9	54.6	32.7	7.7	16.8	36.0
Stoa	51.6	61.6	30.8	9.9	21.2	42.0
Leif	40.9	60.8	27.0	17.2	13.9	35.6
Columbus	40.8	51.8	37.4	7.0	18.9	35.1
Marshall	40.4	56.5	30.5	11.0	16.3	36.6
Pioneer 2369	37.2	60.6	35.5	10.6	21.8	39.4
Norseman	45.5	49.2	40.7	7.0	14.6	34.7
Cutless	47.3	49.2	30.1	5.5	18.0	30.9
Amidon	57.8	53.3	28.3	12.1	23.2	34.9
Butte 86	38.2	51.8	31.1	8.8	23.5	33.1
Celtic	51.1	51.2	27.2	7.7	21.4	31.7
Gus	46.1	56.1	25.9	9.9	20.2	31.6
Grandin	---	51.1	36.9	9.5	18.5	29.0
Nordic	---	65.5	29.7	11.0	21.7	32.0
Prospect	---	62.0	22.0	8.8	18.4	27.8
Telemark	---	58.0	27.0	8.8	22.0	28.9
LSD .05	6.9	7.9	4.0	3.2	4.7	5.6

Table 3. 1989 Dickinson Off-Station Hard Red Spring Wheat Variety Trials

Variety	Dickinson	Beach	Beulah	Glen Ullin	Hannover	Manning	Average 6 Sites
			Bushels per Acre				
Amidon	23.2	32.7	30.5	37.3	39.9	42.1	34.3
Butte 86	23.5	29.4	30.3	40.6	39.3	35.8	33.1
Cutless	18.0	31.9	25.3	36.6	32.2	34.9	29.8
Fjeld	18.6	34.1	30.0	44.6	42.1	39.9	34.9
Grandin	18.5	33.8	28.3	44.6	45.7	37.1	34.7
Gus	20.2	37.4	29.7	42.4	40.2	40.7	35.1
Leif	13.9	33.6	31.4	43.7	48.1	43.5	35.7
Len	16.8	36.3	28.1	42.9	41.3	38.2	33.9
Minnpro	17.7	30.0	25.6	42.9	43.5	38.5	33.0
Norseman	14.6	36.0	29.4	47.9	44.0	39.3	35.2
Pioneer 2369	21.8	37.1	30.0	46.2	46.5	42.6	37.4
Pioneer 2375	20.0	29.4	28.1	43.5	43.2	38.0	33.7
Stoa	21.2	31.1	30.3	47.0	41.3	41.3	35.3
Vance	19.8	34.1	28.1	45.9	45.9	39.3	35.5
Seeding Date:	May 5	May 8	May 5	May 10	May 9	May 4	
Harvest Date:	July 31	Aug. 11	Aug. 4	Aug. 7	Aug. 3	Aug. 1	
LSD 5% (Bu/A):	4.7	5.2	4.6	4.0	6.5	4.4	5.0
CV (%):	18.3	10.9	11.2	6.5	10.7	7.7	
Fertilizer Applied: according to soil test at each site.							
Herbicide Applied: Hoelon-Buctril tank mix							
Seeding Rate: 1 Bu/A							

Table 4. 1989 Dickinson Off-station Hard Red Spring Wheat Variety Trials

Variety	Dickinson	Beach	Beulah	Glen Ullin	Hannover	Manning	Average 6 Sites
			Test Wt. lbs./bu.				
Amidon	57.0	62.0	62.0	59.5	53.0	61.5	59.2
Butte 86	59.0	62.5	63.0	62.5	54.0	62.0	60.5
Cutless	58.5	63.0	63.0	62.0	56.0	62.0	60.8
Fjeld	55.0	61.0	62.0	61.0	58.0	60.5	59.6
Grandin	54.5	62.5	63.0	62.5	58.5	61.5	60.4
Gus	56.5	62.0	62.5	61.0	58.0	61.5	60.3
Leif	55.0	62.0	63.0	61.0	58.0	61.5	60.1
Len	57.0	61.5	63.5	61.0	57.0	62.0	60.3
Minnpro	53.5	59.5	60.5	60.0	56.0	59.5	58.2
Norseman	54.5	61.0	62.0	60.0	56.0	60.5	59.0
Pioneer 2369	58.5	62.5	63.5	63.0	59.0	63.0	61.6
Pioneer 2375	58.0	62.5	62.5	62.0	59.0	62.0	61.0
Stoa	55.5	62.0	62.0	62.0	59.5	61.0	60.3
Vance	56.5	60.5	62.5	61.0	55.5	60.0	59.3

Table 5. 1989 Dickinson Off-station Hard Red Spring Wheat Variety Trials

Variety	Dickinson	Beach	Beulah	Glen Ullin	Hannover	Manning	Average 6 Sites
Protein @ 14 % moisture							
Amidon	15.7	13.8	13.9	13.8	15.7	16.0	14.8
Butte 86	16.5	13.8	13.9	14.7	16.1	15.9	15.2
Cutless	17.1	14.8	14.9	14.5	16.1	17.0	15.7
Fjeld	16.1	13.0	12.7	13.9	14.8	15.6	14.4
Grandin	16.8	14.3	14.3	14.2	14.0	16.5	15.0
Gus	17.6	14.5	13.3	15.4	14.2	16.8	15.3
Leif	16.9	13.8	13.5	15.3	13.2	16.0	14.8
Len	17.1	14.5	13.9	15.3	13.7	16.5	15.2
Minnpro	17.6	14.8	14.6	16.0	16.5	17.3	16.1
Norseman	16.9	14.2	13.7	14.7	15.8	16.4	15.3
Pioneer 2369	16.9	13.5	14.1	15.0	13.7	15.9	14.9
Pioneer 2375	16.9	13.6	13.9	15.1	13.9	16.1	14.9
Stoa	16.6	13.9	13.7	13.7	15.3	15.7	14.8
Vance	17.2	14.3	13.7	15.1	13.6	15.5	14.9

Table 6. 1989 Dickinson Hard Red Spring Wheat Small Plot Trial.

Variety	Bu/A Avg.	Test Wt lbs.
Butte 86	23.5	59.0
Amidon	23.2	57.0
Telemark *	22.0	54.0
Pioneer 2369 *	21.8	58.5
Nordic *	21.7	57.0
Celtic *	21.4	58.5
Pioneer 2385 *	20.8	58.5
Stoa	21.2	55.5
ND 656	20.3	58.0
Gus *	20.2	56.5
ND 652	20.0	57.5
Pioneer 2375 *	20.0	58.0
Vance *	19.8	56.5
Columbus	18.9	53.0
Fjeld *	18.6	55.0
Grandin *	18.5	54.5
Roblin	18.5	53.5
Prospect *	18.4	57.0
ND 650 *	18.3	58.5
W 2501	18.2	53.0
Cutless *	18.0	58.5
Norak *	17.8	56.0
ND 658	17.8	57.5
Minnpro *	17.7	53.5
ND 657 *	17.6	57.0
SD 2980	17.5	57.5
Laura	17.4	56.5
ND 655 *	16.8	59.0
Len *	16.8	57.0
ND 653 *	16.7	57.0
Rambo *	16.6	58.0
Alex	16.4	58.0
Marshall *	16.3	54.5
W 2502	15.2	51.0
ND 654	15.0	57.5
Norseman *	14.6	54.5
Leif *	13.9	55.0
FA 982-220 *	13.9	53.0
ND 643	10.2	54.0
* semidwarf		
Seeding Rate: 1 Bu/A		
Seeding Date: May 5	Harvest Date: July 31	
Fertilizer Applied: 50 lbs. /A 18-46-0		
Herbicide Applied: Hoelon/Buctril tank mix		
L.S.D. 5% = 4.7 Bu/A	C.V. = 18.3%	

Table 7. 1989 Dickinson Durum Variety Trial

Variety	Bu/A Avg.	Test Wt Lbs.	Heading Date	Height in.
D 8380	28.1	62.0	04-Jul	24
D 8370	27.8	61.0	04-Jul	24
D8479	27.2	62.0	01-Jul	28
D 8475	27.2	62.0	30-Jun	28
Lloyd	26.4	61.0	01-Jul	24
D 84130	24.8	63.5	04-Jul	25
Medora	22.8	62.0	29-Jun	30
Rugby	22.8	61.0	30-Jun	29
Vic	22.8	61.5	01-Jul	31
D 8460	22.0	62.5	04-Jul	27
Renville	22.0	61.0	02-Jul	29
Monroe	21.7	61.5	27-Jun	30
CA 885-312	21.2	62.0	01-Jul	24
Regal	20.9	62.0	04-Jul	26
D 8302	20.6	61.5	01-Jul	24
D 8291	19.8	61.5	01-Jul	22
Ward	17.1	60.5	01-Jul	26
Seeding Rate: 1,000,000 live seeds /A (approx. 1 Bu/A)				
Seeding Date: May 2 Harvest Date: August 9				
Fertilizer Applied: 50 lbs./A 18-46-0				
Herbicide Applied: Hoelon/Buctril tank mix				
L.S.D. 5% = 6.6 Bu/A C.V. = 20.0 %				

Table 8. Long Term Yields – Durum, Dickinson

Variety	1985	1986	1987	1988	1989	Average
Lloyd	55.4	51.2	43.2	9.6	26.4	40.2
Vic	33.4	36.5	32.7	11.6	22.8	33.2
Ward	36.4	45.2	36.0	8.5	17.1	33.1
Monroe	42.0	44.1	34.4	9.9	21.7	36.3
Renville	38.1	44.2	41.0	9.6	22.0	31.0
Rugby	--	49.6	40.7	11.8	22.8	34.9
Medora	--	47.8	41.0	11.6	22.8	30.8
Regal	--	--	41.8	10.5	20.9	24.4
LSD .05	1.4	1.4	4.7	2.8	6.6	3.9

Table 9. 1989 Dickinson Off-station Durum Variety Trials

Variety	Dickinson	Beach	Beulah	Glen Ullin	Hannover	Manning	Average 6 Sites
Bushels per Acre							
Lloyd	26.4	32.7	32.5	52.0	26.7	46.8	36.2
Medora	22.8	33.8	31.6	50.2	23.7	40.4	33.8
Monroe	21.7	30.0	30.3	47.0	24.5	37.4	31.8
Renville	22.0	33.8	29.7	52.7	22.6	44.8	34.3
Ward	17.1	32.7	29.2	49.9	23.1	45.1	32.8
Test Wt. lbs./bu.							
Lloyd	61.0	61.0	62.5	56.0	58.5	58.5	59.6
Medora	62.0	63.0	64.0	58.5	61.0	63.0	61.9
Monroe	61.5	62.0	63.0	61.0	62.0	62.5	62.0
Renville	61.0	61.5	63.0	58.0	60.0	62.0	60.9
Ward	60.5	62.5	63.5	58.0	60.5	59.0	60.7
Seeding Date:	May 2	May 8	May 5	May 10	May 9	May 4	
Harvest Date:	Aug. 9	Aug. 11	Aug. 4	Aug. 7	Aug. 10	Aug. 1	
LSD 5 % (Bu/A):	6.6	2.6	3.0	10.3	3.9	7.6	6.3
CV (%):	20.0	5.3	6.3	13.3	10.5	11.5	
Fertilizer Applied: according to soil test at each site.							
Herbicide Applied: Hoelon-Buctril tank mix							
Seeding Rate: 1 Bu/A							

Table 10. 1989 Dickinson Durum Small Plot Trial

Variety	Bu/A Avg.	Test Wt. lbs.
Monroe	14.5	57.0
D 8302	13.7	58.0
CA 885-312	13.5	56.0
Vic	12.9	60.5
Medora	11.9	58.0
D 8475	11.9	58.0
Renville	10.9	57.0
Lloyd	10.7	56.0
Ward	9.9	59.5
Regal	9.8	60.0
D 8460	9.2	58.0
D 8291	9.1	58.0
D 8479	9.0	57.0
Rugby	8.3	59.0
D 8370	5.7	56.5
D 8380	3.1	57.0
D 84130	2.8	58.5
Seeding Rate: 1 Bu/A		
Seeding Date: May 5		Harvest Date: August 1
Fertilizer Applied: 50 lbs. /A 18-46-0		
Herbicide Applied: Buctril/Hoelon tank mix		
L.S.D. 5% = 3.2 Bu/A	C.V. = 23.0 %	

Hard Red Winter Wheat and Winter Rye

The severe drought of 1988 resulted in extremely unfavorable growing conditions for fall seeded small grain. Precipitation during the fall of 1988, September through December was nearly an inch-and-a-half below average and continued the deficit experienced throughout the summer. There was insufficient soil water at the Dickinson Research Center in the fall of 1988 for uniform germination and fall growth of winter grains.

Farther south and west of Dickinson, more favorable soil water conditions existed. Hard red winter wheat in trials at Hettinger, New Leipzig, and Scranton, produced yields ranging from 15.6 to 48.5 bushels per acre. Winter rye at Hettinger average 59.2 bushels and at New Leipzig 35.6 bushels per acre.

Table 11. Long Term Yields – Hard Red Winter Wheat, Dickinson

Variety	1984	1985	1986	1987	1988	1989	Average
Roughrider	44.1	52.1	46.5	20.8	0.0	0.0	27.3
Winoka	45.4	44.6	48.4	24.2	0.0	0.0	27.1
Agassiz	45.9	50.0	50.6	17.3	0.0	0.0	27.3
Siouxland	--	--	59.4	11.8	0.0	0.0	17.8
Seward	--	--	--	24.4	0.0	0.0	8.1
LSD .05	7.3	2.5	3.8	4.8	0.0	0.0	4.0
Yield averages include value of 0 for 1988 and 1989.							

Table 12. Long Term Yields – Winter Rye, Dickinson

Variety	1984	1985	1986	1987	1988	1989	Average
Chaupon	62.8	72.7	49.1	53.9 *	15.9	0.0	42.4
Musketeer	48.4	65.4	35.4	37.6	15.2	0.0	33.7
Puma	49.9	62.5	43.2	33.9	8.5	0.0	33.0
Frederick	--	--	33.0	35.1	15.0	0.0	20.8
LSD .05	10.4	7.5	4.8	3.6	3.2	0.0	5.9
* Chaupon II							
Yield averages include value of 0 for 1989.							

Table 13. 1989 Dickinson Barley Variety Trial

Variety	Bu/A Avg.	Test Wt. lbs.	Heading Date	Height in.
ND 9870	44.3	50.0	29-Jun	25
Hector	44.0	48.0	01-Jul	23
MT 81616	41.6	44.0	04-Jul	21
Gallatin	41.3	47.0	29-Jun	22
Lewis	39.9	49.0	02-Jul	25
ND 9147	37.8	47.5	02-Jul	20
Hazen *	35.1	44.0	01-Jul	22
ND 9866	33.7	49.0	28-Jun	27
Robust *	32.7	48.0	02-Jul	23
Azure *	31.6	45.5	03-Jul	20
B 1602 *	28.2	47.0	02-Jul	20
Morex *	28.2	44.5	28-Jun	26
Bowman	26.1	48.0	27-Jun	22
M 52 *	25.1	42.5	02-Jul	19
B 1603 *	22.3	44.0	01-Jul	22
Ellice	18.9	48.0	04-Jul	22
* 6-row				
Seeding Rate: 1.3 Bu/A				
Seeding Date: May 2		Harvest Date: July 31		
Fertilizer Applied: 50 lbs./A 18-46-0 drill plus 45 lbs./A P and 70 lbs./A N broadcast				
Herbicide Applied: Buctril/Hoelon tank mix				
L.S.D. 5% = 7.6 Bu/A		C.V. = 16.1%		

Table 14. Long Term Yields – Barley, Dickinson

Variety	1985	1986	1987	1988	1989	Average
Azure	66.4	76.0	61.9	7.2	31.6	59.7
Bowman	73.6	82.2	52.3	14.8	26.1	57.4
Morex	77.4	85.6	56.4	11.7	28.2	54.9
Robust	75.3	79.8	61.5	8.9	32.7	55.9
Hazen	64.7	86.6	61.2	10.3	35.1	58.3
Hector	68.3	80.8	70.5	19.3	44.0	59.5
Lewis	77.5	95.9	63.3	14.4	39.9	58.2
Gallatin	--	99.3	72.5	15.5	41.3	61.9
Ellice	--	96.3	64.6	4.5	18.9	51.1
LSD .05	10.7	7.3	4.5	4.2	7.6	7.3

Table 15. 1989 Dickinson Off-station Barley Variety Trials

Variety	Dickinson	Beach	Beulah	Glen Ullin	Hannover	Manning	Average 6 Sites
Bushels per Acre							
Azure	31.6	50.9	52.3	51.6	45.0	57.1	48.1
Bowman	26.1	55.3	54.0	61.2	48.5	65.0	51.7
Gallatin	41.3	52.3	60.8	64.6	49.8	68.4	56.2
Hector	44.0	55.0	58.1	60.8	49.8	70.1	56.3
Morex	28.2	51.6	52.3	55.3	47.8	54.7	48.3
Robust	32.7	52.3	49.8	50.2	46.4	52.9	47.4
Test Wt. lbs./bu.							
Azure	45.5	46.0	46.0	49.0	44.0	47.5	46.3
Bowman	48.0	48.0	49.0	49.5	48.0	52.5	49.2
Gallatin	47.0	47.0	48.0	51.0	46.0	50.5	48.3
Hector	48.0	48.5	47.0	50.0	46.5	50.5	48.4
Morex	44.5	46.0	46.0	50.0	44.0	47.0	46.3
Robust	48.0	49.0	47.5	50.5	44.0	49.0	48.0
Seeding Date:	May 2	May 8	May 5	May 10	May 9	May 4	
Harvest Date:		Aug. 11	Aug. 8	Aug. 7	Aug. 10	Aug. 1	
LSD 5% (Bu/A):	7.6	3.9	2.7	4.5	2.6	5.3	4.8
CV (%):	16.1	4.9	3.3	5.2	3.6	5.7	
Fertilizer Applied: according to soil test at each site.							
Herbicide Applied: Hoelon-Buctril tank mix							
Seeding Rate: 1.3 Bu/A							

Table 16. 1989 Dickinson Barley Small Plot Trial

Variety	Bu/A Avg.	Test Wt lbs.
ND 9870	27.6	42.0
Hector	26.7	44.0
ND 9866	25.5	42.0
Azure	24.4	37.5
Gallatin	23.4	43.5
Robust	21.2	40.5
Morex	20.5	35.5
M 52	19.8	37.0
Bowman	19.7	40.0
Lewis	19.4	44.0
B 1603	18.1	34.5
Hazen	17.1	37.0
B 1602	16.9	40.5
MT 81616	15.4	44.0
ND 9147	10.5	42.5
Ellice	5.0	43.5
Seeding Date: May 5	Harvest Date: July 25	
Fertilizer Applied: 50 lbs./A 18-46-0		
Herbicide Applied: Buctril/Hoelon tank mix		
L.S.D. 5 % Bu/A	C.V. = 19.2%	

Table 17. 1989 Dickinson Oats Variety Trial

Variety	Bu/A Avg.	Test Wt lbs.	Heading Date	Height in.
Otana	44.6	32.5	01-Jul	65
ND 820744	39.9	34.0	30-Jun	57
ND 820294	39.9	29.5	30-Jun	62
Riel	39.4	34.5	30-Jun	54
ND 840341	38.8	36.5	30-Jun	60
ND 830775	37.6	37.0	04-Jul	53
ND 830185	37.6	37.0	30-Jun	64
ND 840769	35.9	35.0	30-Jun	64
ND 820559	35.9	31.5	30-Jun	59
ND 831122	35.9	31.5	28-Jun	57
ND 821742	35.3	32.5	01-Jul	55
Steele	34.2	32.0	30-Jun	63
Valley	33.0	35.0	30-Jun	54
Trucker	32.4	37.0	29-Jun	66
ND 841974	31.8	37.0	02-Jul	59
Dumont	31.8	35.0	02-Jul	64
Hytest	31.3	36.5	28-Jun	72
ND 840413	31.3	35.5	30-Jun	63
Monida	28.9	31.0	05-Jul	61
ND 810104	28.9	29.5	27-Jun	64
ND 830646	28.4	35.0	30-Jun	55
Porter	26.5	33.5	03-Jul	62
ND 840876	22.6	34.0	04-Jul	55
Robert	14.7	32.5	01-Jul	55
Tibor	12.7	40.0	30-Jun	63
Seeding Rate: 1.5 Bu/A				
Seeding Date: May 3		Harvest Date: July 31		
Fertilizer Applied: 50 lbs./A 18-46-0				
Herbicide Applied: Buctril				
L.S.D. 5 % = 4.4 Bu/A		C.V. = 8.3%		

Table 18. Long Term Yields – Oats, Dickinson.

Variety	1985	1986	1987	1988	1989	Average
Otana	81.3	101.6	77.0	12.2	44.6	69.3
Dumont	82.9	116.5	84.5	9.1	31.8	72.9
Steele	76.4	106.2	73.5	20.8	34.2	67.7
Monida	85.0	126.8	86.8	24.8	28.9	70.5
ND 810104	98.5	124.8	50.4	6.5	28.9	61.8
Porter	81.2	114.0	78.7	23.4	26.5	74.6
Valley	91.5	126.3	61.4	19.5	33.0	66.3
Hytest	--	99.5	55.0	14.8	31.3	50.1
Riel	--	112.4	67.7	14.3	39.4	58.4
LSD .05	7.3	15.5	6.9	4.9	4.4	8.8

Table 19. 1989 Dickinson Off-station Oat Variety Trials

Variety	Dickinson	Beach	Beulah	Glen Ullin	Hannover	Manning	Average 6 Sites
Bushels per Acre							
Dumont	31.8	42.5	52.1	64.3	35.2	61.2	47.9
Monida	28.9	47.8	58.6	76.9	47.8	55.6	52.6
Riel	38.8	32.1	57.8	61.7	39.9	56.4	47.8
Valley	33.0	36.0	49.1	55.6	36.0	56.4	44.4
ND 810104	28.9	43.0	53.8	58.6	40.4	57.8	47.1
Test Wt. lbs./bu.							
Dumont	35.0	35.0	37.0	37.0	35.5	37.0	36.1
Monida	31.0	34.0	37.5	37.0	34.0	36.0	34.9
Riel	34.5	38.0	36.5	36.0	36.0	36.5	36.3
Valley	35.0	37.5	36.5	38.5	33.0	39.5	36.7
ND 810104	29.5	33.0	34.0	35.0	32.5	36.0	33.3
Seeding Date:	May 3	May 8	May 5	May 10	May 9	May 4	
Harvest Date:	July 31	Aug. 11	Aug. 4	Aug. 7	Aug. 3	Aug. 1	
LSD 5% (Bu/A):	4.4	9.8	8.0	8.9	3.2	6.1	7.1
CV (%):	8.3	15.6	9.5	9.1	5.1	6.9	
Fertilizer Applied: according to soil test at each site.							
Herbicide Applied: Buctril							
Seeding Rate: 1.5 Bu/A							

Table 20. 1989 Dickinson Oats Small Plots Trial

Variety	Bu/A Avg.	Test Wt lbs.
Monida	40.5	31.5
Otana	39.5	35.0
Riel	37.4	33.0
ND 820294	37.0	31.0
Dumont	36.5	29.0
ND 840341	35.9	28.5
ND 830775	35.9	32.0
ND 820559	35.8	31.5
ND 821742	35.8	31.5
ND 810104	34.8	29.5
Porter	34.8	30.0
ND 831122	34.7	34.0
ND 830646	34.6	32.0
ND 820744	33.7	31.5
ND 840876	33.4	30.0
ND 840413	33.3	33.0
Robert	32.8	24.0
ND 840769	32.6	24.5
Valley	32.5	33.0
ND 830185	31.8	26.5
Steele	31.4	29.0
ND 841974	28.1	24.0
Trucker	26.2	36.5
Hytest	26.1	33.5
Tibor	18.3	40.0
Seeding Date: May 8 Harvest Date: August 11		
Fertilizer Applied: 50 lbs/A 18-46-0 + 80 lbs/A 46-0-0		
Herbicide Applied: Buctril		
L.S.D. 5% = 5.3 Bu/A C.V. = 11.3%		

Miscellaneous Small Grains

Speltz has been grown at the Dickinson station since 1907. Triticale has been grown in production trials since its development in the 1950's and has also been used in feeding trials with beef cattle and swine. Spring rye has also been grown intermittently over the past fifty years.

Production trials with miscellaneous small grains continue on a limited basis to determine adaptability of newly developed varieties. Production of these miscellaneous species is often not equal to the more commonly grown cereal grains. However, they sometimes can be used as non-compliance crops in the federal farm program where acreage of the commonly grown types is restricted. For this reason, farmers are interested in comparative performance.

Table 21. 1989 Dickinson Misc. Small Grain Variety Trial

Variety	Lbs./A Avg.	Test Wt lbs.	Height in.
Bowman Barley	1930.5	50.0	24
Speltz	1600.5	39.0	26
Gazelle Spr. Rye	1072.5	55.5	31
Kramer Triticale	759.0	50.0	24
Seeding Date: May 2		Harvest Date: July 31	
Fertilizer Applied: 50 lbs/A 18-46-0			
Herbicide Applied: Hoelon/Buctril tank mix			
L.S.D. 5% = 232.3 Lbs/A		C.V. = 10.8%	

Table 22. Dickinson Misc. Small Grains 4-yr Average

Variety	1989	1988	1987	1986	Average
Bowman Barley	1931	247	1699	3946	1956
Speltz	1601	160	908	3268	1484
Kramer Triticale	759	13	662	3168	1151
Otana Oats	--	--	1303	3861	--

Safflower Production in Southwestern North Dakota

Safflower is a crop of minor importance in southwestern North Dakota as well as statewide. Trials at the Dickinson Branch Station are conducted in cooperation with the Williston Branch Station where variety improvement has been a cooperative effort with that station and the Eastern Montana Agricultural Research Center, Sidney, Montana.

S-208, S-541, Girard, Finch, and Hartman are recommended varieties for western North Dakota.

Table 23. 1989 Dickinson Safflower Improvement Trial (Project 6386).

Variety	Lbs/A Avg.	Test Wt lbs.
85B 4829	559.3	40.5
Finch	546.0	42.0
S-208	493.4	40.5
S-541	475.2	40.5
Girard	436.7	40.5
MT 3697	418.4	41.0
Seeding Rate: 30 lbs/A		
Seeding Date: May 9 Harvest Date: Sept. 14		
Fertilizer Applied: 65 lbs/A 18-46-0 + 100 lbs/A 46-0-0, broadcast		
Herbicide Applied: 1.5 pt/A Treflan, ppi		
L.S.D. 5% = 120.3 Bu/A C.V. = 16.3%		

Table 24. Long term Yields – Safflower, Dickinson.

Variety	1985	1986	1987	1988	1989	Average
Finch	1182	1484	958	809	546	996
S-541	1223	1552	1220	788	475	1052
S-208	1144	1636	1002	747	493	1004
Girard	1087	1531	1210	747	437	1002
Hartman	886	1088	1045	--	--	--
819-1-2	--	--	--	747	--	--
MT 3697	--	--	--	498	418	--

Buckwheat Production in Southwestern North Dakota

Buckwheat can be grown successfully in southwestern North Dakota, but has become popular with area farmers, and is considered to be a crop of minor importance in the Missouri Slope region.

Grain yields at various experiment station locations in North Dakota over the past few years have varied depending on the growing season. Yields recorded in Dickinson station trials are equal or better than those recorded in other areas of the state.

Construction of the MinnDak elevator in Dickinson in 1988, belonging to a company which specializes in buckwheat and other specialty crops may help to increase the acreage of these crops in southwest North Dakota by providing a ready market for them.

Table 25. 1989 Dickinson Buckwheat Variety Trial

Variety	Lb/A Avg.	Test Wt lbs.
Common	249.2	42.5
Mancan	182.5	36.0
Giant American	144.1	35.0
Manor	0.0	NA
Note: Yields are from nonreplicated samples		
Seeding Rate: 50 lbs/A		
Seeding Date: June 15 Harvest Date: Sept 15		
Fertilizer Applied: 50 lbs/A 18-46-0		

Table 26. Long term yields – Buckwheat, Dickinson.

Variety	1985	1986	1987	1988	1989	Average
Mancan	1826	1290	1810	338	183	1089
Manor	2116	1523	1810	338	0	1157
Windsor Royal	1697	1172	1894	--		
Common	2280	1380 *	3016	637	249	1512
* calculated missing value..						

Dry Edible Bean Production

In 1988, the most recent year for which figures are available, dry beans were grown on 28,000 acres in the 14 county Missouri Slope region. This was an increase over the 1987 bean acreage of 16,000 acres, and represented 7% of the total bean acreage in the state. Production in the Slope region and statewide in 1988 was seriously affected by the drought, averaging 3.1 cwt/acre in the west and 7.3 statewide. Yields in 1987 were 8.6 cwt/acre in the west and 13.6 cwt/acre statewide. Production at the station was slightly better than the average for the Missouri Slope region, at 4.9 cwt/acre. Average yield in 1989 was 4.4 cwt/acre.

Table 27. 1989 Dickinson Bean Variety Trial.

Variety	Lbs/A Avg.	Test Wt lbs.	Seeding Rate lbs/A	Row Width in.
Hyden navy	399.0	58.0	45	30
Othello pinto	648.0	56.5	45	30
Nodak pinto	243.0	58.5	65	30
UC-5 Garbanzo	297.1	58.5	100	10
Can. Field Pea	597.4	63.0	100	10
Seeding Date: June 5 Harvest Date: Sept. 14				
Fertilizer Applied: 50 lbs/A 18-46-0				
Herbicide Applied: Treflan, ppi				
L.S.D. 5% = 113.4 Lbs/A C.V. = 16.7%				

Millet

Foxtail and Proso millets are among the oldest hay crops grown at the Dickinson Branch Station. Results of comparison trials with millets and other crop species used as annual hay crops are recorded in the station's first annual report dated 1907. One of the millet varieties grown that year, Siberian, was also included in the 1989 trials, and continues to be one of the better yielding varieties most years. However, growing conditions were unfavorable for millet in 1989 and while there was some grazing possible on fields of millet, poor growth prevented cutting for hay.

The Proso millets, both red and white, are grown principally for grain. Hay from Proso and German foxtail is inferior in quality to that made from Siberian millet.

Table 28. Dickinson Millet Variety Trial

Variety	Hay yield tons/A 1987	1988	1989	3-yr. Avg.
White Proso	2.0	2.1	0.0	1.4
Red Proso	1.7	2.2	0.0	1.3
German foxtail	1.9	1.8	0.0	1.2
Siberian	1.6	1.9	0.0	1.2
Oats	1.3	0.8	0.0	0.7

Hybrid Corn Comparison Trial

As shown in Table 29, corn silage and grain yields were very good considering the severe drought that prevailed throughout the growing season of 1988. This once again emphasized the adaptability of corn as an alternative crop for southwest North Dakota and the advisability of utilizing it in the diversified crop-livestock production systems recommended for southwest North Dakota.

Table 29. 1989 Dickinson Hybrid Corn Trial.

Hybrid	Silage Tons/A	Harvest Moisture	Grain Bu/A	Test Wt. Lbs/Bu
Top Farm TFSX 1185	12.1	60.0%	51.2	54.9
Cargill 2127	12.0	62.9%	47.2	54.8
Seedtec ST 7148	11.5	66.7%	50.5	52.6
Pioneer 3963	11.3	60.4%	44.6	53.5
Jacques 2750	10.7	60.9%	53.2	56.0
SW Grain mod. 1-way	10.6	59.4%	52.7	52.9
Dahlgren DC-440	10.4	66.6%	46.2	51.2
Top Farm TFSX 1181	10.4	62.0%	44.8	54.8
Interstate Silo King	10.3	59.5%	41.3	56.4
Dahlgren K1114	9.7	62.0%	38.9	55.8
Jacques 3630	9.3	67.1%	43.7	53.0
Pioneer 3902	9.3	64.8%	49.6	54.9
Interstate 313	9.1	67.8%	48.2	55.1
Cargill 809	9.1	61.7%	53.5	55.1
Jacques 2950	8.2	64.4%	46.7	51.6
SW Grain 4-way	7.6	65.4%	33.2	54.4
Moisture Basis:	70%		15.5%	
Seeding date: May 15				
Harvest Date:	Sept. 6		Oct. 2	
L.S.D. 5% =	2.8 tons/A		8.6 bu/A	
C.V. =	19.6%		13.0%	
Seeding Rate: 18,000 seeds/A				
Row Width: 36 inches				
Harvest Population: 13,193 plants/A				
Herbicide Applied: Prowl, preemergence				

Hybrid Sunflower Comparison Trial

Sunflower hybrid comparison trials at Dickinson and Hettinger included nineteen entries in 1989. Total precipitation at Hettinger for the twelve month growing season was 16.72 inches which was above average and adequate for good crop yields. At Dickinson, the twelve month precipitation was 11.52 inches, nearly 4.5 inches, below average and droughty conditions begun in 1988 continued. Considering the droughty character of the season the sunflower crop developed well at Dickinson but was rendered unusable for experimental purposes because of severe bird damage. Results from Hettinger are given in Table 30 to show production under the more favorable weather conditions prevailing at that location.

Table 30. 1989 Hettinger Sunflower Trial

Hybrid	Yield lbs/A	Test Weight lbs/bu	Oil Content %
Pioneer 6240	2462	30.1	46.6
Cargill SF 207	2237	31.7	37.7
Contiseed Hysun 354	1967	29.6	48.1
Cenex 8101	1956	30.0	48.2
Cargill SF 187	1945	30.2	38.6
Dahlgren DO-827	1900	30.7	45.8
Northrup King Sunbred 277	1900	30.2	45.6
Cargill SF 100	1877	31.6	41.9
Seedtec 317	1753	29.0	48.4
Seedtec 330	1720	31.3	47.6
Jacques Ex. 8713	1697	32.4	48.6
Interstate 3311	1607	32.2	47.3
Pioneer 6440	1596	31.0	48.2
Dahlgren DO-707	1551	30.8	43.9
Genetic Resources SN-881	1517	32.9	47.6
Interstate Ex. 65099	1517	29.9	48.6
AgriPro 4200	1495	31.9	51.4
Contiseed Hysun 340	1495	28.6	49.4
Northrup King S-1296	1236	31.0	40.9
Trial Mean	1770	30.8	
C.V. %	25	3.2	
LSD 5%	n.s.	1.4	
Planting Date: 5/16/89			
Plant Population: 18,000 plants/A			
Row Width: 30”			
Fertilizer Applied: 200 lbs/A 28-29-0 + 200 lbs/A 46-0-0			
Herbicide Applied: 2.25 pt/A Eptam + 1.5 pt/A Treflan EC, pre-plant incorporated			
n.s. = no statistical difference between hybrids.			
Yield adjusted to 9% moisture; oil content based on dry weight.			

Cooperative Small Grain Nursery Trials

Plantings in 1989 included: Uniform Regional Hard Red Spring Wheat, Project leader Dr. Robert Busch, University of Minnesota; Uniform Regional Durum, Project leader Dr. R. G. Cantrell, North Dakota State University; Uniform Early and Midseason Oats, Project leader Dr. Howard Rines, University of Minnesota; Western Spring Barley and Western Dryland Spring Barley, Project leader Dr. E.A. Hockett, Montana State University; and Advanced Two-row Barley Nursery, cooperator Dr. Jerry Franckowiak, North Dakota State University. Field performance reports are furnished to respective project leaders for evaluation and compilation into composite regional reports. Required samples for quality analysis are furnished to appropriate state or USDA cereal chemistry laboratories upon request of respective project leaders. Trials included 31 varieties and experimental lines in the Uniform Regional Hard Red Spring Wheat trial; 30 lines in the Uniform Regional Durum Nursery; 79 varieties and experimentals in three barley nurseries; and 65 varieties and experimental cultivars in the Uniform Early and Midseason Oat nurseries.

Yields in all nursery plantings were below average, reflecting the droughty conditions that prevailed in July. Hard red spring wheat yields ranged from a low of 13.9 to high of 23.1 bushels per acre. Durum yields ranged from 13.0 to 24.3 bushels per acre. The highest barley yield in 1989 was 43.4 bushels per acre from ID 85453. Low barley yield was 5.1 bushels per acre. Oat yields ranged from a high of 44.1 bushels to 14.0 bushels per acre.

Table 31. 1989 Uniform Regional Hard Red Spring Wheat Nursery

Entry No.	Entry	Bu/A Avg.	Test Wt. lbs.	Heading Date	Height in.	1000 K.W. grams
1	Marquis	13.9	60.0	05-Jul	25	25
2	Chris	14.3	57.0	03-Jul	25	19
3	Stoa	19.3	57.0	29-Jun	26	19
4	Era	14.0	59.0	04-Jul	19	22
5	Butte 86	19.9	58.0	28-Jun	24	24
6	SD 3005	21.6	56.0	26-Jun	26	21
7	SD 3014	16.3	57.0	30-Jun	25	23
8	SD 3026	21.5	59.0	27-Jun	26	27
9	SD 3032	21.5	59.5	27-Jun	26	28
10	SD 3036	20.0	59.5	28-Jun	27	25
11	MN 85324	20.1	59.5	04-Jul	24	31
12	MN 86018	21.8	59.0	29-Jun	25	25
13	MN 86151	21.2	56.0	01-Jul	19	24
14	MN 86329	21.5	58.5	29-Jun	21	27
15	MN 86383	19.3	59.0	29-Jun	22	25
16	ND 650	22.7	60.5	03-Jul	22	24
17	ND 652	18.2	59.0	01-Jul	21	25
18	ND 653	19.5	59.0	30-Jun	25	23
19	ND 655	21.5	59.5	30-Jun	25	23
20	ND 658	22.8	59.5	28-Jun	27	24
21	HS85-902	14.8	60.0	03-Jul	19	31
22	N86-370	16.8	59.0	02-Jul	20	21
23	N86-476	17.0	58.0	28-Jun	21	22
24	HS85-476	15.5	56.0	03-Jul	19	25
25	HS85-674	17.8	57.5	03-Jul	17	28
26	2375	21.5	59.0	30-Jun	25	27
27	2370	19.7	59.0	29-Jun	22	26
28	DA984-034	18.4	58.5	01-Jul	18	27
29	WA 7493	23.1	57.0	29-Jun	20	28
30	WA 7494	16.0	56.0	02-Jul	21	25
31	BW 114	15.5	57.0	03- Jul	24	21
Seeding Date: May 4				Harvest Date: July 28		
LSD .05 = 5.6 Bu/A						

Table 32. 1989 Uniform Regional Durum Nursery

Entry No.	Entry	Bu/A Avg.	Test Wt. lbs.	Heading Date	Days to Head	Height in.	1000 K.W. Grams
1	Mindum	20.2	60.0	07-Jul	64	34	39.0
2	Stoa	21.9	59.0	02-Jul	59	28	23.0
3	Ward	24.0	61.5	02-Jul	59	29	34.0
4	Rugby	20.2	61.5	03-Jul	60	28	34.0
5	Vic	22.4	61.0	01-Jul	58	28	43.0
6	Lloyd	19.9	60.0	04-Jul	61	22	38.0
7	Monroe	22.1	61.0	29-Jun	56	27	38.0
8	Renville	19.5	60.0	02-Jul	59	26	30.0
9	Medora	23.3	62.0	01-Jul	58	26	37.0
10	Sceptre	19.0	61.0	02-Jul	59	24	32.0
11	Regal	20.0	61.0	04-Jul	61	25	39.0
12	D 8291	20.4	60.5	03-Jul	60	21	33.0
13	D 8302	20.2	60.5	01-Jul	58	22	33.0
14	D 8370	23.4	60.5	04-Jul	61	19	28.0
15	D 8380	18.7	61.5	04-Jul	61	19	32.0
16	D 8460	20.3	60.0	02-Jul	59	24	30.0
17	D 8475	21.9	61.5	01-Jul	58	24	30.0
18	D 8479	21.7	60.0	03-Jul	60	23	35.0
19	D 84130	13.0	61.0	04-Jul	61	19	38.0
20	D 86061	20.0	60.5	04-Jul	61	18	30.0
21	D 86078	24.3	61.0	02-Jul	59	18	34.0
22	D 86013	15.6	60.5	01-Jul	58	18	28.0
23	D 86117	20.6	61.5	02-Jul	59	21	33.0
24	D 86237	21.6	60.5	01-Jul	58	23	30.0
25	D 86398	16.2	60.0	03-Jul	60	22	33.0
26	D 86418	17.8	61.0	03-Jul	60	22	32.0
27	D 86442	17.6	60.5	30-Jun	57	20	32.0
28	D 86464	15.9	59.5	04-Jul	61	24	32.0
29	D 86468	20.5	60.5	01-Jul	58	27	35.0
30	CA885-312	17.8	61.0	30-Jun	57	22	35.0
Seeding Date: May 4				Harvest Date: August 1			
LSD .05 = 8.2 Bu/A							

Table 33. 1989 Advanced 2-row Barley Nursery

Entry No.	Entry	Bu/A Avg.	Test Wt. Lbs.	Heading Date	Heading fr 1/1	Height In.
1	Bowman	31.4	49.5	29-Jun	179	21
2	Hazen	27.5	48.0	01-Jul	181	22
3	Lewis	35.3	48.0	04-Jul	184	19
4	Morex	31.1	45.0	02-Jul	182	20
5	ND 7691	34.6	48.5	30-Jun	180	22
6	ND 10232	26.3	43.0	28-Jun	178	19
7	ND 10242	36.3	48.5	30-Jun	180	20
8	ND 10244	36.1	48.0	02-Jul	182	22
9	ND 10249	33.5	49.0	04-Jul	184	23
10	ND 10252	37.8	50.5	28-Jun	178	24
11	ND 10260	29.8	47.0	04-Jul	184	23
12	ND 10266	36.7	45.5	01-Jul	181	21
13	ND 10270	38.1	49.5	28-Jun	178	22
14	ND 10277	31.3	47.5	28-Jun	178	21
15	ND 10278	34.0	47.5	28-Jun	178	23
16	ND 10341	28.0	45.5	01-Jul	181	20
17	ND 10342	30.6	44.0	01-Jul	181	22
18	ND 10364	34.6	49.0	28-Jun	178	22
19	ND 10394	28.8	44.5	27-Jun	177	22
20	ND 10403	31.9	49.0	28-Jun	178	25
21	ND 10413	31.8	45.0	28-Jun	178	21
22	ND 10419	32.1	45.0	30-Jun	180	20
23	ND 10421	31.2	46.0	30-Jun	180	21
24	ND 10454	32.7	46.5	27-Jun	177	22
25	ND 10469	30.8	49.0	27-Jun	177	22
Seeding Date: May 4				Harvest Date: July 24		
LSD .05 = 7.6 Bu/A						

Table 33. 1989 Advanced 2-row Barley Nursery

Entry No.	Entry	Bu/A Avg.	Test Wt. Lbs.	Heading Date	Heading fr 1/1	Height In.
1	Bowman	31.4	49.5	29-Jun	179	21
2	Hazen	27.5	48.0	01-Jul	181	22
3	Lewis	35.3	48.0	04-Jul	184	19
4	Morex	31.1	45.0	02-Jul	182	20
5	ND 7691	34.6	48.5	30-Jun	180	22
6	ND 10232	26.3	43.0	28-Jun	178	19
7	ND 10242	36.3	48.5	30-Jun	180	20
8	ND 10244	36.1	48.0	02-Jul	182	22
9	ND 10249	33.5	49.0	04-Jul	184	23
10	ND 10252	37.8	50.5	28-Jun	178	24
11	ND 10260	29.8	47.0	04-Jul	184	23
12	ND 10266	36.7	45.5	01-Jul	181	21
13	ND 10270	38.1	49.5	28-Jun	178	22
14	ND 10277	31.3	47.5	28-Jun	178	21
15	ND 10278	34.0	47.5	28-Jun	178	23
16	ND 10341	28.0	45.5	01-Jul	181	20
17	ND 10342	30.6	44.0	01-Jul	181	22
18	ND 10364	34.6	49.0	28-Jun	178	22
19	ND 10394	28.8	44.5	27-Jun	177	22
20	ND 10403	31.9	49.0	28-Jun	178	25
21	ND 10413	31.8	45.0	28-Jun	178	21
22	ND 10419	32.1	45.0	30-Jun	180	20
23	ND 10421	31.2	46.0	30-Jun	180	21
24	ND 10454	32.7	46.5	27-Jun	177	22
25	ND 10469	30.8	49.0	27-Jun	177	22
Seeding Date: May 4				Harvest Date: July 24		
LSD .05 = 7.6 Bu/A						

Table 34. 1989 Western Spring Barley Nursery

Entry No.	Entry	Bu/A Avg.	Test Wt lbs.	Heading fr 1/1	Height in.	---------Plumpness %----------		
						6/64	5.5/64	Pan
1	Trebi	22.7	41.0	05-Jul	23	22.4	57.3	20.2
2	Steptoe	24.8	38.0	27-Jun	23	11.4	68.6	20.0
3	Klages	16.8	41.0	29-Jun	20	16.3	50.4	33.3
4	Morex	20.5	41.0	30-Jun	NA	16.9	51.9	31.2
5	WA 102178	21.8	43.5	01-Jul	22	17.8	57.5	24.5
6	BA 4039	19.6	43.0	02-Jul	21	24.8	23.9	51.1
7	BA 8529	23.5	44.0	03-Jul	22	56.8	18.1	25.1
8	ID 82519	26.7	43.5	04-Jul	23	7.9	60.0	31.9
9	ID 71966	24.7	38.0	28-Jun	23	41.6	34.9	23.3
10	MT 83533	17.0	45.5	07-Jul	22	66.8	26.0	7.5
11	MT 140523	25.9	45.0	09-Jul	22	12.4	63.9	23.8
12	ND 9147	20.0	47.0	06-Jul	20	59.1	24.1	16.8
13	OR 842008	8.3	47.5	15-Jul	19	79.9	15.6	4.4
14	OR 842011	6.2	47.0	15-Jul	17	50.6	39.4	9.8
15	UT 1075	18.3	41.0	10-Jul	20	16.2	58.8	25.0
16	UT 2507	35.6	43.0	30-Jun	22	33.4	55.5	10.9
17	WA 94483	11.5	44.0	14-Jun	19	37.9	29.6	32.4
18	BA 2601	22.4	41.5	03-Jul	18	41.9	38.5	19.4
19	ID 8540	26.8	38.5	28-Jun	23	41.3	26.9	32.2
20	MN 52	18.5	39.0	03-Jul	19	12.3	58.6	29.4
21	MT 83435	22.4	44.0	07-Jul	20	46.5	22.2	31.3
22	MT 851032	20.7	45.0	07-Jul	20	44.6	25.0	31.4
23	ND 9866	29.1	45.5	29-Jun	24	71.9	19.5	8.6
24	OR 1	8.8	45.5	07-Jul	19	22.1	59.1	19.2
25	OR 8623	15.7	43.0	25-Jun	15	68.2	22.7	9.1
26	PB 107	5.1	44.5	14-Jul	18	33.5	45.5	21.0
27	UT 502358	21.0	37.5	04-Jul	18	35.1	50.6	14.3
28	WA 9029	21.9	45.5	07-Jul	19	67.4	24.1	8.2
29	WA 12629	12.7	45.5	07-Jul	16	59.8	27.2	13.0
30	WP 584118	21.8	41.0	04-Jul	16	37.5	49.0	13.5
Seeding Date: May 4				Harvest Date: August 1				
LSD .05 = 5.6 Bu/A								

Table 35. 1989 Wester Dryland Barley Nursery

Entry No.	Entry	Bu/A Avg.	Test Wt. lbs.	Heading Date	Height cm	--------- Plumpness % ----------		
						6/64	5.5/64	Pan
1	Munsing	32.7	46.0	01-Jul	22	59.8	23.0	16.7
2	Steptoe	27.4	45.0	28-Jun	23	66.0	26.5	7.3
3	Clark	35.3	49.5	30-Jun	27	85.7	11.4	2.8
4	Hector	30.4	49.5	05-Jul	27	54.0	38.3	25.5
5	ID 810099	27.2	49.0	07-Jul	17	36.9	37.5	25.5
6	Bowman	34.3	50.5	28-Jun	26	91.4	6.3	2.1
7	MT 140523	37.8	51.0	28-Jun	28	77.0	18.3	4.6
8	MT 83422	38.8	50.0	05-Jul	26	77.6	16.5	5.8
9	MT 83435	40.2	50.5	05-Jul	29	83.3	12.7	3.9
10	MT 83533	38.6	49.5	06-Jul	26	79.1	14.6	6.4
11	ID 71966	39.1	47.5	28-Jun	26	38.4	44.6	16.8
12	ND 9870	35.9	52.0	04-Jul	26	93.9	5.1	0.9
13	WA 755283	34.1	50.0	04-Jul	21	82.2	14.5	3.2
14	WA 777383	15.8	49.5	07-Jul	22	88.6	8.6	2.3
15	WA 102178	25.7	47.5	07-Jul	20	86.8	10.2	2.9
16	Id 82519	36.5	46.5	29-Jun	22	55.7	33.0	11.2
17	ID 85453	43.4	45.0	28-Jun	24	34.9	56.0	9.0
18	MT 851012	35.9	47.5	04-Jul	26	75.7	16.2	8.0
19	MT 851032	30.2	49.0	04-Jul	26	67.1	22.2	10.7
20	MT 851195	28.2	48.0	01-Jul	23	63.3	23.9	12.7
21	ND 9866	42.4	51.5	30-Jun	24	77.8	19.2	2.9
22	ND 10341	35.0	46.5	01-Jul	29	75.5	19.4	5.1
23	WA 136278	25.0	49.0	04-Jul	25	80.7	15.7	3.5
24	WA 944883	31.3	49.0	04-Jul	24	73.4	16.0	10.6

Seeding Date: May 4 Harvest Date: August 1

LSD .05 = 8.3 Bu/A

Table 36. 1989 Uniform Early Oat Nursery

Entry No.	Entry	Bu/A Avg.	Test Wt. lbs.	Height in.	---------- Heading ---------- Date	fr 1/1
1	Otee (ck)	24.3	33.0	26	27-Jun	177
2	IL 81-1882	22.0	28.0	23	29-Jun	179
3	IL 83-8037-1	24.7	33.0	21	29-Jun	179
4	IL 83-8022	29.7	32.0	24	26-Jun	176
5	IL 83-7641-1	37.3	36.5	25	28-Jun	178
6	IL 85-6183-1	25.1	34.5	22	28-Jun	178
7	Don (ck)	14.0	34.0	22	25-Jun	175
8	IA X933-11-2	26.0	34.0	28	27-Jun	177
9	Clintford (ck)	24.6	36.0	25	27-Jun	177
10	OH 1011	31.4	33.5	24	26-Jun	176
11	OH 1012	32.1	29.0	20	28-Jun	178
12	PA 8290-7026	25.4	35.0	22	29-Jun	179
13	PA 8393-15050	21.5	36.0	24	26-Jun	176
14	PA 8598-8415	Lost due to gopher damage.				
15	PA 8598-4200	23.0	33.5	22	27-Jun	177
16	PA 8598-11662	25.8	33.0	23	28-Jun	178
17	SD 830095	28.2	32.0	28	26-Jun	176
18	MN 87180	27.3	37.0	29	26-Jun	176
19	MN 87189	28.1	37.5	27	27-Jun	177
20	MN 87194	29.0	35.0	26	28-Jun	178
21	MN 86108	26.5	36.0	27	26-Jun	176
22	MN 86109	29.4	37.0	25	27-Jun	177
23	MN 87187	27.9	36.5	27	27-Jun	177
24	Andrew (ck)	28.5	34.5	30	26-Jun	176
25	MO 07929	26.8	29.0	25	28-Jun	178
26	MO 07941	28.7	33.0	26	26-Jun	176
27	MO 08054	33.5	31.5	29	29-Jun	179
28	MO 08236	26.7	33.5	25	26-Jun	176
29	MO 08291	35.0	31.0	26	27-Jun	177
30	MO 08139	32.3	31.5	27	29-Jun	179
31	Bates (ck)	30.1	33.0	26	26-Jun	176
32	WI X4872-1-3	32.6	33.0	29	27-Jun	177
Seeding Date: May 4			Harvest Date: July 24			
LSD .05 = 7.7 Bu/A						

Table 37. 1989 Uniform Midseason Oat Nursery

Entry No.	Entry	Bu/A Avg.	Test Wt lbs.	Height in.	----------Heading--------- Date	fr 1/1
1	IL 81-1882	33.8	33.0	31	01-Jul	181
2	IL 82-2154	36.2	35.5	29	01-Jul	181
3	IL 83-8037-1	41.7	32.5	26	03-Jul	183
4	IL 84-3093	37.3	31.0	25	03-Jul	183
5	IL 85-6264-1	34.2	33.0	22	04-Jul	184
6	Ogle	30.3	34.5	28	01-Jul	181
7	P7869D1-5-17-3	37.6	33.0	26	30-Jun	180
8	P76163A1-14-5-3-1-3	44.1	34.5	27	01-Jul	181
9	P7869D1-5-3-2-10-1	33.2	32.5	28	01-Jul	181
10	Robert	28.5	31.5	26	06-Jul	186
11	White Ogle	33.7	30.0	26	29-Jun	179
12	PA 8494-4099	38.4	35.0	24	30-Jun	180
13	PA 8393-11138	34.9	38.5	28	04-Jul	184
14	PA 8494-11717	30.9	37.0	22	29-Jun	179
15	PA 8393-1500	24.0	28.0	21	06-Jul	186
16	Clintland 64	32.7	33.0	26	29-Jun	179
17	SD 840104	25.9	31.0	26	03-Jul	183
18	SD 84065	30.2	31.0	27	02-Jul	182
19	SD 85009	25.5	26.5	25	01-Jul	181
20	MN 84231	30.0	34.0	29	27-Jun	177
21	MN 86226	22.4	32.0	26	28-Jun	178
22	MN 87230	27.4	34.5	23	29-Jun	179
23	Gopher	36.1	32.5	25	29-Jun	179
24	OH 1006	36.2	35.0	24	28-Jun	178
25	OH 1014	33.4	36.5	25	27-Jun	177
26	ND 830775	29.0	34.0	25	30-Jun	180
27	ND 830646	28.9	31.0	24	30-JUN	180
28	ND 840341	27.8	31.5	25	04-Jul	184
29	ND 840769	28.8	26.5	26	01-Jul	181
30	Dal	28.2	33.0	24	29-Jun	179
31	WI X5209-1	29.6	36.0	26	28-Jun	178
32	WI X5229-1	39.6	31.0	25	30-Jun	180
33	WI X5445-4	35.3	32.0	23	05-Jul	185
Seeding Date: May 4			Harvest Date: August 1			
LSD .05 = 10.5 Bu/A						

MINIMUM TILLAGE AND SEEDING, AND DOUBLE DISKING AND CONVENTIONAL SEEDING OF RECROP

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

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

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

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

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

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

In 1983 the Lilliston no-till drill was used for seeding the minimum tillage treatment. The conventional treatment once again consisted of double disking the land in preparation for seeding, then seeding with double disk press drill. Ample stored soil water from heavy fall precipitation, and otherwise excellent growing conditions produced the highest yields recorded in the trial over the past 8 year period, with no advantage shown for either cropping method in this trial this year. Two additional trials in 1983 comparing no-till, conventional disking and seeding and the plow-packer-press drill on recrop land produced the following results. Barley yields were 49.6 bushels per acre for the plow-packer-press drill treatment, 28.1 for the no-till treatment and 27.9 for conventional disking and seeding.

Wheat seeded in a similar comparison trial produced 22.3 bushels per acre on plowing, 19.2 bushels per acre on conventional disking, and 17.7 bushels per acre on the no-till treatment.

Equipment and seeding method for the 1984 trial was the same as described in 1983. The fall of 1983 was drier than average with less than two and one-half inches of precipitation in the four month period, September through December. Precipitation continued below average from January until April 27 when a thirty inch snowfall provided enough soil moisture to carry the crop through the driest May in 93 years of record. Excellent distribution of five inches of rainfall in June was followed by a very dry July.

In 1985, a Lilliston no-till drill was used again for seeding the minimum tillage treatment. The preceding fall and winter precipitation was 1.12 inches below average. April precipitation was considerably lower than average. May rainfall of 4.31 inches was most effective for crop growth. June rains were less than average but were well distributed. Cool temperatures in June promoted excellent growth of small grain crops.

In 1986, the same Lilliston no-till drill was used for seeding the minimum tillage treatment. The conventional treatment once again consisted of double-disking in preparation for seeding, followed by seeding with a double disk press drill. Effective weed control was provided by the use of Hoelon-bromoxynil tank mix applied at recommended rates.

Fall precipitation during the last four months of 1985 was two inches above average and provided good residual soil water for fallow and recrop stubble. Above average precipitation was well distributed during the growing season except for a dry period starting on May 25 and extending through June. While total precipitation for June was above average, 3.30 inches of that total fell during the last four days of the month.

In 1987, the Lilliston no-till drill was used once again for seeding the minimum tillage treatment. The conventional treatment consisted of double-disking in preparation for seeding, followed by seeding with a double disk press drill. Effective weed control was provided by the use of Hoelon-bromoxynil tank mix applied at recommended rates.

Total precipitation for the twelve month period, September, 1986, through August, 1987, was 21.19 inches which was slightly higher than for the preceding twelve month period. However, distribution of precipitation this year was much less favorable for crop growth than that of a year ago, resulting in considerably lower yields. Precipitation in April was only 0.17 inches, in May 1.87 inches, and in June 2.32 inches, totaling 4.36 inches for the three month period. This was nearly 3.00 inches below normal. Coupled with below average precipitation were above average temperatures. Average temperature for April was 7°F, for May 3°F, and for June 5°F higher than the 94-year average.

High temperatures had a major effect on crops. From April through June the number of wheat growing degree days – the sum of daily degrees above 32°f – ranged from 500 to 700 more than normal across the state. This means that by July crops was 14 to 17 days more advanced than usual. Above normal heat combined with a dry spell in April and May to reduce crop yields.

In 1988, the Lilliston no-till drill was used once again for seeding the minimum tillage treatment. The conventional treatment consisted of double-disking in preparation for seeding, followed by seeding with a double disk press drill. Effective weed control was provided by the use of Hoelon-bromoxynil tank mix applied at recommended rates. Severe drought prevailed throughout the growing season of 1988.

Total precipitation for the twelve month period, September, 1987, through August, 1988, was 8.63 inches as compared to the 94 year average of 15.89 inches.

Low rainfall throughout the entire growing season was coupled with temperatures that were far above average. The month of June was the most devastating in terms of adverse weather with average temperatures 14°F higher than the 94 year norm, and with precipitation 2 inches below average. Evaporation for June, July, and August was 34.9 inches compared to the norm of 21.3 inches. High temperature, low precipitation, and excessive wind combined to create the worst growing conditions experienced in this region for the past fifty years.

Precipitation during the fall of 1988, September through December, was nearly and inch and a half below average and continued the deficit experienced throughout the summer. The well above average precipitation in April 1989, provided adequate soil water for germination and early season crop growth. Temperatures were moderate, and crop development was fairly good through May and June, even though precipitation was below average for both months. However, well above average temperatures in July (see weather data summary) coupled with well below average precipitation of 0.68 inch combined to create very poor growing conditions for the remainder of the growing season.

In 1989, the Lilliston no-till drill was used once again for seeding the minimum tillage treatment. The conventional treatment was double disking in preparation for seeding followed by seeding with a double disk press drill. Excellent weed control on both treatments followed use of Hoelon-bromoxynil tank mix applied at recommended rates. Heavy rainfall following seeding caused some soil crusting which was much more severe on the conventional treatment and was the principal cause for lower yields on that treatment.

Table 38. Minimum tillage, double disking, and seeding for wheat production on recrop.

Year	Minimum tillage and seeding	Double disking and conventional seeding
	- - - - - - - - - - - - - - - - Bu/A - - - - - - - - - - - - - - - -	
1976	28.0	27.0
1977	12.6	15.0*
1978	10.3	28.5*
1979	9.6	15.9*
1980	0.0	0.0
1981	15.3	14.3
1982	20.9	31.8*
1983	39.0	38.5
1984	20.4	27.2*
1985	14.8	20.6*
1986	24.3	30.6*
1987	4.8	9.3*
1988	0.0	0.0
1989	9.3	5.7
14-yr. average	15.0	18.9
* Yield of conventional seeding significantly exceeds no-till yield.		

WHEAT PRODUCTION ON FALLOW AND SECOND CROPPING

In 1976, and excellent year for small grain production on stubble land in southwestern North Dakota, yields on conventional summerfallow were 43 bushels per acre, on second cropping 27 bushels per acre, and on continuous cropping 22 bushels per acre. In 1977, a year when hot, dry spring weather conditions were not particularly favorable to the germination and early growth of the crop, yields were appreciably reduced, even though rainfall in late May and June provided ample soil water for satisfactory crop growth. Yields on fallow were 26.9 bushels per acre, on second cropping 11.5, and on continuous cropping 5.5 bushels per acre. Relative differences between production methods were remarkably similar for both years.

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

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

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

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

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

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

Rainfall in September and October 1982, was well above average, providing and excellent soil water recharge. Total fall precipitation from September through December 1982, was 9.4 inches compared to the 90-year average of 3.16 inches. Precipitation of 4.9 inches during April through June was below average, but for the rest of the year was nearly normal. The combination of stored rainfall in September and October 1982, and nearly normal seasonal precipitation provided ample water for good crop growth.

Mean temperatures for April, May, and June in 1983 were well below the 71-year average. Hot spells of several days in July and August when temperatures exceeded 90°F affected late-seeded grain, but early-seeded crops escaped serious damage from high temperatures.

The fall of 1983 was drier than average with less than two and one-half inches of precipitation in the four-month period September through December. Precipitation from January through March, 1984, was also below average, and the dry period extended well into April, with the largest amount of precipitation during the month coming in the form of thirty inches of snowfall on the 27th. May was the driest in 93 years of record. Excellent distribution of five inches of rain in June was followed by a very dry July.

In 1985, the fall and winter precipitation was 1.12 inches below average. April precipitation was considerably lower than average. May rainfall of 4.31 inches was the most effective for crop growth. June rains were less than average but were well distributed. Cool temperatures in June, which included a freeze on the 12th, promoted excellent growth of small grain crops.

Fall precipitation during the last four months of 1985 was two inches above average and provided good residual soil water for fallow and recrop stubble. Above average precipitation was well distributed during the growing season except for the dry period starting May 25 and extending through June. While total precipitation for June was above average, 3.30 inches of that total fell during the last four days of the month. The growing season was generally cool with temperatures in April, May, July, and August, well below the 94-year average.

Total precipitation for the twelve month period, September 1986, through August 1987, was 21.19 inches which was slightly higher than for the preceding twelve month period. However, distribution for precipitation this year was much less favorable for crop growth than that of a year ago, resulting in considerably lower yields. Precipitation in April was only 0.17 inches, in May 1.87 inches, and in June 2.32 inches, totaling 4.36 inches for the three month period. This was nearly 3.00 inches below normal. Coupled with below-average precipitation was above-average temperatures. Temperature for April was 7°, for May 3°, and for June 5°F higher than the 94-year average.

High temperatures had a major effect on crops. From April through June, the number of wheat growing degree days -- the sum of daily degrees above 32 -- ranged from 500 to 700 more than normal across the state. This means that by July 1 the growing season for perennial plants and early-seeded crops was 14 to 17 days more advanced than usual. Above normal heat combined with a dry spell in April and May to reduce crop yields.

Severe drought prevailed throughout the growing season of 1988. Total precipitation for the twelve-month period, September 1987 through August 1988, was 8.63 inches as compared to the 94-year average of 15.89 inches.

Low rainfall throughout the entire growing season was coupled with temperatures that were far above average. The month of June was the most devastating in terms of adverse weather with average temperatures 14°F higher than the 94-year norm, and with precipitation 2 inches below average. Evaporation for June, July, and August was 34.9 inches compared to the norm of 21.3 norm. High temperatures, low precipitation, and excessive wind combined to create the worst growing conditions experienced in this region for the past fifty years.

Precipitation during the fall of 1988, September through December, was nearly an inch-and-a-half below average and continued the deficit experienced throughout the summer. The well above-average precipitation in April 1989 provided adequate soil water for germination and early season crop growth. Temperatures were moderate, and crop development was fairly good through May and June, even though precipitation was below average for both months. However, well above-average temperatures in July (see weather data summary) coupled with well below-average precipitation of 0.68 inch combined to create very poor growing conditions for the remainder of the growing season.

Table 39. Wheat production on fallow and recrop.

Year	Yield	
	Fallow	Continuous Re-cropping
	- - - - - - - - - - - -Bu/A - - - - - - - - - - -	
1976	43.0	22.0
1977	26.9	5.0
1978	38.5	30.6
1979	32.4	12.8
1980	22.3	0.0
1981	21.3	14.0
1982	33.9	24.9
1983	46.1	38.5
1984	34.5	27.2
1985	36.7	20.6
1986	57.8	30.6
1987	20.7	9.3
1988	9.4	0.0
1989	20.1	5.7
14-year average	31.7	17.2

CROPPING SYSTEMS RESEARCH

This trial is designed to include a comparison of several crop rotation sequences as follows:

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

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

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

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

In 1983, fertilizer was applied on all recrop, corn, and sunflowers at the rate of 80 lbs./A N, 30 lbs./A P_20_5, and no K_2O. All wheat on fallow received 40 lbs./A N, 30 lbs./A P_20_5, and no K_2O. All land to be fallowed was not fertilized. In 1984, fertilizer was applied on all corn, sunflower, and small grain recrop at the rate of 60 lbs. N, 30 lbs. P_20_5, and no K_2O. All wheat on fallow received 30 lbs. N, 30 lbs. P_20_5, and no K_2O. Land to be fallowed was not fertilized. In 1985 and 1986, 60 lbs. N and 30 lbs. P_20_5 were applied to all corn, sunflower, and small grain recrop. Fallow land was treated with 30 lbs. N and 30 lbs. P_20_5.

In both 1983 and 1984, weed control was accomplished with: alachlor at 2 lbs./A and dicamba at 0.25 lbs./A in a tank mix on corn; trifluralin at 0.5 lbs./A preplant incorporated on sunflower; and, diclofop at 0.75 lbs./A and bromoxynil at 0.25/A in a tank mix on small grain. In 1985 and 1986, wheat and barley were sprayed with a tank mix of Hoelon at 2 pints/A plus Buctril at 1 pint/A. Weeds in sunflowers were controlled with 0.5 lbs./A Trifluralin preplant incorporated.

Varieties used in the 1983 cropping systems trial were: Alex wheat, Morex barley, Keltgen 582 corn, and Interstate 777S sunflower. In 1984 Alex wheat and Morex barley were used, along with Jacques JX21 corn and Interstate 7111 sunflowers. Stoa wheat, Bowman barley, Jacques JX21 corn, and Interstate 7111 sunflower were seeded in 1985. Stoa wheat, Bowman barley, and Interstate 7111 sunflower were used again in 1986 along with Dahlgren DC408 corn.

Tillage on fallow to prepare a seedbed was with a spring tine cultivator and harrow. Continuous crop stubble, sunflower stubble, and corn stubble land were double disked in preparation for seeding, as was all wheat stubble planted to corn or sunflowers. Excellent yields recorded in 1983 for all crops in all rotation systems were the result of a combination of high fertility, ample reserve soil water, adequate seasonal precipitation, reasonably good growing conditions, and satisfactory cropping management. Because of considerably drier growing conditions in 1984, yields were reduced with small grains showing the most reduction on all treatments. May 1985 rainfall was well above average. Cool temperatures in June slowed development of row crops but promoted excellent growth of small grains.

The excellent yields for all crops in 1986 was the result of above average precipitation and satisfactory growing conditions during most of the growing season. One period of dry weather extending from May 25 through June 25 resulted in soil water stress under recrop.

High temperatures had a major effect on crops in 1987. From April through June, the number of wheat growing degree days -- the sum of daily degrees above 32 -- ranged from 500 to 700 more than normal across the state. This means that by July 1 the growing season for perennial plants and early-seeded crops was 14 to 17 days more advanced than usual. Above normal heat combined with a dry spell in April and May to reduce crop yield.

In 1988, tillage and seeding procedures, fertilizer application, and weed control were the same as was used in previous years.

Severe drought prevailed throughout the growing season of 1988.

Total precipitation for the twelve month period, September 1987 through August 1988, was 8.63 inches as compared to the 94-year average of 15.89 inches.

Low rainfall throughout the entire growing season was coupled with temperatures that were far above average. The month of June was the most devastating in terms of adverse weather with average temperatures 14°F higher than the 94-year norm, and with precipitation 2 inches below average. Evaporation for June, July, and August was 34.9 inches, compared to the norm of 21.3 inches. High temperatures, low precipitation, and excessive wind combined to create the worst growing conditions experienced in this region for the past fifty years.

Precipitation during the fall of 1988, September through December, was nearly an inch-and-a-half below average and continued the deficit experienced throughout the summer. The well above-average precipitation in April 1989 provided adequate soil water for germination and early season crop growth. Temperatures were moderate and crop development was fairly good through May and June, even though precipitation was below average for both months. However, well above average temperatures in July (see weather data summary) coupled with well below-average precipitation of 0.68 inch combined to create very poor growing conditions for the remainder of the growing season. Lack of residual soil water because of the severe drought of 1988 contributed to the low yields in 1989. Row crops were affected more than small grain by the unfavorable growing conditions in July. Sunflower and corn grain production was zero with corn silage yields the lowest recorded in the past twenty years.

Data from the cropping systems trial for the years 1983 through 1989 are summarized in Table 40.

Table 40. Cropping systems trial yields 1983 to 1989.

Crop and Rotation	1983	1984	1985	1986	1987	1988	1989	7-yr Avg.	% of Fallow
Bushels per Acre									
Wheat yields on:									
Fallow	47.1	34.5	36.7	57.8	20.7	9.4	20.1	32.3	100
Continuous Recrop	38.5	27.2	20.6	36.1	9.3	0.0	5.7	19.6	61
No-till continuous	39.0	20.4	14.8	22.9	4.8	0.0	9.3	15.9	49
Sunflower stubble	46.1	21.4	16.9	39.5	6.5	0.0	9.0	19.9	62
Corn Stubble	47.2	32.2	29.6	45.4	16.6	0.0	10.2	25.9	80
Barley yields on:									
Sunflower stubble	64.8	36.3	31.5	43.6	26.8	0.0	9.0	30.3	
Corn yields on									
Wheat stubble:									
Grain (Bu/A)	72.6	72.4	56.5	57.2	82.4	11.2	0.0	50.3	
Silage (tons/A)	10.3	8.9	12.6	9.7	12.7	4.5	2.7	8.8	
Sunflower on:									
Wheat stubble (lbs./A)	1784	1664	1224	2423	1182	0	0	1182	