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Agronomy Pamphlet #76

December 1963

SOUTH CENTRAL RESEARCH FARM
Presho, South Dakota

INTRODUCTION

The 1963 growing season was the sixth year of experimental work at the South Central Research Farm. Precipitation varied with the months, some being below normal and others above, so that overall the total was over an inch above the longtime average. The rainfall pattern was such that light showers were scattered over periods of several days, and as a result were as usuable as a single more intense shower.

An unusually late killing frost occurred on May 22. This destroyed the growing tips of most of the forages and emerging heads of the early cereal crops. As a result, hay and grain yields were severely reduced.

The first killing frost of the season did not occur until October 29. This late frost permitted a growing season of 160 days.

The long growing season made it possible for all of the grain sorghums to mature. However, after the initial heads were mature, axillary buds broke dormancy and produced heads varying from the pollination stage to maturity at the frost date.

SOUTH CENTRAL RESEARCH FARM ADVISORY COMMITTEE

Officers	Address	County
Walter Stolte	Chamberlain	Brule
Fred Lucas	Academy	Charles Mix
Ed Bailey	Lucas	Gregory
Lyn Lyman	Murdo	Jones
John Quillan	Kennebec	Lyman
Dwight Schaffer	Wood	Mellette
Ray Norman	Hayes	Stanley
John Fernen	Mission	Todd
Don Jorgenson	Ideal	Tripp

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Table 1. Weather Data - South Central Research Farm* 1963

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Rainfall in Inches	.45	0	1.02	2.44	1.91	3.44	3.17	1.49	2.31	1.09	Tr	.19	17.51
Longtime Average**	.52	.56	1.08	1.69	2.36	3.28	1.54	2.03	1.38	1.04	.54	..43	16.45
Departure from Longtime Average	-.07	-.56	-.06	.75	-.45	.16	1.63	-.54	.93	.05	-.54	-.24	1.06
Average Air Temperature	---	---	---	47.0	58.1	71.0	77.2	75.1	66.6	59.4	---	---	
Longtime Average**	19.0	22.7	32.2	48.0	59.0	68.7	77.3	75.1	64.8	51.5	34.9	23.5	
Departure from Longtime Average	---	---	---	-1.0	-0.9	2.3	-0.1	0	1.8	7.9	---	---	
Average Maximum - 1963	---	---	---	59.4	72.2	82.8	89.7	89.2	77.2	72.7	---	---	
Average Minimum - 1963	---	---	---	34.6	44.0	59.1	64.7	61.1	55.9	46.2	---	---	
Average Soil Temperature @ 4"	---	---	---	---	54.8	66.2	75.8	73.4	64.3	56.2	42.7	---	
Average Maximum Soil Temp.	---	---	---	---	58.6	71.2	78.5	76.3	66.2	59.9	46.0	---	
Average Minimum Soil Temp.	---	---	---	---	50.9	61.4	73.0	70.5	62.4	52.6	39.3	---	

Maximum Recorded Air Temperature - 106° - 25 July 1963

Last Frost - 22 May, First Frost - 29 October
Growing Season - 160 days

* Data taken and recorded at South Central Research Farm
** Longtime Averages were recorded at Kennebec, South Dakota

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 selections for winter hardiness, grain yield, disease resistance, and other characteristics of area adaptability.

Winter Wheat

Twenty three varieties of winter wheat were seeded in mid-September 1962. Nineteen of the varieties are released and have been grown widely. The other four are unreleased experimentals. Four other tests were grown in which varieties in various stages of development were compared. Precipitation during August and September 1962 was light. This resulted in irregular germination and emergence giving the plots a spotted appearance. Rain which fell in early October and the lateness of frost permitted the cereals to overcome the earlier problems.

Warm days and timely showers in April and May permitted the cereals to head from five to ten days earlier than usual. This resulted in disaster for the earliest varieties which were in the boot stage when a killing frost occurred on May 22. Grain yields and other data are included in tables 2 through 6.

Rye

Five varieties of Rye were grown in the 1962-63 season. Stands were excellent with emergence of the heads occurring about two weeks earlier than usual. This early maturity was not desirable because the plants were pollinating when a killing frost occurred on May 22.

Yields were reduced to about half of that of 1962 because of frost damage. Grain yields and other data are reported in table 7.

Winter Barley

The winter barley varieties presently under test are not recommended because of their apparent lack of winter hardiness. However, under conditions where winter survival is high, one can obtain good yields. The present varieties all have weak straw and can be expected to lodge. Of the four which were tested, Dicktoo and Kearney would be more desirable. Grain yields and other data are reported in table 8.

Spring Wheat, Durum, Oats and Spring Barley

These tests were seeded in mid-April. Three factors contributed to low yields. First, the soil having been cropped continuously for two year, was low in reserve moisture and produced only thin stands of non-vigorous plants. Second, a killing frost occurred on May 22 which set back the unthrifty plants, and thirdly there were above normal temperatures during the month of June, which prevented recovery and production of tillers. Grain yields and other agronomic data are given in tables 9 through 12.

Table 2. Winter Wheat Variety Trial - South Central Research Farm - 1963

Entries	Stem Rust Race 56*	Leaf Rust	Date of Heading	Height in ins.	Lodging**	Per Cent Protein	Test Wt lbs/bu.	Yield Bu/A.	Average Yield 1958-1963***
Northern									
Marmin	S	S	6-9	37	2.5	16.0	55	21.0	19.5e
Minter	R	S	-10	36	2.5	15.8	56	22.8	22.3f
Minturki	S	S	-9	40	3.0	16.3	55	19.6	14.4e
Yogo	S	S	-11	41	3.0	15.6	56	21.2	14.8f
Winalta	MR	S	-8	36	3.0	14.7	59	38.5	38.5a
Kharkof MC 22	S	S	-10	38	2.5	16.0	52	12.0	11.2e
Central									
Nebred	S	S	-8	34	3.0	15.1	58	28.4	18.3f
Cheyenne	S	S	-9	34	2.5	14.9	58	31.4	21.5f
Omaha	S	S	-6	31	3.0	15.3	61	35.0	28.4e
Warrior	S	S	-8	35	3.5	14.9	58	36.4	24.8d
Ottawa	R	R	-5	32	2.0	16.2	60	39.2	30.3c
Lancer	R	MS	-6	34	2.5	14.4	60	35.4	28.2b
S.D. 56-53	R	S	-8	33	3.0	16.1	59	25.0	22.1d
S.D. 56-197	R	S	-10	41	3.5	16.1	56	26.8	19.6c
S.D. 56-292	MR	R	-6	37	4.5	15.6	57	28.3	28.3a
S.D. 56-514	R	S	-6	36	1.5	15.7	56	24.1	18.7c
Southern									
Aztec	S	S	-6	36	2.5	14.8	61	26.0	18.4d
Pawnee	S	S	-5	34	3.0	14.7	57	25.8	22.1f
Bison	S	S	-6	34	5.0	14.8	56	21.4	17.4f
Wichita	S	S	-5	34	4.5	14.8	60	23.2	19.7f
Kaq	S	S	-5	31	4.5	16.2	63	26.7	16.4c
Triumph	S	S	-4	25	5.0	16.1	56	15.4	19.2b
Rodco	R	MR	-6	31	4.0	16.6	58	28.2	24.7b
Average							57	26.6	

Note: Date of Plant - 19 September 1962

* R-Resistant; MR-Medium Resistant; MS-Medium Susceptible; S-Susceptible.

** Lodging Notes: 1 - Standing Upright, 5 - Completely Lodged.

*** a-1 year; b-2 yr. ave.; c-3 yr. ave.;; d-4 yr. ave; e-5 yr. ave.;; f-6 yr. ave.

Table 3. Northern Regional Performance Nursery, Presho - 1963

Entries	Test Wt. Lb/Bu.	Yield Bu/A	Date Headed June	Stem Rust
Kharkof	57.0	25.4	6	S
Minter	55.0	25.0	8	R
Nebred	58.0	25.1	4	S
Cheyenne	57.0	26.7	7	S
Scout	57.5	17.9	3	R
Lancer	58.0	28.0	4	R
C.I. 13666	59.0	27.4	4	S
C.I. 13682	55.0	22.7	8	R
Winalta	58.0	26.8	7	MR
SD 56-53	58.5	24.5	3	R
C.I. 13542	54.5	24.3	8	S
Neb. 61359	58.0	29.2	5	R

Table 4. Advanced Winter Wheat Trial I - Presho - 1963

Entries	Date Headed June	Test Wt. Lbs/Bu	Grain Yield Bu/A
Nebred	4	58.5	19.4
Omaha	2	59.6	18.9
S.D. 56 - 53	5	56.0	16.2
- 192	8	54.0	21.1
- 193	7	56.3	23.5
- 195	8	55.0	22.4
- 232	8	53.0	21.4
- 233	9	53.3	19.4
- 278	6	56.0	17.3
- 303	7	56.2	22.8
- 416	5	56.0	21.7
- 428	6	55.8	21.5
- 470	6	55.7	23.6
- 509	5	58.5	26.0
- 517	5	54.3	22.0
- 563	7	54.8	20.4
- 576	8	56.0	23.8
- 617	7	54.5	19.7
- 620	7	54.0	21.5
- 712	7	54.5	21.6
- 713	8	54.0	20.9
- 727	7	54.7	21.1
- 776	7	53.5	14.4
- 781	5	55.3	22.6
- 797	7	55.0	18.5
- 849	5	57.0	26.0
- 852	7	53.3	23.0
Ottawa	3	58.2	25.9
S.D. 56 - 552	4	55.8	19.7

Table 5. Preliminary Winter Wheat Test I - 1963

Entries	Date Headed June	Test Wt. Lbs/Bu	Grain Yield Bu/A
Minter	8	55.5	18.9
Nebred	4	58.0	21.0
Neb. 61917	7	58.0	18.2
C.I. 13864	6	58.0	18.4
Neb. 61352	5	57.5	17.9
61353	8	56.0	23.6
61355	5	58.0	20.0
61356	6	57.0	19.5
61359	5	56.5	20.1
61360	4	56.5	22.3
S.D. 56-53	3	56.0	17.3

Table 6. Preliminary Winter Wheat Test II - Presho, 1963

Entries	Date Headed June	Test Wt. Lbs/Bu	Grain Yield Bu/A
Lancer	2	59.0	21.7
Scout	2	58.5	18.1
C.I. 13548	3	58.5	27.2
C.I. 13682	6	56.0	26.1
Neb. 60251	4	58.0	27.6
61924	5	57.5	26.6
61930	3	58.0	30.1
61954	6	56.5	27.0
61981	8	57.0	18.1
61982	7	57.5	22.9
61983	7	56.5	22.9
1867-5	9	56.0	21.2
1867-10	9	57.0	18.1
60549	4	57.0	21.5
60237	3	60.5	27.9
Minter	8	56.5	23.5
Nebred	5	59.0	27.5

Table 7. Rye Variety Trial - South Central Research Farm - 1963

Variety	Date of Heading	Test Wt. Lb/Bu.	Grain Yield, Bushel / Acre 1963	1962	1958-1963
Elk	May 27	52	24.3	41.6	23.2
Caribou	17	54	20.2	38.8	25.5
Antelope	17	54	19.3	41.8	27.2
Pierre	15	54	16.8	42.9	23.2
Tetra Petkus	30		12.2		----
Average			18.6		

LSD at 5% level - 11.4 Bu/A

Table 8. Winter Barley Variety Trials - South Central Research Farm - 1963

Variety	Date of Heading	Test Wt. Lb/Bu.	Grain Yield - Bushel / Acre 1963	1962	3 year ave.
Kearney	May 31	48	18.8	30.0	28.6
Mo. B1222	30	47	18.2	----	----
Dicktoo	30	48	16.9	31.7	26.7
Chase	June 1	45	16.6	28.6	22.6
Mo. B969	1	44	13.8	39.8	28.6
Average			16.9		

Table 9. Spring Wheat Variety Trial - South Central Research Farm. - 1963

Variety	Test Wt. Lb/Bu.	Grain Yield - Bushel / Acre 1963	1962	1960
Rushmore	54	9.4	13.4	9.5
Spinkcota	56	7.5	13.0	----
Canthatch	54	7.2	8.1	6.9
Crim	53	6.0	17.1	----
Lee	51	5.0	14.6	10.6
Selkirk	48	4.3	15.3	14.2
Pembina	51	4.0	20.6	9.4
Justin	53	3.4	27.1	18.6
Average		7.4		

LSD at 5% level - 9.6 Bu/A

Table 10. Durum Wheat Variety Trial - South Central Research Farm - 1963

Variety	Test Wt. Lb/Bu.	Grain Yield, Bushel / Acre 1963	3 year ave.
Lakota	54	12.5	12.6
Langdon	55	8.6	13.9
Ramsey	56	9.8	10.8
Wells	56	11.0	----

LSD at 5% level - 6.5 Bu/Acre

Table 11. Oat Variety Trial - South Central Research Farm - 1963

Variety	Test Wt. Lb/Bu.	Average Grain Yield, Bushel/Acre* 1963	1962	1960	1959
Mo-0-205	32	49.2	62.7	43.2	12.6
Dupree	33	49.0	61.7	49.7	16.3
Nodaway	34	47.2	----	----	----
Neal	32	45.8	65.2	----	----
Dodge	32	43.2	60.2	----	----
Ransom	33	41.0	53.9	----	----
Garland	34	40.4	----	----	----
Clintland 60	34	40.4	76.6	41.3	10.9
Minhafer	32	40.2	48.6	37.3	9.5
Portage	33	39.6	50.6	----	----
Burnett	33	38.6	67.8	44.6	12.4
Marion	34	38.6	57.0	40.5	----
Andrew	33	38.2	54.2	43.0	12.4
Nehawka	33	37.2	70.6	46.6	10.5

Yield differences in 1963 were not significantly different statistically.

* 1961 Oat variety test not seeded.

Table 12. Spring Barley Variety Trial - South Central Research Farm - 1963

Variety	Test Wt. Lbs/Bu	Average Grain Yield. Bushel / Acre 1963	1962	1960
Otis	46	22.8	24.1	37.8
Custer	43	19.5	----	----
Plains	44	18.7	47.5	38.3
Liberty	43	17.0	52.5	35.9
Traill*	41	16.5	48.1	26.2
Larker*	43	13.4	55.3	----
Trophy*	38	12.4	50.3	----
Spartan	43	12.3	22.3	30.8

Yield differences not significantly different statistically.

* Malting types.

SPECIALTY CROP TESTING

H. A. Geise

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

Safflower Testing

A more thorough program on Safflower was initiated in 1963. Several tests were grown and a somewhat complete set of Agronomic notes were obtained. Part of the data are presented in Tables 13 and 14.

Safflower should be grown where there is sufficient soil moisture and low relative humidity. An adequate moisture supply is necessary during flowering to insure a good seed set, whereas low relative humidity is essential because of the inherent susceptibility to foliage diseases.

Recent reports indicate that planting in rows permits development of lateral buds. These buds are higher in oil content than the terminal buds. Then too, at present there are no approved weed killers to use for safflower; therefore it seems desirable to row plant where cultivation is possible.

Table 13. Safflower Yield Trial, South Central Research Farm, 1963

Entry	Date of 50% Flower	Height in inches	Lodging*	Branching**	Spines ***	Seed Harvested Lbs/Acre 1963	Seed Harvested Lbs/Acre Average 1962-63
Nebr 472-4-49 (X-ray)	18-7	20	3.0	3.5	4.5	295	582
Nebr 472-48 (Colch.)	19-7	21	2.5	2.5	5.0	383	610
N-6	20-7	21	3.5	3.0	4.0	125	475
Nebr 472-3-49 (X-ray)	19-7	21	2.5	2.0	3.5	416	568
N-8	19-7	21	3.0	3.0	4.0	258	480
N-2377	16-7	19	3.5	3.0	5.0	165	416
Nebr 472-2-48 (Colch.)	19-7	21	3.0	3.5	4.0	151	406
N-4036	16-7	17	3.0	3.0	4.0	388	503
Nebr 472-1-48 (Colch.)	16-7	21	2.0	3.5	4.5	420	494
N-10	18-7	22	3.0	3.0	4.5	115	314
N-4051	15-7	18	3.0	3.0	3.0	75	279
N-4042	16-7	21	3.0	3.0	4.5	341	410
Gila	10-7	17	3.0	3.0	4.5	63	218
Nebr 8-48 (Colch.)	12-7	17	3.0	3.0	3.5	198	281
Pacific #1	10-7	16	3.0	3.0	3.0	81	170
U. S. 10	10-7	19	3.0	2.0	3.0	85	146

LSD at 5% level - 204 lbs per acre.

* Score 1-5, 1-upright, 5-compeltely lodged.

** Score 1-5, 1-terminal, 5-completely branched.

*** Score 1-5, 1-spineless, 5-compeltely spined.

Note: the yields reported in table 13 are an average of two replications. Varieties that may exceed in yield potential may also be low in oil content and therefore are not recommended for growing in large acreages.

Table 14 lists 18 introduced strains of Safflower. These were selected from over one hundred strains on the basis of yield potential alone. A more thorough study involving such factors as % hull of seed, oil content, iodine number, and disease resistance must be concluded before they can be released to growers.

Table 14. Agronomic Notes on Selected Safflower Introductions, Presho - 1963

P.I. Number	Origin	Height in inches	Spines * 1-5	Branching ** 1-5	Lodging ** 1-5	Seed Yield Lbs/Acre
199-877	India	16	5	2	3	500
209-282	Australia	19	2	2	3	541
220-647	Afghanistan	22	1	2	2	503
222-240	Iran	16	3	2	3	542
237-538	Turkey	23	2	3	2	574
237-545	Sudan	27	2	5	3	556
237-546	Sudan	18	4	3	3	571
239-227	Spain	19	2	2	3	646
239-353	Spain	18	2	5	4	507
250-981	Turkey	24	1	2	1	533
251-262	Jordan	21	1	3	2	594
251-289	Jerusalem	19	3	3	2	516
252-040	Turkey	25	1	3	1	804
253-086	Israel	20	2	3	3	664
253-911	Afghanistan	23	1	2	2	617
258-411	Portugal	20	2	2	3	553
262-448	Russia	24	3	2	2	548
262-452	China	23	4	2	3	628

* Presence of Spines: 1-no spines, 5-completely covered.
** Type of branching: 1-one main stem with terminal branches, 5-plant composed of lateral branches.
*** Lodging: 1-plants standing upright, 5-all plants prostrate.

Sunflower Yield Trial

Sunflowers are grown as a crop in the United States for two purposes. They are grown for whole seed uses in the confectionary or bird feed trades for which large-seeded types are of most value. The second and potentially larger demand for sunflower seed is as a source of high linoleic acid edible oil. This purpose would require seeds of high oil content, and at present is not being commercially exploited.

Varieties 1 and 4 through 12 are small seeded and considered as oil seed types. Varieties 3 and 4 are large seeded commercial varieties, and are uniform in height and maturity. Variety #13 is a selection from a dwarf early type, whereas #14 and #15 are introduced varieties having a high oil content.

The yield data and agronomic notes are listed in table 15.

Table 15. Sunflower Selection Yield Trial - Presho - 1963

Selection No.	Date of 50% flower	Height in inches	Lodging 1-5	Test Wt. Lbs/Bu	Seed Yield Cwt/acre
1	24-7	60	3	34	7.9
2	29-7	61	10	31	7.2
3	28-7	58	3	29	6.4
4	26-7	56	7	35	4.0
5	23-7	57	3	34	5.4
6	26-7	55	7	31	2.6
7	23-7	47	7	34	3.5
8	17-7	29	3	36	3.9
9	26-7	49	3	36	5.4
10	24-7	50	3	37	2.6
11	24-7	49	5	34	3.5
12	26-7	52	3	34	3.1
13	22-7	49	10	27	2.8
14	26-7	53	3	35	6.2
15	31-7	56	7	33	3.9

GRAIN SORGHUM PERFORMANCE TESTING

J. J. Bonnemann

Objective: To compare sorghum varieties and hybrids, both commercial and experimental, as to yield potential and certain other agronomic characteristics.

This is the second year that the performance trial of commercial grain sorghum hybrids has been conducted by the Crop Performance Testing Activity. A nominal fee is charged all companies entering the trial. Yields are reported for entries included for two years. Averages are not given because validity of the 1962 yields is questionable. Blackbird damage was very severe in 1962.

The trial at Presho was conducted under favorable conditions during 1963. Moisture was adequate for rapid, uniform germination and beneficial, timely precipitation occurred throughout most of the growing season. Yields averaged 39.5 hundred-weight (cwt.) per acre, ranging from 49.2 down to 26.0 cwt. per acre. Moisture in the grain at harvest ranged from 13.6 to 16.5 percent. All test weights averaged 55 pounds or higher.

The trial was planted on May 23 and harvested October 2, 1963.

Table 16. Grain Sorghum Performance Trial - South Central Research Farm, 1963

Variety	Percent Moisture	Height, Inches	Heading Date	Yield, cwt/A 1962[a/]	Yield, cwt/A 1963	Test Wt. Lbs/Bu.
Frontier 400C	16.5	44	7/23	28.0	49.2	57.0
R S 501	15.6	51	7/22	17.0	46.6	60.0
R S 610	13.6	43	7/24	32.0	44.5	56.5
Paymaster SK 0563	14.6	44	7/21	----	43.3	60.0
R S 608	14.4	42	7/24	29.0	42.6	57.5
Ute	15.1	41	7/29	----	41.8	57.5
N K 120	15.7	42	7/19	36.0	41.3	56.5
Comanche	15.1	41	7/25	32.0	41.0	56.5
Shorty 33	15.6	41	7/23	----	40.5	57.0
SD 503	15.5	44	7/21	25.0	40.1	57.0
Frontier 388	15.4	41	7/24	26.0	40.1	58.0
SD 451	14.6	43	7/20	33.0	39.9	57.0
NK 144	13.8	36	7/21	----	39.0	57.5
SD 441	15.9	48	7/18	24.0	38.8	55.0
NK 125	15.6	43	7/20	28.0	36.7	55.0
Rocket A	13.6	38	7/25	----	34.1	56.5
Reliance	16.5	44	7/18	1.4	26.1	57.0
SD 102	15.2	40	7/18	29.0	26.0	55.0
Mean yield					39.5	
LSD at 5% level - 5.5 Bu/A.					5.5	

a/ Blackbird damage made accuracy of 1962 results questionable.

LEGUME AND GRASS TESTING

Sweetclover Variety Testing

H. A. Geise and M. D. Rumbaugh

Objective: To compare various sweetclover varieties as to their ability to produce forage in the South Central area of South Dakota.

Sixteen varieties of Biennial Sweetclover were seeded in rows in April 1962. Forage yields were obtained in October 1962, and June 1963. The results indicate that the above normal precipitation received in the spring of 1962 contributed to excellent stands, good growth, and high forage yields. The vigor of the plants the first year is also reflected by the 1963 forage yields.

The two experimental varieties N-16 and N-18, appear promising but have not been sifficiently tested to be released. They are also known to be more susceptible to blackstem than desired. The results are published in table 17.

Table 17. Biennial Sweetclover Forage Yield Trial - Seeded May 1962

Variety	Forage Yield - Tons/Acre		
	October 1962	June 1963	Total
Madrid	2.3	4.4	6.7
Goldtop	2.3	4.2	6.5
Evergreen	2.3	4.2	6.5
N-16	2.5	4.0	6.5
N-18	2.5	4.0	6.5
N-17	2.2	3.4	5.6
Spanish	1.8	3.2	5.0
Common White	2.0	4.3	6.3
Arctic	1.7	3.6	5.3
N-13	1.1	4.0	5.1
N-20	1.2	3.9	5.1
Cumino	.8	4.2	5.0
Denta	1.8	3.0	4.8
Erector	1.7	3.0	4.7

A second Biennial Sweet clover test was seeded in April 1963. It was placed in soil which had been fallowed the previous season. Stands were good but forage yields were not as large as those shown for the first years growth of the test seeded in 1962. The yield data are reported in table 18.

Table 18. Biennial Sweetclover Forage Yield Trial - Seeded April 1963

Variety	Forage yield - Tons/Acre
	October 1963
Erector	1.14
Madrid	1.11
Goldtop	.96
Common White	.92
Denta	.89
Common Yellow	.85
N-19	.84
Arctic	.76
N-20	.75
Evergreen	.68
Spanish	.65
N-13	.52
Cumino	.49

An annual sweetclover test has been seeded each year for the past two years. The moisture situation during the same period is reflected by the forage yields shown in table 19.

Table 19. Annual Sweet Clover Forage Yield Trial - Presho

Variety	Forage yield - tons per acre		
	1962	1963	Average
Floranna	3.7	1.42	2.56
Hubam	3.6	1.18	2.39
Israel	3.8	.74	2.27
Golden	3.3	.74	2.02

Alfalfa Forage Production

H. A. Geise, and M. D. Rumbaugh

Objective: To compare the forage production of two varieties of alfalfa when grown under various row spacings with and without the addition of phosphorus fertilizer.

Table 20. Effects of Row Spacing and Fertility on Forage Production of Two Varieties of Alfalfa - 1963.

Row Space	Variety	Fertilizer 60# P_2O_5/A	Forage 1963	Tons/Acre Ave. 1962-63
6"	Teton	P	1.7	2.1
		0	2.2	2.0
	Vernal	P	2.4	2.1
		0	1.9	1.8
42"	Teton	P	1.6	2.0
		0	1.5	1.8
	Vernal	P	1.7	1.9
		0	1.7	1.7

Forage yields in alfalfas in 1963 were severely reduced by the frost which occurred on May 22. The frost killed all growing points, which required a very early harvesting. The after-effect of the frost was such that the alfalfa did not completely recover during the remainder of the growing season. Part of the slow recovery is undoubtedly due to a shortage of subsoil moisture because these plots have been in alfalfa since August 1958.

The application of phosphorus fertilizer to alfalfa does not appear to be an immediate economical practice. Although there was an increase in yield of forage, it was not large enough to pay the cost of the fertilizer. However, because all returns can not be measured directly and immediately, the cost of fertilizer should not be assumed as a complete loss.

An abundance of phosphorus promotes an earlier maturity in plants, but more important is the fact that it promotes root development which increases the feeding area of the plant. The result of increased feeding area is a plant which is better able to withstand adverse conditions. In addition to maturity and root development, the plants are more disease resistant and produce a better quality of forage.

Alfalfa Variety Trial

H. A. Geise, and M. D. Rumbaugh

Objective: To compare the forage production of six varieties of alfalfa.

Six varieties of alfalfa were seeded in 1958. The forage yields in this test are low because of the frost damage which occurred in late May. The three year average reflects the shortage of soil moisture which is a result of overcropping. The soil has been under continuous cropping since 1957. The forage yields are reported in table 21.

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

Variety	Forage yield - Tons/acre	
	1963	3 year average
Nomad	.21	.61
Ladak	.24	.85
Grimm	.22	.72
A 225	.22	.72
Vernal	.23	.75
Rambler	.24	.82

Wheatgrass Variety Trial

J. G. Ross and H. A. Geise

Objective: Te 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. Wheatgrass Forage Yield Trial - South Central Research Farm

Variety	Forage Yield-Tons/Acre			
	Seeded August 1958		Seeded August 1960	
	1963	Ave. 1961-63	1963	1962-63
Crested Wheatgrass				
Summit	.7	1.2	--	---
Mandan 2359	.8	1.3	.6	1.5
Nebraska 10	.8	1.2	--	1.0
Common Fairway	.7	1.1	.7	1.4
Common	.8	1.2	--	--
Nordan	.8	1.2	.9	1.7
Nebraska 3576 Fairway	.9	1.2	.8	.4
Nebraska 20	--	--	.3	1.4
S. D. 15	--	--	.4	.2
Tall Wheatgrass				
S-64	.8	.8	.8	2.4
Nebraska Tall	.9	1.5	--	--
Mandan 1422	.8	1.2	.9	2.4
A12465	--	--	.8	2.5
Alkar	--	--	.8	2.5
Intermediate Wheatgrass				
Nebraska 50	.8	1.6	.7	1.8
Idaho #3	.9	1.3	.8	2.2
Idaho #4	.9	1.6	--	--
Greenar	1.0	1.6	.9	2.4
Ree	1.0	1.6	.8	2.4
Oahe	1.1	1.8	1.0	2.4
Amur	.9	1.6	.8	2.1
Mandan	--	--	.7	2.0
Misc. Wheatgrasses				
S. D. Syn 2-2nd Cycle	.9	1.6	--	--
Slender (A. trachycaulum)	.7	1.3	--	--
Topar Pubescent (A. trichophorum)	.8	1.3	.4	1.4
P-27 (A. sibericum)	.8	1.1	.4	1.6
Whitmar (A. inerme)	.7	1.2	--	--

Intermediate and tall wheatgrasses have consistently produced the highest forage yields. Oahe, an intermediate wheatgrass recently released, was the highest producer of both tests in 1963. It is also one of the highest average producers. The three most adapted intermediate wheatgrass varieties are Oahe, Ree, and Greenar. The tall wheatgrass is a strong competitor of intermediate, but is not as desirable or palatable. Nordan crested wheatgrass was the highest forage producer of the varieties of crested seeded in 1960; it is also the most desirable.

Table 23. Smooth Bromegrass Forage Yield Trial - South Central Research Farm

Variety	Forage Yield-Tons/Acre			
	Seeded August 1958		Seeded August 1960	
	1963	Ave. 1950-63	1963	Ave. 1962-63
Lancaster	.8	1.8	.3	1.5
Southland	.9	1.8	.4	1.4
Wisconsin 81	--	--	.3	1.4
Homesteader	.6	1.6	.3	1.2
Achenbach	--	--	.4	1.3
South Dakota 5	.6	1.4	.4	1.2
Wisconsin 55	.8	1.1	.2	1.0
Lincoln	.8	1.9	.3	1.0
Canadian Common	.4	--	.3	1.2
Manchar	--	--	.2	1.0
Saratoga	--	--	.3	1.0
Lyon	--	--	.4	1.1
Fischer	--	--	.3	1.4

Table 24. Misc. Grass Species Forage Yield Trial - South Central Research Farm

Variety	Forage Yield-Tons/Acre			
	Seeded August 1958		Seeded August 1960	
	1963	Ave. 1962-63	1963	Ave. 1962-63
Vinall Wildrye	.6	1.2	.4	1.0
Common Russian Wildrye	.4	1.1	.5	1.0
Blackwell Switchgrass	1.2	1.3	--	--
Nebraska 28 Switchgrass	.9	1.2	--	--
Ricegrass (Stipa oryopsis)	.4	.7	--	--

Smooth bromegrass was slightly lower in forage yield in 1963 than the wheatgrasses. Part of this low yield can be attributed to frost damage. The other part is a shortage of soil moisture. The high yields in 1962 tended to remove a considerable portion of the available soil moisture. This resulted in unhealthy looking plants during most of the growing season.

Vinall Russian wildrye is in general more easily established and is a better seed producer than the common. The new switchgrass varieties may be useful for establishment of summer pastures.

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 production of grass forage. The effects of row spacing and solid stand are also included.

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

Species	Row Space	Fertilizer	Forage Yield-Tons/Acre 1963	Forage Yield-Tons/Acre Average 1961-63
Intermediate Wheatgrass	6"	0-0-0	.51	1.8
		20-0-0	.65	2.5
		40-0-0	.68	2.2
		40-20-0	.64	2.3
	42"	0-0-0	.56	2.0
		20-0-0	.50	2.2
		40-0-0	.56	2.3
		40-20-0	.53	2.3
Smooth Bromegrass	6"	0-0-0	.24	1.2
		20-0-0	.37	1.7
		40-0-0	.46	1.9
		40-20-0	.50	2.0
	42"	0-0-0	.40	1.9
		20-0-0	.39	2.0
		40-0-0	.45	2.2
		40-20-0	.51	2.1

Forage yields from Smooth Bromegrass and Ree Wheatgrass were sharply reduced in 1963. Two factors can be responsible for this reduction. The unusually late freeze, and a low supply of soil moisture. The effects from these two factors resulted in an unhealthy appearance of the plants during the entire growing season. The damage to the plants was so severe that only a very few seed heads were formed and most of these were sterile.

MANAGEMENT, TILLAGE, AND CULTURAL PRACTICES

Comparison of Different Techniques in Growing Winter Wheat

H. A. Geise

Objectives: To compare yields of winter wheat grown continuously with and without commercial nitrogen, wheat grown in rotation with conventional fallow or sweetclover fallow, and to investigate the possibility of substituting wide space corn or sorghum as a moisture conserving technique to precede winter wheat.

Table 26. Yields of Winter Wheat from Plots Having Six Different Management Practices. (1959 - 1963).

Management Practice	1963		Average
	Test Wt. Lb/Bu	Yield Bu/A	Yield, Bu/A (1959-63)
Continuous Wheat	60	6.0	7.6
Continuous Wheat + 30# N/Yr.	59	6.5	7.5
Winter Wheat - Fallow	57	14.0	13.4
Winter Wheat - Sw. Cl. Fallow	58	16.1	12.4
Winter Wheat - W. S. Corn	58	12.8	8.8
Winter Wheat - W. S. Sorghum	58	12.9	9.4

Table 27. Yield of Grain obtained from Wide Spaced Corn and Wide Spaced Sorghum (Row Spacing - 84 inches).

Crop	Average Yield, Bu/A	
	1963	1958-1963
Corn	10.0	14.7
Sorghum	21.6	16.4

The average winter wheat yields reported in Table 26 clearly show the effects of adequate soil moisture. A complete fallow or a partial fallow, such as a sweet clover green manure type, conserve enough soil moisture to nearly double the yields of continuous cropping. However, when other factors are considered, such as costs of operation, and weed control measures, the lower annual income from a wheat-fallow system is still larger than the return from a continuous wheat crop. Addition of commercial nitrogen has not shown any appreciable difference. The average annual returns per acre for the interseeding of the winter wheat between wide spaced rows of corn and sorghum are double the returns from continuous winter wheat. In this case the size of the present day farm equipment limits the practicability of such operations.

Methods of Summer Fallow

H. A. Geise

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

Table 28. Yields of Winter Wheat Obtained from Plots Where Six Different Fallow Practices were Compared. (1959-1963)

Fallow Practice		Grain Yield of Winter Wheat		
Fall	Summer	Test Weight	Bu/Acre 1963*	Average ('59-62)
(1) One-Way	One-Way	58	14.9	11.8
(2) One-Way	Noble Blade	57	14.0	13.7
(3) One-Way	Noble Blade + 2,4-D	57	15.4	15.2
(4) One-Way	Noble Blade + No treat.	57	13.2	14.3
(5) Chisel	Noble Blade	57	11.3	13.6
(6) One-Way	Chemical (Dalapon+2,4-D)	58	16.6	14.6

*Significant Differences at 1% level.

Table 29. Soil Moisture Conditions as Influenced by Six Different Fallow Techniques. (1962-1963).

Fallow Treatment	Inches of Soil Moisture (0-48")						
	Stubble Oct 63	Stubble Oct 62 (A)	Fallow May 63 (B)	Fallow Oct 63 (C)	Winter Gain (B-A)	Summer Loss (B-C)	Gain for Year (C-A)
1	11.64	11.94	12.50	12.02	.56	.48	.08
2	12.18	12.54	13.43	12.97	.89	.46	.43
3	11.77	13.29	13.80	12.94	.51	.86	-.35
4	11.89	13.06	13.35	13.07	.29	.28	.01
5	12.60	13.36	13.78	13.02	.42	.76	.34
6	10.68	12.97	13.52	10.98	.55	2.54	-1.99

The results presented in Table 28 represent a rather complicated puzzle. The difference in yield reflect soil condition as a result of tillage of a water saturated clay soil rather than of moisture conservation. The heavy spring rain showers of 1962 saturated the soil. This situation remained until late in June. The heavy cover of volunteer wheat and weeds made it necessary to perform tillage before the soil had dried enough to do a satisfactory job. The result of this tillage was formation of large clods which subsequently dried. These clods remained throughout the summer.

The grain yields from these plots are an inverse indication of the amount of clodiness and are listed in descending order: (6) No tillage (chemical

fallow), (1) One way surface tillage, (3) A minimum of subsurface tillage with broadleaved weed control, (2) Normal subsurface tillage, (4) Minimum subsurface tillage chiseled the previous fall and so saturated at time of first fallow that it could not be tilled.

Soil moisture studies made during 1963 indicate that the soil moisture content at the end of the fallow season, except in the chemical fallow treatment, was near that of 1962. The measurement made in May, 1963 placed the chemical fallow within the range of the other five treatments, but its loss during the summer by grassy weeds, which were not controlled by the earlier application of Dalapon, flourished and sapped the moisture from the soil

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

H. A. Geise

Objectives: To determine the optimum time, implement, and row spacing for planting grain sorghum, and the effects of these practices on the yield of the following spring wheat.

Table 30. Effects of Fertilizer, and Date and Method of Planting of Sorghum on Grain Yield in a Sorghum-Spring Wheat Rotation. 1959-1963.

Date of Planting Sorghum	Method of Planting Sorghum	Fert-ilizer*	Grain Yield - Bushel/Acre			
			Spring Wheat **		Grain Sorghum***	
			1963	5 year average	1963	5 year average
May 21	Deep Furrow Drill	0	14.9	10.8	6.0	14.1
		N	16.3	10.6	7.7	14.4
	Lister	0	16.8	11.3	8.0	12.2
		N	17.4	11.2	7.7	13.2
	Corn Planter	0	16.0	11.2	5.6	14.6
		N	16.1	11.6	6.6	14.9
June 2	Deep Furrow Drill	0	15.2	11.0	8.3	16.5
		N	13.2	10.1	6.2	17.1
	Lister	0	16.1	10.9	16.8	17.5
		N	15.6	10.9	22.0	19.2
	Corn Planter	0	17.2	11.4	21.4	19.1
		N	17.0	11.5	20.7	18.7
June 14	Deep Furrow Drill	0	12.2	10.4	31.5	22.3
		N	16.6	11.8	26.4	25.7
	Lister	0	17.4	12.9	37.7	20.4
		N	16.4	11.4	25.4	20.1
	Corn Planter	0	14.7	10.9	36.2	22.1
		N	15.9	11.2	40.4	23.6

* "N" indicates 30 lbs. of Nitrogen

** No significant difference between treatment.

*** Significant difference in grain sorghum yields between Dates of Planting, Method of Planting.

The spring wheat data reported in table 30 do not show statistically significant superiority for any practice. In only one instance during the five years the experiment has been in progress was there any real difference. This differnce resulted from the method of planting sorghum. It appeared to be a moisture problem because a higher wheat yield was returned from plots where sorghum had been seeded in 42 inch rows.

The grain sorghum yields for 1963 indicate real differences exist between dates of planting, and methods of planting. The major factor between dates of planting was the stand obtained. Notes which were taken during the season indicated that stands improved with later plantings. The condition which had the greatest effect was soil temperature at time of seeding. Optimum temperature for sorghum germination is 68-73° Fahrenheit, whereas those recorded at four inches below the surface for ten day periods following seeding were: May 21 - 57°, June 2 - 65°, and June 14 - 67°. A seeding rate of 8 pounds per acre was used which was greater than necessary. In the last date of planting with the deep furrow drill this rate was to heavy, and resulted in only partial heading because of lack of soil moisture.

Stands also varied with method of planting. An implement which places the seed deeper in the soil such as the lister tends to result in poorer stand. There are several things involved, one is that the cooler and more moist soil forms a poorer seed bed, while a second and more important is that during heavy showers the rain forms ponds in the furrows with and end result of heavy crusting. This heavy crust prevents many seedlings from emerging.

CROP DISEASES AND THEIR CONTROL

Plant Pathology Department

The Development of Root and Stalk Rot Resistant Corn Hybrids

C. M. Nagel

Corn is one of the most important and widely grown crops in South Dakota. Stalk and root rot are the most damaging disease problems of this crop in the state.

Surveys in other corn states have also shown that up to 50% of the corn plants in commercial fields are partially or completely killed by the stalk rot disease before harvest. Pathologists at the University of Minnesota have shown, as a result of a three year study in Minnesota, that yields were reduced by as much as 17%.

About 40 three-way experimental hybrids were grown at the South Central Research Farm. In the case of each of these hybrids one of the parents consisted of an inbred line which was being evaluated for its disease control benefits. This may be reflected in better yields, drought resistance, reduced lodging, and standability at harvest time.

The inbred lines which were incorporated in the hybrids referred to above are the results of research conducted by the Plant Pathology Department over the past several years to develop disease resistant inbred lines for ultimate use in commercial hybrids.

As a guide for yield comparisons, four commercial hybrids considered to be best adapted to the area were included in the experiment.

Except for one commercial hybrid, the top 25 highest yielding hybrids were three-way disease resistant crosses. The exception was South Dakota 420, which is a four-way commercial hybrid that yielded 67.6 Bu/A. The top performance hybrid yielded 71.6 Bu/A.

It would appear that the yields of these potential new hybrids might be sufficiently better adapted to the rainfall limitations of the area. This together with the protection from soil-borne root and stalk rot diseases, may provide a basis for silage production. The ear yields would indicate reasonable quality silage in five out of the six years. A near crop failure occurred one out of six years. Yields during this period ranged from 30 to 71 Bu/A. These results also indicate that these new root and stalk resistant hybrids might extend the corn growing area beyond its present range.

Control of Wheat Streak Mosaic

G. W. Buchenau and G. B. Orlob

Control by Delayed Planting: Recommendations for planting winter wheat following the first week in September have resulted in effective control of wheat streak mosaic for the fifth consecutive year.

Table 31. Effect of Planting Date on the Incidence of Wheat Streak Mosaic and Yield of Winter Wheat in 1959, 1960, 1962, and 1963.

Planting Date	1959[a]		1960[b]		1962[c]		1963[d]		4-Year Average Yield Bu/A
	Mosaic %	Yield Bu/A	Mosaic %	Yield Bu/A	Mosaic %	Yield Bu/A	Mosaic %	Yield Bu/A	
August 15	97	0.8	tr.	30.6	40	9.2	30	14.8	13.9
August 25	95	2.8	tr.	37.7	10	7.9	15	20.4	17.2
September 4	65	7.6	tr.	35.6	2	5.3	1	28.5	19.3
September 14	8	14.0	tr.	31.9	tr.	6.6	tr.	33.2	21.4
September 24	6	14.0	0	23.8	tr.	3.5	tr.	36.3	19.4
October 4	1	10.0	0	18.1	tr.	1.3	tr.	34.1	15.9
					LSD	1.5	--	2.9	

[a] Dry year with severe mosaic and little rust
[b] Good year with little mosaic and little rust
[c] Good year with moderate mosaic and very heavy rust
[d] Good year with moderate mosaic, little rust and late frost.

Table 1 shows that planting after September 4 gives good control of wheat mosaic and consequently higher yield and grain quality in moderate and severe mosaic years (1959 and 1963). In 1963 later plantings also escaped damage from a late spring frost which may have been partially responsible for low yields in the early plantings. On the other hand, earlier plantings in a severe rust year (1962) were somewhat better in spite of failure to control mosaic. In a year when neither disease was severe (1960), planting dates from very late August to Mid-September were satisfactory. Although current data indicate that the "best" average planting date is September 14, results from more years are desirable. A decision to plant early in order to control rust would be of questionable value because rust is a severe problem in south central South Dakota less frequently than is mosaic. Furthermore, results from other states have indicated that early planting often results in increased winter kill and root rot.

On the other hand, growers in the northern section of the state less frequently encounter serious damage with wheat streak mosaic. Consequently, planting dates in such areas might be slightly earlier than those chosen in areas where mosaic is more damaging.

Transmission and Spread of Wheat Streak Mosaic

G. B. Orlob

Experiments were designed to study the influence of successive plantings of resistant and susceptible small grains on the occurrence of wheat streak mosaic in adjacent winter wheat. A continuous planting of spring wheat, which is susceptible to both virus and mite, produced 83 per cent infection in the fall crop. Successive plantings of oats, which is a less suitable food plant of the mite, resulted in a 19 per cent infection of the adjacent winter wheat plot. These findings indicate that a continuous presence of wheat during the summer months serves as an important reservoir of virus and mites. It also stresses the need for the destruction of volunteer wheat prior to planting of winter wheat.

However, data obtained from isolated plantings of winter wheat in the White River area indicate that wheat streak mosaic can appear without the presence of wheat or susceptible grasses in the adjacent area. Three out of five plots planted on August 20,1963, had contracted the disease by October 11; all five plots were infested with the mite. It is postulated that mites like other small organisms are dispersed by wind over long distances and are responsible for introducing the virus to the wheat crop.

Table 32. Cooperating Counties and County Agricultural Extension Agents

Name	Address	County Representing
William Anderson	Chamberlain	Brule
Joseph Sperl	Lake Andes	Charles Mix
James Blackketter	Burke	Gregory
Robert Edwards	Murdo	Jones
Merle Aamot	Kennebec	Lyman
Eugene Zimmerman	White River	Mellette
Delwin A. Jensen	Ft. Pierre	Stanley
Louie DeSmet	Mission	Todd
Raymond H. Eilers	Winner	Tripp