Plant Science Pamphlet #38 December 1977

ANNUAL PROGRESS REPORT

CENTRAL CROPS AND SOILS RESEARCH STATION

HIGHMORE, SOUTH DAKOTA

Introduction

The 1977 season was a fairly productive year when compared to 1976. Soil moisture was on the low side but rains in early April provided a moist seedbed to get the crops started. Hot windy days during the main part of the growing season hurt most of the plants and yields were reduced, particularly on the spring planted crops.

Fall plantings, in 1977, germinated and were well stooled at freeze-up time. The abundance of fall rain should increase the amount of moisture in the soil profile for next spring's crop plantings.

A twilight tour of the Central Research Station was conducted June 29th. The tour covered small grains, tillage practices, haylage, weed control, grass varieties, horticultural plantings and gardening. Various other points of interest were pointed out as the group passed by and one was the future site of a new tree planting in cooperation with the USDA. Tree plantings are to be initiated in 1978.

A ram testing program was started in September to test sheep from various sires. This test period ends in March of 1978 and a short field day and dinner will be had at that time.

The Board of Directors met in Highmore December 7, 1977, and the yearly station results were discussed as well as future plans.

NOTE: This is a progress report and therefore the results presented are not necessarily complete nor conclusive. Any interpretation given is strictly tentative because additional data from continuation of these experiments may produce conclusions different than those of any one year. These data accurately reflect the 1977 growing season.

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1977 CROP SEASON

Total Rainfall for Growing Season by Months with their Departure from Long-time Average at Central Research Station, Highmore, SD

Rainfall	Inches	Departure*	Greatest day	Date
April	2.42	+0.55	1.10"	16th
May	1.80	-0.75	0.55	17th
June	2.75	-1.22	0.65	12th
July	1.30	-1.24	0.90	24th
August	2.00	-0.35	0.40	15th
September 3	3.10	+1.49	1.20	23rd
October	1.15	-0.10	0.40	7th

Number of days during month with temperatures 90° or above:
June - 11; July 19; August - 5; September - 3
Last frost - Spring (May 22)
First frost - Fall (September 29)
*Departure from longtime rainfall average April through October: -1.62 inches on the Central Research Station.

CENTRAL RESEARCH STATION

HIGHMORE, SOUTH DAKOTA

TILLAGE AND FERTILITY EXPERIMENTS

Q. Kingsley and M. Volek

TITLE: Tillage Methods and Cropping Sequences

OBJECTIVES OF EXPERIMENTS (Eight experiments in number):

1. Soil moisture change with tillage method or crop sequence.
2. Effect of fertility on yield of grain or silage.
3. Comparison of tillage tools used for weed control.
4. Effect of cropping sequences on yields.

TILLAGE TREATMENTS:

1. Chisel plow, narrow sweeps, disk once or when needed.
2. Mulch, 32" wide sweeps, disk once or when needed.
3. Stubble, no till, chemical weed control
4. Fallow, black, narrow or wide sweeps + disk or duckfoot until black.
5. Fallow, some residue, narrow or wide sweeps + disk or duckfoot until nearly black.

CROP SEQUENCE: (Numbers on side refer to tillage treatments)

	Spring Grain		Winter Grain
1-2	wheat	1-2	wheat
1-2	wheat-oats	1-2	wheat-oats
1-2	wheat-row crop (grain)	1-2	wheat-row crop (silage)
3-4-5	wheat-fallow	3-4-5	wheat-fallow

FERTILITY:

0- 0-0
0-30-0 Phosphorus applied with grain (P_2O_5)
45- 0-0 Nitrogen broadcast on surface
45-30-0

PLANTING SPACE:

Small grain, 7 inch
Row crop, 36 inches

PLOT SIZE:

20 ft. x 32 ft.

STARTING SOIL SAMPLES:

Every plot 0-6", 6-12", 12-18", 18-24"

REPLICATIONS: 4

CROP YEAR HISTORY:

Planted:	HRS wheat, WS 1809, April 23	Harvested:	S. wheat, July 19
	corn, Pioneer 3965, May 10		corn, Oct. 13
	oats, Chief, April 23		oats, July 12
	winter wheat, Centurk, Feb. 9		W. wheat, July 13

Herbicide: Ramrod, 6#/A
7" band, corn

Insecticide: Thimet, 1# active/A on corn

Row Space: wheat 7"
corn 36"

Fertilizer: 45-30-0 45# N-30# P_2O_5-0# K_2O
45- 0-0 Broadcast application
0-30-0 Applied with the grain drill (P_2O_5)

Cultivation: Corn, two times

Tillage: Chisel plow or with 32" sweeps to depths of about 4 to 6 inches

Corn - Silage, Pioneer 3965	Planted May 10	Harvested August 26
Sunflowers	Planted May 24	Harvested Oct. 11
Safflower	Planted May 16	Harvested Aug. 20

Soil type: Glenham-Cavour loam

RESULTS:

Table 1. Influence of Tillage and Fertility on Yields in a Spring Wheat - Corn Rotation. Experiment 1.

SPRING WHEAT

Fertility Treatment Lb/A $N-P_2O_5-K_2O$	% Protein	Wheat Yield Bu/A	Moisture Loss From Profile plus Precipitation Inches Used*	Bushels per Inch of Water Used**	Test Weight
		Tillage: Mulch with 32 Inch Sweeps			
45-30-0	18.01	21.3	9.92	2.15	58.8
45- 0-0	17.96	19.6	10.07	1.95	59.0
0-30-0	18.01	16.5	9.56	1.73	58.5
0- 0-0	17.73	15.4	11.33	1.36	59.3
		Tillage: Chisel Plow			
45-30-0	18.07	24.4	8.05	3.03	59.3
45- 0-0	18.07	22.8	9.17	2.49	59.3
0-30-0	18.13	15.9	8.44	1.88	59.5
0- 0-0	17.78	18.3	8.90	2.26	59.0

Table 2.

CORN

Fertility Treatment Lb/A $N-P_2O_5-K_2O$	% Protein	Corn Yield Bu/A	Moisture Loss From Profile plus Precipitation Inches Used*	Bushels per Inch of Water Used**
		Tillage: Mulch with 32 Inch Sweeps		
45-30-0	12.56	25.1	8.94	2.81
45- 0-0	12.50	22.3	9.15	2.44
0-30-0	12.69	24.4	9.34	2.61
0- 0-0	12.44	13.8	8.34	1.65
		Tillage: Chisel Plow		
45-30-0	12.69	26.3	9.50	2.77
45- 0-0	12.88	29.1	8.40	3.46
0-30-0	12.56	26.5	8.01	3.31
0- 0-0	12.63	13.8	8.14	1.70

* Inches used: Spring wheat, includes 4.65" of rain from April 23 - July 16; Corn, includes 11.85" of rain from May 10 - Oct. 13.

** Calculated by $\frac{\text{Bu. of grain produced}}{\text{Loss + precipitation}}$ = bushels of grain produced per inch of water used.

DISCUSSION:

In comparing Table 1 moisture loss under wheat to the moisture loss for corn in Table 2, the differences in rainfall and the length of time a crop remains on the ground must be considered. Rainfall received after harvest on the spring wheat land was not utilized by the crop and may build up the subsoil moisture. This remaining reserve is then available to the succeeding corn crop.

The method of tillage in a dry year, Table 1 seemed to help in the production of more spring wheat. There was not as much moisture lost and bushels produced per each inch of water used were higher under the chisel plow method. With the addition of 45-30-0, yields were increased about 6 bushels more than the 0-0-0 for both tillage treatments.

Moisture loss from the profile, Table 2 was similar for both tillage methods because the debris on the surface was less than that for spring wheat, Table 1. Cultivation covered much of stubble. The bushels of corn produced per inch of water used are similar for the 45-30-0 treatments in each tillage method and also the 0-0-0 treatment. For the 40-30-0 fertility treatment under mulch, fertilizer increased corn yields 11.3 bushels above the 0-0-0 and under chisel plow there was an increase of 12.5 bushels using the same fertilizer comparisons.

RESULTS:

Table 3. Effect of Tillage and Fertility on Yields in a Winter Wheat - Corn Silage Rotation. Experiment 2.

	WINTER WHEAT				
Fertility Treatment Lb/A $N-P_2O_5-K_2O$	% Protein	Wheat Yield Bu/A	Moisture Loss From Profile Plus Precipitation Inches Used*	Bushels per Inch of Water Used**	Test Weight
		Tillage: Mulch with 32 Inch Sweeps			
45-30-0	16.53	27.1	9.49	2.86	57.5
45- 0-0	16.42	27.9	9.12	3.06	58.0
0-30-0	16.59	22.5	9.53	2.36	57.5
0- 0-0	17.04	20.1	10.16	1.98	57.0
		Tillage: Chisel Plow			
45-30-0	17.73	25.6	10.53	2.43	58.0
45- 0-0	17.39	23.5	11.02	2.13	57.5
0-30-0	16.76	23.3	9.61	2.42	58.0
0- 0-0	16.64	19.1	10.16	1.88	57.0

* Inches Used: Winter wheat, includes 7.07" rains from April 1 - July 12

** Calculated by $\frac{\text{Bu. of grain produced}}{\text{Loss + precipitation}}$ = bushels of grain produced per inch of water used

Table 4.

CORN SILAGE

Fertility Treatment Lb/A $N-P_2O_5-K_2O$	Corn Silage Tons/A 66% H_2O	Corn DM Yield Tons/A	Moisture Loss From Profile plus Precipitation Inches Used*	Tons DM per Inch of Water Used**
	Tillage: Mulch with 32 Inch Sweeps			
45-30-0	11.64	3.84	7.58	0.51
45- 0-0	9.94	3.28	6.04	0.54
0-30-0	10.06	3.32	6.66	0.50
0- 0-0	8.91	2.94	8.09	0.36
	Tillage: Chisel Plow			
45-30-0	11.91	3.93	7.29	0.54
45- 0-0	10.91	3.60	7.89	0.46
0-30-0	10.67	3.52	6.86	0.51
0- 0-0	9.15	3.02	6.82	0.44

* Inches Used: Silage Corn, includes 7.50" rain from May 1 - Aug 26

** Calculated by $\frac{\text{tons of DM produced}}{\text{loss + precipitation}}$ = tons of DM (dry matter) produced per inch of water used

DISCUSSION:

The tillage of the soil in this winter wheat - corn silage sequence is performed as soon after silage removal as possible. If the soil moisture conditions are right, the mulching and chisel plowing are done immediately. In the past years, the soil has been so dry at this time it was necessary to wait till some rain had fallen.

Soil conditions were so dry in the fall of 1976 that no winter wheat was planted. On February 9 of 1977, there was enough dry soil on the surface to plant the winter wheat. All winter wheat experiments were planted at this time and stands were adequate to produce a fair yield. Rainfall and soil moisture were the main limiting factors.

Moisture usage by winter wheat, Table 3 was higher under chisel plow tillage and yields were lower than for mulch tillage. In the corn silage phase of this experiment, Table 4, all the plant is removed except the short stalk. Chisel plow, in this situation, exposed more soil and increased evaporation.

Silage corn yields, Table 4, do not vary to a large degree from the effects of tillage, but increases may be noted where a complete fertilizer is compared to the no treatment phase.

RESULTS:

Table 5. Continuous Winter Wheat. Experiment 3.

WINTER WHEAT

Fertility Treatment Lb/A $N-P_2O_5-K_2O$	% Protein	Wheat Yield Bu/A	Moisture Loss From Profile plus Precipitation Inches Used*	Bushels per Inch of Water Used**	Test Weight
		Tillage: Mulch with 32 Inch Sweeps			
45-30-0	16.99	36.0	10.81	4.30	59.0
45- 0-0	17.50	33.4	10.38	3.22	58.8
0-30-0	16.25	28.5	10.54	2.70	59.8
0- 0-0	17.33	27.1	12.45	2.18	60.4
		Tillage: Chisel Plow			
45-30-0	16.70	36.8	10.16	3.62	58.8
45- 0-0	17.90	32.7	10.39	3.15	58.6
0-30-0	15.90	28.2	10.52	2.68	59.4
0- 0-0	17.84	25.2	10.50	2.40	60.4

Table 6. Continuous Spring Wheat. Experiment 4.

SPRING WHEAT

Fertility Treatment Lb/A $N-P_2O_5-K_2O$	% Protein	Wheat Yield Bu/A	Moisture Loss From Profile plus Precipitation Inches Used*	Bushels per Inch of Water Used**	Test Weight
		Tillage: Mulch with 32 Inch Sweeps			
45-30-0	18.07	27.3	10.64	2.57	58.2
45- 0-0	19.04	23.5	11.01	2.13	57.8
0-30-0	18.13	20.7	10.72	1.93	58.4
0- 0-0	18.64	17.1	10.27	1.67	58.4
		Tillage: Chisel Plow			
45-30-0	17.39	25.3	9.13	2.77	58.0
45- 0-0	19.10	24.8	10.04	2.47	58.2
0-30-0	18.75	20.5	9.96	2.06	58.6
0- 0-0	18.81	16.9	10.68	1.58	58.6

* Inches used: Winter wheat, includes 7.07" rain from April 1 - July 19
Spring wheat, includes 4.65" rain from Arpil 23 - July 19

** Calculated by $\frac{\text{Bu. of grain produced}}{\text{Loss + precipitation}}$ = bushels of grain produced per inch of water used

DISCUSSION:

This experiment is planted continuously to winter wheat, the crop was planted February 9, 1977. No germination occurred at this time, but the seed had gone through a cold period of sufficient length to enable the seed to develop when the weather warmed up and produce a crop.

The yields of winter wheat, Table 5, from this cropping practice are higher for the 45-30-0 treatment than those in Tables 3, 8 and 11. Whether this practice will continue favorable depends on insect and disease build-up in the soil. Overall, soil moisture efficiency was about the same for the crop on both mulch and chisel plow tillage. The utilization of soil moisture was increasingly better as the amounts of fertilizer increased.

Continuous spring wheat yields, Table 6, are higher than those in Tables 1, 7 and 9 at the 45-30-0 level of fertility. The amount of rainfall received during the growing period was 4.65 inches, which is 2.42 inches below that received by the winter wheat. The 2.42 inches of rain was received in early April and some may have been lost due to runoff. The method of tillage did not significantly have much effect on the yields produced, but moisture loss was higher under the mulch tillage practice in 1977.

RESULTS:

Table 7. Degree of Fallow Tillage for Spring Wheat. Experiment 5.

Fertility Treatment Lb/A $N-P_2O_5-K_2O$	% Protein	Wheat Yield Bu/A	Moisture Loss From Profile plus Precipitation Inches Used*	Bushels per Inch of Water Used**	Test Weight
		Tillage: No Till***			
45-30-0	18.47	13.2	7.85	1.68	58.0
45- 0-0	19.15	11.4	6.44	1.77	57.8
0-30-0	18.35	10.9	6.31	1.73	57.5
0- 0-0	18.24	8.6	7.71	1.12	58.0
		Tillage: Some Till***			
45-30-0	18.47	16.6	8.05	2.06	58.3
45- 0-0	19.32	12.4	6.55	1.89	58.0
0-30-0	18.98	14.3	7.60	1.88	58.3
0- 0-0	18.98	11.0	6.37	1.73	57.8
		Tillage: Most Till***			
45-30-0	18.87	18.3	7.14	2.56	57.8
45- 0-0	18.35	16.7	6.80	2.46	58.3
0-30-0	19.55	17.3	6.21	2.79	58.3
0- 0-0	18.98	11.0	7.64	1.44	58.5

* Inches Used: Includes 4.65 inches of rain from April 23 to July 19

** Calculated by $\frac{\text{Bu. of grain produced}}{\text{Loss + precipitation}}$ = bushels of grain produced per inch of water used

*** Tillage: No till -- Weed control with chemicals
Some till -- Chisel plow twice but maintain organic matter
Most till -- Weed free using a chisel plow

DISCUSSION:

The degree of tillage for this spring wheat study produced varying effects, notably "no till" versus "some till" and "most till". Grain produced by the "no till" method, Table 7, with its undisturbed soil, was 5 bushels lower than the "most till" and about 3 bushels less than "some till" when comparing the 45-30-0 treatments. Bushels per inch of water used was higher for the "some" and "most till" methods when compared to the "no till" and the amounts of water used from the profile. In dry years, "no till" tillage does not produce as desirable a seedbed as the other treatments.

RESULTS:

Table 8. Degree of Fallow Tillage for Winter Wheat. Experiment 6.

Fertility Treatment Lb/A $N-P_2O_5-K_2O$	% Protein	Wheat Yield Bu/A	Moisture Loss From Profile plus Precipitation Inches Used*	Bushels per Inch of Water Used	Test Weight
		Tillage: No Till**			
45-30-0	17.36	30.5	11.32	2.69	55.5
45- 0-0	17.13	26.3	10.22	2.57	55.0
0-30-0	17.24	22.7	9.81	2.31	54.8
0- 0-0	16.51	20.8	11.80	1.76	56.5
		Tillage: Some Till**			
45-30-0	16.25	29.6	8.05	3.68	55.3
45- 0-0	16.56	27.7	7.65	3.62	54.8
0-30-0	17.04	23.8	8.62	2.76	53.8
0- 0-0	16.79	18.2	7.39	2.46	54.3
		Tillage: Most Till**			
45-30-0	16.96	29.1	11.03	2.63	56.0
45- 0-0	16.99	28.7	10.26	2.80	55.0
0-30-0	16.79	24.6	11.04	2.23	54.5
0- 0-0	17.22	18.7	10.56	1.77	55.8

* Inches Used: Includes 7.07 inches of rain from April 1 to July 14

** Tillage: No Till -- Weed control with chemicals
Some Till -- Chisel plow twice but maintain organic matter
Most Till -- Weed free using a chisel plow

DISCUSSION:

Winter wheat yields are much higher on the "no till" treatments, Table 8, than for spring wheat using the same method, Table 7. The main reason for this may be the 2.42 inches of rain received in early April when the seed was germinating and starting to grow.

The planting of winter wheat into "no till" soil in the fall, when moisture is present, may be a practical approach to wheat production.

RESULTS:

Table 9. Tillage Methods, Fertility and Yield in a Spring Wheat - Oats Rotation. Experiment 7.

SPRING WHEAT

Fertility Treatment Lb/A $N-P_2O_5-K_2O$	% Protein	Wheat Yield Bu/A	Moisture Loss From Profile plus Precipitation Inches Used*	Bushels per Inch of Water Used**	Test Weight
		Tillage: Mulch with 32 Inch Sweeps			
45-30-0	16.70	20.6	9.11	2.26	58.0
45- 0-0	17.04	17.5	9.15	1.91	57.8
0-30-0	15.90	16.5	8.29	1.99	58.3
0- 0-0	17.90	12.6	9.10	1.38	58.3
		Tillage: Chisel Plow			
45-30-0	16.99	21.4	8.98	2.38	57.8
45- 0-0	16.53	17.3	9.27	1.87	57.5
0-30-0	16.70	15.3	8.05	1.90	58.5
0- 0-0	17.10	11.9	9.08	1.31	57.3

Table 10. Tillage Methods, Fertility and Yield in a Spring Wheat - Oats Rotation. Experiment 7.

OATS

Fertility Treatment Lb/A $N-P_2O_5-K_2O$	% Protein	Oats Yield Bu/A	Moisture Loss From Profile plus Precipitation Inches Used*	Bushels per Inch of Water Used**	Test Weight
		Tillage: Mulch with 32 Inch Sweeps			
45-30-0	15.94	33.1	8.90	3.72	32.3
45- 0-0	16.19	30.8	8.98	3.43	31.8
0-30-0	15.94	33.8	9.06	3.73	33.0
0- 0-0	15.94	27.7	8.62	3.21	31.3
		Tillage: Chisel Plow			
45-30-0	16.50	36.1	9.36	3.86	32.5
45- 0-0	15.63	34.4	9.17	3.75	31.8
0-30-0	16.25	34.9	9.89	3.53	33.0
0- 0-0	16.81	30.4	8.26	3.68	31.5

* Inches used: Spring wheat, includes 4.65" of rain from April 23 - July 19
Oats, includes 4.55" of rain from April 23 - July 12

** Calculated by $\frac{\text{Bu. of grain produced}}{\text{Loss + precipitation}}$ = bushels of grain produced per inch of water used

DISCUSSION:

The method of tillage in the spring wheat and oats rotation had little effect on the spring wheat yields, Table 9. There were differences in yield between fertility treatments in each tillage operation. Moisture loss and bushels of wheat produced per inch of water used are similar for each fertility level under both tillage operations. The 45-30-0 fertility treatment did increase wheat yields when compared to the 0-0-0 treatment 8 bushels on mulch tillage and 9.5 bushels on chisel plowing.

Oats yields, Table 10, were low in 1977 and the test weights at a level that the producer would receive a cut in price at the elevator.

The oats crop received about 50 percent of its moisture from the soil moisture reserves in 1977. Rainfall amounted to 4.55" during the crop season, which is nearly half of the moisture loss from the soil profile.

Phosphorus applied with the seed at planting time increased yields 6 bushels under mulch tillage and 4.5 bushels under chisel plowing when compared to 0-0-0. The effect on yield using 45-30-0 comparison with 0-0-0 is similar to the 0-30-0 treatment. Little effect may be attributed to nitrogen in this year.

RESULTS:

Table 11. Influence of Tillage Methods and Fertility on Yields in a Winter Wheat - Oats Rotation. Experiment 8.

WINTER WHEAT

Fertility Treatment Lb/A $N-P_2O_5-K_2O$	% Protein	Wheat Yield Bu/A	Moisture Loss From Profile plus Precipitation Inches Used*	Bushels per Inch of Water Used**	Test Weight
Tillage: Mulch with 32 Inch Sweeps					
45-30-0	17.73	23.2	10.87	2.13	58.5
45- 0-0	17.96	21.2	9.98	2.12	58.3
0-30-0	18.18	17.3	10.66	1.62	58.0
0- 0-0	18.07	17.0	10.36	1.64	58.5
Tillage: Chisel Plow					
45-30-0	18.07	26.7	10.44	2.56	58.3
45- 0-0	17.44	24.8	10.60	2.34	58.3
0-30-0	17.84	21.9	9.96	2.20	58.5
0- 0-0	18.13	18.3	10.03	1.82	59.0

* Inches used: Winter wheat, includes 7.07" of rain from April 1 - July 13

** Calculated by $\frac{\text{Bu. of grain produced}}{\text{Loss + precipitation}}$ = bushels of grain produced per inch of water used

Table 12. Influence of Tillage Methods and Fertility on Yields in a Winter Wheat - Oats Rotation. Experiment 8.

OATS

Fertility Treatment Lb/A $N-P_2O_5-K_2O$	% Protein	Oats Yield Bu/A	Moisture Loss From Profile plus precipitation Inches Used*	Bushels per Inch of Water Used**	Test Weight
Tillage: Mulch with 32 Inch Sweeps					
45-30-0	15.79	38.1	7.80	6.08	32.3
45- 0-0	15.16	29.5	7.02	4.20	32.5
0-30-0	15.22	23.6	8.27	2.85	33.0
0- 0-0	14.93	19.3	7.28	2.65	32.3
Tillage: Chisel Plow					
45-30-0	15.79	32.0	8.39	3.81	32.5
45- 0-0	14.48	28.8	8.36	3.44	32.3
0-30-0	14.48	23.4	8.86	2.64	32.5
0- 0-0	14.48	21.5	9.32	2.31	32.3

* Inches used: Oats, includes 4.55" of rain from April 23 - July 12

** Calculated by $\frac{\text{Bu. of grain produced}}{\text{Loss + precipitation}} = \frac{\text{bushels of grain produced}}{\text{per inch of water used}}$

DISCUSSION:

This is a winter wheat and oats rotation.

The soils on the Central Research Station are of a Glenham-Cavour loam and this experiment lies on predominately Cavour soil. It is heavier than the Glenham and has a tendency to become chunky when tilled while it is moist. The lack of rain and hot windy days during the summer dried the soil and it became hard and crops did not grow well under these conditions.

The crop yields shown in Tables 11 and 12 are indications of grain production on this type of soil. The percent of protein in the grain varied with each fertility treatment.

Chisel plowing, Table 11, was the better method of soil preparation for winter wheat and the mulch tillage was the better method for seed bed preparation for oats production, Table 12.

HAY, HAYLAGE AND SILAGE PRODUCTION
Q. Kingsley and M. Volek

TITLE: Dry Matter Production from Millets, Small Grains and Forage Sorghums.

OBJECTIVES OF EXPERIMENT:

1. Compare various crops for dry matter production.
2. Obtain regrowth data after first harvest.

DISCUSSION:

This experiment was set up to study dry matter production of various crops as an alternate to corn or alfalfa for feed.

The small grain haylage, Table 13, has various small grains in a comparative study. Nodaway, and early oats, was blended with Lyon, a late oats, at a planting rate of 2½ bushels per acre. Nodaway at .83 bushels and Lyon at 1.67 bushels per acre blended, produced the highest tonnage per acre. The Nodaway kernels were drying and the Lyon kernels were in the dough stage.

Tables 14, 15 and 16 indicate the yields of millets and forage sorghums harvested at 2 different dates and the height of regrowth after the first cutting.

Table 17 is a comparison of all the forage crops where their hay, haylage and silage yields are set up by groups. The days from planting to harvest are listed for each group.

RESULTS:

Table 13. Small Grain Haylage, Tons of Dry Matter* (DM) per acre, Central Research Station, 1977

Crop	Planting Rate Bu/A	Tons per acre DM
Nodaway Lyon	1.25 1.25	2.66
Nodaway Lyon	1.67 0.83	2.45
Nodaway Lyon	0.83 1.67	3.06
Nodaway	2.50	2.70
Lyon	2.50	2.39
Barley (Prilar)	1.00	2.89
Barley Nodaway	0.50 1.25	2.35
Speltz	1.00	2.68

DM average 2.65
Hay (88% DM) 3.01
Haylage (50% DM) 5.30
Silage (33%) DM) 8.00

* To determine yields of hay, haylage or silage: Divide tons of DM by percent DM in hay, haylage and silage; Example (DM average 2.65 ÷ 0.88 = 3.01 or 3.01 tons of 12% moisture hay, etc.)

Planted 4/24/77
Harvested 7/1/77

RESULTS:

Table 14. Millet Haylage 1977, Tons of Dry Matter* (DM) per acre, Central Research Station

Variety	Tons DM per acre	Date Harvested
German Common - Foxtail	3.60	8/25/77
White Wonder - Foxtail	4.24	9/ 8/77
Red Siberian - Foxtail	2.95	8/31/77
Cerina	3.75	8/18/77
IPM 1129	2.21	8/12/77
Albarr	4.12	8/25/77
Minco	3.75	8/25/77
ISCA 474	3.01	8/31/77
Panhandle	3.75	8/25/77
Dawn IPM 1108	1.90	8/12/77

DM average 3.33
Hay (88% DM) 3.78
Haylage (50% DM) 6.66
Silage (33% DM) 10.09

* Formula same as Small Grain Haylage, Table 13

Planted 6/10/77
Planting rate Foxtail 6#/A
Proso 20#/A

RESULTS:

Table 15. Forage Sorghum Tons of Dry Matter* (DM) per acre, Central Research Station

Plant Type and Variety	Seeding Rate lbs/A	Tons per acre of DM	Plant height inches Harvest	Regrowth
Sudan			8/12/77	9/29/77
Acco HS 33	12	2.07	48.3	27.3
NK Trudan	12	2.30	48.0	24.3
Cal West Piper	12	1.73	56.7	25.3
Cal West 3105	12	1.44	50.0	24.3
Forage				
Asgrow Merit	4	1.53	56.3	27.0
Sorgo X Sorgo				
Acco Aztec	4	1.13	47.0	29.7
Forage X Sudan				
Acco Sweet Sioux IV	4	1.99	53.3	27.3
NK X 4224	4	2.47	59.0	24.0
Grain X Sudan				
Pioneer 911	12	1.63	39.3	26.7
Acco S-99	12	1.84	47.7	22.7
Asgrow Grazer W-2	12	1.81	51.7	21.3
Grain X Forage				
Pioneer 956	4	1.61	44.7	22.7
Acco FS 401-E	4	1.96	45.7	23.0
Asgrow Titan E	4	1.56	45.0	21.3
Dual Purpose				
NK 300	4	1.91	41.7	20.3
Acco 2912	4	1.93	37.0	17.3
NK Silo Milo	4	1.87	43.0	18.3
Forage, Leafy				
Pioneer 989	4	2.05	47.0	23.0
Acco FS531	4	1.88	48.3	22.0
NK 367	4	2.47	50.0	23.7
Corn (25,000 Pop/A)				
NK PX32		1.67	47.7	8.0

DM average 1.85
Hay (88% DM)
Haylage (50% DM)
Silage (33% DM)

* Formula same as Small Grain Haylage, Table 13

RESULTS:

Table 16. Forage Sorghum Tons of Dry Matter* (DM) per acre, Central Research Station

Plant type and variety	Seeding Rate lbs/A	Tons per acre of DM	Plant height inches	Percent Headed
Sudan			9/10/77	
Acco HS33	12	3.05	52.3	80.7
NK Trudan	12	2.74	48.0	79.0
Cal West Piper	12	1.73	55.3	90.3
Cal West 3105	12	2.91	51.3	81.7
Forage				
Asgrow Merit	4	4.50	64.0	80.7
Sorgo X Sorgo				
Acco Aztec	4	3.90	57.0	Trace
Forage X Sudan				
Acco Sweet Sioux IV	4	4.05	53.0	45.0
NK X 4224	4	4.37	58.0	76.7
Grain X Sudan				
Pioneer 911	12	3.80	46.7	Trace
Acco S-99	12	3.77	49.3	Trace
Asgrow Grazer N-2	12	4.28	50.7	33.3
Grain X Forage				
Pioneer 956	4	4.06	51.0	53.3
Acco FS 401-R	4	4.61	42.7	51.7
Asgrow Titan E	4	4.68	47.7	49.3
Dual Purpose				
NK 300	4	4.25	40.0	66.0
Acco 2912	4	3.13	38.8	Trace
Nk Silo Milo	4	3.03	47.3	Trace
Forage Leafy				
Pioneer 989	4	4.21	54.0	48.3
Acco FS 531	4	3.84	50.3	Trace
NK 367	4	4.64	64.7	Trace
Corn (25,000 Pop/A)				
NK PX32		4.71	54.3	

DM average 3.82
Hay (88% DM)
Haylage (50% DM)
Silage (33% DM)

* Formula same as Small Grain Haylage, Table 13

RESULTS:

Table 17. Average yield comparison of various forage crops in tons per acre of hay, haylage and silage*

Crop	DM Average	88% DM Hay	50% DM Haylage	33% DM Silage	Harvest Date 1977	Days Planting to Harvest
Small Grain	2.65	3.01	5.30	8.00	7/1	68
Millet	3.33	3.78	6.66	10.09	8/24	64
Sudan Grass	1.89	2.15	3.78	5.28	8/12	73
Sudan Grass	2.61	2.97	5.22	7.91	9/10	102
Forage Sorghum	1.85	2.10	3.70	5.61	8/12	73
Forage Sorghum	4.07	4.63	8.14	12.33	9/10	102
Corn	1.67	1.90	3.34	5.06	8/12	73
Corn	4.71	5.35	9.42	14.27	9/10	102

* Data taken from Tables 13, 14, 15 and 16
Formula same as Small Grain Haylage, Table 13

Planting dates: Small Grain April 24
Millet June 10
Sudan, Forage Sorghum, Corn June 1

Crop Rotation - Soil Moisture Usage Relationship

Q. Kingsley and M. Volek

OBJECTIVE OF EXPERIMENT:

1. To compare various crops with different maturities for soil moisture usage and yielding ability under similar soil and climatic conditions.

DISCUSSION:

Crops chosen for this experiment are of different maturities. Barley is a short season crop. Corn and sunflowers are long season crops. Safflower, in 1977, was earlier maturing than sunflowers.

The major weed problems were in the safflower plantings. Where no Tolban was applied, the weeds reduced yields of safflower to 620 pounds compared to the less weedy safflower yields shown in Table 15. Weeds reduced yields from 1067.8 pounds to 620 pounds, a loss of 447.8 pounds per acre due to poor weed control.

The sunflower land was treated with Tolban and no untreated check for weed control was used.

This is a replicated study and will be continued on a rotation bases where a short season crop may follow a long season crop or vice versa.

RESULTS:

Table 18. Crop Rotation - Soil Moisture Usage Relationship

Crop	Yield in Bu or Lb/A	Moisture Loss From Profile Plus Precipitation Inches Used*	Bu or Lbs per Inch of Water Used**	Test Weight	% Protein
Barley	39.0	8.39	4.65	49.7	14.40
Corn	19.1	8.73	2.19		13.44
Oats	33.7	9.05	3.72	32.0	13.89
Safflower	1067.8#	5.17	206.54#	38.2	
Sunflower	1200.3#	10.39	115.52#	31.3	
Wheat	27.6	8.20	3.37	59.0	17.19

Barley - Prilar, 1 Bu/A
Corn - Pioneer 3965, 16,000 plants/A
Oats - Chief, 2½ Bu/A
Safflower - S208, 1 Bu/A
Sunflower - Interstate 894, 16,000 plants/A
Wheat - WS 1809, 1 Bu/A

Fertility - 40# N, 20# P_2O_5 per acre, Broadcast

* Inches used: Includes soil water loss in the 3-foot section of soil from planting to harvest plus precipitation received during this period. Even though some is lost, all figure into the total used.

** Calculated by $\frac{\text{Bu. of grain produced}}{\text{Loss + precipitation}}$ = bushels of grain produced per inch of water used

EFFECT OF UREA APPLIED WITH THE SEED

E. Adams, P. Carson, R. Gelderman, E. Williamson

This study, initiated in 1975, has been continued for three years; however, some minor adjustments in treatment design have been made during that time. Varying rates of urea and ammonium nitrate nitrogen, along with three other different fertilizers, were again applied in a drill attachment at seeding. Enough additional nitrogen as ammonium nitrate was broadcast to bring total N applied up to 80 lbs actual on most treatments. Urea and Ammonium nitrate were also compared in broadcast topdress applications which are shown in treatments 17 through 22. Uniform rates of P_2O_5 application (30 lbs/A) were used in these treatments with the exception of Treatments 23 and 24. Registered Butte Spring Wheat was seeded in each plot at approximately 90 lbs per acre on April 28, 1977. Surface soil moisture content was favorable at that time. Soil tests were as follows: Nitrates 145 lb/A/2'; Organic matter 2.1; Phosphorus 47 lbs/A; Potassium 790 lbs/A; pH 6.7; Elec. Conductivity 0.3 m mhos/cm. Varying biuret levels previously included were omitted because of inconsistent application. All phosphorus was applied through the drill attachment.

Table 19 shows the yields obtained from the urea--drill attachment part of the experiment in the first 10 treatments, as well as other information, from the various fertilizer treatments. It appears little or no crop injury in terms of yield occurred until urea rates applied with the seed reached or exceeded 30 lbs actual N per acre. Little or no injury occurred with ammonium nitrate applied with the seed until rates approached 60 lbs actual N per acre. In addition to varying rates of urea and ammonium nitrate applied with the seed (Treatments 1 through 13), three other types of nitrogen-phosphorus fertilizer materials were applied with the seed in a drill attachment. Treatment 14 contained 18-46-0 Diammonium phosphate in combination with urea, Treatment 15 contained an experimental urea-ammonium phosphate TVA material (28-28-0), and Treatment 16 contained still another urea-ammonium phosphate material (37-17-0) in combination with 0-44-0. Little or no significance can be attached to these yield differences.

Treatments 17 through 22 compared three different rates of broadcast ammonium nitrate and urea respectively, when applied shortly after emergence. These yields do not differ significantly from the 0+0+0 Treatment (1), therefore, it's not possible to infer one form to be superior to the other when broadcast applied and not incorporated.

An additional point of interest; there was essentially no response to nitrogen at this site, regardless of how it was applied. The same is true for phosphorus. This would be expected since soil test values for both nutrients were quite high.

The apparent yield depression from applications of triple super phosphate alone with the seed is surprising, (Treatments 23 & 24). At this time, no explanation is offered.

Table 19. Effect of Nitrogen Source and Application Method on Spring Wheat Yields, Central Research Station, 1977

Trmt. No.	Drill Applied $N + P_2O_5 + K_2O$	plus	Broadcast lbs N/Ac[b]	Yield Bu/A
1	0 + 0 + 0		0	42.7
2	0 + 0 + 0		80	41.5
3	0 + 30 + 0		0	39.0
4	0 + 30 + 0		80	42.7
5	10[a] + 30 + 0		70	43.2
6	20[a] + 30 + 0		60	46.0
7	30[a] + 30 + 0		50	41.8
8	40[a] + 30 + 0		40	34.1
9	50[a] + 30 + 0		30	38.5
10	60[a] + 30 + 0		20	30.8
11	20[b] + 30 + 0		60	41.2
12	40[b] + 30 + 0		40	41.4
13	60[b] + 30 + 0		20	35.9
14	30[c] + 30 + 0		50	37.6
15	30[d] + 30 + 0		50	40.5
16	30[e] + 30 + 0		50	37.6
17	0 + 30 + 0		20	46.6
18	0 + 30 + 0		40	41.3
19	0 + 30 + 0		60	43.8
20	0 + 30 + 0		20[a]	40.4
21	0 + 30 + 0		40[a]	39.5
22	0 + 30 + 0		60[a]	41.4
23	0 + 15 + 0		80	33.7
24	0 + 45 + 0		80	32.4

a Applied as Urea

b Applied as Ammonium Nitrate

c Urea plus 18-46-0

d Urea ammonium phosphate (TVA 28-28-0)

e Urea ammonium phosphate (TVA 36-17-0)

1977 STANDARD VARIETY SMALL GRAIN TRIALS

J. J. Bonnemann

Six small grain trials were seeded for the 1977 crop year at the Central Research Station. Both the winter wheat and rye trials were abandoned because of winterkill. The spring grain trials were seeded April 25 and harvested on July 18 and 22.

The limited precipitation and higher temperatures earlier in the growing season were quite detrimental to the earlier maturing varieties of all crops, especially oats and barley. The test weight and quality for most varieties was generally good.

Further small grain results are available in Plant Science Pamphlet #35.

RESULTS:

Table 20. Standard Variety Spring Wheat Trial Yields and Available Averages

Variety	Bushels per acre				Test weight, lb/bu			
	1975	1976	1977	3 yr	1975	1976	1977	3 yr
Fortuna	13.8	12.8	29.4	18.7	52	57	58	56
Chris	10.1	11.6	23.5	15.1	54	57	55	55
Waldron	16.3	15.2	27.6	19.7	49	57	56	54
Tioga	15.7	10.9	24.9	17.2	55	57	57	56
Ellar	14.0	14.1	27.9	18.7	52	56	57	55
Butte		11.2	29.8			57	60	
Era	5.0	13.4	32.5	17.0	52	58	54	55
Bonanza	12.8	10.2	27.6	16.9	52	57	56	55
WS 1809	10.4	9.7	30.4	16.8	53	56	58	56
Bounty 208		11.1	30.5			58	60	
Olaf	14.7	13.7	34.3	20.9	54	60	58	57
Kitt	8.0	11.7	28.0	15.9	51	57	52	53
Bounty 309	11.3	12.9	31.9	18.7	51	59	56	55
Profit 75	9.5	14.6	31.5	18.5	52	58	60	57
Prodax	9.9	9.2	27.3	15.5	52	57	52	54
Protor	10.5	10.9	32.4	17.9	50	58	58	55
Funks W444			33.9				60	
WS 25		10.2	29.2			60	59	
Rolette	13.3	11.2	36.4	20.3	60	60	62	60
Ward	10.8	12.4	27.2	16.8	59	59	57	58
Crosby	11.5	13.9	35.2	20.2	59	60	60	60
Rugby	13.7	13.0	29.8	18.8	58	59	57	58
Botno	11.1	14.7	34.1	20.0	58	60	60	59
Cando (semi)		10.4	29.1			54	54	
Mean, Bu/A			29.9					
CV, %			11.0					
LSD (.05)			5.3					

Table 21. Standard Variety Barley Trial Yields and Available Averages

Variety	Highmore							
	Bushels per acre				Test weight, lb/bu			
	1975	1976	1977	3 yr	1975	1976	1977	3 yr
Liberty	29.8	7.8	17.3	18.3	39	47	45	44
Firlbecks III	23.3	11.3	46.1	26.9	39	48	47	45
Larker	27.6	8.2	16.5	17.4	41	48	48	46
Primus II	23.4	9.2	43.0	25.2	39	48	48	45
Bonanza	24.2	8.5	35.0	22.6	37	45	47	43
Prilar	27.3	7.4	41.8	25.5	43	47	49	46
Beacon	23.8	8.5	43.7	25.3	39	47	46	44
Manker	28.7	5.0	25.0	19.6	41	46	46	44
Mean, Bu/A			35.7					
CV, %			16.2					
LSD (.05)			8.2					

Table 22. Standard Variety Oat Trial Yields and Available Averages

Variety	Highmore							
	Bushels per acre				Test weight, lb/bu			
	1975	1976	1977	3 yr	1975	1976	1977	3 yr
Burnett	46.1	20.5	45.5	37.4	34	38	34	35
Trio	53.5	20.5	45.6	39.9	38	36	36	37
Diana	47.0	19.1	37.4	34.5	37	36	33	35
Holden	43.8	17.1	41.1	34.0	33	38	35	35
Portal	45.2	11.1	42.2	32.8	34	34	34	34
Nodaway 70	49.3	13.9	37.9	33.7	38	40	36	38
Froker	37.1	20.2	53.8	37.0	34	38	35	36
Chief	40.4	14.6	38.4	31.1	32	36	33	34
Otee	43.8	15.3	36.6	31.9	36	36	36	36
Dal	29.7	10.8	54.8	31.8	29	33	34	32
Astro	34.5	13.2	57.2	34.0	28	34	30	31
Noble	42.5	14.8	56.5	37.9	32	36	36	35
Stout	47.5	12.4	53.4	37.8	35	36	33	35
Spear	45.9	19.4	44.3	36.4	30	35	34	33
Lyon	50.5	11.9	62.2	41.5	32	33	31	32
Bates		19.1	58.2			35	35	
Wright	42.3	20.7	52.2	38.4	34	38	36	36
Lang	49.4	18.1	55.1	40.9	33	36	33	34
E-77		10.6	34.3			33	36	
Mean, Bu/A			47.5					
CV, %			8.2					
LSD (.05)			5.4					

FLAX VARIETY TRIALS

C. L. Lay

A flax variety trial consisting of 30 entries was conducted at Highmore in 1977. Plots were seeded on April 26 and harvested on August 2. Yields, oil and agronomic data are presented in Table 23. Generally the earlier varieties were better yielding. Seed yields ranged from a high of 14.1 bu/A for Linott to a low of 6.9 bu/A for Nored. An experimental had the highest yield of 19.5 bu/A. Windom, Summit, Norstar and Nored are susceptible to flax rust race 371 in greenhouse tests. In field tests Summit is very susceptible to race 371 while Windom, Nored and Norstar show some resistance. Linott, Culbert and Dufferin are resistant to rust. In North Dakota and Minnesota tests Linott is susceptible to flax wilt while all other varieties tested have an acceptible level of field resistance.

Table 23. Seed yield, oil content and agronomic data for 7 flax varieties grown at Highmore, South Dakota in 1977.

Variety Identification	Seed Yield (bu/A)	Plant height (inches)	Oil Content (%)	Relative Maturity	Rust* Resistance	Wilt* Resistance
Linott	14.1	20	39.2	Early	R	S
Windom	14.1	19	38.1	Early	S	MR
Summit	13.0	20	37.2	Early	VS	R
Culbert	11.3	19	39.3	Early	R	R
Dufferin	10.3	20	39.3	Late	R	R
Norstar	7.9	19	38.3	Late	MR	R
Nored	6.9	23	37.4	Late	MR	R
Total entries in test	30					
Mean of test	10.9	21	38.1			
L.S.D..05	3.5	2	1.7			
C.V.	16	6	2			

* R = Resistant, MR = Moderately resistant, MS = Moderately susceptible, S = Susceptible, VS = Very susceptible.

Seeding date = April 26.

Harvest date = August 2.

GRASS TESTS, CENTRAL RESEARCH STATION, 1977

J. G. Ross and G. L. Holborn

Grass tests to determine forage and seed production of new selections and varieties were seeded on August 25, 1975. These tests were irrigated using lawn sprinklers to get the grass seed germinated. Creeping foxtail did not become established because it needed more moisture than was available. It is suited to low areas that flood in the spring. There were, however, nine replicates of varieties of smooth bromegrass, intermediate wheatgrass and crested wheatgrass established. These came through the winter and in spite of the very low rainfall produced some forage and seed in the summer of 1976. They were harvested with a plot combine on July 13. No significant differences in forage or seed production were found among the varieties of bromegrass and crested wheatgrass. SD 5 yielded more forage and seed than the other varieties but differences were not significant. Likewise, Nordan crested wheatgrass yielded more forage and seed than the other varieties but the differences were not significant. In the intermediate wheatgrass test, Oahe yielded significantly more forage but Slate yielded significantly more seed than the other varieties.

The bromegrass and intermediate wheatgrass varieties had higher forage yield than the crested wheatgraas in 1976.

In 1977, no seed was harvested, but yield data was obtained for forage. No significant differences in forage production were found among the varieties of bromegrass, crested wheatgrass or intermediate wheatgrass. Lincoln yielded more forage than the other bromegrass varieties. Ruff crested wheatgrass yielded more forage than the other varieties, and Slate yielded more forage than the other intermediate wheatgrass varieties. Due to the dry conditions of the previous year and prior to the 1977 harvest in early June crested wheatgrass out-yielded the other two species.

It seems likely that the dry weather effects of 1976 and spring of 1977 covered up any real differences between varieties. Such differences will likely be evident in future years.

Table 24. Forage and Seed Yield (9 replications) of Smooth Bromegrass under Dryland at Highmore in 1976 and 1977.

	Forage (tons/acre) 1976	1977	Seed (lbs./acre) 1976
SD 5	.98 a	2.08 a	254 a
SD 6	.99 a	2.04 a	238 a
Lincoln	.87 b	2.32 a	220 a

Table 25. Forage and Seed Yields (9 replications) of Crested Wheatgrass under Dryland at Highmore in 1976 and 1977.

	Forage (tons/acre) 1976	1977	Seed (lbs./acre) 1976
Nordan	.89 a	2.19 a	317 a
Ruff	.84 a	2.31 a	307 a
SD 711	.79 a	2.18 a	231 a

Table 26. Forage and Seed Yields (6 replications) of Intermediate Wheatgrass under Dryland at Highmore in 1976 and 1977.

	Forage (tons/acre) 1976	1977	Seed (lbs./acre) 1976
Oahe	1.15 a	1.87 a	50 b
Slate	.98 b	2.34 a	158 a
SD 52	.97 b	2.09 a	98 b
SD 51	.92 b	1.95 a	42 b

EFFECT OF FUNGICIDE TREATMENT AND SPRING TILLAGE ON ROOT AND CROWN DISEASE OF ERA SPRING WHEAT AT CENTRAL RESEARCH STATION, 1977.

G. W. Buchenau, J. D. Smolik and C. Wirth

INTRODUCTION:

Crop residue on the soil surface is known to decrease soil erosion by wind and water. It is also known that when wheat is grown in wheat residue, certain foliage diseases such as Septoria and Pyrenophora leaf blights become more severe. This occurs because the overwintering propagules of these fungi are not decomposed by burial; hence they are alive and ready to attack the new crop when weather conditions become favorable for them to infect the new wheat crop.

The effect of crop residue on root and crown disease is not well understood in spite of the fact that these diseases are very common in South Dakota and probably affect plant vigor, tillering and subsequent yield to a much greater extent than is commonly believed.

The objectives of these experiments are

1. to determine the influence of wheat residue on the soil surface on root disease of wheat and
2. to evaluate methods of root disease control.

MATERIALS AND METHODS:

Two cultural practices were established in the spring of 1977. These consisted of alternating strips of disced or noble-bladed stubble. Each strip was 60' wide (later trimmed to 40') and the strips were randomized in each of the three replications. Fungicide treatments were superimposed across the strips; each fungicide plot consisted of two 9-row drill strips. Half of each plot was used for sampling, the other half for yield. Plots were planted on 26 April with a small-plot planter designed and built by Mr. Kingsley. Due to a combine breakdown, windrows were gathered by hand and carried to a thresher for subsequent operations.

RESULTS:

Yield was low and variation among plots treated alike was high, probably due to method of harvest. No significant differences were evident between cultural practices (Table 27). Seed treatment with Benlate T significantly increased yield. Similar trends occurred with supplimental nitrogen, Benlate postemergence spray (5 Leaf stage) and Terraclor granules.

Test weight was significantly higher in noble-bladed plots than in disced plots; plant height was not significantly affected by any treatment (Tables 28 & 29).

Crown health and vigor as measured by crown rot index and tiller score (Tables 30 & 31) were favored by noble blade treatment. Benlate T seed treatment resulted in the least crown rot and the second highest tiller score. Conversely, supplemental nitrogen resulted in high crown rot and a low tiller score.

Root feeding nematodes, over 90% Tylenchorynchus nudus were reduced by spring discing, and were still fewer than under noble-bladed plots by mid-season (Table 32). By harvest, both treatments were almost equal in nematode population. Soil moisture was consistently higher under noble-blade culture than under disc (Table 32).

We attempted to determine populations of the common root rot fungi in crowns at mid-season and at harvest. Temperatures in our laboratory during the critical mid-season analysis were extreme and heavy bacterial growth virtually invalidated that analyeis. Some trends based on extremely sketchy data indicated a lower population of Helminthosporium sativum (a root and crown rotting fungus) in plots treated with Benlate T seed treatment, and a slightly increased incidence of H. sativum in plots treated with Terraclor. By harvest, most crowns were infested with H. sativum (Table 33).

CONCLUSIONS:

Yield increases from Benlate T seed treatment were apparently due to a reduction of crown rot caused by Helminthosporium sativum during the early stages of growth. Other root and crown pathogens were not abundant in this test. The systemic effectiveness of Benlate T and its availability early in the growing season resulted in better performance than later applications of Benomyl or Terraclor.

There were few effects of wheat residue in the 1977 tests, where light residue levels resulted from an extremely poor crop in 1976.

Table 27. Effect of fungicide treatment and spring tillage on yield of Era Spring Wheat at Highmore in 1977.

Fungicide Treatment	Yield (bu/A) Disc (2.7)[a]	Noble (25.5)	Average
Benlate 50W, 4 lb/A Post emergence spray	19.3	16.7	17.9
Benlate T, 1.5 oz/bu Seed treatment	20.1	19.1	19.6
Vitavax 200, 1.8 oz/bu Seed treatment	17.2	13.2	15.2
Terraclor 10G, 100 lb/A Post emergence	17.2	17.9	17.5
RH 2161, 0.6 oz ai/bu Seed treatment[b]	16.4	14.9	15.6
Nitrogen, 30 lb/A, Post emergence granular	18.3	17.9	18.1
Untreated check	15.7	15.6	15.6
Average	17.3	16.3	16.8
LSD .05	NS	NS	2.7

a/ Preplant surface residue in g/m^2.

b/ Active ingredient.

Table 28. Effect of fungicide treatment and tillage on test weight of Era Spring Wheat at Highmore in 1977.

Fungicide Treatment	Test wt (lb/bu) Disc (2.7)[a]	Noble (25.5)	Average
Benlate 50W, 4 lb/A Post emergence spray	57.6	57.8	57.7
Benlate T, 1.5 oz/bu Seed treatment	58.2	59.1	58.6
Vitavax 200, 1.8 oz/bu Seed treatment	57.7	59.3	58.5
Terraclor 10G, 100 lb/A Post emergence	58.6	60.6	59.4
RH 2161, 0.6 oz ai/bu Seed treatment[b]	59.3	59.7	59.5
Nitrogen, 30 lb/A, Post emergence granular	57.5	58.7	58.1
Untreated check	59.1	59.8	59.4
Average	58.4	59.4	58.9

[a] Preplant Residue in g/m^2.

[b] Active ingredient.

Table 29. Effect of fungicide treatment and spring tillage on height of Era Spring Wheat at Highmore in 1977.

Fungicide Treatment	Height (cm) Disc (2.7)[a]	Noble (25.5)	Average
Benomyl-Post E, 4 lb/A Post emergence spray	67.7	68.0	67.8
Benlate T, 1.5 oz/bu Seed treatment	65.7	68.5	67.1
Vitavax 200 S.T., 3 oz/cwt Seed treatment	70.7	68.7	69.7
Terraclor, 100 lb/A Post emergence	67.5	68.2	67.8
RH 2161 S.T., 1 oz ai/cwt[b]	69.2	70.2	69.7
Nitrogen, 30 lb/A Post emergence granular	68.2	67.3	67.8
Untreated check	67.9	68.9	68.4
Average	68.0	68.6	

[a] Preplant residue in g/m^2.

[b] Active ingredient.

Table 30. Effect of fungicide treatment and spring tillage on crown rot of Era Spring Wheat at Highmore in 1977.

Fungicide Treatment	Crown Rot Index[a]		
	Disc (2.7)[a]	Noble (25.5)	Average
Benomyl-Post E, 4 lb/A Post emergence spray	1.96	2.16	2.06
Benlate T, 1.5 oz/bu Seed treatment	1.97	1.87	1.92
Vitavax 200 S.T., 3 oz/cwt Seed treatment	1.95	1.93	1.94
Terraclor, 100 lb/A Post emergence	2.37	1.87	2.12
RH 2161 S.T., 1 oz ai/cwt Seed treatment[b]	2.20	1.76	1.98
Nitrogen, 30 lb/A Post emergence granular	2.14	2.10	2.12
Untreated check	2.10	2.17	2.13
Average	2.09	1.98	

[a] Crown rot on a 0-5 scale, 5 being completely rotted.

[b] Active ingredient.

Table 31. Effect of fungicide treatment and spring tillage on tillering of Era Spring Wheat at Highmore in 1977.

Fungicide Treatment	Tiller Score[a]		
	Disc (2.7)[a]	Noble (25.5)	Average
Benomyl-Post E, 4 lb/A Post emergence spray	2.17	2.50	2.33
Benlate T, 1.5 oz/bu Seed treatment	2.33	2.17	2.20
Vitavax 200 S.T., 3 oz/cwt Seed treatment	2.33	1.67	2.00
Terraclor, 100 lb/A Post emergence	2.00	2.33	2.17
RH 2161 S.T., 1 oz ai/cwt Seed treatment[b]	2.33	2.00	2.17
Nitrogen, 30 lb/A Post emergence granular	1.60	2.17	1.88
Untreated check	1.67	2.33	2.00
Average	2.06	2.17	2.12

[a] Tiller score based on a visual rating: 1 = few, 2 = intermediate, 3 = many.

[b] Active ingredient.

Table 32. Effect of preplant cultural practices on plant feeding nematodes and soil moisture under Era Spring Wheat at Highmore in 1977.

Cultural Practice	Sample Date (Days from planting) 0	30	94
	Plant feeding Nematodes (no/200 cc soil)		
Disc	488	411	1033
Noble	841	567	1089
	% Soil Moisture		
Disc	17.5	18.8	13.2
Noble	18.0	20.0	16.6

Table 33. Effect of preplant cultural practice and Terraclor on colonization of Era Spring Wheat by Helminthosporium sativum at harvest.

Cultural Practice		Fungicide None	Terraclor	CP Av.
		% of Crowns with H. sativum		
Disc	Benomyl-PDA	63	67	69
	Benomyl-Cz	62	81	
Noble	Benomyl-PDA	63	72	69
	Benomyl-Cz	62	78	
	Fungicide Av.	63	75	

WOODY ORNAMENTAL HORTICULTURE RESEARCH
CENTRAL RESEARCH STATION
J. E. Klett and N. P. Evers

Twenty new cultivars of North Central-7 Regional Woody Ornamental trial plants were planted on April 29, 1977. These plantings were made in triplicate and are located along the north entrance just south of the existing shelterbelt adding to the existing NC-7 trial plants which were initially planted at this site in 1971. Also one, five, and ten-year planting and performance evaluations were recorded from the plants in these trials. Included in this year's trial plantings are numerous cultivars of Ligustrum vulgare (Common Privet); Viburnum opulus (European Cranberrybush); and several species of various pines. The 1976 trial plantings for the most part did perform well; however, numerous trial plantings which are a borderline for hardiness did not survive the fairly harsh winter.

Numerous different flowering annual varieties were also planted near the station's house and evaluated for growth characteristics under Central South Dakota growing conditions. Included in these trials were several All-American Selection winners, along with other annual varieties which are commonly sold in the South Dakota bedding plant industry. Results of this research was explained at the Field Day which was held in late June of 1977.

FRUIT PLANTING--HIGHMORE STATION
1977
R. Peterson

The fruit trees and small fruits planted in 1975 and 1976 at Highmore have performed well--especially the tree fruits. The apples, pears, plums, and cherries have all grown well. They were watered during dry periods, and all trees are mulched. The planting will be useful in evaluating cultivars and determining how well this fruit can perform in the area if given water and proper care. Some new selections are under test which may be of special value for the area.

The strawberries did not get well established and a new planting should be made. The grapes killed back close to the ground in the winter of 1976-77 but this is not unusual in young grape vines that are getting established. The vines grew well in the summer of 1977 and we hope they will now become established.

EVALUATION OF HERBICIDES FOR SUMMER FALLOW

W. E. Arnold

Herbicide experiments were conducted at the Central Crops and Soils Substation to determine the performance of several herbicides as an alternative to conventional methods for summer fallow. The herbicides were broadcast on disked winter wheat stubble. The treatments were applied on September 11, 1976, in a 20 GPA spray at 35 PSI. Their performance was evaluated on May 26, 1977, for the control of volunteer wheat, wild buckwheat, Russian thistle and prostrate pigweed. These evaluations were made visually, comparing the population of each weed in a treated plot to the population of that weed in a control plot. Winter wheat was planted in the fall of 1977 and carry-over effects will be evaluated in the spring of 1978.

Table 34. Weed Control of Fall Applied Herbicides for Chemical Fallow (1977).[1]

		Visual Weed Control Estimates[2]					
Herbicide	Rate (lb/A)	Volunteer Wheat (%)	Kochia (%)	Wild Buckwheat (%)	Russian thistle (%)	Prostrate Pigweed (%)	Overall (%)
Chem Hoe 135	3.00	20	0	22	0	0	0
Chem Hoe 135	4.00	50	20	47	15	22	15
Chem Hoe 135	6.00	70	12	22	21	0	15
FMC 23486	1.00	97	90	98	0	97	58
FMC 23486	2.00	98	98	99	24	99	66
FMC 23486	4.00	70	84	92	25	76	57
FMC 19873	1.00	58	72	96	8	91	50
FMC 19873	2.00	90	94	99	48	96	68
FMC 19873	4.00	98	99	99	91	99	95
Sencor	0.50	64	97	98	89	98	86
Sencor	0.75	80	99	96	90	98	83
Sencor	1.00	92	99	99	99	99	98
Sencor	2.00	97	99	99	99	99	99
No herbicide	--	0	0	0	0	0	0

[1]Herbicides were applied on 9-11-76.

[2]Weed control estimates were made on 5-26-77.

Table 35. Weed Control of Fall Applied Herbicides for Chemical Fallow (1977).[1]

Herbicide	Rate (lb/A)	Visual Weed Control Estimates[2] Volunteer Wheat (%)	Kochia (%)	Wild Buckwheat (%)	Russian Thistle (%)	Prostrate Pigweed (%)	Overall (%)
AAtrex	1.00	42	100	64	62	68	53
Vel-5026	0.50	58	99	93	35	64	90
Vel-5026	1.00	76	100	97	74	72	74
Vel-5026	2.00	94	99	100	99	97	50
Vel-5026	4.00	99	100	100	100	99	100
R-33222	2.00	21	73	0	24	22	12
Bladex + X-77	1 1/2 + 1/4	50	99	61	83	52	25
Bladex + diesel oil	1 1/2	55	100	74	79	54	20
AAtrex + Bladex	1/2 + 1.00	48	99	64	52	51	68
AAtrex + Bladex + X-77	1/2 + 1.00 + 1/4	82	98	81	78	66	44
AAtrex + Bladex + diesel oil	1/2 + 1.00	42	99	82	86	51	86
Paraquat + AAtrex + Bladex + X-77	3/8 + 1/2 + 1.00 + 1/4	58	98	54	28	55	55
Bladex	1 1/2	20	98	62	81	50	32
Bladex + X-77	1 1/2 + 1/4	40	100	56	70	50	22
Bladex + diesel oil	1 1/2	39	99	54	74	40	12
No herbicide	--	0	0	0	0	0	0

[1]Herbicides were applied on 9-11-76.

[2]Weed control estimates were made on 5-26-77.