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SOUTH CENTRAL RESEARCH FARM
Presho, South Dakota

INTRODUCTION

This is the ninth annual progress report of the South Central Research Farm. Rainfall for the first and last part of the growing season was below normal but from May until fall, it was slightly above normal.

Yields were above average for winter grains because of the cool temperatures and rainfall at the proper time. Yields were fair for the spring grains. Grain sorghum and forage sorghum yields were also good. In addition, some experiments and varietal tests made in Gregory County by the staff of the South Central Farm and County Extension Agent are reported.

A field tour was held on July 6, 1966 and more than seventy-five people attended. The specialty crops, variety trials, and soil management experiments were discussed. In addition, two motion pictures were shown, one on black stem rust of wheat and the other on loose smut.

SOUTH CENTRAL RESEARCH FARM ADVISORY COMMITTEE

Officers	Address	County
Walter Stolte	Chamberlain 57325	Brule
Fred Lucas	Platte 57369	Charles Mix
Ed Bailey	Lucas 57549	Gregory
Lyn Lyman	Murdo 57559	Jones
John Quillan	Kennebec 57544	Lyman
Jerry Bruning	Wood 57585	Mellette
Lyle Hedman	Hayes 57537	Stanley
John Fernen	Mission 57555	Todd
Don Jorgenson	Ideal 57541	Tripp

This report was prepated by members of the South Dakota Agricultural Experiment Station. It is an annual progress report and results published herein are for one year only. They are therefore neither complete nor conclusive.

Errata:

Page 6, table 4 - yield reported as bu/acre.
Page 16, table 17 - yield reported as lbs/acre.
Page 22, table 21 - yield reported as lbs/acre.

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Table 1. Weather Data - South Central Research Farm 1966

Month	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Rainfall in inches*	.09	.32	1.38	1.11	0.61	3.13	2.17	4.51	1.21	1.15	.22	.11	16.01
Longtime Average**	.47	.57	1.02	1.79	2.38	3.11	1.66	2.08	1.45	0.98	.67	.39	16.57
Departure from Longtime Average	-.38	-.25	.36	-.68	-1.77	.02	.51	2.43	-.24	.17	-.45	-.28	-.56
Average Temperature*	----	----	----	39.9	56.9	68.2	78.9	68.1	60.8	49.9	27.8	17.6	----
Longtime Average**	18.6	21.9	31.8	47.6	58.9	68.7	76.8	75.0	64.5	51.4	34.8	23.9	----
Departure from Longtime Average	----	----	----	-7.7	-2.0	-0.5	2.1	-6.9	-3.7	-1.5	-7.0	-6.3	----
Av. Daily Maximum - 1966*	----	----	----	50.2	73.0	80.7	93.6	81.8	81.8	64.5	40.2	29.3	----
Av. Daily Minimum - 1966*	----	----	----	30.3	40.8	55.7	64.2	55.4	48.0	35.6	15.3	5.9	----
Average Soil Temp. @ 2"	----	----	----	47.4	59.1	76.7	83.3	77.4	68.3	49.5	----	----	
Av. Daily Maximum Soil Temp.	----	----	----	54.4	63.9	83.1	89.4	82.4	72.4	53.4	----	----	
Av. Daily Minimum Soil Temp.	----	----	----	40.5	54.3	70.3	77.2	72.5	64.3	45.7	----	----	

Maximum Recorded Air Temperature - 107° - 11 July 1966
Last Frost - 13 May; First Frost - 15 September; Growing Season - 125 days

* Data taken and recorded at South Central Research Farm
** Longtime averages were recorded at Kennebec, South Dakota, based on 30 year period 1931-1960 inclusive

SMALL GRAIN VARIETY TESTING

D. G. Wells, P. B. Price, R. S. Albrechtsen, J. J. Bonnemann, and H. A. Geise

Objective: To observe and compare small grain varieties and experimental strains for winterhardiness, grain yield, disease resistance, and other characteristics of area adaptability.

Rye

Five varieties of rye were grown in the 1966 season. Data on grain yield and some plant characteristics are shown in table 2. Von Lochow is a newly introduced variety from Germany. It is a short stiff strawed variety that yields slightly more than Elk but is less winter hardy. Both Elk and Von Lochow are less hardy and head several days later than Antelope, Caribou or Pierre.

Frontier is a new variety developed at Swift Current, Saskatchewan. It was only partially tested in 1966, but appears to be winterhardy, of medium maturity, and tall. Frontier has poor lodging resistance. The seeds of this variety are small and predominantly blue-gray in color. It has high bushel weight.

Table 2. Rye Variety Trial - South Central Research Farm, 1963-66

Variety	Heading Date	Height Inches	Test Wt lbs/bu	Grain Yield-Bu/A 1966	Grain Yield-Bu/A Av. 1963-66
Von Lochow	June 3	38	53.6	41.0	54.2*
Elk	June 4	44	53.0	36.4	51.0
Antelope	May 30	41	53.5	29.6	43.4
Caribou	May 31	41	52.8	30.1	41.2
Pierre	May 30	42	54.0	23.3	35.6
			Mean	32.1	

LSD 5% level - 6.4 bu/A
* Average of 1965-66 only

Winter Wheat

Nineteen varieties of winter wheat were tested in 1966. This year was unusual because leaf- and stem-rust infections were not serious enough to reduce yields and in addition there was no lodging. Moisture was sufficient to produce a good yield of high quality grain. Yield data and other plant characteristics are in table 3.

Three new winter wheat varieties are being increased for release. Two of the varieties, Guide (CI13856) and Scout 66 (CI13996) are being increased by Nebraska. Guide is similar to Scout but is not quite as hardy nor as tall. Scout 66 is a mixture of selections from Scout and is slightly more hardy. The third variety, Parker (CI13285) is a Kansas release which matures too early for South Central South Dakota.

Table 3. Winter Wheat Variety Trial - South Central Research Farm - 1966

Variety	Date of Heading	Height Inches	Rust Reaction* Leaf	Rust Reaction* Stem	Percent+ Protein	Test Wt. lbs/bu	Grain Yield bu/acre
Northern:							
Winalta	June 21	35	S	Mixed	17.6	58.6	33.2
Minter	20	36	S	R	19.7	56.3	31.3
Central:							
Lancer	17	33	S	R	16.9	59.4	42.2
Neb. 61355	15	33	S	R	18.4	57.8	39.8
Scout	13	32	S	R	18.0	58.4	38.8
Omaha	13	31	S	S	16.4	59.3	38.4
K 60252	20	32	S	R	19.4	58.1	36.9
Warrior	19	32	S	S	16.9	56.8	36.5
Neb. 61359	16	31	S	S	18.6	58.1	36.3
CI 13862	21	34	S	S	18.5	57.1	34.9
CI 13883	21	35	S	S	16.0	57.8	34.7
Shoshoni	17	34	S	S	17.7	57.8	34.6
Neb. 61358	18	33	S	R	19.3	55.9	34.4
Hume	14	33	S	R	19.1	57.4	34.4
Ottawa	14	33	S	S	16.7	58.9	34.3
Nebred	15	30	S	S	17.8	59.3	34.2
Gage	15	32	R	R	18.4	58.0	33.8
Southern:							
Rodco	17	34	Mix	Mix	18.3	57.4	37.2
Bison	18	33	S	S	15.2	57.3	35.0
						Mean	35.8

Note: Values presented within the table are averages of 3 replications
Date of Planting - 2 October 1965

* Letter indicates usual reaction to rust: S-Susceptible R-Resistant (rust was not a serious problem in 1966)

+ Protein reported on an oven dry basis

Table 4. Winter Wheat Variety Trial - Gregory County.

Variety	Percent Protein	Test Wt. lbs/bu	Grain Yield
Lancer	15.2	61.0	38.0
Scout	16.1	58.7	34.9
Omaha	17.9	60.7	32.2
Hume	16.1	59.5	31.9
Nebred	16.5	61.0	31.6
Ottawa	17.2	60.5	30.8
Bison	17.2	59.3	30.6
Gage	16.8	59.7	28.6
Winalta	17.4	59.8	28.1
Warrior	16.7	58.3	27.9
		Mean	31.5

Winter Barley

The winter barley varieties tested vary in winterhardiness. Kearney and Dicktoo were the most hardy, Chase was intermediate and Mo. B969 and Mo. B1222 were the least hardy. Varieties which are least winter hardy often produce higher yields than the hardy varieties if winter injury is not a problem. However, the survival of the less hardy varieties during severe winters is so low that their average is less than the hardy varieties.

Kearney is a 6-rowed, hulled, rough-awned variety which was released by the Nebraska Agricultural Experiment Station in 1961. It has shown some resistance to Greenbugs. This variety is objected to by the Malting Industry because of small kernels, low extract, and high nitrogen. Dicktoo is similar to Kearney in appearance and is comparable in winter hardiness. It was released by Nebraska in 1952. Chase is also similar to Kearney, but is superior in straw strength. It has a deciduous type awn and was released by Nebraska in 1961. Mo. B1222 is similar to Kearney in straw strength and hardiness, but is slightly earlier, shorter, and has a lower yield. MoB969 is similar to Mo. B1222 but heads a few days later.

Table 5. Winter Barley Variety Trial - South Central Research Farm

Variety	Heading Date	Height Inches	Test Wt. lb/bu.	Grain Yield-Bu/A 1966	1963-66*
Dicktoo	6-13	31	45.6	46.1	32.3
Mo. B1222	6-10	29	47.1	42.5	32.3
Chase	6-13	30	44.4	47.4	32.5
Kearney	6-12	30	46.0	48.9	33.3
Mo. B969	6-13	30	43.8	41.1	31.5

LSD (05) - 7.2 Bu/A

*1965 Crop lost because of winter kill

Oats

Several new varieties were grown in the yield trial at South Central Research Farm in 1966. They were Wyndmere, Dawn, Jaycee, Orbit, Clintford, and Tyler. Wyndmere and Dawn were developed by the North Dakota Agricultural Experiment Station. These two varieties are similar because they were developed from some of the same lines. They are early maturing, crown- and stem-rust resistant, and have medium yields and test weight. Dawn is a tall variety with large, plump, yellow kernels while Wyndmere has a medium height with long, plump, white kernels. Jaycee was developed by the Illinois Agricultural Experiment Station. It is an early, short-strawed, high-yielding variety, which stands well. The light-brown to yellowish kernels are fairly large and plump. It is susceptible to the leaf rusts which infect oat varieties that have the Landhafer oat strain as an ancestor. Orbit was developed by New York Agricultural Experiment Station. It has a short straw, yields well, and has good disease resistance. The seed is white, but has a rather low test weight. Clintford and Tyler were developed by the Indiana Agricultural Experiment Station. They are early maturing, moderately short in height, and have excellant lodging resistance. The kernels are light brown to white, large, and have a high test weight. Additional varietal information can be obtained from Fact Sheet 329- "Recommended Varieties", and Fact Sheet 267- "Oat Production in South Dakota".

Table 6. Oat Variety Trial - South Central Research Farm

Variety	Heading Date	Height Inches	Test Wt. lbs/bu	Grain Yield - Bushel/Acre 1966	Ave. 1964-66
Wyndmere	6-22	29	34.2	40.9	----
Brave	6-21	31	31.8	40.9	----
Burnett	6-23	29	36.6	40.4	59.8
Orbit	6-21	27	32.2	40.0	----
Jaycee	6-22	25	32.0	39.8	----
Tyler	6-22	25	32.2	38.7	----
Dupree	6-18	29	32.3	37.3	57.1
Coachman	6-20	28	35.3	36.8	----
Dawn	6-20	33	32.3	36.2	----
Andrew	6-25	29	35.1	35.9	54.9
Neal	6-21	25	34.5	35.7	50.1
Garland	6-21	27	35.0	35.6	53.9
Santee	6-19	25	33.7	34.5	44.3
Minhafer	6-21	30	34.6	34.3	44.4
Clintford	6-21	26	37.1	31.5	----
Tippecanoe	6-20	25	33.5	30.7	51.0
Lodi	6-28	32	30.8	28.7	----
Garry	6-28	27	31.5	27.8	52.2
Bonkee	6-21	26	33.5	27.6	----
Dodge	6-25	29	32.3	25.4	48.6
Clintland 64	6-22	29	36.3	24.3	37.9
Rodney	6-29	28	31.0	19.3	----
			Mean	33.7	

The Oat variety yield trial in Gregory County in 1966 consisted of two parts. The first part, was the test for measuring varietal adapatability. All new varieties are described in a previous paragraph or in Fact Sheets, except for Peterson 100. This variety was released by a private breeder in Iowa. It is an early, strong-strawed variety with only a fair test weight. It is susceptible to the prevalent races of leaf rust.

The second part of the trial was a comparison of the varieties when seeded in soil which had been either in stubble or fallow the previous year. The yield data are reported in Table 7.

Table 7. Oat Variety Trial - Gregory County - 1966

Variety	Stubble		Fallow		Average
	Test Wt	Grain Yield	Test Wt	Grain Yield	
	lbs/bu	bu/a	lbs/bu	bu/a	bu/a
Tyler	29.5	42.0	31.5	59.2	50.6
Dupree	29.7	40.0	31.7	58.6	49.3
Peterson 100	30.5	40.6	31.5	56.0	48.4
Garland	31.5	38.4	32.5	54.0	46.2
Santee	29.7	40.2	31.7	52.2	46.2
Lodi	28.0	36.8	29.2	54.4	46.1
Burnett	29.8	40.4	30.7	49.0	44.8
Neal	29.7	39.0	30.7	49.4	44.2
Nehawka	30.0	36.6	35.0	51.7	44.1
Brave	27.5	36.4	30.0	49.0	42.7
Clintland 64	30.5	34.8	31.7	49.2	42.0
Clintford	33.5	35.2	34.0	47.6	41.4
Tippecanoe	32.7	36.2	32.7	45.7	41.0
Minhafer	29.7	36.2	30.7	45.3	40.8
Andrew	29.5	34.8	31.0	44.2	39.5
Dodge	32.7	30.8	31.5	44.6	37.6
Coachman	30.5	25.9	32.0	44.2	35.0
Bonkee	29.5	27.0	28.2	27.8	27.4
Rodney	28.5	1.8	28.5	1.8	1.8
Trial Mean	30.2	34.4	46.4	31.1	40.5

Spring Wheat

The yield of spring wheat in small plots ranged from 16.7 to 10.8 bushels per acre. The highest yield was obtained from an experimental line which was also the lowest in percent protein. All of the spring wheats were adversely affected by the below normal spring moisture which caused an abnormally high protein content. The durum wheats were superior to Hard Red Spring wheat in both yield and weight per bushel.

Table 8. Durum Wheat Variety Trial - South Central Research Farm

Variety	Heading Date	Height Inches	Percent Protein	Test Wt. lbs/bu	Grain Yield-Bushel/Acre 1966	Av. 1964-66
Wells	6-24	27	20.9	59.7	24.3	21.6
Lakota	6-25	29	20.0	58.5	22.9	21.0
Leeds	6-24	27	20.9	61.5	19.3	----
Stewart 63	6-28	34	20.6	58.7	16.7	----
				Mean	20.7	

LSD (05) - 3.3 bu/a
Note: The soil was not fertilized, but the plot was seeded on fallow.

Table 9. Spring Wheat Variety Trial - South Central Research Farm

Variety	Heading Date	Height Inches	Percent Protein	Test Wt. lbs/bu	Grain Yield - Bushel/Acre 1966	Av. 1964-66
CI 13773	6-30	26	19.9	58.3	16.7	----
Crim	6-29	29	20.8	54.9	14.9	15.1
SD 62-6	6-26	29	20.8	53.9	14.9	----
BH 632	6-24	29	20.4	54.6	14.8	----
Sheridan	6-27	31	20.0	56.6	14.6	----
Thatcher	6-28	30	21.2	53.6	14.5	----
Rushmore	6-28	27	20.0	55.1	14.3	11.9
BH 631	6-23	28	20.3	54.6	14.2	----
Lee	6-27	28	20.1	55.6	13.6	8.9
Manitou	6-29	28	22.0	53.9	13.4	----
Chris	6-27	29	20.9	55.9	12.6	16.7
Fortuna	6-26	28	20.6	55.6	12.5	----
Pembina	6-27	27	21.6	52.3	11.1	12.5
Selkirk	6-27	26	20.0	50.6	10.9	14.3
Justin	6-28	27	20.9	53.3	10.8	12.5
				Mean	13.6	

LSD (05) = 1.8 bu/a
Note: The soil was not fertilized, but the plot was seeded on fallow.

Table 10. Spring Wheat Variety Trial - Gregory County - 1966

Variety	Stubble		Fallow		Average
	Test Wt	Grain Yield	Test Wt	Grain Yield	
	lbs/bu	bu/a	lbs/bu	bu/a	bu/a
Justin	53.0	18.7	53.5	21.8	20.3
Manitou	52.2	17.6	53.5	21.6	19.6
Crim	53.5	17.8	53.2	21.2	19.5
Lee	54.0	18.0	53.5	19.9	19.0
Chris	55.2	17.0	55.0	19.8	18.4
Selkirk	51.7	16.8	50.5	18.0	17.4
Pembina	47.0	14.9	49.0	19.4	17.2
Sheridan	54.7	13.0	54.5	19.0	16.0
Rushmore	46.7	7.2	47.0	9.8	8.5
Mean	52.0	15.7	52.2	18.9	17.3

Spring Barley

Weather conditions during the spring growing season were not favorable for producing high yields of barley. However the below normal rainfall was offset by below normal temperatures so moisture was sufficient for a fair crop of grain with a moderate test weight. The incidence of foliar diseases was very low.

Primus is a new variety which has just been released jointly by South Dakota Agricultural Experiment Station and Crops Research Division, Agricultural Research Service, United States Department of Agriculture. It is an early maturing, six-row, spring-type barley with long, spreading smooth awns. The kernels are medium sized, plump, free threshing, and has tightly adhering hulls and a colorless aleurone. Primus is resistant to prevalent races of stem rust but susceptible to loose smut and to leaf and head blights.

Table 11. Spring Barley Variety Trial - South Central Research Farm

Variety	Heading Date	Height Inches	Percent Protein	Test Wt. lbs/bu	Grain Yield-Bushel/Acre 1966	Av. 1964-66
Otis	6-22	22	15.4	47.3	43.7	47.6
Trophy	6-27	26	15.0	41.3	32.5	41.6
Traill	6-26	26	15.7	47.8	32.4	41.7
Dickson	6-25	28	15.6	45.8	32.4	----
Primus	6-23	24	15.9	49.0	28.9	----
Liberty	6-25	28	16.2	45.7	28.8	42.7
Larker	6-24	28	16.8	46.0	24.9	39.8
				Mean	31.9	

Note: The soil was not fertilized, but the plot was seeded on fallow.

Table 12. Spring Barley Variety Trial - Gregory County - 1966

Variety	Stubble Test Wt lbs/bu	Stubble Grain Yield bu/a	Fallow Test Wt lbs/bu	Fallow Grain Yield bu/a	average bu/a
Liberty	37.8	35.0	38.0	46.2	40.6
Spartan	39.4	31.7	40.1	46.5	39.1
Larker	37.8	31.3	37.5	40.6	36.0
Plains	36.0	29.0	36.7	41.4	35.2
Traill	36.2	19.4	34.6	33.3	32.6
Trophy	35.5	29.5	37.8	34.8	32.2
Dickson	38.0	29.8	35.1	34.0	31.9
Trial Ave	37.2	31.2	37.1	39.6	35.4

SPECIALTY CROP TESTING

Objective: To observe and compare various specialty crop varieties and selections for grain yield, disease resistance, new management practices, and other characteristics for area adaptability.

Sunflower Yield Trial

H. A. Geise

Sunflowers are grown as a crop for several purposes. The large-seed types are grown for whole-seed-uses in the confectionary trade. They are also preferred by some bird feeders because the large seed is less likely to attract sparrows and is less likely to be lost on the ground. However, the medium- and small-sized seed is better because the hull is thinner. The hulls are low in nutrients so the thin hulled varieties have a greater feed value.

Sunflowers have several major problems. The most important being insects. A seed crop can be destroyed by the Sunflower Moth. The moths larvae tunnel through the seeds leaving a mass of insect frass and strands of weblike material which cover the fact of the heads. The insect injury weakens the plants so they are frequently attacked by Stalk and Head Rots. Late maturing fields may become infected with Mildew.

Sunflower seed can be completely utilized. After the hulls are removed, they are pressed into logs and sold as a fireplace fuel. The oil which is extracted from the meats is an excellent cooking and salad oil, while the meal remaining after oil extraction is sold as a livestock supplement containing about forty-four percent protein.

Table 13. Regional Sunflower Yield Trial - South Central Research Farm

Variety	Height Inches	Date of Flowering	Insect* Damage	Percent Wilted	Test Wt. lbs/bu	Yields lbs/a
Ho 1 (High Oil)	52	7-17	100	5	30	497
Mingren	52	7-17	100	28	22	401
T56002	56	7-19	100	10	26	270
T64002	46	7-17	100	41	28	255
Commander	52	7-17	100	20	20	250
Arrowhead	56	7-13	100	20	27	229
T64001	57	7-19	100	5	29	216
VNIIMK 16.46	54	7-19	100	9	25	213
Kubanec	53	7-13	100	38	30	202
Smena	56	7-19	100	3	25	200
VNIIMK 89.31	56	7-19	100	9	27	183
Armavirec	51	7-11	100	49	28	161
Peredovik	54	7-19	97	11	26	150
Vostok	56	7-17	100	18	27	133
					Mean	240

LSD (05)-57 lb/a

* Damage is based on the total number of heads to which damage was done rather than to the percent of damage to the heads.

Specialty Crop Management

Three specialty crops were studied in row-spacing plantings this past year. Crambe is grown for the Erucic acid which is extracted from its Mustard-like seed. The acid is used in the manufacture of plastics, such as brush bristles and bearings. Yellow Mustard is new to this area but has been grown in Western United States and Canada for Many years. The seeds are used as a relish or condiment. The third crop studied was Safflower which is grown for the high quality cooking oil which is obtained from its seed.

The plots were planted in Mid-May with a grain drill at the following rates: Crambe-15 lbs/A, Mustard-10 lbs/A, and Safflower-30 lbs/A. Excellant weed control was obtained by incorporating Trifluralin into the soil with a disk harrow. The herbicide was applied at the rate of 1 pound per acre.

Seed yields of Mustard were severely reduced by insects feeding on the flowers.

Table 14. Seed Yields of Miscellaneous Specialty Crops as Influenced by Space between Rows.

Crop	Row Width Inches	Test Wt. lb/bu	Seed Yield lb/a
Crambe	6"	22.5	722
	12"	22.0	633
	24"	23.0	429
	42"	22.5	289
Yellow Mustard	6"	53.0	5.8
	12"	----	13.4
	24"	----	6.7
	42"	----	8.0
Safflower	6"	36.5	89
	12"	35.0	133
	24"	37.0	389
	42"	33.0	355

Safflower Testing

H. A. Geise

The Safflower trials conducted in 1966 consisted of varieties which had previously been tested but which were not completely evaluated. The plots were planted in Mid-May and consisted of six rows each with eight inches between rows. Weeds were controlled by a preplant application of Trifluralin. The herbicide, applied at the rate of 1 pound per acre in 5 gallons of water, was immediately incorporated into the soil with a disk harrow.

Table 15. Safflower Variety Trial - South Central Research Farm

Variety	Date of 50% Bloom	Spinescense* (0-5)	Branching* (1-5)	Height Inches	Test Wt. lbs/bu.	Yield-lbs/a 1966	Yield-lbs/a 1963-66
Gila	12-7	3	2	15	39.7	363	641
A0104	13-7	5	2	18	37.3	445	608
US 10	12-7	4	2	16	39.8	478	554
Pacific #1	13-7	4	3	17	38.2	489	524
Ute	16-7	4	2	16	39.7	518	----
12417	13-7	4	2	14	36.0	446	----
A101	14-7	3	2	15	34.5	319	----
A1049	14-7	4	2	14	34.0	311	----
N472-3-49X	21-7	4	2	17	39.2	367	537
N10	18-7	4	3	17	37.8	488	533
N472-1-48C	21-7	5	2	16	38.3	270	515
N472-4-49X	21-7	5	3	19	40.5	478	504
N8-48C	21-7	4	3	16	39.8	474	500
N472-8-48C	21-7	4	2	17	40.1	362	477
N8	19-7	5	3	18	39.8	398	428
N472-2-48C	21-7	4	2	18	39.0	407	411
SDI 38	19-7	5	2	18	40.1	617	619
SDI 87	17-7	2	3	16	40.0	436	604
SDI 85	22-7	2	2	17	40.8	386	598
SDI 30	22-7	1	2	18	39.8	498	587
SDI 83	19-7	0	3	18	39.5	311	586
SDI 103	20-7	3	3	20	38.2	602	582
SDI 39	18-7	1	2	18	39.7	488	569
SDI 25	19-7	1	2	18	38.7	539	566
SDI 12	18-7	4	2	17	42.0	395	560
SDI 86	17-7	4	3	17	40.1	393	554
SDI 46	18-7	3	3	17	40.1	393	554
SDI 96	19-7	2	2	18	39.3	445	544
SDI 24	21-7	1	2	19	40.5	456	542
SDI 47	19-7	3	2	18	40.5	477	517
SDI 102	21-7	4	3	19	39.7	352	504
SDI 94	19-7	2	3	17	41.2	384	493
SDI 18	17-7	2	3	18	38.0	389	487
SDI 84	15-7	1	3	17	38.5	248	486
SDI 82	20-7	4	3	17	40.5	343	472
SDI 37	18-7	2	4	18	42.0	498	----
SDI 35	17-7	5	2	17	41.0	498	----
SDI 54	18-7	5	3	18	42.0	466	----
SDI 48	20-7	1	3	19	36.0	436	----
SDI 21	17-7	5	2	16	42.0	436	----
SDI 44	13-7	3	3	18	41.0	373	----
SDI 40	21-7	3	4	18	40.5	373	----
SDI 31	17-7	5	2	15	41.0	216	----
SDI 14	13-7	5	4	16	41.0	186	----
SDI 10	17-7	5	3	17	40.0	186	----
SDI 4	21-7	2	3	18	39.5	186	----
SDI 29	21-7	3	3	16	42.0	125	----
SDI 2	23-7	5	2	20	----	92	----

* Note: See following page for explanation.

* Spinescence: Scale ranges from 0-(No Spines) to 5-(Heavily Spined).
Branching: Scale range is from 1-(Only tip branching) to 5-(Plant completely branched.

Four groups of safflower varieties were tested in 1966. Group I consisted of eight varieties which were in Regional trials in previous years. Group II consisted of ten experimental varieties of which six were obtained as induced mutations. Group III consisted of nineteen varieties which were selected from the world collection on the basis of yield, and Group IV which are new selections from a world collection. Data from the nursery are reported on table 15.

SORGHUM PERFORMANCE TESTING

Sorghum Breeding

A. O. Lunden

Grain sorghum yields ranged up to 51 hundredweight or over 90 bushels per acre in 1966. The 1966 yield tests of 1965 selections revealed one hybrid which produced consistently well at all locations in the state. It will be more extensively tested, statewide and regionally, in 1967. If performance is acceptable the variety will probably be released in 1968. Four other entries are also scheduled for advanced testing.

A leafy type forage sorghum of high productivity and high protein content will also be more extensively tested in 1967.

Grain Sorghum Performance Testing

J. J. Bonnemann

Objective: To compare the performance of grain sorghum hybrids as to yield and other agronomic characteristics.

Performance trials with grain sorghum have been conducted on a fee basis at the South Central Research Farm since 1962. The accompanying table 16 reports the 1966 yields and agronomic data. Long-term averages and other information can be found in Circular 181, 1966 Grain Sorghum Performance Trials.

Table 16. Grain Sorghum Performance Trial - South Central Research Farm

Variety	Height Inches	Date Headed	Percent Moisture	Test Wt. lbs/bu	Yield-100 lbs/a 1966	Yield-100 lbs/a 1965-66
Colo. 606	42	7-29	32.7	61.0	51.0	33.2
Sokota 510	42	7-30	30.6	59.0	47.1	----
RS 610	42	7-29	26.8	58.0	46.8	28.8
Pioneer 885	38	7-30	32.3	59.0	46.6	----
Frontier S 400	40	7-30	30.8	59.0	44.9	----
T-E Exp 22120	40	7-26	18.8	59.0	44.4	----
Advance 22	44	7-26	19.3	59.5	44.3	----
Nebr. 504	44	7-26	23.2	59.0	42.1	31.2
Pioneer 872	39	7-30	33.3	59.0	41.7	----
Pioneer 872A	38	7-30	29.6	59.5	41.0	----
Advance 54	36	7-27	22.8	58.5	40.5	----
T-E Exp 22128	46	7-25	22.6	57.5	40.3	----
PAG 304	37	7-26	22.2	58.0	40.2	29.5
Frontier 400B	38	7-30	35.1+	60.0	39.9	----
AMAK R-1o	38	7-30	28.5	60.0	38.6	27.2
Colo. 604	42	7-26	18.3	59.0	38.5	28.1
SD 503	44	7-26	23.1	58.0	37.6	35.8
NK 133	41	7-25	18.9	59.0	37.5	28.2
DeKalb B-32	43	7-29	21.8	59.0	37.1	25.5
Pawnee	44	7-25	21.7	59.0	36.8	25.1
Comanche	39	7-31	32.3	60.0	36.6	23.8
T-E 44C	45	7-25	19.6	58.0	34.8	----
SD 451	45	7-24	21.4	56.0	34.2	26.8
Pioneer 865	35	8-2	34.2	57.0	32.9	17.0
Frontier 388	39	7-28	27.0	59.0	31.7	24.0
T-E 44	36	7-28	20.2	58.0	31.6	27.4
T-E Exp 07120	42	7-24	18.3	58.0	30.7	----
T-E Exp 07128	44	7-24	19.4	58.0	29.7	----
NK 115	41	7-22	17.4	55.0	28.8	26.1
NK 120	42	7-22	23.0	57.0	26.5	----
Colo. 585	42	7-26	19.7	57.0	26.2	19.4
NK 125	42	7-24	19.1	55.0	26.1	25.7
				Mean	37.7	

LSD (05) = 11.6 bu/a

+Electronic moisture meter was calibrated for moisture contents of 0 to 35 percent. The sign indicates moisture in grain was above 35 percent and could not be measured.

Grain Sorghum Row Spacing and Weed Control

W. G. Wright & H. A. Geise

Objective: To evaluate row spacing, a heavy planting rate, and weed control on a late-planted early maturing sorghum.

Experimental Procedure: SD 102, an early maturing grain sorghum was planted June 16, 1966 in 12, 24, 24, and 42 inch rows. A uniform rate of 10-12 pounds of seed per acre was used in all row spacings. Pre-emergence herbicide treatments were made June 21 and the post treatments were applied July 14 when the weeds were 2-6" tall and the sorghum 8" tall. The plots received no cultivation. Control readings were made September 6, 1966 and are reported in table 17.

A (dense) stand of rough pigweed and some purselane was present in all plots. Rainfall received after herbicide application was: June 20 (.47), 22 (.63), July 4 (.60) and 7 (.67).

Results:

Table 17. Effects of Row Spacing and Chemicals on Grain Yield and Weed Control in Sorghum.

Treatment	Rate lb/a	% Pigweed Control			Yield-Bu/A*		
		12"	24"	42"	12"	24"	42"
Atrazine	2.5	97	98	94	3593	4208	3541
Norea	2.5	74	71	52	3667	4067	3185
Ramrod	4.0	93	90	86	3756	4489	3586
Atrazine + Ramrod	1+2	98	98	95	3889	4512	3437
Atrazine + Oil**	1+1	96	94	94	3678	4423	3437
Atrazine + Norea	1+1	90	83	75	4067	4660	3675
2,4-D amine**	1/2	95	95	93	2126	2045	2141
Check	---	0	0	0	3208	3712	2867

* significant difference at 1% level for yield due to row spacing.
** applied post emergence

Summary: All treatments except Norea and Atrazine + Norea in 24 and 42 inch rows showed excellent weed control with no cultivation. Highest yields for all treatments were obtained in 24 inch rows. In all row spacings, grain yields from treated plots were increased substantially over those of the untreated areas.

The 2,4-D amine seriously damaged the sorghum plants and grain yields were reduced. This damage is unusual for this amine and its cause has not been determined.

Sorghum Forage Testing

H. A. Geise

Objective: To compare the various forage sorghums, sudangrasses, and sorghum-sudangrass hybrids as to their adaptability, their forage production, and their forage quality.

A multitude of forage sorghum varieties and hybrids, sorghum-sudangrass crosses, and sudangrasses were tested. The entries were scored for various characters such as leafiness, stage of maturity, forage quality, and forage yield when harvested once or several times during the season.

In all cases, yields were higher from single than from multiple cuttings. However some varieties are designed for grazing and under those conditions the yield and quality would be quite different.

The results of the trial are reported in tables 18 and 19.

Table 18. Sorghum Forage Summary - South Central Research Farm - 1966

Identity	Maturity	Height Inches	Leafiness	Green Chop*** Percent Protein	Green Chop*** Percent Dry Matter	Green Chop*** Yield Tons/A	Silage*** Percent Protein	Silage*** Percent Dry Matter	Silage*** Tons/A Dry Wt.
SUDAN GRASSES									
NK Trudan IV	2	94	12	10.3	18.8	1.7	7.78	25.9	4.0
NK Trudan II	2	97	12	13.1	18.4	1.7	10.43	31.2	3.7
Georgia Suhi I	3	90	12	11.5	19.5	1.3	6.03	28.5	3.5
Northrup King Trudan	2	96	11	11.3	19.8	1.4	7.24	32.1	3.4
Piper	2	85	10	11.3	20.9	1.0	7.54	33.4	2.8
Frontier H-40	2	93	11	11.7	18.4	1.8	7.42	28.9	2.8
								Mean	3.7
SORGHUM SUDAN									
Frontier Hidan 39	3	50	10	12.2	18.7	1.6	8.02	30.5	5.6
Caladino-Greelan	2	52	11	14.2	17.7	1.6	7.48	27.5	5.3
Northrup King Sordan	2	47	11	13.3	17.2	1.4	8.02	28.5	5.1
Superdan FS550	2	91	12	11.8	17.7	1.5	8.02	31.4	5.0
Excel Chow-Maker	3	50	11	13.2	18.6	1.4	6.27	28.6	4.9
Frontier H-35X	2	50	10	12.0	18.6	1.6	5.37	32.1	4.8
Asgrow Grazer	2	43	10	12.5	18.2	1.2	8.20	28.6	4.5
Asgrow Grazer A	3	87	13	13.3	18.9	1.4	7.90	27.3	4.4
Doreman Suregraze	3	48	11	13.5	16.6	1.2	8.98	26.4	4.3
Sexauer S-100	2	45	9	12.7	19.4	1.1	8.26	32.0	4.2
Excel Chow-Maker 21	2	52	10	12.6	18.0	1.4	8.44	32.0	4.0
Frontier Hidan 38	4	44	9	13.3	19.4	1.1	7.12	29.0	4.0
Frontier Hidan 37	2	48	9	12.6	17.7	1.0	8.02	30.5	4.0
DeKalb SX-11	2	50	10	12.6	16.7	1.9	6.75	28.3	4.0
Pioneer 981	3	47	10	13.5	20.3	1.2	6.69	31.3	4.0
S.D. 1X Tift	2	81	11	14.0	17.9	1.3	8.08	33.4	3.8
Paymaster Sweet Sioux	3	50	10	13.3	18.5	1.3	9.16	28.9	3.7
Advance 1038G	2	47	9	14.4	18.7	1.3	7.66	35.4	3.7
Frontier 3818	3	50	10	12.0	19.3	1.4	8.02	32.0	3.6
S.D. 25X Tift	2	81	11	13.0	17.7	0.9	7.72	31.3	3.4
S.D. 25X Piper	2	86	11	13.2	20.4	1.2	6.87	33.8	3.4
Nebraska 280S	2	49	10	13.0	16.4	1.3	6.99	33.5	3.3
Asgrow Orbit	3	42	8	13.0	16.8	1.1	6.45	24.3	2.5
								Mean	4.2

Scoring Legend: see page 20 for explanation.

Table 19. Sorghum Forage Summary - South Central Research Farm - 1966

Identity	Maturity* (1-5)	Height Inches	Leafiness No./Plant	Coarseness** (1-5)	Percent Protein	Percent Dry Matter	Yield,T/A-Dry Wt. 1965	Yield,T/A-Dry Wt. 1966
FORAGE SORGHUM								
Northrup King 320	4	77	16	3	8.80	34.9	---	8.6
Asgrow Beefbuilder T	5	82	14	3	9.59	23.5	3.9	6.9
Advance 1071F	3	85	14	3	8.50	29.7	3.2	6.7
Advance 1085F	5	76	17	4	9.52	22.9	---	6.1
Northrup King 300	4	62	15	3	10.25	25.5	---	5.9
Waconia	3	71	13	3	9.65	31.9	1.7	5.6
Asgrow Sorgusbord	3	73	12	2	8.68	36.4	---	5.4
DeKalb FS22	4	82	12	3	8.38	26.6	2.6	5.4
Asgrow Titan R	4	71	17	3	9.77	23.4	---	5.2
Asgrow Dairy D	4	75	15	3	9.71	21.1	---	5.0
S.D. 65FS001	4	60	19	5	12.12	25.5	---	4.9
Arkansas AK-44(Leafy Hyb)	2	60	12	4	9.65	28.2	3.0	4.8
Weathermaster FS500	4	80	16	4	8.92	22.4	---	4.8
Pioneer 931	5	90	17	4	10.43	19.4	2.3	4.7
Weathermaster FS445	4	64	15	2	7.78	22.0	---	4.7
Northrup King 315	4	72	15	3	7.72	26.5	---	4.6
Frontier FX200	4	65	17	3	10.07	23.8	2.1	4.5
Weathermaster FS440	3	72	14	2	10.49	23.0	---	4.5
Northrup King 330	4	57	17	3	6.87	29.8	---	4.4
Advance 1076F	4	75	14	3	8.56	21.5	---	4.4
Frontier S210	3	75	13	3	7.42	26.4	---	4.1
Arkansas AK-43	4	56	18	3	5.97	25.8	1.9	4.1
Excel Bundle-N-Bale	3	75	13	3	9.22	23.4	---	4.0
Asgrow Duet	4	66	14	3	9.04	21.8	2.5	4.0
Frontier S206	4	60	16	2	9.35	26.2	---	3.8
Frontier S211	4	74	13	3	10.61	23.5	---	3.7
Frontier S209	3	80	13	3	9.04	21.8	---	3.7
Frontier S205	1	68	11	2	11.64	27.9	2.7	3.6
DeKalb FS1A	4	60	15	3	7.36	21.0	2.1	3.6
Northrup King 145	2	77	11	1	6.70	29.9	1.3	3.4

(Continued on next page)

Table 19 (Con't)

Identity	Maturity* (1-5)	Height Inches	Leafiness No./Plant	Coarseness** (1-5)	Percent Protein	Percent Dry Matter	Yield, T/A-Dry Wt. 1965	Yield, T/A-Dry Wt. 1966
Frontier FX201	4	56	17	3	8.80	20.5	---	3.4
Frontier FX131	3	61	14	3	9.65	25.9	---	3.3
S.D. 63X Dual	1	62	10	2	7.12	32.8	---	3.2
Frontier S212	3	74	14	4	9.35	24.7	---	3.2
Lindsey 92F	4	84	13	4	10.19	24.5	---	3.2
Frontier FX202	4	58	16	2	8.38	27.3	---	3.1
S.D. 252F	1	61	10	3	8.13	32.5	1.6	3.0
Rancher	1	63	8	2	6.39	28.8	1.3	2.9
Dual	1	60	9	2	6.75	33.0	1.0	2.5
39-30-S	1	66	8	2	7.90	28.5	1.3	2.5
S.D. 25X Dual	1	58	14	2	7.96	30.6	---	2.4
S.D. 1X Dual	1	58	11	2	7.90	23.6	---	1.7
LSD (05) = 1.4 T/A							Mean	4.2

Scoring Legend:

*Maturity: 1-Mature seeds; 2-Hard dough; 3-Soft dough; 4-Heading or pollinating; 5-No heads.

**Coarseness: 1-Fine stemmed, leafy; 2-Fine stemmed, few leaves; 3-Medium stemmed, leafy; 4-Medium stemmed, few leaves; 5-Large stemmed, leafy.

***All Sudans and Sorghum Sudan were harvested twice during the growing season; Silage harvest was made just prior to frost.

LEGUME AND GRASS TESTING

Alfalfa Forage Production

H. A. Geise and M. D. Rumbaugh

Objective: To compare the forage production of six varieties of alfalfa when grown alone or in combination with a second variety.

Six varieties of alfalfa were selected on the basis of growth type, recovery rate, disease resistance, and other characters which could be used to identify each. The varieties were seeded alone and in all possible two variety combinations.

Table 20. Forage Yields of six alfalfa varieties seeded as mixtures and in pure stands.

Mixture or Varieties	Forage Yield - Pounds Per Acre							Average
	1959	1960	1961	1963	1964	1965	1966	1959-66*
Cossack	1791	1213	1510	898	1125	1210	738	1212
Cossack + Ranger	1671	1436	1460	887	1642	1320	1010	1346
Cossack + DuPuits	1652	1935	1510	953	1935	1720	848	1507
Cossack + Teton	1771	2040	1436	1069	1744	1440	648	1449
Cossack + Semipalatinsk	1671	1796	1510	980	1744	1420	1085	1458
Cossack + Travois	1830	1268	1704	1062	1710	1600	889	1437
Ranger	1791	1129	1412	958	1136	800	723	1136
Ranger + DuPuits	1930	2166	1412	1094	1944	1460	949	1565
Ranger + Teton	1691	1852	1461	1059	1451	1180	536	1318
Ranger + Semipalatinsk	1552	1610	1364	991	1845	1600	734	1380
Ranger + Travois	1731	1374	1364	909	1598	1440	738	1307
DuPuits	1572	1244	1486	933	1586	1260	700	1254
DuPuits + Teton	1850	1604	1436	989	1642	1540	1055	1445
DuPuits + Semipalatinsk	1651	1541	1364	901	1609	1840	791	1385
DuPuits + Travois	1691	1446	1412	805	1416	1180	587	1219
Teton	1771	1509	1144	783	1035	1520	648	1201
Teton + Semipalatinsk	1671	2378	1266	838	1642	1400	1733	1561
Teton + Travois	1512	1460	1412	1012	1541	920	588	1206
Semipalatinsk	1651	1604	1071	1037	1080	1040	814	1185
Semipalatinsk + Travois	1771	2040	1826	931	1699	1660	904	1547
Travois	1612	1416	1461	922	1540	980	882	1259

*Plots were not harvested in 1962.

Forage yields have been harvested from the plots every year since 1959, except 1962. Rainfall in 1961 was far below normal and as a result there was not enough forage produced to warrant harvest. Yields, as listed in table 20 indicate that more forage may be produced by growing certain varieties in mixtures than by growing in a pure stand. Whether these differences are statistically significant has not been determined.

Table 21. Alfalfa Variety Forage Yield Trial - South Central Research Farm

Variety	Forage Yield--Tons/Acre	
	1966	6-Year Average
Rambler	1080	1420
Nomad	1080	1360
Vernal	960	1280
Grimm	920	1220
Ladak	900	1440
A 225	760	1240

Grass Variety Trials

J. G. Ross and H. A. Geise

Objective: To determine which species and varieties of introduced grasses are best adapted to the South Central area on the basis of their forage production.

Table 22. Smooth Bromegrass Forage Yield Trial - South Central Research Farm (Seeded August 1958)

Variety	Forage Yield--Tons/Acre	
	1966	7-Year Average
Southland	.84	1.39
Lincoln	.83	1.38
Lancaster	.79	1.36
Homesteader	.68	1.16
South Dakota 5	.85	1.16
Wisconsin 55	.96	1.00
Canadian Common	.65	.94

Table 23. Miscellaneous Grass Species Forage Yield Trial - South Central Research Farm (Seeded August 1958)

Variety	Forage Yield--Tons/Acre	
	1966	5-Year Average
Common Russian Wildrye	.25	1.40
Vinall Wildrye	.33	1.47

Table 24. Wheatgrass Forage Yield Trial - South Central Research Farm

Variety	Forage Yield - Tons/Acre*			
	Seeded August 1958		Seeded August 1960	
	1966	7 Year Ave	1966	5 Year Ave
Crested Wheatgrass				
Common	.48	.95	---	---
Common Fairway	.44	.73	.49	.95
Mandan 2359	.46	.86	.50	1.03
Nebraska 10	.52	.95	---	---
Nebraska 20	---	---	.50	.92
Nebraska 3576 Fairway	.48	.91	.63	1.00
Nordan	.50	.97	.58	1.10
Summit	.52	.96	---	---
Tall Wheatgrass				
Alkar	---	---	.28	1.30
A12465	---	---	.24	1.32
Mandan 1422	.42	1.12	.25	1.26
Nebraska Tall	.52	.91	---	---
S-64	.42	.72	.25	1.25
Intermediate Wheatgrass				
Amur	.56	1.23	.40	1.20
Greenar	.58	1.23	.32	1.32
Idaho #3	.50	.97	.32	1.24
Idaho #4	.45	1.31	---	---
Mandan	---	---	.36	1.13
Nebraska 50	.57	1.25	.35	1.06
Oahe	.61	1.35	.43	1.40
Ree	.56	1.19	.34	1.30
Miscelleaneous Wheatgrass				
P-27 (A. sibericum)	.54	.88	.27	.98
Topar Pubescent (A. trichophorum)	.54	.80	.30	.86
Whitmar (A. inerme)	.48	.61	---	---

* Absence of a yield indicates variety was not included in trial that year.

Intermediate and Tall Wheatgrasses have consistently produced the highest forage yields. Oahe, an intermediate wheatgrass, although not the highest yielding in 1966, has the highest average of the groups seeds in 1958 and 1960 (table 24). The recommended intermediate wheatgrass varieties are Oahe, Amur, and Greenar. Tall Wheatgrass yields nearly as well as intermediate but is not as desirable nor palatable. Nordan crested wheatgrass was the highest forage producer of the crested wheatgrass varieties and is also the most desirable from other agronomic standpoints.

Grass Forage Production with Various Fertilizers and Row Spacings

J. G. Ross and H. A. Geise

Objectives: To determine optimum rates and ratios of fertilizers to be used in the production of grass forage. The effects of row spacing and solid stand are also included.

The response of introduced grasses to commercial fertilizers have been unexpected and as yet are not completely explained. Yields increase with nitrogen fertilization but when phosphorous has been applied too, the yields were reduced. Because phosphorous sometimes reduces the availability of zinc to a plant, the phosphorous-treated plots were divided and zinc was applied to half of each plot. Yields taken in 1966 (table 25) indicated that zinc deficiencies may be involved.

Leaf samples were collected and analyzed for the minor elements present. The results indicated that the copper content was extremely low.

Table 25. Influence of Row Space and Fertilizer on Forage Yield of Smooth Bromegrass and Intermediate Wheatgrass.

Species	Row Space	Fertilizer*	Forage 1966**	Yield-Tons/Acre (Ave. 1961-66)
Smooth Bromegrass	6"	0-0-0	.64	1.04
		20-0-0	.85	1.48
		40-0-0	.94	1.63
		40-9-0	.90	1.73
		40-9-0+Zn	1.20	----
	42"	0-0-0	.75	1.51
		20-0-0	.78	1.59
		40-0-0	.73	1.72
		40-9-0	.84	1.70
		40-9-0+Zn	.77	----
Intermediate Wheatgrass	6"	0-0-0	.85	1.54
		20-0-0	1.02	2.18
		40-0-0	1.03	1.87
		40-9-0	.96	1.94
		40-9-0+Zn	.99	----
	42"	0-0-0	.82	1.62
		20-0-0	.76	1.78
		40-0-0	.79	1.92
		40-9-0	.76	1.83
		40-9-0+Zn	.88	----

* Nitrogen and Phosphorous fertilizers were applied as pounds of element at the rate indicated. Zinc was applied at 10 pounds per acre as zinc sulphate.

** Fertilizer and Spacing differences are significant at the 5% level.

Table 26. Effect of Fertilizer on Forage Yield and Protein of Brome grass.

Fertilizer Rate	Percent Protein	Forage Yield Tons/Acre	Pounds of Protein/A
0-0-0	10.67	.68	145
40-0-0	13.51	.94	254
80-0-0	15.26	.94	287
120-0-0	14.89	.98	292
160-0-0	14.41	1.12	322

In a second experiment to study the effects of high nitrogen fertilizer, ammonium nitrate was broadcast on Smooth Bromegrass sod in the fall of 1965. The sod had been established since 1958 and the plants exhibited extreme nitrogen deficiency. The plots were harvested in 1966 and samples analyzed for protein. The results are listed in table 26. The yield increase due to nitrogen fertilizer was largest with the 40-pound-per-acre rate and the additional increase was only minor for higher rates of nitrogen. However protein content could be increased by applying up to eighty pounds per acre.

MANAGEMENT, TILLAGE, AND CULTURAL PRACTICES

H. A. Geise

Comparison of Different Techniques in Growing Winter Wheat

Objective: To compare yields of winter wheat grown, (1) continuously with and without commercial nitrogen, (2) in rotation with conventional fallow or sweetclover fallow, and (3) in rotation with corn or sorghum harvested as an ensilage crop.

Yields and quality data from experiments conducted since 1959 with different management practices are reported in table 27. Soil moisture apparently is the main limiting factor of those studied. Continuous wheat can produce slightly more grain in a two year period than can a wheat-fallow system. The low yield in the continuous wheat experiments with nitrogen fertilization may be due to the more complete use of soil water to grow a larger plant so that less water remains to produce grain.

The partial fallow obtained by using a row crop during the fallow year increases the wheat yields slightly above the annual yield of continuous wheat, but yields of the forage produced (table 28) were not enough to justify their use.

Table 27. Yields of Winter Wheat from Plots Having Eight Different Management Practices

Management Practice	1966 Test Wt. Lbs/Bu.	1966 Percent Protein	1966 Yield Bu/A	Av. Yield Bu/Acre (1959-66)
Continuous Wheat	57.5	16.69	15.1	7.8
Continuous Wheat + 40# N/yr	56.9	19.15	13.9	7.4
Continuous Wheat + 80# N/yr	56.5	19.69	11.2	----
Continuous Wheat +120# N/yr	56.0	19.69	12.0	----
Winter Wheat - Fallow	55.0	19.37	18.6	13.0
Winter Wheat - Sw. Cl. Fallow	54.4	19.21	14.6	10.4
Winter Wheat - Corn (Silage)	55.5	19.32	14.2	8.2
Winter Wheat - Sorghum (Silage)	57.1	18.03	13.2	8.3

LSD at 5% level - 2.6 Bu/A

Table 28. Yields of Forage obtained from Corn and Sorghum - 1966

Crop	Percent Dry Matter	Forage Yield - Tons/Acre Wet	Dry
Corn	29%	6.3	1.8
Sorghum	31%	6.4	2.0

Methods of Summer Fallow

Objectives: To compare various fallow techniques in which the type of tillage and number of tillage operations vary.

The fallow methods listed in table 29 have been studied over a period of seven years. The larger yields in 1966 were obtained from those treatments which included tillage operations during the entire fallow season. The highest yield was obtained where subsurface tillage and Broad-leaved herbicide were used in 1966 but the yield is not much greater than several other of the methods.

Longtime averages show that best yields are obtained by subsurface fallow methods which destroy weeds and other plants from the time of harvest until seeding time. These implements leave the soil loose so water can be readily absorbed. They also leave the stubble standing to catch snow which melts and is absorbed to increase the soil moisture content.

Table 29. Yields of Winter Wheat Obtained from Plots where Six Different Fallow Practices were Compared. (1959-1966)

Fallow Practice		Grain Yield of Winter Wheat			
Fall	Summer	Test Wt. lbs/bu	Percent Protein	Bu/A* 1966	Average (1959-66)
1) One-Way	One-Way	55.6	19.32	19.8	13.9
2) Noble Blade	Noble Blade	55.5	19.32	19.8	16.4
3) Noble Blade	Noble Blade or 2,4-D	55.7	19.26	20.4	15.9
4) Noble-Chem**	Chemical*** + 1 Tillage	55.5	19.15	17.2	14.5
5) No Tillage	Noble Blade	55.5	19.32	18.5	15.3
6) Noble Blade	Chemical****	55.7	19.26	16.8	13.8

* LSD at 5% level - 3.0 Bu/A
** Fall Treatment consists of 5# of Dalapon + 1/2# of 2,4-D per acre.
*** Spring Treatment consists of 1/4# of Paraquat/Acre/each of 2 applications.
**** Two applications of Paraquat at 1/4#/A per treatment.

Table 30. Soil Moisture Conditions as Influenced by Six Different Fallow Techniques. (1965-1966)

Fallow Treatment	Total Inches of Soil Moisture (0-48")						
	Stubble Oct 66	Stubble Oct 65	Fallow May 66	Fallow Oct 66	Winter Gain*	Summer Loss**	Gain for Year***
1	10.87	10.61	12.24	10.87	1.63	1.37	0.26
2	11.68	10.29	13.39	11.68	3.10	1.71	1.39
3	11.82	10.94	13.21	11.82	2.27	1.39	0.88
4	11.43	10.55	13.07	11.43	2.52	1.64	0.88
5	11.38	10.55	12.91	11.38	2.36	1.53	0.83
6	11.53	9.98	12.47	11.53	2.49	0.94	1.55

* moisture accumulated in soil October 1965 to May 1966.
** moisture loss by evaporation or plant use from May 1966 to October 1966.
*** difference between winter gains and summer loss.

Management, Methods of Seeding Sorghum, and Fertilizer Effects on a Sorghum-Spring Wheat Rotation

Objectives: To determine the effect of nitrogen fertilizer, row spacing, and planting rate on grain sorghum yields and effects of these practices on the yield of spring wheat the next year.

Yields of spring wheat in the sorghum-spring wheat rotation have been similar for several years. Yields were larger from the plots which had not been fertilized and had small sorghum populations the preceeding year. These two conditions point to a moisture problem. Fertilization produced larger plants which needed more moisture for growth thus causing a drought condition at the time when the grain was filling. The fertilizer has been applied by broadcasting on the surface and disking in. This type of application promotes root growth in the upper soil and may limit the plants in their use of subsoil moisture.

Further research into the placement of fertilizer and root development in the heavy clay soils need to be investigated. It maybe possible to place the fertilizer deeper in the soil and in this way direct the roots downward, thus utilizing more of the moisture in the subsoil.

Table 31. Effects of Fertilizer, Rate of Seeding, and Row Spacing of Grain Sorghum on Grain Yield of Spring Wheat and Grain Sorghum in a Sorghum-Spring Wheat Rotation

Rate of Planting Sorghum	Sorghum Row Spacing	Fertilizer*	Grain Yield-1966** Spring Wheat % Protein	Spring Wheat Bu/A	Sorghum Bu/A
2 lbs/A	12"	O	21.45	6.5	19.0
		N	22.46	6.3	26.5
	24"	O	21.23	8.5	25.6
		N	22.24	7.8	27.7
	42"	O	22.20	8.1	28.5
		N	22.35	8.1	27.2
4 lbs/A	12"	O	21.45	7.4	22.0
		N	22.24	6.1	22.3
	24"	O	21.98	8.7	32.8
		N	22.52	7.9	31.6
	42"	O	21.82	7.5	29.8
		N	22.41	7.4	25.7
8 lbs/A	12"	O	20.65	7.1	19.0
		N	22.20	6.1	22.3
	24"	O	21.13	7.6	28.8
		N	22.24	6.3	32.2
	42"	O	21.13	6.8	24.4
		N	22.12	6.4	29.4

*"N" indicates 30# of Nitrogen per acre, "O" indicates fertilizer was not applied.

**Significant Difference in wheat yield because of fertilizer and row spacing.

CROP DISEASE CONTROL

Plant Pathology Department

Chemical Rust Control in Winter Wheat

G. W. Buchenau

Resistant varieties represent the first line of defense for protection against rust damage. However, races of rust arise periodically that damage previously resistant varieties. Such races can destroy a formerly resistant crop in an unusually favorable growing season unless a rust-control chemical can protect the wheat crops during that season.

Previous experiments conducted at several locations in South Dakota have shown that chemical control of stem and leaf rusts of wheat can provide economical yield increases when rust infections are severe. One important aspect in the use of fungicides for the control of rust is the proper time of application. Spraying of rust-control chemicals has been most effective when the plants are in the stage between jointing to ten days after heading. However, the best time during this period depends on the weather and earliness of rust development in the particular year. A rust forecasting system capable of predicting rust epidemics in advance would greatly improve the efficiency of chemical rust control.

The 1966 season was characterized by dry weather and only a few spores were blown into South Dakota from southern regions. The subsequent development of both rusts was unusually light, never exceeding trace amounts in the unsprayed plots. As might be expected, fungicide applications to control rust did not increase yields over those of the unsprayed plots (table 32). The apparent yield increases in certain treatments were more closely associated with the amount of soil moisture than with fungicide treatment.

Table 32. Yield and test weights of Omaha winter wheat from chemical rust control plots at Presho in 1966.[a/]

Treatment	Number of Applications	Dosage per Application	Growth Stage When Applied	Test Wt. lb/bu	Yield bu/acre
Manzate D	4	2 lbs/acre	6"tall (May 9) & every 10 days	55.0	17.5
Manzate D	3	2 lbs/acre	Joint, Head, & Head + 10 days	55.3	21.6
Manzate D	2	2 lbs/acre	Joint, Head	54.7	14.4
Manzate D	2	2 lbs/acre	Head, Head + 10 days	55.0	12.8
Zineb	3	2 lbs/acre	Joint, Head, & Head + 10 days	54.0	9.8
Zineb	2	2 lbs/acre	Joint, Head	55.0	22.8
Zineb	2	2 lbs/acre	Head, Head + 10 days	54.4	18.2
RH 539	3	3 lbs/acre	Joint, Head, & Head + 10 days	54.4	13.4
RH 539	2	3 lbs/acre	Joint, Head	54.4	16.9
RH 539	2	3 lbs/acre	Head, Head + 10 days	54.4	13.8
Check (Unsprayed)				55.0	15.4

[a/] The data recorded here do not reveal significant differences between treatments and apparent benefits are closely associated with random spots of higher moisture within the field.

Control Of Wheat Streak Mosaic By Regulation Of Planting Date

G. W. Buchenau and H. A. Geise

Wheat streak mosaic, a mite transmitted virus disease was sucessfully controlled by proper selection of planting date for the eighth consecutive year in plots at the station. As in the past, planting dates after the first week in September provided excellent control of the disease, as well as optimum yields (table 33). The low yield of early planted wheat cannot be attributed to the light mosaic infection of 1966. It would appear the soil moisture use in the fall by the early planted grains, was not replenished because of the rainfall. Thus, the plants were shorter and yields lower than for the late-planted wheat.

Table 33. Effect of planting date on severity of Wheat Streak Mosaic, Yield and other characteristics of Omaha winter wheat at Presho, 1966.

Planting Date	% of Plants Infected	Height Inches	Percent Protein	Test Wt. Lbs/Bu.	Grain Yield* Bu/Acre
August 15	10	15	19.2	55.5	10.4
September 2	5	18	19.3	57.7	20.2
September 7	t	21	19.2	57.0	24.6
September 23	t	22	18.3	57.7	25.4
October 1	t	25	18.5	56.0	24.6
October 9	t	25	18.8	54.8	21.1

*LSD at 5% level - 4.4 Bu/Acre.

The Influence of Root and Stalk Rot Resistance on Drought Resistance in Corn

--C. M. Nagel

Forty-four experimental 3-way hybrids developed by the Plant Pathology Department for resistance to root and stalk rot were planted at the South Central Research Farm in 1966. Most commercial hybrids are quite susceptible to root rot, and because they are, this means that varying portions of the root system become diseased and die. In severe cases the entire root system may be killed by the root-rot organism. The damaged root system retards growth of the plant, causes poor kernal set and shriveled kernels, and reduces yields. Corn hybrids possessing a high degree of resistance to the damaging root-rot disease can increase drought resistance and thereby extend successful corn production farther into the low rainfall areas.

In 1966, 44 disease-resistant experimental hybrids were grown, along with 4 commercial hybrids found most productive in the South Central area. With one exception, the commercial hybrids used as checks were out yielded by the disease-resistant experimental 3-way hybrids. The four commercial hybrids grown as checks were all 4-way hybrids.

Root-rot resistance can increase "drought resistance" because the corn roots will have less disease damage and have a more extensive root system thereby making it possible for the plants to draw moisture from a larger mass of soil. A healthier root system will likewise reduce lodging and increased yields. Yield data from the 1966 test are reported in Table 34.

Table 34. Yield, moisture content, and performance rating of 44 top-yielding 3-way experimental hybrids possessing varying degrees of root- and stalk-rot resistance. Presho, 1966.

Experimental hybrid or commercial check	Yield Bu/A	Ear Moisture at harvest	Performance Rating*	Experimental hybrid or commercial check	Yield Bu/A	Ear Moisture at harvest	Performance Rating*
1	56.4	24.5	113.8	23	46.6	22.2	99.5
SD250	56.4	21.3	113.9	24	46.4	26.0	97.2
2	56.2	20.9	112.2	25	46.0	26.1	99.4
3	56.1	23.3	110.8	26	45.9	18.4	100.5
4	56.0	24.1	110.2	27	45.7	24.8	99.7
5	54.0	25.0	110.3	28	45.4	22.1	98.0
6	53.8	25.8	109.7	29	45.3	24.4	99.4
7	51.8	24.1	105.0	30	44.8	28.2	96.8
8	51.8	26.7	103.6	SD420	44.4	29.5	94.2
9	51.5	25.8	103.7	31	44.3	28.1	96.2
10	50.9	28.4	104.6	32	44.0	24.2	95.1
11	50.8	25.9	102.7	33	44.0	24.3	97.8
12	50.5	26.4	105.1	34	43.2	23.1	94.7
13	49.7	25.7	101.5	35	43.2	25.3	93.5
14	49.6	28.3	102.9	36	43.1	26.3	97.9
15	49.3	23.8	102.0	37	42.4	24.1	93.2
16	48.5	22.2	101.8	38	40.6	21.7	92.2
17	48.1	25.9	99.4	39	40.5	22.6	94.2
18	48.0	26.2	102.0	40	40.3	25.9	92.2
19	48.0	26.5	101.8	41	39.5	27.6	90.3
20	47.9	26.9	98.6	42	38.5	24.9	90.4
21	47.6	21.8	103.8	43	38.1	23.6	88.1
22	47.2	27.1	100.5	44	38.1	24.8	90.0
SD270	46.8	26.8	98.7	PAG 62	37.1	27.8	92.0

Average Yield 46.9 Average Moisture 24.9 Average Performance Rating 100.0

*Performance score is a value based on percent of moisture and grain yield in the corn at harvest. A rating of 100 or more indicates a low-moisture, high-yield corn crop.