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SOUTH CENTRAL RESEARCH FARM
Presho, South Dakota

INTRODUCTION

This is the tenth annual progress report of the South Central Research Farm. The experimental area, located on the Glen Hutchison farm, is approximately ten and one-half miles south of Presho, South Dakota. The soil, a fine clay, was derived from Pierre shale and is identified as a Promise clay. It contains 3.3% organic matter, is medium in available phosphorous and is high in potassium.

Rainfall in 1967 was below normal for all months, except June, August, September, and October. However, cool temperatures and timely showers caused excellent small grain yields. Grain sorghum yields were reduced because of cool conditions and many fields were damaged by frost before the grain matured.

More than eighty people attended a field tour held on July 6, 1967. The Wheat Streak Mosaic Breeding and Control plots, Chemical Rust Control plots, Variety Trials, and Sorghum Forage Production and Management studies were discussed.

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
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This report was prepared 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.

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Table 1. Weather Data - South Central Research Farm 1967

Month	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Rainfall in inches*	.08	.13	.19	.35	1.55	5.11	.53	2.90	1.70	1.00	tr	.21	13.75
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	-.39	-.44	-.83	-1.44	-.83	2.00	-1.13	.82	.25	.02	-.67	-.18	-2.82
Average Temperature*	17.9	16.3	33.3	45.2	51.3	64.6	71.8	70.9	63.2	50.5	36.8	20.8	
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	-0.7	-5.6	1.5	-2.4	-7.6	-4.1	-5.0	-4.1	-1.3	-0.9	2.0	-3.1	
Av. Daily Maximum - 1967*	28.5	28.8	45.0	60.0	64.3	76.7	88.6	87.2	77.2	63.1	50.2	33.0	
Av. Daily Minimum - 1967*	7.2	3.8	21.6	30.4	38.2	52.6	55.0	54.7	49.2	38.0	23.4	8.6	
Av. Soil Temp @ 2" (sod)	----	----	----	48.9	54.7	65.6	79.3	76.0	67.0	51.9	----	----	
Av. Daily Maximum Soil Temp.	----	----	----	53.2	58.6	70.6	85.3	81.8	71.5	54.9	----	----	
Av. Daily Minimum Soil Temp.	----	----	----	44.6	50.9	60.6	73.3	70.3	63.4	48.9	----	----	
Average Inches of water Evaporated from free surface	----	----	----	----	5.92	6.80	7.39	7.47	5.63	5.10	----	----	

Maximum Recorded Air Temperature - 105° - 21 July 1967
Last Frost - 20 May; First Frost - 27 September; First Killing Frost - 27 September; Growing Season - 147 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

Eighteen varieties of rye were grown in the 1967 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 stiff strawed variety with an average yield slightly more than Elk. Both Elk and Von Lochow are less hardy and head several days later than Antelope, Caribou, or Pierre.

Table 2. Drill-Strip Rye Trial - South Central Research Farm, 1963-67.

Variety	Date of Heading	Height Inches	Test Wt Lbs/Bu	Grain Yield-Bu/A 1967*	Grain Yield-Bu/A Av 1963-67
Von Lochow	6-5	44	54.3	47.0	51.8**
Elk	6-1	49	53.3	36.5	37.9
Antelope	6-4	45	55.0	29.6	32.0
Caribou	6-1	45	54.3	24.2	29.5
Pierre	6-1	44	54.8	26.0	26.6

LSD(05) = 4.1 Bu/A Mean = 32.2

* Damage by hail before mature enough to harvest reduced yields by 20%.

**Average of 1965-67 only.

Frontier is a new variety developed at Swift Current, Saskatchewan. From tests in 1966 and 1967, it appears to be winterhardy and has medium maturity. Frontier is tall and has poor lodging resistance. The seeds of this variety are small and predominantly blue-gray in color. It has high bushel weight. Some of the other varieties listed in Table 3 have not been thoroughly tested.

Table 3. Rod Row Rye Variety Trials - South Central Research Farm, 1967.

Variety	Date of Heading	Percent Survival Centerville-1967	Test Wt. Lbs/Bu.	Grain Yield Bu/Acre
Elk	6- 4	97	56.0	51.5
Zelder	6- 3	94	56.0	51.1
Dominant	6- 3	95	55.5	49.2
Von Lochow	5-31	97	56.5	48.7
Petkus	6- 3	95	54.5	47.8
Guelzower	6- 3	95	55.0	47.5
Frontier	5-28	100	57.0	46.9
Sangaste	6- 1	95	53.0	41.6
Toiva	6- 3	95	52.5	39.9
Antelope	5-28	100	55.0	39.2
Caribou	5-26	100	55.5	37.9
Pierre	5-25	100	55.0	37.8
Adams	5-26	99	54.5	35.7
Dakold	5-25	100	56.4	35.3
7276	5-28	87	56.0	29.1
N.F. #7	5-25	70	54.0	29.1
Elbon	5-26	30	56.0	27.5
Bonel	5-25	68	55.0	25.4

Mean = 40.4

Winter Wheat

Winter wheat varieties were evaluated in two separate trials in 1967. The larger test, containing the recommended varieties (Table 6,Page 6), was seeded in large drill-sized plots and harvested with a self-propelled combine. They were seeded on September 20, 1966 and harvested directly from the field on July 24, 1967.

The second trial (Table 4) contained a number of new selections in varying stages of development. It was seeded on September 13, 1966 and harvested on July 24, 1967.

Table 4. Northern Regional Winter Wheat Performance Trial, 1967.

C.I. or Selection Number	Date of Heading	Percent* Leaf Rust	Test Wt Lbs/Bu	Grain Yield Bu/Acre
Kharkof	6- 9	100	61.3	52.7
Warrior	6- 7	100	61.6	46.7
Winalta	6-10	100	62.3	43.1
Trader (Neb 64322)	6- 9	100	61.8	46.5
Trapper (Neb 64323)	6- 9	100	61.8	40.9
Neb 61355	6- 7	1	61.7	44.0
S.D. 56497	6- 8	100	61.1	43.6
S.D. 56758	6-11	100	60.4	44.1
Winalta Selection	6-11	80	62.9	47.5
Neb 64365	6- 8	100	62.6	50.2
Neb 64334	6- 9	100	62.7	50.3
Neb 64312	6- 8	100	62.4	52.7
Mont 639	6-11	100	62.2	45.5
Minn 13858	6-11	100	61.4	43.9
Minn 13994	6-10	100	60.5	41.2
Minn 13995	6-10	100	59.6	39.3
LSD(05) = 5.1 Bu/A			Mean =	46.1

* Percentage of Plants infected with Leaf Rust

A rate-of-seeding study was conducted in which two varieties were seeded at rates varying from 10 to 60 pounds per acre. They were compared on the basis of grain yield, test weight, and date of heading. The data are shown in Table 5.

Table 5. Rate of Seeding Winter Wheat - South Central Research Farm, 1967.

Variety	Rate of Seeding Lbs/Acre	Date of Heading	Test Wt Lbs/Bu	Grain Yield Bu/Acre
Lancer	10	6-10	61.1	32.0
	20	6- 9	62.0	37.2
	30	6- 9	62.5	38.0
	40	6- 8	62.1	37.0
	50	6- 7	62.6	38.2
	60	6- 7	62.7	39.3
Hume	10	6-12	58.9	24.2
	20	6-11	60.8	29.0
	30	6-11	61.4	34.7
	40	6-11	61.4	36.1
	50	6-11	61.0	36.7
	60	6-11	61.2	37.6

Table 6. Winter Wheat Variety Trial - South Central Research Farm - 1967

Variety	Date of Heading	Height Inches	Rust Reaction* Leaf	Rust Reaction* Stem	Percent Moisture	Percent** Protein	Sedimentation Value	Test Wt Lbs/Bu	Grain Yield Bu/Acre
Northern:									
Winalta	6-14	37	S	Mixed	9.08	13.6	36.4	61	47.5
Minter	6-16	45	S	R	10.33	14.3	42.8	58	44.4
Winalta 66	6-19	41	S	R	9.70	13.0	42.5	58	42.3
Central:									
Trader	6-14	40	S	R	7.42	14.0	38.1	62	53.1
Trapper	6-12	41	S	R	7.66	13.5	45.0	61	51.3
Gage	6-12	37	S	R	7.59	14.8	37.4	60	50.2
Lancer	6- 8	37	S	R	6.79	13.5	41.1	62	46.0
Scout	6-12	38	S	R	7.26	14.2	37.9	61	45.7
Hume	6-12	40	S	R	6.68	13.2	47.7	61	43.9
Ottawa	6-12	37	S	S	6.58	12.5	49.3	63	43.7
Nebred	6-14	40	S	S	6.83	12.2	40.9	60	41.5
Omaha	6-10	37	S	S	6.35	16.2	41.6	62	38.3
Southern:									
Bison	6-12	38	S	S	6.98	14.7	48.7	60	37.0

LSD(05) = 5.5 Bu Mean = 45.2

*Letter indicates usual reaction to rust: S-Susceptible, R-Resistant (No stem rust present in 1967)
**Protein reported on an oven dry basis

Date of Planting: 20 September 1966 Harvest Date: 24 July 1967

Winter Barley

The winter barley varieties tested vary in winterhardiness. Kearney and Dicktoo were the most hardy, Mo. B1222 was intermediate, and Mo. B969 and Chase 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. Mo. B969 is similar to Mo. B1222 but heads a few days later.

Table 7. Winter Barley Variety Trial - South Central Research Farm

Variety	Percent Survival	Date of Heading	Height Inches	Test Wt Lbs/Bu	Grain Yield-Bu/A	
					1967	1963-67*
Kearney	83	6-16	30	48.5	60.5	40.8
Dicktoo	83	6-16	31	48.5	53.8	37.8
Mo. B1222	80	6-13	27	49.5	55.2	36.9
Chase	73	6-18	31	47.5	35.0	34.0
Mo. B969	77	6-17	28	48.0	37.4	32.3

LSD(05) = 14.2 Bu
* 1965 Crop lost because of winter kill

Oats

Several new varieties were grown in the yield trials at South Central Research farm in 1967. They were Wyndmere, Dawn, Jaycee, O'Brien, Clintford, Tyler, Portal, and Santee. Wyndmere and Dawn were developed by the North Dakota Agriculture 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. O'Brien was developed by Iowa Agricultural Experiment Station. It has a medium-length straw, yields well, has good disease resistance, and good test weight. Clintford and Tyler were developed by the Indiana Agricultural Experiment Station. They are early maturing, moderately short in height, and have excellent lodging resistance. The kernels are light brown to white, large, and have a high test weight. Santee was

developed by the Nebraska Agricultural Experiment Station. It is a mid-season oats, with good straw strength. It has also shown good resistance to lodging. Portal was released from the Wisconsin Agricultural Experiment Station. It is a little taller, and matures later than Garland but carries resistance to race 264 of leaf rust. It has a yellow hull. All varieties listed in Tables 8 and 9 were seeded on Fallow and received 18#/acre of phosphorous with the seed.

Table 8. Oat Variety Trial - South Central Research Farm, 1965-67.

Variety	Date of Heading	Height Inches	Test Wt Lbs/Bu	Grain Yield-Bu/Acre 1967	Grain Yield-Bu/Acre Av.1965-67
Wyndmere	6-22	41.8	36.4	113.5	----
Tyler	6-20	35.0	36.5	111.2	74.2
Tippecanoe	6-20	37.0	38.0	110.9	68.7
Brave	6-20	39.2	36.0	108.3	78.6
Portal	6-24	39.5	35.0	104.4	----
Santee	6-20	37.0	37.0	98.5	62.4
Holden	6-24	37.0	35.0	97.2	----
O'Brien	6-21	39.2	38.0	96.0	----
Jaycee	6-19	32.8	38.4	92.6	----
Minhafer	6-20	40.0	36.9	91.6	60.3
Burnett	6-23	37.8	36.5	89.0	68.7
Dodge	6-22	40.5	36.6	88.4	62.2
Clintford	6-21	34.5	39.9	87.4	63.2
Coachman	6-23	38.2	37.6	84.8	64.3
Dawn	6-21	44.5	36.4	81.5	----
Garland	6-21	37.2	35.1	75.9	62.8
Clintland 64	6-22	37.5	36.0	67.1	47.9

LSD(05) = 17.4 Bu/A Mean = 94.1

Table 9. Oat Variety Trial (Forage Type) - South Central Research Farm, 1967.

Variety	Date of Heading	Height Inches	Silage Yield* T/A	Silage Yield* Protein	Test Wt Lbs/Bu	Grain Yield Bu/Acre
Lodi	7- 1	43.5	4.9	8.0	32.8	96.0
Garry	6-30	42.8	5.3	8.2	33.2	85.2
Ortley	6-27	42.8	4.9	7.4	36.5	82.8
Rodney	7- 2	40.2	5.3	8.6	35.2	81.0
Portage	6-25	44.5	5.4	7.3	34.2	76.6

LSD(05) = 10.7 Bu/A Mean = 84.3

* Silage yield is reported in dry tons per acre, protein content was determined by Kjeldahl analysis and is reported on an oven-dry basis.

Spring Wheat

The yield of spring wheat in small plots ranged from 42.8 to 17.8 bushels per acre. The highest yield of hard red spring wheat was obtained from Fortuna, a recently released variety. It is solid stemmed, beardless, and sawfly resistant. It also has good resistance to the prevalent races of leaf and stem rust, but is susceptible to scab. Grain yields and other agronomic data pertaining to hard red spring wheat are shown in Table 10. The yields and other data for durum Wheat are shown in Table 11. All varieties reported in Tables 10 and 11 were seeded on fallow and received 18#/acre of phosphorous with the seed. Protein content was determined by Kjeldahl analysis and is reported on an oven-dry basis.

Table 10. Hard Red Spring Wheat Variety Trial - South Central Research Farm

Variety	Date of Heading	Height Inches	Percent Protein	Test Wt Lbs/Bu	Grain Yield-Bushel/Acre 1967	Av. 1965-67
Fortuna	6-26	40.0	16.0	56.1	42.8	----
Lee	6-23	39.5	15.4	52.9	40.8	21.1
Manitou	6-26	41.0	16.3	53.2	40.0	23.7
Chris	6-25	41.0	16.6	56.0	36.4	25.6
Polk	6-29	41.0	16.2	57.0	36.0	----
Sheridan	6-27	42.2	15.6	56.2	35.2	24.5
Crim	6-28	40.8	15.7	52.1	35.1	23.9
BH 631	6-25	42.5	15.5	56.0	34.4	23.5
Rushmore	6-25	39.8	15.2	56.2	29.0	19.8
BH 632	6-26	42.8	16.1	55.1	28.1	21.4
Pembina	6-25	38.5	14.9	54.7	27.0	19.2
Justin	6-25	41.8	16.9	53.0	25.6	18.7
Selkirk	6-28	40.8	14.8	52.1	22.0	17.2
Ceres	7- 1	43.2	15.3	53.1	17.8	----

LSD(05) = 7.8 Bu/A Mean = 32.2

Table 11. Durum Wheat Variety Trial - South Central Research Farm - 1967.

Variety	Date of Heading	Height Inches	Percent Protein	Test Wt Lbs/Bu	Grain Yield-Bushel/Acre 1967	Av. 1965-67
Leeds	6-23	43.2	17.1	59.0	48.2	----
Wells	6-26	43.8	17.1	56.4	38.8	29.5
Lakota	6-24	44.0	17.1	55.1	36.0	28.0
Stewart 63	6-29	48.5	18.0	56.4	33.4	24.7

LSD(05) = 5.0 Bu/A Mean = 39.1

Spring Barley

Weather conditions during the spring growing season were most favorable for producing high yields of barley. The above normal rainfall in June was complemented by below normal temperatures, so moisture was more than sufficient for a good crop of grain with high test weight. The incidence of foliar diseases was very low.

Primus is a new variety which has 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.

Conquest was developed and released in Canada. It is a blue aleurone barley with Parkland as one of its parents and is expected to replace some of the Parkland acreage. It is an accepted barley in Canada where blue barleys are largely used for malting purposes. Blue barleys have a limited demand for malting purposes in the United States. This type of barley grown in South Dakota is usually considered as feed barley.

Conquest is smooth awned, tall growing, has good straw strength, and is of medium maturity. In comparison to Larker, it is about the same maturity, has smaller kernel size with a lower test weight. It is susceptible to the foliar diseases of barley, moderately resistant to stem rust and resistant to loose smut.

The yields and other agronomic data collected in the last three years are included in Table 12. All varieties reported in Table 12 were seeded on fallow and received 18#/Acre of phosphorous with the seed.

Table 12. Spring Barley Variety Trial - South Central Research Farm

Variety	Date of Heading	Height Inches	Percent Protein	Test Wt Lbs/Bu	Grain Yield-Bushel/Acre 1967	Av.1965-67
Dickson	6-23	39.2	12.6	50.2	95.4	----
Larker	6-22	39.8	13.8	51.4	91.0	63.6
Primus	6-18	37.0	13.3	51.1	83.6	----
Liberty	6-22	36.8	14.5	50.2	82.7	63.9
Otis	6-21	31.0	14.3	50.2	77.7	64.0
Trophy	6-22	40.0	13.2	50.5	77.0	61.7
Conquest	6-21	40.5	14.3	47.8	71.6	----

LSD(05) = 6.4 Bu Mean = 82.7

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 moth's larvae tunnel through the seeds leaving a mass of insect frass and strands of weblike material which cover the face 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.

Table 13. Regional Sunflower Yield Trial - South Central Research Farm, 1967.

Variety	Date of Heading	Height Inches	Percent Lodging	Test Wt Lbs/Bu	Seed Yield Lbs/Acre
T56002 (1)	8- 1	46	43	35	285
T56002 (2)	8- 2	50	31	36	472
T64001	8- 2	46	28	35	450
T66001	8- 2	46	38	34	413
Peredovik	8- 1	53	38	34	288
VNIIMK 89.31	8- 1	52	44	34	336
Smena	7-26	49	40	32	90
Kubanec	7-26	49	40	32	216
Vostock	7-29	50	42	34	196
Peredovik-Blacklaw Sel.	7-28	50	48	33	268
Armavirec	7-25	44	38	32	233
Lethbridge 159	7-26	48	48	34	190
Krasnodarets	7-25	50	39	33	509
VNIIMK 16.46	8- 1	52	43	34	358
NK HO 1	8- 2	52	26	30	162
Mingren	7-30	46	46	28	462
Commander	7-31	49	38	29	288
Arrowhead	7-25	48	48	33	382
P-21 ms X HA-60	8- 2	50	28	34	388

LSD(05) = 173 lbs. Mean = 315

Safflower Testing

H. A. Geise

The Safflower trials conducted in 1967 consisted of varieties which had previously been tested but which were not completely evaluated. The plots were planted in Mid-May and consisted of three rows spaced twenty four inches apart. 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.

Three groups of safflower varieties were tested in 1967. Group I consisted of eight varieties which were in Regional trials in previous years. Goup II consisted of eight experimental varieties of which six were obtained as mutations. Group III consisted of eleven varieties which were selected from the world collection on the basis of yield. Data from the nursery are reported in Table 14.

Table 14. Safflower Variety Trial - South Central Research Farm, 1963-67.

Variety	Date of 50% Bloom	Spinescense (0-5)*	Branching (1-5)**	Height Inches	Test Wt Lbs/Bu	Yield-Lbs/A 1967	Yield-Lbs/A 1963-67
Gila	7-31	3	2	20	42.0	746	662
A0104	8- 1	5	2	22	38.2	680	623
US 10	7-31	4	2	22	40.0	648	572
Pacific #1	8- 1	4	3	21	39.1	692	558
Ute	8- 1	4	2	20	43.1	506	503
12417	8- 1	4	2	22	35.8	479	621
A101	8- 1	3	2	19	35.2	582	452
A1049	8- 1	4	2	20	34.5	479	541
N472-3-49X	8- 3	4	2	22	38.0	316	493
N 10	8- 2	4	3	23	38.2	506	528
N472-1-48C	8- 2	5	2	20	41.5	218	455
N472-4-49X	8- 2	5	3	26	41.4	359	475
N8-48C	8- 3	4	3	22	41.1	490	498
N472-8-48C	8- 2	4	2	25	41.0	484	479
N8	8- 2	5	3	20	40.5	556	434
N472-2-48C	8- 2	4	2	22	42.2	376	404
SDI 38	8- 1	5	2	24	42.9	556	607
SDI 87	8- 2	2	3	23	42.8	414	566
SDI 85	8- 3	2	2	24	44.9	561	591
SDI 30	8- 3	1	2	22	43.1	512	572
SDI 83	8- 2	0	3	21	43.9	528	574
SDI 103	8- 2	3	3	26	42.8	556	576
SDI 39	8- 2	1	2	24	42.5	485	552
SDI 25	8- 2	1	2	21	43.1	566	566
SDI 96	8- 2	2	2	21	43.2	223	480
SDI 24	8- 2	1	2	23	40.6	479	494
SDI 18	8- 2	2	3	22	40.9	403	470

* 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).

SORGHUM PERFORMANCE TESTING

Sorghum Breeding

A. O. Lunden

South Dakota Hybrid and Regional sorghum test yields ranged from 10 to over 90 bushels per acre in 1967 with good seed quality in most adapted entries. The top Regional Test entry was a South Dakota experimental hybrid involving the cross of Martin male sterile with a new selection. This hybrid performed well in preliminary testing at several locations in the regional test and will be included in final regional yield tests in 1968 for potential release.

Preliminary tests of other hybrids revealed several promising grain and a very promising group of short leafy forage-type sorghum hybrids. The top yielding grain hybrids produced 80 to 100 bushels per acre and involved crosses with four of the standard male steriles -(Reliance, Martin, Dwarf Redbine, and Combine Kafir-60)- with 3 new experimental selections. The highest yielding hybrids resulted from crosses of Dwarf Redbine ms, or Martin ms with an early experimental dwarf restorer and Combine Kafir-60 ms with a slightly earlier experimental dwarf.

The best forage hybrids were produced from crosses of the standard male sterile lines with two plant introductions. The resultant hybrids are of medium to late maturity with many large leaves, thick stalks, and short plants, and have been excellant yielders in preliminary tests. These forage hybrids are designed for late fall harvest when near maturity or after frost and do not lodge or lose their leaves in early fall like Dual or SD 252F. Final testing is planned for 1968 with probable release in 1969.

Table 15. Experimental Hybrid Grain Sorghum Yields - South Central Research Farm, 1967.

Entry	Height Inches	Test Wt Lbs/Bu	Grain Yield Lbs/Acre
NB 505	35	58	2160
RS 610	34	54	2870
SD 441	36	58	3060
SD 451	36	58	3560
SD 503	36	57	3140
SD 25228	37	57	3900
SD 25265	38	60	4900
SD 26756	38	59	5700*
SD 25121	42	59	5000*

*Approximate yield from preliminary test.

Grain Sorghum Performance Testing

J. J. Bonnemann

Objective: To compare the performance of grain sorghum hybrid varieties 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 1967 yields and agronomic data. Long term averages and other information can be found in Circular 184, 1967 Grain Sorghum Performance Trials.

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

Variety	Height Inches	Test Wt Lbs/Bu	Grain Yield Lbs/Acre
SD 451	43	57	4420
NK 120	40	56	4040
SD 441	48	57	4030
Paymaster Ex. 1036	40	56	4000
SD 503	46	56	3950
T-E 44	37	42	3850
Neb. 504	45	57	3690
DeKalb DD-50	43	51	3670
T-E 44C	43	58	3670
Advance 19	40	57	3660
NK 210A	40	50	3570
Frontier GX 402	37	43	3540
Haapala BL-101	43	56	3490
Advance 22	47	48	3490
NK 125	43	56	3400
T-E Grainmaster A	40	50	3400
Sokota 510	44	51	3370
Frontier 370	39	41	3360
NK 133	39	54	3340
Pioneer 885	41	47	3320
Pawnee	41	57	3310
Frontier GX 482	41	49	3220
Pioneer 894	33	58	3200
RS 610	44	51	3120
Frontier GX 675	38	56	3110
T-E Mucho	38	42	3100
NK 222	37	50	2970
Frontier Super 400	39	45	2810
Paymaster R 102	41	48	2700
		Mean =	3470

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. The results of the trials are reported in tables 17 through 20.

Table 17. Performance Trial of Sorghum Forage Varieties - South Central Research Farm, 1966-67.

Identity	Height Inches	Number of Leaves	Maturity* Rating	Percent Protein	Percent Dry Matter	Forage Yields** 1967	Forage Yields** 1966-67
FORAGE SORGHUM							
Advance 1076F	56	16	5	8.8	28.9	2.9	3.6
Asgrow-Dairy D	57	16	5	7.3	32.8	4.4	4.7
Asgrow-Sorgusbord	66	13	2	6.9	42.8	4.1	4.8
Asgrow-Titan R	63	14	2	6.9	40.0	5.0	5.1
Excel-Bundle N Bale	66	14	2	7.2	34.1	4.9	4.4
Frontier FX-201	52	13	2	9.1	35.0	3.3	3.4
Frontier FX-202	45	15	4	8.3	36.3	2.9	3.0
Frontier S-206	53	18	3	7.6	35.0	3.9	3.8
Frontier S-209	78	11	2	6.3	41.0	4.8	4.2
Frontier S-211	82	14	4	7.6	37.3	4.9	4.3
Frontier S-212	53	17	5	9.0	31.0	3.1	3.2
NK-300	52	12	2	7.2	35.9	4.2	5.0
NK-315	64	13	2	8.6	34.2	3.7	4.1
NK-320	55	13	2	7.7	32.5	4.2	6.4
NK-330	49	15	5	8.7	36.1	4.0	4.2
SD 1XDual	60	8	1	6.7	54.0	2.5	2.1
SD 25XDual	64	10	1	6.2	51.1	2.4	2.4
SD 63XDual	60	9	1	6.3	52.5	2.9	3.0
Weathermaster FS440	60	13	2	5.8	35.2	4.4	4.4
Weathermaster FS445	54	14	2	7.7	38.5	4.8	4.8
Weathermaster FS500	65	13	5	7.4	35.0	4.3	4.6
SORGHUM-SUDAN							
Asgrow-Grazer A	91	14	1	7.6	33.5	4.7	4.6
Excel ChowMaker 21	85	14	1	6.3	42.2	3.3	3.6
Frontier Hidan-38	79	12	2	10.7	31.2	4.2	4.1
Frontier Hidan-39	85	13	3	12.3	31.5	4.8	5.2
SD 25XPiper	75	11	1	5.8	52.4	3.4	3.4
SD 25XTift	78	13	1	5.9	56.7	3.6	3.5
SD 1XTift	82	9	1	6.6	50.6	3.7	3.8
Weathermaster Superdan	82	12	1	6.9	45.3	4.7	4.8
SUDANGRASS							
NK-Trudan	77	12	1	6.6	50.9	4.0	3.7

* Maturity Rating: 1-Mature seeds; 2-Hard Dough; 3-Soft Dough; 4-Heading or Pollinating; 5-No Heads.

** Forage Yields are reported on a 12% moisture basis, and in tons per acre.

Table 18. Performance Trial of Forage Sorghum Varieties - South Central Research Farm, 1965-67.

Identity	Height Inches	Number of Leaves	Maturity* Rating	Percent Protein	Percent** Digestible	Forage Yield** 1967	Forage Yield** 1965-67
FORAGE SORGHUM							
Waconia	62	12	2	7.0	72.3	2.8	3.3
Dual	59	8	1	7.2	66.3	2.5	2.0
Rancher	66	8	1	4.5	72.6	2.8	2.3
39-30-S	66	8	1	4.2	73.3	2.4	2.0
Arkansas AK-43	48	18	5	8.8	73.2	2.8	2.9
Arkansas AK-44	47	14	2	8.7	66.3	3.7	3.8
Advance 1071F	59	15	2	6.3	72.1	3.3	4.4
Advance 1085F	56	16	5	8.4	69.0	3.7	3.7
Asgrow-Beefbuilder T	59	12	5	7.3	72.4	4.0	4.9
Asgrow-Duet	56	12	1	8.2	71.0	4.0	3.5
DeKalb FS1A	54	14	2	7.6	70.3	3.9	3.2
DeKalb FS22	66	16	5	6.9	72.3	3.8	3.9
Frontier FX-200	59	17	5	9.4	67.6	4.6	3.9
Frontier S-205	67	12	1	5.4	63.0	3.7	3.3
Frontier S-210	74	16	2	8.2	72.2	3.4	3.1
NK-145	78	11	1	6.1	69.9	3.3	2.6
Pioneer 931	72	16	5	9.2	73.4	4.3	3.7
SD 252F	65	10	1	6.6	74.0	3.3	2.6

* Maturity Rating: 1-Mature seeds; 2-Hard Dough; 3-Soft Dough; 4-Heading or Pollinating; 5-No Heads.
** Percent digestible dry matter was determined by the 48 hour In Vitro fermentation procedure (Artificial Rumen) using forage produced in 1965.
***Forage yields are reported in tons per acre on a 12% moisture basis.

Table 19. Performance Trial of Sorghum-Sudan and Sudangrass Forages - South Central Research Farm, 1965-67.

Identity	Height Inches	Number of Leaves	Maturity* Rating	Percent Protein	Percent** Digestible	Forage Yields*** 1967	Forage Yields*** 1965-67
SORGHUM-SUDAN							
Advance 1038G	75	12	2	8.0	61.8	3.4	2.8
Asgrow-Grazer	82	13	2	8.1	68.4	3.9	3.3
Asgrow-Orbit	80	9	3	6.9	65.7	3.4	2.4
Caladino-Greenlan	82	17	1	8.3	67.1	3.7	3.7
DeKalb SX-11	82	11	2	6.3	68.8	3.8	3.2
Doreman-Suregraze	70	13	4	8.8	67.6	3.5	3.1
Excel-Chowmaker	80	15	1	8.1	64.6	4.6	3.8
Frontier H35-X	70	12	1	6.7	64.2	3.3	3.2
Frontier Hidan-37	70	15	5	---	70.5	2.8	2.8
Nebraska 280S	78	12	1	6.9	69.4	3.7	2.8
NK-Sordan	80	12	3	6.9	69.2	4.0	3.6
Paymaster Sweet Sioux	82	14	2	9.1	70.7	3.7	3.2
Pioneer 981	83	13	1	8.1	61.2	4.4	3.3
S-100	85	13	1	5.7	67.0	3.7	3.2
SUDANGRASS							
Frontier H-40	76	10	1	6.1	72.5	2.6	2.1
Georgia Suhi I	80	14	1	9.8	70.4	3.1	2.4
NK-Trudan II	84	10	1	6.3	66.4	3.6	2.8
NK-Trudan IV	78	14	1	6.8	69.1	3.7	3.0
Piper	76	11	1	6.1	68.8	2.5	2.1

* Maturity Rating: 1-Mature seed; 2-Hard dough; 3-Soft dough; 4-Heading or Pollinating; 5-No heads.

** Percent digestible dry matter was determined by the 48 hour In Vitro fermentation procedure (Artificial Rumen) using forage produced in 1965.

***Forage yields are reported in tons per acre on a 12% moisture basis.

An experiment was designed in 1967 to study various forage types. These varieties were selected because of the outstanding characteristics portrayed in forage tests conducted in previous years. The conditions which were established to compare these selections were: (1) maximum forage yield, which is obtained by single cuttings, (2) a range of populations for each variety, bracketing the older suggested seeding rates, and (3) the protein content of the selections which is a measure of their feeding value. The preliminary results of the test are reported in table 20.

Table 20. Silage Production of Corn and Sorghum Forage Varieties, 1967.

Variety	Percent Protein	Row Space	Plants/Acre Thousands	Height Inches	Silage Weight Tons/A @12%H_2O
Silage Corn Pioneer Blend B	9.0	20	26	66	2.62
			19	65	2.94
		40	19	71	2.69
			13	72	2.60
Forage Sorghum Waconia	7.6	20	104	65	3.30
			78	72	3.67
		40	78	70	3.05
			52	75	3.13
Forage Sorghum Hybrid Leafy, Pioneer 931	9.7	20	52	80	3.82
			39	85	3.71
		40	39	87	3.49
			26	84	3.40
Forage Sorghum Hybrid Advance 1071F	7.8	20	104	72	3.67
			78	72	4.01
		40	78	70	2.84
			52	72	3.55
Sorghum-Sudan Hybrid Caladino-Greenlan	8.5	20	208	66	3.38
			156	68	3.48
		40	156	76	3.14
			104	71	2.86
Sudangrass Hybrid NK-Trudan II	6.0	20	208	66	3.08
			156	69	3.29
		40	156	70	2.68
			104	74	2.84

GRASS TESTING

Grass Variety Trials

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.

All varieties of Smooth Bromegrass (Table 21) and Wildrye (Table 22) were fertilized with 40# of nitrogen per acre.

Table 21. Smooth Bromegrass Forage Yield Trial - South Central Research Farm. (Seeded August 1958)

Variety	Forage Yield--Tons/Acre	
	1967	8-Year Average
Southland	.48	1.28
Lincoln	.45	1.27
Lancaster	.53	1.26
Homesteader	.46	1.08
South Dakota 5	.54	1.08
Wisconsin 55	.56	.95
Canadian Common	.44	.88

Table 22. Wildrye Variety Forage Yield Trial* - South Central Research Farm. (Seeded August 1958)

Variety	Forage Yield--Tons/Acre	
	1967	8-Year Average
Common Russian Wildrye	1.0	.76
Vinall Wildrye	1.1	.84

Intermediate and Tall Wheatgrasses have consistently produced the highest forage yields of the wheatgrasses. Oahe, an intermediate wheatgrass, although not the highest yielding in 1967, has the highest average of the groups seeded in 1958 and 1960 (Table 20). The recommended intermediate wheatgrass varieties are Oahe, Amur, and Greenar. Tall Wheatgrass yields nearly as well as intermediate but is not as palatable. Nordan Crested Wheatgrass although not the highest forage producer of the crested wheatgrass varieties is the most desirable from other agronomic standpoints.

Table 23. Wheatgrass Forage Yield Trial* - South Central Research Farm.

Variety	Forage Yield - Tons/Acre**			
	Seeded August 1958		Seeded August 1960	
	1967	8-Year Ave	1967	6-Year Ave
Crested Wheatgrass				
Common	.92	.94	----	----
Common Fairway	1.02	.79	1.14	.98
Mandan 2359	.98	.87	1.26	1.04
Nebraska 10	.93	.95	----	----
Nebraska 20	----	----	1.13	1.11
Nebraska 3576 Fairway	1.01	.92	.98	.93
Nordan	.96	.97	1.15	1.05
Summit	1.07	.98	----	----
Tall Wheatgrass				
Alkar	----	----	1.70	1.36
A12465	----	----	1.10	1.28
Mandan 1422	1.10	1.13	1.60	1.31
Nebraska Tall	1.23	.93	----	----
S-64	1.03	.76	1.10	1.22
Intermediate Wheatgrass				
Amur	1.36	1.24	1.50	1.25
Greenar	1.24	1.23	1.40	1.33
Idaho #3	1.28	1.01	1.70	1.32
Idaho #4	1.26	1.30	----	----
Mandan	----	----	1.60	1.20
Nebraska 50	1.17	1.23	1.70	1.16
Oahe	1.28	1.34	1.30	1.38
Ree	1.18	1.20	1.60	1.35
Miscellaneous Wheatgrass				
P-27 (A. sibericum)	1.08	.90	1.30	1.04
Topar Pubescent (A. trichophorum)	1.26	.85	1.30	.93
Whitmar (A. inerme)	1.04	.66	----	----

* This variety trial is fertilized with 40#/acre of Nitrogen each year.
**Absence of a yield indicates variety was not included in trial that year.

Grass Forage Production with Various Fertilizers and Row Spacings

H. A. Geise

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

Table 24. Influence of Row Space and Fertilizer on Forage Yield of Smooth Bromegrass and Intermediate Wheatgrass.

Species	Row Space	Fertilizer* Applied	Percent Protein	Forage Yield-Tons/Acre 1967**	(Ave. 1960-67)
Smooth Bromegrass	6"	0-0-0	6.4	.21	1.18
		20-0-0	6.7	.40	1.57
		40-0-0	8.6	.41	1.46
		40-9-0	7.7	.45	1.51
		40-9-0-Zn	6.6	.61	----
	42"	0-0-0	6.5	.24	1.24
		20-0-0	7.7	.35	1.38
		40-0-0	8.2	.34	1.48
		40-9-0	8.7	.46	1.43
		40-9-0-Zn	9.8	.45	----
Intermediate Wheatgrass	6"	0-0-0	6.7	.23	.81
		20-0-0	7.0	.59	1.18
		40-0-0	7.8	.59	1.29
		40-9-0	7.7	.48	1.36
		40-9-0-Zn	6.9	.50	----
	42"	0-0-0	7.3	.44	1.19
		20-0-0-	8.5	.44	1.24
		40-0-0	8.4	.38	1.34
		40-9-0	10.0	.46	1.33
		40-9-0-Zn	9.0	.44	----

*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 species differences are significant.

An experiment was initiated to study the effects of high nitrogen fertilizer. Ammonium nitrate was broadcast on Smooth Bromegrass sod in the fall of 1965, and again in 1966. The sod had been established in 1958 and the plants exhibited extreme nitrogen deficiency. The plots were harvested and samples analyzed for protein. The results are listed in Table 25.

Table 25. Effect of Fertilizer on Protein Content, Forage Yield, and Seed Production of Smooth Bromegrass - South Central Research Farm.

Fertilizer Rate	Percent Protein* Early	Late	Forage Yield-Tons/A** 1967	Ave. 1966-67	Pounds of Seed/Acre
0-0-0	5.5	5.9	.47	.57	60
40-0-0	5.0	5.9	.91	.92	118
80-0-0	6.0	7.6	1.32	1.13	148
120-0-0	6.2	9.6	1.38	1.18	146
160-0-0	9.3	9.6	1.82	1.47	165

*Protein content calculated from Kjeldahl analysis and reported as though forage containing 14% moisture. Early cut forage was harvested in early bloom, late cut forage was harvested when seed was mature.
**Forage reported in tons per acre at 12% moisture.

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 1966 with different management practices are reported in Table 26. 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 lower 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, or it may be due to variation between plots.

Table 26. Yields of Winter Wheat from Plots Having Eight Different Management Practices - South Central Research Farm, 1966-67.

Management Practice	1967			(1966-67)
	Test Wt Lbs/Bu	Percent Protein	Yield Bu/A	Av. Yield Bu/Acre
Continuous Wheat	57.6	14.1	18.8	17.7
Continuous Wheat + 40# N/yr	56.5	15.7	27.2	14.8
Continuous Wheat + 80# N/yr	57.9	14.2	30.8	14.4
Continuous Wheat +120# N/yr	57.6	15.3	29.5	15.4
Winter Wheat - Fallow	60.0	14.3	36.2	25.2
Winter Wheat - Sw. Cl. Fallow	59.4	14.7	29.5	20.2
Winter Wheat - Corn (Silage)	56.9	14.6	26.2	11.7
Winter Wheat - Sorghum (Silage)	59.2	12.2	29.2	15.0
LSD(05) = 4.6 Bu		Mean =	26.0	

Table 27. Yields of Forage obtained from Corn and Sorghum - 1967

Crop	Percent Dry Matter	Percent Protein	Forage Yield-Tons/Acre	
			Wet	Dry
Silage Corn Pioneer Blend B	24.2	9.0	13.2	3.2
Forage Sorghum Pioneer 931	24.0	9.7	19.0	4.6

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 28 have been studied for nine years. The largest grain yield in 1967 was from the treatment which included only one subsurface tillage operation. However, the vegetation was controlled by the use of a desiccant.

Longtime averages show that best yields are from plots treated with 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 absorbed. They also leave the stubble standing to catch snow which melts and is absorbed to increase the soil moisture content.

Table 28. Yields of Winter Wheat from Plots where Six Different Fallow Practices were Compared. (1959-67)

Fallow Practice		Grain Yield of Winter Wheat			
Fall	Summer	Test Wt Lbs/Bu	Percent Protein	Bu/A* 1967	Average (1959-67)
1) One-Way	One-Way	58.8	15.0	26.8	15.4
2) Noble Blade	Noble Blade	58.5	14.8	25.4	16.3
3) Noble Blade	Noble Blade or 2,4-D	59.5	14.6	25.6	17.0
4) Noble-Chem**	Chemical *** + 1 Tillage	59.1	14.2	29.6	16.2
5) No Tillage	Noble Blade	57.5	14.5	23.6	16.2
6) Noble Blade**	Chemical ****	58.5	14.7	16.3	14.1

*LSD (05) = 5.0 Bu
**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.
****One application of 5# of Dalapon + 1/2# of 2,4-D + one application of Paraquat at 1/4#/acre.

Table 29. Soil Moisture Conditions as Influenced by Six Different Fallow Techniques. (1966-1967)

Fallow Treatment	Total Inches of Soil Moisture (0-48")						
	Stubble Oct 67	Stubble Oct 66	Fallow May 67	Fallow Oct 67	Winter Gain*	Summer Gain**	Gain for Year***
1	12.41	10.87	11.29	11.85	.42	.56	.98
2	13.99	11.68	12.38	12.85	.70	.47	1.17
3	14.24	11.82	12.44	12.40	.62	- .04	.58
4	12.09	11.43	11.84	11.56	.41	- .28	.13
5	13.71	11.38	12.26	11.86	.98	- .40	.58
6	11.63	11.53	13.35	12.04	1.82	-1.31	.51

*Moisture accumulated in soil October 1966 to May 1967.
**Moisture loss by evaporation or plant use from May 1967 to October 1967.
***Difference between winter gains and summer loss.

Soil moisture changes have also been studied in relation to the various fallow methods. These studies indicate more soil moisture can be stored during the winter months if the green vegetation is destroyed by a chemical early in September. The most soil moisture was conserved in 1967 by the use of subsurface tillage which loosened the soil enough so the June rains could be absorbed.

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.

Table 30. 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, 1967.

Rate of Planting Sorghum	Sorghum Row Spacing	Fertilizer*	Spring Wheat			Sorghum
			Sediment. Value	Percent Protein	Yield Bu/A	Yield** Lbs/A
2 Lbs/A	12"	O	28.5	13.6	10.0	560
		N	34.9	16.9	15.8	616
	24"	O	28.6	13.2	17.5	490
		N	43.2	16.4	18.1	638
	42"	O	38.8	13.6	11.8	278
		N	39.1	15.2	20.4	248
4 Lbs/A	12"	O	33.8	13.8	13.6	585
		N	44.8	17.1	18.1	647
	24"	O	31.7	13.3	11.6	627
		N	50.9	16.9	17.7	641
	42"	O	29.6	13.7	14.3	329
		N	35.4	17.1	14.8	518
8 Lbs/A	12"	O	33.4	14.1	13.5	546
		N	38.8	16.4	23.5	510
	24"	O	33.3	13.7	9.7	731
		N	41.1	16.8	17.1	644
	42"	O	44.6	14.1	8.1	535
		N	47.4	16.4	15.3	538

* "N" indicates 40# of Nitrogen per acre, "O" indicates fertilizer was not applied.

**Significant Difference in yield because of row spacing.

Yields of spring wheat in the sorghum-spring wheat rotation have varied between years. Yields were larger from the plots which had not been fertilized and had small sorghum populations the preceding year. These two conditions pointed 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.

The rainfall pattern in 1967 was quite different from preceding years. The showers which fell in June, and the cool temperatures, complemented each other and provided optimum conditions during heading and filling. The grain yield pattern, therefore, was like one would expect. There were yield increases in all cases where nitrogen fertilizer was applied with higher protein content and higher sedimentation values.

Grain sorghum yields, although quite low because of later droughty conditions, also were increased because of nitrogen fertilizing. Highest grain yields were obtained where sorghum had been seeded in 24 inch rows and had been fertilized.

Influence of Date of Planting on Grain Yield of Spring Wheat

Objective: To compare yield, grain quality, and other characters of spring wheat when seeded at weekly intervals commencing with the earliest possible date in the spring.

Table 31. Effects of Date of Planting and Fertilizer on Yield of Spring Wheat South Central Research Farm, 1967.

Date of Planting	Fertilizer*	Percent** Protein	Date of Heading	Test Wt Lbs/Bu	Grain Yield Bu/Acre
April 7	P	16.7	June 26	52.5	25.7
	0	16.7		52.0	20.6
April 15	P	16.7	June 30	51.9	20.8
	0	17.2		51.6	18.4
April 23	P	17.3	July 14	52.5	15.0
	0	17.2		49.8	13.0
May 8	P	17.8	- - - -	49.1	4.3
	0	17.6		49.1	3.0
May 15	P	17.6	- - - -	49.8	3.9
	0	17.8		49.5	2.9

LSD(05) = 5.8 Bu

*Fertilized plots received 18# of elemental phosphorous with the seed.

**Percent protein calculated from Kjeldahl analysis and reported on the basis of material containing 14% moisture.

Spring wheat was seeded at weekly intervals from April 7 to May 15. The plots were subdivided at seeding time with one-half of each receiving phosphorous fertilizer at the rate of 18 pounds per acre. The results from the trial indicate an average decrease in yield of five-tenths of a bushel per day for each day of delay in seeding after April 7. The decrease was slightly greater for plots which received phosphorous fertilizer with the seed and slightly less for unfertilized plots. In addition to yield there was also an increase in test weight by planting earlier.

Influence of Fertilizers on Grain Quality and Yield of Winter Wheat

Objective: To study winter wheat responses which are influenced by addition of fertilizers.

Two experiments were initiated to study the effects of fertilizing winter wheat in a Promise clay soil. The fertilizers used contained the essential plant-nutrient elements: Nitrogen, Phosphorous, Potassium, and Sulphur. The fertilizers were placed with the seed by using a drill attachment.

The first experiment was placed on fallow land and consisted of various rates and ratios of plant food. The results of this trial (Table 33) indicated the light rate of phosphorous (0-15-0) to be the only fertilizer that returned a good profit.

Table 33. Influence of Fertilizer on Grain Yields of Winter Wheat in Fallow South Central Research Farm, 1967.

Fertilizer Treatment	Date of Heading	Percent Protein*		Test Wt Lbs/Bu	Grain Yield Bu/Acre
		Grain	Straw		
0-0-0	6-23	13.0	8.7	57.2	39.8
15-0-0	6-21	12.7	7.1	58.4	33.1
15-15-0	6-18	11.0	6.8	58.2	33.5
15-30-0	6-16	12.5	7.0	58.7	39.7
30-0-0	6-23	11.8	8.0	57.4	29.1
30-15-0	6-17	12.6	7.4	58.4	38.8
30-30-0	6-18	12.5	6.1	58.6	32.6
0-15-0	6-16	12.8	6.9	58.9	40.6
0-30-0	6-20	12.5	9.8	58.4	36.6
0-0-30	6-21	13.5	8.4	57.9	30.1
30-15-30	6-21	13.1	9.4	57.6	26.0
30-15-60	6-18	12.1	7.8	58.4	34.6
0-0-0-Sulphur	6-18	12.5	7.0	57.9	32.5
30-15-0-Sulphur	6-21	12.2	6.6	57.9	28.6

LSD(05) = 7.62 Bu Mean = 33.4

*Percent protein is calculated on a basis of 14% moisture in the straw.

The second experiment was placed on winter wheat in stubble and consisted of similar fertilizer treatments except the nitrogen levels were doubled. The results (Table 34) show the only profitable increase in yields was obtained by using 30 pounds of nitrogen plus 15 pounds of phosphorous per acre.

Table 34. Influence of Fertilizer on Grain Yields of Winter Wheat in Stubble South Central Research Farm, 1967.

Fertilizer Treatment	Percent* Protein	Test Wt Lbs/Bu	Grain Yield Bu/Acre
0-0-0	13.1	54.8	12.5
30-0-0	14.6	54.0	10.2
30-15-0	15.0	56.8	17.9
30-30-0	13.7	57.2	17.1
60-0-0	12.8	53.3	10.5
60-15-0	14.3	56.1	14.6
60-30-0	15.1	56.8	17.8
0-15-0	13.2	57.5	12.7
0-30-0	14.2	57.4	16.7
0-0-30	13.7	54.3	10.3
30-15-30	14.5	55.1	13.4
30-15-60	14.2	56.5	13.7
0-0-0-Sulphur	14.1	53.8	11.1
30-15-0-Sulphur	14.4	55.6	13.6
		Mean =	13.7

* Percent protein is calculated on a basis of 14% moisture.

CROP DISEASE CONTROL

Plant Pathology Department

Chemical Rust Control in Winter Wheat

G. W. Buchenau

Research at the South Central Research Farm and at other locations in the winter wheat area has shown that rust on winter wheat can be effectively controlled with fungicide sprays. Rust epiphytotics do not occur each year in South Dakota so spraying is unnecessary every year. The 1967 spray trials were conducted as part of a rust forecasting system designed to predict the need for such sprays in any particular season. Rus susceptible varieties were used because a susceptible wheat is needed to evaluate the spray treatment.

Rust forecasts on June 16 (early heading stage) indicated leaf rust would not cause major damage in 1967. This conclusion was based on the very light rust intensity at this date and the length of time required for damaging levels of rust to develop. Stem rust had not been found in the plots by June 16, consequently a "No Spray" forecast was indicated.

The data show that the forecast was reasonably accurate (Table 35). Rust control improved yield by less than 7 bushel per acre and all spray schedules were marginal on a cost/return basis.

Neither of the two fungicides used in the test was superior to the other. Only Dithane M-45 has received clearance from the Food and Drug Administration for use on wheat.

Table 35. Effect of Rust Fungicides on Yield, Test Weight, and Rust Development on Nebred Winter Wheat - South Central Research Farm, 1967.

Fungicide*	Number of Applications	Growth Stage When Applied	Percent Rust** Stem	Leaf	Test Wt Lbs/Bu	Yield Bu/A
Dithane M-45	2	Joint and Heading	16	16	58.8	41.9
Dithane M-45	2	Heading and 10 days later	8	27	59.1	41.1
Dithane M-45	3	Joint, Heading and 10 days later	12	13	58.1	43.1
Manzate D	2	Joint and Heading	19	16	58.4	41.2
Manzate D	3	Joint, Heading and 10 days later	8	13	58.4	43.9
Check (Unsprayed)	0	---	26	82	57.8	37.2

*All fungicides applied at 2 pounds per acre per application.
**Percent leaf rust on flag leaf, 20 days after heading.

Wheat Streak Mosaic Control on Winter Wheat by Proper Selection of Planting Date

G. W. Buchenau and W. S. Gardner

Near perfect control of wheat streak mosaic was obtained by planting at the proper date at the South Central Research Farm. This has been true for the eighth consecutive year (Table 36).

Excessive fall growth of the August-planted plots in 1966 depleted the soil moisture. In the spring of 1967, the August plantings were drought striken by late May while adjacent plots planted in mid-September were only mildly striken. The combined effects of wheat streak mosaic control and efficient moisture utilization nearly doubled yields (September 14, 40 bu vs August 25, 21 bu.).

Over a period of years, the advantages of mid-September planting dates may be summarized as follows:

1. Reduction of loss from wheat streak mosaic.
2. Reduction of winterkilling.
3. Reduction of spring frost damage.
4. Reduction of excessive soil moisture loss in the fall.

Certain disadvantages of mid-September planting have been minimized by variety improvements. Rust damage for example, is more severe on the late than on the early maturing wheat. Stem rust resistant varieties such as Hume, Gage, Scout, and Lancer now make mid-September plantings less vulnerable to these rust attacks than formerly was the case.

Table 36. Effect of Planting Date on the Incidence of Wheat Streak Mosaic, Height, Yield, and Test Weight of Winter Wheat--South Central Research Farm.

Planting Date	1967*				8 Year Ave.	
	Percent Mosaic	Height Inches	Test Wt Lbs/Bu	Yield Bu/A	Percent Mosaic	Yield Bu/A
August 15	37	20	54	15	50	12
August 25	25	22	56	21	41	16
September 4	5	26	59	33	13	22
September 14	trace	30	60	40	3	22
September 24	trace	33	58	27	2	26
October 4	trace	32	53	22	1	18

LSD(05) = 8.0 Bu/A
*Lancer winter wheat

Other disadvantages of mid-September planting include: (a) decreased ground cover, thereby affecting erosion and snow holding capacity and (b) later maturity which increases hail and drought hazards. The mid-September planting generally provides adequate ground cover although it is not as complete as that from earlier plantings. The increase in the hail and drought hazards caused by the few days later maturity associated with mid-September planting seems minor in relation to the yield increases.

The Development of Disease Resistance in Hybrid Corn

C. M. Nagel

During the past several seasons, more than 300 experimental disease-resistant corn hybrids were developed. Seed was produced by hand pollination methods of both 3-way and 4-way hybrids to be used in experiments to determine the beneficial effects of disease resistance to root rot and stalk rot on yield.

Table 37 shows the yield and other performance scores obtained from 52 experimental 3-way hybrids in comparison to 6 commercial hybrids grown at the South Central Research Farm in 1967. Based on the moisture in the cobs and kernels at harvest, the experimental hybrids would mature in this area. Sixteen of the experimental disease resistant hybrids yielded more than the highest yielding commercial check hybrid. The corn was planted on May 25 and harvested on October 23.

Table 37. Yield, Moisture content, and other Performance ratings of 66 3-way experimental hybrids possessing varying degrees of root and stalk rot resistance in comparison to 6 other Commercial Hybrids Grown at the South Central Research Farm, 1967.

Expt'l hybrid or commercial check		Yield** Bu/A	Ear Moisture at harvest	Total* Performance Score	Yield Performance Score	Moisture Performance Score
Expt'l	1	46.7	16.5	119.68	127.64	107.72
"	2	45.5	29.2	108.90	118.92	93.87
"	3	45.4	23.2	111.88	118.58	101.82
"	4	44.8	27.7	108.55	117.01	95.86
"	5	44.0	20.4	111.22	115.00	105.54
"	6	43.9	22.1	112.10	119.83	100.50
"	7	43.9	31.9	104.92	114.66	90.29
"	8	43.4	26.3	107.15	113.43	97.71
"	9	42.9	23.6	107.80	112.12	101.29
"	10	42.6	22.3	108.02	111.34	103.20
"	11	42.5	20.6	108.81	111.16	105.27
"	12	41.9	22.8	108.56	114.53	99.60
"	13	41.6	18.1	110.49	113.71	105.66
"	14	41.6	22.1	106.51	108.65	103.28
"	15	41.1	23.0	105.35	107.50	102.09
"	16	41.1	24.3	104.65	107.50	100.37
	SD270	41.1	22.4	106.39	114.71	101.41
Expt'l	17	40.8	21.7	107.27	111.44	101.01
"	18	40.7	23.8	106.03	111.17	98.30
"	19	40.4	19.6	105.95	105.51	106.60
"	20	39.5	21.7	105.09	107.81	101.01
	SD250	39.2	20.0	104.69	104.76	104.50
Expt'l	21	38.7	22.8	103.22	105.62	99.60
"	22	38.7	23.9	101.05	101.15	100.90
"	23	38.6	20.0	104.55	105.43	103.21

(Continued on Page 31)

Table 37 (Continued)

Expt'l hybrid or commercial check	Yield** Bu/A	Ear Moisture at harvest	Total* Performance Score	Yield Performance Score	Moisture Performance Score
PAG62	38.3	29.3	98.46	102.45	92.46
Expt'l 24	38.1	24.7	101.35	104.15	97.14
" 25	37.7	21.8	100.64	98.61	103.68
" 26	37.4	23.3	100.88	102.15	98.95
" 27	36.7	24.9	98.85	100.16	96.89
" 28	36.6	25.0	97.17	95.66	99.44
" 29	36.4	19.3	101.35	99.50	104.11
" 30	36.1	17.1	101.95	98.60	106.95
" 31	35.8	20.8	99.59	97.86	102.18
SD220	35.7	16.1	101.43	95.98	109.67
Expt'l 32	35.4	25.1	96.62	96.61	96.63
" 33	35.2	22.6	97.68	96.23	99.85
" 34	35.2	22.0	96.62	92.08	103.42
" 35	35.1	19.7	99.01	95.95	103.59
" 36	34.8	25.5	94.09	90.95	98.78
" 37	34.6	22.2	95.52	90.43	103.15
" 38	34.6	31.1	90.85	90.51	91.35
" 39	34.5	21.9	96.90	94.31	100.76
" 40	34.4	17.6	97.60	89.83	109.25
SD420	33.9	34.9	90.97	90.50	91.65
Expt'l 41	33.8	23.6	94.87	92.40	98.56
SD240	33.2	23.9	98.61	88.64	99.48
Expt'l 42	33.1	22.7	94.19	90.49	99.72
" 43	33.1	24.8	93.01	90.33	97.01
" 44	33.1	22.6	92.91	86.43	102.62
" 45	32.4	25.0	91.85	88.58	96.76
" 46	32.3	38.1	83.53	84.50	82.07
" 47	32.0	30.2	87.20	83.63	92.54
" 48	30.3	22.0	88.84	79.11	103.42
" 49	29.9	32.8	82.58	78.22	89.10
" 50	29.6	26.2	86.55	80.77	95.21
" 51	29.1	23.3	87.32	79.56	98.95
" 52	26.2	21.2	82.88	68.47	104.48

*Total performance score is a value based on percent of moisture and grain yield in the corn at harvest. A rating of 100 or more indicated a low-moisture, high-yielding hybrid.

**A difference of 8.6 Bu/A between any two hybrids indicates that one is significantly better than the other.