

**SIXTH
ANNUAL**

WESTERN DAKOTA

CROPS DAY RESEARCH REPORT



**HETTINGER ARMORY
DECEMBER 7, 1989**

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6th ANNUAL WESTERN DAKOTA CROPS DAY

DECEMBER 7, 1989

HETTINGER ARMORY

MST

- 9:00 am Registration
Coffee and doughnuts. Free time to view exhibits
and visit with Ag Industry Program Sponsors.
- 10:30 Welcome
Dr. H. R. Lund, Director of Agriculture, NDSU,
Fargo.
- 10:45 Crop Variety Updates and Highlights of Ongoing Crop
Production Research
Tom Conlon, Superintendent and Agronomist,
Dickinson Research Center

Eric Eriksmoen, Agronomist, Hettinger Research
& Extension Center
- 12:00 Lunch
Provided by Program Sponsors. Free time to
visit with sponsors.
- 1:00 pm Ag Industry Update
"Detection and Control of Common Root Rot"
Mr. Kyle Schafer, Agsco, Bismarck.

"Herbicide Management - The Biggest Bang for
your Buck", Mr. Greg Webster, BASF, Grand Forks.

"Specialty Crops in Southwestern North Dakota"
Mr. Steve Edwardson, Minn-Dak Growers, Dickinson.
- 1:30 Ammonia Losses from Broadcast Urea
Mr. Dave Claypool, Dickinson Research Center.
- 2:00 Low Input Sustainable Agriculture
Mr. Fred Kirschenmann, Producer, Windsor, ND.
- 2:30 Alfalfa Production and Management
Dr. Ed Twidwell, South Dakota State University,
Brookings, SD.
- 3:00 Conclusion
Drawing for door prizes, coffee and opportunity
to visit with sponsors.

4TH ANNUAL WESTERN DAKOTA GROW DAY

WAGGONER, W. 1989

WETTINGER, ARMOY

Time	Activity
9:00 am	Registration Coffee and doughnuts. Free time to view exhibits and visit with Ag Industry Program Sponsors.
10:30	Welcome Dr. H. R. Lamb, Director of Agriculture, NDSU, Ward.
10:45	Crop Variety Updates and Highlights of Ongoing Crop Production Research Tom Coston, Superintendent and Agronomist, Dickinson Research Center Eric Eriksson, Agronomist, Wettinger Research & Extension Center
12:00	Lunch Provided by Program Sponsors. Free time to visit with sponsors.
1:00 pm	Ag Industry Update "Detection and Control of German Root Rot" Mr. Kyle Scherer, Assoc. Biologist, "Herbicide Management - The Biggest Bang for Your Buck", Mr. Greg Webster, DARD, Grand Forks "Specialty Crops in Southwestern North Dakota" Mr. Steve Erickson, Minn-Dak Growers, Dickinson
1:30	Announcements from Broadcast Unit Mr. Dave Claypool, Dickinson Research Center.
2:00	Low Input Sustainable Agriculture Mr. Fred Rischmann, Producer, Winstad, ND.
2:30	Agiles Production and Management Dr. Ed Twissell, South Dakota State University, Brookings, SD.
3:00	Conclusion Drawing for door prizes, coffee and opportunity to visit with sponsors.

ACKNOWLEDGEMENTS

The Hettinger Research and Extension Center and the Dickinson Research Center gratefully acknowledge and thank the following companies and organizations for their financial support and participation in this year's Western Dakota Crops Day. Those listed below have provided for the noon meal and have sponsored the event in total. We thank them for their past and present commitment and support.

1989 Western Dakota Crops Day Sponsors

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We also acknowledge and thank the following individuals for their willingness to cooperate with us at our off-station plot sites. Their participation has enable us to gather valuable information which would not otherwise be possible.

Daryl Birdsall, New Leipzig
Gordon Paulson, Scranton
August and Perry Kirschmann, Regent
Calvin Hepper, Selfridge
Dan Christman, Hettinger
Amos and Walter Gietzen, Glen Ullin
Ted Reich, Beulah
Pat Doll, Hannover
Golden Valley SCD, Beach

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Ammonia Losses from Broadcast Urea Applied to Pasture,
Stubble, and Tilled Soil in Southwestern North Dakota.

SECTION III

Economic Return Comparison of Hard Red Spring Wheat
Varieties in Southwestern North Dakota.

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

<u>Precipitation</u>	<u>1987-88</u>	<u>1988-89</u>	<u>95 Year Average</u>
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.	<u>1.87</u>	<u>1.92</u>	<u>3.89</u>
Total	8.63	11.52	15.84

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

GROWING CONDITIONS
 HETTINGER RESEARCH AND EXTENSION CENTER
 -1989-

Total precipitation for the twelve month period, September, 1988 through August, 1989 was 16.72 inches resulting in generally adequate soil moisture throughout the growing season. Lack of timely fall moisture caused stress on the hard red winter wheat and resulted in severe winter kill. Soil crusting early in the growing season contributed to some thin small grain stands throughout the area.

Hot temperatures during the first 2 weeks of July resulted in pollen sterility (blast) and lower yields in some crops (corn and buckwheat) and some varieties (Stoa HRSW and Bowman barley, etc.).

Common root rot of HRSW, durum and barley was the most prevalent disease problem while tan spot of wheat and sclerotinia head rot of sunflowers were also noted.

WEATHER DATA SUMMARY
 HETTINGER

Precipitation	1987-88	1988-89	30 Year Average
Sept. - Dec. 1987	1.31	2.03	2.97
Jan. - Mar. 1988	2.24	1.62	1.13
April - June	4.79	7.38	8.08
July - August	1.78	5.69	3.81
Total	10.12	16.72	15.99

Average Temperature F.	1988	1989	30 Year Average
April	43.4	42.8	42
May	58.0	54.2	54
June	74.8	61.6	64
July	71.4	74.2	70
August	69.9	70.0	69

INTERPRETING STATISTICAL ANALYSIS

Field research involves the testing of one or more variables such as crop varieties, fertilizers, tillage methods, etc. Field testing of such variables is conducted in order to determine which variety, tillage method, or fertilizer, etc., is best for the particular area of production. The main objectives of crop production research are to determine the best means of producing the crop and how to maximize yield and economic return from farming.

Agricultural researchers use statistics as a tool in helping to differentiate the production variables in question so real and meaningful conclusions can be drawn from a relatively large amount of data. One of these tools is the Coefficient of Variability (C.V.%). This statistic gives an indication of the amount of variation in an experimental trial. Trials conducted use four replications or repetitions of the variable in question. For example, the variety Stoa HRSW appeared four times (four replications) in the HRSW variety trial. In this case, the C.V.% for yield of the Hettinger HRSW variety trial was 11.9%. This C.V.% is a relative measure of how much the yield of all HRSW varieties varied between replications. In other words, C.V.% is a measure of the precision or effectiveness of the trial and procedures used in conducting the trial.

More can be said about a field trial with a relatively low C.V.% (10 or less) than one with a C.V.% of over 10. Attempts are made to control human error and some environmental conditions such as conducting field studies on a uniform soil so variability between replicates is minimized with a resulting low value for C.V.%. In summation, a trial with C.V.% of 8 is more precise and more can be concluded from it than a trial with a C.V.% of 18.

Another important statistical tool is the Least Significant Difference or LSD. If the yield of variety A exceeds variety B by more than the LSD 5% value you can conclude that under like environmental conditions, variety A will significantly out-yield variety B 95% of the time. The LSD value allows you to separate varieties, tillage practices, or any other variable and determine whether or not they are actually different. The LSD 1% value is always larger than the value for LSD 5% and is used in the same manner. If the yield of variety A exceeds variety B by more than the LSD 1% value you can conclude that under like environmental conditions, variety A will significantly out-yield variety B 99% of the time. Little confidence can be placed in variety or treatment differences being meaningful unless the results differ by more than the LSD value.

1989 Dickinson Hard Red Spring Wheat Yield Trial

Variety	----- 1989	Yield 3-yr. avg.	----- 1989 Test Wt.
Butte 86	23.5	21.1	59.0
Amidon	23.2	21.2	57.0
Telemark *	22.0	19.2	54.0
Pioneer 2369 *	21.8	22.6	58.5
Nordic *	21.7	20.8	57.0
Celtic *	21.4	18.8	58.5
Pioneer 2385 *	20.8	--	58.5
Stoa	21.2	20.6	55.5
ND 656	20.3	--	58.0
Gus *	20.2	18.7	56.5
ND 652	20.0	--	57.5
Pioneer 2375 *	20.0	--	58.0
Vance *	19.8	--	56.5
Columbus	18.9	21.1	53.0
Fjeld *	18.6	--	55.0
Grandin *	18.5	21.6	54.5
Roblin	18.5	--	53.5
Prospect *	18.4	16.4	57.0
ND 650 *	18.3	--	58.5
W 2501	18.2	--	53.0
Cutless *	18.0	17.9	58.5
Norak *	17.8	18.7	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	19.1	57.0
ND 653 *	16.7	--	57.0
Rambo *	16.6	16.9	58.0
Alex	16.4	21.3	58.0
Marshall *	16.3	19.3	54.5
W 2502	15.2	--	51.0
ND 654	15.0	--	57.5
Norseman *	14.6	20.7	54.5
Leif *	13.9	19.4	55.0
FA 982-220 *	13.9	--	53.0
ND 643	10.2	--	54.0
LSD .05	4.7		
* semidwarf			

1989 HETTINGER HARD RED SPRING WHEAT TRIAL

Variety	Yield bu/A	Test Weight lbs/bu	Grain Protein %	Heading Date June	Plant Height cm	3 Year Average* bu/A	Gross Income 1989** \$
Alex	56.6	59.7	17.2	27.2	75	37.4	215.08
Nordic	56.2	61.6	15.2	26.8	73	36.7	213.56
P2369	54.3	61.2	16.9	25.0	65	38.0	206.34
Grandin	52.4	60.3	17.6	23.0	70	38.9	199.12
ND655	51.3	60.9	17.6	25.5	73		
P2385	50.7	60.6	16.9	21.5	68	34.5	192.66
Marshall	50.2	57.2	16.6	27.8	64	36.2	190.76
FA982220	50.1	59.3	16.0	27.5	65		
Fjeld	50.0	59.0	16.6	23.2	67		190.00
Norseman	49.9	56.0	17.5	27.8	66	33.9	189.78
Norak	49.8	59.5	16.4	24.8	63	35.0	189.10
ND656	49.6	61.1	18.0	23.5	80		
ND653	49.3	58.5	17.0	26.8	73		
Prospect	49.0	59.2	16.2	25.0	72	34.5	186.23
ND652	48.8	60.3	18.3	27.0	74		
W2502	48.7	56.9	17.0	21.8	68		
Vance	48.6	58.4	17.0	27.5	65	34.6	184.74
ND657	47.5	60.5	18.6	25.5	73		
Amidon	47.0	59.3	18.3	25.8	79	26.2	178.70
Rambo	47.0	60.6	17.0	26.0	65	35.4	178.65
W2501	46.9	56.2	16.5	25.2	63		
ND650	46.8	61.4	19.4	27.5	72		
Len	46.5	59.4	17.6	26.8	64	33.4	176.54
Coteau	46.1	58.8	18.8	30.0	75	33.2	175.24
Columbus	46.1	58.8	19.2	28.2	87	30.7	175.22
Gus	46.0	60.0	18.0	26.5	74	32.9	174.96
Minnpro	45.9	56.3	18.9	26.8	69	33.2	174.44
P2375	45.5	60.3	17.7	22.0	69		172.81
Cutless	45.4	58.8	19.3	29.5	75	31.6	172.58
Celtic	45.2	58.9	18.0	25.5	74	31.4	171.58
Leif	45.1	58.6	17.3	26.2	76	34.2	171.52
Telemark	44.5	56.8	18.7	26.5	57	32.7	169.21
Laura	44.0	58.2	18.9	23.8	81	32.7	167.29
Roblin	43.5	56.5	18.4	20.5	74	33.7	165.19
ND654	43.4	58.6	18.9	25.8	74		
Waldron	43.2	56.9	19.3	25.2	80	30.1	177.77
Stoa	43.0	57.2	17.8	26.2	74	33.2	163.29
Wheaton	41.9	56.2	17.0	25.5	68	33.8	159.37
SD2980	41.8	61.0	17.2	21.8	74		
Katepwa	41.7	57.1	18.9	26.0	89	31.3	158.53
Butte 86	41.2	58.8	18.0	21.8	71	34.8	156.60
ND658	37.0	59.2	19.2	22.0	81		
ND643	35.1	55.8	22.4	26.5	79		

L.S.D. 5% 7.8

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
Lelf	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 9 May 10 May 4
 Harvest Date: July 31 Aug. 11 Aug. 4 Aug. 7 Aug. 1
 LSD 5% (Bu/A): 4.7 5.2 4.6 4.0 4.4
 CV (%): 18.3 10.9 11.2 6.5 7.7
 Fertilizer Applied: according to soil test at each site.
 Herbicide Applied: Hoelon-Buctril tank mix
 Seeding Rate: 1 Bu/A

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

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
Leu	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

1989 HETTINGER OFF-STATION HARD RED SPRING WHEAT TRIAL

Variety	Yield bu/A					Average 5 Sites
	Hettinger	Regent	Scranton	New Leipzig	Selfridge	
Alex	56.6	30.2	34.4	39.8	39.2	40.0
Nordic	56.2	37.9	35.9	47.8	47.8	45.1
P2369	54.3	35.4	36.5	42.2	42.4	42.2
Grandin	52.4	31.9	31.1	41.7	40.0	39.4
Amidon	47.0	34.0	36.3	40.0	38.8	39.2
Len	46.5	31.6	33.7	39.6	37.2	37.7
Coteau	46.1	29.2	29.0	36.3	35.6	35.2
Gus	46.0	32.8	36.2	39.9	39.8	38.9
Cutless	45.4	29.0	28.3	36.2	35.2	34.8
Celtic	45.2	34.6	33.3	41.3	40.8	39.0
Leif	45.1	33.5	31.6	44.8	46.8	40.4
Stoa	43.0	30.8	31.8	43.0	40.6	37.8
Butte 86	41.2	32.2	32.4	41.7	39.9	37.5
Trial Mean	46.8	32.6	33.2	41.1	40.3	
C.V. %	11.9	7.1	10.3	7.0	7.3	
LSD 5%	7.8	3.6	4.9	4.4	4.5	
LSD 1%	10.3	4.9	n.s.	6.2	6.3	
# of Reps	4	4	4	4	4	

Variety	Test Weight lbs/bu				
	Hettinger	Regent	Scranton	New Leipzig	Selfridge
Alex	59.7	59.2	60.5	62.3	62.0
Nordic	61.6	60.4	61.0	62.8	62.7
P2369	61.2	60.0	61.6	62.8	62.4
Grandin	60.3	58.3	58.2	62.0	61.6
Amidon	59.3	58.8	59.5	61.2	60.8
Len	59.4	58.1	58.8	62.0	61.4
Coteau	58.8	57.2	58.8	60.5	59.6
Gus	60.0	58.8	59.4	61.8	61.4
Cutless	58.8	57.4	58.2	60.7	60.0
Celtic	58.9	58.1	59.8	62.2	62.0
Leif	58.6	56.4	58.8	61.5	61.6
Stoa	57.2	57.1	58.0	61.4	60.8
Butte 86	58.8	58.9	59.7	61.8	62.0
Trial Mean	58.8	58.4	59.4	61.8	61.4
C.V. %	1.6	1.8	1.4	0.7	0.6
LSD 5%	1.3	1.5	1.1	0.6	0.5
LSD 1%	1.7	2.0	1.5	0.9	0.7
# of Reps	4	4	4	4	4

Hettinger Off-Station HRSW continued.

Variety	Hettinger	Regent	Scranton	New Leipzig	Selfridge	Average 5 Sites
	Grain Protein %					
Alex	17.2	18.9	17.8	16.1	16.2	17.2
Nordic	15.2	15.9	14.9	13.9	14.2	14.8
P2369	16.9	17.2	16.1	15.7	16.2	16.4
Grandin	17.6	17.8	17.8	16.9	16.8	17.4
Amidon	18.3	18.1	17.5	16.6	16.6	17.4
Len	17.6	18.2	17.6	16.2	16.6	17.2
Coteau	18.8	19.7	18.9	17.4	18.0	18.6
Gus	18.0	18.2	17.3	16.4	16.3	17.2
Cutles	19.3	19.8	19.4	17.3	17.8	18.7
Celtic	18.0	18.0	17.1	16.3	15.9	17.1
Leif	17.3	18.0	16.7	15.8	15.6	16.7
Stoa	17.8	17.6	17.4	16.0	15.8	16.9
Butte 86	18.0	17.2	17.1	16.3	16.1	16.9
Trial Mean	17.8	18.0	17.3	16.2	16.3	
C.V. %	3.9	2.7	3.5	2.9	1.6	
LSD 5%	1.0	0.7	0.9	0.7	0.4	
LSD 1%	1.3	0.9	1.2	1.0	0.6	
# of Reps	4	4	4	4	4	

Planting

Date: 4/14 4/19 4/19 4/20 4/20

Harvest

Date: 8/1 8/2 8/2 8/4 8/4

Seeding Rate: 1.1 million live seeds/A (approx. 1.25 bu/A)

Fertilizer Applied: According to soil test at each site

Yield Goal: 60 bu/A

n.s. = no statistical difference between varieties

1989 Dickinson Durum Yield Trial

Variety	Yield		1989 Test Wt.
	1989	3-yr. avg.	
D 8380 *	28.1	23.7	62.0
D 8370 *	27.8	24.0	61.0
D 8479	27.2	--	62.0
D 8475	27.2	---	62.0
Lloyd *	26.4	26.4	61.0
D 84130 *	24.8	---	63.5
Medora	22.8	25.1	62.0
Rugby	22.8	25.1	61.0
Vic	22.8	22.4	61.5
D 8460	22.0	---	62.5
Renville	22.0	24.2	61.0
Monroe	21.7	22.0	61.5
CA 885-312 *	21.2	---	62.0
Regal	20.9	24.4	62.0
D 8302	20.6	20.5	61.5
D 8291 *	19.8	24.3	61.5
Ward	17.1	20.5	60.5
LSD .05	6.6		
* semidwarf			

1989 HETTINGER DURUM TRIAL

Variety	Yield bu/A	Test Weight lbs/bu	Grain Protein %	Heading Date June	Plant Height cm	3 Year Average* bu/A	Gross Income 1989** \$
Regal	49.0	62.1	18.0	26.2	90	36.6	186.38
D8370	48.1	60.7	17.6	27.8	64		
D8475	46.6	61.3	17.7	25.0	74		
Lloyd	46.5	62.1	17.9	27.0	62	35.5	176.76
Ward	46.4	61.5	18.6	25.2	90	33.2	176.32
D8479	46.4	60.4	17.7	26.0	69		
D8380	46.3	62.4	17.4	27.8	64		
D8302	44.6	60.5	18.1	25.5	65		
Medora	44.1	61.6	19.7	25.2	89	32.8	167.57
Monroe	43.1	60.6	18.7	22.0	81	33.8	163.63
D8291	42.8	59.4	18.6	27.2	58		
Vic	42.6	61.5	18.7	25.8	83	32.8	161.88
D8460	42.5	59.6	19.2	25.5	70		
Renville	40.5	59.5	19.2	26.2	80	32.5	154.01
D84130	39.1	60.1	20.2	27.5	58		
Rugby	35.6	60.2	20.0	25.8	80	28.1	135.19
Trial Mean	44.0	60.8	18.6	26.0	74		
C.V. %	15.7	1.4	5.5	0.1			
LSD 5%	n.s.	1.2	1.5	0.9			
LSD 1%	n.s.	1.6	1.9	1.2			
# of Reps	4	4	4	4	1		

Planting Date: 4/14/89

Seeding Rate: 1.1 million live seeds/ A (approx. 1.25 bu/A)

Fertilizer Applied: 75 lbs/A 18-46-0

Herbicide Applied: 3 pt/A Hoelon + 1 pt/A Buctril + 1.5 oz/A MCPA ester

Yield Goal: 60 bu/A

Harvest Date: 8/1/89

* = average of 1987, 1988 and 1989 crop years.

** = gross income based on USDA estimate adjusted to ND for 1989 crop (\$3.80/bu).

n.s. = no statistical difference between varieties.

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 9 May 10 May 10 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
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

1989 HETTINGER OFF-STATION DURUM TRIAL

Variety	Hettinger	Regent	Scranton	New Leipzig	Selfridge	Average 5 Sites
	Yield bu/A					
Lloyd	46.5	35.2	41.8	41.7	39.8	41.0
Medora	44.1	40.2	41.0	44.2	39.2	41.7
Monroe	43.1	37.0	40.0	36.4	36.4	38.6
Regal	49.0	30.9	42.1	37.9	40.8	40.1
Renville	40.5	28.5	39.4	40.0	42.4	38.2
Vic	42.6	30.6	37.1	38.0	39.6	37.6
Ward	46.4	30.3	36.7	39.5	40.8	38.7
Trial Mean	44.0	31.4	39.7	39.7	39.8	
C.V. %	15.7	9.5	9.2	15.4	10.4	
LSD 5%	n.s.	n.s.	n.s.	n.s.	n.s.	
# of Reps	4	4	4	4	4	

	Test Weight lbs/bu					
Lloyd	62.1	60.9	62.9	64.1	63.9	62.8
Medora	61.6	60.7	63.2	63.6	62.7	62.4
Monroe	60.6	59.3	63.0	62.6	62.3	61.6
Regal	62.1	61.3	63.1	63.7	63.2	62.7
Renville	59.5	58.4	61.7	62.8	62.0	60.9
Vic	61.5	61.1	62.9	63.4	62.5	62.3
Ward	61.5	60.4	62.7	63.7	62.8	62.2
Trial Mean	60.8	60.0	62.3	63.4	62.8	
C.V. %	1.4	0.9	0.7	0.8	0.4	
LSD 5%	1.2	0.8	0.6	0.8	0.4	
LSD 1%	1.6	1.1	0.8	1.1	0.5	
# of Reps	4	4	4	4	4	

Planting

Date: 4/14 4/19 4/19 4/20 4/20

Harvest

Date: 8/1 8/2 8/2 8/4 8/4

Seeding Rate: 1.1 million live seeds/A (approx. 1.25 bu/A)

Fertilizer Applied: According to soil test at each site

Yield Goal: 60 bu/A

n.s. = no statistical difference between varieties

1989 Dickinson Barley Yield Trial

Variety	----- Yield ----- 1989 3-yr. avg.	1989 Test Wt.
ND 9870	44.3	50.0
Hector	44.0	48.0
MT 81616	41.6	44.0
Gallatin	41.3	47.0
Lewis	39.9	49.0
ND 9147	37.8	47.5
Hazen *	35.1	44.0
ND 9866	33.7	49.0
Robust *	32.7	48.0
Azure *	31.6	45.5
B 1602 *	28.2	47.0
Morex *	28.2	44.5
Bowman	26.1	48.0
M 52 *	25.1	42.5
B 1603 *	22.3	44.0
Ellice	18.9	48.0
LSD .05	7.6	
* 6-row type		

1989 HETTINGER BARLEY TRIAL

Variety	Yield bu/A	Test Weight lbs/bu	Grain Protein %	Heading Date June	Plant Height cm	3 Year Average*	Gross Income 1989** \$
ND9870	82.3	53.3	15.0	27.0	67		
ND9866	75.0	53.5	15.0	27.2	68		
ND9147	73.2	52.8	15.4	28.0	60		
MT81616	71.1	49.3	17.0	30.0	69		
Gallatin	70.5	50.3	16.7	27.0	78	58.2	123.38
Lewis	68.4	49.9	17.4	28.5	67	56.9	119.70
M52	64.9	46.8	16.2	26.5	65		
Morex	63.5	47.6	16.2	26.0	77	53.6	111.12
Bowman	62.5	53.4	16.4	28.2	77	60.1	109.40
Hazen	61.8	47.6	15.0	26.0	65	55.2	108.17
Ellice	61.1	48.8	17.5	27.8	67	45.1	106.95
Azure	59.9	46.5	15.8	23.0	70	55.7	104.74
Robust	59.3	47.5	16.5	26.0	83	49.2	103.76
Hector	58.5	49.2	16.0	28.5	72	54.4	102.39
B1603	53.5	48.0	18.4	23.8	70		93.70
B1602	49.8	46.0	16.4	26.5	70		87.13
Trial Mean	64.7	49.4	16.3	26.9	70		
C.V. %	10.7	3.1	13.1	0.1			
LSD 5%	9.9	2.2	n.s.	1.2			
LSD 1%	13.2	3.0	n.s.	1.6			
# of Reps	4	4	4	4	1		

Planting Date: 4/14/89

Seeding Rate: 750,000 live seeds/ A (approx. 1.3 bu/A)

Fertilizer Applied: 75 lbs/A 18-46-0

Herbicide Applied: 3 pt/A Hoelon + 1 pt/A Buctril + 1.5 oz/A MCPA ester

Yield Goal: 80 bu/A

Harvest Date: 7/28/89

* = average of 1987, 1988 and 1989 crop years.

** = gross income based on USDA estimate adjusted to ND for 1989 crop (\$1.75/bu).

n.s. = no significant difference between varieties.

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

1989 HETTINGER OFF-STATION BARLEY TRIAL

Variety	Hettinger	Regent	Scranton	New Leipzig	Selfridge	Average 5 Sites
Yield bu/A						
Gallatin	70.5	45.7	71.7	52.8	65.9	61.3
Bowman	62.5	51.4	70.3	52.6	66.9	60.7
Hector	58.5	45.2	69.6	44.0	68.4	57.1
Azure	59.9	32.8	55.0	48.9	41.1	47.5
Morex	63.5	31.4	52.2	45.5	42.9	47.1
Robust	59.3	31.4	51.9	48.3	42.0	46.6
Trial Mean	64.7	39.7	61.8	48.7	54.5	
C.V. %	10.7	9.3	7.0	18.2	9.7	
LSD 5%	9.9	5.5	6.5	n.s.	7.9	
LSD 1%	13.2	7.5	8.9	n.s.	10.8	
# of Reps	4	4	4	4	4	
Test Weight lbs/bu						
Gallatin	50.3	49.5	52.2	51.0	51.2	50.8
Bowman	53.4	52.0	54.0	51.8	53.4	52.9
Hector	49.2	48.2	52.1	48.5	50.8	49.8
Azure	46.5	45.3	49.3	49.1	48.6	47.8
Morex	47.6	45.6	49.5	49.6	48.2	48.1
Robust	47.5	46.5	49.4	49.7	50.1	48.6
Trial Mean	49.4	47.9	51.1	49.9	50.4	
C.V. %	3.1	1.8	1.6	2.5	2.5	
LSD 5%	2.2	1.3	1.2	1.7	1.9	
LSD 1%	3.0	1.8	1.6	n.s.	2.6	
# of Reps	4	4	4	4	4	
Grain Protein %						
Gallatin	16.7	17.7	16.1	15.3	14.9	16.1
Bowman	16.4	16.4	16.1	15.7	14.8	15.9
Hector	16.0	17.6	16.5	15.4	17.4	16.6
Azure	15.8	16.6	15.4	14.0	14.7	15.3
Morex	16.2	17.7	16.2	14.8	14.9	16.0
Robust	16.5	16.3	16.1	15.2	15.2	15.9
Trial Mean	16.3	17.1	16.1	15.1	15.3	
C.V. %	13.1	3.3	3.0	4.9	14.8	
LSD 5%	n.s.	0.8	n.s.	n.s.	n.s.	
LSD 1%	n.s.	1.1	n.s.	n.s.	n.s.	
# of Reps	4	4	4	4	4	
Planting						
Date:	4/14	4/19	4/19	4/20	4/20	
Harvest						
Date:	8/1	8/2	8/2	8/4	8/4	
Seeding Rate:	750,000 live seeds/A (approx. 1.3 bu/A)					
Fertilizer Applied:	According to soil test at each site					
Yield Goal:	80 bu/A					
n.s. = no statistical difference between varieties						

1989 Dickinson Oat Yield Trial

Variety	----- 1989	Yield 3-yr. avg.	----- 1989 Test Wt.
Otana	44.6	44.6	32.5
ND 820744	39.9	42.4	34.0
ND 820294	39.9	45.3	29.5
Riel	39.4	40.5	34.5
ND 840341	38.8	--	36.5
ND 830775	37.6	44.5	37.0
ND 830185	37.6	40.9	37.0
ND 840769	35.9	--	35.0
ND 820559	35.9	38.5	31.5
ND 831122	35.9	38.6	31.5
ND 821742	35.3	43.0	32.5
Steele	34.2	42.8	32.0
Valley	33.0	38.0	35.0
Trucker	32.4	--	37.0
ND 841974	31.8	--	37.0
Dumont	31.8	41.8	35.0
Hyttest	31.3	33.7	36.5
ND 840413	31.3	42.2	35.5
Monida	28.9	46.8	31.0
ND 810104	28.9	28.6	29.5
ND 830646	28.4	46.2	35.0
Porter	26.5	42.9	33.5
ND 840876	22.6	--	34.0
Robert	14.7	--	32.5
Tibor	12.7	--	40.0
LSD .05	4.4		

1989 HETTINGER OAT TRIAL

Variety	Yield bu/A	Test Weight lbs/bu	Grain Protein %	Heading Date June	Plant Height cm	3 Year Average* bu/A	Gross Income 1989** \$
Monida	93.7	34.8		29.5	70	80.8	140.61
Border	92.5	34.5		28.0	63	81.5	138.82
Riel	89.3	40.5		27.0	74	75.5	133.97
ND831122	88.2	38.6		26.0	60		
Kelsey	86.9	39.4		26.8	73	70.3	130.42
Otana	85.9	36.4		27.2	77	71.1	128.81
Robert	80.3	39.8		28.2	68		120.42
Trucker	78.8	41.2		25.5	69		118.16
Proat	77.9	38.7		29.5	62	67.9	116.86
ND810104	77.7	37.8		25.8	60		
Steele	77.5	40.6		26.0	68	63.1	116.22
ND840413	76.8	38.6		25.8	71		
Hyttest	75.8	42.2		25.0	80	59.9	113.64
ND830646	74.9	38.3		28.8	71		
ND821742	74.7	37.9		26.0	70		
ND820744	74.0	38.5		26.2	71		
ND840341	73.6	42.2		28.2	70		
ND820559	72.7	36.9		26.0	74		
Porter	72.1	37.6		27.2	68	62.5	108.15
Sandy	71.5	39.2		26.0	75	13.9	107.18
Valley	71.0	40.4		26.5	56		106.53
Dumont	69.7	40.8		28.5	65	60.9	104.60
ND840769	69.1	40.8		27.5	68		
ND820294	66.7	35.3		26.2	70		
ND830775	66.3	35.6		29.0	70		
ND830185	65.9	38.9		26.2	69		
ND840876	64.6	38.8		7/02	70		
ND841974	52.3	37.9		37.8	65		
Tibor	51.7	46.4		26.0	78		77.48
Trial Mean	74.9	38.9		29.6	69		
C.V. %	17.0	3.9		0.1			
LSD 5%	17.7	2.1		0.9			
LSD 1%	23.3	2.8		1.1			
# of Reps	4	4	1	4	1		

Planting Date: 4/14/89

Seeding Rate: 750,000 live seeds/ A (approx. 1.5 bu/A)

Fertilizer Applied: 75 lbs/A 18-46-0

Herbicide Applied: 0.25 pt/A Banvel + 0.75 pt/A MCPA

Yield Goal: 80 bu/A

Harvest Date: 8/1/89

* = average of 1987, 1988 and 1989 crop years.

** = gross income based on USDA estimate adjusted to ND for 1989 crop (\$1.50/bu).

1989 Dickinson Off-station Oats 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						

1989 HETTINGER OFF-STATION OAT TRIAL

Variety	Hettinger	Scranton	New Leipzig	Selfridge	Average 5 Sites
			Yield bu/A		
Monida	93.7	68.2	94.9	61.1	79.5
Border	92.5	67.0	80.3	61.1	75.2
Riel	89.3	62.3	78.6	69.0	74.8
Otana	85.9	52.9	66.7	57.5	65.8
Valley	71.0	42.7	64.4	50.9	57.2
Steele	77.5	26.8	45.8	41.5	47.9
Trial Mean	74.9	53.3	70.8	56.8	
C.V. %	17.0	10.9	23.5	6.7	
LSD 5%	17.7	8.7	24.8	5.7	
LSD 1%	23.3	12.0	n.s.	7.8	
# of Reps	4	4	4	4	

			Test Weight lbs/bu		
Monida	34.8	42.3	40.4	40.3	39.4
Border	34.5	41.9	38.1	38.0	38.1
Reil	40.5	42.8	41.4	41.8	41.6
Otana	36.4	41.9	40.3	40.6	39.8
Valley	40.4	42.0	39.4	42.4	41.0
Steele	40.6	37.9	38.2	40.4	39.3
Trial Mean	38.9	41.4	39.6	40.6	
C.V. %	3.9	2.1	3.1	2.2	
LSD 5%	2.1	1.3	1.8	1.3	
LSD 1%	2.8	1.8	n.s.	1.8	
# of Reps	4	4	4	4	

Planting

Date: 4/14 4/19 4/20 4/20

Harvest

Date: 8/1 8/2 8/4 8/4

Seeding Rate: 750,000 live seeds/A (approx. 1.5 bu/A)

Fertilizer Applied: According to soil test at each site

Yield Goal: 80 bu/A

n.s. = no statistical difference between varieties

1989 HETTINGER HARD RED WINTER WHEAT VARIETY TRIAL

Variety	Yield bu/A	Test Weight lbs/bu	Grain Protein %	Heading Date June	3 year Average* bu/A	Income** 1989 \$
Seward	48.5	57.2	14.4	19.5	36.8	184.34
ND8212	47.5	56.0	15.9	19.5		
Arapahoe	47.4	59.5	14.6	12.5		
Roughrider	46.2	58.1	16.5	18.5	31.4	180.17
ND8286	45.8	56.7	15.8	18.0		175.72
ND8407	42.8	56.9	16.1	20.2		
ND8215	40.8	54.3	15.9	20.5		
Winoka	40.5	59.8	15.3	18.5		153.82
ND8581	39.4	54.4	15.4	19.0		
Norstar	39.3	57.2	15.8	23.5	27.2	149.33
Rose	39.2	57.8	14.7	17.0	30.6	148.82
Siouxland	39.1	58.2	14.7	13.0	29.6	148.45
Abilene	38.3	59.2	15.0	13.0		145.64
ND8530	36.4	57.2	15.5	18.5		
Thunderbird	34.6	60.0	14.9	12.0	29.6	131.43
Agassiz	34.3	56.4	16.6	21.5	27.3	130.21
Trial Mean	41.3	57.4	15.4	17.8		
C.V. %	21.5	2.6	4.6	0.3		
LSD 5%	n.s.	2.2	1.0	2.5		
LSD 1%	n.s.	2.9	1.3	3.3		
# of Reps	4	4	4	4		

Planting Date: 9/20/88

Seeding Rate: 1 million live seeds/A (approx. 1 bu/A).

Fertilizer Applied: None at planting. 46 lbs/A 18-46-0 as
spring top dress.

Yield Goal: 50 bu/A.

Herbicide Applied: Hoelon 3 pt/A + Buctril 1 pt/A +
MCPA ester 1.5 oz/A.

Harvest Date: 7/27/89.

* = average of 1987, 1988 and 1989 crop years.

** = gross income based on USDA estimate adjusted to ND for 1989
crop (\$3.80/bu).

n.s. = no statistical difference between varieties.

1989 HETTINGER OFF-STATION WINTER WHEAT VARIETY TRIAL

New Leipzig

Variety	Yield bu/A	Test Weight lbs/bu	Grain Protein %	Plant Height cm	2 year Average*	Income 1989** \$
Agassiz	45.6	61.6	15.4	80	27.6	173.39
Seward	42.5	60.8	13.0	66	27.4	161.45
Siouxland	40.7	61.6	14.4	65	28.0	154.76
Norstar	39.3	61.3	14.6	66	23.4	149.30
Roughrider	37.0	60.4	15.2	65	24.0	140.62
Rose	35.1	61.7	14.6	68	26.4	133.44
Arapahoe	34.9	60.9	14.9	60		132.59
Thunderbird	30.5	62.5	15.0	56		115.77
Trial Mean	38.2	61.4	14.6	66		
C.V. %	13.4	0.8	2.7			
LSD 5%	7.5	0.7	0.6			
LSD 1%	10.2	1.0	0.8			
# of Reps	4	4	4	1		
Planting Date:	9/22/88		Harvest Date:	8/4/89		

Scranton

Variety	Yield bu/A	Test Weight lbs/bu	Grain Protein %	Plant Height cm	3 year Average***	Income 1989** \$
Agassiz	28.2	56.2	14.5	69	26.9	107.04
Arapahoe	28.0	57.0	14.1	61		106.26
Siouxland	26.2	57.8	14.0	60	25.2	99.40
Norstar	25.9	58.3	14.1	85	26.5	98.57
Seward	24.5	57.2	12.6	67		93.06
Roughrider	18.7	57.7	14.8	66	22.1	70.98
Rose	16.0	57.8	14.1	70		60.88
Thunderbird	15.6	59.2	15.0	50		59.42
Trial Mean	23.0	57.6	14.1	66		
C.V. %	39.5	4.3	2.0			
LSD 5%	n.s.	n.s.	0.5			
LSD 1%	n.s.	n.s.	0.7			
# of Reps	4	4	4	1		
Planting Date:	9/21/88		Harvest Date:	8/2/89		

Notes: * = average of 1988 and 1989 crop years.
 ** = gross income based on USDA estimate adjusted to ND for 1989 crop (\$3.80/bu).
 *** = average of 1987, 1988 and 1989 crop years.
 n.s. = no statistical difference between varieties.
 Regent and Selfridge winter wheat plots were not harvested due to poor winter survival.
 Fertilizer was applied according to soil test at each site.

1989 HETTINGER WINTER RYE TRIAL

Variety	Yield bu/A	Test Weight lbs/bu	Heading Date June	3 year Average* bu/A	Gross Income 1989** \$
Prima	74.5	53.9	5.0	47.2	111.75
ND4	61.0	51.3	12.0		
ND5	60.4	53.6	6.5		
Musketeer	59.6	53.8	5.0	30.9	89.40
Fredrick	57.8	53.9	5.0	41.7	86.70
Dako	57.8	50.5	12.2		86.70
Puma	43.3	53.2	7.5	23.3	64.95
Trial Mean	59.2	52.9	7.6		
C.V. %	14.0	0.9	0.9		
LSD 5%	12.2	0.7	0.8		
LSD 1%	16.6	1.0	1.1		
# of Reps	4	4	4		

1989 NEW LEIPZIG WINTER RYE TRIAL

Variety	Yield bu/A	Test Weight lbs/bu	Plant Height cm	Gross Income 1989** \$
Prima	39.8	53.6	100	59.70
Fredrick	36.9	54.6	92	55.35
Musketeer	36.5	54.2	100	54.75
Puma	29.4	55.0	97	44.10
Trial Mean	35.6	54.3	97	
C.V. %	12.9	0.9		
LSD 5%	7.1	0.7		
LSD 1%	n.s.	n.s.		
# of Reps	4	4	1	

Planting Date: Hettinger 9/20/88

New Leipzig 9/22/88

Seeding Rate: 1 million live seeds/A (approx. 1 bu/A).

Fertilizer Applied: None at planting.

Hettinger 46 lbs/A 18-46-0 as spring top dress.

New Leipzig 87 lbs/A 28-29-0 + 87 lbs/A 46-0-0 as
spring top dress.

Yield Goal: 60 bu/A.

Herbicide Applied: Hettinger Hoelon 3 pt/A + Buctril 1 pt/A +
MCPA ester 1.5 oz/A.

New Leipzig Hoelon 2 pt/A + Buctril 22 oz/A

Harvest Date: Hettinger 7/27/89.

New Leipzig 8/04/89.

Notes: * = average of 1986 - 1989 crop years.

** = gross income based on USDA estimate adjusted to ND
for 1989 crop (\$1.50/bu).

n.s. = no statistical difference between varieties.

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 %

1989 HETTINGER CANOLA/RAPE TRIAL

Variety	Yield	Date of 1st Flower	Plant Height	Harvest Date
Legend	354	7/07	74.5	8/23
Andor	345	7/04	64.0	8/23
Tobin	285	6/24	49.5	8/23
AG-005	261	7/11	90.2	9/13
HC-130	248	7/04	74.8	8/23
Global	245	7/10	85.8	9/13
Westar	146	7/07	67.2	9/13
Topas	129	7/10	78.8	9/13
AG-003	123	7/06	71.5	9/13
Hyola 40	115	7/04	66.0	9/13
Torch	110	6/26	53.2	8/23
AG-002	82	7/04	67.7	9/13
AG-006	78	7/06	72.5	9/13
AG-004	77	7/06	71.0	9/13
AG-001	61	7/05	74.0	9/13
Candle	54	6/27	55.2	9/13
R-500	47	6/27	46.0	8/23
Trial Mean	163	7/04	68.3	
C.V. %	77		7.7	
LSD 5%	178		2.8	
LSD 1%	237		3.8	
# of Reps	4	4	4	

Planting Date: 5/17/89
 Seeding Rate: 10 lbs/A
 Fertilizer Applied: 75 lbs/A 18-46-0
 Notes: hail on 8/24/89 caused extensive shatter loss prior to harvest.

1989 Dickinson Safflower Production Trial

Variety	Lbs/A Avg.	Test Wt lbs.	Seeding Rate Lbs/A
S-541	701.5	41.5	30
MT 3697	493.9	42.0	30
Girard	484.2	41.0	30
Meyer Crambe	0.0	--	25
Westar Canola	0.0	--	10
Tobin Canola	0.0	--	10

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% = 79.6 Bu/A C.V. = 8.2 %

1989 Dickinson Safflower Improvement Trial

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: September 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 %

1989 HETTINGER SAFFLOWER TRIAL

Variety	Yield lbs/A	Test Weight lbs/bu	Date of 1st Flower July	Plant Height cm	3 Year Average* lbs/A	Gross Income 1989** \$
S-317	2022	41.0	19.2	53	1645	232.55
85B4431	1987	40.8	17.8	54		228.52
S-541	1903	41.9	20.0	55	1712	218.87
Finch	1896	43.6	18.2	56	1556	218.06
83B1954	1889	42.0	19.0	56		217.26
87B4311	1875	42.4	19.2	56		215.65
87B1650	1875	38.7	19.8	55		215.65
87B1298	1861	42.4	20.2	54		214.04
A-24	1826	42.5	19.8	47	1623	210.02
85B1837	1805	40.6	19.5	50		207.60
82B3555	1763	41.3	19.2	53		202.77
Saffire	1637	43.1	17.2	50		188.29
MT3697	1588	43.8	17.8	54		182.66
85B3918	1462	37.4	19.2	55		168.17
Oker	1224	39.8	19.5	49	1131	140.81
Girard	1085	40.8	21.1	53	1384	124.72
S-208	455	39.1	21.3	51	1084	52.30
Trial Mean	1656	41.3	19.3	53		
C.V. %	11	1.4	0.1	6		
LSD 5%	256	0.8	1.0	4		
LSD 1%	341	1.1	1.4	6		
# of Reps	4	4	4	4		

Seeding Rate: 350,000 live seeds/A

Planting Date: 5/8/89

Fertilizer Applied: 46 lbs/A 18-46-0

Herbicide Applied: 0.25 oz/A Harmony, post emergence.

Yield Goal: 2500 lbs/A

Harvest Date: 9/6/89

* = average of 1986, 1987 and 1989 crop years.

** = gross income based on USDA estimate adjusted to ND for 1989 crop (\$0.115/lb).

Yield adjusted to 10% moisture.

1989 HETTINGER BUCKWHEAT TRIAL

Variety	Yield lbs/A	Test Weight lbs/bu	Date of 1st Flower July	2 Year Average* lbs/A	Gross Income 1989** \$
Tokyo	467	43.8	13.0		46.70
Windsor Royal	420	38.8	16.0	638	42.00
Mancan	420	38.8	15.0	604	42.00
Common	413	43.6	13.5		41.30
Manor	413	38.7	16.0	760	41.30
Giant American	313	36.9	16.2		31.30
Trial Mean	408	40.2	15.0		
C.V. %	37	1.7	0.1		
LSD 5%	n.s.	1.0	0.8		
LSD 1%	n.s.	1.4	1.0		
# of Reps	4	4	4		

Planting Date: 6/7/89

Seeding Rate: 700,000 live seeds/A

Fertilizer Applied: 46 lbs/A 18-46-0 as spring top dress.

Herbicide Applied: None

Harvest Date: 9/18/89

* = average of 1988 and 1989 crop years.

** = gross income based on USDA estimate adjusted to ND for 1989 crop (\$0.10/lb).

n.s. = no statistical difference between varieties.

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

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

1989 HETTINGER CORN TRIAL

Hybrid	Relative Maturity days	Silage tons/A	Harvest Moisture %	Grain bu/A	Test Weight lbs/A
Pioneer 3963	80	7.4	44.6	68.6	54.0
Cargill 809	85	5.9	38.3	51.2	49.2
Northrup King 2001	85	5.7	42.0	47.7	49.9
Interstate 232A	87	6.6	43.4	41.7	46.8
Contiseed 8200	85	6.6	35.6	40.7	49.1
Top Farm sx1181	80	6.1	42.5	35.1	50.3
Jacques 2750	80	5.7	42.1	34.7	49.2
Pioneer 3902	85	6.8	43.0	33.3	47.9
Interstate 313A	83	6.3	41.5	32.8	49.0
Jacques 2950	80	4.8	43.0	32.4	41.4
Northrup King 2440	90	5.4	45.5	32.0	49.5
Top Farm sx1185	85	6.8	43.8	30.0	47.6
Seedtec 7212	93	7.6	40.8	28.1	42.9
Dekalb 397	89	5.9	42.7	21.7	46.9
Contiseed 8304	92	5.5	44.3	21.7	40.3
Cargill 2227	85	5.0	38.3	20.9	42.7
Jacques 3630	85	5.4	46.0	16.9	39.5
Trial Mean		6.0		34.0	46.9
C.V. %		25.2		33.0	4.9
LSD 5%		n.s.		16.0	3.3
LSD 1%		n.s.		21.3	4.4
# of Reps		4		4	1

Planting Date: 5/16/89

Planting Rate: 21,000 seeds/A (culled to 18,000 plants/A)

Fertilizer Applied: 200 lbs/A 28-29-0 + 200 lbs/A 46-0-0

Herbicide Applied: 4 pt/A Eradicane + 2 pt/A Bladex, Pre Plant Incorp.

Row Width: 30"

Yield Goal: Silage - 13 tons/A, Grain - 80 bu/A

Harvest Date: Silage - 9/13/89, Grain - 10/10/89

Yields are based on 70% moisture for silage and 13.5% moisture for grain

n.s. = no statistical difference between hybrids

1989 NEW LEIPZIG CORN TRIAL

Hybrid	Relative Maturity days	Silage tons/A	Harvest Moisture %	Grain bu/A	Test Weight lbs/A
Top Farm sx1181	80	8.1	46.1	56.0	57.2
Interstate 373	88	7.9	44.9	51.0	52.7
Dahlgren 440	90	8.9	43.9	46.3	53.1
Interstate 232A	87	7.1	44.0	43.9	52.2
Top Farm sx1185	85	7.8	45.9	42.0	55.2
Pioneer 3902	85	6.3	45.6	39.3	52.8
Seedtec 7006	87	4.7	46.0	35.4	54.0
Keltgen 2270	86	6.6	47.0	31.2	46.5
Keltgen 2185	85	5.9	46.4	28.2	51.5
Pioneer 3963	80	6.2	45.5	not harvested	
Keltgen 115	115	5.8	50.8		
Trial Mean		6.8		41.5	52.8
C.V. %		20.5		11.9	
LSD 5%		2.1		8.1	
LSD 1%		n.s.		11.7	
# of Reps		3		3	1

Planting Date: 5/18/89

Planting Rate: 21,000 seeds/A (culled to 18,000 plants/A)

Fertilizer Applied: 80 lbs/A 18-46-0 + 130 lbs/A 46-0-0

Herbicide Applied: 1.5 pt/A Tandem, post-emergence

Row Width: 30"

Yield Goal: Silage - 13 tons/A, Grain - 80 bu/A

Harvest Date: Silage - 9/12/89, Grain - 10/13/89

Yields are based on 70% moisture for silage and 13.5% moisture for grain

n.s. = no statistical difference between hybrids

1989 REGENT CORN TRIAL

Hybrid	Relative Maturity days	Silage tons/A	Harvest Moisture %	Grain bu/A	Test Weight lbs/A
Pioneer 3963	80	7.7	47.4	43.0	52.2
Pioneer 3902	85	6.4	46.9	36.3	50.5
Interstate 353	83	6.1	45.0	35.5	52.7
Top Farm sx1181	80	5.2	44.4	34.9	52.6
Top Farm sx1185	85	5.9	47.0	34.9	53.2
Dahlgren K127	80	4.7	44.3	34.8	51.7
Cargill 809	85	6.6	43.8	32.3	51.1
Dahlgren 440	90	7.8	45.5	29.4	54.3
Interstate 232A	87	4.9	44.0	29.4	52.1
Cargill 2127	85	5.3	48.8	26.1	49.4
Trial Mean		6.1		33.6	52.0
C.V. %		28.1		22.5	
LSD 5%		n.s.		n.s.	
# of Reps		4		4	1

Planting Date: 5/18/89

Planting Rate: 21,000 seeds/A (culled to 18,000 plants/A)

Fertilizer Applied: 80 lbs/A 18-46-0

Herbicide Applied: 3 pt/A Prowl, Pre Emergence

Row Width: 30"

Yield Goal: Silage - 13 tons/A, Grain - 80 bu/A

Harvest Date: Silage - 9/8/89, Grain - 10/13/89

Yields are based on 70% moisture for silage and 13.5% moisture for grain

n.s. = no statistical difference between hybrids

1989 HETTINGER SUNFLOWER TRIAL

Hybrid	Yield lbs/A	Test Weight lbs/bu	Oil Content %	Gross Income* \$
Pioneer 6240	2462	30.1		233.85
Cargill SF 207	2237	31.7		212.49
Contiseed Hysun 354	1967	29.6		186.87
Cenex 8101	1956	30.0		185.80
Cargill SF 187	1945	30.2		184.73
Dahlgren DO-827	1900	30.7		180.46
Northrup King Sunbred 277	1900	30.2		180.46
Cargill SF 100	1877	31.6		178.32
Seedtec 317	1753	29.0		166.58
Seedtec 330	1720	31.3		163.37
Jacques Ex. 8713	1697	32.4		161.24
Interstate 3311	1607	32.2		152.70
Pioneer 6440	1596	31.0		151.63
Dahlgren DO-707	1551	30.8		147.36
Genetic Resources SN-881	1517	32.9		144.15
Interstate Ex. 65099	1517	29.9		144.15
AgriPro 4200	1495	31.9		142.02
Contiseed Hysun 340	1495	28.6		142.02
Northrup King S-1296	1236	31.0		117.46
Trial Mean	1770	30.8		
C.V. %	25	3.2		
LSD 5%	n.s.	1.4		
LSD 1%	n.s.	1.9		
# of Reps	4	4	1	

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

Yield Goal: 2400 lbs/A

Harvest Date: 9/28/89

* = gross income based on USDA estimate adjusted to ND for 1989 crop (\$0.095/lb).

n.s. = no statistical difference between hybrids.

Yield adjusted to 9% moisture.

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	648.3	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 %

1989 HETTINGER NAVY BEAN TRIAL

Variety	Yield lbs/A	Test Weight lbs/bu	Date of 50% Bloom	3 Year Average* lbs/A	Gross Income 1989** \$
Midnight	2144	56.5	20.8		536.00
Black Magic	2107	58.0	23.8		526.75
Mayflower	1763	57.7	16.2		440.75
Seafarer	1754	60.1	9.5	924	438.50
Hyden	1657	57.6	15.0	983	414.25
Upland	1575	59.5	12.5	916	393.75
C-20	1561	57.9	18.2	999	390.25
NX 041	1483	58.8	13.2	1107	370.75
NX 040	1400	56.8	12.5		350.00
Fleetwood	895	60.5	16.2	714	223.75
Trial Mean	1609	58.2	15.6		
C.V. %	22	1.0	0.2		
LSD 5%	521	0.8	2.5		
LSD 1%	701	1.1	3.3		
# of Reps	4	4	4		

Seeding Rate: 45 lbs/A
 Planting Date: 5/17/89
 Row Width: 30"
 Fertilizer Applied: 115 lbs/A 28-29-0
 Herbicide Applied: 3 pt/A Eptam + 1.5 pt/A Treflan EC, pre-plant
 incorporated

Yield Goal: 2500 lbs/A
 Harvest Date: 9/13/89

* = average of 1987, 1988 and 1989 crop years.

** = gross income based on USDA estimate adjusted to ND for 1989
 crop (\$0.25/lb).

Yield adjusted to 12% moisture.

1989 HETTINGER PINTO BEAN TRIAL

Variety	Yield lbs/A	Test Weight lbs/bu	Date of 50% Bloom	3 Year Average* lbs/A	Gross Income 1989** \$
Sierra	1875	54.5	19.2		450.11
Othello	1702	55.0	9.0	1192	408.43
Pindak	1630	55.0	15.8		391.20
Nodak	1378	55.6	11.0	1066	330.63
Olathe	1331	54.8	14.8		319.52
Fiesta	1273	54.0	10.5	949	305.63
UI 114	1273	54.8	14.8	948	305.63
Topaz	1204	53.1	10.5	887	288.96
Trial Mean	1458	54.6	13.2		
C.V. %	25	1.8	0.4		
LSD 5%	n.s.	n.s.	4.4		
LSD 1%	n.s.	n.s.	5.9		
# of Reps	4	4	4		

Planting Date: 5/17/89

Seeding Rate: 65 lbs/A

Row Width: 30"

Fertilizer Applied: 115 lbs/A 28-29-0

Herbicide Applied: 3 pt/A Eptam + 1.5 pt/A Treflan EC, pre-plant
incorporated

Yield Goal: 2500 lbs/A

Harvest Date: 9/13/89

* = average of 1987, 1988 and 1989 crop years.

** = gross income based on USDA estimate adjusted to ND for 1989
crop (\$0.24/lb).

n.s. = no statistical difference between varieties.

Yield adjusted to 12% moisture.

1989 REGENT PINTO BEAN TRIAL

Variety	Yield lbs/A	Test Weight lbs/bu	100 Kernel Weight g	Gross Income* \$
Othello	1240	55.8	29.8	297.72
Pindak	1068	56.4	29.0	256.35
Nodak	1020	56.4	26.6	244.71
111	847	55.1		203.18
126	754	55.2	28.6	181.01
UI 114	703	55.8	29.0	168.81
Fiesta	696	55.3	31.6	167.04
Topaz	372		26.4	89.29
Trial Mean	867	55.7	28.7	
C.V. %	28			
LSD 5%	358			
LSD 1%	484			
# of Reps	4	1	1	

Planting Date: 5/18/89

Seeding Rate: 65 lbs/A

Row Width: 30"

Fertilizer Applied: 80 lbs/A 18-46-0

Herbicide Applied: 4 oz/A Pursuit, post emergence.

Yield Goal: 2500 lbs/A

Harvest Date: 9/8/89

* = gross income based on USDA estimate adjusted to ND for 1989 crop (\$0.24/lb).

Yield adjusted to 12% moisture.

1989 Dickinson Fungicide Trial

Variety	Treatment	Bu/A Avg.	Test Wt lbs.
----- Spring Wheat -----			
Amidon	Control	12.8	58.0
Amidon	Vitavax	15.3	58.0
Amidon	Vit.+Imazalil	13.8	57.5
Stoa	Control	16.2	57.0
Stoa	Vitavax	14.3	57.5
Stoa	Vit.+Imazalil	15.5	57.5
L.S.D. 5% = 3.9 Bu/A		C.V. = 14.7 %	
----- Barley -----			
Azure	Control	16.6	46.0
Azure	Vitavax	12.2	40.5
Azure	Vit.+Imazalil	11.4	43.0
Bowman	Control	15.1	45.5
Bowman	Vitavax	16.6	43.5
Bowman	Vit.+Imazalil	16.4	44.5
L.S.D. 5% = 5.8 Bu/A		C.V. = 22.8 %	
----- Durum -----			
Vic	Control	10.7	53.5
Vic	Vitavax	11.6	58.0
Vic	Vit.+Imazalil	10.3	56.0
Ward	Control	10.8	56.5
Ward	Vitavax	10.9	58.0
Ward	Vit.+Imazalil	10.0	58.0
L.S.D. 5% = 2.1 Bu/A		C.V. = 13.1 %	
Seeding Date: May 8			
Harvest Date: Aug. 2			
Fertilizer Applied: 60 lbs/A 18-46-0 +			
100 lbs/A 46-0-0, broadcast			
Imazalil Flo Pro 30% applied at 0.5 fl.oz. per cwt.			

SECTION II

**AMMONIA LOSSES FROM BROADCAST UREA
APPLIED TO PASTURE, STUBBLE, AND
TILLED SOIL IN SOUTHWESTERN NORTH DAKOTA**

BY

**DAVE CLAYPOOL
RESEARCH SPECIALIST
DICKINSON RESEARCH CENTER**

SECTION 3

AMMONIA LOSSES FROM BROADCAST UREA
APPLIED TO PASTURE STUBBLE, AND
TILLED SOIL IN SOUTHWESTERN NORTH DAKOTA

BY

DAVE CLAYPOOL
RESEARCH SPECIALIST
DICKINSON RESEARCH CENTER

Ammonia Losses from Broadcast Urea

by Dave Claypool

INTRODUCTION

When urea fertilizer is broadcast and not incorporated into the soil surface some of the nitrogen may be lost through a process called ammonia volatilization. The rate of this process depends upon the soil and environmental conditions and does not necessarily happen after every application. Ammonia volatilization occurs when urea, water, and urease (a microbial catalyst) combine to produce ammonia gas and carbon dioxide.

A study was conducted at the Dickinson Research Center in 1986 to quantify the amount of nitrogen that can be lost from urea and to identify the conditions under which ammonia volatilization occurs in southwestern North Dakota. Laboratory analyses for this study were completed in 1988.

PROCEDURE

Two forms of commercial fertilizer, urea and ammonium nitrate, were applied separately to three types of ground cover: native pasture, barley stubble, and tilled soil (barley stubble disked until no straw remained on the surface). Ammonium nitrate was used as a comparison treatment because it does not volatilize at normal soil pH ranges. The soil surface pH was 6.2 which is slightly acid. Applications were made at six different times, three in the spring and three in the fall. The fertilizer applications were made when the soil was dry enough to drive fertilizer equipment on the field. Applications were timed to avoid rain within 3-5 days so that the maximum loss could occur. In this way, it was possible to estimate ammonia loss under field conditions in western North Dakota.

RESULTS AND DISCUSSION

Nitrogen losses from applications on stubble ranged from 12-44% and occurred four times. One 31% loss occurred from applications on pasture. No volatilization loss was detected from applications on tilled soil in this study.

Soil drying and high urease levels due to plant residues were the most important factors contributing to nitrogen loss in this study. Each time ammonia loss occurred the soil had dried following fertilizer application. The barley stubble and pasture contained enough urease to produce volatilization but the tilled soil did not. The weather conditions in the week following fertilization were more important than the time of year.

The environmental conditions which promote ammonia volatilization are: soil drying, high soil pH (above 7.0), high temperatures, high relative humidity, and high urease levels. Moisture from dew or fog can dissolve urea granules and start the volatilization process if drying conditions follow. A rain of 1/2 inch or more can prevent nitrogen volatilization loss by washing the fertilizer into the soil.

RECOMMENDATIONS

There are several ways to minimize ammonia volatilization losses.

1. Apply urea in late fall or early spring when temperatures are cool and precipitation is likely. Do not apply fertilizer to frozen ground as runoff may occur.
2. Apply urea when the soil is dry or when rain is expected in the next 2-3 days.
3. Incorporate urea within 2 days of application, especially if the soil is moist. Urea is not as volatile as some herbicides (such as Treflan). The volatilization process takes a day or two to begin.
4. Know your soil's pH. If it is above 7.0 you have a good chance of losing nitrogen regardless of the type of ground cover if you don't incorporate. If the pH is below 7.0, applying urea to bare soil seems to be fairly safe.

SECTION III

**ECONOMIC RETURN COMPARISON
OF HARD RED SPRING WHEAT VARIETIES
IN SOUTHWESTERN NORTH DAKOTA**

**BY
BERDETTE HOWE**

**Economic Return Comparison
of Hard Red Spring Wheat Varieties
in Southwestern North Dakota**

by Berdette Howe

Since yield alone does not always determine the greatest economic returns of wheat varieties, tables were developed to include the price impact of the combination of yield and protein on gross income per acre.

In Tables 1 and 2, varieties are ranked based on averages from various sites within the same year. In addition, the Hettinger and Dickinson sites were used to compare average returns from the past three years (Tables 3 and 4). Note that there was no protein premium in 1989.

Price quotes are received from Southwest Grain Cooperative on or about November 1st of each year. Using the Southwest Grain price as a base, an addition is made to allow for the impact of farm program payments. A deduction is made to allow for transportation differences away from the Gladstone terminal. The net effect is an adjustment of +\$.35/bu. to the base price.

