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Research Progress Report: Eureka - North Central Substation, Highmore - Central Substation, Redfield-Irrigation Research Substation

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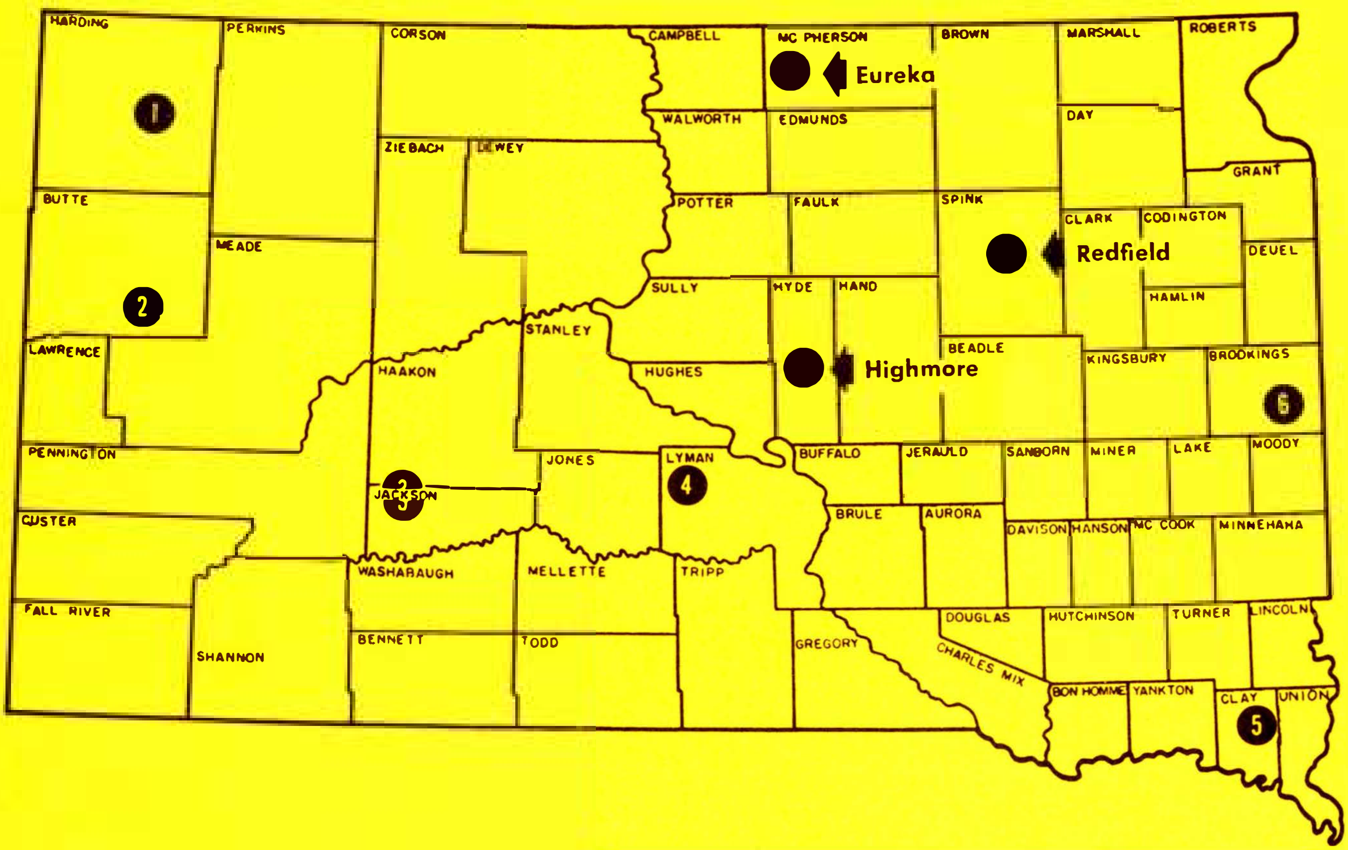
RESEARCH PROGRESS REPORT

EUREKA—North Central Substation
HIGHMORE—Central Substation
REDFIELD—Irrigation Research Substation



Agricultural Experiment Station
South Dakota State University
Brookings

Agricultural Experiment Station
South Dakota State University
Brookings, South Dakota

Orville G. Bentley, Director A. L. Musson, Ass't Director

This progress report combines a summary of research conducted at Eureka, Highmore and Redfield substations of the South Dakota Agricultural Experiment Station. While the area of each of the substations has its own specific problems or differences as far as agricultural production is concerned, combined they form a large somewhat similar area in central-northern-eastern South Dakota in which research activities can be related.

Results shown are not necessarily complete nor conclusive. Interpretations given are tentative because additional data resulting from continuation of these experiments may result in conclusions different from those based on any one year.

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The report for each area will be found on these pages:

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Other permanent substations making up the network of eight covering the entire state as indicated on the South Dakota map on the cover are:

1. Harding County. Antelope Range Field Station, Buffalo.

2. Butte County. U. S. Irrigation and Dryland Field Station, Newell.

3. Jackson County. Range Field Station, Cottonwood.

4. Lyman County. Reed Ranch Field Station, Presho.

5. Clay County. Southeast South Dakota Experiment Farm, Centerville.

Headquarters and the main station of South Dakota Agricultural Experiment Station of the South Dakota State University are located at Brookings, South Dakota.

AGRICULTURAL ADVISORY GROUP

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Eureka

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SOUTH DAKOTA STATE UNIVERSITY
John T. Stone, Director

County Extension Agents of the North Central Substation Area

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Leonard Nelson	Ipswich	Edmunds County
Wayne Nesby	Leola	McPherson County
James Perkins	Selby	Walworth County

NORTH CENTRAL SUBSTATION

Eureka

Contents

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INTRODUCTION

Albert Dittman

Much has been accomplished during the past 10 years; but, undoubtedly, the future presents far more challenging problems than the past. Research has increased greatly during the last 25 years, but the need for more research is becoming more urgent each year. Inadequate facilities, equipment, land, and finances are all limiting factors which reduce the amount of research that can be carried on at the North Central Substation.

Among the many natural resources in the north central area, one of the most important is grass. Several years ago the area Soil Conservation Committee, and the North Central Substation Advisory Committee requested more research on our native grasses, but an expanded program for grassland research did not materialize. However, this effort may have paved the way for the work now started at the Plains Research Station at Norbeck, South Dakota.

The farmers in the north central area put up good roughage feed, but which of the feeds grown here are best adapted for the type of feeding done in the area? Also, which is the more economical way to feed the cattle--feeding out or wintering at a moderate gain?

Progress reports for the several research projects at the North Central Substation are explained in more detail throughout this report. The work by the Agronomy, Horticulture, and Plant Pathology Departments has resulted in higher yielding, better adapted crops and improved crop rotations, and a better understanding of disease control. Newer varieties better adapted to the North Central area have been and continue to be developed.

Animal, Poultry, and Veterinary Science Departments are concerned with the improvement of livestock and poultry, their management, and disease control. Breeding projects and nutritional studies have provided valuable information for the farmer and have demonstrated possible alternatives in livestock production for the area. Agricultural Engineering has directed its attention to the development of improved farm structures, farm building ventilation, farm machinery design, and the recording of climatic conditions.

The effort, time and study put forth by these various departments should pave the way for a greater and better South Dakota, especially in the north central area.

One characteristic of South Dakota's climate is the daily and seasonal variation. As our state slogan--Land of Infinite Variety--indicates, the weather is not monotonous. Its variability makes the State's climate one that requires adaptability and wise planning.

The climatic factors which limit the development of agriculture in the state are temperature and rainfall. Both agriculture and business seek information which will enable them to overcome the handicaps caused by the variations in South Dakota's temperature and precipitation. The following pages show the average temperature and precipitation along with the departure from normal, given for each month for the past 10 years. The averages and departures are figured on a 25 year basis.

Climatic Summary

The 1955 small grain season was characterized by above normal temperatures and below normal rainfall. Fall rains in 1954 had restored the soil moisture reserve and provided moisture to start the crop, but windy April rapidly exhausted this moisture. A severe drouth in May limited early growth of small grains, and pushed early varieties toward early heading. Late in May rains came and June was favorable. After late June the crop received no further rain until ripe. Despite the July drouth, test weights were good and yields were not reduced seriously.

The severe heat and drouth in May resulted in serious weed problems. Grasshoppers were numerous and would have caused some damage, but the early maturity of the 1955 crop gave it escape value. Aphids and greenbugs were common to severe in the cool damp weeks of early June and May which reduced yields to some extent.

The fall rains of 1955 were not sufficient to restore the soil moisture reserve, but spring rains of 1956 did help to get the crop off to a good start. June is the critical month in small grain production. An early June intense heat wave of long duration, equalling the famous "Memorial Day heat wave of 1936", hit small grain that was already short of moisture. Subsequent temperatures in late June and July were quite cool, but lack of moisture prevented recovery.

Soil moisture reserves were abnormally low for the fourth consecutive year, and this slowed early small grain development and made the standing crop extremely liable to heat injury.

In 1957, the very low moisture reserve on April 1 gave little indication of reasonable small grain yields. Even as planting was in progress, the situation began to change. Abundant rainfall and low temperatures in the first couple of months of the growing season were very favorable to heavy tillering and thick stands of all small grain. In early July, very severe winds lodged many acres of small grain. High temperatures and sudden drop-off in rainfall from late June to late July, put severe stress on all small grains not close to maturity. Test weight of late maturing spring wheat, barley and especially oats, was reduced severely. There was no severe damage from stem rust in 1957 although some observations indicated changes in the races of stem rust.

In 1958, the moisture reserve had not improved to any degree but as planting progressed moisture conditions did improve by late May. Crop growth was dependent upon local showers. The critical month of June was dry and yields were reduced. Severe July storms lodged many acres of small grain. Hail was a great threat in this area and many acres were hailed out.

The reserve moisture conditions in 1959 had not greatly improved and again the small grain had to depend upon local showers for moisture. Most of the seeding was completed by May when moisture conditions improved greatly. Temperatures remained below normal; the growing conditions were very favorable and heavy tillering took place. High temperatures and reduced rainfall in June and July reduced yields considerably.

The 1960 season was one of the more successful seasons for small grain. Cool temperatures with a relatively dry spring got seeding under way. Late April moisture and heavy rains in May got the small grain off to a good start. The badly needed showers in June failed to come, but cool temperatures helped to conserve the moisture that was present. July temperatures and low moisture conditions reduced the small grain yields.

The soil moisture reserve condition in 1961 was somewhat improved, but early spring rains were far and few between and the reserve was soon depleted. Throughout the growing season moisture conditions for the area were below normal. Even though yields were limited by lack of adequate rainfall, especially early in the growing season, production was possible because of the cooler season. Also, moisture conservation practices lowered the moisture requirement and prevented a total failure of the crop.

Near record quantities of snowfall in early 1962 contributed to excessive surface water retarding spring operations. With heavy rainfall in May, many fields had to be seeded late or not at all. The wet field conditions slowed up corn planting, and many areas throughout the State did not get their corn planted. With the high moisture conditions and cooler temperatures, the small grain had heavy tillering. Yields were very favorable this year.

Lack of moisture in 1963 until the middle of June caused uneven germination. Higher than normal temperatures in April did encourage rapid germination. Subnormal temperatures accompanied the below-normal precipitation during May. A hard freeze on May 22 was detrimental to rye that had begun to head, and caused much damage to winter wheat. Flax escaped with little or no injury. It would normally be expected that a sudden drop in temperature so late in May would kill flax. However, three days prior to the severe freeze, temperatures hovered just above freezing and the activity within the plants had become very low. Had the drop occurred following several days of favorable growing conditions, the damage would have been more severe.

The soil moisture conditions were fairly favorable and the early spring rains got the small grain off to a good start. Due to long dry periods in May the corn germination was very uneven. June precipitation was much above normal but most of this fell June 18--6.73 inches in about seven hours. In McPherson County alone, crop damage was estimated at two million dollars. Small grain yields were reduced by soil compaction, soil erosion, pollen destruction, and weed growth. Grasshoppers were at a high population late in the season.

PRECIPITATION

Total Precipitation per Year and Departure from Normal

Month	1955 Tot Pre	1955 Dep	1956 Tot Pre	1956 Dep	1957 Tot Pre	1957 Dep	1958 Tot Pre	1958 Dep	1959 Tot Pre	1959 Dep	1960 Tot Pre	1960 Dep	1961 Tot Pre	1961 Dep	1962 Tot Pre	1962 Dep	1963 Tot Pre	1963 Dep	1964 Tot Pre	1964 Dep
Jan	.21	-.10	.81	.43	.19	-.19	.69	.31	.27	-.11	.19	-.19	T	-.38	.47	.08	.26	-.13	.04	-.35
Feb	1.12	.71	.12	-.27	.32	-.07	.82	.43	.45	.06	.32	-.07	.20	-.19	.73	.33	.35	-.05	.15	-.25
Mar	.12	-.47	1.21	.52	.10	-.59	.22	-.47	.06	-.62	.28	-.41	.45	-.24	.21	-.42	.84	.21	.43	-.20
Apr	1.31	-.16	.50	-.88	2.65	1.27	1.36	-.02	.53	-.85	.86	-.52	.93	-.45	.38	-.97	.99	-.36	2.37	1.20
May	2.24	-.06	3.26	.86	3.91	1.51	2.46	.06	4.33	1.93	3.71	1.31	2.39	-.01	3.61	1.02	2.69	.10	2.95	.36
June	2.72	-.64	2.96	-1.06	3.51	-.51	3.90	-.12	2.13	-1.89	1.94	-2.08	2.61	-1.41	3.66	-.17	2.98	-.85	9.59	5.59
July	2.08	-.20	3.93	1.56	3.61	1.24	3.15	.78	1.80	-.57	1.71	-.66	1.67	-.70	6.18	3.73	2.55	.10	2.37	-.08
Aug	3.25	1.08	4.30	2.10	4.06	1.86	1.31	-.89	2.51	.31	5.13	2.93	1.33	-.87	1.14	-1.27	3.54	1.13	.80	-1.61
Sept	1.15	-.32	.51	-.79	2.75	1.45	.57	-.73	1.99	.69	1.46	.16	4.36	3.06	2.76	1.44	1.66	.34	.74	-.56
Oct	.16	-.76	1.25	.26	1.56	.57	.52	-.47	.79	-.20	.28	-.71	.16	-.83	.41	-.56	.72	-.25	T	-.96
Nov	.32	-.13	2.21	1.83	.55	.17	.95	.57	.42	.04	.20	-.18	.08	-.30	.39	-.07	0.14	-.32	.15	-.31
Dec	.31	-.01	.17	-.08	.29	.04	.34	.09	.10	-.15	.41	.16	.27	.02	.09	-.17	.17	-.09	.19	-.07
Total	14.99	-1.06	21.23	4.48	23.50	6.75	16.29	-.46	15.39	-1.36	16.49	-.26	14.45	-2.30	20.03	2.97	16.89	-.17	19.78	2.72
Nor-mal	16.05		16.75		16.75		16.75		16.75		16.75		16.75		17.06		17.06		17.06	

TEMPERATURE

Average Temperature per Year and Departure from Normal

Month	1955 Temp	1955 Dep	1956 Temp	1956 Dep	1957 Temp	1957 Dep	1958 Temp	1958 Dep	1959 Temp	1959 Dep	1960 Temp	1960 Dep	1961 Temp	1961 Dep	1962 Temp	1962 Dep	1963 Temp	1963 Dep	1964 Temp	1964 Dep
Jan	15.8	5.7	9.3	-1.3	4.3	-6.3	20.0	9.4	6.7	-3.9	10.8	0.2	13.1	2.5	9.0	-1.6	4.0	-6.6	18.4	7.8
Feb	8.5	-5.7	7.4	-7.4	16.3	1.5	11.8	-3.0	8.0	-6.8	12.2	-2.6	19.4	4.6	11.5	-2.7	18.9	4.7	22.3	8.1
March	24.9	-3.4	25.8	-0.9	29.1	2.4	28.9	2.2	32.8	6.1	16.3	-10.4	36.2	9.5	21.9	-4.8	36.7	10.0	22.9	-3.8
April	51.9	8.1	38.3	-5.6	42.6	-1.3	44.7	0.8	42.6	-1.3	42.1	-1.8	39.3	-4.6	43.8	0.2	44.0	0.4	44.8	1.2
May	60.7	5.4	55.6	-0.7	53.7	-2.6	59.4	3.1	53.3	-3.0	55.2	-1.1	53.1	-3.2	56.2	0.1	54.6	-1.5	57.2	1.1
June	63.4	-1.5	69.9	4.8	62.7	-2.4	59.6	-5.5	68.3	3.2	62.2	-2.9	69.0	3.9	63.8	-1.2	68.3	3.3	65.3	.3
July	75.0	3.0	68.1	-4.7	74.1	1.3	66.3	-6.5	72.3	-0.5	73.3	0.5	69.9	-2.9	66.4	-6.0	72.2	-0.2	72.6	.2
Aug	73.3	3.9	67.8	-2.8	68.8	-1.8	71.9	1.3	74.6	4.0	70.5	-0.1	74.1	3.5	69.4	-1.3	70.4	-0.3	66.3	-4.4
Sept	60.1	0.5	58.8	-1.4	56.5	-3.7	61.6	1.4	59.4	-0.8	60.0	-0.2	54.6	-5.6	57.0	-3.1	61.6	1.5	56.8	-3.3
Oct	49.7	3.6	52.5	4.9	46.5	-1.1	48.9	1.3	41.7	-5.9	48.5	0.9	47.9	0.3	49.7	2.1	57.0	9.4	46.8	- .8
Nov	18.5	-11.1	31.1	1.2	31.5	1.6	30.1	0.2	22.3	-7.6	30.5	0.6	30.8	0.9	35.5	5.7	35.1	5.3	27.9	-1.9
Dec	7.3	-8.9	22.2	5.1	25.8	8.7	14.3	-2.8	26.1	9.0	15.4	-1.7	10.3	-6.8	20.2	2.5	10.8	-6.9	7.2	-10.5
Avg Temp	42.4	-0.1	42.2	-0.8	42.7	-0.3	43.1	0.1	42.3	-0.7	41.4	-1.6	43.1	0.1	42.0	-0.9	44.5	1.6	42.4	-0.5
Avg Temp per Yr	42.5		43.0		43.0		43.0		43.0		43.0		43.0		42.9		42.9		42.9	

FRUIT PLANTINGS

R. M. Peterson

An orchard was first planted at the Eureka station about 25 years ago. The apple plantings consisted primarily of hardy selections and varieties of poor quality. During the past 5 years, many of these have been replaced by newer varieties of superior quality. These are just starting to come into production and it is hoped they will serve as a basis for variety recommendations.

Plums did very well, demonstrating that they may be grown in the area. The trees were removed so that other fruits could be tested.

North Star and Meteor sour cherries have been tried in test plantings. Meteor is doing well and has no winter damage. North Star has not done well.

Of the small fruits, Latham red raspberry has done very well. Gooseberries and red currants have also performed well but in some years need to be sprayed for foliage diseases.

Three varieties of strawberries--Senator Dunlap, Robinson, and Vermillion--were set out but were not winter mulched so winter hardiness cannot be evaluated. Senator Dunlap has produced well despite the lack of protection, but Robinson and Vermillion failed to survive.

All fruit, including the orchard trees, has been grown under clean cultivation. This reduces competition for moisture to a minimum. It appears that red raspberries, gooseberries, currants, and strawberries as well as apples, plums and sour cherries have a place in the home orchard in north central South Dakota.

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Flowers

Most of several kinds of annual flowers planted at Eureka in recent years have performed well. The planting has demonstrated that some of the more frost tolerant kinds, such as petunias, can put on a good display right through the summer until late fall.

1964 SOYBEANS

A. O. Lunden and C. J. Franzke (Emeritus)

Objective: Performance testing of experimental South Dakota soybean lines and potential. Regional releases.

Replicated yield tests of 48 regional soybean lines and varieties and 11 experimental lines produced an average yield of only 10 bushels per acre in 1964. This was an especially poor year due to cold weather and uneven moisture. Yields of selected lines are reported below. All lines were immature at harvest and seed quality was low. Variety comparisons are not dependable from this data.

Yield and Field Performance of Selected Soybean Lines

Line	Yield Bu/acre	Days to Maturity	Height
Grant	12.3	121	24
Merit	13.2	120	26
Norchief	13.9	121	23
Chippewa	11.6	124	24
Chippewa 64	11.9	123	25
M 406	14.0	121	27
12-14-1B	13.5	123	25

1964 GRAIN SORGHUM

A. O. Lunden and C. J. Franzke (Emeritus)

Objective: Preliminary testing of South Dakota sorghum lines and hybrids.

Field plots of 24 sorghum lines and hybrids were planted for yield tests. Moderate bird damage before harvest and extremely poor weather conditions coupled with an early frost resulted in low yields in 1964. The planting will be repeated in 1965 with special treatment to prevent or reduce losses from birds.

Grain Sorghum Performance Trial

Eureka, 1964

Variety	Percent Moisture	Height inches	Date Headed	T.Wt lb/bu	Yield, 100#/A 1964	Yield, 100#/A 1962-64	Statistical Significance
NK 120	15.4	40	8/8	46	14.2	21.2	
NK 125	11.1	46	8/10	42	11.5	20.8	
NK 115	10.5	42	8/2	47	11.2		
SD 441	12.1	50	8/4	47	6.5	19.3	
SD 451	22.9	47	8/12	44	6.2	17.4	
Taylor-Evans 44	13.5	40	8/12	22	3.6		
SD 102	20.0	40	8/2	45	3.5	15.8	
DeKalb Shorty 33	16.1	41	8/8	37	3.3		
DeKalb B32	13.2	45	8/8	40	2.6		
RS 501	17.8	52	8/12	33	2.3	18.6	
Pawnee	23.5	49	8/10	34	2.3		
NK 144	12.0	41	8/12	32	2.2		
Pioneer 885	21.7	43	8/12	25	2.2		
PAG 430	22.7	41	8/18	32	2.1		
SD 503	10.4	51	8/12	33	2.0	18.4	
Rocket A	16.0	41	8/14	30	2.0		
RS 610	20.0	44	8/12	29	1.7	14.0	
NK 133	11.1	43	8/12	26	1.7		
PAG 304	15.0	35	8/15	31	1.6		
PAG 410	19.2	43	8/18	28	1.5		
RS 608	31.3	40	8/16	27	1.4	12.1	
SD 502	25.0	49	8/16	33	1.3		
Comanche	14.6	42	8/16	27	1.1		
Asgrow H623	15.4	38	8/20	20	1.0		
PAG 275	22.9	43	8/2	27	0.7		
Ute	14.3	40	8/20	18	0.6		
			Mean Yield		3.5		
CV - 37%			L.S.D. (.05)		2.1		

1964 CROP PERFORMANCE TESTING

J. J. Bonnemann

Results of 1964 small grain trials of spring wheat, oats and barley plus the 5-year averages given in tables below are from Experiment Station Circular 165, "1964 Small Grain Variety Trials."

Results of a corn performance trial, conducted as such since 1964 under supervision of the Crop Performance Testing Activity program, are in tables below from Experiment Station Circular 166, "1964 Corn Performance Trials."

A third program--a hybrid grain sorghum performance trial--is reported in the tables below from Experiment Station Circular 167, "1964 Grain Sorghum Performance Trials."

Standard Variety Spring Wheat and Durum Trials, Eureka 1960-1964

Variety	1960	1961	1962	1963	1964	1960-64	1964 Test Wt. lb/bu	Statistical Significance
	Average Yields, bushels per acre							
Lakota	16.8	11.5	30.6	15.6	50.1	24.9	60.0	
Wells	12.4	6.8	27.2	17.4	48.6	22.5	61.0	
CI 13586				17.9	45.4		61.5	
CI 13654				18.9	45.2		62.5	
CI 13751				17.8	42.6		61.0	
CI 13655					40.1		62.0	
Crim		23.5	23.4	12.3	39.7		61.0	
Justin		28.1	24.3	14.7	35.8		59.0	
Pembina		25.2	30.9	16.6	33.6		59.0	
Canthatch	15.2	32.1	21.8	16.5	32.6	23.6	60.0	
Thatcher	14.3	28.1	25.7	15.7	32.5	23.3	59.0	
Rushmore	15.0	23.5	24.5	16.4	32.4	22.4	60.0	
Selkirk	13.5	19.3	29.0	13.8	31.0	21.3	56.5	
Lee	14.2	26.0	26.6	13.7	27.9	21.7	59.5	
		Mean yield			38.4			
LSD .05	N.S.		7.5	N.S.	6.5			

Standard Variety Oat Trials, North Central Substation, Eureka 1960-1964

Variety 1960 1961 1962 1963 1964 1960-64

Standard Variety Oat Trials, North Central Substation, Eureka 1960-1964

Variety	1960	1961	1962	1963	1964	1960-64	1964 Test Wt. Lb/bu	Statistical Significance
	Average Yields, bushels per acre							
Ortley	35.4		76.2	42.7	120.8		35.5	
Lodi				29.7	114.4		32.0	
Rodney			54.7	34.1	112.9		35.5	
Burnett	33.6	35.8	56.6	53.6	109.2	57.8	35.5	
Mo. 0-205	37.2	33.1	58.5	30.8	105.6	53.0	34.0	
Portage				44.9	102.4		33.0	
Garry	32.0	29.5	54.2	25.7	102.3	48.7	33.5	
Brave					99.9		32.5	
Minhafer	30.4	36.5	72.9	46.5	98.1	56.9	33.5	
Tippecanoe					97.9		34.5	
Coachman				53.0	95.9		33.0	
Dupree	27.8	38.5	47.4	35.4	92.7	48.4	32.5	
Bonkee				32.6	92.1		33.5	
Clintland 64					91.9		34.0	
CI 7978					91.7		32.0	
CI 7679					90.7		32.0	
Andrew	36.4	33.4	57.0	47.8	89.8	53.1	32.0	
AuSable				34.3	87.3		33.5	
CI 7463					85.9		34.5	
Neal			64.8	44.9	85.7		31.0	
Dodge		23.7	50.6	47.7	84.4		33.5	
Putnam 61					83.4		33.5	
Clintland 60	28.0	24.0	58.7	41.2	83.0	47.0	34.0	
Garland			60.6	51.6	82.5		34.0	
CI 7454					79.6		31.0	
Nehawka	32.6	29.1	59.7	27.7	67.6	43.3	33.0	
Mean yield					94.1			
LSD .05	N.S.	9.5	N.S.	13.9	25.4			

OAT PERFORMANCE NURSERY

R. S. Albrechtsen

The 1964 Uniform Early Oat Performance Nursery included entries primarily from states in the North Central Region and superior new strains from experiment stations, plus appropriate long-time check varieties and some recently released varieties. Most entries are of a maturity equal to or earlier than the Clintland type oats.

This nursery is grown by cooperating agencies throughout the North Central Region. Varieties originating at State Experiment Stations are normally grown in this nursery for 2 to 4 years prior to release as a new variety. Through such a cooperative testing program, varieties developed in one state may be found suitable for production in other states in the region.

Results of the Uniform Early Oat Performance Nursery[1]
Eureka, 1964 (E 64 UEOPN)

1964 Entry No.	C. I. No.	Variety or Source	Test wt.	Seed yield	Yield rank
			Lbs.	Bu.	
5	7693	Ill.	32.0	116.4	1
3	7969	Ill.	32.0	112.4	2
9	7639	Cltd. 64	33.5	104.9	3
2	8064	Ill.	32.0	96.4	4
7	7971	Ill.	32.0	96.2	5
15	7697	USDA	33.5	95.7	6
17	4988	Mo.-0-205	32.0	94.2	7
20	7690	Brave	30.5	93.9	8
8	7679	Purdue	32.0	93.4	9
18	7272	Nodaway	34.5	92.9	10
21	7680	Tippecanoe	35.0	91.9	11
1	8063	Ill.	32.0	90.7	12
16	7698	USDA	32.0	88.7	13
6	7970	Iowa	33.0	88.2	14
24	8039	Mo.	32.0	88.2	15
4	4170	Andrew	31.5	87.7	16
13	8066	Nebr.	29.0	86.2	17
10	8065	Purdue	35.5	85.2	18
14	839	Kanota	28.5	84.0	19
23	8038	Mo.	31.0	83.4	20
11	7463	Purdue	33.0	82.2	21
22	7805	Mo.	36.0	81.7	22
19	7663	USDA	34.0	78.5	23
12	2820	Columbia	31.5	72.5	24

1/ Seeded April 23, harvested July 29.
Overall mean yield = 91.1 bushels per acre
Number of reps = 1

Standard Variety Barley Trials, North Central Substation, Eureka 1960-1964

Variety	1960	1961	1962	1963	1964	1960-64	1964 Test Wt. lb/bu	Statistical Significance
	Average Yields, bushels per acre							
Larker		26.6	57.9	51.6	71.5		51.0	
Traill	13.6	24.3	33.4	43.8	65.6	36.1	48.5	
Liberty	22.2	26.5	46.5	52.1	57.7	41.0	47.5	
Plains		17.6	37.1	40.4	56.5		49.5	
Trophy		26.6	33.3	40.9	55.5		48.0	
Spartan	29.3		37.8	43.7	52.3		48.0	
Parkland	14.8		35.6	49.1	51.9		48.5	
Betzes	24.6	27.3	34.5	45.0	49.9	36.3	46.5	
Custer		24.4	36.1	50.5	48.2		43.5	
Otis			40.1	55.1	46.6		44.0	
Feebar	8.9	17.7	35.3	37.8	43.9	28.7	45.5	
Kindred	12.0	24.7	35.8	29.4	41.9	28.8	46.5	
		Mean yield			53.5			
LSD .05	4.6	6.1	10.3	7.8	10.1			

Two and Three-Year Average Yields and Moisture Percentages of Hybrid Corn Entries 1962-64

Variety	Yield, bu/ac		Percent Moisture	
	1962-64	1963-64	1962-64	1963-64
Cargill 577	40.8	28.2	31.1	22.8
Cargill 590	41.1	29.2	26.8	23.2
DeKalb 57		22.0		30.0
Funks G-10A		29.2		26.4
Master F-30		27.9		21.4
Master F-31A		29.0		20.1
Master F-34		28.5		28.4
Master F-35		24.6		20.5
Pioneer 3812		29.1		24.0
Pioneer 384	40.3	28.7	28.2	25.3
Pioneer 385	44.1	29.9	29.1	26.2
Pioneer 3862	36.9	28.1	22.4	19.4
Pioneer 388	37.0	26.5	23.6	21.2
Pioneer 391	39.1	32.1	22.7	19.5
Sokota 215		27.6		21.5
Sokota 225		28.7		17.8
Sokota 255	37.2	26.5	32.0	23.4
SD 210	34.1	27.1	21.7	18.0
SD 220	35.6	26.3	22.4	18.0
SD 240	42.8	32.8	26.3	21.9
SD 250	39.9	29.0	27.2	22.9

CORN PERFORMANCE TRIAL, EUREKA, 1964

Variety	Performance rating	Percent * R.L.	Percent * S.B.	Percent * E.D.	Yield, bu/ac	Percent Moisture	Statistical Significance
Pioneer 391 (4x)	2	1	1	4	35.3	23.3	
SD Exp 43 (4x)	1	1	6	3	35.0	20.5	
SD 240 (4x)	4	2	7	2	34.3	28.5	
Pioneer 3812 (4x)	7	4	3	12	33.4	30.5	
Master F-31A (4x)	6	0	2	6	32.7	25.8	
Pioneer 385 (4x)	13	3	1	2	32.3	31.0	
SD 210 (4x)	5	1	6	17	32.2	22.5	
DeKalb 45 (4x)	3	2	11	5	32.0	18.9	
Cargill 590 (4x)	9	4	12	12	31.7	27.0	
Pioneer 384 (4x)	14	0	1	6	31.5	31.2	
Sokota 225 (4x)	8	0	5	8	30.6	21.8	
SD Exp 44 (4x)	12	1	6	10	30.6	25.2	
Master F-34 (4x)	21	2	0	1	30.6	32.7	
Sokota 215 (4x)	19	2	5	28	30.4	29.1	
Pioneer 388 (4x)	15	5	10	4	30.3	27.7	
Northrup King KE 435(4x)	11	3	13	10	30.2	22.4	
Funks G-10A (4x)	24	6	6	4	30.1	33.4	
SD 250 (4x)	20	1	10	4	30.1	28.5	
SD 220 (4x)	10	0	17	28	30.0	21.7	
Master F-30 (4x)	18	2	2	2	29.9	27.3	
Pioneer 3862 (4x)	17	1	6	12	29.4	25.0	
DeKalb XL-15 (2x)	26	0	1	6	29.4	37.7	
Master F-15 (4x)	16	3	1	3	29.3	24.5	
Sokota 255 (4x)	23	3	1	11	29.2	29.5	
Cargill 577 (3x)	27	1	2	6	28.2	34.9	
Funks G-18A (4x)	28	3	2	4	27.8	36.1	
Pioneer 3854 (4x)	22	0	2	6	27.7	22.8	
Master F-35 (4x)	25	0	10	2	26.3	25.9	
Funks G-15A (4x)	29	0	9	7	25.9	38.5	
DeKalb XL-308 (3x)	30	1	0	4	25.1	38.1	
Northrup King KE 471(4x)	31	3	19	1	23.0	35.0	
DeKalb XL-325 (3x)	33	0	1	0	22.3	46.0	
DeKalb 57 (4x)	32	0	2	2	22.0	40.9	
			Mean		29.7	29.2	

CV-12.3% L.S.D.(.05) 5.1

R.L. - Root lodging
S.B. - Stalks broken
E.D. - Ears dropped

(2x) - Single cross
(3x) - Three-way cross
(4x) - Double cross

PASTURE AND GRAZING RESEARCH

R. A. Moore

Grazing with lambs on alfalfa paddock was resumed in 1964. Pure stands of hay and pasture type varieties, grazed for 5 years primarily as a persistence study, had fair to excellent stands at the end of that period. The plots were mowed for hay in 1963, and in 1964 4 levels of phosphorus fertilizer were applied to gain information on the recovery of stands

GRASS VARIETIES

James G. Ross

Nordan and Fairway crested wheatgrass and Vinall Russian wild rye have been found superior for persistence and early spring growth. Highest forage yields have been obtained from Lincoln bromegrass and Oahe intermediate wheatgrass. These grasses have also been satisfactory in seed production. In 1964, it was not possible to obtain comparable yield data because of drouth and uneven stands.

Different varieties of smooth bromegrass, intermediate wheatgrass and crested wheatgrass have shown little difference in yields when measured as hay production. Lincoln type bromegrass, Oahe intermediate wheatgrass and Nordan crested wheatgrass have yielded more on the average than other varieties. In combination with alfalfa, yields were between two to three times greater than grass by itself.

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TILLAGE EXPERIMENT

Fred E. Shubeck

Early results have been variable depending on climatic conditions. No conclusions or recommendations are made now. Objectives concern nitrogen application in stubble mulch tillage vs. conventional plow disk drag methods; soil temperature and moisture conservation of stubble mulch tillage; all tillage in spring vs. combination of fall and spring tillage for weed control, moisture conservation and grain yield; deep subsoiler tillage in fall vs. shallow fall tillage; yield comparisons from pony press, stubble mulch and conventional plow disk drag plant methods.

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ROOT AND STALK ROT DISEASE CONTROL IN HYBRID CORN, EUREKA

C. M. Nagel

Some 50 experimental three-way corn hybrids involving one root and stalk rot resistant parent in each were grown in 1964. Results show over-all performance including resistance to disease, lodging, moisture and yields. Only the 15 top-yielding three-way hybrids and commercial checks from each of two experiments are listed in the following tables:

Plots were planted on May 25 and harvested October 12.

Experiment # 1. Expt'l Hybrid or Commercial Check	Yield Bu/A	Moisture at Harvest	Experiment # 2. Expt'l Hybrid or Commercial Check	Yield Bu/A	Moisture at Harvest
Expt'l	40.0	27.8	Expt'l	40.1	27.4
ND307	39.7	21.2	SD210	37.7	21.7
SD220	37.5	20.0	ND307	37.0	21.9
SD210	37.4	23.5	Expt'l	38.7	28.6
Expt'l	37.7	29.6	Expt'l	38.1	29.5
P388	36.5	33.6	P388	36.8	30.8
Expt'l	34.2	25.9	Expt'l	36.7	32.5
ND110	33.7	25.4	Expt'l	34.1	26.2
Exp'l	33.9	27.1	SD240	35.3	30.6
"	32.6	29.9	ND110	33.8	26.5
"	31.8	27.6	Expt'l	33.6	27.0
"	30.9	27.5	SD220	31.7	22.8
ND132	32.4	33.2	Expt'l	33.5	29.3
SD240	32.1	34.8	Expt'l	34.6	36.0
Expt'l	28.2	26.7	Expt'l	32.4	30.8
Differences of less than 4.81 Bu/A are not significant differences.			Differences of less than 5.46 Bu/A are not significant differences.		

SYSTEMATIC ROTATION CROSSING AND SPF MANAGEMENT IN SWINE PRODUCTION

J. W. McCarty and Albert Dittman

(This report is from Animal Science Department Report No. AS64-22)

Work with swine at Eureka is intended to demonstrate:

1. Usefulness of systematic rotation breed crossing,
2. Herd management with SPF or disease free swine, and
3. Feeding and management for sound swine production.

Substation Facilities Not Elaborate

Facilities for swine at the substation are not elaborate. A barn, without running water or sewer system, was modified for farrowing by addition of "homemade" farrowing stalls. Necessary supplemental heat during farrowing is supplied by heat lamps. Pigs are raised on pasture from shortly after birth until reaching market weight of about 210 pounds. Pasture shelter is provided by portable houses. Complete ground mixed rations are self-fed in commercially available feeders and standard hog water fountains are used. Pasture of native grass-alfalfa is set up to be used as a three-year rotation. Complete growing and finishing rations and management are according to current experiment station recommendations.

The Breeding Program

Systematic rotation crossbreeding is a breeding program for taking advantage of genetic hybrid vigor which is the result of crossing two or more breeds. The advantages of hybrid vigor are realized in two general ways: (1) combining two breeds in the crossbred pig produces greater livability and growth rate, (2) using the crossbred gilt as a dam takes advantage of her greater fertility and mothering ability. Crossbreeding also makes possible the combination, in the crossbred, of the desirable traits from the two or more breeds used in the cross. For example, a three breed rotation cross might be planned to take advantage of the superior fertility of one breed, the superior growthiness of another, and the superior carcass characteristics of the third breed.

Since 1953, the 14-18 sow herd at Eureka has been maintained as a breed-line rotation cross in which crossbred gilts produced each season were mated to boars of the Hampshire, Duroc and Yorkshire breeds in their turn in the rotation. Boars were from inbred lines produced at the Brookings Station. Beginning with boars purchased to sire the 1963 pig crop, Hampshire and Duroc boars successively have come from SPF purebred herds in South Dakota. The 1964 pig crop was sired by Duroc boars and is the seventeenth crossbred generation since the crossing program was initiated at the Brookings Station in 1947.

Change to an SPF Herd

Atrophic rhinitis became a problem in 1959 and 1960. The decision was made to continue the herd from a nucleus group of animals "born" by hysterectomy and started in an SPF pig laboratory. The nucleus animals, or so-called primary SPF pigs, were raised at the substation during 1961 following a six month break in hog production there. A minimum break in production of six weeks is necessary. The rotation crossing program has since continued using purchased certified SPF boars and gilts produced in the herd each season. No special management or rations are provided nor have they been found necessary, except that there is strict control to maintain isolation of the pigs.

The Meaning of SPF

SPF (Specific Pathogen Free) or as sometimes called "disease free" are terms used to describe a system of managing swine to eliminate two costly swine diseases, atrophic rhinitis (AR) and virus pig pneumonia (VPP). These diseases are transmitted from one pig to another by pig-to-pig contact. Breaking this contact is accomplished by hysterectomy (surgical removal of pigs from the sow just before normal farrowing), and artificial rearing of the baby pigs to four weeks of age. Continued isolation of the herd from non-SPF pigs is necessary to keep the "clean" herd free of AR and VPP.

Herds in which AR and VPP have not been a problem can be infected by bringing in apparently healthy but actually carrier animals, such as breeding animal replacements. Certified SPF herds are the source of "clean" breeding animals with respect to these two diseases. Certification is maintained in these herds by having representative samples of pigs in each pig crop subjected to slaughter inspection of snouts and lungs.

Replacement boars or gilts which a producer might buy from a purebred SPF herd are not necessarily either more or less desirable genetically for productivity than similar boars or gilts from non-SPF herds. Such boars or gilts cannot transmit disease resistance or freedom from AR or VPP to their offspring when used in non-SPF herds. The use of SPF herd replacements assures the buyer that he is not unknowingly infecting his herd with either disease. However, if either disease is already present in his herd he will not, by using an SPF boar, change the disease status of his herd.

SPF procedures or the purchase of SPF animals are useful when:

1. A producer wants to "clean up" a herd in which these two diseases are seriously limiting herd productivity, or
2. A producer wants to be certain he does not unknowingly buy AR and VPP with his replacement breeding animals.

Herd Performance

During the 7-year period, 1954 through 1960, records show that performance averages for the Eureka herd were: 11.0 pigs farrowed alive per litter, 9.7 pigs raised per litter, 56 day (weaning) litter and pig weights of 379 and 39 pounds respectively, and average 5 month (154 day) weight per pig of 188 pounds. Over this period, this herd has produced an average of about three profit pigs per litter at a marketing age averaging under 5 1/2 months.

Since repopulation of the herd with SPF pigs, data are available for only two seasons when herd size is again in the 14-18 litter range. Therefore, comparison of performance now with that prior to the removal of some disease stress is difficult. Performance for the two seasons is shown in tables below.

Eureka Station Litter Performance Summary - 1963, 1964

	1963 Spring			1964 Spring		
	Sire 1	Sire 2	Herd	Sire 1	Sire 2	Herd
Number litters	9	10	19	8	9	17
Average number pigs						
Farrowed	10.7	12.5	11.6	10.5	12.6	11.6
56 days (weaning)	9.1	9.5	9.3	9.2	10.8	10.1
154 days (5 months)	8.7	9.2	8.9	9.2	10.8	10.1
Average pig weight						
Farrowed	3.0	2.8	2.9	3.0	2.8	2.9
56 days	45	43	44	46	47	46
154 days	226	209	216	214	230	223
Average litter weight						
Farrowed	32	35	34	32	36	34
56 days	414	409	411	425	509	469
154 days	1956	1919	1936	1980	2480	2245

Note that for each year's summary data are shown according to sire groups and also combined into a herd average. Performance differences between sire groups are often large enough so that selection of herd replacements with such differences in mind may be advantageous. Weights of pigs at 56 and 154 days suggest some improvement in growth rate in the herd.

As more data becomes available, meaningful comparisons will be possible which reflect the improvement in performance of this herd as a result of removing the disease stress of AR and VPP from the Eureka Station environment.

Carcass data (table 2) are collected on a representative sample of barrows from each pig crop so that a complete picture of herd productivity is possible. Carcasses produced from this herd are of acceptable quality for today's market but could be improved by reduction in backfat and increases in loin eye size and ham and loin yield. Choice of herd replacements will reflect these considerations.

Although as shown in table 1 1964 season pigs by Sire 2 are growthier (compare 154 day weights), table 2 suggests that pigs by Sire 1 produced more acceptable carcasses. Both traits need to be considered as a part of the swine production program.

Eureka Station Carcass Data Summary - 1963, 1964

	1963			1964		
	Sire 1	Sire 2	Herd	Sire 1	Sire 2	Herd
Number carcasses	29	37	66	27	42	69
Average						
Market age, days	151	153	152	151	150	150
Market weight, lb.	228	219	223	213	216	214
Carcass length, in.	29.6	28.9	29.2	29.6	29.4	29.4
Carcass backfat, in.	1.71	1.58	1.64	1.50	1.67	1.60
Loin eye area, sq. in.	3.91	3.94	3.93	4.03	3.81	3.89
Percent ham-loin	35.2	35.9	35.6	37.8	36.1	36.8
Percent lean cuts[1]	52.3	53.3	52.8	54.7	52.9	53.6

[1] Includes trimmed ham, loin, butt and shoulder.
Carcass data collected through the courtesy and cooperation of Armour and Company, Huron, South Dakota.

Comment

Pigs at the Eureka Station are produced in an environment which combines excellent management, a sound breeding program, adequate but not expensive equipment and facilities, and the use of recommended rations for all stages of production. Veterinary checks of snouts and lungs of barrows slaughtered for carcass data indicate that AR and VPP are not disease problems in the herd. Strict herd isolation is observed to maintain freedom from these two diseases. Very satisfactory performance is achieved under the conditions at the station.

MEAL OR PELLETED BARLEY RATIONS, THE EFFECT OF SHADED FEEDERS AND WATERERS FOR GROWING-FINISHING PIGS ON PASTURE

J. W. McCarty, R. W. Seerley and Albert Dittman

(This report is from Animal Science Department Swine Report No. AS64-26)

This trial was conducted at the Eureka Station which is an area of the state where barley is relatively more easily available than corn as a swine feed.

Barley has been shown to have about 90% of the feeding value of corn when properly supplemented. Barley has higher protein content than corn but also has a higher fiber content. One means which has been used to make this otherwise excellent feed more useful is to pellet complete ground mixed barley rations. Results have been variable with respect to improved pig gains and feed efficiency when barley rations were fed in both meal and pelleted form.

Pasture-raised spring pigs which are provided with only minimum shelter and have access to feed and water free-choice usually appear to be uncomfortable on warm days. Eating and drinking is usually limited to the night or cooler periods of the daytime. It is known that excessive heat reduces feed consumption which in turn reduces gains. Shade over feeders and waterers might be a means of permitting pigs to eat any time during the day.

Swine production facilities at the Eureka Station limit the production to pasture conditions which are typical of those found on many farms. The objectives of this trial were to: (1) Compare performance of pigs fed a complete ground mixed barley ration in both meal and pelleted form, (2) compare performance of pigs with and without shade for the feeder and waterer, and (3) determine, if any, the joint effects of these treatments.

Composition of the Barley Ration

Ground barley	870
Soybean meal (44%)	90
Meat and bone scraps (50%)	20
Dicalcium phosphate	6
Limestone	6
Trace mineral salt	5
Vitamin antibiotic premix[1]	5
Calculated analysis	
Crude protein, %	15.25
Calcium, %	.67
Phosphorus, %	.56

[1] Each pound of ration contained: 1500 U.S.P. units vitamin A, 150 I.U. vitamin D_3, 1 mg. riboflavin, 2.5 mg. D-pantothenic acid, 7.5 mg. niacin, 50 mg. choline, 5 mcg. vitamin B_{12} and 5 mg. oxytetracycline.

Results

This trial was conducted using two replicates of four treatments each. Statistical analyses showed that for the major treatment effects (meal or pellet form of the ration and shaded or not shaded feeders and waterers) performance of the pigs in the two replicates was essentially the same. Therefore, the data for both replicates were pooled and are reported as four treatments showing the four possible combinations of those treatments. In addition, the data were summarized to show the effects of meal or pelleted ration form and shade or no shade separately. Table 2 summarizes the latter comparisons, while tables 3 and 4 summarize the gain and feed usage information and the carcass information, respectively.

Pellets vs. Meal and Shade vs. No Shade

	Pellets	Meal	Shade	No Shade
Average daily gain, lb.	1.76	1.70	1.75	1.70
Feed per cwt. gain	335	380	358	356
Feed cost per cwt. gain, $	8.88	9.30	9.13	9.08

Under the conditions of this trial all pigs fed pelleted rations gained 3.5% faster on 11.8% less feed per hundredweight gain than pigs fed the same ration in meal form. The difference in daily gain of 0.06 pound was statistically significant. However, it is questionable that this difference is of practical importance. The difference in feed usage is important. Although pelleting cost an additional 20 cents per hundredweight feed, the reduction in feed requirement per unit of gain more than offset this extra cost.

The data indicate that there was no advantage in this trial from providing shade over the feeder and waterer.

Examination of the data showing the four treatment combinations (table 3) confirms the broader comparisons already discussed. In all comparisons physical form of the ration was of more importance in increasing gain and feed efficiency than was the presence or absence of shade for feeders and waterers.

Summary of Gain and Feed Data

	Lot 1 Meal Shade	Lot 2 Pellets Shade	Lot 3 Meal No Shade	Lot 4 Pellets No Shade
Number pigs per lot	26	26	26	26
Average initial weight	64.0	66.1	63.1	65.3
Average final weight	207	213	201	209
Average days on test	82.5	82.5	82.5	82.5
Average daily gain	1.73	1.77	1.67	1.74
Pounds feed/cwt. gain	375.0	341.3	384.9	328.7
Average daily feed/pig	6.49	6.05	6.42	5.72
Average feed cost/cwt. gain, $[1]	9.19	9.04	9.43	8.71

[1] Feed and processing costs: Barley $1.75/cwt., soybean meal $4.25/cwt., meat and bone scraps $5.25/cwt., dicalcium phosphate $6.25/cwt., limestone $1.80/cwt., trace mineral salt $3.00/cwt., vitamin-antibiotic premix $1.25 per 1000 pounds complete feed, grinding and mixing $0.20/cwt., pelleting $0.20/cwt., bagging $0.10/cwt.

Carcass data (see table below) were available only for the barrows which were at correct market weight when the trials were closed. Since pigs in lot 3 (see table on preceding page) gained at a slower rate than pigs in the other lots, fewer barrows were available from which to collect carcass information. (Distance from slaughter facilities prevented marketing all barrows for carcass test as they reached market weight.)

Barrows in lots 2, 3 and 4 were essentially similar in carcass characteristics. Barrows in lot 1 had less fat and had greater loin eye area than barrows in the other 3 lots. However, the differences were not large. The data do not support the conclusion that the treatments imposed were responsible for real differences in carcass quality characteristics.

Summary of Carcass Data [1]

	Lot 1 Meal Shade	Lot 2 Pellets Shade	Lot 3 Meal No Shade	Lot 4 Pellets No Shade
No. of carcasses	11	14	6	11
Average Market Weight	214.1	215.6	214.3	214.8
Average market age	152.5	152.9	152.3	151.8
Average carcass length	29.4	29.4	29.6	29.5
Average carcass backfat	1.54	1.63	1.63	1.66
Average loin eye area	4.20	3.94	3.81	3.86
Average % ham, loin[2]	38.0	37.0	37.2	36.7
Average % lean cuts[2]	55.5	54.1	54.3	53.3

[1] Collected with the cooperation of Armour and Company, Huron, South Dakota.
[2] As percent of cold carcass weight.

Summary

Under the condition of this trial:

1. Pelleting complete barley rations produced real but practically unimportant increases in average daily gain and affected feed efficiencies sufficiently to offset the increased cost of feed preparation.

2. Shading feeders and waterers was of no advantage to pig performance.

3. Neither physical form of the ration nor presence or absence of shade had important influences on carcass quality.

VALUE OF VARIOUS LEVELS OF HAY WITH ROLLED BARLEY FOR FINISHING CATTLE

L. B. Embry, A. E. Dittman and F. W. Whetzal

Four feeding trials have been conducted at the North Central Substation, Eureka, to determine the value of feeding various levels of hay with rolled barley for finishing beef cattle. The results of the four trials are summarized in this report.

Experimental Procedure

Four lots with 10 steers initially were fed in two feeding trials in each of the two years of this experiment. Calves which had been wintered for gains of around 1 lb. per head daily were used in the trials which were started in the spring, and yearlings were used in the trials started in late fall.

Four ration treatments used in each trial of the experiment were as follows:

1. Rolled barley
2. Rolled barley with 10% ground prairie hay
3. Rolled barley with 20% ground prairie hay
4. Rolled barley with free-choice prairie hay

The prairie hay fed during this experiment appeared to be of good quality and ranged in total crude protein content from 7.2 to 7.8 per cent, on a 10 per cent moisture basis. The hay was ground with a hammer mill using a 1-inch screen and mixed with the rolled barley. When offered free-choice, baled hay was supplied in a manger in the outside exercise lot. In the last trial with the yearling cattle, the hay offered free-choice was chopped.

The barley was obtained at a local elevator as needed. It was dry rolled at the elevator and mixed with the ground hay. A good grade of barley was obtained which averaged about 47 lbs. test weight. The average crude protein content was about 11.7% and the range during the experiment was from 11.2 to 12.1%.

A protein-mineral supplement was fed at a rate of 1 lb. per head daily to all lots. The ingredient composition of the supplement was as follows (%): soybean meal, 39; ground barley, 39; beet molasses, 5; ground limestone, 10; trace mineral salt, 6; and vitamin A premix, 1 (30,000 I. U. per pound of the supplement). A mineral mixture composed of equal parts dicalcium phosphate, ground limestone and trace mineral salt and additional trace mineral salt were offered free-choice.

The cattle had access to a shed with outside exercise lots. Water was provided by electrically-heated automatic waterers. The barley mixtures were offered in mangers inside the shed. The free-choice hay was provided in a manger in the outside lots. All feeding was once daily and fed in amounts to be available all the time, once the cattle were on full feed. All the cattle were implanted with 36 mg. diethylstilbestral at the beginning of the trials.

This report is from Animal Science Department Report No. AS 65-3. Prepared for the Ninth Annual Beef Cattle Field Day, April 21, 1965.

Trial 1. The 40 steers used in this trial were purchased in mid-April, 1962. They were full-fed prairie hay and 1 lb. of protein supplement prior to the beginning of the feeding trial on June 22. The average weight at this time was about 635 pounds. They were allotted to 4 lots of 10 steers on the basis of weight and one lot fed each of the four rations previously listed.

The cattle were started at 4 lbs. daily of the feed mixtures. The feed was raised one-half pound daily until the rate of feeding reached 10 lbs. per head daily. Thereafter, the raises were reduced to about one-fourth pound daily until the cattle were on full feed.

The lot fed hay free-choice was given free access to hay in a manger in the outside lot from the beginning of the experiment. The cattle in the other lots were fed hay during the first 3 weeks of the trial. They were fed hay at a daily rate per head of 6 lbs. the first week, 4 lbs. the second week and 2 lbs. the third week. No hay was fed to these lots except that in the feed mixture after the third week.

The cattle were marketed after 178 days on the trial. The final weights represent the market weight after being trucked about 180 miles. The initial weight was obtained after withholding feed and water for about 18 hours. Carcass data were obtained upon slaughter.

Trial 2. The cattle used in this trial were purchased with those used in trial 1. They were allotted into two uniform groups for drylot feeding (trial 1) and for pasture.

The cattle grazed native prairie pasture without supplemental feeding from June 22 to August 31, 1962. After this date, they were fed rolled barley on pasture. During late fall, they had access to standing grass or prairie hay. The barley was hand-fed to get the cattle on full feed and then self-fed from a self feeder.

There were only 38 cattle in this group when the drylot feeding trial was started on December 20, 1962. They were allotted into 4 lots of 9 or 10 steers each. The cattle averaged about 965 lbs. at this time.

Since the cattle were being full-fed barley at the time of the experiment, they were started at 8 lbs. of the rations and raised to a full-feed in about 2 weeks. Hay was fed at 2 lbs. per head daily for 3 days to lots where hay was part of the ration. It was fed at this level for 2 weeks for the lot fed rolled barley without hay. The cattle were marketed after 117 days on this experiment using procedures similar to those for trial 1.

Trial 3. The steers used in this trial were purchased in the fall and wintered on prairie hay and protein supplement for gains of about one pound daily. They were started on the barley trial on April 23, 1963, when they averaged about 550 lbs. Procedures for this trial were similar to those in trial 1. It was terminated after 232 days.

Trial 4. The steers used in this trial were from the same original group as those in trial 3. They grazed native prairie pasture without supplemental feeding from April 23 to October 27. Thereafter, until the beginning of the trial on December 17, they were fed about 4 lbs. of barley, 5 lbs. ground sorghum fodder, 1 lb. soybean meal per head daily and full feed of alfalfa-brome grass hay.

They were started at 6 lbs. per head daily of the feed mixture with the amount being raised one-half pound daily until on full feed. Hay was fed at 12 lbs. per head daily initially and reduced by 3 lbs. each week until no hay was fed except for the appropriate treatments after 4 weeks.

Results of Experiment

The feedlot performance in the experiment differed considerably for the steers put on full feed after the wintering period and those put on full feed after one grazing season. However, trends were quite similar for the two age groups. These results are, therefore, presented as an average for these two groups of steers.

Lightweight Group.

The results obtained in two feeding trials with steers put on full feed after the wintering period are presented in table 1. Rate of gain appeared to be improved by the addition of hay to the rations, with the highest rate of gain being obtained with the 10% level of hay.

The hay at 10% of the ration did not reduce consumption of barley. However, barley consumption was reduced slightly by higher levels of hay, either when mixed with barley at 20% of the ration or when offered free-choice. The total average daily hay consumption was the same under these two conditions and the rate of gain was the same. The cattle fed hay free-choice did consume slightly more barley.

The total feed consumed daily and per 100 lbs. of gain increased with increasing amount of hay in the rations. However, the total feed per 100 lbs. of gain was only slightly more when barley was fed with 10% hay than without hay. In this comparison, 100 lbs. of hay saved about 84 lbs. of barley on the basis of feed required per 100 lbs. of gain. The barley saved on the basis of feed requirements was somewhat less when the ration with 20% hay was fed. In this instance, 100 lbs. of the hay saved about 48 lbs. of barley.

While the steers fed hay free-choice consumed the same amount of hay daily and made the same rate of gain as those fed the ration with 20% hay, they consumed slightly more barley daily and per 100 lbs. of gain. The hay consumed in the free-choice ration saved only 33 lbs. of barley per 100 lbs. of gain in comparison to feeding no hay. These results gave hay fed free-choice a somewhat lower value than when ground and mixed with barley at 20% of the ration.

There were only small differences in dressing percent and carcass grade between the treatments. The cattle which received the various treatments were fed for the same length of time. Apparently the differences in rate of gain and final weights between treatments were not large enough to have much effect on carcass yield and grade.

Heavy Group (Yearlings).

The rate of gain did not appear to be affected to any appreciable extent in these two feeding trials by feeding rations with the various levels of hay or offering hay free-choice (table 2). These yearling cattle were more fleshy than the lighter cattle and made lower rates of gain.

These cattle consumed more feed than the lighter cattle. There was a decrease in barley consumption but an increase in total amount of feed with increasing amounts of hay in the ration. Thus the hay in the ration resulted in a reduction in the amount of barley required per 100 lbs. of gain. On this basis, 100 lbs. of hay fed at the 10% level saved 55 lbs. of barley. The value was somewhat less when hay was included at 20% of the ration, 100 lbs. saving only 28 lbs. of barley.

The cattle fed free-choice hay consumed less hay than did those fed the mixed barley-hay ration with 20% hay. However, they consumed enough more barley to give the same total feed consumption. These steers required only 25 lbs. less barley but 211 lbs. more hay per 100 lbs. of gain than those fed the barley without hay. On this basis the hay had a low value in relationship to barley, 100 lbs. of hay saving only 12 lbs. of barley.

Carcass grades and dressing percents would not indicate any important differences between treatment in these trials.

Summary

The effects of various levels of hay with rolled barley on rate of gain and feed consumption by finishing cattle appears to vary somewhat with initial weight and condition of the cattle. Calves following a wintering period gained at a faster rate when fed barley with hay than without hay. On the basis of feed required per 100 lbs. of gain, hay at 10% of the ration resulted in a greater saving of barley than when fed at 20% of the ration, 84 and 48 lbs. per 100 lbs. of hay, respectively, for the 10 and 20% levels.

With more fleshy yearling cattle, there were only minor differences in gain when no hay, 10% or 20% hay was fed with rolled barley. However, barley consumption was decreased but total feed consumption increased with increasing amounts of hay in the ration. The saving in barley on the basis of feed requirements in these comparisons amount to 55 and 28 lbs. per 100 lbs. of hay at the 10 and 20% levels.

Offering hay free-choice, baled or chopped in one trial, did not result in as efficient feed utilization as when consumed at approximately the same rate when ground and mixed with barley (20% level) in trials with both weight group of steers. Barley consumption was higher when hay was fed free-choice but gains were about the same as when the hay was mixed at 20% of the ration. There was some hay wasted under this system with the actual amount consumed being less than shown in the tables. Free-choice feeding of hay appeared to be a satisfactory method. Even with the higher feed requirements, the system would appear economical in comparison to the rations with 20% hay when the cost of grinding the hay and mixing with barley is taken into account.

Carcass grade and dressing percent did not show any important difference between treatments with either weight group of cattle.

Results of these feeding trials indicate that feeding some hay with rolled barley for finishing cattle is advisable from a management standpoint and that 10% of the ration appears to be an adequate amount. This level was more beneficial with lightweight cattle than with heavy yearling cattle. Higher levels of hay resulted in lower values for hay in terms of barley saved, especially when fed to yearling cattle and when offered free-choice.

Table 1. Dry Rolled Barley with Different Amounts of Prairie Hay
Trial 1 and 3 (lightweight cattle, 1962-63)

Item	Levels of Hay			
	0	10	20	Free-choice
Number of steers	19	19	19	19
Avg. Initial shrunk wt., lb.	593	586	591	592
Avg. Final shrunk wt., lb.	1093	1128	1105	1104
Avg. Daily gain, lb.	2.45	2.66	2.51	2.51
Avg. Daily ration, lb.				
Barley	18.2	18.2	16.7	17.4
Hay *	.4	2.4	4.5	4.5
Protein supplement	1.0	1.0	1.0	1.0
Total	19.6	21.6	22.2	23.9
Feed/100 lbs. gain, lb.				
Barley	745	684	666	693
Hay *	19	92	183	179
Protein supplement	41	38	39	39
Total	805	814	888	911
Dressing percent	61.0	61.2	60.7	60.9
Carcass Grade	19.2	19.4	18.4	18.9
Marbling Score	5.9	5.9	5.4	5.7

* Includes hay fed to get cattle on full feed

Table 2. Dry Rolled Barley with Different Amounts of Prairie Hay
Trial 2 and 4 (heavy yearling group, 1962-64)

Item	Levels of Hay			
	0	10	20	Free-choice
Number of steers	19	20	19	20
Avg. Initial shrunk wt., lb.	884	873	882	872
Avg. Final shrunk wt., lb.	1148	1136	1137	1128
Avg. Daily gain, lb.	1.96	1.95	1.92	1.90
Avg. Daily ration, lb.				
Barley	19.7	19.0	18.2	18.8
Hay *	.7	2.8	5.3	4.7
Protein Supplement	1.0	1.0	1.0	1.0
Total	21.4	22.8	24.5	24.5
Feed/100 lbs. gain, lb.				
Barley	1015	932	950	990
Hay *	38	189	273	249
Protein Supplement	51	51	51	52
Total	1104	1172	1274	1291
Dressing percent	60.6	60.7	60.5	59.7
Carcass grade	18.0	18.2	18.2	18.8
Marbling score	5.0	5.3	5.2	5.5

POULTRY - EGG LAYING TRIALS

Walter Morgan

Poultry houses at Eureka and Highmore are divided into four equal-sized pens for experimental purposes. Each September, 240 pullets hatched at Brookings in mid-April, are taken to each substation to be checked for egg laying performance and related factors during an 11-month period, October 1 to August 31. Rations and management practices are similar at both substations.

There are two differences each yeqr which may affect results in this project: (1) pullets have different kinds of parents, and (2) two locations in South Dakota are involved. Information from each substation includes number of eggs laid each day, weight of a sample of eggs each month, feed consumed, deaths and broody periods.

Past experiments show that outstanding egg laying performance may result when laying pullets are from two or more inbred lines of parents. One major objective of the substation studies is to determine effectiveness of developing useful inbred lines by different selection methods. Various mating combinations are made among the inbreds and with non-inbreds from the lines developed at the main station at Brookings. Pullets hatched from these matings are reared at Brookings for performance testing at the substations. Most inbred lines are difficult to maintain. They usually lay fewer eggs than non-inbreds, have a higher death rate, and poor hatchability.

This research seeks answers to breeders' questions such as "What effect does selection of the best layers in an inbred line have upon the performance of that line and upon the performance of hybrids resulting from the use of that line?"

Pullets from crosses involving the new White Leghorn inbred lines were first compared in the test-year ending August 1963. At Eureka, a pen of pullets from the selected inbreds laid eight more eggs per pullet than did those from the unselected inbred lines. At Highmore, the ½ullets from selected inbreds averaged 17 eggs more per pullet. Adult body weight and laying-house deaths were about the same for both groups at both locations. At Highmore, the pullets from the selected inbred parents laid larger eggs than did those from the unselected inbred parents.

During the following year several inbred lines were used to sire pullets to be tested at several substations. At Highmore, one select inbred line sire group and two unselected inbred line sire groups were used for three pens of pullets; the dams in each instance were from a non-inbred White Leghorn flock. At Eureka, one pen of pullets was sired by inbred Barred Plymouth Rocks, and another by non-inbred Barred Plymouth Rocks. The crossbred pullets were larger and had more broody periods than did the pure White Leghorns, but their egg production and egg size was not remarkably different than the purebred White Leghorns.

Thus far the results show that inbreeding causes a decline in egg production, in egg size, and in hatchability. It looks as though the egg laying ability of the pullets from crosses of one inbred line (E-3 which resulted from selection for high rate-of-lay) is better than the egg laying ability of pullets from any of the crosses with unselected inbred lines. This was surprising because one of the unselected inbred lines (G-4) was the most vigorous line, with large eggs and good hatchability. Some pens of pullets from select inbred lines did not lay better than some of the best pens from unselected inbred lines.

Results from the tests at the substations indicate that selection for high rate-of-lay while inbreeding develops White Leghorns which, in turn, are likely to produce better laying pullets than those which are inbred without such selection.

FORAGE CROPS FOR GROWING TURKEYS

Edmund Guenthner and C. W. Carlson

Previous studies have shown that turkeys grown from 10 weeks of age to market on range with alternating rows of corn and rape grew somewhat faster with less feed than those grown on range with alternating drilled strips of oats and rape. The advantage could have been due to the wind and shade protection afforded by the corn.

During the past two summers, corn or sorghum interplanted with rape the first season and with oats the second season, were the treatment variables. There were no differences in final weights or feed efficiencies of turkeys grown under these conditions. Sorghum or corn are therefore of apparent equal value as range crops for growing turkeys.

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Central Substation

Highmore

Pierre Barnes	Blunt
Fred Holscher	Faulkton
Henry Hertel, Jr.	Onida
Art Hibbison	Miller
Keith Kleppin	Wessington Springs
Francis Martens	Wessington
O. K. Peterson	Holabird
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THE COOPERATIVE EXTENSION SERVICE

South Dakota State University

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James Lickness	Pierre	Hughes County
Wilford G. Paynter	Highmore	Hyde County
Douglas Wallace	Faulkton	Faulk County
Harold E. Wood	Onida	Sully

CENTRAL SUBSTATION

Highmore

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INTRODUCTION

Frank Holmes

The Central Substation at Highmore consists of 117 acres. The work here has been devoted largely to crops research and, in earlier years, soils work. Calf feeding experiments are carried on in the winter time. A poultry project compares inbred and top crossed lines for egg production. An important study has been carried on in recent years on the value of preserving hay by different methods of storage--round bales, square bales, and loose stack.

The Horticulture Department maintains an experimental orchard of fruit trees and woody ornamentals. Each year the superintendent has a flower and vegetable garden which is of interest to the local garden clubs.

In the spring of 1964, farmers showed considerable anxiety because of wheat streak mosaic in winter wheat. An Extension tour was programmed in April and a large group of farmers took part. Tests indicated that fields ranged from 5% to 90% infected; consequently, some fields were plowed up and planted to spring grain.

The Advisory Board meeting was held in February with county agents and personnel from South Dakota State University. A tour of the farm, conducted by Extension Agronomist, Ralph Cline, was held in July.

The station has been a volunteer weather reporting station for more than 50 years. The weather records for the station are available from the Agricultural Engineering Department. The significant highlights concerning climatological data for the past 3 years are presented in the weather summary below.

Weather Summary

1962: The total precipitation was 25.59 inches. This was 8.49 inches above normal. During the growing season, from April 1 to September 1, there was a total of 21.09 inches of precipitation or 8.15 inches above normal. This was a good year for grain with temperatures 0.7 degrees below normal. The last frost in the spring, May 1 with a temperature of 30 degrees; first frost in the fall on October 17, temperature of 32 degrees; first killing frost on October 20, 26 degrees.

1963: The total precipitation was 19.49 inches. This was 2.39 inches above normal. Total for the growing season was 14.57 or 1.63 inches above normal. The last spring frost on May 22 was very late. This did considerable damage, especially to the rye crop. Blossoms on fruit and other trees were killed. Temperatures for the year were 2.2 degrees above normal. The first frost in the fall came on September 29 with 32 degrees; a killing frost came on November 27.

1964: Total precipitation was 17.45 inches or .35 inches above normal. During the growing season, precipitation was 16.51 inches or 3.57 inches above normal. These rains came in large amounts each time with long periods of drouth between and hot winds. Although normal rainfall from April 1 to September 1 is 12.94 inches and the amount received during that period in 1964 was 16.51 inches, the area still went into the winter with the driest conditions in years. To make the fall conditions worse, only .37 inches of rain fell from July 11 to December 11. The first frost came on September 24, killing frost on September 27. Last frost in the spring was on June 2 at 30 degrees and with no damage.

TREE PLANTINGS

P. E. Collins

Tree plantings at Highmore were made at three different times. The first, north and west of the buildings begun in 1942, included alternation of different species in the row and use of a large number of species. The second plantings, in 1952, included the three-row windbreak south of the buildings and a short section in the southwest corner. The third planting, in 1955, was a spacing study planted in the northeast quarter of the substation land.

The first two plantings were made primarily for protection purposes. All species performed satisfactorily except sandcherry and skunkbush which were removed because of a weed control problem. The alternation of species did not prove to be satisfactory and is not recommended. Adapted species include: common chokecherry, Siberian peashrub, Russian-olive, buffalo berry, common lilac, indigobush amorpha, Tatarian honeysuckle, green ash, American elm, hackberry, boxelder, Siberian elm, honeylocust, Dahurian buckthorn, Eastern redcedar and ponderosa pine. The latter two have grown exceptionally well.

The spacing study compared row spacings of 10 and 20 feet. Species used in this planting were Eastern redcedar, ponderosa pine, green ash, Chinkota elm and Tatarian honeysuckle. Establishment was no problem; all species survived and have grown well. In the close spacing it was not possible to cultivate the Chinkota elm after four growing seasons. It is now difficult to cultivate the pine rows since their crowns are beginning to touch. The border Eastern redcedar row has caused deep accumulation of snow in the pine rows and subsequent breakage of many lower branches and of some tops.

WOODY ORNAMENTAL PLANTINGS

W. G. Macksam

Highmore is one of two locations in South Dakota where woody plant materials are being tested as part of the NC-7 Regional Plant Introduction program. Plantings have been made annually since 1954 with pertinent information published at the Regional headquarters at 5 year intervals.

The Moraine honeylocust tree has been outstanding in performance as have dwarf peashrubs in the shrub category. The plants are grown on summer fallow land and cultivated at least a couple of feet out from the trunks.

Flowers

Annual flowers have been grown for several seasons at Highmore. They have attracted considerable attention and demonstrate that a large number of species will do well in the area.

GRAIN SORGHUM 1964

A. O. Lunden and C. J. Franzke (Emeritus)

Objective: Preliminary testing of South Dakota sorghum lines and hybrids and regional sorghum hybrids. This program is developed in cooperation with sorghum breeders in all state experiment stations.

Regional hybrids are in various phases of development and testing and will be released for commercial production in areas in which test results are favorable. Severe bird damage occurred before harvest making yield comparisons unrealistic, but fair yields were obtained for many lines with estimated maximum production of about 60 bushels per acre. This planting will be continued in 1965 with special attention to reduction or prevention of losses from birds at time of harvest. Results reported in the following table are from Experiment Station Circular 167, "1964 Grain Sorghum Performance Trials."

Grain Sorghum Performance Trial, Highmore 1964

Variety	Percent Moisture	Hgt. in.	Date Headed	Percent Lodging	T.Wt. lb/bu	Yield, 100#/A 1964[a]	Yield, 100#/A 1962-64	Statistical Significance
NK 120	15.8	38	7/20	35	53	27.4	30.5	
RS 610	18.3	43	7/30	0	50	27.1	28.2	
SD 451	15.0	43	7/23	10	54	26.8	30.2	
NK 125	8.9	40	7/23	27	52	24.9	27.3	
NK 115	9.9	38	7/21	17	52	24.2		
PAG 430	8.4	39	7/30	0	54	23.9		
SD 102	11.1	38	7/18	7	54	20.2		
Shorty 33	18.3	37	7/25	12	54	19.5		
SD 441	10.2	46	7/25	2	51	19.2	26.4	
Taylor-Evans44	9.3	35	7/28	70	44	18.5		
RS 608	20.8	39	7/30	2	50	16.4		
NK 144	14.5	37	7/25	45	53	16.4		
PAG 275	9.0	41	7/22	15	53	15.8		
Comanche	13.5	40	7/31	5	50	15.8		
SD 502	14.3	44	7/24	10	50	14.0		
Ute	10.7	38	7/31	3	51	13.6		
Pioneer 885	15.2	38	7/28	38	48	13.0		
PAG 410	12.1	38	7/28	17	50	12.6		
Pawnee	10.8	40	7/23	15	52	12.5		
NK 133	12.5	40	7/24	22	49	12.4		
Rocket A	11.0	37	7/29	8	45	11.3		
DeKalb	14.7	41	7/29	8	50	10.3		
PAG 304	10.3	35	7/26	0	45	7.7		
Asgrow H623	19.0	32	7/27	13	43	7.3		
RS 501	9.9	45	7/24	5	45	6.2	14.5	
SD 503	12.7	45	7/25	7	43	6.2	18.1	
				Mean Yield		16.3		

CV - 20% L.S.D. (.05) 9.3

a - bird damage occurred in varying degrees; some entries were damaged more severly than others.

CASTOR BEANS 1964

A. O. Lunden and C. J. Franzke (Emeritus)

Objective: Preliminary testing of South Dakota improved strains of castor beans to determine the potential of adapted selections.

Four dwarf selections from colchicine treated lines were planted for yield and performance testing. These strains averaged only 26 inches in height which would provide ease of harvest and allow growth under limited rainfall. Yields are reported below. The equivalent value of the best strain would be equal to about 35 bu/acre of barley based on the long-time market price of the two crops. Further testing will be necessary to evaluate the potential value of this crop in South Dakota.

Yields of Castorbean Seed in 1964

Strain	Yield (lbs/acre)
SD 63-1	325
SD 63-6	597
SD 63-7	833
SD 63-15	761

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CROP PERFORMANCE TESTING

J. J. Bonnemann

Small grain trials included spring and winter wheat, oats, barley, flax and rye. Results reported here are taken from Experiment Station Circular 165, "1964 Small Grain Variety Trials." Conclusive results are not yet available for the alfalfa performance trials; they will be published later.

Standard Variety Spring Wheat and Durum Trials, Highmore 1960-1964

Variety	1960	1961	1962	1963	1964	1960-64	1964 Test Wt. lb/bu	Statistical Significance
	Average Yields, bushels per acre							
CI 13655					30.4		62.0	
Lakota	21.9	14.2	47.1	21.3	29.6	26.8	60.5	
CI 13654				17.6	28.9		62.0	
CI 13751				19.2	28.1		62.0	
Wells	21.5	14.5	52.4	22.8	27.5	27.7	62.5	
Selkirk	23.1	18.5	37.6	11.5	26.4	23.4	57.5	
CI 13586				16.7	26.3		60.0	
Rushmore	23.4	17.8	30.9	14.7	25.3	22.4	60.5	
Canthatch	22.6	18.1	26.1	14.6	24.9	21.3	60.0	
Crim		18.2	33.8	14.2	24.0		60.0	
Justin		16.2	37.4	13.4	23.8		59.0	
Pembina	24.5	17.6	39.6	15.0	23.4	24.0	58.0	
Thatcher	20.5	17.1	27.0	12.6	22.9	20.0	59.5	
Lee	24.6	16.4	37.2	16.7	20.3	23.0	59.5	
		Mean yield			25.8			
LSD .05	3.0		8.7	2.7	7.0			

Standard Variety Winter Wheat Trials, Highmore 1961-1964

Variety	1961	1963	1964	1961-64	1964 Test Wt. lb/bu	Statistical Significance	Rust LR%	7-1-64 SR%
	Average Yields, bu/acre							
Gage			27.4		59.5		R-0	MR-1
Scout			27.1		60.5		S-65	R-0
Ottawa	8.5	40.5	25.6	24.9	59.0		X-10	S-40
Wichita	6.6	36.9	24.8	22.8	59.5		S-65	S-25
Omaha	6.9	36.0	24.3	22.4	57.5		S-65	S-65
Rodco	1.8	36.3	23.7	20.6	59.5		MR-10	Mixed
Aztec	12.3	24.8	23.3	20.1	61.5		S-65	S-65
Cheyenne	9.7	26.4	22.9	19.7	59.0		S-65	S-25
Shoshoni			22.4		58.0		S-40	S-40
Nebred	12.2	28.9	22.2	21.1	57.5		S-65	S-25
Bison	2.9	30.8	21.8	18.5	58.0		S-65	S-65
Lancer	7.6	30.5	21.7	19.9	58.5		S-65	R-0
Warrior	10.2	34.8	21.3	22.1	57.5		S-65	S-65
Winalta			18.3		58.0		S-65	Mixed
SD 56-53	8.0	31.7	16.0	18.6	55.5		S-65	R-0
Minter	22.2	23.5	15.3	20.3	56.0		S-65	R-0
		Mean yield	22.4					
LSD .05		5.1	4.8					

Standard Variety Barley Trials, Highmore 1960-1964

Variety	1960	1961	1962	1963	1964	1960-64	1964 Test Wt. lb/bu	Statistical Significance
	Average Yields, bushels per acre							
Traill	16.7	22.2	69.4	41.3	41.5	38.2	51.0	
Larker		24.0	52.7	43.1	39.1		51.0	
Trophy		21.7	61.3	45.1	38.6		51.0	
Parkland	16.8	24.4	57.7	44.0	37.7	36.1	49.5	
Betzes	32.3	20.0	43.0	37.4	35.6	33.7	49.5	
Liberty	32.7	28.7	54.0	37.5	32.9	37.2	49.0	
Spartan	36.0		43.8	33.9	30.5		50.5	
Plains		20.9	50.8	32.4	29.3		49.5	
Otis			53.0	45.1	28.1		49.5	
Kindred	14.1	18.0	46.3	35.4	27.9	28.3	48.5	
Feebar	33.9	19.0	42.0	36.9	27.6	31.9	47.0	
Custer		35.7	67.0	36.8	27.5		47.5	
		Mean yield			33.0			
LSD .05	7.5	6.6	12.6	6.7	6.4			

Standard Variety Oat Trials, Highmore 1960-1964

Variety	1960	1961	1962	1963	1964	1960-64	1964 Test Wt. lb/bu	Statistical Significance
	Average Yields, bushels per acre							
Garry	69.7	35.5	86.0	35.6	61.4	57.6	33.5	
Brave					60.8		35.0	
Mo. 0-205	69.0	41.5	88.7	51.1	60.3	62.1	35.0	
Lodi				39.2	59.5		35.0	
Rodney			91.2	36.2	59.5		37.0	
Dupree	63.4	40.6	87.6	49.5	58.8	60.0	35.0	
Portage				41.9	53.9		34.5	
AuSable				36.6	53.1		36.5	
Burnett	72.2	47.1	98.8	50.4	52.6	64.2	35.5	
Andrew	84.1	39.0	84.2	48.9	51.8	61.6	35.0	
Ortley	62.1	33.3	106.9	38.5	51.4	58.4	35.0	
CI 7454					51.0		33.0	
Coachman				41.4	50.3		35.5	
CI 7679					49.0		33.5	
CI 7978					47.7		33.5	
Minhafer	70.4	44.8	112.7	39.2	47.4	62.9	32.5	
Neal			112.1	47.8	47.3		34.5	
Garland			110.4	38.4	45.4		35.0	
Clintland 64					45.1		34.5	
Tippecanoe					44.7		34.5	
Bonkee				40.1	44.6		36.0	
Putnam 61					43.1		33.0	
Nehawka	76.8	42.9	90.7	38.5	42.2	58.2	34.5	
Clintland 60	42.7	45.6	103.5	36.6	42.0	54.1	35.0	
Dodge		27.6	96.2	41.9	41.0		35.0	
CI 7463					40.8		36.5	
Nodaway		46.4	88.3	29.0	39.7		35.0	
Mean yield					49.8			
LSD .05	14.7	6.0	14.9	8.9	12.1			

Standard Variety Rye Trials, Highmore 1960-1964

Variety	1960	1961	1962	1963	1964	1960-64	1964 Test Wt. lb/bu
	Average Yields, bushels per acre						
Pierre	20.7	43.6	22.3	21.5	44.9	30.6	57.0
Caribou	19.3	52.6	17.6	32.1	44.3	33.2	56.5
Elk	26.0	54.4	15.8	28.2	43.6	33.6	56.0
Antelope	22.9	36.9	29.5	30.4	42.6	32.5	56.5
Mean yield					43.9		
LSD .05				6.0	N.S.		

Standard Variety Flax Trials, Highmore 1960-1964

Variety	1960	1961	1962	1963	1964	1960-64	1964 Test Wt. lb/bu	Statistical Significance
	Average Yields, bushels per acre							
Summit	23.2	10.8	7.5	10.4	17.1	13.8	53.0	
Bolley	22.3	10.0	6.9	7.6	16.1	12.6	51.5	
CI 1909					16.1		54.5	
CI 1910					15.5		54.0	
Windom	17.2	13.0	5.0	8.1	15.3	11.7	53.5	
Linda	19.6	10.7	4.7	8.1	14.5	11.5	50.5	
Marine 62				7.2	14.1		53.0	
Caldwell				9.2	13.5		53.0	
CI 2426					13.3		52.5	
Marine	19.2	10.7	9.8	7.7	13.1	12.1	51.5	
Amalla					12.7		51.0	
Arny	17.1	9.5	9.7	9.3	12.6	11.6	51.5	
Norland	12.1	7.2	3.6	9.4	12.1	8.9	53.0	
B-5128	16.7	10.5	6.1	9.1	11.9	10.9	52.0	
Redwood	16.9	8.9	6.0	9.1	11.1	10.4	51.5	
B-5128(ss)				10.7	10.7		52.0	
Cree				10.0	9.8		50.5	
De Oro				5.4	3.0		48.0	
Mean yield					12.9			
LSD .05	3.5	2.2	3.5	1.9	3.6			

OAT PERFORMANCE NURSERY

Rulon S. Albrechtsen

The 1964 Uniform Early Oat Performance Nursery included entries primarily from states in the North Central Region and superior new strains from experiment stations plus appropriate long-time check varieties and some recently released varieties. Most entries are of a maturity equal to or earlier than the Clintland type oats.

Varieties originating at state experiment stations in this region are normally grown in this nursery for 2 to 4 years prior to release as a new variety. This makes possible the determination of areas of adaptation for newly developed varieties and serves as a basis for decision to release new varieties.

Results of the Uniform Early Oat Performance Nursery 1964[1]

1964 Entry No.	C.I. No.	Variety or Source	Test Wt.	Seed Yield	Yield Rank	Statistical Significance [2]
17	4988	MO.-0-205	32.8	58.7	1	a
3	7969	Ill.	30.2	58.2	2	a
12	2820	Columbia	32.0	55.3	3	ab
21	7680	Tippecanoe	32.8	54.3	4	ab
8	7679	Purdue	31.2	52.8	5	abc
22	7805	Mo.	34.8	52.3	6	abcd
4	4170	Andrew	31.0	52.2	7	abcd
14	839	Kanota	29.8	51.6	8	abcd
16	7698	USDA	30.2	51.0	9	abcd
22	7690	Brave	31.2	50.5	10	abcd
23	8038	Mo.	31.5	50.5	11	abcd
7	7971	Ill.	32.8	50.3	12	abcd
11	7463	Purdue	33.5	50.0	13	abcd
18	7272	Nodaway	31.8	49.3	14	abcd
24	8039	Mo.	31.5	49.0	15	abcd
13	8066	Nebr.	32.8	48.1	16	abcd
2	8064	Ill.	31.8	46.5	17	bcd
19	7663	USDA	33.2	45.9	18	bcd
1	8063	Ill.	31.8	45.7	19	bcd
15	7697	USDA	33.0	45.6	20	bcd
5	7693	Ill.	31.0	45.5	21	bcd
6	7970	Iowa	32.5	43.0	22	cd
9	7639	Cltd. 64	32.0	42.6	23	cd
10	8065	Purdue	33.8	41.8	24	d

[1] Seeded April 16. Harvested July 17.
[2] Using Duncan's New Multiple Range Test.

Overall mean yield	=	49.6 bushels per/A
C. V.	=	12.5 %
L. S. D. .05	=	8.7 bushels per/A
Number of reps	=	4

GRASS TESTS

James G. Ross

Various varieties of intermediate wheatgrass, smooth bromegrass and crested wheatgrass have been tested. Crested wheatgrass makes earlier growth in the spring than either bromegrass or intermediate wheatgrass. Yield differences between these three species were not significant in most years. Oahe intermediate wheatgrass, Lincoln type bromegrass and Nordan crested wheatgrass have been superior to other grass varieties. Testing of 20 experimental strains of each of these species have been made for forage and seed production. New adapted strains are being selected.

SOIL MANAGEMENT STUDIES

Dwight Hovland

Field plots were used to follow the influence of several soil treatments on crop production of Williams soils. Methods of handling crop residues, nitrogen and phosphorus fertilizers, types of tillage, and sequence of crops were soil treatments studied. Most plots were started in 1942 and the results from the first 20 years were published in South Dakota Agricultural Experiment Station Bulletin 513. Some of the 1964 data are in the tables below. In general, these results substantiated earlier findings. Refer to Bulletin 513 for details.

Spring Wheat Yield Following Residue Treatments
in a Sorghum-wheat and a Fallow-wheat Sequence
at Highmore 1964

Residue Treatment	Sequence	
	Fallow	Sorghum
	Bu/A	Bu/A
Residues removed	18	15
8 T. Manure/acre	24	20
Residues Returned	18	17

Influence of Tillage, Residue, and Fertilizer Treatments on Yield of Wheat and Oats at Highmore 1964

Fertilizer N	Fertilizer P	Subsurface Tilled: Residues Removed	Subsurface Tilled: Manure 8 T/A	Subsurface Tilled: Residues Returned	Moldboard Plowed: Residues Removed	Moldboard Plowed: Manure 8 T/A	Moldboard Plowed: Residues Returned
(Lbs/A)			(Bu/A)				
			Oats				
0	0	17	23	17	30	40	30
0	17	15	29	21	31	41	34
20	17	28	33	29	40	41	45
40	17	28	30	31	49	45	46
			Wheat				
0	0	16	17	16	16	14	8
0	17	15	20	16	13	18	14
20	17	15	24	17	11	15	16
40	17	13	21	15	11	15	13

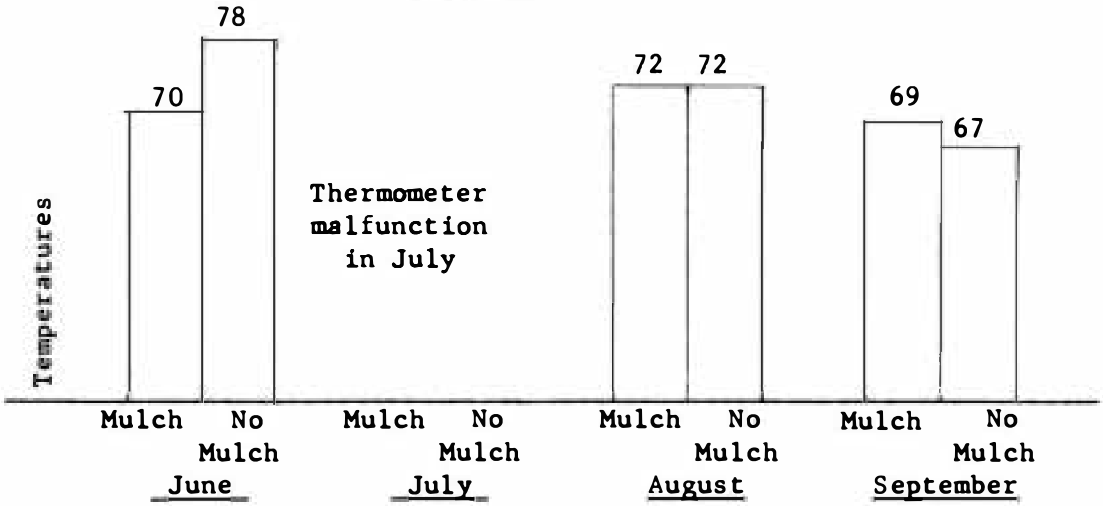
MULCH TILLAGE WITH CORN

Fred E. Shubeck

Objectives of Experiment:

1. Can a straw mulch reduce the wasteful loss of soil moisture by evaporation?
2. If moisture is saved, can it be exploited by corn plants to give greater yields under the environmental conditions altered by the mulch?

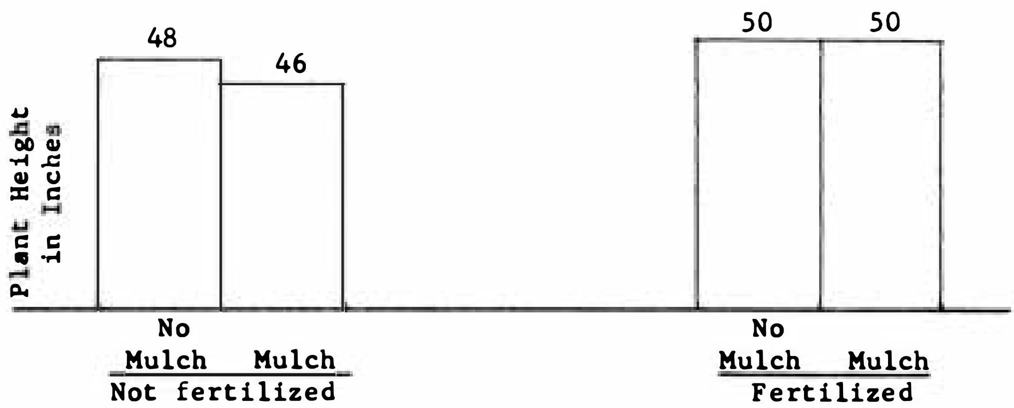
Effect of Straw Mulch on Soil Temperature (Monthly Average at 1:00 p.m.) Under Corn



Treatment and Month

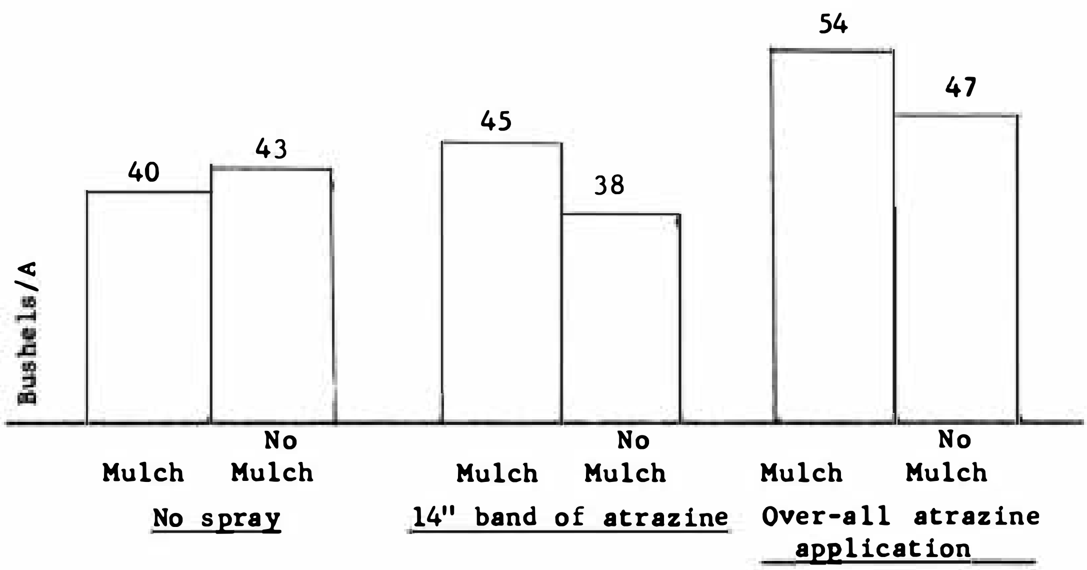
No temperatures were given for July because of thermometer malfunction. Early in the season, soil was cooler under a mulch cover. By August, there was no measurable temperature difference. By September when the soil was losing heat, the mulch appeared to act like a blanket to slow down the heat loss.

Effect of Straw Mulch and Fertilizer on Plant Height July 27, 1964



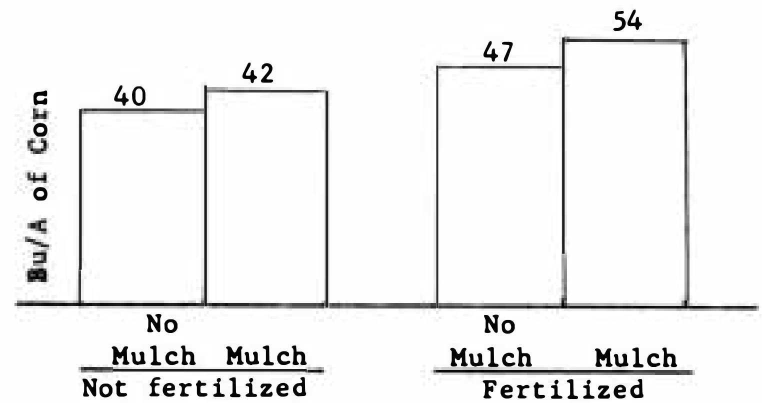
Corn in mulched plots got off to a slower start where no fertilizer was applied. Where fertilizer was applied, corn hieght was about the same in mulched and non-mulched plots on July 27. Fertilized plots received 80 lbs of N and 30 lbs of P_2O_5 per acre broadcast.

Effect of Straw Mulch and Pre-emergence Atrazine Spray on Corn Yield (Fertilized)



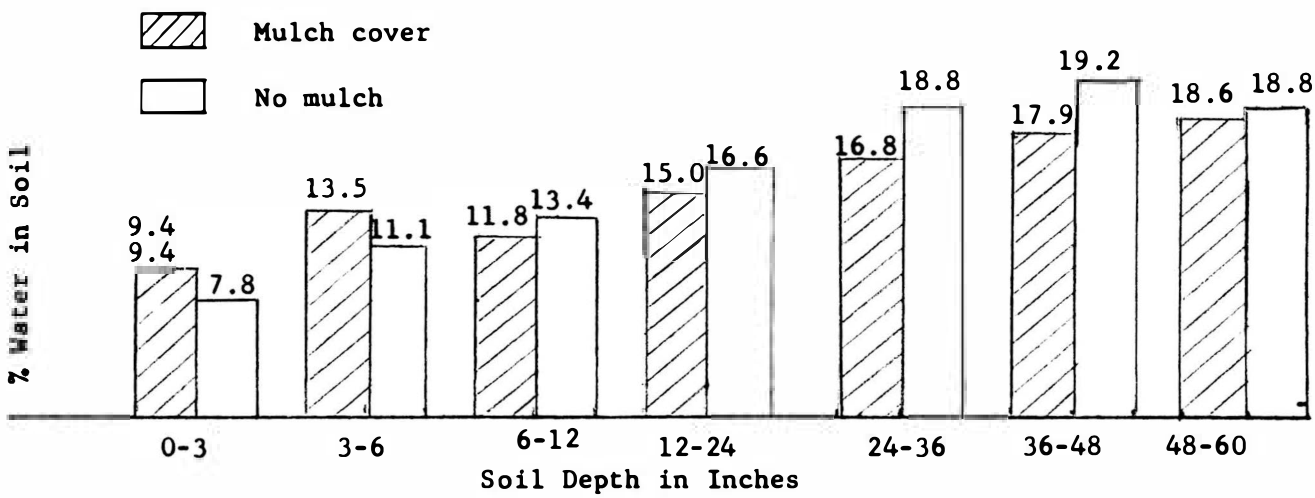
It is difficult to control weeds in mulched plots without the aid of chemicals. When weeds were controlled chemically, mulched plots yielded more corn than plots without a surface mulch.

Effect of Mulch Cover on Fertilizer Response
(With over-all atrazine application)



Fertilizer applied was 80 lbs of N and 30 lbs of P_2O_5 per acre. The mulch was more effective in increasing corn yield when plots were fertilized.

Effect of Straw Mulch Cover on Percent of Water in Soil
under Corn July 30, 1964 *



* All of these plots were fertilized with 80 lbs of N and 30 lbs of P_2O_5 per acre. An over-all spray of atrazine was applied.

The straw mulch was effective in saving water in the two sampling depths closest to soil surface where the greatest amount of evaporation would be expected.

Below 6 inches the unmulched plots had a higher percentage of water than mulched plots. These soil moisture results are different from those of 1963. There was an increase in corn yield due to the mulch in 1964 but not in 1963.

ROOT AND STALK ROT DISEASE CONTROL IN HYBRID CORN, HIGHMORE

C. M. Nagel

Approximately 130 experimental three-way corn hybrids involving one root and stalk rot resistant parent in each were grown in 1964. Results were obtained on the over-all performance including resistance to disease, lodging, moisture and yields. Only the 15 top-yielding three-way hybrids and commercial checks from each of four experiments are presented in the following tables.

The plots were planted May 25 and harvested October 13.

Experiment # 1.

Expt'l Hybrid or Commercial Check	Yield Bu/A	Moisture at Harvest
SD240	44.2	15.9
SD250	40.9	14.1
Expt'l	38.8	15.2
"	38.1	13.9
"	37.6	13.1
"	36.0	10.8
"	36.9	15.6
"	36.4	15.0
"	34.9	13.6
"	33.9	12.2
"	34.0	14.3
"	34.2	18.1
SD210	32.2	10.8
Expt'l	33.5	19.3
"	31.5	12.5

Differences of less than 8.36 bu/A are not significant differences.

Experiment # 2.

Expt'l Hybrid or Commercial Check	Yield Bu/A	Moisture at Harvest
Expt'l	40.2	15.3
"	36.8	16.3
"	34.2	12.1
"	33.8	13.4
SD250	33.0	14.9
Expt'l	32.7	13.8
"	31.5	9.8
SD210	32.3	13.6
Expt'l	31.4	11.8
"	30.2	10.7
"	30.2	11.3
"	31.0	16.5
"	30.5	16.7
"	30.9	18.5
"	30.0	16.6

Differences of less than 9.34 bu/A are not significant differences.

Experiment # 3.

Expt'l Hybrid or Commercial Check	Yield Bu/A	Moisture at Harvest
Expt'l	47.4	14.8
"	42.7	16.2
"	43.1	18.2
"	42.2	18.0
"	40.5	16.4
"	41.0	20.2
"	38.9	13.6
"	40.3	21.5
"	39.0	17.2
"	38.6	15.9
"	38.4	17.5
"	37.9	16.2
SD250	39.4	22.0
SD210	35.6	12.1
Expt'l	37.2	17.6

Differences of less than 5.58 bu/A are not significant differences.

Experiment No. 4.

Expt'l Hybrid or Commercial Check	Yield Bu/A	Moisture at Harvest
Expt'l	48.6	22.2
"	45.7	15.2
"	44.4	13.0
"	45.8	27.6
"	44.2	23.3
"	41.5	15.4
SD250	41.8	17.6
Expt'l	39.6	10.9
"	41.2	18.7
"	39.6	14.6
SD240	41.6	23.1
SD210	38.0	12.6
Expt'l	38.8	15.9
"	36.0	11.4
"	38.9	22.3

Differences of less than 6.10 bu/A are not significant differences.

WINTERKILL REDUCTION IN WINTER WHEAT BY SOIL FUMIGATION

G. W. Buchenau

Investigations on the causes and reduction of winterkilling in small grains have been conducted by Experiment Station personnel for several years. The role of plant diseases in the winterkill problem has been an item of particular interest to plant pathologists and growers alike. The effectiveness of a soil fumigant, chloropicrin (tear gas), in reducing winterkill has been especially significant because it is highly toxic to many plant-disease causing microorganisms which live in soil.

The effects of chloropicrin, however, are not limited to plant disease control. It also kills insects and weed seeds and increases soil fertility. Furthermore, it is virtually impossible to implicate any one plant disease as a winterkilling factor because most soil-borne diseases are controlled by the chemical. Experiments at Highmore in 1964 were designed to find another chemical effective in reducing winterkill but which has a more limited range of disease control. (Chloropicrin is used here as an experimental chemical.)

Data from these experiments (see table below) show that none of the materials tested except chloropicrin (and combinations including chloropicrin) were effective in reducing winterkill. Spring isolations from the plots also revealed that chloropicrin was the only chemical that effectively reduced populations of Fusarium roseum, a widespread root- and crown-rotting fungus that rarely kills plants outright but may do so if plants are injured by cold.

Yield was not significantly affected by any of the treatments, an occurence presumably due to the low order of winterkilling in 1964. Most investigators familiar with winterkilling agree that up to 50% winterkilling may occur before wheat yields become depressed.

Effect of Soil and Foliage Treatments on Winter Survival and Yield of Winter Wheat 1964 [1]

Treatment	Dosage	Winterkill %	Plants with F.Roseum %	Yield Bu/A
Chloropicrin	320 lbs/A	23.3	40	32.9
Chloropicrin Sodium Pentachlorophenate	320 lbs/A 20 lbs/A	23.3	46	32.7
Chloropicrin Soil Treater X	320 lbs/A 43.5 lbs/A	25.0	40	32.3
Tetrachloronitroanisole (TCNA)	8 lbs/A	37.5	93	30.7
N-(3-nitrophenyl)itaconimide (B-720)	180 lbs/A	39.9	93	31.4
Dithane M-45 (Fall, Spring Applications)	3 lbs/A	41.7	93	32.7
Puratized Agricultural (Fall, Spring Applications)	100 ppm. Till run-off	41.7	67	32.6
19-19-0 Fertilizer	150 lbs/A	43.3	93	31.0
Check (no treatment)	---	45.0	93	31.8
Soil Treater X	43.5 lbs/A	45.9	87	33.1
Cyprex (Soil Treat.)	43.5 lbs/A	48.3	87	29.6
Pentachlorophenol	20 lbs/A	50.0	100	30.6
	LSD_{05}	16.0		N.S.

[1] Average survival of Pawnee and Nebred. No significant difference occurred between varieties.

SUPPLEMENTING PRAIRIE HAY FOR WINTERING CALVES

L. B. Embry, G. F. Gastler and F. P. Holmes

(This report is from Animal Science Department Report No. AS65-1)

South Dakota farmers and ranchers harvest an average of about 5 million acres of hay annually. Nearly one-half of this acreage is wild hay with an average yield of about 0.7 ton per acre (South Dakota Agriculture, 1963). Thus, it is evident that wild hay is an important feed for cattle in the state.

Even though prairie hay is a valuable cattle feed, it generally has certain deficiencies. Previous research has shown that the stage of maturity when harvested has a major influence on its feeding value. Protein, phosphorus and carotene decline with advancing maturity. Supplementary sources of these nutrients are generally needed with prairie hay. The amounts of these supplements needed will vary, however, depending on the quality of the hay, especially the stage of maturity when harvested.

The supplement needed in the largest amount with prairie hay will generally be protein. A limited feed of alfalfa hay and protein supplements of various ingredient composition are common ways of supplying the supplementary protein. This experiment was conducted to compare alfalfa hay and various types of protein supplements as sources of protein with prairie hay for wintering calves.

Experimental Procedure

Forty-eight Hereford steer calves were purchased for this experiment. During a preliminary period of about 5 weeks, the calves were full-fed prairie hay, 2 lbs of oats and 2 lbs of protein supplement with about 40% protein per head daily. Each calf received an average of 350 mg. of aureomycin and 10,000 I.U. of vitamin A daily during this time.

The calves were allotted to 4 lots of 12 each for the experiment. The supplementary source of the protein to a full feed of prairie hay was 6 lbs of alfalfa hay or 2 lbs of a 30% protein supplement as follows:

Lot 1 - alfalfa hay
Lot 2 - soybean meal (60%) and ground shelled corn (40%)
Lot 3 - soybean meal (48%) and dehydrated alfalfa meal (52%)
Lot 4 - soybean meal (31%), urea (4%) and ground shelled corn (65%)

A mineral mixture composed of equal parts trace mineral salt and dicalcium phosphate was offered free-choice. Aureomycin and vitamin A were added to the mineral mixture to furnish 750 mg. of aureomycin and 100,000 I.U. of vitamin A per pound of the mixture. Plain block salt was also offered free-choice. The mineral mixture was mixed three times during the experiment to insure a fresh supply. Protein, calcium, phosphorus and carotene contents of the feeds are presented in the table on page 49.

The cattle had access to a shed with outside exercise lots. They were fed once daily with the hay being fed inside the shed and the protein supplements in feed bunks in the outside lots. The mineral mixes were offered inside the shed. Water was provided by electrically-heated automatic waterers.

Results of the Experiment

Feedlot Performance: Results of the experiment are presented in the table on page 50. Each ration contained about 11% total protein. There was some refusal of the hay with the amount ranging from about 3/4 to 1 pound per head daily for each lot.

The differences in the carotene contents of prairie hay and alfalfa hay and the protein supplements with and without the dehydrated alfalfa meal resulted in some major differences in the carotene intake by the calves. However, the lowest level of carotene consumed is considered in excess of the amount needed to meet the need for vitamin A by calves of the weight used in this experiment. Since they also received vitamin A through the mineral mixture, the differences in the vitamin A value of the rations should not be a factor in any difference in the performance of the calves.

The highest daily gain was obtained when feeding the soybean meal and corn supplement. Hay consumption was about the same but daily gain was 0.16 lbs less for the calves fed the soybean meal and dehydrated alfalfa meal supplement. These two lots of calves also consumed about the same amount of the mineral mixture and received about the same amount of aureomycin. Differences in rate of gain of this magnitude between lots of cattle with the number used are not uncommon even when they are fed alike. However, further comparisons should be made between these supplements. The results do indicate that soybean meal is an adequate protein supplement with prairie hay and that it was not improved by the inclusion of dehydrated alfalfa meal at slightly more than 1 pound per head daily.

When the calves were fed the protein supplement with soybean meal, urea and corn, the rate of gain was about the same as for those fed the supplement with soybean meal and dehydrated alfalfa meal. Free-choice consumption of the mineral mixture was only slightly less resulting in nearly the same intake of the aureomycin. The urea and corn appeared to be a satisfactory replacement for the dehydrated alfalfa meal and part of the soybean meal in comparison to the soybean meal and dehydrated alfalfa meal supplement.

The rate of gain was less when 6 pounds of alfalfa hay was fed with the protein supplements. In previous experiments, alfalfa hay and soybean meal gave similar results when used to supplement rations with prairie hay at equal levels of protein.

The calves fed alfalfa hay and no protein supplement consumed only about one-half as much of the mineral mixture as the calves fed the protein supplements. The resulting smaller intake of the antibiotic may have been a factor in the apparent lower rate of gain. In other experiments with wintering calves, an improvement in rate of gain and feed efficiency has been obtained from feeding 70 mg. of an antibiotic per head daily in the protein supplement and when consumed at about 40 mg. daily in a free-choice mineral supplement.

The ration with alfalfa hay was also lower in energy than those with the protein supplements. The calves fed the rations with the protein supplements consumed only about 1 pound less hay but were fed 2 pounds of the protein supplements. This would result in enough difference in energy consumption to have an effect on the rate of gain. Other experiments are needed to compare alfalfa with other sources of protein in wintering rations for calves where the levels of feeds and any antibiotic are controlled.

Mineral Consumption: The amount of mineral supplements consumed with various rations and the regularity of intake are important considerations when mineral supplements are being used as carriers for other supplements and feed additives. The mineral mixture was used as a carrier for aureomycin and vitamin A in this experiment. Records were kept on consumption to determine the intake of the antibiotic and vitamin A. Plain block salt was offered free-choice in addition to the mineral mixture. The blocks were placed in the feed bunks in the outside lots. Consumption plus weather loss amounted to about one 50-pound block for each lot of 12 calves during the 145-day experiment.

The experiment did not afford a comparison of the adequacy of the method of mineral supplementation used with other methods. Also, the hay and protein supplements furnished calcium and phosphorus in excess of the 13 gm. of calcium and 10 gm. of phosphorus recommended as being adequate for calves of this weight during the experiment.

The low consumption of the mineral mixture composed of equal parts trace mineral salt and dicalcium phosphate when the calves also had access to other salt might be interpreted to mean that the need for the mineral elements contained in a mineral supplement determines the amount which will be consumed. This is the assumption upon which the free-choice method of supplementation is based. The fact that the calves fed the alfalfa hay and receiving the most calcium in the ration also consumed the least amount of the mineral mixture would tend to lend further support to this method of mineral supplementation. A question is raised, however, as to the effects of an excess of one element in relation to a deficiency of another on free-choice consumption of a mineral mixture. In this experiment there was some consumption of the mineral mixture even though the calcium intake in some instances was considerably in excess of the recommended requirement.

The low consumption of the mineral mixture and the variation encountered with the type of rations as in this experiment should be considered when using a mineral supplement as a carrier for other supplements and feed additives. This would mean that each set of conditions would present individual problems and would prevent generalized recommendations for this method of supplementation.

Stability of the products when mixed with minerals is also an important consideration. No study of stability was made during the experiment. The vitamin A was added at a calculated level of 100,000 I.U. per pound of the mixture. Only an average of 78% of this was found upon analysis of three samples taken at time of mixing. Variations between samples were quite large. Further work is planned on this problem.

Summary

The inclusion of dehydrated alfalfa meal with soybean meal in a protein supplement for wintering calves fed prairie hay did not improve the performance over feeding a supplement composed of soybean meal and corn.

A protein supplement composed of 4% urea, 31% soybean meal and 65% corn was equal to a supplement with the same amount of protein and composed of 48% soybean meal and 52% dehydrated alfalfa meal.

Calves fed a combination of alfalfa hay and prairie hay gained at a lower rate than those fed prairie hay and 2 pounds of 30% protein supplements. The rations with the alfalfa hay resulted in lower consumption of energy and the calves consumed a low level of aureomycin with this ration because of a low consumption of the mineral carrier for the antibiotic.

A free-choice mineral supplement may be used satisfactorily as a carrier for other supplements provided due consideration is given to the various factors that may influence the intake of the supplements.

Chemical Composition of Feeds
(10% moisture basis)

Feedstuff	Protein %	Calcium %	Phosphorus %	Carotene Mg/lb
Alfalfa hay	14.79	1.08	.22	8.15
Prairie hay	8.22	.35	.19	3.35
Soybean-corn supplement	30.75	.23	.45	
Soybean-dehy. alfalfa supplement	30.73	.95	.51	29.5
Soybean-urea-corn supplement	29.96	.13	.35	
Mineral mix [1]		8.32	7.49	

[1] Vitamin A palmitate and aureomycin added to supply a calculated 100,000 I.U. and 750 mg. per pound. Average vitamin A content for three mixes as analyzed was approximately 78,000 I.U. per pound.

Types of Protein Supplements With Prairie Hay
(December 26 - May 19, 1964, 145 days)

	Alfalfa Hay	Soybean Meal-corn	Soybean meal-dehy. alfalfa	Soybean meal-urea-corn
Lot	1	2	3	4
Number of steers	12	12	11 [1]	12
Init. filled wt., lb.	431	422	426	430
Final filled wt., lb.	535	571	551	552
	0.72	1.02	0.86	
Avg. daily gain, lb.	0.72	1.02	0.86	0.84
Avg. daily ration				
Prairie hay, lb.	7.7	12.6	12.7	12.6
Alfalfa hay, lb.	6.0	--	--	--
Prot. suppl., lb.	--	2.0	2.0	2.0
Mineral mix, gm.	14.2	26.9	27.2	24.1
Feed/100 lb. gain, lb.				
Prairie hay	1067	1234	1472	1504
Alfalfa hay	830	--	--	--
Prot. suppl.	--	196	232	239
Total minerals consumed, gm./head daily				
Trace mineral salt	7.1	13.4	13.6	12.0
Calcium	42.84	24.35	31.07	23.21
Phosphorus	13.69	16.97	17.63	15.86
Carotene consumption, mg./daily	74.7	42.2	101.5	42.2
Vitamin from mineral mix, I.U./daily	2440	4621	4673	4140
Aureomycin from mineral mix, mg./day	23	44	45	40

[1] One calf died during the experiment. Results for 11 head.

POULTRY - EGG LAYING TRIALS

The poultry egg laying trials at Highmore parallel the similar work conducted at Eureka and is reported for both stations in the Eureka section of this circular. (See page 28.)

REDFIELD IRRIGATION RESEARCH SUBSTATION

Redfield

Contents

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REDFIELD IRRIGATION RESEARCH SUBSTATION

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INTRODUCTION

Lloyd B. Dye

This report covers a 3-year period beginning November 1, 1961, at which time the author became superintendent of the substation. Prior to his appointment, it had been agreed that the entire production of crops would be used in experiments with beef cattle; consequently, the 1961 production of grains and forages was stored at the station for use in the feeding trials that were conducted during 1962. Obviously 1961 had been a good crop year at the station.

During November 1961 four feed lots were built, waterers installed and fence line bunks arranged. Some grading and sloping of the lots was accomplished and the watering system arranged to accommodate additional lots.

One hundred head of calves arrived December 3, 1961. As 33 more calves were to be delivered from several outlying stations, two more lots were built during December. One of these was cross fenced to make seven useable lots. The experimental results obtained for this and subsequent years are, or will be, available through the Department of Animal Science. Summaries here are from the 1964 Animal Science Department publication. Frank Whetzal is project leader for the beef cattle trials.

During October 1962, the seventh feed lot was completed. A catch pen, loading chute head gate, and working alley were also built. The workability of this cattle handling yard and loading chute has proved to be exceptionally good. In December 1962, 120 head of calves were purchased to be used in the 1963 trials. In addition to these, 27 calves from other stations were delivered to Redfield.

During September and October of 1963, the feed lot arrangement was completed. It consists of 8 lots suitable for experimental work; 3 of these have access to shelter. There is one large holding lot in which 150 calves can be kept. This lot has access to shelter for up to 40 calves. There is also one small lot (hospital) with access to shelter, which can hold up to 15 head of calves.

During November 1963, 160 head of calves to be used in the 1964 trials were purchased, and 39 calves were delivered from other stations. During October, November and December of 1963 and January 1964, a feeding trial was conducted with 36 head of coming two-year old bulls.

In early October 1964, a semi-permanent corn crib to hold about 3,000 bushels of corn was built.

In November of 1964, 181 head of calves were purchased to be used in the 1965 trials. Nineteen head of calves were sent to Redfield from other stations--a total of 200 head. There are about the right number of cattle at the station now.

The calves for the 1965 trials were allotted on the 15th of December 1964. There was very little sickness and no losses among these calves. All cattle have gone directly to the processors from this station, and carcass data has been taken and summarized in feeding trial reports.

The next big project is to produce enough roughages and grain at the station, without purchasing any, to send to the killers 200 head of cattle weighing 1,100 pounds, grading high good and choice. This rate of crop production seems to be within easy reach. Major emphasis should be placed on the proper rotation of crops best suited to beef cattle feeding, those crops which will produce the most beef per acre. During the months of November and December 1964, there were 2,550 cow days of stalk field gleaning.

At the station, there is a total of 129.5 acres of tillable irrigated land and 35.3 acres of non-irrigated crop land. Fourteen acres of the irrigated land is an experimental plot area used primarily in agronomic research. Most of the crop production from these acres is used at the station. The winter of 1961 and 1962 was a rather hard winter, above average snowfall with considerable 1962 spring runoff.

Neither of the men at the station had had previous experience working with gravity irrigation. Their first observation, upon attempting to till the land, was that it had been over-irrigated and under-farmed. Organic matter was seriously depleted on many of the fields. The system of surface drains had been allowed to silt and erode full to the extent that many of them were almost useless.

Irrigation ditches had always been left open. Wet weather made it impossible to clean these ditches. Weeds and grass soon became a serious problem. It was decided to plow the ditches shut to control the weeds and brome, and most of the surface drains were plowed shut. Ditches and drains were reopened prior to irrigating season. Much work has been done in cleaning surface drains and relocating culverts to promote proper drainage. Some work is still to be done. This system of ditch management has proved so satisfactory that it is being done annually.

Irrigation ditches and some drains are all closed prior to sorghum and corn harvest each fall. Drains are all opened and thoroughly cleaned before fall freeze up. Irrigation ditches are opened as they are needed the following season. Many advantages are derived from this system of ditch management.

The 1962 production of crops was somewhat below average due primarily to a wet spring and an early summer, poor drainage, and the need for considerable land leveling. Inexperience on the part of the operators was also a problem; however, a good deal of experience was obtained during this 1962 season.

The 1963 season was nearly perfect for the irrigator and was far above average for the dryland farmer in this area. It was generally thought that some of the best crops in the history of the Redfield station were produced in 1963. Four crops of alfalfa were taken. Corn grain averaged 119 bushels per acre with one field up to 128 bushels; grain sorghum in plots up to 130 bushels; irrigated barley, 86 bushels; corn silage averaged 18 tons; and sorghum silage in plots to 35 tons. All crops were equally high in quality.

The 1964 season was exactly opposite, weatherwise, from 1963. Rainfall at the station was not much different in total amount, but most of the rains equalled from 0.05 to 0.20 inches, not enough at one time to do much good. Temperatures were above normal and there were many days of strong and high winds. Seed planted did not germinate well. In many cases, the crop was replanted.

Yields were below average on all crops. It is possible to do a much better job on the land and to produce more and better crops on land that is fall plowed. This past fall all land possible, except for non-irrigated acres, was plowed. As soon as possible, all of the land will be machine levelled. This should be done on all the irrigated land to facilitate better drainage and in turn produce higher yields.

Experiment Station Bulletin 516, "Fertilizing Irrigated Rotations in the Proposed Oahe Irrigation Area", contains results of evaluations of various fertilizer rates and times of application in two irrigated rotations. Published in 1964, the bulletin includes information from experiments conducted from 1953 through 1962.

The growth in attendance at the station's annual field day is a good indication of the increased interest in the progress made at the station each year. In 1961, 50 persons attended; 1962, 85 in attendance; 1963, 135 in attendance; and in 1964, 200 persons attended.

Precipitation and Temperatures

Months	High for Month	Days Over 100°	Last Frost Spring	First Frost Fall	Precipitation (In's)	Days with Precipita.
April 1962	4/25 95°	0			1.47	6
May	5/4 87°	0	5/1 29°		7.04	16
June	6/20 91°	0			6.22	11
July	7/7 90°	0			3.21	9
Aug	8/27 97°	0			.71	4
Sept	9/11 89°	0		9/20 27°	1.48	5
Oct	10/14 85°	0			.55	2
				Total	20.68	53
April 1963	5/14 81°	0			1.15	9
May	5/30 84°	0	5/22 21°		3.27	11
June	6/29 101°	1			1.62	5
July	7/23 96°	0			4.34	11
Aug	8/7 96°	0			1.69	6
Sept	9/11 87°	0			1.08	4
Oct	10/5 97°	0	10/27 28°	10/27 28°	.87	3
				Total	14.02	49
April 1964	4/16 91°	0			3.62	9
May	5/21 94°	0	5/13 28°		2.20	5
June	6/25 100°	1			1.73	7
July	7/17 105°	7			2.67	9
Aug	8/1 102°	2			2.14	10
Sept	9/1 91°	0		9/27 25°	.61	3
Oct	10/15 81°	0			.09	1
				Total	13.06	44

NITROGEN FOR IRRIGATED FORAGE SORGHUM

Paul D. Evenson

The 1964 growing season was characterized by near normal precipitation and by above average temperatures from April through July and below average temperatures during August and September. The lack of rainfall and the abnormally high wind velocities that occurred from late May through June produced extremely dry seedbeds. Therefore, resulting crop stands were very poor.

Precipitation and Temperature

	Precipitation - inches		Temperature - °F	
	Total	Departure from Normal	Average	Departure from Normal
April	3.62	+ 1.77	48.6	+ 2.4
May	2.40	+ .06	60.6	+ 1.9
June	1.72	- 2.00	69.0	+ .7
July	2.67	+ .60	77.3	+ 2.0
August	2.14	+ .09	69.4	- 3.9
September	.61	- .75	60.3	- 2.6
Total for Season	13.16	- .23		

Objective of Experiment: To determine the optimum nitrogen fertilization rate for irrigated forage sorghum grown in narrow row spacings.

Effect of Nitrogen Fertilization on the Dry and Wet Weight Yields of Forage Sorghum Grown in 21" Row Spacings at Redfield

Treatment Lbs. of N/Acre	Dry Weight Yields Tons/Acre	Wet Weight Yields Tons/Acre
0	4.9	27.1
80	5.3	29.1
120	5.1	29.0
160	5.5	31.1
200	5.9	31.5

Rox Orange forage sorghum was planted on plots where various rates of nitrogen had been plowed under. The sorghum was first planted on May 28 and was replanted on June 25. Nonuniform stands of sorghum resulted from each planting. This nonuniformity of stand would account for the fact that treatments demonstrated no significant differences in wet weight yields. The experiment was harvested on September 30.

Two experiments designed to determine the optimum population densities for growing forage and grain sorghum were not harvested due to inadequate stands. A third experiment involving sorghum-beet and corn-beet rotations was abandoned for the same reason.

Chemical analyses of soils taken from the barley-alfalfa-alfalfa-corn-corn and barley-corn-corn rotations which were terminated in 1962 are still being determined and interpreted.

Data from a study designed to correlate the evapo-transpiration of crops with various microclimatic measurements for purposes of predicting irrigation needs has not been completely reduced at this time. There can be no interpretation of these data until the reduction of the data is completed.

FERTILIZING IRRIGATED ROTATIONS IN THE PROPOSED OAHE IRRIGATION AREA

Some results of an experiment conducted from 1953 through 1962 at the Redfield Irrigation Research Substation are compiled in Bulletin 516, "Fertilizing Irrigated Rotations in the Proposed Oahe Irrigation Area", by P. D. Evenson and L. O. Fine. The experiment evaluated various fertilizer rates and times of application in two irrigated rotations. This work was done in cooperation with the U. S. Bureau of Reclamation and the Agricultural Research Service, United States Department of Agriculture.

CROP PERFORMANCE TESTING AT THE REDFIELD IRRIGATION RESEARCH SUBSTATION

J. J. Bonnemann

Two phases of the Crop Performance Testing Activity were carried out at the Development Farm during 1964.

Corn performance trials have been conducted on the dryland portion of the station since 1961. The 1964 trial included 40 entries of hybrid corn. The results of the 1964 trial also appear in Circular 166, "1964 Corn Performance Trials."

The second phase of the testing program was an irrigated hybrid grain sorghum performance trial. The 29 entries were planted in narrow row spacings, 21 inches between rows. Poor emergence reduced the desired plant population. Results of this trial also appear in Circular 167, "1964 Grain Sorghum Performance Trials."

CORN PERFORMANCE TRIAL 1964

Variety	Performance Score	Percent R.L.*	Percent S.B.*	Yield, bu/ac	Percent Moisture	Statistical Significance
SD 248 (3x)	1	5	0	55.8	24.1	
Sokota 463 (4x)	3	1	0	52.3	37.7	
Pioneer 3812 (4x)	2	1	0	51.9	23.3	
Sokota TS-50 (2x)	4	2	0	47.3	25.1	
SD 270 (4x)	5	1	0	47.0	26.0	
SD Exp 47 (4x)	6	4	0	46.0	28.9	
Pioneer 3622 (4x)	9	1	1	45.8	32.7	
SD 250 (4x)	7	3	0	44.2	24.6	
Pioneer 3681 (4x)	10	1	1	42.3	26.4	
Funks G-18A (4x)	13	4	0	42.2	32.0	
Master F-31A (4x)	8	3	0	42.0	20.8	
DeKalb XL-304 (3x)	11	1	0	40.4	24.4	
Northrup King KE 449 (4x)	12	0	1	39.9	24.9	
Funks G-15A (4x)	16	2	0	39.8	31.8	
Disco 101-A (4x)	17	1	0	39.4	31.5	
SD 240 (4x)	15	5	0	39.3	26.6	
Master F-30 (4x)	14	0	1	38.9	24.2	
Pioneer 385 (4x)	19	4	1	38.6	31.3	
Sokota 407A (4x)	21	0	0	38.3	33.4	
Pioneer 368-A (4x)	23	2	0	37.4	36.7	
Sokota 407 (4x)	22	0	0	36.4	33.4	
Pioneer 3854 (4x)	18	1	0	36.2	24.1	
Sokota 405 (4x)	25	1	0	36.1	35.2	
Disco 1030 (4x)	30	2	0	34.3	36.1	
SD 220 (4x)	20	1	1	34.1	19.9	
Funks G-17A (4x)	27	12	0	33.8	33.0	
Master F-70 (4x)	26	2	0	33.5	32.0	
Northrup King KE 475 (4x)	24	1	2	33.3	25.8	
Funks G-37 (4x)	33	1	0	32.6	35.7	
DeKalb XL-308 (3x)	29	5	1	32.5	30.8	
Master F-34 (4x)	28	2	0	31.7	28.2	
Pioneer 3648 (4x)	35	3	0	31.4	37.7	
Pioneer 3775 (2x)	37	2	0	29.8	37.7	
DeKalb 45 (4x)	31	0	0	29.5	23.7	
DeKalb XL-325 (3x)	38	0	0	29.3	41.7	
Northrup King KE 471 (4x)	34	5	7	29.2	31.0	
DeKalb XL-15 (2x)	36	1	0	29.2	33.8	
Master F-35 (4x)	32	4	0	28.5	23.9	
Funks G-4390 (2x)	39	0	1	28.0	38.8	
Northrup King KE 497 (4x)	40	1	1	20.0	35.2	
		Mean		37.5	30.1	
CV - 24%		L.S.D.	(.05)	12.6		

* R.L. - Root lodged S.B. - Stalk broken

GRAIN SORGHUM PERFORMANCE TRIAL, IRRIGATED, 1964

Variety	Percent Moisture	Height inches	T.Wt lb/bu	1964 Yield 100#/A	Statistical Significance
NK 227	20.5	55	54	53.4	
SD 503	14.9	57	55	52.6	
TE 44	24.9	52	50	52.5	
RS 610	20.2	58	53	49.4	
Pawnee	24.0	55	57	48.9	
RS 501	17.2	60	57	47.9	
NK 144	11.1	47	56	46.7	
NK 133	20.8	50	54	45.4	
Frontier 388	11.5	54	56	45.0	
SD 502	19.9	55	54	44.3	
Frontier 400C	16.2	55	50	43.7	
Pioneer 885	18.2	51	52	43.2	
PAG 410	15.5	53	53	42.0	
DeKalb B32	14.3	52	56	41.6	
NK 125	16.0	52	54	41.1	
RS 608	16.2	54	52	40.8	
Rocket A	14.5	54	50	40.8	
PAG 275	15.7	51	55	40.3	
SD 451	15.1	55	54	40.2	
RP 110	12.3	55	49	39.4	
NK 120	19.4	49	55	38.5	
Comanche	23.1	54	54	38.0	
NK 115	12.8	47	53	37.2	
PAG 304	11.2	45	52	36.9	
SD 441	16.2	56	54	34.5	
Ute	24.5	49	51	31.3	
Frontier 400D	12.4	51	46	27.1	
SD 102	17.1	45	53	25.2	
Frontier 401	14.2	48	47	23.1	
			Mean Yield	41.1	
CV - 18%			L.S.D. (.05)	11.8	

a - The field was irrigated and seeding was in rows spaced 21 inches apart.

1964 DRAINAGE RESEARCH AT REDFIELD FARM

Walter D. Lembke

Water Table Study with Grain Sorghum:

Thirty-eight varieties of grain sorghum were seeded in 21 inch rows 146 feet long on the Redfield drainage plot on June 5, 1964. The purpose of the experiment was to compare these varieties under irrigated conditions and to observe the effect of a high water table during the period of heading of the sorghum plants. The cultural schedule of the sorghum is summarized in table 1 below.

Cultural Operations for Grain Sorghum

Operation	Date
Planting	June 5
Flooded	June 11
Cultivated	June 25
Flooded	July 16
Maintained high water table	July 21-July 31
Harvested sorghum	September 17

The sorghum varieties are listed in table 2 and will be referred to by number throughout this report.

Grain sorghum on the east side of the plot was somewhat uneven and was not included in this analysis. The cause for the unevenness was attributed to a slightly lower area where water stood on the surface during flooding of the grain sorghum during June and the earlier part of July.

The average water table elevation, as measured using piezometers during the period July 21-31, and the ground surface elevation are shown in figure 1. These elevations are based on two lines of piezometer stations.

The water table was maintained at the edge of the plot by periodic flooding of the boundary using the farm irrigation system and was maintained in the center of the plot using the tile system and a sump with a float controlling the water level. This maintained the water level within 0.3 foot of the average line shown in figure 1 until July 30 when a rain caused the water table to rise slightly above the ground surface at 70 feet from the tile drain.

During the period between July 21 and July 31 varieties 2 and 10 began heading. Variety 2 began heading out July 24 while variety 10 had close rolled spikes on July 24 and began heading out July 31. On August 3 varieties 2, 4, 10, 11, 14, 18, 25, 36 and 37 were heading, and by August 10 all varieties were heading except 16, 17, 23 and 24.

Some observations of growth were made during the period of water table control. The growth of varieties 10 and 11 showed a difference as a result of the controlled water table. On July 24 there was little difference in growth within variety 10 with an average plant height of 39 inches. On July 31 the plants

WATER TABLE LEVEL DURING PERIOD JULY 21 - JULY 31

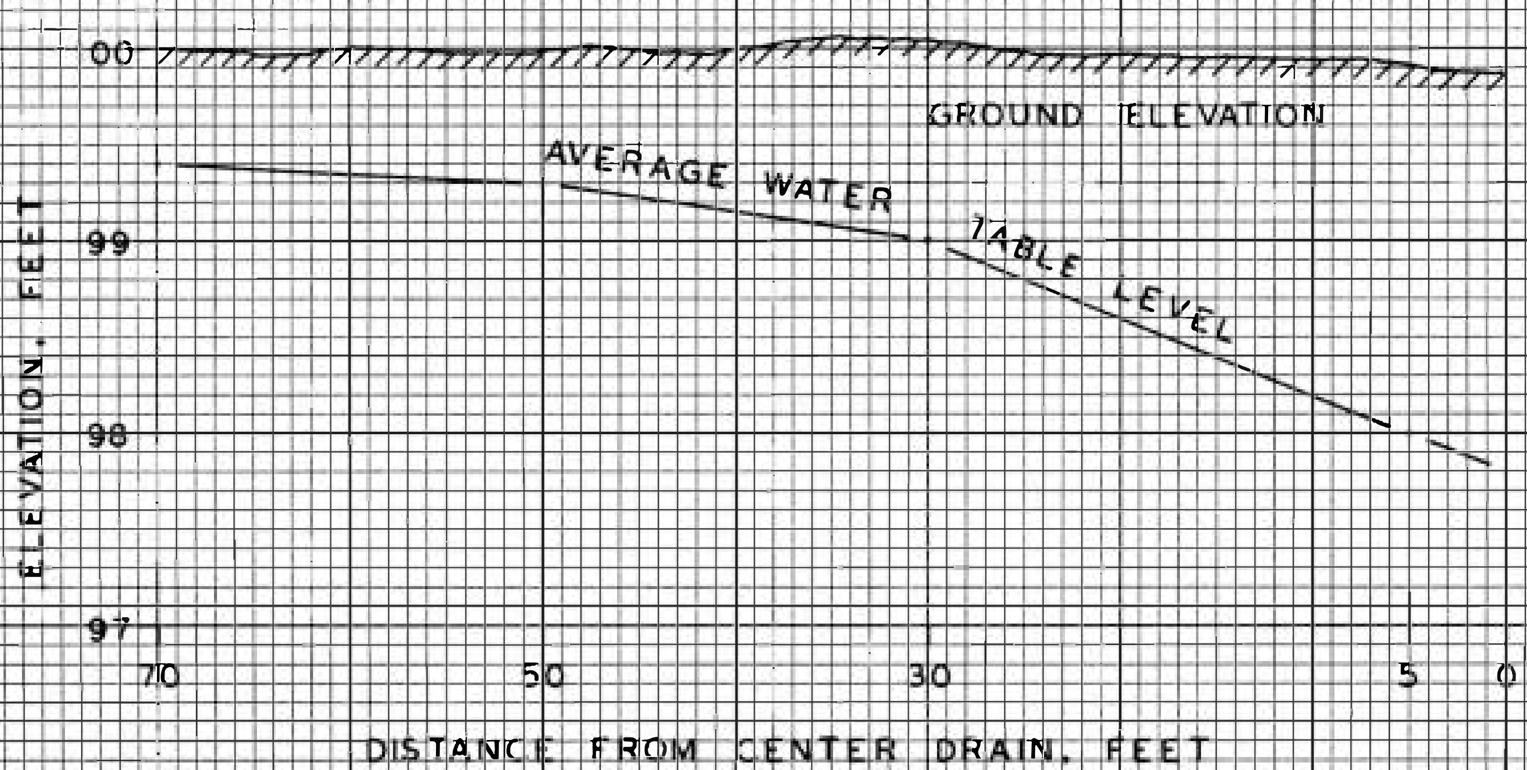


FIGURE 1

of variety 10 with the high water table had grown to 43 inches while plants with the lower water table had grown to 50 inches. Variety 11 plants showed the same trend. There was an average plant height of 46 inches on July 24, but on July 31 the plants with a high water table had grown to 48 inches while those with the low water table had grown to 54 inches. There was no noticeable difference in the other varieties. Varieties 10 and 11 were the most rapid growing of all varieties tested during the period of the controlled water table. At the time of harvesting,varieties 10 and 11 were again measured. Variety 10 had grown to 62 inches with the high water table and to 65 inches with the low water table. Variety 11 had grown to 72 inches with the high water table and to 70 inches with the low water table. While growth rate had been reduced with both varieties as a result of the high water table, recovery had been such that the growth difference had been regained before the harvest.

Yields were sampled in the plot at the point of high water table, at the point of low water table and at the intermediate water table. These yields are tabulated in table 2, The yield trends were observed from the high water table to the low water table. It was observed that for the plot as a whole, there was a slight increase in yield with the higher water table. For some varieties, however, there was a reversal of this trend. In the case of varieties 2 and 10 there was more than 700 pounds per acre increase with the lower water table. These varieties had a greater increase with the low water table than any others tested. These were also the only varieties that were heading out throughout the period of a controlled water table. Variety 10 had also shown a reduction in growth rate with the high water table. Variety 11 had a lesser yield reduction with the high water table. This evidence points to a decrease in yield with the high water table when the water table is held up during the heading out period. The yield difference for variety 11 was not significant at the 95 percent level. There may also be a yield reduction with a high water table when sorghum is growing rapidly, but this reduction does not appear to be great.

The occurrence of early flooding damage during June and early July indicates that a water table study should be planned for the early stages of grain sorghum growth.

Since there was little difference in sorghum yields for most of the varieties as a result of the high water table, the remaining varieties (all except 2 and 10) were compared for yields under irrigation.

The average yield (based on 12 percent moisture) for each variety is presented in table 2. The significant difference at a 95 percent confidence level for comparison of yields is 1000 pounds.

Table 2.

YIELDS OF SORGHUM VARIETIES ON DRAINAGE PLOT
WITH VARYING WATER TABLE LEVELS, REDFIELD - 1964

		Water Table Level			Ignoring Water Table Effect	
No.	Variety Name	High 6 inches	Medium 1 foot	Low 2 feet	Average Yield/lb	Rank
1	NK 227	5240	5360	4160	4920	1
2	SD 102	2090	1750	2990	--	-
3	Paymaster UTE	3180	3460	2740	3120	25
4	PAG 275	2890	3050	3340	3090	27
5	Rudy Patrick RP 110	3540	3610	3240	3460	13
6	DEKALB E 57	3160	3440	3030	3210	23
7	Funks Lindsay 531	2770	2850	2910	2840	29
8	Pioneer 885	3940	3170	3740	3610	11
9	NK 212	3590	3960	3480	3670	9
10	SD 441	2930	2610	3640	--	--
11	NCT Hybrid RS 501	2910	2890	3390	3060	28
12	PAG 430	3570	3080	3510	3380	14
13	Frontier 401	3770	3240	3560	3520	12
14	DeKalb B 32	3680	2920	3240	3280	19
15	Funks Lindsay 551	3670	2870	3580	3370	15
16	Funks Lindsay 755	2980	2310	3200	2830	30
17	Pioneer 848	3540	3610	2980	3370	16
18	NK 144	3260	3370	3200	3270	20
19	NCT Hybrid RS 608	4910	3770	4130	4270	6
20	NCT Hybrid RS 610	4810	4450	3830	4360	5
21	Paymaster Kiowa	2510	3200	2500	2730	32
22	Frontier 388	2740	3520	3670	3310	18
23	Asgrow 623	2500	2440	2130	2350	36
24	Pioneer 846	2850	2810	2510	2720	33
25	Taylor Evans TE 44	4940	4420	5340	4890	3
26	NK 125	3350	3520	2810	3220	22
27	NK 222	4520	3810	4300	4210	7
28	SD 503	3300	3250	3380	3310	17
29	Paymaster Pawnee	5120	4370	4390	4620	4
30	PAG 304	3340	2210	1660	2400	35
31	DeKalb C 44 B	3960	2440	3050	3150	24
32	Frontier 400 C	3780	3370	2670	3270	21
33	Funks Lindsay 744	3760	2850	2740	3120	26
34	Pioneer X 0921	4170	3560	3240	3650	10
35	NK 133	4870	3680	2730	3760	8
36	NK 120	5750	4740	4200	4890	2
37	NK 115	3020	3170	1800	2660	34
38	Paymaster Comanche	2920	3300	2050	2750	31

Permeability Measurements of Backfill Material

During the construction of the drainage plot a trench was excavated for installation of the tile drain lines. The trench dimensions are shown in figure 2. The permeability of this soil as measured by tile drainage outflow depends a great deal on the condition of the backfill material.

Three auger holes were spaced in the backfill material in June. The auger holes were lined using a slotted downspout pipe with a four-inch diamter and with a five-foot length as shown in figure 2. Measurements of permeability were made using the auger hole method each time the plot was flooded. The pump was stopped and the water table was allowed to come to equilibrium for each measurement. The hydraulic conductivities measured are presented in table 3. These measurements show that the backfill material had settled sufficiently so that there was no more than the usual expected difference in permeability that occurs from time to time in all field measurements. These measurements also show that the average settled backfill permeability was close to average of the permeability rates in the profile as measured using soil cores (see annual report for 1963). This relationship may be accidental. The permeability of backfill material mixtures should be studied intensively before a conclusion about this result is reached.

Table 3.

Hydraulic Conductivity of Backfill Material in Inches Per Hour

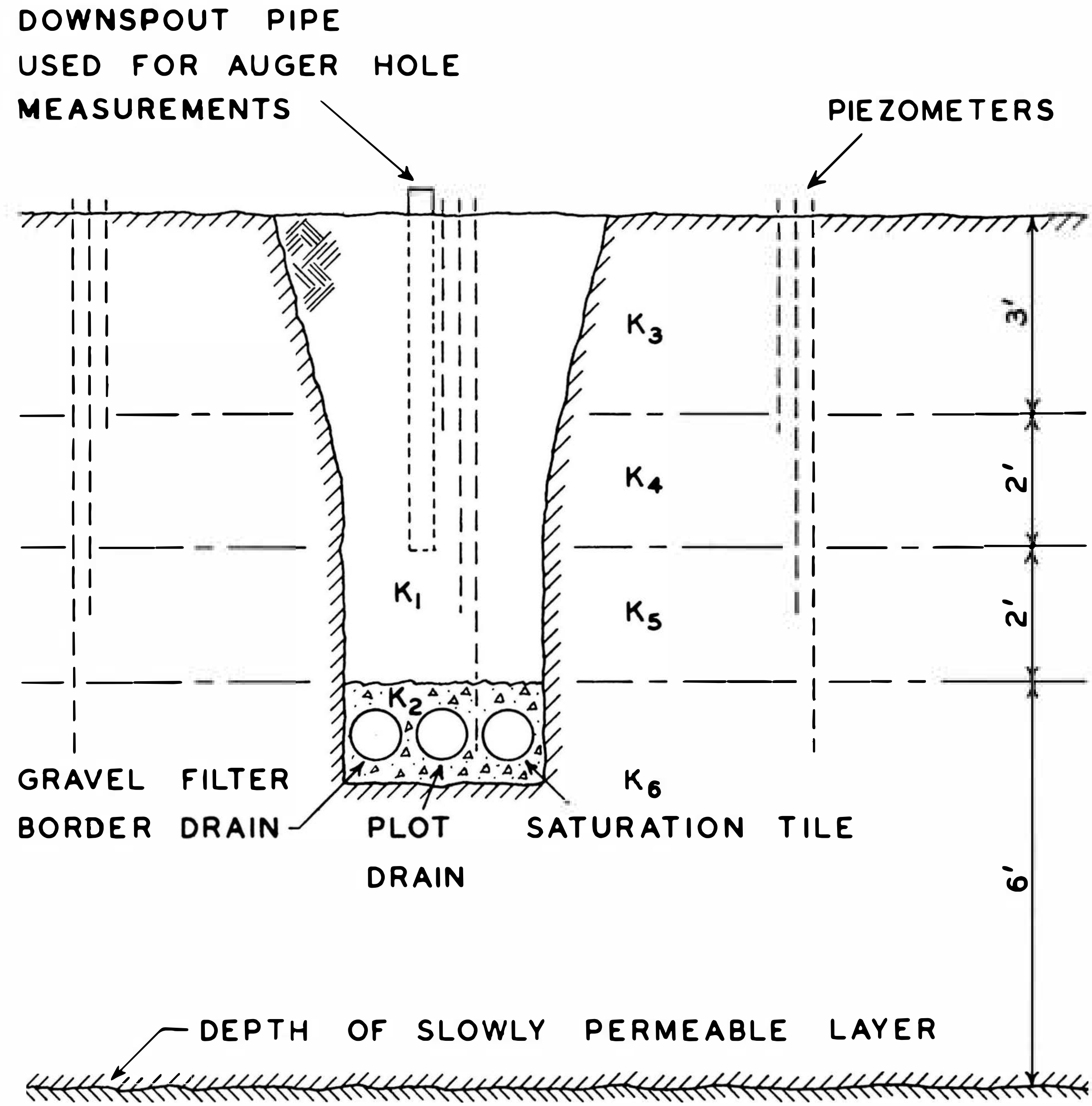
Date	Location 1	Location 2	Location 3
June 15	.20	.38	.20
June 25	.31	.36	.30
July 21	.37	.49	.51
July 27	.25	.61	*
July 31	.32	.71	.38
August 3	.37	.58	.36
Average	.30	.52	.35

*Equipment failure

Deep Percolation and Lateral Seepage With No Tile Outflow

On October 12 the drainage plot was flooded to determine the infiltration rate of the soil with no tile outflow. The plot had been flooded periodically for a period of 10 days to assure saturation to the slowly permeable layer at 13 feet.

CROSS-SECTION OF CENTER OF DRAIN LINE



The plot and boundary were flooded and stage recorders were installed inside the plot area and in the boundary. The plot was observed for a period of one day. The water stage on the plot surface is presented in figure 3. The evaporation pan measurements from the farm weather station indicate 0.10 inches of evaporation during this period. This was modified by the sheltering effect of the full stand of dried grain sorghum stalks on the plot.

The application of water to the plot and boundary was limited to periodic applications of large amounts of water. Water was applied through a field ditch that was constructed along the north boundary of the plot. Water was applied on the morning of October 12 prior to the installation of the recorder. Prior to this application water was standing over most of the plot surface. As shown by figure 3 the water in the plot boundary fell quite rapidly due to lateral seepage. While the water was above the inner plot stage, there was a small rate of addition to the stage of the inner plot. At the point of equal stage there was no visible change to the inner plot level and with a lower stage on the boundary plot there was a decrease in stage on the inner plot. This means that there was some seepage through the plot boundary with a stage difference. It also means that there was very little deep seepage or evaporation from the plot with equal stages in the boundary and in the plot.

The period between 6:00 p.m., October 12, and 10:00 a.m., October 13, was used to determine the relation between a difference in stage and lateral seepage from the inner plot.

Tile Outflow From the Drainage Plot With a Ponded Water Condition

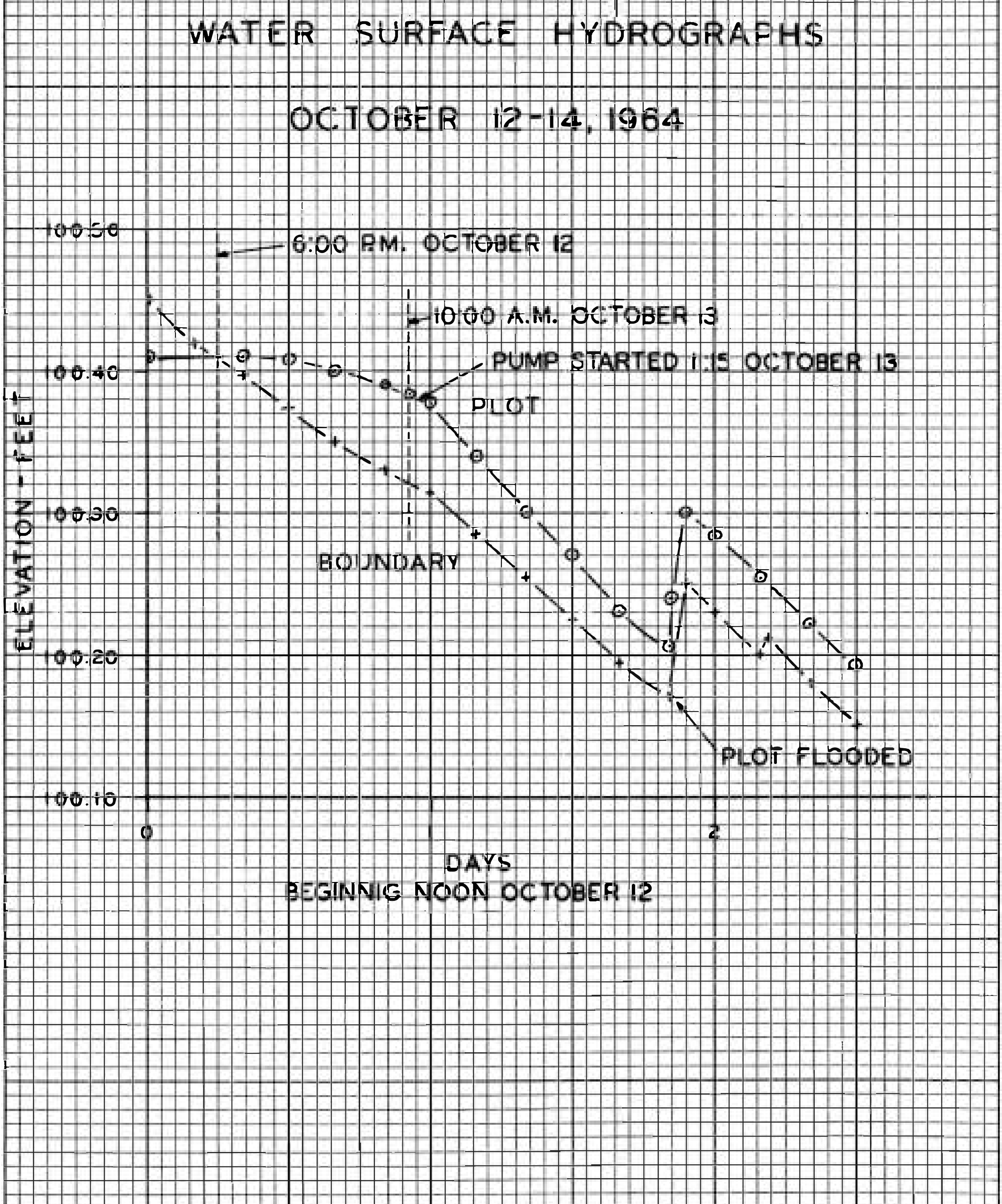
Beginning 11:15 a.m., October 13, the outlet sump was drained continuously for the remainder of the test. The tile outflow was measured using a tipping bucket mechanism and a recorder.

The hydrograph of tile outflow is shown in figure 4 while the hydrograph of the plot surface is shown in figure 3. On the morning of October 14 the plot was flooded causing the rise in the plot surface hydrograph. The early steep recession of the tile outflow hydrograph is caused by the initially high outflow rate of gravitational water from the gravel filter shown in figure 2.

Tile outflow can be compared with the plot surface hydrograph if an allowance is made for seepage. Using the plot stage recession at 1:00 p.m., October 14, and correcting for lateral seepage, the recession attributed to tile outflow is 1.62 inches per 24 hours. Tile outflow at this same time is 1.56 inches per 24 hours. The difference can be attributed to evaporation and error in measurement.

Analysis is being conducted at the present time to relate tile outflow to the hydraulic conductivity of the soil profile.

FIGURE 3


WATER SURFACE HYDROGRAPHS
OCTOBER 12-14, 1964
6:00 P.M. OCTOBER 12
10:00 A.M. OCTOBER 13
PUMP STARTED 1:15 OCTOBER 13
PLOT
BOUNDARY
PLOT FLOODED
ELEVATION - FEET
100.50
100.40
100.30
100.20
100.10
0
1
2
DAYS
BEGINNIG NOON OCTOBER 12

Tile Outflow for a Transient Water Table

The previous paragraph dealt with the high outflow that occurs with a layer of ponded water on the ground surface. Actual field conditions involve outflow with a falling water table. The latter portion of the tile flow hydrograph for October after the second day shows this decrease in tile flow while figure 5 shows the drawdown of water in the soil profile during this same period.

The water table was also drawn down by the tile drain from a level about two feet from the ground surface. This tile outflow period began on August 3 and is also shown in figure 4. Again there was observed a period of rapid flow as the gravel filter material was being drained. This was followed by a gradual decline similar to the recession hydrograph in October.

A detailed analysis is presently underway to determine how tile outflow and drawdown rates can be predicted.

The removal of salts in tile outflow

During October test measurements were made of the water quality before and after passing through the soil profile. The results of this analysis are presented in table 4. These results indicate that there is an increase in some salts as water passes through the soil profile. A detailed study of this and additional data to determine the leaching requirement of this soil will be conducted during 1965.

Table 4.

	Cond.	Cations-me/L				Anions-me/L		
	EC x 10^6	Na	Ca	Mg	K	HCO_3	SO_4	Cl
Surface average	1575	6.52	6.00	3.00	.51	8.00	4.68	2.82
Tile outflow average	2300	6.1	11.6	7.9	.31	10.0	12.37	2.82

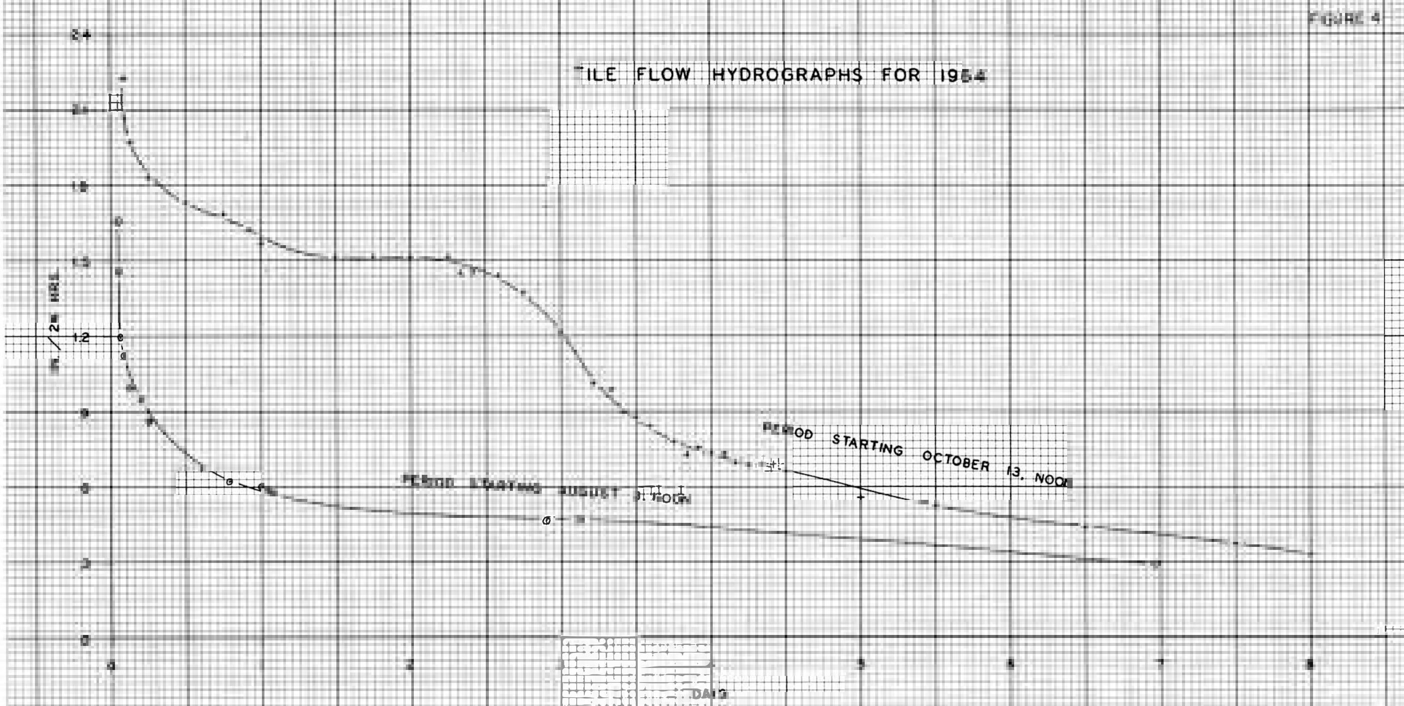
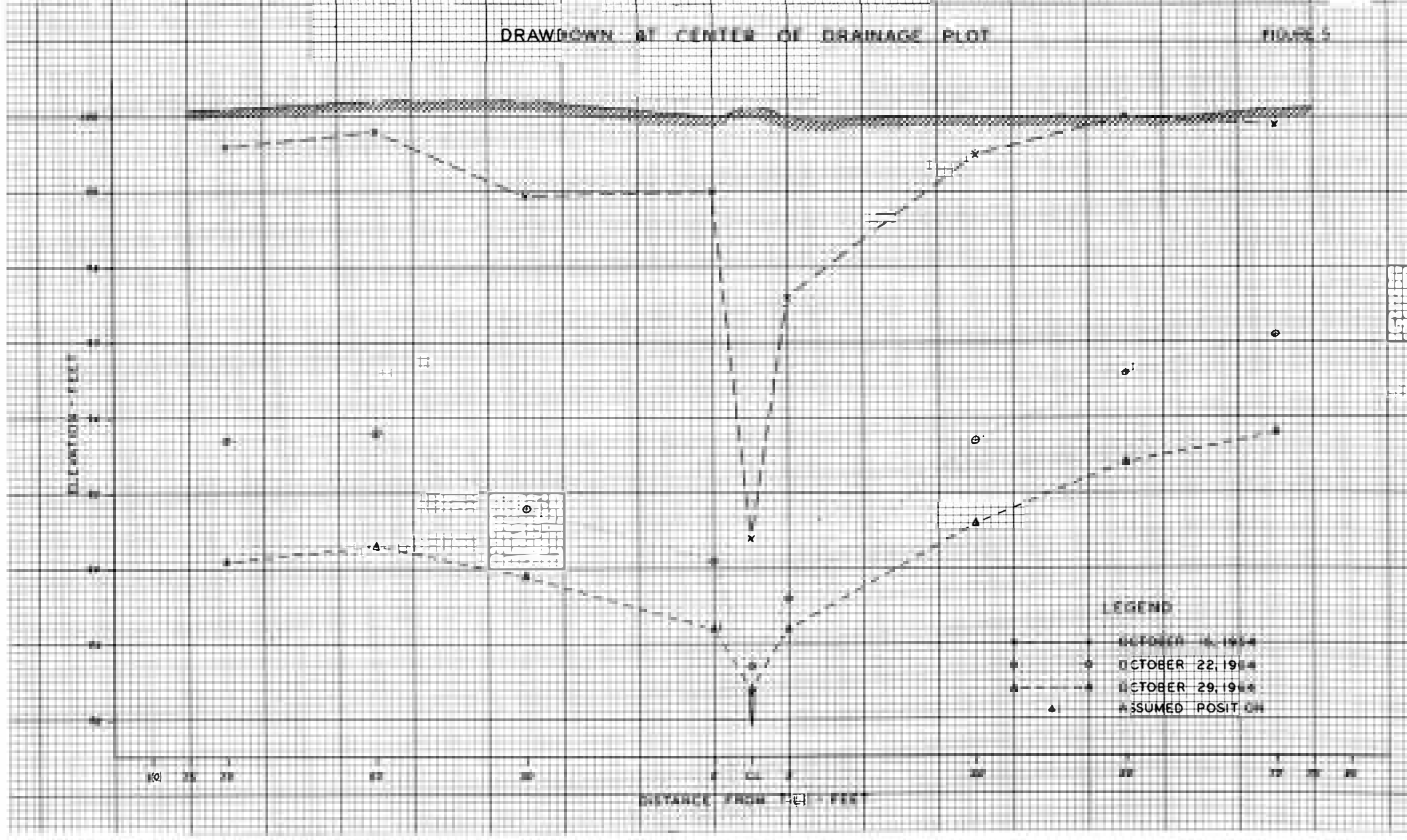
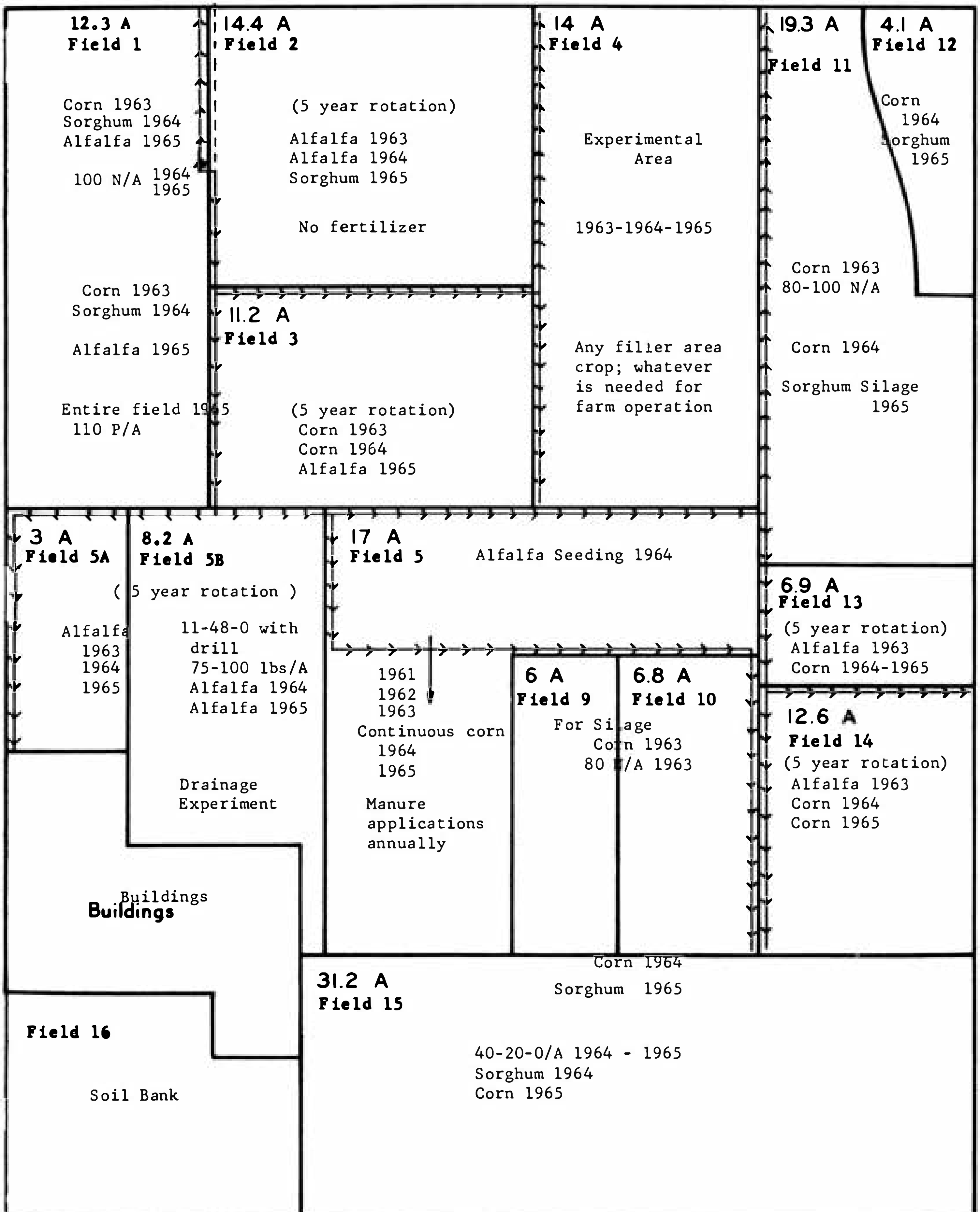


FIGURE 4
TILE FLOW HYDROGRAPHS FOR 1954
IN./24 HRS.
PERIOD STARTING OCTOBER 13, NOON
PERIOD STARTING AUGUST 9, NOON
DAYS


DRAWDOWN AT CENTER OF DRAINAGE PLOT
FIGURE 5
ELEVATION - FEET
DISTANCE FROM TILE - FEET
LEGEND
OCTOBER 16, 1954
OCTOBER 22, 1954
OCTOBER 29, 1954
ASSUMED POSITION

REDFIELD IRRIGATION RESEARCH SUBSTATION

(REDFIELD DEVELOPMENT FARM)



(2/1/64)

REDFIELD IRRIGATION RESEARCH SUBSTATION

(REDFIELD DEVELOPMENT FARM)

1964 Crop Season

12.3 A
Field 1

Replanted to Rox Orange and Lindsey 77. July 21-24, 1st irrigation.
Aug 15-19 2nd irrigation.
Planted June 26.
Frost Sept. 26
Harvest Sept. 28

14.4 A
Field 2

Alfalfa
June 8-12 1st cutting Chopped for silage, 39 T 40% haylage. June 17-22 1st irrigation. July 7-8 2nd cutting, 7½ T baled hay plus 18 tons haylage. July 10-13 2nd irrigation. Aug. 12-19 3rd cutting dry chopped-17 T. Aug 20-Sept 2 - 3rd irrigation. Oct 10- 4th cutting 8 tons hay.
Oct 15 - Fall plowed

14 A
Field 4

Experimental Area

1964 Field notes are available from Lloyd Dye on dates of irrigation, etc.

19.3 A
Field 11

Corn
May 20 - planted Pioneer 377A 3658
July 3-8, 1st irrigation.
July 18-21 2nd irrigation
Aug 15-19 3rd irrigation
Nov 3 - Yield 74 bu/acre

4.1 A
Field 12

Corn cultivations on 6/17 &23, 7/1. Harvest 7 ton/A silage. 25-30 bu.on var. test plot.

11.2 A
Field 3

Corn ground
May 17-19 Stalks chopped, disked, harrowed
Planted XL15 and Pioneer 3568
Too much volunteer corn.
June 17-21, 1st irrigation.
June 26-July 2, 2nd cultivation
July 11-13, 2nd irrigation
Aug 12-15, 3rd irrigation
Oct 30, Yield 84 bu/acre.

3 A
Field 5A

8.2 A
Field 5B

Alfalfa 6/12-15, 1st cutting
14 ton haylage & 7 ton hay.
June 19, 1st irrigation.
July 17, 5 T dry chopped hay
July 22, 2nd irrigation.
Aug 18, 7 T hay (baled)
4 T dry chopped hay
Sept 2, 3rd irrigation

17 A
Field 5

New seeding alfalfa
Planted Vernal May 2.
June 22-26, 1st irrigation.
July 24-27, 2nd irrigation.
Aug 27, 24 tons haylage harvested

6.9 A
Field 13

Corn Pioneer 368A 3568. Cultivation 6/7-23. Irri's 6/29,7/8 & 8/3.

6 A
Field 9

6.8 A
Field 10

March & April, Heavy manure applications. May 18, planted DeKalb 409 & 59 50/50. Cultivations June 11, 20, & 29. Irrigation July 1, 17, Aug 9 & 14.
Sept 24, 335 tons silage
22" corn - 1160 lbs per row
36" corn - 1660 lbs per row
Fall plowed, Oct 9 - 13.

12.6 A
Field 14

Same as Field 13.

Buildings

Field 16

Soil Bank

31.2 A
Field 15

(A) Planted to corn - DeKalb 59 15.6 acres
June 17 - Cultivated A & B
June 23-25, 2nd cultivation of corn. July 3-4 last cultivation. 8.1 tons/acre corn silage. Estimated 80 bu. corn.

(B) Planted to sorghum. West half heavy applications of manure. Spring plowed. Planted NK 120 May 23.
July 1, 2nd cultivation.

15.6 acres. Yield 31 bu dry sorghum/acre

(2/1/64)

EFFECTS OF LEVELS OF ALFALFA HAY AND EAR CORN WITH CORN SILAGE ON CATTLE PERFORMANCE DURING GROWING PHASE AND WHEN FINISHING ON HIGH GRAIN RATIONS

F. W. Whetzal, L. B. Embry and L. B. Dye

(A. S. Series 64-16)

This experiment was conducted at the Redfield Irrigation Farm. The feeds produced on the farm were fed to cattle in a two-phase experiment designed to further study various systems of feeding and management. The objectives of the experiment were: 1) To compare rate of gain and feed efficiency of steers fed rations with various levels of energy during a growing phase, 2) to compare alfalfa hay and soybean meal as protein supplements to high corn silage and corn silage with limited grain rations, 3) to study the effects of earlier treatments on performance during a finishing phase on high grain rations, and 4) to measure the production in gains per acre from the various feed combinations.

Rations composed of corn silage with various levels of alfalfa hay, with and without ground ear corn, were fed during the first phase of the experiment. This phase was followed by a finishing period using a full feed of ground barley and a limited feed of low moisture alfalfa silage.

Procedure

Phase 1

One hundred and twenty-six Hereford steer calves that averaged about 450 lb. were purchased for this experiment and allotted to six lots on the basis of weight. Ground alfalfa hay was fed at the rate of 0, 4 and 8 lb. per head daily along with a full feed of corn silage to three lots of the calves. Soybean meal was fed at 1 lb. per head daily with 4 lb. of hay and 2 lb. daily when no hay was fed. No protein supplement was fed when feeding 8 lb. of the hay. The other three lots were fed in the same manner except that ground ear corn was fed at 10 lb. per head daily.

The cattle were implanted with either 24 or 30 mg. of diethylstilbestrol initially and again after 160 days with 36 mg. They were also used to test some grub control treatments with these treatments being balanced between ration treatments.

The cattle were fed in unpaved outside lots without shelter. They were hand fed twice daily in fence-line feed bunks. Trace mineral salt and dicalcium phosphate were offered free-choice.

The alfalfa hay fed in the experiment was first-cutting which had been exposed to rain damage during harvest. It was baled and stored in outside stacks. The hay was chopped with a forage harvestor into 2 to 3-inch lengths before feeding. It contained about 16.5% protein but only 0.02 mg. of carotene per pound.

The corn silage had to be harvested at an immature stage because of a late planting date and an early frost. The grain was in the milk and early dough stages when ensiled. The moisture content was about 76% with about 1.3% protein on this moisture basis. The carotene content as fed was about 2.2 mg. per pound. The silage was stored in a trench silo.

The corn harvested as grain was well matured and of good quality. It yielded about 80 bushels per acre with a protein content of about 8%. It was ground with a hammer mill using a 1 inch screen.

After 158 days on the experiment, the cattle were put on the second phase of the experiment.

Phase 2

A finishing ration composed of 6 lb. of low moisture alfalfa silage with a full feed of ground barley was fed to all steers during the second phase of the experiment. The low moisture alfalfa silage averaged about 40% moisture and was made from second-cutting alfalfa. The yield was about 6.6 tons per acre on this moisture basis. It was stored in an 18 x 36 ft. concrete stave silo.

The barley yielded about 50 bushels per acre. It was ground with a hammer mill to a medium degree of fineness.

When making the change to the finishing rations, low moisture alfalfa silage was full-fed during the first week of this phase and the barley was increased 1 lb. per head daily after starting at 6 lb. per head. After 1 week the amount of low moisture alfalfa silage was reduced 1 lb. per head daily as the barley continued to be increased. After 3 weeks the steers were consuming 20 lb. of barley and 6 lb. of the low moisture alfalfa silage per head daily. One pound per head of soybean meal containing 100,000 I.U. of vitamin A was fed once weekly to all steers.

The cattle from lots 4, 5 and 6 were marketed after 138 days on the finishing phase of the experiment. Those in lots 1, 2 and 3 were marketed after 177 days. The final weights represent the market weights after being held off feed and water overnight.

Results of the Experiment

Phase 1

The results of the first phase of the experiment are presented in table 1.

The addition of the ground ear corn to the rations increased the rates of gain an average of 0.62 lb. daily (35.6%) in comparison to feeding the rations without ear corn. The percentage improvement with the ear corn increased with the amount of hay in the rations.

Consumption of corn silage was reduced an average of about 20.5 lb. daily by feeding the 10 lb. of ground ear corn, with the reduction being the greatest with 8 lb. of hay. This rate of reduction in silage consumption (76% moisture) from feeding the ear corn (about 2 lb. of silage for each 1 lb. of ear corn) resulted in an increase in intake of dry matter and total digestible nutrients when feeding the ear corn.

Amount of gain per acre was highest for the rations without ear corn even though rate of gain and feed efficiency were improved with the ear corn. Average gain per acre was 1280 lb. for the rations without the ear corn in comparison to 927 lb. for the rations with the corn during this phase of the experiment.

Rate of gain was reduced by feeding the alfalfa hay without ear corn with the reduction being greater with 8 lb. of hay. Reduction in corn silage consumption amounted to about 2 lb. for each 1 lb. of hay except with 8 lb. of hay without ear corn. Consumption of corn silage in this instance was only slightly less than when feeding 4 lb. of hay.

At yields of corn silage and alfalfa hay obtained, gains per acre were reduced by feeding the hay. The protein supplement required per acre of feed was 724 and 1747 lb. for the rations with 4 lb. of hay and no hay. However, in comparison to the ration with 8 lb. of hay, this resulted in an increase in gain per acre of 55 and 45 lb. for each 100 lb. of the protein supplement fed with these rations.

Rate of gain was reduced by feeding 8 lb. of alfalfa hay, but not by 4 lb. in comparison to feeding no hay in the rations with the ground ear corn. Gains per acre were also reduced when using the hay but to a lesser extent than when feeding the rations without the ear corn. Since the rate of gain was slightly higher with the ration which contained 4 lb. of hay and 1 lb. of protein supplement than with the one with 2 lb. of protein supplement and no hay, there was very little extra gain obtained from the greater amount of protein supplement required with the ration without hay. However, the lower gain per acre obtained when feeding the ration with 8 lb. of hay resulted in about 25 lb. increase in gain per acre for each 100 lb. of protein supplement required when feeding no hay.

There was no difference in daily gains between steers implanted initially with 24 or 30 mg. of stilbestrol.

Phase 2

Results for the finishing phase are shown in table 2.

One steer died from bloat and one was removed from trial as a chronic bloater. Two steers that suffered from impaction on occasion were kept on trial until its completion then held for further feeding. Some founder was encountered, however, it was not a serious problem.

The steers fed 10 lb. ground ear corn with corn silage during phase 1 were marketed 39 days sooner and averaged 35 lb. heavier (shrunk wt.) than those not fed ear corn. Average daily gains up until the time the first cattle were sold were quite similar. Gains on a filled weight basis for lots 4, 5 and 6 averaged 2.38 lb. daily compared to 2.43 lb. daily for the remaining lots. Performance of the steers in lots 1, 2 and 3 was somewhat less during the last 39 days and was due partly to severe weather.

Considerably less gain was produced per acre with the rations fed during the finishing phase when compared with those fed during the initial phase of the trial. The reduced production is due to the lower yields per acre of crops fed, the greater feed requirements of cattle as slaughter weights and finish are approached and in part due to inclement weather conditions late in the experiment.

Summary - Phase 1 and 2

The combined results of phases 1 and 2 are shown in table 3.

The cattle fed 10 lb. ground ear corn with corn silage during phase 1 gained an average of 676 lb. or 2.29 lb. daily for 296 days on trial. The three lots fed corn silage without ear corn initially were fed for 335 days and gained an average of 639 lb. or 1.91 lb. daily.

Market weights averaged 35 lb. heavier (1102 lb. vs. 1067 lb.) for the cattle fed the shorter length of time, however, those fed the greater length of time dressed and graded higher.

Rate of gain and gains per acre were reduced when 8 lb. of hay was fed in the silage ration with or without ear corn. Four lb. of hay fed in the ration without ground ear corn reduced daily gains and gains per acre except when fed in the ration with ground ear corn.

The relative economy of rations with alfalfa hay or protein supplement would depend on yields and feed prices. In the first phase of this experiment, gains per acre favored maximum use of the high-yielding corn silage fed with the protein supplement.

The advantages in beef gains per acre shown for the high corn silage rations during the first phase of the trial were overcome during the finishing phase. All cattle were changed to the finishing phase of the experiment at the same time. This resulted in a shorter finishing period for the heavier cattle fed the ear corn. Had the cattle been changed to the finishing ration at equal weights, those fed no ear corn would have been fed for a longer period of time on the first phase with a shorter finishing period. This probably would have resulted in more favorable results for the high silage rations.

Table 1. Performance of Steers During Growing Phase at Redfield Irrigation Farm
Phase 1 - January 18, 1963 to June 25, 1963 - 158 days

Treatment[a]	Corn silage			Corn silage + 10# ear corn		
	2# SBOM	1# SBOM 4# alf. hay	8# alfalfa hay	2# SBOM	1# SBOM 4# alf. hay	8# alfalfa hay
Lot number	1	2	3	5	6	4
Animals per lot	21	21	21	21	21	21
Initial filled weight	447	451	[illegible]	446	451	446
Final filled weight	741	735	699	826	840	799
Total gain/lot	6185	5955	5240	7980	8175	7410
Av. daily gain	1.86	1.79	1.58	2.40	2.46	2.23
Av. daily ration						
Corn silage	41.1	33.4	31.5	23.1	13.6	6.9
Ground ear corn				9.7	9.7	9.7
Soybean meal	2.0	1.0		2.0	1.0	
Alfalfa hay		4.0	7.9		4.0	7.9
Feed/100lb. gain						
Corn silage	2206	1858	1994	960	551	310
Dry matter (15% moisture)	622	525	564	271	155	87
Ground ear corn				404	396	433
Soybean meal	107	56		83	41	
Alfalfa hay		221	503		161	354
Acres req./100 lb. gain[b]						
Corn silage	.061	.052	.055	.027	.015	.009
Ground ear corn				.072	.070	.077
Alfalfa hay		.025	.056		.018	.039
Plus soybean meal, lb.	107	56		83	41	
Total	.061	.077	.111	.099	.103	.125
Gains per acre	1639	1299	901	1010	971	800
Soybean meal req./acre, lb.	1747	724		838	398	

[a]One-half of steers in each lot implanted with 24 mg. stilbestrol and one-half with 30 mg. All steers reimplanted with 36 mg. after 160 days.
[b]Based on yields per acre: Corn silage, 18 tons; corn, 80 bushels; and alfalfa hay, 4.5 tons.

Table 2. Results of Feeding Barley and Low-Moisture Alfalfa Silage During the Finishing Period
Phase 2 - June 25, 1963 to November 11 or December 19, 1963

Treatment - Low moisture alfalfa silage, 6 pounds barley full-fed						
Date terminated	December 19, 1963 (177 days)			November 11, 1963 (138 days)		
Lot number	1	2	3	5	6	4
Animals/lot[a]	21	19	21	21	21	20
Init. filled wt., lb.	741	730	699	826	840	799
Final filled wt., lb.	1110	1077	1103	1155	1175	1115
Total gain/lot, lb.	7755	6590	8490	6914	7020	6430
Av. daily gain, lb.	2.09	1.96	2.28	2.39	2.42	2.34
Av. daily ration, lb.						
Barley	21.3	20.6	22.0	20.9	21.0	20.1
Low moist. alf. silage[b]	7.3	7.2	7.3	8.2	8.2	8.2
Feed/cwt. gain, lb.						
Barley	1023	1052	963	873	866	862
Low moist. alf. silage	351	366	321	344	339	351
Acres req./cwt. gain[c]						
Barley	.426	.438	.401	.364	.361	.359
Low moist. alf. silage	.027	.028	.024	.026	.026	.027
Total	.453	.466	.425	.390	.387	.386
Gains/acre	221	215	235	256	258	259

[a]One animal died and one other removed from lot 2 - one animal removed from lot 4.
[b]Low moisture alfalfa silage full-fed and reduced 1 lb./head daily for approximately 3 weeks until steers were on a full feed of barley.
[c]Based on yields per acre: Barley, 50 bu. and low moisture alfalfa silage, 6.6 tons.

Table 3. Summary of Redfield Cattle Feeding Trials
Summary - Phase 1 and 2

	Corn silage			Corn silage + 10# ear corn		
Phase 1 Treatments	2# SBOM	1# SBOM 4# alf. hay	8# alfalfa hay	2# SBOM	1# SBOM 4# alf. hay	8# alfalfa hay
Phase 2	Low moisture alfalfa silage, 6 pounds barley full-fed					
Lot number	1	2	3	5	6	4
Number per lot	21	19	21	21	21	20
Days fed	335	335	335	296	296	296
Init. shrunk wt., lb.	428	428	429	426	431	421
Final shrunk wt., lb.	1087	1047	1068	1105	1124	1078
Av. gain/steer, lb.	659	619	639	679	693	657
Av. daily gain/steer, lb.	1.97	1.85	1.91	2.30	2.34	2.22
Av. feed req./steer, lb.						
Corn silage	6497	5275	4970	3647	2146	1092
Ground ear corn				1570	1575	1527
Alfalfa hay		628	1254		628	1248
Soybean meal	314	158		314	158	
Barley	3776	3651	3890	2874	2896	2772
Low moist. alf. silage	1295	1272	1295	1131	1134	1128
Total	11882	10984	11409	9536	8537	7767
Feed req./cwt. gain, lb.	1803	1774	1786	1404	1232	1182
Steer gains/acre	356	336	320	409	410	391
Soybean meal req./A., lb.	170	86		190	95	
Carcass grade score[a]	19.4	19.3	18.9	18.7	18.6	17.8
Dressing percent	61.1	60.8	60.7	60.1	60.9	59.3
Av. price/100 lb., $	20.79	20.76	20.66	21.94	22.15	21.64
Av. price rec'd./head, $	226.03	217.33	220.77	242.45	248.89	233.34

[a]Carcass grade score based on: Good = 17, High Good = 18, Low Choice = 19 and Choice = 20.

Beef Cattle Project Conducted at Redfield
1963-64

Investigation:

Comparison of performance between heifers and steers of similar breeding when left untreated, implanted with Snyovex or implanted with stilbestrol and fed a growing and finishing ration in dry lot.

Objectives:

1. To compare performance (rate of gain and feed efficiency) between heifers and steers of similar breeding when fed alike during growing and finishing.
2. To determine the value of Synovex and stilbestrol implants when administered to heifers and steers.
3. To measure the production of beef per acre from heifers and steers that are untreated or receive different hormonal treatments and when fed feed crops grown under irrigation.
4. To evaluate carcasses produced by the different sexes from the different treatments and when sold at different weights.

Procedures:

Seventy-five heifers and seventy-five steer calves that were purchased from three producers were allotted uniformly into six lots with twenty-five heifers per lot in 3 lots and 25 steers per lot in the other three lots.

Corn silage supplemented with 4 lb. ground alfalfa hay and 1 lb. of protein supplement was fed for 112 days. The corn silage supply was depleted at this time and ground ear corn was fed. After 157 days on trial, 5 lb. of haylage was fed instead of 4 lb. of alfalfa hay. Haylage was fed for the remainder of the trial.

The cattle received implants initially and were reimplanted after 155 days on trial.

Salt and minerals were fed free-choice.

One-half of the cattle from each lot were sold when the heifers weighed about 950 lb. and the remaining cattle sold when the steers averaged about 1100 lb. Carcass data were obtained.

A summary of the results is shown in table 3.

The crops yields and prices used in calculating gains and feed costs and returns were as follows:

Corn silage - 16 tons/A containing 64.2% moisture @ \$8/ton
Haylage - 7 tons/A containing 50.0% moisture @ \$12/ton
Alfalfa hay - 4 tons/A containing 12.0% moisture @ \$20/ton
Ear corn - 90 bu./A containing 15.0% moisture @ \$32/ton
Soybean meal - @ \$90/ton

Table 3.

Comparison of implanted and non-implanted heifers and steers

Treatment	Heifers			Steers		
	des	Synovex	Control	des	Synovex	Control
Lot number	1	2	3	4	5	6
No. animals[a]	25	24	24	25	25	25
Initial shrunk wt., lb.	451	447	448	499	502	498
Final shrunk wt., lb.	980	988	949	1119	1101	1035
Avg. gain, lb.	529	541	501	620	599	537
Avg. da. gain, lb.	1.97	2.0	1.85	2.29	2.21	1.99
Avg. da. ration, lb.						
Corn silage	12.0	11.5	11.5	12.8	13.2	12.8
Grnd. ear corn	12.0	11.6	10.7	12.4	12.8	11.6
Alfalfa hay	2.3	2.3	2.3	2.3	2.3	2.3
Haylage	2.0	2.0	2.0	2.1	2.1	2.1
Protein suppl.	1.0	1.0	1.0	1.0	1.0	1.0
Feed/cwt. gain, lb.						
Corn silage	610	576	619	559	599	642
Grnd. ear corn	612	580	578	542	578	583
Alfalfa hay	118	116	125	101	105	116
Haylage	104	102	110	90	93	102
Protein suppl.	50	50	54	43	45	50
Total (dry basis)	958	914	945	850	901	941
Prot. suppl. req./acre, lb.	370	388	409	358	351	382
Beef gains/acre, lb.	740	775	758	833	781	763
Carcass grade score[b]	18.7	18.5	19.3	18.7	18.4	19.4
Dressing, %	62.5	62.6	63.4	62.3	62.0	62.3
Avg. price/cwt. of carcass[c], $	36.90	36.85	37.08	38.83	38.66	38.68
Avg. price rec'd/head, $	226.11	227.93	223.00	270.83	263.79	249.39
Init. and feed cost/head, $	203.38	200.62	196.99	229.00	232.09	224.93
Avg. return/head over init. and feed cost, $	22.73	27.31	26.00	41.83	31.70	24.46

[a] One heifer removed with throat ailment and 1 heifer died.

[b] Carcass grade score: Good = 17; Choice = 20.

[c] Based on actual carcass price rec'd when first half of cattle sold.