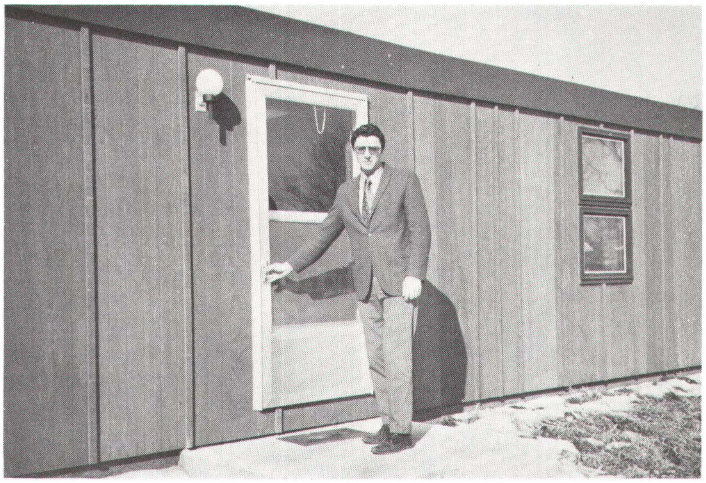
Redfield
March 1973

James Valley Agricultural Research and Extension Center

Annual Progress Report

Agricultural Experiment Station
South Dakota State University
Brookings



Raymond C. Ward, research manager, in front of new office building at the James Valley Agricultural Research and Extension Center.

COVER PHOTO

A center-pivot irrigation system in operation at the James Valley Agricultural Research and Extension Center, east of Redfield, S.D.

This annual report of the research program at the James Valley Agricultural Research and Extension Center has special significance for those engaged in agriculture and the agriculturally related businesses in the North-Central area of South Dakota. The results shown are not necessarily complete or 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. Trade names are used in this publication merely to provide specific information. A trade name quoted here does not constitute a guarantee or warranty and does not signify that the product is approved to the exclusion of other comparable products.

SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION
BROOKINGS, SOUTH DAKOTA 57006

Duane Acker, Director A. L. Musson, Assoc. Director

ANNUAL PROGRESS REPORT

James Valley Agricultural Research and Extension Center

CONTENTS

Annual Progress Report

R. C. Ward

The Redfield Development Farm became known as the James Valley Agricultural Research and Extension Center during 1972, along with several other changes. I became Research Manager for the Center on February 1, 1972 when I moved from South Dakota State University, Plant Science Department where I had worked in soil testing and soil fertility research and teaching. During the spring and summer months several new sprinkler systems were installed and became operational. In October Mr. Lloyd Dye, who had been superintendent of the irrigation farm since 1961, accepted a position with Hubbard Milling Co., Inc. at Mankato, Minnesota. A new office building was installed at the Center which has been very beneficial in coordinating research activities and in visiting with poeple interested in various phases of the Center's research activities. For me, this past year has been a year of learning the operations of the research farm, installing new sprinkler irrigation systems, and coordinating research activities with project leaders from the Agricultural Experiment Station at South Dakota State University.

The Annual Field Day was held on August 11 with a good attendance. The new sprinkler systems were featured along with new ideas in irrigated crop production. Two other groups also toured the farm and many individuals stopped to visit projects. New research projects are anticipated for the new cropping and irrigation season and we welcome you to stop and visit.

Individual reports that follow represent the research and demonstration work that was conducted at the Center during 1972. The results shown may not be complete or conclusive but represent findings under the conditions encountered in 1972.

Brief History

The Redfield Development Farm was established in 1948 by the United States Department of Interior, Bureau of Reclamation for the purpose of studying and demonstrating gravity irrigation potential on lake plain soils of the Oahe Project Area. It was operated by the Bureau of Reclamation through 1952. Then the farm was operated by an individual farmer, except for research areas that were under supervision of South Dakota State University, U.S.D.A. Agriculture Research Service, and Bureau of Reclamation. In 1959 South Dakota State University began operating the farm.

Irrigation water is obtained from the James River. The pump is located one-half mile north of the farm and is capable of pumping 1400 gallons per minute. Farm size is approximately 190 acres with about 140 acres of irrigable land. During the early years of operation many crops were grown under irrigation including many truck crops. Yields of various crops can be obtained by writing to the Center.

Many of the early research findings can be found in the following bulletins.

(1) Soil Moisture Depletion by Irrigated Crops Grown in South Dakota, 1954. SDSU Agricultural Experiment Station Circular 104.
(2) Irrigation Research in the James River Basin, 1954. SDSU Agricultural Experiment Station Circular 107.

(3) Soil, Water, and Crop Management on Newly Irrigated Lands in the Dakotas, 1961. USDA-ARS Production Research Report No. 53.
(4) Fertilizing Irrigated Rotations in the Proposed Oahe Irrigation Area, 1964. SDSU Agricultural Experiment Station Bulletin 516.
(5) Crop Production Practices for Irrigated Land, 1964. SDSU Agricultural Experiment Station Bulletin 517.

Research work conducted during the 1960's pertained to crop production techniques, soil management practices, and drainage through tile systems, etc. In 1970 and 1971 several new types of flood irrigation equipment were installed in addition to installing underground pipe to replace open ditches used extensively before. In 1972 several sprinkler systems were installed. Thus, at the present time, the Center has many types of irrigation equipment on display for your observation and evaluation.

1972

Weather

Timeliness of field operations for research projects and crop production were controlled to a great extent by the weather in 1972. Table 1 shows the precipitation and temperature data for the Center. The most significant weather effect was the excessive rainfall in May which delayed corn, sorghum, and soybean plantings to the first two weeks of June. The below-normal June and July temperatures slowed row crop growth after the late planting which caused grain sorghum and corn to mature very late. The above-normal rainfall in July reduced the need for irrigation until August. The late frost (October 12) allowed the row crops to mature enough to produce respectable yields.

Table 1. Precipitation, Temperature, and Evaporation Data for the James Valley Agricultural Research and Extension Center for 1972

Month	Ppt'n. Inches	Departure	Temperature (F)	Departure	Evaporation (open pan)
January	.24	-.20	7.0	-5.6	---
February	.36	-.20	10.0	-6.5	---
March	.81	-.02	29.4	-12.0	---
April	1.69	-.25	44.6	-1.1	1.28*
May	10.24	+7.57	59.6	+2.2	5.81
June	1.17	-2.32	66.8	-0.5	7.20
July	5.03	+2.58	70.0	-3.5	8.23
August	.06	-2.23	72.1	+0.5	7.19
September	.09	-1.53	61.3**		3.36**
October	1.60	+.31	42.3	-6.6	---
November	.73	+.14	30.8	-1.5	---
December	.78	+.32	10.0	-8.7	---

*Beginning April 17th.
**Ending September 17th.

Last frost May 7--26F.
First frost Oct. 12--26F (32F on Oct. 7).
Frost free days--163.

Crop Production

Almost all land had been fall tilled and fertilized. Oats and alfalfa seedings were slightly later than normal but the planting of row crops was delayed two to three weeks. Oat fields seeded without alfalfa were sprayed with 2,4-D to control broadleaf weeds. Most of the corn was banded with granular Lasso and granular Furadan at planting time. Corn row spacing was 30 inches. One field of grain sorghum received a broadcast application of Ramrod just after seeding and then was sprayed (aerial) with 2,4-D in July. Grain sorghum row spacing was 21 inches. All grain sorghum was treated with Cygon (aerial) to control greenbugs which were very severe. Good control of all pesticides was noted.

Figure 1 shows the field design of the farm. Crop production areas not involved in research experiments are discussed below.

Field 1: All areas of this field were used for experimental research (weed control in corn, potato production, and smooth bromegrass selection).

Field 2: This field was seeded the last week of April to alfalfa (Vernal) with oats (Burnett) as a nurse crop. A rate of 120 pounds of P per acre was applied in the fall of 1971. Oat yields were approximately 80 bushels per acre. The new alfalfa seeding was irrigated August 19-22 with about 8 inches of water. A weed control trial in new alfalfa was located on the east side of the field. A demonstration strip using Balan at the rate of $1\frac{1}{4}$ pounds per acre controlled weeds very well resulting in two cuttings of newly seeded alfalfa that produced a total yield of 3.63 tons per acre (corrected to 12% moisture). This strip of alfalfa was seeded the first week of May in 1972.

Field 3: This field was in alfalfa. Three cuttings were taken as follows: June 16--2.10 tons/acre; August 6--1.84 tons/acre; and September 27--1.31 tons/acre. This field was irrigated with about 8 inches of water during August 19-22.

Field 4: This area was involved in a microenvironment study with grain sorghum, in weed control of soybeans, and in atrazine carryover.

Field 5: A soybean variety trial was located on the west side. Rest of the field was in corn (Pioneer 3812 and 3784). Alfalfa was fall plowed in the fall of 1971. Thus, no fertilizer was applied. Ear corn yield was estimated to be 99 bushels per acre (15% moisture). Silage yield was estimated to be 12 tons per acre (65% moisture). Corn was irrigated August 13-15 with about $5\frac{1}{2}$ inches of water and August 30-September 1 with $3\frac{1}{2}$ inches of water.

Field 5B: This area was devoted to drainage research. Grain sorghum was planted about June 15. Greenbugs almost destroyed stand before it was sprayed with Cygon. This field was irrigated twice for drainage research. Yield was 35 bushels per acre because of late planting and greenbug damage which delayed maturity of the grain sorghum.

Field 5A: This field was in corn (Pioneer 3781). Research report is found elsewhere.

Field 8: Corn (Curry's SC 142, Pioneer 3784 and 3812) was grown on all of this field except for a herbicide study with grain sorghum on the east side. Corn was planted June 14 and 15. Ear corn yield was 90 bushels per acre (15% moisture) and silage yield 12 tons per acre (65% moisture). The land was fall fertilized with 120 lbs of N and 15 lbs P per acre. The corn was irrigated twice; August 14-16 and September 3-5. About 5 inches of water were applied each time.

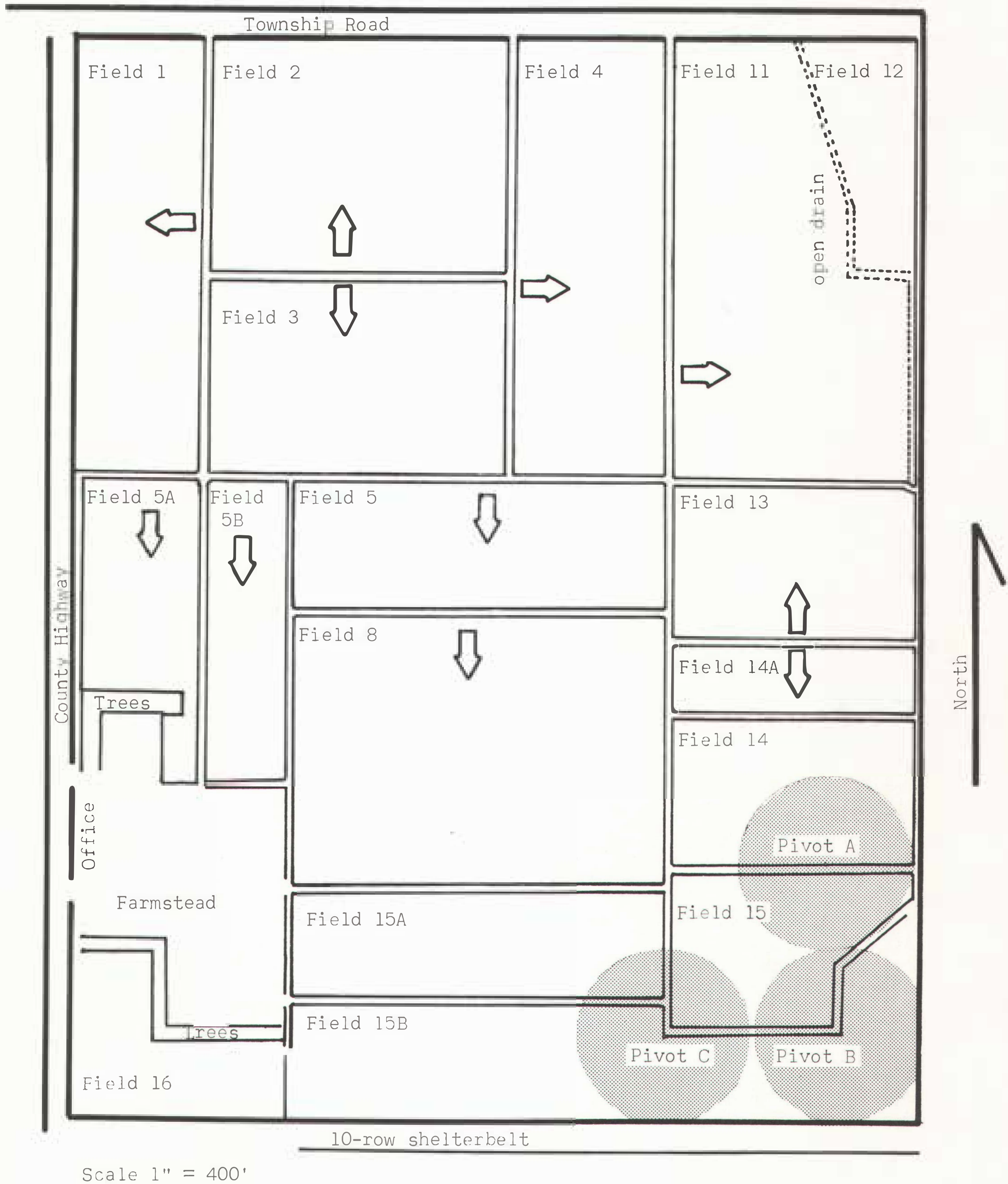

Township Road
Field 1
Field 2
Field 4
Field 11
Field 12
open drain
Field 3
Field 5A
Field 5B
Field 5
Field 13
Field 8
Field 14A
Field 14
County Highway
North
Trees
Office
Pivot A
Farmstead
Field 15A
Field 15
Field 15B
Trees
Pivot C
Pivot B
Field 16
10-row shelterbelt
Scale 1" = 400'

Figure 1

Field 11: Corn (Pioneer 3812) was grown on the north half of this field. Corn yield was approximately 75 bushels per acre. The corn was planted June 1 and the stand was thinned by wireworms. The south half of the field was in alfalfa which yielded a total of 4.6 tons per acre (12% moisture). Both crops were irrigated twice in August.

Field 12: Oats (Burnett) were planted the last week of April and yielded about 80 bushels per acre. This field is not irrigated.

Field 13: This corn field (Pioneer 3781) was used for a water application rate study with sprinkler irrigation. The results are reported later.

Field 14: Grain sorghum (Pioneer 894) was grown in this field. Although parts of the field were irrigated, no visual response to irrigation could be observed. The estimated yield was 90 bushels per acre. It was planted on June 5 and 6. Fertilization was 150 lbs of N and 30 lbs of P per acre in the fall of 1971.

Field 15: East half of this field was in grain sorghum similar to field 14. The west half was in dryland oats (Burnett) which produced approximately 80 bushels per acre. It was fertilized with 40 lbs of N and 20 lbs of P per acre.

Field 16: This field was in oats just as the west half of field 15.

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"The experienced gardener knows that anything that grows like a weed, is."

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Part of field day crowd and equipment display.

Corn and Grain Sorghum Performance Trials

J. J. Bonnemann

To adequately evaluate the performance ability of corn and grain sorghum varieties, they must be grown under different environmental conditions. The corn and grain sorghum performance trials at the Redfield site were but one of seven or eight locations around the state in different crop adaptation areas.

The entries included in the commercial trials are the choice of the participating companies. A minimal fee is charged for each entry in each trial. Only corn hybrids registered with the State Department of Agriculture for the year of the trial are eligible for entry. The Agricultural Experiment Station also includes some experimental and check entries.

The corn trials were seeded on June 1 and the grain sorghum on June 2. The corn row spacing was 36 inches; grain sorghum was 21 inches. All trials were drilled in rows using cone-planters mounted over flexi-planter units with double-disc openers. A recommended herbicide and insecticide were banded over and in the row at time of seeding. These were for grassy weed and corn rootworm control, respectively.

The grain sorghum was seeded at a heavy rate and then thinned to 100,000 plants per acre. Because of climatic conditions during germination and emergence this level was difficult to achieve at thinning time. The dryland corn trial had an average population of 9,900 plants per acre at mid-August counts. The irrigated trial was to have 18,- and 22,000 plants per acre but mid-August counts were only 16,400 and 19,300 for the two levels. Average yields for a variety are presented in the irrigated corn table (Table 2) because the yield differences between stands were not statistically significant.

The grain sorghum was hand harvested on October 10. The dryland corn trial was harvested on November 6 and the irrigated trial on November 7, both by picker-sheller. The irrigated corn results are lower than expected under the favorable conditions that prevailed. No explanations are readily apparent except lateness of seeding and possible loss of nitrogen fertilizer by the excessive May rainfall.

The plot areas had all been fall plowed. Approximately 120 pounds of N and 20 pounds of P per acre were broadcast in the spring and disced under. The grain sorghum plots were sprayed with Cygon in early July for greenbug control and again in late July with 2,4-D for weed control. The irrigated trials received four applications of supplemental water from August 2 through September 13 totalling about 8 inches.

The results presented in Tables 2, 3, and 4 are for 1972 only. Additional information will be found in circulars published by the Agricultural Experiment Station.

Table 2. Corn Performance Trial, Area C1 (IRRIGATED), Redfield, 1972

Brand & Variety	Type	Cross	Performance Score	Percent Moisture	Percent Stalks Broken	Yield, B/A
Trojan TXS 104	N	2X	1	32.9	11.3	116.3
Pride R-200A	N	3X	2	28.4	14.8	109.6
Renks RK 44	N	2X	3	32.1	4.3	109.6
Disco SX 16	T	2X	5	32.2	3.9	107.6
Trojan TXS 99	N	2X	6	28.2	4.4	103.7
ACCO UC 1900	T	2X	4	26.1	7.6	103.4
Pioneer 3932	N	2X	7	24.6	17.9	103.0
Disco SX 14	T	2X	10	28.3	25.8	103.0
Pride R-290	N	2X	9	29.3	18.6	102.7
Pioneer 3781	N	M2X	11	30.1	7.3	97.8
ACCO U 333	T	3X	16	28.1	25.8	97.7
McCurdy's MSP 333	N	3X	12	29.6	9.2	97.3
Payco SX 775	N	2X	14	27.5	18.8	97.1
Pioneer 3780	N	2X	13	29.0	8.3	95.6
Pioneer 3956A	N	2X	8	23.4	2.8	95.5
Trojan TXS 94	N	2X	15	26.9	14.7	95.2
Curry's SC-144	N	2X	20	34.5	4.3	94.5
Curry's SC-142	N	2X	23	33.4	9.9	94.0
ACCO UC 3201	N	2X	21	33.8	4.5	93.6
SDAES EX 70	N	3X	35	29.9	29.7	93.3
Sokota TS-62	N	2X	41	29.7	35.9	93.0
McCurdy's 2X4	N	2X	22	32.6	5.7	92.4
Pride R-369	N	3X	19	30.0	5.3	91.7
ACCO UC 2900	T	2X	24	30.0	13.9	91.7
Trojan TXS 102	N	2X	27	31.8	10.7	91.6
Western KX 55	T	2X	25	32.4	5.0	91.0
ACCO UC 1301	N	2X	18	27.1	7.4	90.0
Western KX 46	N	M2X	30	27.4	20.9	89.6
ACCO UC 3300	T	2X	38	33.7	7.6	89.3
SDAES PP158	N	2X	42	30.9	20.5	89.2
McCurdy's MSP 111	T	3X	33	26.6	25.0	89.1
Coop T-207	N	3X	43	35.2	7.2	88.9
Pioneer 3778	N	3X	28	29.6	9.1	88.6
Trojan TX 90	N	3X	17	24.4	9.9	88.4
Trojan M 95	N	M3X	31	26.7	19.2	88.3
Coop S-201	N	2X	34	32.1	6.9	88.2
Renks RK 9	N	2X	37	28.5	17.8	87.9
Trojan TX 100	N	3X	26	26.5	13.4	87.7
SDAES PP156	N	2X	32	29.5	8.1	86.7
Curry's SC-138	N	2X	29	26.5	8.2	85.1
SDAES SD 200	N	2X	40	23.9	21.7	84.7
Pioneer 3784	N	2X	36	27.4	8.0	84.0
McCurdy's 69-15A	N	2X	47	30.2	23.3	83.9
Renks RK 11A	N	M3X	48	28.4	27.3	83.4
Payco SX 865	N	2X	45	32.6	2.5	82.4
SDAES PP155	N	M3X	49	31.5	14.4	82.1
Trojan TXS 85	N	M2X	39	23.3	14.4	82.0
McCurdy's MSX 22E	T	2X	44	27.9	12.3	82.0
ACCO UC 2700	T	2X	46	28.3	19.2	81.6
SDAES PP157	N	2X	51	36.8	3.2	78.8
SDAES SD 230	N	4X	52	28.2	24.9	77.3
SDAES SD 250	T	4X	56	30.7	26.2	74.9
Pioneer 3579	N	M2X	53	32.4	5.6	74.4
Western KX 33	T	2X	50	26.2	9.4	74.1
McCurdy's 36M	T	M2X	54	31.5	8.0	74.1
ACCO U 326	N	3X	55	27.9	22.2	71.2
			Means	29.4	13.3	90.5

CV=19.6%

Table 3. Corn Performance Trial, Area C1 (DRYLAND), Redfield, 1972

Brand & Variety	Type	Cross	Performance Score	Percent Moisture	Percent Stalks Broken	Yield, B/A
Pioneer 3773	N	2X	1	26.3	0.0	93.3
Trojan TXS 102	N	2X	3	27.6	2.1	90.7
Trojan TXS 94	N	2X	2	24.6	1.0	90.3
Western KX 55	T	2X	6	28.2	0.0	82.9
Pride R-290	N	2X	5	26.7	0.0	82.5
Curry's SC-144	N	2X	10	29.1	4.4	81.9
Payco SX 775	N	2X	9	27.1	2.3	81.4
Pioneer 3784	N	2X	7	25.3	0.0	80.8
ACCO UC 1900	T	2X	4	23.5	0.0	80.5
ACCO U 326	N	3X	8	23.1	1.1	79.4
Pioneer 3932	N	2X	14	24.6	2.4	77.5
Trojan M 95	N	M3X	15	24.3	3.4	77.5
SDAES PP146	N	4X	12	23.3	3.1	77.4
Pioneer 3662	N	4X	16	26.6	1.1	77.3
ACCO DC 146	T	4X	13	23.1	3.4	77.2
Trojan TX 90	N	3X	11	23.5	0.0	77.1
Pride R-369	N	3X	17	26.1	1.0	76.4
Curry's SC-146	N	2X	26	30.8	0.0	75.9
ACCO UC 1301	N	2X	20	24.8	9.0	75.9
Coop S-201	N	2X	29	28.6	5.4	74.8
Trojan TX 100	N	3X	18	24.9	0.0	74.7
Pioneer 3778	N	3X	25	28.2	0.0	74.6
O's Gold SX 1010	N	2X	23	26.2	0.0	74.4
Pioneer 3956A	N	2X	19	24.4	0.0	74.1
Pioneer 3814	N	4X	21	23.8	3.3	73.9
SDAES SD 250	T	4X	22	23.1	4.4	73.5
SDAES EX 91	N	4X	24	19.9	2.2	70.7
ACCO U 313	T	3X	27	21.7	4.6	70.6
ACCO U 324	N	3X	28	22.1	2.2	70.2
Pride R-200A	N	3X	34	25.5	3.6	70.1
SDAES PP133	N	4X	30	22.4	2.2	69.6
SDAES PP112	N	4X	31	23.8	0.0	69.1
Sokota 232	T	4X	33	22.9	3.4	68.4
Coop D-200	N	4X	40	30.0	0.0	68.2
SDAES PP142	N	3X	32	21.2	2.2	67.2
SDAES EX 92	N	4X	35	21.1	1.2	64.6
Trojan TXS 99	N	2X	36	22.7	0.0	64.1
SDAES PP127	N	4X	39	23.2	0.0	64.0
SDAES SD 200	N	2X	38	21.5	3.8	63.9
SDAES PP147	N	4X	37	21.5	0.0	63.1
SDAES SD 230	T	4X	44	26.3	4.4	62.5
O's Gold SX 900	N	2X	42	22.7	2.8	62.2
Sokota 229	T	4X	41	21.1	0.0	61.6
ACCO DC 108	T	4X	43	20.6	10.0	60.0
ACCO DC 138	T	4X	47	21.7	16.7	60.0
Trojan TXS 85	N	M2X	45	21.1	3.7	58.1
SDAES PP154	N	3X	46	21.5	4.3	57.4
SDAES SD 220	T	4X	48	21.5	4.8	54.0
Trojan M 70	N	M3X	49	19.9	1.2	39.1
			Means	24.2	2.5	71.7

CV=12.9%

Table 4. Grain Sorghum Performance Trial, Area C1 (IRRIGATED), Redfield, 1972

Brand & Variety	Date Headed	Height, inches	Percent Moisture 9/25/72	Test wt. lb/B	Yield, lb/A
Northrup-King 180	8/15	49	33.5	58	5580
RS 506	8/15	56	28.8	57	5440
Pioneer X5568	8/4	43	30.5	50	5400
Warner W-600	8/10	50	32.8	58	5290
Pride P-500A	8/9	49	30.7	58	5135
Early Oro	8/25	57	35.+	57	5000
ACCO R 920	8/8	58	26.3	58	4995
Western WS 201	8/6	48	32.4	58	4910
Warner W-601	8/16	52	33.7	58	4900
DeKalb X-1355	8/7	41	33.8	56	4690
Pioneer 883	8/18	46	35.+	53	4650
SD 25702	8/16	44	35.+	58	4630
Pioneer 894	8/6	41	33.3	59	4605
Warner W-501	8/7	51	21.8	57	4590
SD 503	8/15	57	35.+	57	4580
Northrup-King 233	8/18	56	34.6	57	4540
Pride P-550BR	8/8	47	31.8	59	4530
ACCO R 1010	8/12	55	33.1	59	4510
DeKalb B-36	8/18	51	35.+	56	4465
SD 451	8/6	55	28.8	55	4435
Pioneer 866	8/21	52	35.+	55	4415
DeKalb A-26	8/11	38	35.+	56	4400
Western WS 206	8/18	52	35.+	57	4295
Warner W-55	8/20	42	35.+	53	4285
Niagara Shoo Bird	8/21	44	35.+	54	4195
ACCO R 1019	8/25	46	35.+	56	4120
P-A-G 3849	8/3	45	28.0	57	4070
Frontier Super 400A	8/21	49	35.+	52	3925
RS 610	8/20	49	35.+	55	3635
Pioneer 878	8/16	43	34.8	57	3485
NB 634	8/24	56	35.+	53	3175
NB 635	8/27	53	35.+	52	2860
				Mean	4490

CV=13.4%

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"A man who says that he is boss in his home,
will also fib about other things."

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Corn Herbicide Screening

W. E. Arnold and B. O'Neal

The purpose was to evaluate the effectiveness of herbicides and herbicide combinations for their control of annual weeds in corn.

Soil texture of the experimental plot was silty clay loam. The organic matter level was 3.3% and soil pH was 7.4. Pioneer 3812 corn was planted June 2 in 30-inch rows. Planting rate was 18,000 seeds per acre. Individual plot size was 10 by 30 feet and each herbicide treatment was repeated four times. All treatments were applied with a tractor sprayer applying 20 gpa at 40 psi. Preemergence treatments were applied June 2. Postemergence applications were made June 22 when corn was in the 6-leaf stage of growth, six inches tall; foxtail was in the 3-leaf stage, 2½-3 inches tall; and redrood pigweed and lambsquarter were 1-1½ inches tall. The plots were not cultivated; however, all plots were furrowed for irrigation in early June.

All weed control observations were taken before the irrigation season. Early season grass control and corn injury notes were taken on June 27. Predominate weed species present were yellow foxtail (*Setaria lutescens*), green foxtail (*Setaria viridis*), redroot pigweed (*Amaranthus retroflexus*), prostrate pigweed (*Amaranthus blitoides*), and lambsquarters (*Chenopodium album*). Corn injury data was based on a scale of 0-10 where 0=no injury and 10=complete kill. Table 5 shows the results of the corn herbicide trial. Only .42 inch of rainfall was received within two weeks after application of preemergence treatments. Observations at several locations in 1972 showed that MC-4379 applied in combination with a herbicide to control grasses appeared promising for areas with sporadic rainfall.

Corn Herbicide Demonstration Results

L. J. Wrage, W. E. Arnold, and W. B. O'Neal

The above trial shows how herbicides (weed killers) are evaluated for weed control in corn. Some of these herbicides will never be manufactured for farmer use because of poor weed control, crop injury, or carryover. The screening trials gather this information so that only useful herbicides are sold in South Dakota. Herbicides presently sold for weed control in corn were evaluated in demonstration plots. These plots were always marked for your observation during the growing season.

Results of weed control from the demonstration plots are shown in Table 5D. Rainfall is perhaps the most important factor affecting year-to-year performance. June rainfall was low (Table 1) and consisted of several light showers. On the average, the most consistant performance can be expected from treatments that have given a high degree of control under the varying conditions as shown for the 3-year, 3-locations columns in Table 5D.

Table 5. Corn Herbicide Screening

Treatment	Rate lb/A	June 27, 1972 Crop Injury	% Grass Control	% Blw Control
Preemergence				
Atrazine	2½	0.0	58	79
DS-5328	3	0.0	15	0
DS-5328+Alachlor	2 + 2	0.0	75	58
Cyanazine	2½	0.0	56	12
Cyanazine+Alachlor	1½ + 1½	0.0	66	34
Cyanazine+Propachlor	1½ + 3	0.0	82	60
Cyanazine+Prynachlor	1½ + 3	0.0	79	48
Cyanazine+GS-13529	1½ + 1½	0.2	65	90
Cyanazine+Tergitol 15-5-9	2½ + 1%	0.0	50	8
Cyanazine+Tergitol 15-5-12	2½ + 1%	0.0	45	8
Cyanazine+Tergitol 15-5-40	2½ + 1%	0.0	52	12
Prynachlor	3	0.2	76	15
Prynachlor	4	0.0	84	39
Propachlor	5	0.0	88	32
MC-4379	2	4.2	80	100
MC-4379+Alachlor	1 + 1½	3.0	75	95
MC-4379+Alachlor	1½ + 1½	4.0	85	99
Alachlor+Dicamba	2 + ½	0.0	75	76
Alachlor + Dicamba (gran)	2 + ½	0.0	71	45
Split Application				
Prynachlor (Pre) + Bentazon (Post)	3 + 1	0.7	84	92
Postemergence				
Atrazine+Oil	1 + 1gal	0.0	28	78
DS-21376	¼	0.5	20	8
DS-21376	½	1.0	15	15
DS-21376	1	2.5	12	12
Cyanazine	2	0.8	22	30
Bentazon	1	0.3	5	70
Bentazon	1	0.2	5	64
MC-4379	1	8.0	68	100
MC-4379	1½	8.0	68	100
No Herbicide	---	0.0	18	0

Table 5D. Corn Herbicide Demonstration Results

Herbicide	Active ingredient lbs/A	% Early Season Weed Control			
		1972-Redfield		3 yr., 3 loc.	
		Grass	Bdlf.	Grass	Bdlf.
Preplant Incorporated					
atrazine (AAtrex)	2½	95	100	92	98
butylate + atrazine (Sutan + AAtrex)	3 + 1	97	80	91	93
butylate (Sutan)	4	80	0	88	46
Preemergence					
atrazine (AAtrex)	2½	20	95	83	97
alachlor (Lasso)	2½	90	0	89	49
alachlor + atrazine (Lasso + AAtrex)	2 + 1	90	60	91	84
alachlor + linuron (Lasso + Lorox)	2 + 1	90	60	--	--
propachlor (Ramrod)	5	93	0	93	39
propachlor + atrazine (Ramrod + AAtrex)	3 + 1	80	60	92	82
propachlor + linuron (Ramrod + Lorox)	3 + 1	70	50	89	70
cyanazine (Bladex)	2½	90	0	84	40
Postemergence					
cyprazine (Outfox)	3/4	60	0	--	--
atrazine + oil (AAtrex)	1 + 1 gal	70	85	74	90

Soybean Herbicide Screening

W. E. Arnold and B. O'Neal

The purpose was to evaluate the effectiveness of herbicides and herbicide combinations for crop tolerance and annual weed control in soybeans.

Plot size and soil properties are similar to the corn herbicide trial. Corsoy soybeans were planted June 9 in 30-inch rows at a population of 125,000 seeds per acre. All applications were made with a tractor sprayer applying 20 gpa at 40 psi. Preplant incorporated treatments were applied June 9 and incorporated with a tandem disk, followed by two draggings. Preemergence applications were made on June 12. The plots were not cultivated; however, irrigation furrows were dug through all plots August 2.

Visual observations of weed control and soybean injury were made August 1. Grassy weeds present were yellow foxtail (Setaria lutescens) and green foxtail (Setaria viridis). Broadleaf weeds present were redroot pigweed (Amaranthus retroflexus) and lambsquarters (Chenopodium album). Soybean injury data were based on a 0-10 scale where 0=no injury and 10=complete kill. The data are shown in Table 8, page 19.

Soybean Herbicide Demonstration Results

L. J. Wrage, W. E. Arnold, and W. B. O'Neal

The screening trial is used to select the most desirable herbicides (weed killers) for weed control in soybeans. Herbicides that perform well are manufactured for farmer use. Weed control of these herbicides are demonstrated at the Center every year so that one may observe and evaluate them under field conditions.

The demonstration trial results are shown in Table 8D. The average results for 3 years at 4 locations represent the type of weed control that can be obtained under varying conditions for the kinds of weeds shown above. (Table 8D, page 20).

Phytotoxicity of Dicamba When Additives are Added

B. A. Brinkman and W. E. Arnold

The objective of this experiment was to determine the phytotoxicity (degree it is poisonous to plants) of dicamba (Banvel) when additives are added to corn and broadleaf weeds.

This experiment was carried out on a silty clay loam having an organic matter content of 3.3% and a pH of 7.4. Pioneer 3812 corn was planted on June 2 in 30-inch rows at 18,000 seeds per acre. Single post treatments were applied June 22 when the corn was from 6-8 inches tall. Predominant weed species were pigweed species and lambsquarters and were 1-2 inches tall when treated. The treatments were applied with a tractor sprayer at 20 gpa at 40 psi with the exception of Dacagin and Accutrol where a foam nozzle was utilized at 20 gpa at 60 psi. Visual estimates of percent weed control and corn injury were based upon an untreated area at the margins of the experiment and were made on June 29 and July 6, respectively. Ear corn yields were taken on October 4. Injury to the crop was observed to be rolling of the leaves. As the rate of dicamba increased, corn injury increased when additives were added. The addition of most of the additives to dicamba increased control of lambsquarters. However, Dacagin and Accutrol decreased weed control, presumably because of poor spray coverage.

Table 6. Phytotoxicity of Dicamba When Additives are Added

Treatment	Rate (lb/A)	% Corn Injury	% Weed Control: Redroot Pigweed	% Weed Control: Prostrate Pigweed	% Weed Control: Lambsquarters	Corn Yield (bu/A)
Dicamba-Check	1/16	11	28	17	34	106
Dicamba + oil a/+ Tronic	1/16 + 1 gal + ½%	15	37	5	78	106
Dicamba + Agri-oil plus	1/16 + 1½ qt	11	45	6	79	114
Dicamba + Bio-Veg	1/16 + 1 qt	14	31	5	65	103
Dicamba + Amoco conc.	1/16 + 1½ qt	13	45	13	78	103
Dicamba + X-77	1/16 + ½%	14	35	4	75	100
Dicamba + Surfoil plus	1/16 + 2 qt	13	54	4	78	102
Dicamba + Accutrol	1/16 + ½%	13	28	5	61	100
Dicamba + Accutrol b/	1/16 + ½%	19	28	6	43	100
Dicamba + Decagin	1/16 + 1 lb	13	25	2	38	104
Dicamba-Check	1/8	10	33	13	71	99
Dicamba + oil a/ + Tronic	1/8 + 1 gal + ½%	24	76	12	79	97
Dicamba + Agri-oil plus	1/8 + 1½ qt	15	53	8	85	101
Dicamba + Bio-Veg	1/8 + 1 qt	18	44	10	80	99
Dicamba + Amoco conc.	1/8 + 1½ qt	20	66	15	86	98
Dicamba + X-77	1/8 + ½%	18	53	8	83	87
Dicamba + Surfoil plus	1/8 + 2 qt	18	59	12	75	95
Dicamba + Accutrol	1/8 + ½%	15	50	10	80	109
Dicamba + Accutrol b/	1/8 + ½%	14	48	5	72	99
Dicamba + Dacagin	1/8 + 1 lb	10	36	4	37	96
Dicamba-Check	¼	11	73	13	72	99
Dicamba + oil a/ + Tronic	¼+1 gal + ½%	39	70	21	83	107
Dicamba + Agri-oil plus	¼ + 1½ qt	34	82	19	90	104
Dicamba + Bio-Veg	¼ + 1 qt	29	77	18	89	99
Dicamba + Amoco conc.	¼ + 1½ qt	38	87	18	84	95
Dicamba + X-77	¼ + ½%	33	65	11	83	100
Dicamba + Surfoil plus	¼ + 2 qt	35	78	17	83	113
Dicamba + Accutrol	¼ + ½%	21	60	10	80	106
Dicamba + Accutrol b/	¼ + ½%	23	54	12	74	99
Dicamba + Dacagin	¼ + 1 lb	11	28	10	45	95

a/ Texaco 754 spraytex superior
b/ Double coverage and volume (40 gpa)

Herbicide Screening for Establishment of Alfalfa

W. E. Arnold and B. O'Neal

The purpose was to evaluate recommended and experimental herbicides for crop tolerance and annual weed control while establishing alfalfa.

Plot size was 10 by 20 feet. Soil texture was a silty clay loam, soil organic matter was 3.3%, and soil pH was 7.4. Vernal alfalfa was planted May 8. All herbicide applications were made with a tractor sprayer applying 20 gpa at 40 psi. Preplant treatments were applied April 26 and incorporated immediately after spraying with a tandem disk. Preemergence treatments were applied May 10. Postemergence treatments were applied June 2 when the alfalfa was 2-4 inches tall and the growth stages of the weeds were: foxtail 2-3 inches or 3 leaf, and redroot pigweed, 2-4 true leaves.

Visual observations of percent grass and redroot pigweed (*Amaranthus retroflexus*) were taken July 11 and are shown in Table 7. Alfalfa injury could not be evaluated because of water kill resulting from the wet May.

Table 7. Herbicide Screening for Establishment of Alfalfa

Treatment	Rate (lb/A)	July 11, 1972 % Grass Control	% Blw Control
Preplant Inc.			
EPTC	3	79	0
Benefin	1¼	84	68
Trifluralin	3/4	92	95
USB-3584	½	90	98
A-820	2	90	90
Preemergence			
Asulam	1½	28	20
MC-4379	2	18	89
Dinoseb	1½	8	31
S-6044	2	0	15
S-6044	3	12	8
Postemergence			
Asulam	1½	85	5
Bromoxynil	¼	10	51
2,4-DB	1½	0	95
MC-4379	½	15	97
CIPC	2	12	48
No Herbicide	--	0	0

Table 8. Soybean Herbicide Screening

Treatment	Rate lb/A	August 1, 1972 Crop Injury	% Grass Control	% Blw Control
Preplant Incorporated				
Trifluralin	3/4	0.2	92	94
Trifluralin	1	2.0	97	98
BAS-3921-H	1	0.0	96	83
Split Applications				
Trifluralin[2]+MC-4379[1]	3/4 + 1	1.2	96	100
Trifluralin[2]+Chloramben[1]	3/4 + 2	1.0	99	100
Trifluralin[2]+Metribuzin	3/4 + 3/8	1.2	96	99
Trifluralin[2]+Linuron[1]	3/4 + 1½	1.3	94	100
Preemergence				
Alachlor	2½	0.0	79	46
Chloramben (2 lb/g)	3	0.0	78	82
Chloramben (6 lb/g)	3	0.0	68	75
Prynachlor	3	0.2	94	93
Prynachlor	4	0.0	92	83
Propachlor	4	0.2	98	55
R-21403	3	0.0	46	32
DS-21376	½	0.0	20	0
DS-21376	1	0.2	32	8
MC-4379	2	0.5	28	84
MC-4379+Alachlor	1 + 1½	0.0	68	91
MC-4379+Alachlor	1½ + 1½	1.2	87	95
Alachlor+Cyanazine	2 + 1	0.0	79	54
Alachlor+Metribuzin	2 + 3/8	0.0	78	76
Oryzalin	2	0.0	45	42
Oryzalin+Chloramben	2 + 2	0.0	82	99
Oryzalin+Metribuzin	2 + 3/8	0.5	66	48
Oryzalin+Linuron	2 + 1½	0.0	57	93
Oryzalin+MC-4379	2 + 1	0.0	36	58
No Herbicide	---	0.0	0	0

1 Preemergence
2 Preplant Incorporated

Table 8D. Soybean Herbicide Demonstration Results

Herbicide	Active ingredient lbs/A	% Early Season Weed Control 1972-Redfield Grass	Bdlf.	3 yr., 4 loc. Grass	Bdlf.
Preplant Incorporated (ppi)					
vernolate (Vernam)	2½	95	99	81	76
trifluralin (Treflan)	3/4	99	99	85	85
Split Application (ppi & pre)					
trifluralin and linuron (Treflan & Lorox)	3/4 & 1	90	95	--	--
Preemergence (pre)					
chloramben (Amiben)	2½	75	80	71	76
alachlor (Lasso)	2½	95	95	87	86
alachlor + linuron (Lasso + Lorox)	2 + 1	90	95	93	91
fluorodifen (Preforan)	4	95	100	76	88
NPA + chlorpropham (Solo)	3 + 3	20	90	--	--
DCPA + linuron (Shamrox)	6 + 3/4	50	90	--	--

Sorghum Herbicide Screening

W. E. Arnold and B. O'Neal

The purpose was to evaluate the effectiveness of herbicides and herbicide combinations for crop tolerance and control of annual weeds in sorghum.

Soil properties and plot size were similar to the corn herbicide trial. Sokota 102 sorghum was planted June 9 in a 30-inch row spacing at a seeding rate of five pounds per acre. Preemergence treatments were applied June 12 with a tractor sprayer applying 20 gpa at 30 psi. Postemergence applications were made with a bicycle sprayer applying 30 gpa at 22 psi on June 29. The sorghum was in the 3-4 leaf stage (4 inches tall) and the foxtail was in the 2-3 leaf stage (2-3 inches tall) at the time of postemergence applications.

Visual observations of percent grass control were made on June 27. Predominate species were yellow foxtail (*Setaria lutescens*) and green foxtail (*Setaria viridis*) with some barnyard grass (*Echinochloa crusgalli*) present. Visual observations of grass control were made again on August 2. These ratings were based on a scale of four weed control categories for both grassy weeds and broadleaf weeds. The four categories were E=excellent (96-100% control), S=satisfactory (86-95% control), M=marginal (70-85% control), and U=unsatisfactory (0-69% control). Broadleaf weeds present when the second evaluations were made were redroot pigweed (*Amaranthus retroflexus*) and lambsquarters (*Chenopodium album*). The weed control results are shown in Table 9.

Grain Sorghum Herbicide Demonstration Results

L. J. Wrage, W. E. Arnold, and W. B. O'Neal

Herbicides that are cleared for weed control in grain sorghum were demonstrated at the Center in 1972. These results along with the average results from 3 locations for 2 years are shown in Table 9D. The screening trial results reported in Table 9 are used to evaluate experimental herbicides, but the demonstration results evaluate herbicides available for commercial use.

Table 9. Sorghum Herbicide Screening

			Summary* August 2, 1972							
			Grass				Bdlf			
Treatment	Rate (lb/A)	% Grass Control (June 27)	E[1]	S[2]	M[3]	U[4]	E	S	M	U
Preemergence										
Propachlor	4	100	0	4	0	0	0	2	0	2
Terbutryne+Propazine	2 + .8	75	0	2	0	2	0	4	0	0
Terbutryne+Atrazine	2 + .8	90	0	1	1	2	0	4	0	0
Terbutryne	2.4	61	0	1	1	2	0	3	1	0
DS-16654	2	28	0	0	0	4	0	0	0	4
DS-16654	3	8	0	0	0	4	0	0	0	4
Cyanazine	$2\frac{1}{2}$	42	0	0	0	4	0	0	0	4
Cyanazine+Propachlor	1 + 3	99	0	3	0	1	0	1	0	3
Cyanazine+Prynachlor	1 + 3	100	0	3	1	0	0	3	1	0
Cyanazine+GS-13529	$1\frac{1}{2} + 1\frac{1}{2}$	65	0	1	0	3	0	3	1	0
MC-4379	2	94	0	0	1	3	0	4	0	0
MC-4379+Propachlor	1 + 3	99	0	4	0	0	0	4	0	0
MC-4379+Propachlor	$1\frac{1}{2}$ + 3	97	0	3	1	0	0	4	0	0
Prynachlor	3	100	0	3	1	0	0	2	2	0
Prynachlor	4	99	0	3	0	1	0	2	2	0
R-15302	3	45	0	1	0	3	0	0	1	3
R-15302+Atrazine	2 + 1	45	0	0	0	4	0	0	2	2
Postemergence										
Propachlor	4	--	0	1	0	3	0	1	0	3
Propachlor+Atrazine	2.4 + 1	--	0	0	0	4	0	3	1	0
Alachlor+Atrazine	2 + 1	--	0	0	0	4	0	3	1	0
No Herbicide	--	--	0	0	0	4	0	0	0	4

[1]E=Weed control 96-100%
[2]S=Weed control 86-95%
[3]M=Weed control 70-85%
[4]U=Weed control 0-69%

*These columns indicate the number of replications with a given weed control level

Table 9D. Grain Sorghum Herbicide Demonstration Results

Herbicide	Active ingredient lbs/A	% Early Season Weed Control 1972-Redfield Grass	Bdlf.	2 yr., 3 loc. Grass	Bdlf.
Preplant Incorporated					
propazine (Milogard)	2	-	-	53	99
Preemergence					
propazine (Milogard)	2	50	85	50	93
propachlor (Ramrod)	4	98	90	93	83
propachlor + atrazine (Ramrod + AAtrex)	2 + 1	95	99	94	96
propachlor + linuron (Ramrod + Lorox)	2 + 1	95	95	95	83
norea + atrazine (Herban + AAtrex)	2 + 1	65	95	83	87
norea (Herban)	3	65	20	-	-

Reclamation and Improvement of Solidized Solonetz (Alkali Claypan) Soils

L. O. Fine and D. G. Shannon

The research site 5 miles northwest of the Research Center was continued under lease from Glenn Mager in 1972. The site has been used since late autumn, 1969, for a deep plowing, chemical amendment, drainage research effort on alkali claypan soils of the James River Basin.

The objectives of the work are:

1. To evaluate deep tillage, chemical amendments, and lignite fly ash as ameliorating factors in the adverse physical properties of Aberdeen and similar solodized solonetz soils.
2. To study drainability of the above soils by installing plastic pipe drains.
3. To obtain information on water quality which would occur below the rooting zone of crops when these soils are irrigated.

Procedure

Thirteen (13) acres of moderately and severly solodized claypan soils were leased in 1969, samples of soil obtained, and part of the area plowed approximately 30 inches deep with a large moldboard type plow. Gypsum, sulfur, and lignite fly ash were applied in 1970 and 1971 and worked into the surface soils. Plots were set up 60 X 75 ft. and irrigation was practiced by the basin technique on those plots designated to receive water.

A drainage system was installed at 5 to 5½ ft. depth in 1970, connected to a main sump capable of being pumped. The drain has functioned very well in 1971 and 1972, removing 1 - 1½ inches of ground water each year from the entire experimental area. Waters removed have been sampled and analyzed.

After leveling and planing the area in early spring 1971, alfalfa-intermediate wheatgrass was sown in the basin type plots. An excellent stand was obtained.

Results

Extremely heavy runoff from adjacent land in 1972, coupled with the lack of adequate surface water relief channels, caused flooding and loss of plant stands on a major portion of the plots.

After much difficulty, a surface drain was opened to the James River, after which the intermediate wheatgrass was reseeded in October. Alfalfa will be replanted in April, 1973.

Drainage water was removed by the drain system continuously from April 18 until October 3, except one period of about 5 weeks in May and June when flood waters shorted and destroyed the pump motor. Water levels were so high that the sump and all equipment were submerged, and could not be put back in operation.

Water samples obtained when the subsurface drain and pump were operating were analyzed, with the following results:

Date	Elect. Cond. Micromhos/cm	Estimated Total Salts me/L	Sodium Absorption Ratio
4-18-72	840	8.4	0.9
4-21	704	7.0	---
4-24	794	7.9	---
6-22	464	4.6	0.9
6-23	1867	18.7	1.8
7-27	2850	28.5	2.4
8-2	2630	26.3	2.3
8-8	2980	29.8	2.5
10-3	3540	35.4	2.6

The volume of water being pumped per day diminished during April, and again after the flooding, from June through September. Less than 5 gallons per hour were being removed in early October. As the volume being pumped diminished, the total salinity of the water gradually increased, as did the sodium absorption ratio.

Observation of the plots indicated that after the very heavy rains of May, water seldom remained any length of time on the deep-plowed plots, but sank away in 1-3 days. Shallow plowed plots retained free surface water a week or longer. However, those that were surface flooded in the eastern end of the tract by extensive run-in or water from adjacent land lost their alfalfa-grass stands nevertheless, and water remained standing on all those plots, deep or shallow plowed, until a surface drain could be installed in mid-June.

Conclusions

Internal drainage of these soils appears feasible.

Flexible plastic drain pipe (4 in. diam.) as installed herewith has functioned satisfactorily.

Salinity levels in drainage waters so far exhibit normal patterns: inversely related to total volume of water being removed. Excessive salinity has not been encountered.

Sodium absorption ratios thus far observed in drainage waters are not cause for concern about soil dispersion due to sodium.

Development and Evaluation of Irrigation Water Management Practices for Optimum Crop Production

D. D. Brosz and R. Frankenstein

Auto-mechanization of irrigation systems is bringing about the practice of frequent light applications of irrigation water in contrast to the traditional few heavy applications. The feasibility and effects of one, two, and three inch applications on corn yield, soil moisture distribution, application uniformity, and irrigation efficiency is being investigated through the following objectives:

1. To evaluate the soil moisture extraction pattern and yield of a crop that is irrigated with frequent light applications in relation to less frequent heavier applications.
2. To develop irrigation water management practices, based on soil water depletion, that optimize crop production and maximize water use efficiency.
3. To establish guidelines for irrigator assistance in system selection.

Procedure

The research plots were planted on June 7, 1972. The late planting date was due to unusual wet conditions at the research farm. The plots were planted in 30-inch rows at an approximate planting rate of 27,000 kernels per acre. The variety planted was Pioneer 3781. Furadan was applied at one pound per acre for rootworm control. Lasso was banded in a 12-inch band and was applied at a 30 to 35 pound rate for weed control. The harvest population of the plots was approximately 22,000 plants per acre.

Three application treatments were imposed on each of six replications under both sprinkler and gravity irrigation systems. All irrigation water applied, runoff water on the gravity plots, and water retained in the root zone were measured. One, two, and three inch application treatments were applied on the sprinkler plots. The application of the irrigation water was planned according to the irrigation scheduling procedure developed for South Dakota by Brosz and Wiersma. The application treatments for the furrow plots were set at 1.7, 2.6, and 3.7 inches.

Irrigation on the research plots did not begin until August 3, 1972 due to more than adequate rainfall during the previous months. Soil moisture measurements in the plots were made with a neutron probe and tensiometers to an approximate depth of 5.5 feet.

Results

Ten inches of irrigation water were applied to the one and two-inch application sprinkler plots and nine inches of irrigation water were applied to the three-inch treatment plots. Soil moisture measurements indicated a total consumptive use of approximately 14.3 inches from July 11 through September 25. Although total consumptive use was nearly equal among the sprinkler treatments, the soil water extraction pattern was not the same. The soil water extraction patterns for the three sprinkler treatments are shown in the following table:

Table 10. Percent of Soil Water Extracted at Various Depths

Soil depth (ft)	Water application depth in inches 1	2	3
0-1	63%	53%	40%
1-2	21%	22%	32%
2-3	9%	12%	16%
3-4	4%	9%	9%
4-5	3%	4%	3%

Average corn yields of 123, 118, and 124 bushels per acre were harvested from the one, two, and three-inch application treatment plots respectively.

The furrow irrigation plot data were greatly influenced by a persistent water table on all of the plots during the irrigation season. The water table fluctuated between three and five feet below the soil surface. The average yields from the furrow irrigated plots were 122, 117, and 122 bushels per acre for the 1.7, 2.6, and 3.7 inch application treatments respectively.

Tensiometer board and tubing used in measuring soil moisture.

Regrowth Selection in Smooth Bromegrass

J. G. Ross

The objective of this work is to obtain a variety of smooth bromegrass capable of regrowth similar to alfalfa so it will maintain itself in mixture with alfalfa under an intensive harvesting program designed for maximizing alfalfa yields.

Bromegrass was seeded, one seed to a hill, 40 inches each way, in the fall of 1969 on six acres of irrigated land. In the spring it was overseeded with alfalfa and in subsequent seasons harvested to maximize alfalfa yields.

Outstanding plants have been marked before each cutting. The identity of outstanding plants is maintained. These plants will be eventually removed from the field for formation of a synthetic variety for testing. In addition to regrowth, seed set, disease reaction, and forage quality will be used as selection criteria.

Smooth bromegrass selection study. One of the bromegrass plants at first alfalfa cutting.

A bromegrass plant at second cutting.

A bromegrass plant at third cutting.

Potato Project

P. Prashar

Red Pontiac, Superior, and Norchip potatoes were grown under irrigation to obtain maximum yield.

Red Pontiac, Superior, and Norchip potatoes were planted in replicated plots on May 9. The rows were 350 feet long, 36 inches apart, and seed pieces were placed 8 inches apart within a row, but stands were poor because of a wet, compacted seedbed. Weed and pest control recommendations were followed during the growing season. The potato plants were irrigated July 10 with 3 inches of water. No irrigation water was applied in August. The potatoes were harvested on September 19.

Red Pontiac, Superior, and Norchip potatoes yielded 10.04, 11.30, and 7.20 tons per acre respectively. The specific gravity of Red Pontiac, Superior, and Norchip were 1.071, 1.079, and 1.083 respectively.

The yields of potatoes under irrigation in 1972 were very poor. A number of factors contributed to low yield but the two main factors responsible were (1) wet, compacted soil at planting time and excessive May rainfall which resulted in poor stands, and (2) a lack of proper irrigation.

Soybean Breeding and Testing

A. O. Lunden

Soybean test plantings included both standard varieties and commercial entries in 1972. Seed samples were solicited and obtained from seven major companies and were planted in those locations recommended by the sender. All entries were planted at Brookings and entries listed for Brookings were also planted in the irrigated test at Redfield. Field plantings consisting of single row plots with four replications were delayed about two weeks at both locations because of heavy spring rains. The Redfield plot was seeded on June 9 in 21 inch rows with $2\frac{1}{2}$ pounds of Lasso for control of weeds. Weed control was effective and growth was satisfactory but some entries were lodged severely at time of harvest. The soybeans were irrigated August 13 with $5\frac{1}{2}$ inches of water and on August 30 with $3\frac{1}{2}$ inches. Yields and lodging at Redfield and relative maturity ratings at the Brookings test site are reported in Table 11. Note average yields are available for only 8 of the 24 entries planted in 1972 and single year results should be interpreted with caution.

Wells is a new release from Indiana which has not been outstanding in other tests in the state but which performed very well in this test. Corsoy has been the best entry at Redfield since initiation of the annual testing program in 1967 and should serve as a good standard of comparison for all other entries. The test will be repeated in 1973 to provide more substantial data on soybean performance.

Table 11. Soybean Yields at the Redfield Irrigation Farm

Entry (1)	Maturity (2)	Lodging (3)	1972 Yield (Bu/A)	1969-72 Yield (Bu/A)
Wells	M	1.7	41.6	---
Corsoy	M	3.4	34.8	35.7
Hark	M	2.2	32.8	32.2
Ramage	M	2.2	32.8	31.5
Wirth	E	2.6	32.6	31.1
Steele	E	2.7	31.3	---
Anoka	E	3.3	29.4	30.0
Chippewa 64	E	2.0	29.0	28.5
Amsoy 71	ML	2.5	22.7	24.9
Provar	M	3.3	22.0	24.3
IVR 0810	E	2.8	36.3	---
L-O-L Go45	E	2.2	34.6	---
TEW x K505	ML	2.3	33.3	---
TEW x K125	M	2.2	31.9	---
MCC 2A	M	1.9	31.7	---
IVR 1120	E	3.0	31.5	---
SRF 150	M	1.5	29.2	---
MCC 90+	M	3.3	29.2	---
PET 2090	ME	2.9	29.1	---
FFR 5048	M	3.0	27.6	---
SRF x 7065	ML	2.8	27.2	---
PET 2100	ML	2.3	26.5	---
SRF 100	E	2.7	23.9	---
TAMA S-20	M	2.7	23.1	---
LSD			2.8	

(1) Entries include standard varieties and the following commercial entries: Farmers Forage Research Cooperative (FFR), Improved Varieties Research, Inc. (IVR), Felco-Land-O-Lakes Inc. (LOL), Peterson SEEDs (PET), Soybean Research Foundation (SRF), Security Seed co. (TAMA) and L. Tewles Co. (TEW).

(2) Maturity is reported as Early (E), Mid-early (ME), Medium (M), and Mid-late (ML) as observed at the Brookings test site in 1972.

(3) Lodging readings are based on a scale of 1 to 5 from erect to prostrate.

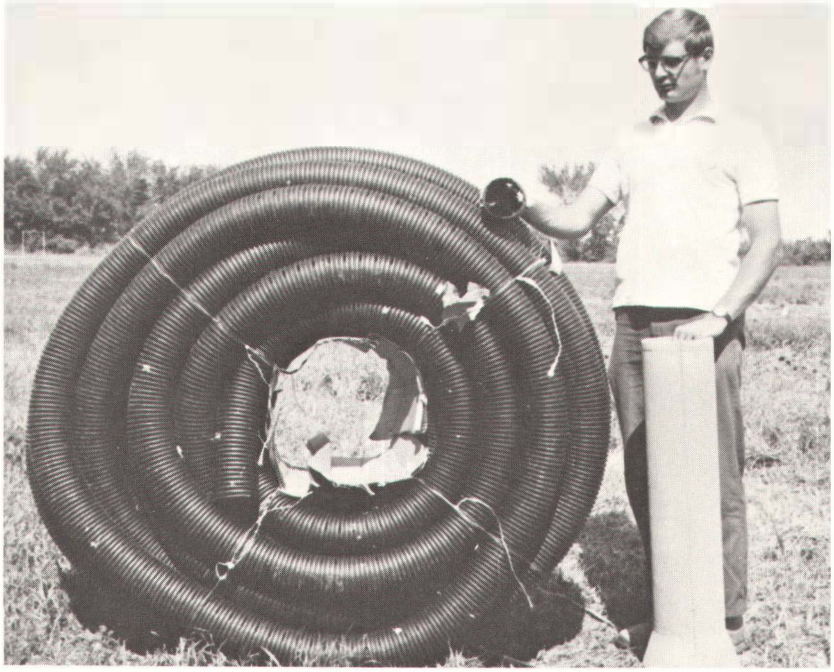
Bi-Level Drainage Experiment

D. W. DeBoer and J. M. Kienholz

The experimental area consists of a deep and two shallow 75 foot long drain lines. The eight foot drain line was installed in 1963 and the shallow (3.5 foot) lines were installed in the fall of 1970. The experimental drain lines were operated for two weeks in 1971 and for two weeks in 1972.

The diked experimental area was flooded for one day before the drain lines were operated in 1972. This allowed the water table to come above the soil surface within the experimental area. The drain lines can be operated as desired because of the pumped outlet condition.

Figures 2 and 3 show the water table drawdown and the drain line discharge data during a two week experimental period. The results of this experiment will be used to test analytical and laboratory studies. The primary limitation of the data is the 75 foot drain line spacing in the experimental area does not represent the wider spacing found in actual design.



Two types of tile -- plastic and concrete -- used in drainage research.

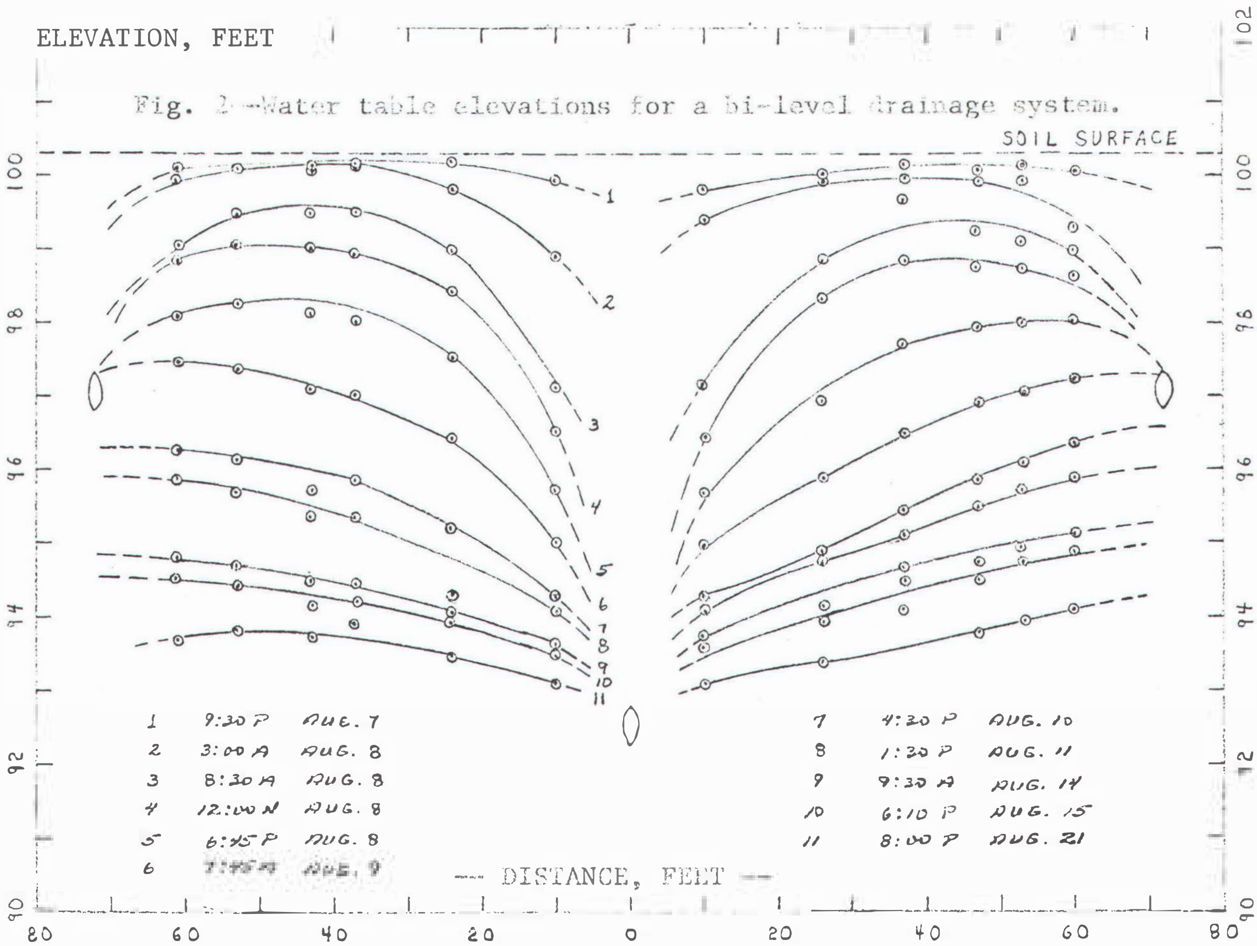


Fig. 2 --Water table elevations for a bi-level drainage system.

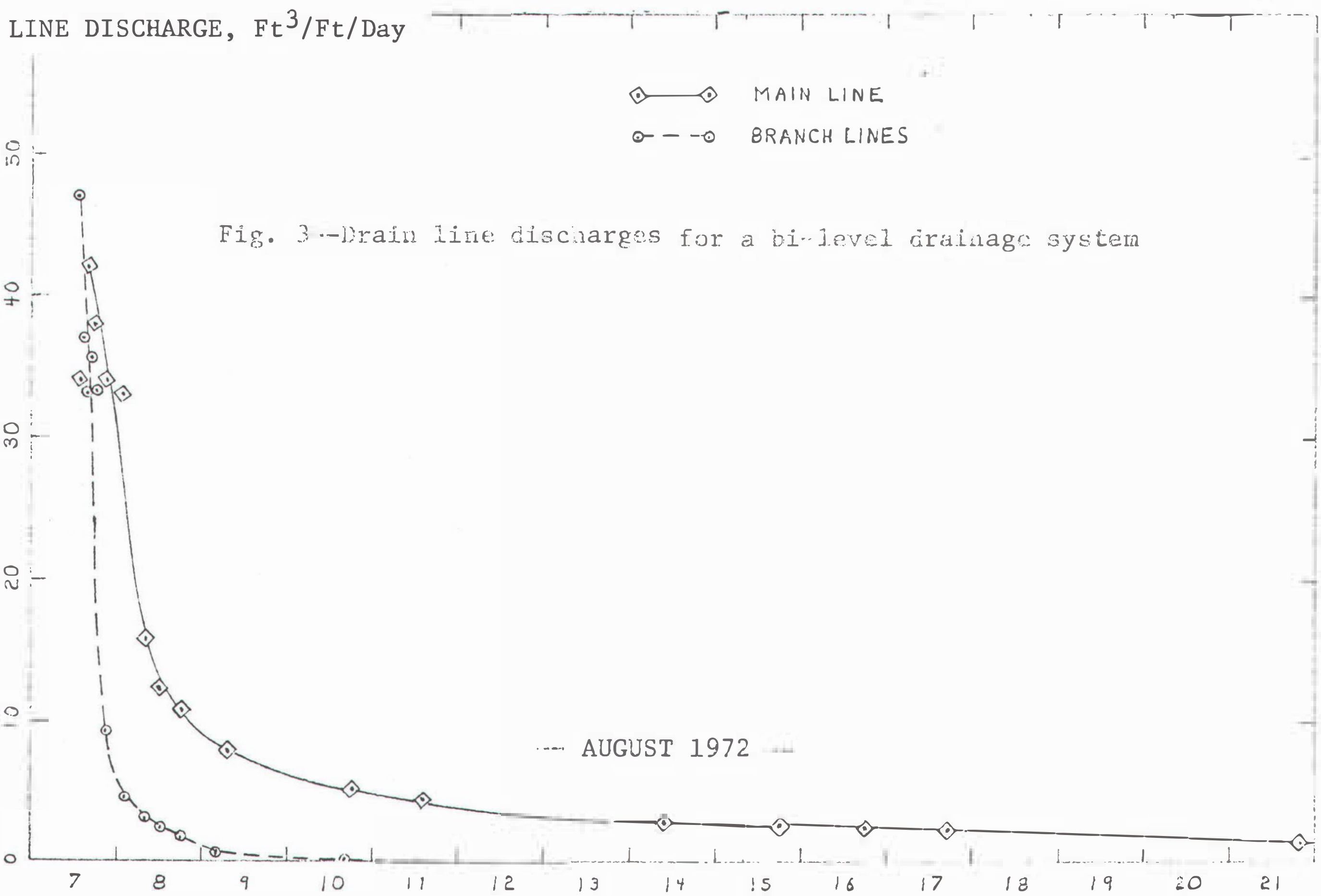


Fig. 3 --Drain line discharges for a bi-level drainage system

Drainage Water Quality

D. W. DeBoer

A five acre area immediately north of the farmstead is partially drained by subsurface drain lines. The discharge from these drain lines was periodically sampled for water quality analyses during 1972. Table 12 gives detailed chemical analyses of water samples collected from four drain lines and the James River on September 5, 1972. These analyses are representative of the 1972 water quality analyses. Figure 4 shows the areas drained by the individual drain lines. The location is significant because the two eastern lines have a lower water quality than the west lines. Chemical analyses of the soil saturation extracts verify this difference.

Table 12. Chemical Analyses of Drain Line Discharges and the James River Near the Center Taken September 5, 1972

Measurement	Tile Line Location				James River
	BN	BS	CN	CS	
Calcium (Ca), ppm	356	380	332	456	75
Magnesium (Mg), ppm	338	881	343	634	31
Sodium (Na), ppm	450	2280	510	1830	102
Potassium (K), ppm	14	29	14	26	22
Sulfate (SO_4), ppm	2420	8125	2450	6050	185
Nitrate (N), ppm	10.25	9.10	14.5	12.5	0.19
Chloride (Cl), ppm	160	225	202	315	44
Alkalinity (MO), ppm (as $CaCO_3$)	500	462	528	562	310
(PP), ppm	12	28	20	34	0
Conductivity, umho/cm	4123	9425	4653	7599	1202
SAR	4.10	14.69	4.69	13.02	2.50
Sodium, % of cations	29.90	51.88	32.97	51.34	39.33
pH	8.16	8.31	8.12	8.38	8.08
Total Cations, meq/l	65.48	191.16	67.27	155.05	11.29
Total Anions, meq/l	65.55	185.19	68.23	146.79	11.29

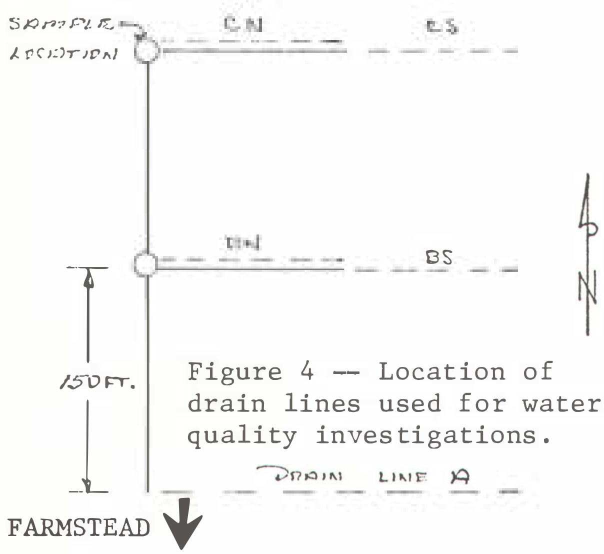
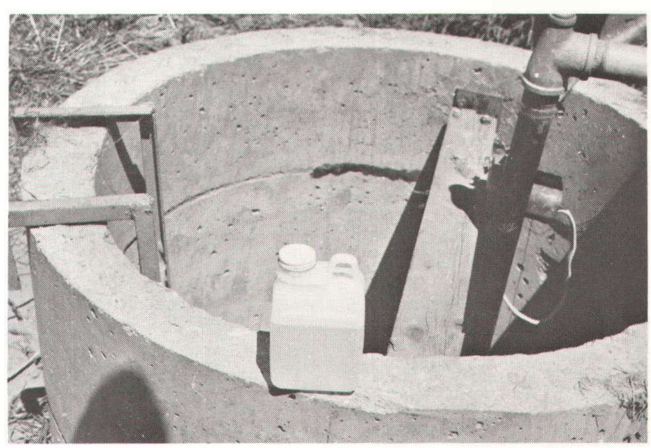


Figure 4 — Location of drain lines used for water quality investigations.



Water samples for water quality research are taken from this sump.

Adaptation of Feedlot Cattle to Urea and Antibacterial Compounds

J. D. Burkhardt and L. B. Embry

A period of adaptation to urea during which feedlot performance is suppressed is frequently experienced when this product is added to rations of cattle not previously, or recently, fed it. This effect appears more evident with levels of urea used when it forms the major source of supplemental protein to the ration.

Urea and antibiotics in combination are common additions to protein supplements or mixed rations. At usual levels for continuous feeding of antibiotics and safe levels of urea for the dietary conditions, the combination appears satisfactory and to offer the beneficial effects from these compounds after a suitable period of urea adaptation. However, much less is known about the effects of high levels of antibacterial compounds and urea together during early stages in the feedlot with unadapted cattle. More research is needed to answer questions concerning levels of these compounds during early stages in the feedlot, especially with calves shipped at weaning or a few weeks thereafter. Other information needed includes the relative effects of adaptation to urea and antibacterials singularly and together after various times of arrival of the cattle at the feedlot.

Effects of adding urea to furnish the major source of supplemental protein to a corn silage ration for calves at various times following arrival at the feedlot was investigated in this experiment. Urea additions were made to rations of calves fed with and without antibacterial compounds.

Procedures

One hundred twenty steer calves were purchased in late January for the experiment. The average weight of the steer calves was about 510 lbs. The calves had been given treatments usually associated with "preconditioned" calves but reported to have not received any antibiotics or urea in their feed.

They were allotted into 8 pens of 15 each on basis of weight taken after arrival. The experimental design was as follows:

Design of the Experiment

Protein Supplement Treatment	Control Group	Antibiotic Group[a]
Soybean meal	15 steers	15 steers
Urea on day 1	15 "	15 "
Urea on day 14[b]	15 "	15 "
Urea on day 28[b]	15 "	15 "

[a]Fed as Aureo S-700 to furnish 350 mg each of chlortetracycline and sulfamethazine per head daily for the first 28 days of the experiment and then chlortetracycline at 70 mg per head daily.

[b]Supplement prior to these days will be the soybean meal with or without Aureo S-700 according to the experimental design.

Rations during the experiment consisted of 2 lb of protein supplement (about 37% protein) and a full feed of corn silage. Animals were fed twice daily. All animals were implanted with 24 mg of diethylstilbestrol at the beginning of the experiment.

The protein supplements were soybean meal or corn-urea based supplements. The soybean meal supplement contained 84.5% soybean meal with the remainder being minerals and vitamins. The corn-urea supplement contained about 70% corn, 11% urea and the remainder being minerals and vitamins. Calcium sulfate was added to the corn-urea supplement in an amount to supply 1 part sulfur to 10 parts nitrogen that came from urea.

Four protein supplements were provided for the first 28 days of the experiment. Two of these were soybean meal supplements, one with and one without chlortetracycline-sulfamethazine, and the other two were corn-urea supplements, also with and without the antibacterials.

Results

Results of the experiment are shown in Table 13. Overall comparisons between control and antibiotic groups show essentially no differences from supplementing the cattle with 350 mg each of chlortetracycline and sulfamethazine for 28 days followed by 70 mg of chlortetracycline for the remainder of the 120-day experiment. The initial high level of the antibacterials did not appear to result in any consistent improvement in early feedlot performance for the various protein supplement groups. Calves fed the soybean meal supplement did gain at a faster rate with the antibacterial. However, this effect was not consistent during the first month of the experiment when other groups received the same rations for 14 or 28 days.

Results do not show any benefit from adding urea after 14 or 28 days in comparison to starting the calves on the urea supplement at the beginning of the experiment. In fact, those supplemented with urea at the later dates gained at slightly lower rates than calves fed urea from the beginning of the experiment. The latter group gained at about the same rate as calves supplemented with soybean meal.

Type of supplement as to antibacterials or protein source did not appear to affect feed consumption. Therefore, calves making slightly faster rates of gain also had small advantages on feed efficiency.

Calves used in the experiment had not been fed urea or an antibiotic prior to the experiment. However, they had been weaned and fed growing type rations for several weeks. This may have been important in the response to the antibacterial and in adaptation to urea.

Summary

A high level of chlortetracycline and sulfamethazine (350 mg each daily) followed by 70 mg daily of the antibiotic did not affect feedlot performance of calves in this experiment where corn silage was full fed with a protein supplement for 120 days. Results from the antibacterials did not appear to be affected by protein source (soybean meal or urea) in the supplements.

Adding urea after 14 or 28 days in the feedlot offered no benefits in comparison to feeding urea from the beginning of the experiment. Weight gains were at a slightly lower rate when urea was added at the later dates.

Age, weight, and previous treatments for the calves may have had important influence on the results obtained. Such calves are more resistant to effects of stress from the shipping and adaptation to a new location and rations than would be calves weaned and immediately subjected to these stresses.

Under conditions of this experiment, it would appear unnecessary to avoid urea in the protein supplement for a period of 2 to 4 weeks after arrival of the cattle. Adaptation to urea may be accomplished with less evident depression in feedlot performance at the same time as adaptation to the new location and rations changes than at a later date.

Table 13. Results of Urea and Antibacterial Compounds Fed to Growing Feedlot Cattle (January 27 to May 26--120 days)

	CONTROL					ANTIBIOTIC[a]				
	SBOM	Urea on day 1	Urea on day 14[b]	Urea on day 28[b]	Avg.	SBOM	Urea on day 1	Urea on day 14[b]	Urea on day 28[b]	Avg.
No. of steers	15	15	15	15	60	15	15	15	15	60
Init. shrunk wt (lb)	508.7	507.3	511.3	510.0	509.3	509.7	511.0	511.3	512.0	511.0
Final shrunk wt (lb)	777.0	783.3	780.3	762.0	775.6	801.7	787.7	778.0	771.7	784.8
Avg. daily gain (lb)	2.24	2.30	2.24	2.10	2.22	2.43	2.31	2.22	2.16	2.28
Avg. daily feed										
Corn silage	37.00	37.77	37.80	37.77	37.58	37.93	37.61	37.91	37.77	37.80
Supplement	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97	1.97
Feed/100 lb gain (lb)										
Corn silage	1655	1642	1686	1798	1695	1559	1631	1706	1745	1660
Supplement	88	86	88	94	89	81	85	88	91	86

[a]Fed as Aureo S-700, (aureomycin and sulfamethazine each at 350 mg per head daily), for the first 28 days of the experiment and then aureomycin at 70 mg per head daily.

[b]Supplement prior to these days was the soybean meal with or without Aureo S-700 according to the experimental design.

Levels of Diethylstilbestrol With and Without Aureomycin Fed to Finishing Feedlot Cattle

J. D. Burkhardt and L. B. Embry

In a previous experiment, steers fed 20 mg daily of diethystilbestrol (DES) and 70 mg of chlortetracycline (CTC) gained at a faster rate than steers not fed the antibiotic or those fed 10 mg of DES. Since the antibiotic had not been cleared for feeding with 20 mg DES, more information appeared to be needed. Therefore, this experiment was conducted to compare rations with and without 70 mg daily of CTC when fed with 10 or 20 mg daily of DES.

Since the experiment was completed, including DES in the feed for cattle has been prohibited by the Food and Drug Administration (FDA). However, results obtained with the two levels of DES are believed to be of academic interest. The experiment also provides a comparison on the value of the antibiotic under conditions of high concentrate finishing rations.

Procedure

One hundred-twenty Hereford-Angus x Shorthorn steers were used in this experiment. DES was fed at 10 or 20 mg per head daily with and without 70 mg CTC for the four dietary treatments. They were randomly allotted on basis of weight to 8 pens with 15 head per pen.

Diets consisted of 2 lbs chopped alfalfa hay, 1 lb 40% protein supplement and ground sorghum grain being fed to appetite. The cattle were fed in fence-line feed bunks twice daily and were in pens with access to shade or shelter. The experiment was terminated after 76 days. Carcass characteristics are not presented as those cattle receiving 20 mg DES in conjunction with 70 mg CTC had to be removed from the experimental treatments for a period of 28 days prior to slaughter to comply with FDA requirements.

Results

Steers fed 20 mg DES daily gained 8.7% faster than those fed the 10 mg level (Table 14). They consumed about the same amount of feed as steers without DES. In view of the high rate of gain, they had lower feed requirements.

Steers fed CTC gained 3.6% more with 3.6% lower feed requirements with the 10 mg level of DES. An average response to the antibiotic of about this magnitude has been reported frequently with high concentrate rations. With the higher level of DES, rate of gain and feed consumptions were about the same with and without CTC. These results differ from previous ones which showed a greater response to CTC with the higher level of DES. In view of this variability, it would appear that response to the antibiotic in increased weight gains and improved feed efficiency is low (4-5%) when fed in high concentrate finishing rations.

Summary

Steers fed 20 mg DES gained 8.7% faster than those fed DES at 10 mg daily. However, FDA regulations at present do not permit feeding DES, but it may still be used as an implant in the ear.

Steers fed 70 mg daily of chlortetracycline (CTC) gained 3.6% more with 3.6% lower feed requirements than steers without the anitbiotic when fed 10 mg DES. The antibiotic was without effect in this experiment when fed with 20 mg DES. Results of this and other experiments indicate that the response in weight gain and feed efficiency to CTC by cattle fed high concentrate rations is variable and generally low. The response of 3.6% obtained when fed with 10 mg DES is about the magnitude of the average response reported for CTC under these conditions.

Table 14. Levels of Diethylstilbestrol With and Without Aureomycin (June 29-September 14, 1972--76 days)

Diethylstilbestrol Aureomycin	10 mg. 0 mg.	10 mg. 70 mg.	20 mg. 0 mg.	20 mg. 70 mg.
No. steers	30	28*	30	30
Init. shrunk wt., lb.	825.0	829.0	823.1	822.3
Final shrunk wt., lb.	1015.3	1025.7	1034.0	1032.2
Av. daily gain	2.50	2.59	2.77	2.76
Av. daily feed				
Sorghum grain	24.77	24.69	24.75	24.74
Hay	3.57	3.58	3.57	3.57
Suppl.	.934	.952	.934	.835
Total	29.274	29.222	29.254	29.145
Feed/100 lb. ga., lb.				
Sorghum grain	991	954	892	897
Hay	143	139	129	130
Suppl.	37	36	33	30
Total	1171	1129	1054	1057

*Two steers removed from experiment and not attributed to treatment.

Evaluation of "Damp-Chop" vs "Dry-Chop" Methods of Harvesting Alfalfa Hay

W. H. Peterson

The purpose of this study was to determine the savings in pounds of feed preserved for feeding and pounds of protein preserved for feeding by damp-chopping and drying in the stack compared with dry-chopping at 15% moisture.

Field 3 was selected for this study. All of the field was mowed and raked at the same time. Then one-half of the hay was damp-chopped and one-half dry-chopped. The hay is stored in stacks on the farm and will be fed later this winter at which time quality samples will be taken and dry matter losses will be recorded. Atmospheric air is forced through the damp-chopped stack until moisture content is low enough to prevent heating.

Results and Discussion

There are some very good advantages for chopping hay, such as labor savings, utilization of silage cutting equipment, less feeding losses, and permits harvesting sooner after cutting. Thus, we have attempted to answer some questions on chopping hay such as determining field losses of dry-chopping over damp-chopping, storage losses from damp-chopped hay dried in stack to dry-chopped hay, and feed value per acre after storage. The data obtained to date in this study are shown in Table 15. The protein concentration decreases when left in the windrow which points out the importance of getting the alfalfa harvested as quickly as possible. There was very little difference in total yield between damp-chop and dry-chop.

Table 15. Yield, Moisture, Protein, and Carotene of Alfalfa From Damp-Chopped and Dry-Chopped Hay

Harvest Method	Date	Yield tons/A (12% moisture)	% Moisture at harvest	% Protein (moisture free)	% Carotene (moisture free)
Damp-Chop	June 17	2.01	34	15.16	9.74
Dry-Chop	June 22	2.10	12	13.41	4.24
Damp-Chop	Aug 7	1.85	21	17.07	2.32
Dry-Chop	Aug 9	1.82	12	14.30	2.37

Hay drying research. Fan (at left) blows air through pipe extending into center of hay stack.

Irrigation Equipment and Water Distribution

D. Pahl and F. Kerr

The purposes of new installations were to: (1) modernize the irrigation techniques and equipment previously used, (2) improve the quality and accuracy of the agronomic research by providing excellent water control, and (3) evaluate and demonstrate the most modern equipment available to today's irrigator.

Gravity irrigation equipment valued at approximately $30,000 was installed at the James Valley Research and Extension Center. These installations included underground pipe of various materials, water meters, automated gated pipe systems, concrete lined ditch systems plus the conventional gated pipe system. This equipment was obtained and installed through financial gifts from various public and private organizations and by equipment gifts from interested manufacturers. No state money was involved.

Within the irrigation industry the trend is toward automation. The four automated gravity irrigation systems which were installed in 1971 are as follows:

1. Concrete lined ditch with spiles. This is a conventional lined ditch with tubes through the side at one elevation for each irrigation set. Putting a check dam in the ditch would raise the water high enough to flow out the spiles for a given set, but yet be too low to flow from the spiles of the preceding set. Changing sets is done by moving the check dam down the ditch to lower the water level to the next level of spiles.
2. Manifold valve. This system was primarily developed by the Agricultural Research Service and employs the use of one large valve which controls one entire set of gated pipe. The manifold valve contains an inflatable bladder to control the water. The bladder is inflated by a remote air supply.
3. "Pot" system. This system uses an underground pipe with a riser and "pot" containing three "Toro" water controlled gates to water three rows. These gates did not operate properly and were replaced with conventional gates at the time that the "pots" were modified to use the inflatable bladder which can be used successfully.
4. Automated plastic gates. This was a conventional gated pipe with "Toro" water operated gates using a "Toro" clock controller for automation. These gates developed many problems which appear to make the system impractical for farm use. This system was discontinued.

The underground pipe materials including PVC, Techite and Polyethylene have performed satisfactorily.

An appropriation of $12,500 by the 1972 State Legislature provided funds for a high pressure water system, including a pump, to deliver water to the sprinkler irrigation research part of the farm. A major portion of the sprinkler irrigation equipment is on no-charge lease contracts with S.D.S.U.

(continued, outside back cover)

"Irrigation Systems Evaluation and Demonstration Facility" is the title of a report about the various systems at the James Valley Agricultural Research and Extension Center. Copies are available through the Agricultural Engineering Department, South Dakota State University, Brookings, South Dakota, 57006

The first leasing contracts for sprinkler irrigation equipment were signed in 1972. These contracts were made available to any commercial company which wished to make its equipment available to the farm for demonstration purposes.

The no-charge leased equipment was delivered to the farm at no charge, by the company involved. It will be demonstrated for two years, after which time, other companies will have the opportunity to do likewise.

Three center pivots (2 tower or 250' radius) were installed this year--the HiGROWMatic Hi-Truss, Olson irrigator Model 103P, and the Electrogator--as well as a Vermeer Pow-R-Sprinkler and Big Gun by Vermeer Mfg. Co, and a Big Red towline by Lindsay Mfg. Co., Inc. All of this equipment received limited use in 1972 and was demonstrated at the Field Day.

Over 6600 feet of distribution lines were installed to serve gravity irrigation as well as the sprinkler systems. A second re-use pump was installed in the southeast corner of the farm. This unit feeds a gravity system and collects surplus water draining from the south half of the farm.

Of the 6600 feet of distribution lines installed, 2800 feet is low pressure PVC serving the re-use system and gravity systems; 2800 feet of high pressure PVC serves the sprinkler system; and 800 feet of concrete underground line which is a replacement of an installation made in 1971.

All of these systems are available for inspection by the public.

Financial, technical or equipment donations used in the development of the James Valley Research and Extension Center are from the following:

1. Agricultural Research Service - USDA
2. Aluminum Supply Co.
3. Berkeley Pump Co.
4. Buckner Sprinkler Co.
5. Bureau of Reclamation - USDI
6. Black Hills Conservancy Sub-District
7. Canton Concrete Products
8. Certainteed Products Corporation
9. Cooks Trenching
10. Crane Deming Pump Co.
11. Daktronics Inc.
12. Daniel Scramcik
13. East Dakota Conservancy Sub-District
14. East River Power Cooperative
15. Enresco Inc.
16. Fort Randall Conservancy Sub-District
17. Gifford-Hill
18. Lindsay Manufacturing Co.
19. Lower James Conservancy Sub-District
20. McCrometer Corporation
21. Midwest Irrigation Co.
22. Nebraska Plastics Inc.
23. Northern Pump & Irrigation Co.
24. Oahe Conservancy Sub-District
25. Olson Brothers Manufacturing Co.
26. Paramount Pipe Co.
27. Western Rainbird Sales.
28. Rainchief Irrigation Co.
29. Redfield Cement Products Co.
30. Reinke Manufacturing Co.
31. Schnell & Sons
32. Scott-Hourigan Co.
33. South Dakota Cement Plant
34. South Dakota Concrete Products Co.
35. South Dakota Readimix Assoc.
36. Spink Electric Cooperative
37. State of South Dakota
38. Toro Manufacturing Co.
39. United Aircraft Corporation
40. Vermeer Manufacturing Co.
41. Waterman Industries
42. Western Land-Roller Co.
43. West River Conservancy Sub-Dist.
44. Worthington Sales International