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Crop Production Trials

AGRONOMIC INVESTIGATIONS at the DICKINSON RESEARCH CENTER

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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 and cereals in southwestern North Dakota (1) To assist in evaluation of unnamed cultivars for possible release to North Dakota farmers; (2) To provide grain for 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; (3) off-station testing of newly released varieties from both public and private sources.

Regional Nursery Trials

Each year regional 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 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 5 year period. Acreage in 1985 was 233,000, in 1986, 215,000 acres, and in 1989, 211,000 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 1989 crop would be $23,600,350.00.

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 5 year period. During that time the average annual value of the sunflower crop in those three 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. By 1989 the sunflower acreage in the three southwestern districts had dropped to 127,000 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 for narrow row spacing, use fertilizers effectively, be adapted to combine harvesting and be 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 bushel), 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 agricultural weed control guide circular W253 as revised

annually. All nursery and yield 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, seedling 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 Research Center each year. Trials consist of named cereal cultivars and advanced experimental 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 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 supplies 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 is 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 moisture basis for the species being tested. Corn silage yields are determined on a 70%

moisture 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 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 test are supplied as required to the Department of Cereal Science and Food Technology, NDSU.

Data are analyzed using statistical procedure for analysis of variance.

Growing Conditions 1988-1990

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. 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, above average temperatures in July coupled with below average precipitation of .68 inch combined to create very poor growing conditions for the remainder of 1989.

Precipitation in the fall of 1989 was nearly average and provided adequate soil water for germination and establishment of winter wheat and winter rye, and some stored soil water in both re-crop and fallow. Marginal precipitation in April and May of 1990, provided sufficient soil water for germination and early crop growth of spring seeded crops. June was the month that made the crop, with a total of 5.80 inches of rainfall, well distributed during the month. Measurable precipitation was recorded on 14 days in June. However, luck ran out in July and August with total rainfall for the two months being 2.60 inches below average. Considering the droughty weather pattern of the past three years, yields recorded in 1990 are nothing short of phenomenal.

Weather Summary Table

Tan spot was the principal leaf disease of consequence. Common root rot was once again a problem of concern.

Table 18	1990 Dickinson Oats Variety Trial
Table 19	Long Term Yields - Oats. Dickinson
Table 20	Dickinson Off-station Oats Variety Trials
Table 21	1990 Dickinson Oats Yield Trials
Table 22	1990 Dickinson Winter Rye Variety Trial
Table 23	Long Term Yields - Winter Rye, Dickinson
Table 24	1990 Dickinson Winter Rye Yield Trial

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.

Miscellaneous Small Grain Trial Tables

Buckwheat Production in Southwestern North Dakota

Buckwheat can be grown successfully in Southwestern North Dakota. It 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 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.

Buckwheat Production Tables

Hybrid Corn Comparison Trial

As shown in Table 35, corn silage and grain yields were very good considering the severe drought that prevailed throughout the growing season of 1990. 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.

1990 Dickinson Hybrid Corn Comparison Trial Table

Dry Edible Bean Production

Dry edible bean production in the three southwestern agricultural statistics reporting districts increased from 3400 harvested acres in 1985 to 21000 acres in 1988, and dropped to 17000 acres in 1989. Production was highest in 1985, 1986 and 1987 averaging more than 1200 pounds per acre for that three year period. Yields of 240 and 427 pounds per acre in the drought years of 1988 and 1989 combined to reduce the five year average yield to 879

pounds per acre.

1990 Dickinson Bean Variety Trial Table

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 1990 trials, and continues to be one of the better yielding varieties most years. However, growing conditions were unfavorable for millet in 1990 and while there was some grazing possible on fields of millet, poor growth prevented cutting for hay, in many plantings.

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. Grain yields from the Proso millets usually are less than yields from cereal grain species. In 1990 Red Proso produced 521 lbs/A and White Proso 561 lbs/A, compared to 2024 lbs/A of Monida oats grown in the same comparison trial.

Dickinson Millet Variety Trial Table

Root Rot Control & Fungus Trial Tables

Wheat Yield With Alga Min Seed Treatment Table

Cooperative Small Grain Nursery Trials

Plantings in 1990 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 32 varieties and experimental lines in the Uniform Regional Hard Red Spring Wheat trial; 26 lines in the Uniform Regional Durum Nursery; 79 varieties and experimentals in three barley nurseries; and 69 varieties and experimental cultivars in the Uniform Early and Midseason Oat nurseries.

Small Grain Nursery Trial Tables

MINIMUM TILLAGE AND SEEDING, DOUBLE DISKING AND

CONVENTIONAL SEEDING ON 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 for 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 water 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 the 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^{o}F, for May 3^{o}F, and for June 5^{o}F higher than for 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^{o}F - 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.

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 temperatures $14^{O}F$ 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 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.

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.

In 1990 the Tye no-till drill was used for seeding the minimum tillage treatment. The conventional treatment and weed control on both treatments was identical to that described for 1989. Growing conditions did not favor high yields from

re-crop in 1990.

Minimum Tillage & Double Disking Yield Table

WHEAT PRODUCTION ON FALLOW AND SECOND CROPPING

In 1976, an excellent year for small grain production on stubble land in southwestern North Dakota, yields on conventional summerfallow were 43 bushels per acre, 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 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 with 31.4 on second cropping and 30.6 on continuous cropping. High yields on stubble land were a result of the excellent soil water recharge provided by the well above average precipitation coming in the fall of 1977, plus adequate seasonal moisture and cool growing season temperatures.

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

In 1980, severe drought conditions prevailed through the third week of 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^{o}F and above were recorded on 7 days, with a maximum reading of 110^{o}F. Evaporation measured 3.93 inches during this ten day period.

Precipitation during the last four months of 1981 was above average, providing 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 an 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^{o}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 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 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 was above-average temperatures. Temperature for April was 7^{o}F, for May 3^{o}F, and for June 5^{o}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^{o}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.

Nearly average fall and winter precipitation, and marginal rainfall in April and May provided sufficient soil water for germination and early growth. June, with a total of 5.80 inches of well distributed rainfall, was not enough to counteract a July and August which was 2.60 inches below average. The low yields for both treatments were a result of the cumulative effect of three years of below average precipitation.

Wheat Production on Fallow and Recrop Table

CROPPING SYSTEMS RESEARCH

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

Treatment1: 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, 30lbs./A P_2O_5, and no K_2O. All wheat on fallow received 40 lbs./A N, 30 lbs./A P_2O_5, and no K_2O. All land to be fallowed was not fertilized. In 1984, fertilizer was applied to all corn, sunflower, and small grain recrop at the rate of 60 lbs. N, 30 lbs. P_2O_5, and

no K_2O. All wheat on fallow received 30 lbs. N, 30 lbs. P_2O_5, and no K_2O. Land to be fallowed was not fertilized. In 1985 and 1986, 60 lbs. N and 30 lbs. P_2O_5 were applied to all corn, sunflower, and small grain recrop. Fallow land was treated with 30 lbs. N and 30 lbs. P_2O_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 lbs./A in a tank mix on small grain. 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 were 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^{o}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.

Precipitation in the fall and winter period of 1989-90 was nearly average and combined with marginal April and May rainfall provided sufficient soil water for germination and early season growth of spring seeded crops. June, with a

total of 5.80 inches of well distributed rainfall provided excellent growing conditions. This was counteracted by a July and August when recorded precipitation was 2.60 inches below average. The cumulative effect of three years of below average precipitation was too much for the favorable June conditions to overcome. Row crops were affected more than small grains by the unfavorable late season conditions, with sunflowers being more seriously affected than corn. Re-cropping which was totally dependent on seasonal rainfall was seriously affected as well.

Data from the cropping systems comparison for the years 1983-1990 are summarized in table 52.

Table 52. Cropping systems trial yields 1983 to 1990

1988-90 Weather Data Summary				
Precipitation	1987-88	1988-89	1989-90	95 Year Average
Sept. - Dec.	1.16	1.74	3.00	3.14
Jan. - Mar.	1.96	1.17	0.57	1.53
April - June	3.64	6.69	8.98	7.29
July - Aug.	1.87	1.92	1.29	3.89
Total	8.63	11.52	13.84	15.84
Average Temperature ^{o}F	1988	1989	1990	95 Year Average
April	42	42	42	41
May	59	53	51	54
June	75	60	63	61
July	71	74	67	69
August	68	69	69	67

Table 1. 1990 Dickinson Hard Red Spring Wheat Variety Trial				
Variety	Bu/A Avg.	Test Wt lbs.	Heading date	Height in.
Amidon	47.9	62.0	26-Jun	35
Bergen*	39.1	60.5	26-Jun	28
Butte 86	40.2	62.5	23-Jun	32
Cutless*	32.7	62.0	27-Jun	32.5
Fjeld*	45.4	62.0	27-Jun	31.5
Grandin*	49.5	61.5	26-Jun	32.5
Gus*	44.3	60.0	27-Jun	31.5
Laura	32.2	61.5	26-Jun	32
Len*	43.7	62.0	29-Jun	31.5
Marshall*	41.0	59.5	29-Jun	30
Minnpro*	40.4	60.5	27-Jun	31
N 86-0370*	46.0	62.0	29-Jun	31.5
2369*	57.5	62.5	28-Jun	31.5
2370*	44.3	61.5	26-Jun	32
2375*	52.5	60.0	27-Jun	34
2385*	43.7	60.0	25-Jun	32.5
Stoa	45.9	62.0	28-Jun	34.5

Vance*	49.5	61.5	30-Jun	30.5
MT 8402*	43.7	59.5	27-Jun	31
ND 655*	45.4	63.5	27-Jun	34
ND 656	42.9	61.5	26-Jun	35
ND 657*	48.1	62.5	27-Jun	34
ND 659*	50.9	59.5	27-Jun	33.5
ND 660	48.1	62.0	27-Jun	34
ND 661	41.8	63.0	25-Jun	34
ND 662*	58.0	62.0	27-Jun	33
ND 663	37.7	63.0	25-Jun	32
ND 664*	49.0	59.5	25-Jun	30.5
ND 665*	45.4	61.5	26-Jun	28.5
SD 2980	46.5	62.0	24-Jun	28.5
W 2501*	53.9	60.0	25-Jun	26
W 2502*	48.7	58.5	25-Jun	28.5
XW 371*	44.8	59.5	25-Jun	28.5
Golden 86*	41.0	63.0	29-Jun	24.5
Stoa+alga Min	39.9	60.0	28-Jun	28

*Semidwarf

Seeding Rate: 1,000,000 live seeds per acre (approx 1 Bu/A); Seeding Date: April 23; Harvest Date: August 3; Fertilizer Applied: 50 lbs/A 18-46-

0 drill application; Herbicide Applied: Hoelon/Buctril tank mix; L.S.D. 5% = 6.72 Bu/A; C.V. % = 9.00

Table 2. Long Term Yields- Hard Red Spring Wheat, Dickinson.						
Variety	1986	1987	1988	1989	1990	Average
Len	54.6	32.7	7.7	16.8	43.7	31.1
Stoa	61.6	30.8	9.9	21.2	45.9	33.9
Marshall	56.5	30.5	11.0	16.3	41.0	31.1
2369	60.6	35.5	10.6	21.8	57.5	37.2
Cutless	49.2	30.1	5.5	18.0	32.7	27.1
Amidon	53.3	28.3	12.1	23.2	47.9	33.0
Butte 86	51.8	31.1	8.8	23.5	40.2	31.1
Gus	56.1	25.9	9.9	20.2	44.3	31.3
Grandin	51.1	36.9	9.5	18.5	49.5	33.1
LSD .05	7.9	4.0	3.2	4.7	9.0	

Table 3. 1990 Dickinson Off-station Hard Red Spring Wheat Variety Trials							
Variety	Dickinson	Beach	Beulah	Glen Ullin	Hannover	Manning	Average 6 Sites
	Bushels per Acre						
Amidon	47.9	21.7	41.8	53.4	25.0	31.9	37.0
Bergen	39.1	22.8	42.1	58.6	25.6	42.9	38.5
Butte 86	40.2	20.4	40.4	55.6	24.5	38.0	36.5
Cutless	32.7	20.1	39.1	49.0	20.9	30.8	32.1
Grandin	49.5	25.6	41.0	62.4	24.2	35.2	39.7
Gus	42.3	25.9	45.4	61.9	25.9	39.6	40.2
Len	43.7	24.5	41.3	58.3	25.3	41.0	39.0
Minnpro	40.4	22.8	38.8	53.6	22.8	36.0	35.7
2369	57.5	28.1	45.1	59.1	25.9	46.8	43.8
2375	52.5	25.0	50.3	61.3	27.0	41.8	43.0
Stoa	45.9	24.8	45.4	58.6	25.8	40.7	40.2
Vance	49.5	27.2	49.0	60.0	25.9	42.4	42.3
Seeding Date	April 23	April 26	April 30	May 1	May 2	April 27	
Harvest Date	Aug. 3	Aug. 2	Aug. 20	Aug. 13	Aug. 6	Aug. 7	
L.S.D. 5%							

(Bu/A)	6.72	2.34	6.97	5.52	3.91	6.8	
C.V. %	9.0	6.1	10.0	6.02	9.9	11.0	

Fertilizer Applied: According to soil test at each site; Herbicide Applied: Hoelon/Buctril tank mix; Seeding Rate: 1 Bu/A

Table 4. 1990 Dickinson Off-station Hard Red Spring Wheat Variety Trials							
Variety	Dickinson	Beach	Beulah	Glen Ullin	Hannover	Manning	Average6 Sites
	Test Wt. lbs./Bu.						
Amidon	62.0	56.5	61.0	55.0	57.0	60.0	58.6
Bergen	60.5	60.0	60.0	60.0	59.0	61.5	60.2
Butte 86	62.5	60.5	60.5	59.0	59.0	62.0	60.6
Cutless	62.0	60.0	61.0	60.5	58.5	62.5	60.8
Grandin	61.5	61.0	61.0	61.0	59.5	62.0	61.0
Gus	60.0	60.0	61.0	60.0	59.5	61.5	60.3
Len	62.0	59.5	59.5	60.5	56.5	62.0	60.0
Minnpro	60.5	56.0	56.0	60.0	52.0	60.0	57.4
2369	62.5	61.0	59.5	61.0	58.5	62.0	60.8
2375	60.0	60.5	59.0	62.0	58.0	61.5	60.2
Stoa	62.0	60.5	59.5	61.5	58.0	62.0	60.6
Vance	61.5	59.0	58.0	60.5	57.0	61.5	59.6

Table 5. 1990 Dickinson Off-station Hard Red Spring Wheat Variety Trials							
	Dickinson	Beach	Beulah	Glen Ullin	Hannover	Manning	Average 6 Site
	Protein @ 14% Moisture						
Amidon	15.3	16.1	15.3	14.7	17.3	14.2	15.5
Bergen	15.6	16.0	14.5	13.9	16.1	13.7	15.0
Butte 86	15.3	15.6	15.7	14.9	17.0	14.0	15.4
Cutless	15.5	16.5	15.7	15.2	17.3	14.9	15.9
Grandin	15.8	16.4	15.9	15.0	17.4	14.5	15.8
Gus	15.8	16.6	15.5	14.9	17.9	14.7	15.9
Len	15.2	16.6	15.4	14.3	17.4	13.6	15.4
Minnpro	15.1	17.6	15.8	14.6	18.0	14.3	15.9
2369	14.8	16.7	15.0	14.7	17.4	14.1	15.5
2375	15.3	16.1	15.3	14.3	17.0	13.6	15.3
Stoa	15.1	16.0	15.2	14.3	16.9	13.7	15.2
Vance	14.2	15.7	14.9	14.2	16.9	13.5	14.9

Table 6. 1990 Dickinson Hard Red Spring Wheat Yield Trial.		
Variety	Bu/A	Test Wt lbs.
Amidon	30.7	60.0
Bergen*	31.4	60.0
Butte 86	29.4	60.5
Columbus	27.2	58.5
Cutless*	26.3	60.0
Fjeld*	35.9	58.0
Golden 86*	31.0	62.0
Grandin*	34.3	58.5
Gus*	32.4	60.0
Laura	30.2	60.0
Len*	30.4	59.5
Marshall*	31.4	59.0
Minnpro*	30.6	57.5
N 86-3070*	36.7	59.5
Nordic*	33.7	61.0
2369*	35.4	61.0
2370*	38.2	62.0
2375*	32.7	60.0

2385*	30.7	61.0
Spillman*	32.0	56.5
Stoa	35.5	59.0
Vance*	32.8	58.0
BW 114	28.2	59.5
MN 85324*	32.3	60.0
MT 8402*	36.6	59.5
ND 655*	38.1	63.0
ND 656	28.8	61.0
ND 657*	33.4	61.0
ND 659*	35.8	59.5
ND 660	32.6	59.0
ND 661	31.9	60.5
ND 662*	37.4	59.5
ND 663	36.5	64.0
ND 664*	38.4	60.5
ND 665*	34.7	59.0
ND 666*	35.2	59.5
SD 2980	36.4	62.0
W 2501*	36.4	56.5
W 2502*	34.7	57.5

XW 371*	41.1	59.5

*Semidwarf

Seeding Rate: 1,000,000 live seeds/A (approx. 1 bu/A); Seeding Date: April 23; Harvest Date: August 3; Fertilizer Applied: 50 lbs/A 18-46-0 drill application; Herbicide Applied: Hoelon/Buctril tank mix; L.S.D. 5% = 6.74 Bu/A; C.V. = 13%

Table 7. 1990 Dickinson Durum Variety Trial				
Variety	Bu/A Avg.	Test Wt lbs.	Heading Date	Height Inches
Lloyd*	47.9	57.5	June 29	30.5
Medora	40.4	60.0	June 28	36
Monroe	45.7	61.5	June 23	28
Renville	39.3	59.5	June 28	33
Rugby	38.8	60.0	June 27	34
Sceptre	39.6	59.0	June 26	27.5
Vic	43.5	61.5	June 27	32.5
Ward	39.3	60.0	June 26	31
D 8302	51.2	59.5	June 27	25
D 8460	43.7	61.5	June 26	31.5
D 8475	45.4	60.5	June 26	28.5
D 8479	40.7	58.5	June 26	26.5
D 86117	44.6	60.0	June 28	27.5
D 86398	46.8	59.0	June 29	28.5
D 86-1523*	45.9	61.0	June 27	26
D 87-1531*	55.3	61.0	June 28	27
*semidwarf				

Seeding Rate: 1,000,000 live seeds/A (approx. 1 bu/A); Seeding Date: April 24; Harvest Date: August 6; Fertilizer Applied: 50 lbs/A 18-46-0; Herbicide Applied: Hoelon/Buctril tank mix; L.S.D 5% = 6.60 Bu/A; C.V. = 9.0%

Table 8. Long Term Yields - Durum, Dickinson.						
Variety	1986	1987	1988	1989	1990	Average
Lloyd	51.2	43.2	9.6	26.4	47.9	35.7
Vic	36.5	32.7	11.6	22.8	43.5	29.4
Ward	45.2	36.0	8.5	17.1	39.3	29.2
Monroe	44.1	34.4	9.9	21.7	45.7	31.2
Renville	44.2	41.0	9.6	22.0	39.3	31.2
Rugby	49.6	40.7	11.8	22.8	38.8	32.7
Medora	47.8	41.0	11.6	22.8	40.4	32.7
LSD .05	1.4	4.7	2.8	6.6	6.6	

Table 9. 1990 Dickinson Off-station Durum Variety Trials.

Variety	Dickinson	Beach	Beulah	Glen Ullin	Hannover	Manning	Average 6 Sites
	Bushels per Acre						
Lloyd	47.9	24.8	49.0	55.3	17.3	43.2	39.6
Medora	40.4	24.5	52.8	59.4	18.4	45.4	40.2
Monroe	45.7	28.1	54.5	61.1	21.2	51.4	43.7
Renville	36.3	24.2	53.1	61.3	18.4	42.9	39.4
Ward	39.3	24.5	50.6	57.2	18.7	46.8	39.5
	Test Wt. lbs/Bu.						
Lloyd	57.5	58.0	59.5	60.0	54.0	61.0	58.3
Medora	60.0	59.5	61.5	62.5	60.5	62.5	61.1
Monroe	61.5	60.5	62.0	62.5	61.0	62.0	61.6
Renville	59.5	58.0	60.5	61.0	59.0	61.0	59.8
Ward	60.0	58.5	61.0	62.5	59.0	61.5	60.4
Seeding Date	April 24	April 26	April 30	May 1	May 2	April 27	
Harvest Date	Aug. 6	Aug. 2	Aug. 20	Aug. 31	Aug. 6	Aug. 7	
LSD 5% (Bu/A)	6.60	2.43	6.48	5.31	3.30	12.23	
CV (%)	9.0	6.1	7.8	5.6	9.4	16.7	
Fertilizer Applied: According to soil test at each site; Herbicide Applied: Hoelon-Buctril							

tank mix; Seeding Rate: 1,000,000 live seeds/A (approx.70 lbs/A)

Table 10. Durum Yield Trial- Dickinson - 1990		
Variety	Bu/A Avg	Test Wt. Lbs.
Lloyd	40.6	58.0
Medora	39.9	62.0
Monroe	41.9	61.5
Renville	43.1	61.0
Rugby	39.7	61.0
Sceptre	37.7	60.5
Vic	40.8	62.5
Ward	42.1	61.0
D8302	42.4	62.0
D8460	40.9	62.0
D8475	42.6	61.6
D8479	35.0	69.5
D86117	42.6	61.0
D86 398	41.3	62.0
D86-1523	41.4	63.5
D87-1531	37.9	61.0
LSD 5%=4.77 Bu/A; C.V. = 7.4%		

Table 11. 1990 Dickinson Hard Red Winter Wheat Variety Trial			
Variety	Bu/A Avg.	Test Wt lbs.	Protein %
Agassiz	49.8	62.0	14.3
Arapahoe	48.4	61.5	15.5
Judith	51.0	59.5	13.3
Roughrider	51.9	61.5	15.0
Seward	55.6	62.0	12.4
Protein is at 14% Moisture; Seeding Rate: 50 lbs/A; Seeding Date: Sept. 13, 1989; Harvest Date: Aug. 28, 1990; Fertilizer Applied: 50 lbs/A 18-46-0; Herbicide Applied: Hoelon/Buctril tank mix; L.S.D. 5% = 3.53 Bu/A; C.V. = 6.00 %			

Table 12. Long Term Yields - Hard Red Winter Wheat, Dickinson

Variety	1984	1985	1986	1987	1988	1989	1990	7 Yr. Avg.
Roughrider	44.1	52.1	46.5	20.8	0.0	0.0	51.9	30.8
Winoka	45.4	44.6	48.4	24.2	0.0	0.0	---	---
Agassiz	45.9	50.0	50.6	17.3	0.0	0.0	49.8	30.5
Siouxland	---	---	59.4	11.8	0.0	0.0	55.6	---
Seward	---	---	---	24.4	0.0	0.0	55.6	---
L.S.D. .05	7.3	2.5	3.8	4.8	0.0	0.0	3.53	

Yield averages include value of 0 for 1988 and 1989.

Table 13. 1990 Dickinson Hard Red Winter Wheat Yield Trial.

Variety	Bu/A Avg.	Test Wt lbs.
Abilene	40.3	62.5
Agassiz	50.5	62.5
Arapahoe	44.7	61.0
Judith	41.8	59.5
Norstar	49.7	62.0
Rose	45.5	62.5
Roughrider	48.0	62.0
Seward	46.7	61.5
Siouxland	45.6	62.0
Winoka	39.1	63.0
8212	49.1	61.5
8407	39.4	61.5
85137	41.8	61.5
8530	47.3	62.0
8581	40.5	61.0
86105	36.4	58.5

Seeding Rate: 50 lbs/A; Seeding Date: September 13; Harvest Date: August 28; Fertilizer Applied: Hoelon/Buctril tank mix; L.S.D. 5% = 6.42 Bu/A; C.V. = 9.14%

Table 14. 1990 Dickinson Barley Variety Trial				
Variety	Bu/A Avg.	Test Wt lbs.	Heading Date	Height in.
Azure (6R)	66.7	40.0	June 26	31.5
B 1602 (6R)	61.5	43.0	June 27	28.5
B 1603 (6R)	57.1	41.0	June 26	28
Bearpaw (2R)	62.6	42.5	June 30	27.5
Bowman (2R)	76.0	48.5	June 20	25.5
Excel (6R)	69.5	41.0	June 28	26.5
Gallatin (2R)	87.3	46.5	June 23	27
Harrington (2R)	77.7	44.0	June 30	28.5
Hector (2R)	76.0	45.0	June 27	28.5
Lewis (2R)	71.2	46.5	June 27	30
Morex (6R)	77.7	44.0	June 23	31
Robust (6R)	76.3	45.0	June 26	27.5
Wanubet (2R)	60.9	41.0	June 28	28.5
ND 9668 (6R)	77.7	44.0	June 26	31
ND 9675 (6R)	82.2	41.0	June 26	30
ND 9866 (2R)	50.5	48.0	June 22	28.5
ND 9870 (2R)	78.8	47.0	June 22	28.5

ND 10277 (2R)	74.3	47.0	June 20	27
ND 10278 (2R)	68.1	47.0	June 20	29.5
ND 10419 (2R)	71.5	44.5	June 20	27
Seeding Rate: 1.3 Bu/A; Seeding Date: April 24; Harvest Date: August 1; Fertilizer Applied: 50 lbs/A 18-46-0; Herbicide Applied: Hoelon/Buctril tank mix; L.S.D. 5% = 12.78 Bu/A; C.V. = 11.0%				

Table 15. Long Term Yields - Barley, Dickinson						
Variety	1986	1987	1988	1989	1990	Average
Azure	76.0	61.9	7.2	31.6	66.7	48.7
Bowman	82.2	52.3	14.8	26.1	76.0	50.3
Morex	85.6	56.4	11.7	28.2	77.7	51.9
Robust	79.8	61.5	8.9	32.7	76.3	51.8
Hector	80.8	70.5	19.3	44.0	76.0	58.1
Lewis	95.9	63.3	14.4	39.9	71.2	56.9
Gallatin	99.3	72.5	15.5	41.3	87.3	63.2
LSD .05	7.3	4.5	4.2	7.6	11.0	

Table 16. 1990 Dickinson Off-station Barley Variety Trials.

Variety	Dickinson	Beach	Beulah	Glen Ullin	Hannover	Manning	Average 6 Sites
	Bushels per Acre						
Azure	67.7	34.7	82.5	64.6	33.4	69.8	58.8
Bowman	76.0	40.2	73.1	82.9	46.1	73.9	65.4
Gallatin	87.3	40.9	69.1	88.7	45.0	70.1	66.9
Hector	76.0	44.7	68.4	70.8	41.9	69.8	61.9
Morex	77.7	47.8	79.8	65.0	35.1	67.7	62.2
Robust	76.3	43.3	86.3	72.9	33.4	71.2	63.9
	Test Wt. lbs./Bu.						
Azure	40.0	47.5	46.5	50.0	48.0	48.0	46.7
Bowman	48.5	49.5	48.0	51.0	49.5	51.0	49.6
Gallatin	46.5	48.0	46.5	51.0	47.5	49.5	48.2
Hector	45.0	49.0	45.5	48.0	50.5	48.0	47.7
Morex	44.0	48.5	45.0	49.0	48.5	48.0	47.2
Robust	45.0	48.5	47.0	51.0	47.5	49.0	48.0
Seeding Date	April 24	April 26	April 30	May 1	May 2	April 27	

Harvest Date	Aug. 1	Aug. 2	Aug. 20	Aug. 13	Aug. 6	Aug. 7	
L.S.D. 5% (Bu/A)	12.78	6.49	8.33	4.91	4.86	13.25	
C.V. (%)	11.0	9.7	6.9	4.2	7.8	11.8	
Fertilizer Applied: According to soil test at each site; Herbicide Applied: Hoelon/Buctril tank mix; Seeding Rate: 1.3 Bu/A							

Table 17. 1990 Dickinson Barley Yield Trial		
Variety	Bu/A Avg.	Test Wt lbs.
Azure	59.0	46.0
B 1602*	55.6	45.5
B 1603*	53.8	46.0
Bearpaw	61.9	45.0
Bowman	66.6	48.5
Excel*	64.8	45.0
Gallatin	60.8	48.0
Harrington	57.9	45.0
Hector	62.5	48.0
Lewis	59.6	47.5
Morex*	61.9	47.0
Robust*	60.2	46.0
Wanubet	51.5	51.0
ND 9668*	62.5	45.5
ND 9675*	71.8	42.5
ND 9866	61.4	48.5
ND 9870	57.3	49.0
ND 10277	53.3	48.5

ND 10278	65.4	47.5
ND 10419	62.5	49.0

*6-row

Seeding Date: April 24; Harvest Date: August 1; Fertilizer Applied: 50 lbs/A 18-46-0; Herbicide Applied: Hoelon/Buctril tank mix; L.S.D 5% = 8.5 Bu/A; C.V. = 8.8%

Table 18. 1990 Dickinson Oats Variety Trial				
Variety	Bu/A Avg.	Test Wt lbs.	Heading Date	Height Inches
Dumont	74.7	38.0	July 1	31.5
Hytest	68.5	39.5	June 28	31.5
Monida	76.7	39.5	June 30	31
Newdak	78.8	36.0	June 26	28
Otana	81.2	38.5	June 30	28
Porter	76.8	39.0	July 1	31.5
Riel	74.2	39.0	June 30	30.5
Robert	68.0	34.5	July 2	29.5
Steele	73.7	36.5	June 30	33
Tibor	63.3	37.0	June 30	30
Trucker	76.7	36.5	June 30	30.5
Valley	74.7	38.5	June 29	35.5
ND 820294	78.8	40.0	June 29	30.5
ND 820559	81.9	38.5	June 29	34
ND 821742	74.7	37.0	July 1	29
ND 830185	75.7	36.5	June 29	31.5
ND 830646	77.3	37.5	July 2	30

ND 830341	75.2	37.0	July 2	30
ND 840413	68.0	37.0	June 28	30

Seeding Rate: 1.5 Bu/A; Seeding Date: May 2; Harvest Date: August 2; Fertilizer Applied: 50 lbs/A 18-46-0; Herbicide Applied: Buctril; L.S.D. 5% = 12.0 Bu/A; C.V. 10.0%

Table 19. Long Term Yields - Oats. Dickinson.						
Variety	1986	1987	1988	1989	1990	Ave
Otana	101.6	77.0	12.2	44.6	81.2	63.3
Dumont	116.5	84.5	9.1	31.8	74.7	63.3
Steele	106.2	73.5	20.8	34.2	73.7	61.6
Monida	126.8	86.8	24.8	28.9	76.7	68.8
Porter	114.0	78.7	23.4	26.5	76.8	63.9
Valley	126.3	61.4	19.5	33.0	74.7	63.0
Hytest	99.5	55.0	14.8	31.3	68.5	53.8
Riel	112.4	67.7	14.3	39.4	74.2	61.6
LSD .05	15.5	6.9	4.9	4.4	10.0	

Table 20. Dickinson Off-station Oats Variety Trials.							
Variety	Dickinson	Beach	Beulah	Glen Ullin	Hannover	Manning	Average 6 Sites
	Bushels per Acre						
Dumont	74.7	57.7	88.0	105.1	46.4	86.5	76.4
Monida	76.7	62.8	80.3	101.0	45.3	79.3	74.2
Newdak	78.8	49.4	88.6	96.8	46.9	77.8	73.1
Otana	80.3	57.4	87.0	105.1	51.5	88.1	78.2
Riel	70.0	54.6	68.0	86.0	48.9	73.7	66.9
Valley	74.7	56.3	101.5	107.2	53.6	80.9	79.0
	Test Wt. lbs/Bu.						
Dumont	38.0	38.5	35.0	39.0	37.0	38.5	37.7
Monida	39.5	34.5	36.0	39.0	31.0	35.0	35.8
Newdak	36.0	35.0	36.0	37.0	33.5	34.0	35.3
Otana	38.5	38.0	38.0	40.0	36.0	37.5	38.0
Riel	39.0	35.5	35.0	38.0	35.5	36.0	36.5
Valley	38.5	38.0	39.0	40.0	35.5	38.0	38.2
Seeding Date	May 2	April 26	April 30	May 1	May 2	April 27	

Harvest Date	Aug. 2	Aug. 2	Aug. 20	Aug. 13	Aug. 6	Aug. 7	
L.S.D. 5% (Bu/A)	12.0	6.10	10.70	9.72	6.98	9.58	
C.V. (%)	10.0	6.8	7.9	6.1	9.0	7.4	
Fertilizer Applied: According to soil test at each site; Herbicide Applied: Buctril; Seeding Rate: 1.5 Bu/A							

Table 21. 1990 Dickinson Oats Yield Trials		
Variety	Bu/A Avg.	Test Wt lbs.
Dumont	92.0	39.0
Hytest	85.1	37.0
Monida	92.0	36.0
Newdak	80.8	38.0
Otana	99.0	37.5
Porter	78.2	39.0
Riel	79.0	36.5
Robert	87.8	33.5
Steele	79.3	38.0
Tibor	75.9	37.0
Trucker	79.0	35.0
Valley	88.6	38.0
ND 820294	85.9	36.0
ND 820559	77.3	36.5
ND 821742	74.2	38.0
ND 830185	90.3	37.5
ND 830646	84.2	33.5
ND 840341	81.6	37.0

ND 840413	80.7	36.0
ND 851098	91.2	35.5
ND 851634	77.3	35.5
ND 852107	78.1	35.0
ND 860416	92.0	34.5
ND 861246	85.1	38.0
ND 861253	83.4	36.5
ND 862095	79.9	37.0
ND 862106	79.9	38.0
ND 862415	92.0	37.5
ND 862585	86.8	36.5
Seeding Date: May 2; Harvest Date: August 2; Seeding Rate: 1.5 Bu/A; Fertilizer Applied: 50 lbs/A 18-46-0 drill application; Herbicide Applied: Buctril; L.S.D. 5% = 15.1; C.V. = 11.3%		

Table 22. 1990 Dickinson Winter Rye Variety Trial		
Variety	Bu/A Avg.	Test Wt. Lbs.
Frederick	38.6	55.0
Dacold	81.5	55.0
Musketeer	62.4	55.5
Prima	74.5	55.5
Seeding Rate: 60 lbs/A; Seeding Date: September 13; Harvest Date: August 10; Fertilizer Applied: 50 lbs/A 18-46-0 drill application; No weed control required.; L.S.D. 5% = 9.6 Bu/A; C.V. = 6.0%		

Table 23. Long Term Yields - Winter Rye, Dickinson						
Variety	1986	1987	1988	1989	1990	5 yr Avg
Musketeer	35.4	37.6	15.2	0.0	62.4	30.5
Puma	43.2	33.9	8.5	0.0	---	---
Frederick	33.0	35.1	15.0	0.0	38.6	24.3
LSD .05	4.8	3.6	3.2	0 0		
Yield averages include value 0 for 1989.						

Table 24. 1990 Dickinson Winter Rye Yield Trial		
Variety	Bu/A Avg.	Test Wt lbs.
Frederick	30.8	54.0
Dacold	63.0	53.5
Musketeer	53.5	55.5
Prima	67.4	56.5
ND 5	61.2	53.5
X 97-8	39.8	54.0
Seeding Rate: 60 lbs/A; Seeding Date: September 13; Harvest Date: August 10; Fertilizer Applied: 50 lbs/A 18-46-0 drill application; No weed control required; L.S.D. 5% = 6.8 Bu/A; C.V. = 8.2%		

Miscellaneous Small Grain Trial Tables

Table 25. 1990 Dickinson Misc. Small Grain Variety Trial		
Variety	Lbs/A Avg.	Test Wt lbs.
Bowman Barley	4241	51.0
Speltz	2970	38.0
Gazelle Spr. Rye	3135	53.0
Kramer Triticale	2723	44.0
Seeding Date : May; Harvest Date: July; Fertilizer Applied: 50 lbs/A 18-46-0; Herbicide Applied: Hoelon/Buctril tank mix; L.S.D. 5% = 391 lbs/A; C.V. = 7.5%		

Table 26. Dickinson Misc. Small Grains 5 Yr. Average						
Variety	Pounds/Acre					5 Year Average
	1990	1989	1988	1987	1986	
Bowman Barley	4241	1931	247	1699	3946	2413
Speltz	2970	1601	160	908	3268	1781
Gazelle Spr. Rye	3135	1073	145	1338	2705	1679
Kramer Triticale	2723	759	13	662	3168	1465

Table 27. 1990 Dickinson Safflower Production Trial		
Description	Lbs/A Avg.	Test Wt lbs.
Centennial	1067.3	42.0
MT 3697	955.3	44.0
87B 3797	991.3	42.0
89A 3697	787.8	43.5
Meyer Crambe	603.3	27.0
Westar Canola	162.0	53.0
Tobin Canola	130.8	51.0
Seeding Rate: 30 lbs/A; Seeding Date: May 4; Harvest Date: Safflower Sept. 10, Crambe and Canola Aug. 15; L.S.D. 5% = 143.6 lbs/A; C.V. 13.5%		

Table 28. 1990 Dickinson Safflower Quality Trial		
Description	Lbs/A Avg.	Test Wt lbs.
Centennial	890.3	40.5
MT 3697	745.3	42.0
87B 3797	767.8	41.5
89A 3697	468.8	42.5
Meyer Crambe	434.8	27.0

Westar Canola	158.0	53.0
Tobin Canola	166.5	51.0
R 500 Rape	0.0	---
87B 3882-3	501.5	42.0
88B 2903	773.3	39.0
88B 3515	1057.3	38.5
87B 3449-3	469.5	39.0
Seeding Rate: 30 lbs/A; Seeding Date: May 4; Harvest Date: Safflower Sept. 10, Crambe and Canola Aug. 15; L.S.D. 5% = 158.8 lbs/A; C.V. = 15.5%		

Table 29. 1990 Dickinson Safflower Improvement Trial

Description	Yield lbs/A	Test Wt lbs.
87B 3797	1181.5	44.0
89A 3697	913.5	43.5
MT 3697	950.5	45.0
Centennial	1246.8	42.5
L.S.D. 5%	151.4	
C.V.	8.9%	

Date Seeded: May 4; Date Harvested: Sept. 10

Table 30. 1990 Dickinson Flax Yield Trial

Variety	Bu/A Avg.	Test Wt lbs.
Clark	8.3	56.5
Flor	6.9	56.5
Verne	6.1	56.0
Neche	7.5	56.5
CI 3131	5.9	56.0

Seeding Rate: 40 lbs/A; Seeding Date: May 7; Harvest Date: Aug. 23; Fertilizer Applied: 50 lbs/A 18-46-0; Herbicide Applied: Hoelon/Buctril tank mix; L.S.D. 5% = 1.14 Bu/A; C.V. = 6.6%

Buckwheat Production Tables

Table 31. 1990 Dickinson Buckwheat Variety Trial		
Variety	Lb/A Avg.	Test wt lbs.
Common	729	49.5
Mancan	401	44.0
Giant American	355	47.5
Manor	507	45.0
Seeding Rate: 50 lbs/A; Seeding Date: June 1; Harvest Date: Sept.; Fertilizer Applied: 50 lbs/A 18-46-0; LSD 78 lbs/Acre; C.V. = 9.9%		

Table 32. Long term yields - Buckwheat, Dickinson.							
Variety	1985	1986	1987	1988	1989	1990	6 yr Avg.
Mancan	1826	1290	1810	338	183	401	975
Manor	2116	1523	1810	338	0	507	1049
Common	2280	1380*	3016	637	249	729	1382
*calculated missing value.							

Table 33. Buckwheat Date and Rate of Seeding Variable

Treatment	Yield lbs/A	Test Wt lbs.
Mancan @ 40 lbs/A	266.0	43.0
Manor @ 40 lbs/A	256.3	42.0
Mancan @ 50 lbs/A	232.5	43.0
Manor @ 50 lbs/A	228.5	42.0
Mancan @ 60 lbs/A	211.0	44.0
Manor @ 60 lbs/A	201.0	42.0
L.S.D. 5% = 46.1 lbs/A; C.V. = 12.0%; Seeding Date: June 1; Harvest Date: Sept. 24		

Table 34. Buckwheat Date and Rate of Seeding Variable

Treatment	Yield lbs/A	Test Wt lbs.
Mancan @ 40 lbs/A	506.0	43.5
Manor @ 40 lbs/A	490.0	40.5

Mancan @ 50 lbs/A	558.0	42.0
Manor @ 50 lbs/A	480.0	40.0
Mancan @ 60 lbs/A	464.0	42.5
Manor @ 60 lbs/A	385.0	40.5
L.S.D. 5% = 72.9 lbs/A; C.V. = 9.5%; Seeding Date: June 30; Harvest Date: Sept. 27		

Table 35. 1990 Dickinson Hybrid Corn Comparison Trial				
Hybred	Silage Tons/A	Harvest Moisture	Grain Bu/A.	Test Wt lbs.
Cargill 809	7.07	74.5	33.6	52.0
Cargill 2037	8.49	74.0	10.7	53.0
Cenex 809	8.16	71.5	37.0	51.5
Dahlgren K2204	8.22	71.0	6.2	52.5
Hammel H85	7.85	73.5	26.3	53.0
Hammel H90	8.89	73.5	17.7	52.0
Interstate 232A	7.45	71.5	18.6	52.5
Interstate Silo King	6.56	74.5	18.0	53.0
Interstate SF80A	6.55	74.5	23.0	54.5
Interstate SF78	6.95	68.5	37.3	55.5
Jacques 2750	7.02	70.5	10.3	59.0
Jacques 3630	7.10	75.0	8.0	53.0
Pioneer 3831	8.90	72.5	11.9	52.5
Pioneer 3921	7.68	73.5	18.0	52.5
Pioneer 3965A	6.59	77.0	15.5	54.5
Moisture basis	70%		15.5%	
Seeding Date	May 14			

Harvest Date	Aug. 23		Sept. 8	
L.S.D. 5%	1.05 tons/A		6.67 Bu/A	
C.V.	7.00 %		16.0 %	
Seeding Rate: 18,000 seeds/A; Row Width: 36 inches; Harvest Population: 14,500 plants/A; Herbicide Applied: Prowl, Preemergence				

Table 36. 1990 Dickinson Bean Variety Trial			
Variety	lbs/A Avg	Test wt lbs	Row Width inches
Hyden navy	404	60.0	12
Othello pinto	757	60.0	12
Nodak pinto	815	60.5	12
UC-5 Garbanzo	1180	58.0	12
Brewer Lentil	291	61.5	6
Seeding Date: May 22; Fertilizer Applied: 50 lbs/A 18-46-0; Herbicide Applied: Treflan, ppi; LSD 5% = 126 Lbs/A; C.V. 11.5%			
Hyden navy	520	62.0	36
Othello pinto	792	60.0	36
Nodak pinto	832	61.5	36
Seeding, fertilizer and herbicide application same as for 12 inch spacing. LSD 5% = 101 lbs/acre; C.V. = 8.8%			

Table 37. Dickinson Millet Variety Trial					
Variety	Hay yield tons/A @ 12% moisture				
	1987	1988	1989	1990	Average 4-yr.
White Proso	2.0	2.1	0.0	1.76	1.47
Red Proso	1.7	2.2	0.0	2.1	1.50
German Foxtail	1.9	1.8	0.0	---	---
Siberian	1.6	1.9	0.0	2.49	1.50
Piper Sudan	---	---	---	1.80	---

Table 38. Root Rot Control on Barley - 1990		
Treatment	Yield Bu/A	Test Wt lbs.
Azure - Control	31.9	43.0
Azure + Vitavax	31.9	43.5
Azure + Vitavax + Imazilil	27.4	46.0
Bowman - Control	32.8	49.0
Bowman + Vitavax	32.0	47.0
Bowman + Vitavax + Imazilil	27.8	49.0
L.S.D. 5% = 5.77 Bu/A; C.V. = 11.8%		

Table 39. Root Rot Control on Durum - 1990		
Treatment	Yield Bu/A	Test Wt lbs.
Vic - Control	19.3	58.0
Vic + Vitavax	19.0	57.0
Vic + Vitavax + Imazilil	20.9	59.0
Ward - Control	22.3	59.0
Ward + Vitavax	18.5	59.0
Ward + Vitavax + Imazilil	18.1	58.0

L.S.D. 5% = 2.96 Bu/A; C.V. = 9.4%

Table 40. Root Rot Control on Wheat - 1990		
Treatment	Yield Bu/A	Test Wt lbs.
Amidon - Control	22.7	58.0
Amidon + Vitavax	22.1	58.0
Amidon + Vitavax + Imazilil	20.5	58.0
Stoa - Control	25.3	57.5
Stoa + Vitavax	20.6	56.5
Stoa + Vitavax + Imazilil	17.4	56.0
L.S.D. 5% = 2.0 Bu/A; C.V. = 6.0 %		

Table 41. 1990 Dickinson PB50 Fungus Trial		
Treatment	Bu/A Avg.	Test Wt Lbs.
Stoa No P	36.0	60.0
Stoa Plus P	44.0	61.0
Stoa Plus P Plus		

PB50	43.5	61.0
Stoa Plus PB50	41.5	61.0

Seeding Rate: 1,000,000 live seeds/A (approx 1/Bu); Seeding Date: May 1; Harvest Date: Aug. 6; Fertilizer drill applied: 65 lbs/A where indicated.; Herbicide Applied: Hoelon/Buctril tank mix; L.S.D. 5% = 3.18 Bu/A; C.V. = 4.50%

Table 42. Wheat Yield With Alga Min Seed Treatment			
Treatment	Yield Bu/A	Test Wt lbs.	Height Inches
Stoa - Control	45.9	62.0	34
Stoa Treated With Alga Min	39.9	60.0	28
L.S.D. 5% = 6.72 Bu/A; C.V. = 9.0 %			

Small Grain Nursery Trial Tables

Table 43. 1990 Uniform Regional Hard Red Spring Wheat Nursery, Dickinson.
Cooperator: T.J. Conlon; Plot Area Harvested: 16 sq. ft.

Entry No.	Entry	Bu/A Avg.	Test Wt lbs.	Heading Date	Height in.	1000 K.W. grams	Bushel per Acre		
							Rep 1	Rep 2	Rep 3
1	Marquis	24.5	58.5	04-Jul	34	25.4	27.1	21.5	24.9
2	Chris	31.7	57.0	01-Jul	32	23.9	28.2	31.5	35.5
3	Stoa	36.4	58.0	28-Jun	31	24.2	36.6	39.1	33.4
4	Era	30.6	56.5	02-Jul	32	22.8	35.4	25.2	31.1
5	Butte 86	34.7	59.0	21-Jun	32	26.2	44.0	31.2	28.9
6	SD 3014	34.1	58.5	29-Jun	33	25.2	42.5	27.6	32.2
7	SD 3036	36.4	59.0	22-Jun	32	26.2	42.1	30.6	36.6
8	SD 3052	40.2	56.5	22-Jun	32	23.5	52.5	29.9	38.3
9	SD 3053	40.6	58.0	22-Jun	31	22.3	53.2	35.9	32.8
10	SD 3055	37.3	58.0	22-Jun	32	29.0	53.9	32.0	26.1
11	SD 3056	40.4	58.0	23-Jun	33	28.9	56.5	33.8	30.9
12	MN 85324	35.8	58.0	27-Jun	31	26.8	47.8	34.3	25.4
13	MN 86383	36.0	59.0	26-Jun	31	28.8	38.7	37.4	31.8
14	MN 86165	38.8	59.0	29-Jun	28	25.0	43.2	33.2	40.0
15	MN 87106	37.1	58.0	27-Jun	29	23.6	45.8	35.6	29.9
16	MN 87150	34.4	57.0	28-Jun	27	24.0	41.4	28.3	33.5
17	ND 655	39.5	60.0	28-Jun	32	24.5	42.3	38.1	38.1
18	ND 656	39.9	59.5	28-Jun	35	27.4	49.4	34.9	35.3

19	ND 657	30.1	59.5	26-Jun	33	26.6	41.8	23.2	25.3
20	ND 659	38.6	57.0	27-Jun	32	26.2	45.8	30.4	39.4
21	ND 660	36.9	59.0	27-Jun	31	25.6	37.7	37.6	35.5
22	XW 371	33.5	58.5	27-Jun	28	26.7	37.0	30.3	33.3
23	MT 8402	35.1	57.5	27-Jun	28	25.6	34.9	39.0	31.5
24	MT 8651	32.8	59.0	28-Jun	28	24.4	35.3	27.3	36.0
25	N86-0370	32.0	58.0	30-Jun	26	21.0	33.2	40.7	22.0
26	N86-0903	32.3	60.0	27-Jun	27	24.9	39.1	28.7	28.9
27	N86-0542	38.5	58.0	29-Jun	27	25.1	44.8	44.1	26.5
28	N87-0002	35.2	56.0	23-Jun	27	26.5	44.2	32.7	28.6
29	DA 984-034	38.6	58.5	27-Jun	27	26.7	51.7	29.4	34.6
30	PH 984-045	32.0	52.0	30-Jun	27	24.3	32.2	36.6	27.3
31	BW 114	33.1	59.0	29-Jun	32	25.6	39.7	37.7	21.9
32	BW 120	27.2	57.5	29-Jun	34	26.5	23.6	30.1	27.8
Seeding Date: April 24; Harvest Date: July 25; LSD .05 = 9.6 Bu/A; C.V. = 16.7 %									

Table 44. Uniform Regional Durum Nursery, Dickinson.
Cooperator: T.J. Conlon; Plot Area Harvested: 16 sq. ft.

Entry No.	Entry	Bu/A Avg.	Test Wt lbs.	Heading Date	Days to Head	Height in.	1000 K. grams	Bushels per Acre			
								Rep 1	Rep 2	Rep3	Rep 4
1	Mindum	31.9	60.0	01-Jul	68	33	33.7	23.6	37.5	39.2	27.2
2	Stoa	38.9	59.0	27-Jun	64	28	26.1	24.1	45.8	46.2	39.3
3	Ward	38.4	60.0	26-Jun	63	29	34.9	27.2	34.0	51.5	41.0
4	Rugby	37.2	60.5	27-Jun	64	32	33.1	34.2	32.6	44.8	37.3

5	Vic	36.4	61.0	27-Jun	64	31	38.0	33.3	46.6	35.0	30.7
6	Lloyd	34.4	56.0	30-Jun	67	24	31.5	32.8	37.0	37.8	30.2
7	Monroe	34.3	59.0	27-Jun	64	32	36.7	31.4	38.0	36.7	30.9
8	Renville	40.3	59.5	29-Jun	66	35	34.0	41.4	40.5	40.8	38.2
9	Medora	38.5	60.5	28-Jun	65	36	35.4	42.4	34.6	44.1	32.9
10	Sceptre	37.4	60.0	27-Jun	64	31	32.9	37.7	34.0	41.2	36.5
11	CA 885-3121A	34.4	59.5	02-Jul	69	25	33.3	33.1	34.3	41.3	29.1
12	D 8302	33.1	59.0	27-Jun	64	29	31.9	30.0	32.2	36.8	33.5
13	D 8460	38.4	58.8	27-Jun	64	30	30.9	31.7	41.0	49.2	31.8
14	D 8475	35.1	59.5	27-Jun	64	30	32.2	38.2	33.1	40.2	29.0
15	D 8479	36.6	57.5	28-Jun	65	30	31.6	35.9	33.6	46.5	30.4
16	D 86117	42.3	59.0	29-Jun	66	27	29.1	38.7	47.2	50.7	32.7
17	D 86398	40.2	59.5	29-Jun	66	32	35.5	39.9	39.9	44.7	36.3
18	D 86530	42.3	58.0	30-Jun	67	27	27.5	46.6	31.2	44.5	46.8
19	D 86560	41.8	59.0	27-Jun	64	28	32.8	42.2	35.1	46.2	43.7
20	D 86683	41.5	60.0	26-Jun	63	26	31.2	47.6	35.7	47.3	35.3
21	D 86686	41.8	59.5	26-Jun	63	26	32.2	51.2	34.0	44.8	37.2
22	D 86717	39.2	60.0	27-Jun	64	25	37.2	44.9	41.8	35.3	34.6
23	D 86725	40.2	61.0	27-Jun	64	26	35.6	45.4	43.5	32.4	39.6
24	D 86741	37.1	59.5	26-Jun	63	24	31.9	35.3	33.8	34.3	44.9
25	D 86743	39.3	58.0	23-Jun	60	24	31.4	42.0	36.8	36.7	41.8
26	D 86747	36.6	60.5	23-Jun	60	24	37.0	36.7	43.2	34.5	31.9
Seeding Date: April 24; Harvest Date: July 25; LSD .05 = 8.0 Bu/A; CV = 14.9%											

Table 45. Western Dryland Barley Nursery, Dickinson.
Cooperator: T.J. Conlon; Plot Area Harvested: 16 sq. ft.

Entry No.	Entry	Bu/A Avg.	Test Wt lbs.	Heading Date	Ht. cm	Plumpness %			Bushel per Acre		
						6/64	5.5/6	Pan	Rep 1	Rep 2	Rep 3
1	Munsing	63.4	48.0	27-Jun	27	38.1	47.9	14.1	62.3	62.1	65.8
2	Steptoe	61.8	44.5	22-Jun	25	39.9	47.9	12.3	61.9	61.2	62.5
3	Clark	73.1	52.0	24-Jun	28	68.4	28.6	3.0	71.1	71.0	77.4
4	Hector	69.8	49.0	27-Jun	28	45.1	47.9	7.0	71.0	69.3	69.0
5	ID 810099	66.6	47.0	30-Jun	23	18.8	54.0	27.2	56.2	71.0	72.5
6	Bowman	77.6	52.0	22-Jun	28	85.1	13.4	1.5	71.9	81.8	79.0
7	MT 140523	77.2	52.0	23-Jun	30	88.2	10.6	1.1	77.7	75.1	78.8
8	ID 71966	74.8	48.0	22-Jun	26	54.6	36.4	8.9	72.1	63.5	88.9
9	ND 9870	77.9	51.5	24-Jun	30	80.4	18.0	1.7	72.6	81.4	79.6
10	WA 102178	63.2	47.0	29-Jun	24	50.5	41.8	7.6	66.3	58.3	65.1
11	ID 82519	73.0	47.0	23-Jun	31	36.0	43.1	20.9	75.3	75.0	68.7
12	ID 85453	75.4	47.5	22-Jun	30	47.8	43.4	8.8	78.8	70.6	76.6
13	MT 851012	63.2	48.0	30-Jun	30	55.1	36.7	8.2	74.1	54.9	60.6
14	MT 851195	71.5	49.0	29-Jun	29	45.2	47.6	7.2	77.3	67.3	70.0
15	ND 9866	83.9	52.5	24-Jun	31	82.4	14.0	3.6	82.9	85.5	83.5
16	WA 136278	66.4	44.5	30-Jun	27	25.7	54.2	20.1	75.1	66.1	58.0
17	WA 944883	66.3	44.0	02-Jul	27	19.7	55.1	25.2	69.1	66.7	63.1
18	ID 852323	72.5	49.0	27-Jun	27	56.8	32.9	10.3	73.0	65.4	79.2
19	MT 860224	68.4	47.5	27-Jun	26	45.6	44.9	9.5	71.3	68.3	65.7

20	MT 860756	76.2	49.5	26-Jun	31	57.4	31.3	11.4	89.2	72.5	66.9
21	ND 10277	86.1	51.0	23-Jun	30	79.2	15.1	5.7	91.5	83.9	83.0
22	ND 10278	81.0	51.0	23-Jun	30	70.9	21.3	7.7	90.6	76.7	75.7
23	ND 10419	81.9	50.5	23-Jun	28	65.9	26.3	7.8	85.7	75.9	84.0
24	WA 112246	67.5	46.5	28-Jun	28	59.3	29.0	11.6	74.1	63.8	64.7
Seeding Date: April 24; Harvest Date: July 23; LSD .05 = 9.7 Bu/A; CV = 8.2 %											

Table 46. 1990 Western Spring Barley Nursery, Dickinson.
Cooperator: T.J. Conlon; Plot Area Harvested: 16 sq. ft.

Entry No.	Entry	Bu/A Avg.	Test Wt lbs.	Heading Date	Height in.	Plumpness %			Bushel per Acre		
						6/64	5.5/64	Pan	Rep 1	Rep 2	Rep3
1	Trebi	54.7	43.0	29-Jun	28	16.1	44.7	38.7	60.0	60.7	43.6
2	Steptoe	72.2	45.5	27-Jun	27	42.1	36.4	21.0	70.2	60.4	86.0
3	Klages	68.2	43.5	28-Jun	28	20.9	47.1	32.0	57.7	70.8	76.0
4	Morex	62.7	46.0	30-Jun	29	27.6	48.1	24.3	66.4	57.0	64.6
5	ID 71966	62.7	45.5	26-Jun	26	32.7	34.9	32.1	63.6	55.8	68.8
6	WA 944883	65.4	44.5	04-Jul	25	15.7	54.2	29.8	61.4	57.4	77.3
7	BA 2601	58.5	44.5	30-Jun	25	7.1	40.5	52.3	63.6	53.1	58.8
8	ID 8540	74.0	47.0	26-Jun	28	40.5	42.8	16.6	66.6	68.3	87.2
9	MN 52	59.7	45.0	28-Jun	28	22.6	43.7	33.8	68.7	59.8	50.6
10	ND 9866	78.1	49.5	21-Jun	28	74.3	19.0	6.8	77.2	78.7	78.4
11	OR 1	57.7	44.0	05-Jul	24	17.2	51.3	31.3	56.2	56.1	60.8
12	PB 107	55.1	46.5	30-Jun	28	28.7	46.9	24.2	53.2	61.2	50.9
13	UT 502358	55.4	40.0	30-Jun	24	30.8	40.1	29.0	55.7	58.2	52.2

14	WA 9029	62.4	45.0	30-Jun	26	33.4	51.7	14.8	65.8	62.6	58.9
15	WP 584118	57.4	41.0	30-Jun	22	28.4	45.5	16.0	61.0	50.9	60.3
16	BA 854026	62.8	48.0	29-Jun	27	32.5	55.6	11.7	64.0	52.7	71.6
17	BA 865169	69.4	47.0	01-Jul	28	35.9	49.4	14.7	67.2	67.6	73.4
18	ID 842974	64.1	48.5	01-Jul	28	31.3	49.7	18.9	61.9	60.6	70.0
19	MT 851012	66.4	46.0	28-Jun	26	46.6	39.8	13.4	56.2	72.0	71.1
20	MT 851195	70.4	48.0	27-Jun	27	45.8	43.8	10.3	69.3	67.7	74.2
21	MT 860756	72.6	48.0	26-Jun	27	60.9	26.8	12.2	66.9	81.2	69.7
22	ND 10277	69.0	50.0	20-Jun	26	79.9	16.8	3.3	56.5	65.9	84.5
23	ND 10278	72.3	49.0	21-Jun	27	69.0	22.9	8.0	56.7	76.4	83.9
24	OR 006	64.1	43.5	29-Jun	24	23.0	40.2	36.7	59.9	61.8	70.7
25	OR 1209	57.6	42.0	29-Jun	21	5.7	54.8	39.6	51.7	60.4	60.7
26	OR 2	61.0	44.5	29-Jun	22	25.7	53.5	20.7	61.9	51.6	69.5
27	OR 3	62.3	43.0	27-Jun	22	11.1	56.3	32.5	65.1	52.3	69.4
28	UT 1378	63.0	44.5	22-Jun	26	24.3	44.3	31.3	61.7	65.1	62.2
29	UT 1705	74.4	43.5	22-Jun	27	43.6	43.4	13.0	69.4	74.0	79.7
30	WA 903584	68.8	44.5	29-Jun	26	24.3	56.4	19.3	65.7	70.7	70.0
Seeding Date: April 24; Harvest Date: July 23; LSD .05 = 11.7 Bu/A; CV = 11.0 %											

Table 47. 1990 Advanced 2-row Barley Nursery, Dickinson.
Cooperator: T.J. Conlon; Plot Area Harvested: 16 sq. ft.

Entry No	Entry	Bu/A	Test Wt lbs.	Heading Date	Height in.	Bushels per Acre		
						Rep 1	Rep 2	Rep 3

1	Morex	60.4	49.0	23-Jun	31	77.2	54.3	49.7
2	Bearpaw	59.2	44.5	02-Jul	28	69.5	51.9	56.2
3	Bowman	73.7	52.0	20-Jun	29	82.3	61.9	76.9
4	Hazen	64.4	46.0	26-Jun	29	73.4	60.8	58.9
5	ND 10270	63.7	50.5	20-Jun	30	68.2	54.8	68.0
6	ND 10403	68.0	51.5	22-Jun	28	81.3	54.9	67.7
7	ND 11138	66.3	51.0	21-Jun	29	78.7	53.8	66.6
8	ND 11283	65.8	49.5	24-Jun	29	66.9	73.0	57.6
9	ND 11167	61.7	53.0	20-Jun	30	67.3	61.3	56.5
10	ND 11224	68.1	50.5	28-Jun	30	71.4	68.0	64.9
11	ND 11230	68.3	51.5	23-Jun	28	70.8	64.6	69.4
12	ND 11231	70.9	52.5	20-Jun	30	73.3	69.0	70.3
13	ND 11237	64.4	51.5	24-Jun	29	65.4	67.7	60.2
14	ND 11241	60.0	51.0	20-Jun	26	70.7	52.0	57.3
15	ND 11246	65.8	51.0	21-Jun	28	71.6	65.6	60.2
16	ND 11257	57.7	49.5	27-Jun	27	60.6	60.0	52.7
17	ND 11258	67.8	51.0	20-Jun	28	70.0	69.5	64.0
18	ND 11259	66.3	51.5	20-Jun	29	72.9	54.2	71.9
19	ND 11374	66.1	50.0	25-Jun	29	68.8	72.4	57.0
20	ND 11390	67.4	49.5	24-Jun	27	73.0	64.7	64.5
21	ND 11410	70.9	50.5	20-Jun	29	73.9	75.0	63.7
22	ND 11444	56.8	49.0	25-Jun	28	60.7	60.5	49.2
23	ND 11456	72.8	51.0	20-Jun	29	77.2	72.8	68.3
24	ND 11465	70.2	51.5	21-Jun	30	86.4	64.4	59.9

25	ND 11470	67.3	51.0	25-Jun	28	79.4	66.2	56.2
Seeding Date: April 24; Harvest Date: July 23; LSD .05 = 10.3 Bu/A								

Table 48. 1990 Uniform Early Oat Performance Nursery, Dickinson
Cooperator: T.J. Conlon; Plot Area Harvested: 16 sq. ft.

Entry No.	Entry	Bushel per Acre			Bu/A Avg.	Test Wt lbs.	Height in.	Height cm.	Heading	
		Rep 1	Rep 2	Rep 3					Date	fr 1/1
1	Otee (ck)	91.0	61.1	62.7	71.6	36.0	30	77	26-Jun	176
2	IL 83-7641-1	100.5	77.5	77.2	85.1	36.0	30	75	26-Jun	176
3	IL 85-6183-1	75.9	64.7	61.6	67.4	35.0	24	62	26-Jun	176
4	IL 86-1973	107.9	76.3	103.0	95.7	35.0	29	73	23-Jun	173
5	IL 86-5773	95.1	85.4	88.5	89.7	36.5	29	73	23-Jun	173
6	IL 85-524-1	84.0	71.1	83.8	79.6	35.0	28	71	23-Jun	173
7	Don (ck)	90.6	66.7	62.4	73.3	35.0	27	69	22-Jun	172
8	IA X933-11-2	97.2	66.3	58.6	74.0	36.5	29	73	24-Jun	174
9	IA D826-922	85.3	61.2	58.0	68.2	35.0	28	70	20-Jun	170
10	IA Y949-9-2	100.0	72.6	95.8	89.5	36.0	30	75	24-Jun	174
11	IA D 920-51	93.6	80.5	84.3	86.1	35.0	31	78	23-Jun	173
12	P7971A1-15-3-6	89.6	78.3	80.0	82.6	36.0	28	72	24-Jun	174
13	P8646B1-X-11-4	92.6	77.1	75.4	81.7	33.5	26	65	24-Jun	174
14	Clintford (ck)	70.6	75.3	64.6	70.2	37.0	27	68	23-Jun	173
15	OH 1011	62.9	71.6	63.6	66.0	33.0	22	57	22-Jun	172
16	OH 1012	69.4	65.2	67.8	67.5	34.0	25	63	23-Jun	173

17	OH 1014	73.6	55.4	62.7	63.9	34.5	25	64	21-Jun	171
18	PA 8393-15050	47.6	44.4	69.9	54.0	36.0	24	60	21-Jun	171
19	PA 8598-8415	68.3	56.1	68.1	64.2	36.0	24	62	20-Jun	170
20	PA 8598-4200	58.3	57.9	60.9	59.0	35.5	22	55	21-Jun	171
21	PA 8598-11662	67.1	75.4	59.6	67.4	36.5	25	63	21-Jun	171
22	SD 86067	82.4	70.8	65.9	73.0	37.0	30	77	20-Jun	170
23	MN 87189	55.5	52.9	57.1	55.2	36.0	29	73	22-Jun	172
24	MN 87194	70.6	66.9	58.8	65.4	37.0	28	71	22-Jun	172
25	MN 86108	75.7	55.1	66.3	65.7	35.0	29	73	24-Jun	174
26	MN 86109	85.4	79.4	67.7	77.5	35.5	30	75	24-Jun	174
27	MN 87187	67.6	64.8	64.5	65.6	36.5	28	71	24-Jun	174
28	Andrew (ck)	69.4	71.9	60.3	67.2	35.5	31	80	20-Jun	170
29	MO 08054	70.5	68.7	62.6	67.3	32.0	29	73	27-Jun	177
30	MO 08139	76.1	61.8	70.0	69.3	31.5	30	75	26-Jun	176
31	MO 8368	66.8	70.2	66.2	67.7	34.0	27	69	20-Jun	170
32	MO 8382	78.3	72.7	66.7	72.5	34.0	29	74	26-Jun	176
33	Bates (ck)	69.4	75.7	69.7	71.6	34.5	28	70	23-Jun	173

Seeding Date: April 24; Harvest Date: July 24; LSD .05 = 12.9 Bu/A; CV = 11.0%

Table 49. 1990 Uniform Midseason Oat Performance Nursery, Dickinson
Cooperator: T.J. Conlon; Plot Area Harvested: 16 sq. ft.

Entry No.	Entry	Bushel per Acre			Bu/A Avg.	Test W lbs.	Height in.	Height cm	Heading	
		Rep 1	Rep 2	Rep 3					Date	fr 1/1

1	IL 82-2154	76.6	84.7	82.2	81.2	33.0	30	75	26-Jun	176
2	IL 85-6264-1	70.7	83.4	81.5	78.5	34.0	27	69	29-Jun	179
3	IL 83-8518-1	62.6	65.6	62.6	63.6	34.5	26	67	26-Jun	176
4	IL 85-2069-1	54.9	71.1	68.2	64.7	34.0	28	72	20-Jun	170
5	IL 86-1919	72.0	66.7	75.4	71.4	34.5	28	70	22-Jun	172
6	Ogle (ck)	87.0	68.1	74.9	76.7	35.5	29	74	27-Jun	177
7	P76134C3-37-3-5-3-1-8	60.3	60.6	59.9	60.3	34.0	29	73	27-Jun	177
8	P76189RD4-18-2-4-5-10	61.9	63.0	66.6	63.8	35.0	27	69	22-Jun	172
9	P86104A1-1-6	71.6	71.4	64.8	69.3	32.5	31	78	28-Jun	178
10	IA B605X	60.6	61.9	73.1	65.2	36.0	28	72	20-Jun	170
11	IA D226X	61.8	60.2	65.1	62.4	35.0	27	69	20-Jun	170
12	White Ogle	69.1	72.1	73.2	71.5	33.5	28	71	27-Jun	177
13	PA 8393-11138	59.7	67.1	72.1	66.3	38.0	29	74	29-Jun	179
14	PA 8494-11717	40.8	39.0	71.2	50.4	36.0	25	63	22-Jun	172
15	PA 8393-1500	73.8	75.4	74.5	74.5	34.5	29	73	29-Jun	179
16	Clintland 64 (ck)	90.1	63.7	71.6	75.2	33.5	31	79	23-Jun	173
17	SD 840104	83.7	63.7	86.8	78.1	36.0	31	79	28-Jun	178
18	SD 85009	87.7	75.8	62.0	75.2	35.0	32	81	28-Jun	178
19	MN 86231	87.1	77.6	86.3	83.7	36.0	29	74	28-Jun	178
20	MN 86228	68.8	72.4	68.0	69.7	37.0	30	75	24-Jun	174
21	MN 88233	68.6	64.8	73.7	69.0	37.0	28	72	27-Jun	177
22	Gopher (ck)	71.7	76.3	86.5	78.2	34.0	31	79	27-Jun	177
23	OH 1006	78.1	67.1	82.4	75.9	32.5	28	72	27-Jun	177
24	OH 1023	71.1	59.2	71.3	67.2	32.5	24	61	21-Jun	171
25	OH 1022	79.5	71.0	93.0	81.2	34.5	26	66	28-Jun	178

26	OH 1007	62.7	51.3	76.9	63.7	34.5	27	68	23-Jun	173
27	ND 862585	75.1	65.5	88.1	76.2	36.0	30	76	29-Jun	179
28	ND 860416	70.0	73.6	69.3	71.0	36.5	30	77	29-Jun	179
29	ND 862106	72.3	51.3	70.1	64.5	36.0	31	80	28-Jun	178
30	ND 861246	87.1	81.4	87.0	85.1	36.5	32	82	27-Jun	177
31	ND 862415	65.9	75.9	85.7	75.8	36.0	33	83	28-Jun	178
32	Dal (ck)	68.0	76.0	71.8	71.9	34.5	29	74	28-Jun	178
33	WI X5229-1	74.2	72.5	73.0	73.2	31.5	29	74	28-Jun	178
34	WI X5445-4	60.4	65.5	72.8	66.2	32.5	28	72	30-Jun	180
35	WI 5560-1	71.8	71.7	79.8	74.4	33.5	30	75	28-Jun	178
36	WI X5560-2	65.4	74.5	72.6	70.8	33.5	29	73	28-Jun	178
Seeding Date: April 24; Harvest Date: July 24; LSD .05 = 11.7 Bu/A; CV = 10.1%										

Table 50. 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
1990	11.8	10.6

15 Year Average	14.7	18.3
*Yield significantly higher.		

Table 51. Wheat production on fallow and recrop.		
Year	Yield	
	Fallow	Continuous Re-cropping
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
1990	33.7	10.6

15 Year Average	31.8	16.8

Table 52. Cropping systems trial yields 1983 to 1990										
Crop and Rotation	1983	1984	1985	1986	1987	1988	1989	1990	8 Year Average	% of Fallow
	Bushels per Acre									
Wheat Yields on:										
Fallow	47.1	34.5	36.7	57.8	20.7	9.4	20.1	36.9	32.9	100
Continuous recrop	38.5	27.2	20.6	36.1	9.3	0.0	5.7	10.6	18.5	56
No-till continuous	39.0	20.4	14.8	22.9	4.8	0.0	9.3	11.8	15.4	47
Sunflower stubble	46.1	21.4	16.9	39.5	6.5	0.0	9.0	15.6	19.4	59
Corn stubble	47.2	32.2	29.6	45.4	16.6	0.0	10.2	17.7	24.9	76
Barley Yields on:										
Sunflower stubble	64.8	36.3	31.5	43.6	26.8	0.0	9.0	21.8	29.2	
Corn Yields on Wheat Stubble:										
Grain (Bu/A)	72.6	72.4	56.5	57.2	82.4	11.2	0.0	21.9	46.8	
Silage (Tons/A)	10.3	8.9	12.6	9.7	12.7	4.5	2.7	7.9	8.7	
Sunflower on:										
Wheat stubble (Lbs/A)	1784	1664	1224	2423	1182	0.0	0.0	0.0	1035	