March 1974

James Valley Agricultural
Research and Extension Center
Redfield, S. D. 57469

progress report

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1973 WEATHER

JAMES VALLEY AGRICULTURAL RESEARCH AND EXTENSION CENTER

Climatic conditions of 1973 are shown in the table. Rainfall was extremely limiting during the growing season. By August 31 the deficit was 5.12 inches. Some good rains in September and October helped to start rye and winter wheat. Subsoil moisture is still much less than the fall before.

The good crop yields obtained in 1973 with the great lack of rainfall are attributed to the excellent soil moisture reserves acquired from the above normal rainfall in 1972. The silt loam and silty clay loam soils at the Station are capable of storing 8 to 10 inches of water in 4 feet and were charged to this level at the beginning of the 1973 growing season. High crop yields cannot be expected with below normal rainfall unless the subsoils are filled with available water.

Irrigation was limited to research plot areas on July 1 by request of the Water Rights Division, Natural Resource Department, State of South Dakota. This amounted to irrigating approximately 40 acres sparingly until August 13 when the James River level dropped so low we could not pump any longer. Yields of some experimental plots were reduced because of less than adequate irrigation.

Temperatures were below normal during May and a reached low of 25F on May 14 and 15. August was warmer than normal but was only over 100 once (106 - August 28). (Red. 1M--3-74--1976).

Table 1. Precipitation, Temperature, and Evaporation Measurements at the James Valley Agricultural Research and Extension Center for 1973. (Redfield 6E).

Month	Precipitation Inches	Departure*	Temperature (^{o}F)	Departure*	Evaporation (open pan) Inches
January	.52	+0.08	15.4	+2.8	--
February	.36	-0.20	22.8	+6.3	--
March	1.33	+0.50	37.5	+7.5	--
April	1.05	-0.89	43.5	-2.2	--
May	1.96	-0.71	53.4	-4.0	8.24
June	1.57	-1.92	67.4	+0.2	8.55
July	1.61	-0.84	73.1	-0.4	9.40
August	1.15	-1.14	75.3	+3.7	9.17
September	2.27	+0.65	57.6	-3.8	4.13
October	2.52	+1.23	52.5	+3.6	--
November	.70	+0.11	29.1	-3.2	--
December	.30	-0.16	15.1	-3.6	--
Total	15.35	-3.29			39.49

Last frost - May 17 (28^{o}F)
First frost - October 4 (29^{o}F)
Frost free days - 140 days

*From weather observer station at Redfield.

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CORN AND GRAIN SORGHUM PERFORMANCE TRIALS

J. J. Bonnemann
Assistant Professor, Plant Science Department

Introduction

Corn and grain sorghum varieties must be grown under different environmental conditions if their performance ability is to be adequately evaluated. The trials conducted at Redfield are one of six grain sorghum or eight corn locations around South Dakota.

The entries included in these trials are the choice of the participating companies. Only corn hybrids registered with the State Department of Agriculture for the year of the trial are eligible for entry. Some experimental and check entries of each crop are also included by Agricultural Experiment Station (SDAES) plant breeders.

Discussion

The corn and the grain sorghum trials were all seeded May 17. The row spacing for all trials was 30 inches. All trials were drilled in rows using cone-planters mounted over flexi-planter units with double disk openers. Recommended herbicide and insecticide treatments were banded over and in the row at time of seeding. They were for grassy weed and corn rootworm control, respectively.

The field was spring plowed, double disked, anhydrous fertilizer knifed in and disked again. The seedbed was harrowed just before seeding. The cloddiness of the field and lack of beneficial quantities of precipitation seriously reduced the stand levels below those desired for both crops under irrigation. The grain sorghum stand level was reduced more than the corn as the shallower planting depth usually desirable for sorghum adversly affected germination and growth because the lumpy seedbed dried more rapidly and remained that way for some time. The lack of moisture also reduced the effectiveness of the herbicide used.

The grain sorghum stand was about half that desired, 100,000 plants per acre, and the corn stands were about two-thirds the desired goals.

The grain sorghum trial was hand harvested September 28. The material had been nipped lightly by frost but the stalks were very green. The date was about that of normal killing frosts in the area. The irrigated corn trial was harvested November 1 and the dryland trial November 2. Despite the poor stands and dry season the yields of corn are very good. Any explanation for the excellent corn yields would be conjecture as the conditions during germination and early growth would not be considered very favorable for the yields obtained.

Anhydrous ammonia fertilizer was the only fertilizer applied as indicated by soil tests. The dryland trial area received 75 of actual nitrogen and the irrigated trials received 180 pounds of actual nitrogen.

The corn was cultivated three times. The corn and grain sorghum trials were irrigated twice; the total water applied about 6 inches.

The results presented are only for the 1973 trials (Tables 1, 2, and 3). Additional information will be found in circulars from the SDSU Agricultural Experiment Station. (Red. 2--3-74--1M--1967).

(Turn page for Tables)

Table 1. Grain Sorghum Performance Trial, 1973

Brand & Variety	Yield, lb/A	Test Wt. lb/B	% H20 9/17/73
Northrup-King NK 180	4670	57	33.8
Northrup-King NK 233A	4470	59	35.+
SDAES RS 610	4395	56	35.+
Excel 9163	4165	59	35.+
Funk's G-399	3910	59	35.+
Excel 202 C	3855	56	35.+
Pioneer 866	3795	57	35.+
Asgrow Dorado E	3590	58	35.+
SDAES SD 503	3415	58	32.3
Northrup-King NK 129	3380	58	33.9
ACCO R 1010	3360	59	29.8
Niagara NCX 1002S	3350	58	34.2
Excel 433	3310	57	35.+
Funk's Exp HW 3075	3305	57	35.+
Funk's G-393	3300	57	34.1
ACCO R 1019	3255	58	35.+
Pioneer 883	3235	55	35.+
DeKalb A-26	3230	54	34.4
Horizon 84	3210	54	35.+
Horizon 80	3205	53	35.+
Horizon Exp 920	3070	52	35.+
Horizon 45	3040	55	35.+
SDAES RS 506	3005	57	31.5
ACCO X-7275	2945	55	35.+
Horizon 25	2915	59	34.9
DeKalb A-25	2830	53	28.2
ACCO R 920	2750	56	24.5
Western WS 201	2740	56	29.6
Frontier 350	2680	58	27.1
SDAES SD 451	2665	56	29.2
Pioneer 8901	2615	48	35.+
Pioneer 894	2590	56	26.6
Funk's Exp HW 3843	2480	53	35.+
Funk's G-251	2470	57	30.1
SDAES SD 106	2470	55	30.8
Frontier 385	2330	55	33.5
SDAES SD 104	2140	57	30.7
Western WS 102	1285	56	33.5
Mean	3145		
CV - 20.8% LSD(.05)	1060		

Table 2. Irrigated Corn Performance Trial, 1973

Brand & Variety	Yield, B/A	Percent Moisture	% Stalk Lodged
Renk RK 44	159.0	24.7	1.7
Sokota TS-67	156.6	25.8	0.0
Pride R-290	156.6	23.5	2.0
Payco SX 865	150.3	25.9	0.0
McCurdy 2 x 4	147.0	26.1	0.5
McCurdy MSP 333	146.7	25.0	0.0
Trojan TXS 102	145.7	26.4	2.2
Renk RK 11AA	145.5	23.5	0.0
Western KX-55	145.1	25.4	0.5
Sokota MS-67	142.2	26.1	0.5
ACCO UC 3201	141.7	26.2	0.6
Payco SX 775	134.7	23.1	0.0
Pioneer 3780	134.2	23.8	0.0
ACCO U 334	134.0	23.0	0.0
Sokota MS-59	133.3	23.0	0.6
ACCO UC 1150	132.8	21.4	1.1
Disco SX-16	131.3	25.0	1.8
McCurdy MSP 111B	130.1	22.5	0.6
SDAES PP 181	128.7	25.2	0.0
Trojan TXS 94	128.6	23.0	0.0
ACCO UC 1901	127.1	21.8	2.5
Sokota TS-49	126.6	23.3	1.1
ACCO UC 2901	126.4	22.6	2.8
SDAES SD 250	125.7	22.5	5.2
Curry's SC-142	125.4	25.8	0.6
Pride R-200A	125.2	22.3	2.3
McCurdy's 3 x 4	124.4	21.0	2.9
Disco SX-14	123.7	22.8	1.9
Curry's SC-144	123.3	26.0	0.6
Pride R-221	122.6	21.0	1.9
SDAES PP 187	122.1	24.2	0.0
Pioneer 3764	120.9	24.1	0.0
Trojan TXS 99	120.7	21.7	0.6
Pioneer 3740	120.5	23.0	0.6
Trojan TX 100	119.5	23.0	1.2
ACCO U 309	119.4	20.9	9.8
Western KX-52	119.1	24.2	1.8
Trojan TXS 92	118.9	20.3	2.8
ACCO UC 1301	116.8	22.9	3.1
SDAES PP 189	112.6	25.2	4.1
O's Gold SX 900	112.2	22.0	5.2
Renk R 235A	110.0	24.3	0.7
Pioneer 3932	109.3	21.2	0.6
Asgrow RX 42	109.0	21.7	1.4
Trojan TXS 85	107.8	19.7	0.0
O's Gold TX 85	103.1	20.7	0.6
Pioneer 3785	101.9	22.6	1.4
Trojan TX 90	101.4	21.7	2.6
SDAES PP 178	100.1	26.9	0.0
SDAES SD 200	95.6	21.7	5.3
SDAES PP 192	88.6	24.4	0.9
SDAES PP 188	86.8	28.1	0.0
SDAES SD 230	84.3	23.8	2.5
Mean	124.1	23.5	1.5
CV - 14.1% LSD(.05)	19.9		

Table 3. Dryland Corn Performance Trial, 1973

Brand & Variety	Yield, B/A	Percent Moisture	% Stalk Lodged
Sokota MS-67	111.9	24.7	0.0
Sokota TS-67	110.1	24.7	2.0
Trojan TXS 102	99.6	24.8	1.1
Trojan TX 100	96.3	22.7	2.2
Western KX-55	94.1	25.2	0.0
Curtis A 201	93.9	24.6	0.0
Payco SX-775	93.3	22.9	1.1
Pride R-290	89.8	23.1	0.0
Disco SX-9	89.0	18.8	1.1
Pride R-221	88.9	19.7	0.0
Pioneer 3816	88.4	20.2	0.0
Curry's SC-144	88.2	24.9	0.0
Trojan TXS 99	86.0	20.7	1.3
Curtis 457	85.2	23.1	0.0
Asgrow RS 42	84.9	21.7	0.0
Trojan TXS 94	84.6	21.0	2.1
ACCO U 334	84.3	20.9	2.4
ACCO DC 147	84.2	20.1	1.2
SDAES PP 183	84.1	20.6	1.1
Pioneer 3773	83.2	22.8	0.0
Trojan TX 90	82.7	20.2	1.1
Pioneer 3662	82.4	22.3	0.0
ACCO U 326	81.4	21.4	2.1
ACCO UC 1150	81.2	19.7	1.2
Pioneer 3780	81.1	21.7	0.0
Pioneer 3764	81.1	21.3	0.0
SDAES PP 175	80.7	21.5	1.1
SDAES SD 250	80.6	21.7	3.2
SDAES PP 174	79.3	21.0	1.1
Trojan TXS 92	78.9	19.0	0.0
SDAES PP 195	78.7	18.8	2.2
Pioneer 3932	78.6	19.4	1.1
O's Gold TX 85	75.1	19.5	1.0
ACCO U 309	74.9	19.7	1.3
SDAES PP 147	74.1	20.0	2.3
Curry's TX-343	72.9	22.9	1.3
ACCO UC 1901	72.1	20.2	0.0
Disco SX-10	70.9	20.4	0.0
SDAES EX 92	70.5	19.2	1.2
O's Gold SX 900	70.3	21.1	0.0
SDAES PP 171	69.6	19.7	0.0
ACCO UC 1301	67.8	21.8	3.8
Trojan TXS 85	67.4	19.4	1.2
SDAES SD 230	66.4	21.3	2.7
Sokota TS-49	64.1	21.2	0.0
SDAES SD 220	55.8	18.7	3.8
SDAES PP 148	52.2	21.9	1.8
SDAES PP 172	51.4	18.5	2.6
SDAES SD 200	44.2	18.4	0.0
Mean	79.7	21.2	1.1
CV - 19.6% LSD(.05)	21.7		

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SPRING WHEAT BREEDING PROGRAM

R. W. Pylman, Jr., G. Buchenau and K. Sellers
Associate Professors and Technical Assistant,
Plant Science Department

Summary

The semi-dwarf wheats had a very good year. Bounty 208, World Seed 1809, and others were consistently high performers at Redfield. Quality data will be run on all entries at the Cereal Lab in Fargo, North Dak.

Introduction

We are planning to develop a major effort toward breeding for new spring wheat varieties at the Redfield Station. Our 1973 crop was our first attempt at growing replicated yield trials and segregating material on the Station.

Results and Discussion

The yield test plots were planted with a new planter which allowed us to plant plots 4 feet in width and in 6-inch row spacing. The plot size was adjusted to allow harvesting the plots with a small self-propelled plot combine. The segregating material was screened for agronomic appearance and some disease reaction. We selected many heads and plants and bulk harvested several rows. The variety demonstration strips were planted on fall plowed alfalfa ground and looked very appealing to the eye. Several of the varieties are listed in Table 1 with the resultant yield in bushels per acre. Semi-dwarf varieties had a very good year.

The advanced line yield test included some of the now grown varieties. This test was spring plowed alfalfa ground. The yield data of these varieties are in Table 2. These data are for further information on known varieties and breeding lines are not presented.

A second dryland study which was planted at a rate of 70 pounds seed per acre on spring plowed alfalfa ground is summarized in Table 3.

One irrigated yield plot was planted. This plot was irrigated May 10 with 1 inch, May 12 with 1 inch, and June 11 with 3.3 inches of water. This study included two seeding rates of 68 lbs/A and 119 lbs/A. This information is in Table 4.

Era was not ready to harvest as it was quite high in moisture at the time of harvest. The low test weight of Era indicates this is true. Varieties that are this late should have one more irrigation to be properly managed. (1.5M--3-74--1977).

Table 1. Variety Demonstration. Plot yields, 1973. Plot size was 4 feet wide by 50 feet long. Seeding rate was approximately 70#/Acre.

Variety	Yield in Bu/A	Variety	Yield in Bu/A
Bounty 208	55.3	Bonanza	43.6
World Seeds 1809	49.6	Nordak	43.2
Era	49.2	Lark	42.2
Sheridan	48.0	II-64-33	41.6
BW-25	46.0	Manitou	41.5
Hercules (Durum)	45.5	Waldron	36.8
Nowesta	45.4	Polk	34.3
Olaf	45.4	Chris	31.8

Table 2. Yield Data of Several Varieties in the Advanced Line Yield Test. Plot size was 4' by 20' and 4 Replications. Seeding rate was approximately 75#/A.

Variety	Test Weight	Yield in Bu/A
Protor	61.4	46.2
Bounty 208	61.6	44.6
II-66-33 (Mimm)	57.0	44.5
Era	61.1	43.5
Bonanza	59.4	43.2
Lark	61.3	41.0
World Seed 1809	60.0	40.8
Waldron	58.5	40.5
Nowesta	61.0	39.0
Chris	59.5	37.9
Fortuna	58.1	32.5

Table 3. Dryland Yield Test. Plot size was 4 feet by 20 feet and 3 replication per entry.

Variety	Test Weight	Yield in Bu/A
Lark	61.7	35.2
World Seeds 1809	60.5	33.7
Bounty 208	61.6	33.1
Era	61.5	32.5
Waldron	59.6	32.2
II-64-33	59.8	32.1
Olaf	60.6	31.8
Nowesta	60.3	31.2
Bonanza	59.6	30.5

Table 4. Irrigated Yield Test Data. Plot size 4 feet by 30 feet and 40 feet with two replications each.

68 lbs seed/A			119 lbs seed/A	
Variety	Test Weight	Bu/A	Variety	Bu/A
Protor	61.7	49.6	Bounty 208	50.5
II-64-33	58.7	47.7	Lark	50.5
Bounty 208	61.6	45.4	Waldron	46.9
World Seeds 1809	59.5	45.0	Olaf	46.9
Lark	61.3	44.4	Bonanza	46.5
Waldron	59.5	43.9	W.S. 1809	46.1
Olaf	60.8	42.5	Era	44.4
Era	51.0	41.7	Minn II-64-33	42.9
Bonanza	59.2	41.1	Nowesta	41.0
Nowesta	60.0	35.5		

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PLOWING VS. DISKING FOR CORN AND TIMING OF IRRIGATION AFTER FURROWING

Raymond Ward and Robert Sanders
Research Manager and Technical Assistant

Summary

This experiment illustrated the importance of proper planting depth. By planting too deep, corn yields were reduced, moisture content of the corn was higher, and plant population was reduced. Results showed that it is not necessary to plow the land to obtain good corn yields. Delayed irrigation after furrowing did not reduce yields significantly.

Introduction

Preparation of the seedbed for planting corn or any crop is very important for establishing uniform and desirable stand. There are many methods of preparing the seedbed but in this experiment we selected plowing vs. tandem disking as the two methods of preparing the seedbed. Another objective of this study was to determine how soon we should irrigate after furrowing for flood irrigation. Root pruning occurs when furrows are made and corn may suffer moisture stress if water is not applied soon after furrowing.

Procedure

The land was in corn silage in 1972. No fall tillage was conducted. On May 16 one half of the field was plowed. The plowing was tandem disked and harrowed May 17 and May 18. The disked half of the field was tandem disked and harrowed twice May 18. Corn was planted May 18. Pioneer 3780 was planted at 27,000 seeds per acre in 30 inch rows. Lasso was broadcast over the entire area at three quarts of material per acre. The field was cultivated once before furrowing.

On July 3 the entire field was furrowed. Sixteen rows were irrigated with about 3 inches the same day on both tillage plots. Seven days later (July 10) another 16 rows were irrigated. The remaining rows were flooded July 21. The entire experimental area was flooded August 1 with an estimated three to four inches of water. Corn yields were taken by hand October 16.

Results and Discussion

Yield, moisture content of ear corn, and population of the experiment are illustrated in Table 1. The disk-drag-disk-drag tillage treatment produced 20 bu more corn per acre than the plow-disk-drag-disk-drag treatment. The moisture content was 2% higher for the plow plot and the population was about 2000 plants less per acre.

Corn planter planting depth was adjusted to place corn seeds two inches deep on the disk-drag-disk-drag tillage treatment. When the corn began emerging it was observed that the disk tillage treatment was emerging much faster than the plow tillage treatment. Observation of the plot showed that the plowed plots were planted 1 to 1.5 inch deeper than the disked treatment. Since the seedbed was softer where plowed the planter seeded the corn deeper. The deeper planting also caused a delay in maturity as shown by the moisture percentage and caused a reduced stand as shown by the population.

There were small differences in the timing of irrigation after furrowing although these differences were not statistically significant. There appears to be a disadvantage to flooding seven days after furrowing compared to irrigating the same day of furrowing or 18 days later. There was no rainfall during this time to reduce moisture stress.
(1M--3-74--1978)

Table 1. Influence of Tillage and Irrigation Timing on Yield, Moisture Content, and Population of Corn.

TILLAGE TREATMENT	IRRIGATION AFTER FURROWING	YIELD Bu./A	MOISTURE %	POPULATION Plants/acre
Disk-Disk	same day	164.1	33.8	21,130
Drag-Drag	7 days later	157.7	33.8	20,550
	18 days later	167.9	32.4	20,980
	mean	163.2	33.3	20,880
Plow-Disk-	same day	151.2	35.1	19,600
Drag-Disk-	7 days later	134.1	36.3	18,370
Drag	18 days later	144.9	34.7	18,880
	mean	143.4	35.4	18,950
LSD (.05)	for tillage	15.4	1.1	1,263
Coefficient of variation		9.7%	3.2%	6.2%

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EFFECTS OF VARIETY, POPULATION, AND IRRIGATION ON SUNFLOWER YIELDS

Raymond Ward and Robert Sanders
Research Manager and Technical Assistant

Summary

Hybrid sunflower varieties, HS-52 and Cargill 101, yielded 3 to 4 cwt/A more than the open-pollinated varieties, Peredovik and Sputnik. There was no yield response to irrigation. The emergence of seedlings was 50 to 60% of the actual seeding rates. Maximum yields were obtained when the actual population was near 16,000 plants per acre.

Introduction

Sunflowers are a relatively new oilseed crop grown in northern South Dakota. They are noted for their drought tolerance and therefore, appear to be a good row crop in this area. The objectives of this study were: (1) to determine yield of sunflowers under dryland and irrigated conditions; (2) to measure yield differences among varieties; and (3) to obtain yield differences due to population.

Procedure

Sunflowers were planted May 18 on grain sorghum land that was plowed in April and tandem disked and harrowed twice to prepare the seedbed. They were planted in 30" rows. A starter fertilizer of 12 gal of 8-20-6-5-1 ($N+P_2O_5+K_2O+S+Zn$) per acre was applied at planting. The irrigated experiment had an application of 180 lb of actual N/A and the dryland experiment 75 lb of actual N/A as anhydrous ammonia.

Treflan was incorporated to control weeds. The experiments were cultivated once and furrowed. The sunflowers were irrigated July 6, July 24, and August 6 with an application of about three inches of water per application. Sunflowers were hand harvested September 25.

Results and Discussion

Dryland yields and final population of four sunflower varieties are shown in Table 1. Cargill 101 planted at 22,000 seeds per acre produced the highest yield (24.5 cwt per acre). Final population was slightly over 10,000 plants per acre showing that germination and emergence of this variety was slightly less than 50% which was the lowest rate of emergence. Yields of all varieties were very good. Although the yields are inflated because of the hand harvesting they show the high producing capacity of sunflowers with limited rainfall.

The maximum irrigated yield was obtained from the Cargill 101 variety planted at 32,000 seeds per acre (25.8 cwt per acre) (Table 2). Sputnik and Peredovik varieties produced similar yields, but were 3 to 4 cwt per acre less than the two hybrid sunflower varieties. Populations were 50 to 60% of the seeding rate. There was a tendency for the yield to be higher with a higher population but the yield difference was not statistically different.

It is interesting to note that there was very little difference between dryland and irrigated sunflowers yields (Table 3). This shows that sunflowers are capable of obtaining a considerable amount of soil moisture from the subsoils and are able to yield well even when rainfall is below normal, providing the subsoil moisture is high. The population for maximum yield for each variety of sunflowers was estimated by mathematical calculations. The R^2 values listed in Table 4 show the portion of yield explained by population. The two hybrid sunflower varieties showed significance in relating population to yield. Around 16,000 plants per acre produced the highest yields.
(1.5M--3-74--1979)

Table 1. Effect of Planting Population and Variety on Yield and Final Population of Sunflowers Grown on Dryland.

VARIETY	PLANTING RATE seeds/acre	YIELD cwt/acre	POPULATION plants/acre
Romania HS-52	17,000	21.9	11,620
	22,000	22.3	13,940
Cargill 101	17,000	19.9	6,970
	22,000	24.5	10,070
Sputnik	17,000	21.2	10,840
	22,000	23.5	12,390
Peredovik	17,000	17.0	9,290
	22,000	20.0	12,200
LSD (.05)	for population	2.1	1,600
	for variety	2.4	1,850
Coefficient of variation		9.1%	13.8%

(Other tables on back)

Table 2. Effect of Planting Population and Variety on Yield and Final Population of Sunflowers Grown on Irrigated Soil.

VARIETY	PLANTING RATE seeds/acre	YIELD cwt/acre	POPULATION plants/acre
Romania HS-52	22,000	22.7	12,200
	32,000	24.4	16,460
Cargill 101	22,000	24.7	9,290
	32,000	25.8	13,750
Sputnik	22,000	19.9	11,620
	32,000	21.9	17,230
Peredovik	22,000	19.7	12,390
	32,000	20.0	17,230
LSD (.05)	for population	ns	2,110
	for variety	3.3	ns
Coefficent of variation		12.2%	17.7%

Table 3. Effects of Irrigation and Varieties on the Yield and Population of Sunflowers (Oilseed Types).

VARIETY	MANAGEMENT	YIELD cwt/acre	POPULATION plants/acre
Romania HS-52	dryland	22.3	13,940
	irrigation	22.7	12,200
Cargill 101	dryland	24.5	10,070
	irrigation	24.7	9,290
Sputnik	dryland	23.5	12,390
	irrigation	19.9	11,620
Peredovik	dryland	20.0	12,200
	irrigation	19.7	12,390
LSD (.10)		ns	2,050
Coefficient of variation, %		14.0%	17.3%

Table 4. Estimated Maximum Yield and Corresponding Population of Sunflowers Grown at the James Valley Research and Extension Center in 1973.

VARIETY	MAXIMUM YIELD cwt/A	POPULATION plants/A	R^2
Cargill 101	27.1	15,680	.662**
Romania HS-52	24.4	16,262	.484*
Peredovik	20.5	15,100	.348
Sputnik	22.3	19,750	.056

**Significant at .01 level of probability.
*Significant at .10 level of probability.

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SUNFLOWER VARIETY TRIALS--IRRIGATED AND DRYLAND

Harry A. Geise
Instructor, Plant Science Department

Introduction

Objectives are to compare varieties of the various types of sunflowers for adaptation to the Northern James Valley of South Dakota. Evaluation of varieties is based on characters such as: seed yield, seed quality, plant height, damage by birds, disease tolerance and insect susceptibility.

Procedures and Results

The variety trials included both the confectionery and oilseed types in dryland and irrigated tests. They were seeded in replicated single row plots May 9. The dryland rate of seeding was 16,000 plants per acre for oilseed and 9,500 plants per acre for nonoilseed varieties. Irrigated plots were seeded at 25% higher rates. Trifluralin was applied at 3 pints per acre or 3/4 pound of active chemical, and provided excellent weed control. Insects were present in the area but the damage caused was minor. The irrigated test received 8.5 inches of additional water during the growing season. The first 2.5 inches were applied after hilling July 6, 3 inches were applied at early heading on July 24, and 3 inches at the end of pollination on August 6. The plots were hand harvested September 17. Results are in Tables 1 and 2. (1M--3-74--1980)

Table 1. Summary of Sunflower Yield Trial - Redfield, South Dakota - 1973 - Dryland

Cultivar	Seed Yield Lbs/Acre	Seed Yield Lbs/Bu	Heading Date 1st	Heading Date 50%	Maturity* Date	Height Inches	Percent Lodging	Percent Stand
NONOILSEED VARIETIES								
Sundak	1699	25.0	7-21	7-26	6	56	1	66
SD68001	1488	30.2	7-20	7-23	4	59	3	56
Commander	1068	25.0	7-21	7-25	2	57	tr	50
Mingren	1024	22.8	7-20	7-23	2	56	tr	56
Arrowhead	941	29.1	7-16	7-21	1	51	3	41
OILSEED VARIETIES								
Record	2496	30.4	7-24	8- 1	4	68	2	58
Peredovik 66	2190	29.1	7-21	7-27	2	56	0	80
VNIIMK 8931-66	1971	28.1	7-23	7-29	2	63	tr	78
Sputnik	1691	29.9	7-21	7-25	2	62	tr	71
Luch	1246	30.1	7-23	7-29	4	61	tr	76
OILSEED VARIETIES PRODUCED BY GENETIC MALE STERILITY METHODS								
Romsun HS-52	1894	27.5	7-24	7-28	4	58	0	61
OILSEED HYBRIDS PRODUCED BY THE CYTOPLASMIC MALE STERILITY-RESTORER METHOD								
cmsP21VR1 x RHA269	2805	31.0	7-26	7-30	6	71	2	81
cmsHA234 x RHA266	2483	32.5	7-21	7-26	6	69	2	66
(cmsHA89xHA234) x RHA271	2448	33.2	7-22	7-27	5	64	2	85
cmsP21VR1 x RHA266	2442	30.6	7-21	7-21	4	63	tr	64
cmsHA89 x RHA266	2309	30.6	7-24	7-29	6	65	tr	81
cmsHA234 x RHA271	2292	34.5	7-23	7-27	6	62	1	65
cmsHA89 x RHA265	2284	32.1	7-28	8- 4	5	71	0	72
cmsHA89 x RHA271	2106	32.6	7-29	8- 1	4	56	0	68
cmsHA89 x RHA269	2031	32.4	7-28	8- 1	5	67	0	68
cmsHA234 x RHA265	2085	32.4	7-26	7-31	3	73	2	61
cmsHA232 x RHA266	1998	31.5	7-21	7-27	4	63	tr	76
Cargill Hybrid 102	1958	32.0	7-27	7-31	5	72	2	75
cmsHA234 x RHA269	1943	33.4	7-26	7-31	11	76	tr	80
cmsHA232 x RHA265	1898	31.4	7-23	7-29	2	66	0	55
cmsHA99 x RHA266	1893	30.6	7-25	7-29	5	64	0	74
Cargill Hybrid 101	1809	31.4	7-25	8- 1	4	62	1	79
cmsHA99 x RHA271	1801	32.9	7-27	7-31	5	61	1	64
cmsHA99 x RHA265	1790	31.8	7-29	8- 2	4	75	tr	66
cmsHA232 x RHA271	1654	33.5	7-19	7-24	4	54	2	71
cmsP21VR1 x RHA265	1503	29.0	7-21	7-31	3	63	2	65
Cargill Hybrid 111	1404	31.5	7-21	7-31	11	75	1	65

LSD(.05)-877 Lbs/Acre Mean - 1895 C.V. - 33.2%

*Figure indicates number of days before sunflowers would be dry enough for harvest after September 17.

Table 2. Summary of Sunflower Yield Trial - Redfield, South Dakota - 1973 - Irrigated

Cultivar	Seed Yield Lbs/Acre	Seed Yield Lbs/Bu	Heading Date 1st	Heading Date 50%	Height Inches	Percent Lodging	Percent Stand
NONOILSEED VARIETIES							
SD68001	1779	29.0	7-19	7-23	64	2	88
Sundak	1664	24.9	7-23	7-29	61	0	66
Commander	1539	24.2	7-21	7-29	62	3	74
Arrowhead	1481	28.9	7-20	7-23	60	2	62
Mingren	1278	23.9	7-20	7-27	55	2	79
OILSEED VARIETIES							
VNIIMK 8931-66	2133	29.8	7-25	7-31	68	2	86
Sputnik	2026	29.8	7-21	7-31	63	tr	76
Record	1933	32.0	7-29	8- 2	76	2	64
Peredovik 66	1765	29.1	7-26	7-29	71	tr	89
Luch	1338	31.5	7-23	7-29	64	2	90
OILSEED VARIETIES PRODUCED BY GENETIC MALE STERILITY METHODS							
Romsun HS-52	1842	26.9	7-24	7-31	64	0	64
OILSEED HYBRIDS PRODUCED BY THE CYTOPLASMIC MALE STERILITY-RESTORER METHOD							
cmsHA234 x RHA265	2698	34.6	7-28	7-31	79	tr	86
cmsHA99 x RHA265	2664	33.9	7-31	8- 4	80	0	88
cmsHA89 x RHA269	2524	34.0	7-29	8- 2	78	0	90
cmsHA234 x RHA271	2521	35.4	7-21	7-27	64	tr	94
Cargill Hybrid 102	2483	33.6	7-31	8- 2	76	tr	80
cmsP21VR1 x RHA269	2418	32.5	7-28	7-31	72	tr	82
cmsHA232 x RHA266	2315	32.6	7-20	7-25	76	0	84
cmsHA89 x RHA266	2262	32.5	7-25	8- 1	75	1	91
Cargill Hybrid 101	2250	31.6	7-21	7-24	72	0	69
(cmsHA89xHA234) x RHA271	2219	34.6	7-23	7-28	68	tr	67
Cargill Hybrid 111	2198	31.6	7-30	8- 4	88	tr	91
cmsHA234 x RHA269	2150	34.4	7-28	8- 1	82	tr	86
cmsP21VR1 x RHA265	2054	30.6	7-27	8- 2	72	2	79
cmsHA99 x RHA271	2020	35.0	7-28	8- 1	71	0	85
cmsHA232 x RHA265	1986	31.6	7-25	7-29	72	1	69
cmsHA234 x RHA266	1978	33.4	7-24	7-27	74	tr	79
cmsHA232 x RHA271	1874	33.8	7-18	7-22	60	2	86
cmsHA99 x RHA266	1805	31.2	7-24	7-31	73	tr	78
cmsHA89 x RHA265	1804	33.8	8- 1	8- 5	79	1	86
cmsP21VR1 x RHA266	1687	30.5	7-23	7-25	64	3	86
cmsHA89 x RHA271	1589	34.4	7-29	8- 2	66	tr	72

LSD(.05)-540 Lbs/Acre Mean-2009 C.V.-19.3%

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RECLAMATION AND IMPROVEMENT OF SOLODIZED SOLONETZ (ALKALI CLAYPAN) SOILS

L. O. Fine and D. G. Shannon
Professor, Plant Science, and Assistant
in Plant Science Department

Conclusions

Infiltration studies indicate a dense subsoil has not reformed on deep plowed plots.

Salinity levels in drainage waters followed normal patterns as in 1971 and 1972 without excessive salinity being encountered.

Introduction

Research work continued on the alkali claypan soils of the James River Basin at a site 5 miles northwest of the James Valley Research station. Research is aimed at improving these claypan soils by deep plowing, chemical amendment and drainage.

Work was begun in the fall of 1969 on 13 acres of moderately and severely solodized claypan soils. Part of the area was plowed approximately 30 inches deep with a large moldboard type plow. Amendments of gypsum, sulfur and lignite fly ash were later applied and worked into the soil surface. Plots of 60 x 75 ft were set up and irrigation has been done by the basin technique on those plots designated to receive water.

A pump located in a main sump removes water from a drainage system 5 to 5½ feet under the plots. Drainage waters are sampled and analyzed at periodic intervals.

Results: 1973

Alfalfa stands lost to flooding in 1972 were reseeded in April. Surface relief channels along with reduced rainfall in 1973 resulted in no water standing on the plots. Reseeded alfalfa stands were reduced during the summer months due to the dry conditions.

The flexible plastic drainage system functioned satisfactorily again this year. Pumping of drainage water was begun on May 2 with a water table within 1½ to 2 feet of the ground surface and continued until the system was dry on June 21. A total of 16,146 cubic feet (0.34 surface inches for the 13 acres) of water was pumped during this period. The volume of water being pumped per day diminished during the pumping period. As the volume pumped diminished the total salinity increased.

Table 1 gives analyses of water samples taken from the subsurface drains during 1973 and comparable analyses for 1971.

Two irrigations had been planned for those plots which were to receive additional water but due to the low level of the James River only one irrigation was completed during the last week of June.

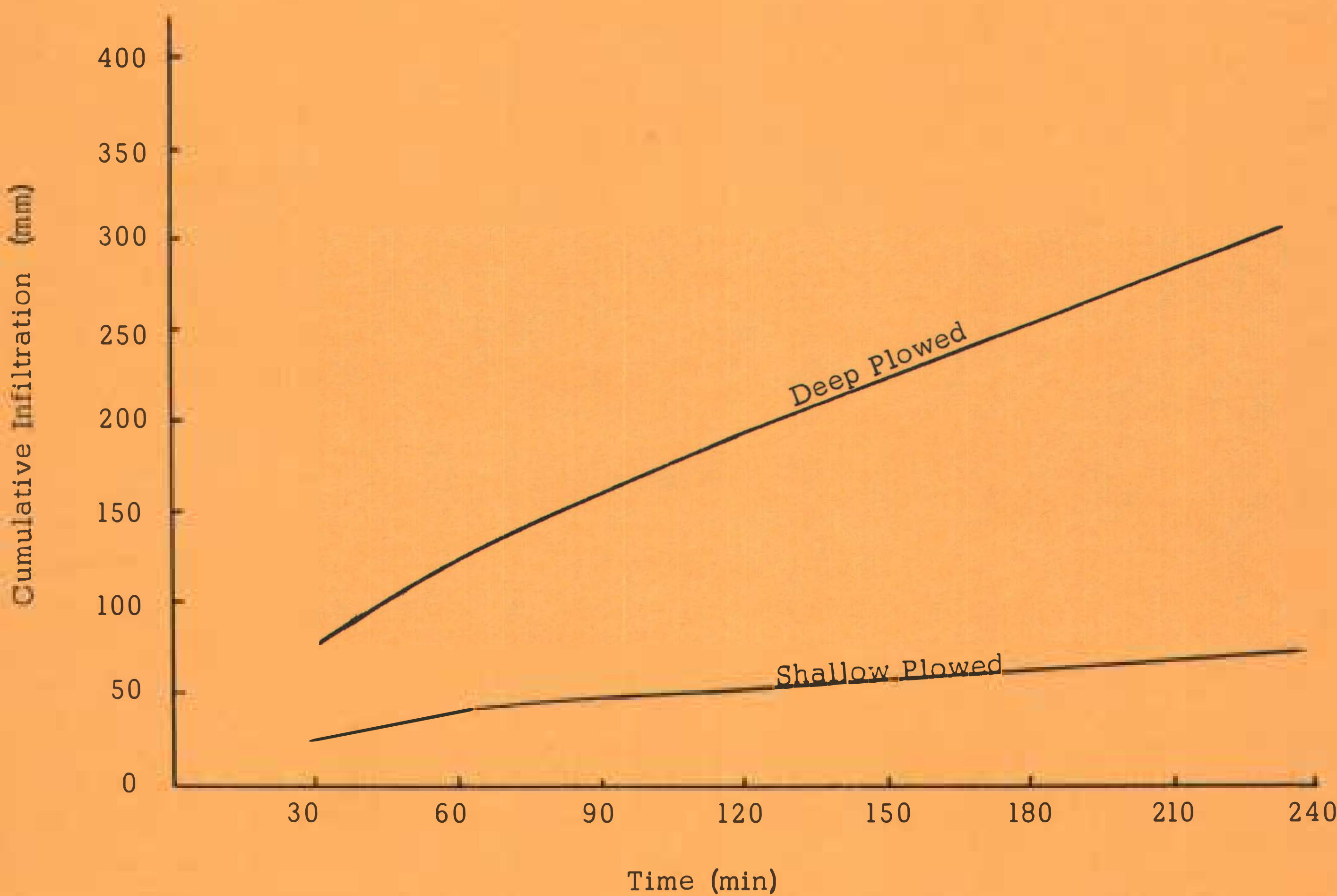
Infiltration tests were conducted in September, 1973, four years after plowing (Figure 1). The deep plowed plots (30 inches deep) had cumulative infiltration of six times that of the shallow or normal field tillage plowing depth. The deep plowed plots were also observed to have much better workability at the time alfalfa reseeding was done. (Red. 1M--3-74--2027)

(Over)

Table 1. Analyses of Drainage Water Samples from 1973 and 1971.

1973 Date	Elect. Cond. E.C. X 10^3	Sodium Adsorbtion Ratio	1971 Date	Elect. Cond. E.C. X 10^3	Sodium Adsorbtion Ratio
4-26	590	1.2	5-5	500	3.4
5-2	565	1.0	5-14	1430	3.6
5-14	970	1.6	5-25	2100	4.0
5-24	1770	2.2	6-2	2475	3.6
5-31	2010	1.4	6-28	2870	3.0
6-12	2724	2.0	7-7	3600	4.2

Figure 1. Water Infiltration: Claypan Experiment Site 4 years after Plowing. Cumulative Infiltration from 8 Plots with 3 MeasurementsPer Plot.



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DEVELOPMENT AND EVALUATION OF IRRIGATION WATER MANAGEMENT PRACTICES FOR OPTIMUM CROP PRODUCTION

Delvin D. Brosz
Research and Extension Irrigation Engineer

Introduction

Irrigation treatments of 1, 2 and 3 inch application depths were applied to corn on a Great Bend silt loam for the second year under a research project sponsored by the Water Resources Institute. The objective of the study is to evaluate the soil moisture extraction pattern and yield of a crop that is irrigated with frequent small applications in relation to less frequent larger applications. After completion of the study guidelines will be established for irrigation water management practices and irrigation system selection.

Procedure

The three application treatments were imposed on each of four replications under a sprinkler irrigation system. Soil moisture measurements in the plots were made with tensiometers located at the 15, 30, 60, 90 and 120 centimeter depths. The application treatments of the irrigation water were planned according to the irrigation scheduling procedure developed for South Dakota by the Water Resources Institute.

Pioneer 3781 was planted May 15 in 30 inch rows on corn ground. Nitrogen fertilizer at 180 lbs N/acre was knifed in May 1. Starter fertilizer (8-20-6-5-1) was applied at 12 gallons per acre. Thimet was banded to control corn rootworms and atrazine was broadcast preemergence to control weeds.

The soil water extraction patterns for the three application treatments will be evaluated after the third year of the project in 1974.

Results and Discussion

The first irrigation on the research plots took place on June 13, 1973 and irrigation ceased after the first week in August. Water could not be applied to the plots after the 10th of August due to the low flow of the James River, which is the water source for the irrigation system. Consequently, the corn crop was under a stress conditon sometime in late August which may have affected yields.

Average corn yield of 129.5, 120.5, and 120.5 bushels per acre were harvested from the one, two, and three inch application treatment plots, respectively. The average harvest population of the plots was approximately 18,000 plants per acre.

(Red. 1M--3-74--2028)

Solid set sprinkler system irrigating the research plots.

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AIR POLLUTION DETECTION IN SOUTH DAKOTA USING SENSITIVE INDICATOR PLANTS

W. S. Gardner and R. C. Ward
Professor, Plant Science Department
and Research Manager

The James Valley Agricultural Research and Extension Center was used as one location in 1973 for sensitive indicator plants for detection of air pollution in South Dakota (Table 1). The ozone-sensitive tobacco plants indicated that ozone air pollution was present at the Center in 1973. The amount of injury was classified as very mild (Figure 1 and Table 1), and was comparable to the level of injury found at Highmore, Pierre, and Bemis. These locations had the least amount of injury in South Dakota in 1973. The injury, in the form of dead spots on leaves of Bel-W3 tobacco leaves, was present at all of 17 locations in South Dakota where indicators were planted. There was no indication of sulphur dioxide, fluoride, or perocyacetyl nitrate (PAN) pollution at any location. (Red. 1M--3-74--2029)

Figure 1. White dead spots on a leaf of Bel-W3 tobacco that was grown at the James Valley Agricultural Research and Extension Center in 1973. The spots are typical of ozone injury symptoms on this very sensitive plant. The large holes near the base of the leaf also indicate hail injury.

Table 1. Indicator Plants Used to Identify Plant-injurious Air Pollutants in South Dakota - 1973. James Valley Agricultural Research and Extension Center.

Indicator	Cultivar	Known Reaction	Pollutant	Injury Response	Injury Severity
Tobacco	Bel-B	Resistant	Ozone	Negative	
Tobacco	Bel-C	Moderately sensitive	Ozone	Negative	
Tobacco	Turkish	Moderately sensitive	Ozone	Negative	
Tobacco	Bel-W3	Very sensitive	Ozone	Positive	Very mild
Tobacco	Glutinosa	Sensitive	PAN*	Negative	
Petunia	Fiesta	Very sensitive	PAN*	Negative	
Gladiolus	Snow Princess	Very sensitive	Fluoride	Negative	

*Peroxyacetyl nitrate - a photochemical air pollutant.

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INCREASING WATER USE EFFICIENCY OF SMOOTH BROMEGRASS THROUGH PLANT SELECTION

James G. Ross
Professor, Plant Science Department

Introduction

The objective of this work is to obtain, through plant selection, a variety of smooth bromegrass which will continue to produce forage during the summer, and remain in mixture with alfalfa under an intensive harvesting program designed to maximize alfalfa yields.

Procedure

Bromegrass was seeded one seed to a hill, 40 inches each way in the fall of 1969 on 6 acres of irrigated land. The next spring alfalfa was over-seeded and in subsequent seasons harvested to give maximum yield. In 1973 harvests were made on May 30, June 29, August 10 and October 9. Total yield of alfalfa for the season was 5.25 tons.

Results and Discussion

Outstanding plants have been marked before each cutting in each year. The identity of outstanding plants has in this fashion been maintained. On May 3, 1973, the plants which had consistently given good regrowth the previous year were marked with a wooden permanent stake. Small plastic stakes were used to mark the outstanding plants before each harvest during 1973. A similar technique will be followed in 1974. The plants which have consistently given good regrowth eventually will be removed from the field, tested for desirable agronomic characteristics such as seed set, disease and forage quality and the best of these placed in a synthetic for testing.

In addition to this nursery another nursery was established in August from outstanding plants in the Brookings nursery. These will be overseeded with alfalfa in the spring of 1974 and subjected to the same harvesting regime as the other overseeded nursery.

(Red. 1M--3-74--2030)

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SEED PRODUCTION OF KENTUCKY BLUEGRASS VARIETIES UNDER IRRIGATION

James G. Ross
Professor, Plant Science Department

Introduction

The objective of this experiment was to investigate the seed yield potential of lawn grass varieties of Kentucky bluegrass under irrigation.

Procedure

On August 22, 1972, a 4 replicate test of 7 varieties of Kentucky bluegrass was established (Table 1). Each plot consisted of 4 rows, 1' apart and 46' long. In April, 60 lbs. of nitrogen in the form of ammonium nitrate was applied.

Results and Discussion

Head production, however, was very low probably because the plants were seedlings. The yields of seed varied from 10.5 lbs per acre for P-141 to 44 lbs per acre for Park. Yields from these varieties were low but since this was the establishment year such low yields might be expected. (Red. 1M--3-74--2031)

Table 1. 1973 Seed Yields of Lawngrass Varieties of Kentucky Bluegrass Planted on August 22, 1972, Under Irrigation.

Variety	Seed Yields, lbs/acre
S. Dak. Certified	29.8
Park	44.0
P-59	19.6
P-141	10.5
P-143	19.4
P-162	22.1
P-170	38.1

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WHOLE OR GROUND OATS WITH ALFALFA HAY AND ZINC BACITRACIN FOR GROWING CALVES

L. B. Embry
Professor, Animal Science Department

Summary

One hundred twenty steers were fed 5 lb. of oats along with 1 lb. of pelleted supplement (largely oats) and a full feed of chopped alfalfa hay. Rate of gain was about the same for steers fed whole oats as for those fed the oats when ground. Grinding the oats did not appear to affect feed intake and thus feed efficiency. Rate of gain with the ration was 1.4 lb. daily and represents a satisfactory rate for growing calves for herd replacements or later feedlot finishing.

Zinc bacitracin at 70, 140 or 280 mg per head daily did not improve feed intake or rate of gain. A few losses occurred during the experiment and were not reduced by the bacitracin treatments.

Introduction

Alfalfa hay with a limited feed of grain is a common diet in growing calves for herd replacements or later feedlot finishing. Feeding could be simplified and costs reduced by feeding the grain in the whole form. Studies with corn have indicated an improvement in weight gain and feed efficiency from processing the grain for finishing cattle where the roughage level exceeds about 20% of the diet. There seems to be less effects from processing grain for calves during the first few months following weaning than for older feedlot cattle. Other common feed grains--sorghum, wheat, barley and oats--appear to be benefited more from various methods of processing than does corn.

Oats are a common grain in diets for growing calves. Bloat is sometimes a problem when oats are fed with alfalfa hay. It is possible that an antibiotic acting primarily within the digestive tract might result in a more favorable environment for microbial digestion and thus reduce the problems from bloat and other digestive disorders sometimes encountered with diets of alfalfa hay and oats.

The experiment was designed to compare whole and ground oats fed with alfalfa hay and with zinc bacitracin at various levels.

Procedures

One hundred twenty steer calves were purchased for the experiment. They were allotted into 8 pens of 15 each on basis of weight. The antibiotic treatments were 0, 70, 140 and 280 mg per head daily. Each of the four levels of zinc bacitracin was fed with whole oats and with ground oats. Diets consisted of 5 lb. oats, 1 lb. supplement and a full feed of chopped alfalfa hay.

The control supplement was composed of the following ingredients (%): ground oats, 88.85; trace mineral salt, 6.0; cane molasses, 5.0 and vitamin A premix (20,000 IU/lb. suppl.), 0.15. Zinc bacitracin (Baciferm-40) was added to provide the treatment levels of bacitracin and replaced an equal weight of the ground oats. All supplements were pelleted.

The alfalfa hay was field chopped at around 30% moisture, stacked in 12- to 15-ton stacks and dried by use of ducts and a fan with unheated air. Average protein content on a moisture-free basis was about 17.5%. The oats contained about 15% protein on a moisture-free basis. A hammer mill was used to grind the oats fed to this treatment group. They were ground to a degree of fineness so there were no whole oats remaining (medium fineness).

The cattle were fed in outside, unpaved pens without access to shelter. Feeding was once daily with the hay being offered in about equal amounts to all pens of cattle.

Results

Whole vs. Ground Oats: Results for the comparison between whole and ground oats averaged for zinc bacitracin treatments are shown in Table 1. The experiment was started in December and the cattle were fed for 203 days. Initial and final weights represent an overnight stand without feed and water.

Rate of gain was essentially the same for steers fed whole or rolled oats at 5 lb. per head daily with the 1 lb. of supplement and a full feed of chopped alfalfa hay. It would therefore appear there was no advantage for grinding the oats when fed at this level with the alfalfa hay. The hay was fed at approximately the same rate to both groups of cattle. It was offered slightly in excess of consumption but there was no noticeable difference in hay consumed between the two groups.

The rates of gain obtained (1.44 and 1.43 lb. daily) represents rather typical ones for the rations fed and satisfactory for growing cattle for later feedlot finishing.

Zinc Bacitracin: Results obtained from the various levels of zinc bacitracin averaged for whole and ground oats are presented in Table 2. Differences in rate of gain between the various treatment levels were small and indicate no advantage for the antibiotic in this experiment. While hay offered was about the same but with a slight surplus for each pen of cattle, there was no noticeable differences in hay consumption between bacitracin treatment levels.

Some death losses occurred or cattle were removed as indicated by the numbers finishing the experiment. However, no problems were encountered from bloat and losses did not appear to be reduced by the bacitracin treatments. (Red. 1M--3-74--2032)

(See back for Tables)

Table 1. Whole or Ground Oats with Alfalfa Hay for Growing Calves (Dec. 19, 1972 to July 10, 1973 - 203 days)

	Whole Oats	Ground Oats
No. animals	57	56
Avg. initial wt., lb.	424	418
Avg. final wt., lb.	716	707
Avg. daily gain, lb.	1.44	1.42
Avg. daily feed, lb.		
Chopped alfalfa hay	15.7	15.6
Oats	5.0	5.0
Suppl.	1.0	1.0
Total	21.7	21.6
Feed/100 lb. gain, lb.		
Chopped alfalfa hay	1090	1099
Oats	347	352
Suppl.	69	70
Total	1506	1521

Table 2. Zinc Bacitracin with Alfalfa Hay and Limited Amount of Oats for Growing Calves (Dec. 19, 1972 to July 10, 1973 - 203 days)

	Levels of Zinc Bacitracin, mg/head			
	0	70	140	280
No. animals	29	30	27	27
Avg. initial wt., lb.	423	420	419	421
Avg. final wt., lb.	719	703	706	717
Avg. daily gain, lb.	1.46	1.39	1.41	1.46
Avg. daily feed, lb.				
Chopped alfalfa hay	15.7	15.6	15.6	15.8
Oats	5.0	5.0	5.0	5.0
Suppl.	1.0	1.0	1.0	1.0
Total	21.6	21.6	21.6	21.8
Feed/100 lb. gain, lb.				
Chopped alfalfa hay	1075	1122	1106	1082
Oats	342	360	355	342
Suppl.	68	72	71	68
Total	1485	1554	1532	1492

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ZINC RATE EXPERIMENT

Raymond Ward and Robert Sanders,
Research Manager and Technical Assistant,
James Valley Agricultural Research and Extension Center

Introduction

Zinc deficiency often occurs in plants grown on irrigated lands that have been leveled for irrigation and on soils high in phosphorus. Zinc deficiency symptoms in corn were observed under these field conditions during 1972. The objective was to determine the need for zinc on this soil.

Procedure

The land was in corn the previous year (1972). Zinc fertilizer was broadcast May 21, 1973 as zinc sulfate. The plot area was plowed May 21 and harrowed twice. Jacques JX 62 was planted May 22 in 30 inch rows. Lasso was broadcast and the plot was cultivated twice and furrowed for irrigation. This experiment was irrigated July 16 and August 3. Between two and three inches of water were applied at each application. Yield samples were harvested October 15.

Results and Discussion

The yield and moisture content of the corn are shown in Table 1. There was no significant yield increase from the application of zinc fertilizer. However, there was a tendency for the 10 pound and 20 pound rates of zinc to yield more corn than the check plot. There is no difference in the moisture content of the corn due to the zinc treatments. The carryover of this zinc fertilizer will be measured in future years.
(Red. 1M--3-74--2033)

Table 1. Influence of Added Zinc on Yield and Moisture Content of Irrigated Corn.

ZINC RATE pounds Zn/A	YIELD Bu/A	MOISTURE %
0	106.4	26.7
5	106.4	25.9
10	111.1	27.9
20	116.1	25.8
LSD .05	ns	ns
Coefficient of variation	10.7%	4.8%

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RESPONSE OF WHEAT TO IRRIGATION

Raymond Ward and Robert Sanders,
Research Manager and Technical Assistant,
James Valley Agricultural Research and Extension Center

Summary

Irrigated Bounty 208 yielded 12 bu per acre more than dryland Bounty 208. World Seeds 1809 and Chris produced a 7 bu per acre response to irrigation. Semi-dwarf yields were 8 to 12 bu more than Chris. More work needs to be done to select varieties of wheat for irrigation and to determine when to apply water to produce maximum yields of wheat under irrigation.

Introduction

The objective was to compare the yields of three varieties of spring wheat grown under dryland and irrigated conditions. Profitable irrigation of small grains could extend the irrigation season, maximize equipment use, and minimize fixed costs.

Procedure

Three hard red spring wheat varieties were seeded at 60 pounds per acre on dryland and 60 and 100 pounds per acre on irrigated land. Wheat was seeded April 13. Eight gallons of 10-34-0 liquid fertilizer was applied with the seed. Nitrate-nitrogen exceeded 200 pounds actual N in 2 feet of soil.

The 1972 oat stubble was noble-bladed in August and then tandem disked and harrowed prior to seeding. Wheat was sprayed with 2,4-D amine May 25. It was irrigated May 12, June 8, and June 18 with approximately 1, 2, and 2 inches of water, respectively. Harvesting was completed July 30.

Results and Discussion

World Seeds 1809 and Bounty 208 produced 36 bu per acre on dryland which was considered to be very good for the amount of rainfall received during the growing season (Table 1). Chris wheat produced 8 bushels less than the two semi-dwarf varieties. Test weight was similar for all varieties. Protein was highest in Chris wheat.

Irrigated Bounty 208 planted at 100 lbs seed per acre was significantly higher yielding than World Seeds 1809 or Chris (Table 2). Chris yields were much lower than the two semi-dwarf wheats. There was no significant difference between the two seeding rates. Test weights were 1-2 pounds per bu less when the wheat was seeded at the 100 lb rate. Seeding rate did not influence wheat protein. Protein was highest in Chris.

Irrigated Bounty 208 yielded 12 bu per acre more than dryland Bounty 208 (Table 3). World Seeds 1809 and Chris produced approximately 7 bu more wheat under irrigated conditions than dryland conditions. It appears variety potential is different under irrigated conditions than under dryland conditions. For example, Bounty 208 and World Seeds 1809 produced the same yield under dryland, while irrigated Bounty 208 out yielded World Seeds 1809 by 5 bu per acre. Test weight was higher when wheat was irrigated. Protein decreased slightly under irrigated conditions.
(Red. 1M--3-74--2034)

Table 1. Yield, Test Weight, and Protein of Three Hard Red Spring Wheat Varieties Grown on Dryland.

VARIETY	YIELD* Bu/A	TEST WT. Lb/bu.	PROTEIN %
Bounty 208	35.6 a	58	15.9
World Seeds 1809	36.1 a	58	15.7
Chris	28.0 b	59	17.1

*When values are followed by the same letter they are not significantly different (Duncan's new multiple range test at .05 level).

(Over for Tables 2 and 3)

Table 2. Influence of Seeding Rate and Variety on Yield, Test Weight, and Protein of Hard Red Spring Wheat Grown on Irrigated Land.

	SEEDING RATE, LBS/ACRE					
	60	100	60	100	60	100
VARIETY	Yield, bu/A*		Test wt, lb/bu		Protein, %	
Bounty 208	47.8ab	49.9a	60	59	14.7	15.0
World Seeds 1809	42.8b	42.3b	59	57	14.9	15.0
Chris	34.5c	30.9c	62	61	16.6	16.0

*When values are followed by the same letter they are not significantly different (Duncan's new multiple range test at .05 level).

Table 3. Yield and Test Weight Comparisons of Three Hard Red Spring Wheat Varieties on Dryland and Irrigated Fields.

	IRRIGATED			DRYLAND		
VARIETY	Yield,*	Test Wt.	Protein	Yield,*	Test Wt.	Protein
Bounty 208	47.8a	60	14.7	35.6c	58	15.9
World Seeds 1809	42.8b	59	14.9	36.1c	59	15.7
Chris	34.5c	62	16.6	28.0d	58	17.1

*When values are followed by the same letter they are not significantly different (Duncan's new multiple range test at .05 level).

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COMPARISON OF OAT AND BARLEY VARIETIES UNDER IRRIGATED AND DRYLAND CONDITIONS

Raymond C. Ward and Robert A. Sanders,
Research Manager and Technical Assistant,
James Valley Agricultural Research and Extension Center

Summary

Irrigated barley yields were 9-33 bu per acre greater than dryland. Primus II produced 82 bu per acre when irrigated. Response of oats to irrigation varied from 7 to 40 bushels. Chief and Froker yielded 97 bu per acre when irrigated. The data showed that the best variety on dryland may not be the best when irrigated.

Introduction

The need for comparing small grain yields grown under irrigated and dryland conditions is desirable. If small grains can be irrigated economically it would enable an irrigator to use his irrigation system over more land to reduce his fixed costs per acre. The objective of this demonstration was to determine the yields of several varieties of oats and barley under dryland and irrigated conditions.

Procedure

The land was oat stubble which had been noble bladed in August, 1972. Prior to seeding the land was tandem disked and harrowed. All grains were planted at 60 pounds per acre April 13. Fertilizer treatment was 8 gallons of 10-34-0 (oxide basis) applied with the seed at seeding time. Soil tests were very high in potassium and phosphorus and nitrate-nitrogen totaled over 200 pounds of actual nitrogen in 2 feet of soil. The irrigated strips were irrigated May 12 with about 1 inch of water and June 8 and 18 with about 2 inches of water per application.

Results and Discussion

The yield, test weight, and protein content of the oat and barley varieties are shown in Table 1. The irrigated crops always yielded more than the dryland crops. Primus II barley yielded 82 bu/acre under irrigated conditions and 60 bu/acre under dryland conditions. The response of Larker to irrigation was not as great. Beacon barley did not yield as well under dryland conditions (15 bu/acre less than Primus II); but the yield under irrigated conditions was similar to Primus II, indicating that Beacon barley needs more moisture to produce high yields. Test weight was similar for the three varieties under irrigated conditions, and was lower under dryland conditions. Protein level appears to be slightly less under irrigated conditions.

Oat varieties yielded very well under dryland conditions considering the type of moisture received during the 1973 growing season. There is a considerable difference in the response of the oats to irrigation. Burnett and Kelsey varieties gave a very small increase to irrigation but Chief and Froker produced about 40 bu more per acre when irrigated. However, Chief and Froker yields were considerably less under dryland conditions.

These results point out the need for evaluating varieties of oats and barley under irrigated conditions. Yield potential under irrigated conditions appears to be different than under dryland conditions.

(Red. 1M--3-74--2035)

Table 1. Yield, Test Weight, and Protein Content of Oat and Barley Varieties Grown Under Dryland and Irrigated Conditions.

		IRRIGATED			DRYLAND		
CROP	VARIETY	Yield bu/A	Test Wt. lb/bu	Protein %	Yield bu/A	Test Wt. lb/bu	Protein %
Barley	Primus II	82	46	12.8	60	45	12.3
	Larker	70	45	13.4	61	40	14.7
	Beacon	78	44	13.1	45	40	14.5
Oats	Burnett	89	35	15.3	80	36	14.9
	Chief	97	36	15.7	57	35	15.7
	Froker	97	36	15.1	61	35	15.2
	Kelsey	83	35	12.6	77	35	12.3

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ALFALFA MANAGEMENT

Raymond Ward and Robert Sanders,
Research Manager and Technical Assistant,
James Valley Agricultural Research and Extension Center

Summary

These data show that it is possible to obtain a 3.5 to 4 tons per acre of alfalfa in the seeding year by using a herbicide with intention of harvesting two or three cuttings of alfalfa.

Introduction

Planting alfalfa with a nurse crop limits the production of forage the first year to that of the nurse crop. By using a herbicide to control weeds in new alfalfa seedings perhaps a highly profitable alfalfa crop could be obtained the first year.

Procedure

Alfalfa was planted May 5 in oat stubble that had been noble bladed in August, 1972. Prior to seeding, the land was tandem disked twice. Balan was sprayed at 1.25 lb active ingredient per acre. The field was tandem disked immediately after spraying and harrowed to pack the seedbed. Alfalfa was planted with a grass seeder attachment on the grain drill. Approximately 12 lbs of seed was planted per acre. About 6 inches irrigation water was supplied. No fertilizer was applied. Soil tests were high for phosphorus and potassium. Yield samples were taken after mowing with a sickle mower. Yields were converted to tons of 12% moisture hay per acre. Alfalfa was cut July 18 and September 6.

Results and Discussion

Yields of the three varieties of alfalfa are shown in Table 1. There was no significant difference among the three varieties for the first cutting. For the second cutting Iroquois alfalfa was the highest yielding of the three varieties and Vernal was the lowest yielding. The total hay produced in the seeding year was 3.82 tons per acre of Iroquois and 3.36 tons per acre for Vernal. There was no significant difference in total production between the three varieties.

Iroquois and Saranac alfalfa varieties have been selected because of their regrowth characteristics. After both cuttings Iroquois and Saranac alfalfa were observed to grow back at more rapid rates. This regrowth could be observed for about three weeks after cutting.

Next year these alfalfa varieties will be cut at three different growth stages. This will give an idea of the actual value of the rapid regrowth characteristics of Iroquois and Saranac varieties.
(Red. 1M--3-74-2036)

Table 1. Yield of Three Varieties of Alfalfa in the Seeding Year.

VARIETY	CUTTING First	Second	Total
	Yield, tons per acre		
Vernal	1.73	1.63	3.36
Iroquois	1.68	2.14	3.82
Saranac	1.71	1.88	3.59
LSD (.05)	0.19	0.19	ns

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VEGETABLE RESEARCH

Paul Prashar
Associate Professor,
Horticulture-Forestry Department

Pea Beans

We are always looking for new crops which can increase the income of our farmers. Pea beans are the beans which are generally used in making pork and beans. Pea beans are planted and grown similar to soybeans, but are harvested by special swathers and combines. Cultural requirements, fertilizer, and other operations are also very similar to soybeans. Pea beans do have one advantage over soybeans that the crop is generally harvested at about 18% moisture or about the time of first frost. This means the crop is finished before the farmers get busy with corn and soybean harvest.

At present most of the pea beans are grown in Michigan. The Campbell Soup Company, which is one of the big users of pea beans, is interested in expanding the area of pea beans in South Dakota. At harvest time the price of pea beans is 25-30¢ per pound to the grower. The data at James Valley Agricultural Research and Extension Center show that a farmer can make about $300 per acre from pea beans.

Last summer the department of Horticulture and Forestry conducted variety trial test at Redfield. The data indicate that beans can be successfully grown in this area. The results indicate that a grower can expect 1200-1400 lbs. of pea beans on dry land during the average growing season. The yields are greater under irrigation. The Campbell Soup Company is interested in having large acreages of pea beans in this area. As soon as the company can get enough growers to grow pea beans they will locate a buying plant in the area. At present the buying plant is located in Olivia, Minnesota.

Fourteen varieties of pea beans were planted on May 23, 1973. The middle two rows of four rows were harvested for yield purposes. The beans were harvested on September 4, 1973. The yield data are listed in Table 1. All of the varieties grown were not suitable for South Dakota because some of these are too late for our growing conditions. Variety Atlas, Bonus, Chief, Capital, and SVC 1036 are too late for South Dakota. After harvest many plants were green and were dried in greenhouse before threshing. There is no serious pest of pea beans which cannot be easily controlled during the growing season with proper cultural practices. None of the varieties was sprayed for any disease or insect control during the growing season.

Potatoes

For the past five years Kennebec and Red Pontiac potatoes were planted at James Valley Agricultural Research and Extension Center. Every year certified seed from Minnesota, North Dakota, and South Dakota were planted in replications of each variety. The data indicate that there is significant difference in the yield of potatoes from various seed sources. South Dakota certified seed was lower in yield (Red Pontiac 10-18% lower, and Kennebec 11-26% lower) as compared to the certified seed from North Dakota and Minnesota. There was no significant difference in yield from the seed from Minnesota and North Dakota. The experiments indicate that the yield of both of these varieties can significantly be increased if good certified seed is used. It also indicates that South Dakota certified seed is not as good as from Minnesota and North Dakota. No attempt was made to determine whether the quality of the seed was poor when it was harvested or the quality deteriorated during the storage conditions. In every case the seed was bought in April from commercial sources. The yield of potatoes in South Dakota is about half of the national average yield. Part of this may be contributed to poor quality of certified seed used in the state. Potatoes were planted in spring plowed grain sorghum land April 27, 1973. About 500 lbs of 11-16-16 fertilizer was applied per acre and disced in before planting. Nitrogen was sidedressed at 100 lbs actual N per acre. Potato rows were 36 inches wide and planting distance was 8 inches between seed pieces. Water was applied May 9, June 14, June 28, July 23, August 1, and August 10. Two to three inches of water were applied each time. They were harvested September 11.

Yields are shown in Table 2. Yields were lower this year than in some previous years. Red Pontiac was the highest yielding at 317 cwt/acre. Superior, an early variety, produced 153 cwt/acre.

Squash

Acorn squash, representative of the vine crops, was planted on dry land on May 25 and harvested on September 24, 1973. The rows were 6 feet apart and the hills 3 feet apart within a row. Three seeds per hill were planted. The yield of the marketable fruit was 4.4 tons per acre and the average weight per fruit was 1.5 pounds. The crop was sprayed twice for cucumber beetles during the growing season. The wholesale price of acorn squash was 10¢ per fruit at the time of harvest. The crop is worth over $600 per acre. (Red. 1M--3-74--2037)

(Turn page for Tables 1 and 2)

Table 1. Dry Beans Variety Trial (under dry land), Redfield, South Dakota.

Entry Name	Yield/acre lbs.
Sanilac	1356.2
Seafarer	1256.1
Gratiot	1492.3
Aurora	1308.9
Atlas	1401.8
Bonus	1618.8
Chief	1704.4
Capital	1242.5
W-5 (6R-395)	1532.3
W-6 (6R-320)	1156.0
W-10 (W-26)	1633.2
W-15 (W-34)	1750.9
W-25 (6R-295)	1411.4
SVC 1036	983.9

Table 2. Yield of Irrigated Potatoes.

Name of variety	Yield 100 lbs/acre
Red Pontiac	317
Abanaki	228
Kennebec	180
Norchip	173
Superior	153

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FIELD EVALUATION OF SOIL HYDRAULIC CONDUCTIVITY

Darrell W. DeBoer and David E. Kramer
Associate Professor and Graduate Assistant,
Agricultural Engineering Department

Introduction

Point measurements of soil hydraulic conductivity are often used as a basis for the design of subsurface drainage systems. The Bureau of Reclamation has been conducting subsurface drainage investigations, including the point measurement of soil hydraulic conductivity, within the Oahe Unit project area. Most of the soils under current dryland farming practices do not have the high water tables which often occur under irrigated conditions. Therefore, the Bureau has been using a field method called the "pump-in" method which can be used to estimate saturated hydraulic conductivities under low water table conditions.

There is another point measurement method which can be used to estimate saturated hydraulic conductivities under high water conditions called the "auger hole" method. This method is normally the preferred point measurement method because the soil condition at the time of measurement is similar to the soil condition when the drain lines are in operation. Drain line discharges give a measure of the average hydraulic conductivity along the line in contrast to the point measurements. Point measurements are normally used because of the cost of the measurement.

The primary objective of the 1973 field experiment was to compare the pump-in, auger hole and drain line hydraulic conductivities within field 5B immediately north of the farmstead.

Procedure

Point hydraulic conductivity measurements within the plot were made by the auger hole and pump-in methods. Each method was used to measure the conductivity at 18 random locations within the experimental area. The pump-in tests were run at two depths, from 4 to 6 feet, and from 8 to 10 feet. The auger hole tests were run from 3 to 6 feet and from 7 to 10 feet. These depths were chosen because of the change in the soil profile at the 7 foot depth. Bureau of Reclamation personnel and equipment assisted in the data collection.

The drain line hydraulic conductivities were evaluated from a falling water table drainage equation, measured drain line discharges and water table evaluations.

Results

Table 1 summarizes the results of the auger hole and pump-in tests. This table shows that the average pump-in values are consistently lower than the average auger hole values and that the ratio of the two is approximately 0.50. It should be noted that the values from the east side of the plot are greater than the west values. The auger hole tests on the east side at the 7 to 10 foot depth were not completed because saturated soil conditions could not be maintained.

The data were statistically analyzed by an analysis of variance as summarized in Table 2. Two of the sources of variation had statistically significant "F" values. These sources were the method of measurement and the zone of measurement in the soil profile. This means there is a difference between the results of the pump-in and the auger hole methods and between the results of the 3 to 7 foot and the 7 to 10 foot regions of the soil profile. The analysis indicates that no significant difference exists between the soils found in the east and west side of the experimental area. No interaction factors were significant in the analysis.

Table 3 shows a comparison among the average auger hole, pump-in and drain line hydraulic conductivity values. The auger hole value is about 2.7 times as large as the drain line value and the pump-in value is about 1.4 times as large as the drain line value. The pump-in value is the average of 36 tests while the auger hole value is the average of 23 values. The drain line value is the average of data collected during a six year period. (Red. 1M--3-74--2038).

Table 1. Average Hydraulic Conductivities (ft/day) by the Auger Hole and Pump-in Methods for the East and West Sides of the Experimental Area

Depth	Side	Pump-in	Auger hole	Ratio
3-7	East	1.18	2.06	0.57
3-7	West	0.70	1.78	0.39
3-7	Ave.	0.94	1.92	0.49
7-10	East	1.90		
7-10	West	1.68	3.36[a]	0.50
7-10	Ave.	1.79		

[a]Average of five measurements, all the other values are averages of nine measurements.

(Turn page for Tables 2 and 3)

Table 2. Analysis of Variance for the Pump-in and Auger Hole Method Hydraulic Conductivity Results

Source	D.F.	Sum of Squares	Mean Squares	F
Method	1	269.86	269.86	7.41**
Side	1	2.70	2.70	0.07
Depth	1	147.64	147.64	4.06*
Method x side	1	2.76	2.76	0.08
Method x depth	1	67.83	67.83	1.86
Side x depth	1	11.75	11.75	0.32
Error	52	1893.07	36.41	
Total	58			

**Significant at .01 level.
*Significant at .05 level.

Table 3. Average Hydraulic Conductivities (ft/day) for the Pump-in Auger Hole, and Drain Line Methods

Depth	Pump-In	Auger Hole	Drain Line
3-10	1.38	2.64	0.96

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PERFORMANCE OF HERBICIDES IN CORN AND SOYBEANS

W. E. Arnold, L. J. Wrage and W. B. O'Neal
Assistant Professor, Plant Science, Extension
Agronomist-Weeds, and Assistant, Plant Science

Introduction

Herbicide screening experiments are conducted at the James Valley Agricultural Research and Extension Station at Redfield to give area farmers a chance to compare the performance of several herbicides which may be used in their area. The performance of herbicides used on corn and soybeans this year as compared to previous years is presented in Tables 1 and 2.

Procedure

Chippewa 64 soybeans were planted in 30-inch rows May 31. Preplant incorporated treatments were applied on May 31 and incorporated with a tandem disking followed by dragging. Preemergence applications were made May 31.

Pioneer 3781 seed corn was planted in 30-inch rows May 15. Preplant incorporated treatments were applied May 15 and incorporated with a tandem disking followed by dragging. Preemergence treatments were applied May 15. Postemergence treatments were applied May 29.

All herbicide treatments were applied in a 20 gpa water spray at 40 psi. The planting and spraying information for previous years are reported in the James Valley Agricultural Research and Extension Station Progress Report for the year in question.

Results and Discussion

No rainfall was received for 8 days after corn planting; therefore, 2 inches of irrigation water was applied. An additional 2 inches of moisture was received that night in the form of rain.

Several new herbicide combinations were labelled for use this past year. Area farmers will be especially interested in comparing the performance of these with the older standard treatments. (Red. 1M--3-74--2039).

Table 1. Corn Herbicide Demonstrations

Treatment	Rate lb/A	% Weed Control July 20, 1973 Grass	Broadleaf	4-Yr. Avg. Grass	Broadleaf
PREPLANT INCORPORATED					
atrazine (AAtrex)	2.5	90	99	95	99
butylate (Sutan)	4	75	90	84	45
butylate + atrazine (Sutan + AAtrex)	3+1	80	95	90	88
PREEMERGENCE					
atrazine (AAtrex)	2.5	80	85	72	90
alachlor (Lasso)	2.5	80	80	88	40
propachlor (Ramrod)	5	85	75	92	38
cyanazine (Bladex)	2.5	60	60	77	30
alachlor + atrazine (Lasso + AAtrex)	2+1	75	80	86	70
alachlor + cyanazine (Lasso + Bladex)	2+1.5	60	80	—	—
alachlor + linuron (Lasso + Lorox)	2+1	65	80	—	—
cyanazine + atrazine (Bladex + AAtrex)	1.5+1.5	85	80	—	—
propachlor + linuron (Ramrod + Lorox)	3+1	70	70	82	60
propachlor + atrazine (Ramrod + AAtrex)	3+1	80	80	88	70
POST-EMERGENCE					
atrazine + oil (AAtrex)	1+1	65	99	68	92
cyprazine (Outfox)	3/4	65	99	—	—
Check	0	0	0	0	0

Table 2. Soybean Herbicide Demonstrations

Treatment	Rate lb/A	Crop Injury	% Weed Control June 19, 1973 Grass	Broadleaf	4-Yr. Avg. Grass	Broadleaf
PREPLANT INCORPORATED						
trifluralin (Treflan)	3/4	0	80	50	89	80
vernolate (Vernam)	2.5	2	75	75	84	78
Dinitramine (Cobex)	.5	0	80	70	—	—
PREPLANT INCORPORATED & PREEMERGENCE						
trifluralin & metribuzin (Treflan & Sencor, Lexone)	3/4+3/8	0	85	80	—	—
trifluralin & linuron (Treflan & Lorox)	3/4+1	0	75	70	—	—
PREEMERGENCE						
chloramben (Amiben)	3	0	85	85	84	87
alachlor (Lasso)	2.5	0	70	65	85	83
alachlor + linuron (Lasso + Lorox)	2+1	0	60	60	85	84
alachlor + metribuzin (Lasso + Sencor, Lexone)	2+3/8	0	80	60	—	—
metribuzin (Sencor, Lexone)	.5	0	60	65	—	—
alachlor + chlorbromuron (Lasso + Maloran, Bromex)	2+1.5	0	50	10	—	—
chloroxuron (Preforan, Soyex)	4	0	70	20	83	72
Check	0	0	0	0	0	0

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ARBOVIRUS SURVEILLANCE

REDFIELD AREA, SOUTH DAKOTA

G. C. Parikh and Curtis D. Wilson
Professor and Graduate Assistant, Microbiology

Introduction

Studies were initiated at Redfield to determine the effect that full-scale irrigation might have upon mosquito populations and related health problems. Since the Oahe project is in developmental stages, the present study was undertaken to determine the arbovirus (virus transmitted by mosquito vector) activity present before irrigation.

Arbovirus activity in the Redfield area in 1972 was investigated by virus isolation from trapped mosquitos and serological tests performed on blood collected from sentinel chickens. In addition, serum samples were collected from human residents of Redfield State Hospital and tested for immunologic conversion to St. Louis Encephalitis (SLE) and Western Equine Encephalitis (WEE) viruses.

Procedure, Results and Discussion

Mosquito trapping: During the summer of 1972 over 17,000 mosquitos were trapped at five major sites near Redfield. In addition to the James Valley Research Farm (R-5), trap sites included farmsteads within a 10-mile distance owned by Goodwin (R-1), Frericks (R-2), Jessen (R-3), and Osborne (R-4). Site locations are shown in Figure 1. Miniature mosquito-catching traps, modeled after those of the Center for Disease Control, Atlanta, Georgia, "baited" with dry ice were used for all catches made in 1972. Of the 17,000 total mosquito species trapped at these sites, over 48% were the major encephalitis (sleeping sickness) vector, *Culex tarsalis*. *Aedes vexans*, the major mosquito species in most areas of South Dakota was present at lower levels (44%) in the Redfield area. These five trap areas yielded 32 virus isolations. Sixteen of these isolated viruses have been identified and confirmed. More detailed results are presented in Table 1.

Sentinel flocks: One set of 30 chickens caged in CDC-type sentinel cages was located at the James Valley Research Farm. The birds were positioned on June 15 and bled monthly thereafter until the end of September. By following the level of encephalitis antibodies present in each chicken's blood serum, it was possible to determine, for all animal species, the peak times of virus exposure. Seroconversion rates are tabulated in Table 2. The high WEE conversion rates and lower SLE rates at Redfield paralleled well with the results obtained from virus isolations from mosquitos.

Arbovirus activity in man: To determine encephalitis exposure levels in human populations, a serum sample was obtained from each resident of Redfield State Hospital before and after the summer mosquito season of 1972. The collected serum was then tested for the presence of WEE and SLE antibodies using hemagglutination-inhibition (HI) procedures. Conversion rates for human volunteers are shown in Table 3. The percent conversion of the test population provides an encephalitis activity indicator for human populations in the entire Redfield area. Relatively high SLE conversion rates were observed for males (6.0%) and females (4.7%) at the hospital in 1972.

Conclusions

Pre-irrigation studies conducted around Redfield in 1972 suggest that encephalitis activity levels are already very high. It appears that full-scale irrigation might tend to increase mosquito populations which could lead to increased encephalitis activity.

Further research appears necessary to confirm or disprove evidence from 1972.

1973 Summer Mosquito Season Studies

In 1973 arbovirus activity in the Redfield area was, once again, studied using (1) virus isolation procedures from trapped mosquitos, (2) seroconversion rates observed for 852 human volunteers from the Redfield State Hospital bled October 24, 1973, and (3) seroconversion rates for 25 chickens at the James Valley Research farm positioned and bled June 25 and monthly thereafter until August 24. Laboratory serology tests for the human population and sentinel chickens have not been completed and will not be reported here.

Total mosquito species trapped at the five Redfield sites (same as 1972) numbered 3,969. Of this total, *Culex tarsalis* comprised 14.8%. Virus isolations from these trapped mosquitos are still in a tentative state and will be reported later. It may be noted, however, that the total mosquito species trapped in 1973 are down more than 13,000 from the 1972 count. Also, observable from 1973 and 1972 data is the relative drop in *C. tarsalis* catch percentage (48% in 1972 to 14.8% in 1973). These drastic decreases in total and *C. tarsalis* populations are probably directly related to the rainfall levels in the two summers. Studies to relate climatic factors to mosquito populations will be continued in subsequent years. (Red. 1M--3-74--2040).

Table 1. Viruses Isolated from 17,164 Mosquitoes Collected in Redfield Area in 1972.

Virus (No.)	Mosquito	Site	Week of collection
WEE (1)	*Culex tarsalis*	R-1	7/23-7/29
WEE (3)	*Culex tarsalis*	R-2	8/6 -8/12
WEE (4)	*Culex tarsalis*	R-2	8/20-8/26
SLE (1)	*Culex tarsalis*	R-2	8/20-8/26
WEE (2)	*Culex tarsalis*	R-3	7/9 -7/15
SLE (1)	*Culex tarsalis*	R-3	7/9 -7/15
WEE (1)	*Aedes vexans*	R-3	7/23-7/29
WEE (1)	*Culex tarsalis*	R-3	8/6 -8/12
WEE (1)	*Culex tarsalis*	R-3	8/20-8/26
WEE (1)	*Culex tarsalis*	R-4	8/6 -8/12

Table 2. Immunologic Conversion Rates in Sentinel Chickens at James Valley Agricultural Research Farm, June 15 to September 30, 1972.

Antibody tested for	Number chickens tested	% Conversion[a]	Date first detection
WEE	30	36.7	8-09-72
SLE	30	6.7	9-15-72

[a]Percent of birds developing antibodies during the mosquito season.

Table 3. WEE and SLE Conversion Rates in Human Volunteers at Redfield State Hospital in 1972.

	Male	Female
WEE	17/487 (3.5)*	6/358 (1.7)*
SLE	29/487 (6.0)*	17/358 (4.7)*

* No. converted[b] / No. tested (%)

[b]No. converted refers to those samples from individuals following the summer of 1972 which showed a four-fold or greater increase in HI titer.

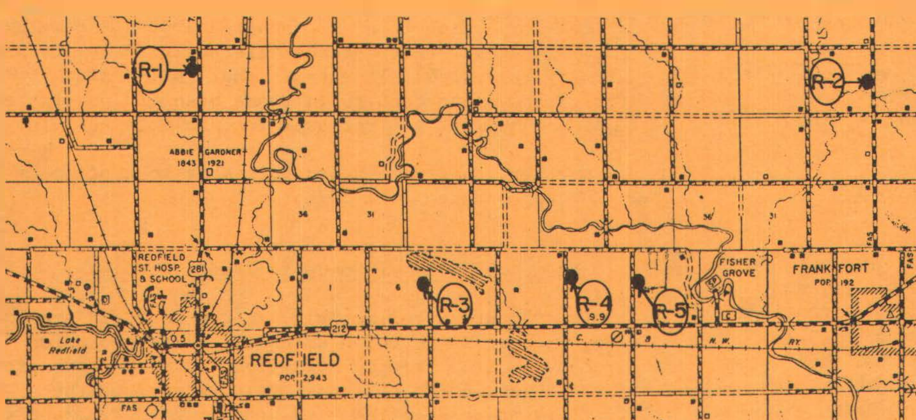

Figure 1. Locations of arbovirus surveillance study sites R-1, R-2, R-3, R-4 and R-5 near Redfield, South Dakota in 1972.

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EARLY GRAIN SORGHUM RESEARCH AND TESTING

REDFIELD, 1973

A. O. Lunden and G. W. Erion
Associate and Assistant Professors,
Plant Science Department

Grain sorghum research at Redfield emphasized testing of the new early maturing South Dakota Experiment Station releases, as well as planting dates and irrigation methods. Plantings included the new early lines, regional test entries and several experimental hybrids. The main test was planted on May 25 in 30 inch rows and later plantings of both 12 and 30-inch rows were made on May 30 and June 8. The main plot was furrow irrigated and the narrow-row test area was sprinkler irrigated with a center pivot system. Yields are presented in Table 1.

The two new early varieties, SD 104 and SD 106, produced good yields in the past three years with yields averaging, respectively, 22% and 72% more than the popular early line SD 102. These grain sorghums are somewhat resistant to bird losses because of open heads instead of the high-tannin type of bird resistance found in most bird tolerant hybrids. These lines appear to have good yield potential even without irrigation as their moisture requirement is much less than that of the taller hybrids. RS 506 also has an excellent yield record relative to other midseason to full-season hybrids and has averaged over 90 bushels per acre in the last 3 years. This hybrid, however, is moderately susceptible to lodging and seed is in very short supply for planting in 1974.

Time of planting is very important to achieve optimum weed control and to ensure the best possible plant population for maximum yield. Results from this test and several others suggest that grain sorghum should be planted after June 1 to enhance seed germination and plant growth immediately after planting. Row spacing appears to be less important with no advantage for rows closer than 30 inches. 1973 plantings were more resistant to lodging in 30 inch rows than in 12 inch rows. SD 104 is good and SD 106 is especially well adapted for early harvest or late planting.

The early sorghums gave an average yield increase of nearly 50% when planting was delayed until late May. Yields reported in the table also show that planting in early to mid-June is more desirable than late May. High yields obtained from late narrow row plantings at three locations in 1972 suggested that delayed planting should be coupled with drill plant row spacing so the late planted 1973 plots included both 12 and 30-inch rows.

Yield advantage of these late planted grain sorghums was not related to use of narrow row spacing in this test or in other 1973 test sites where "wide" row spacing was 30 inches. Most entries yielded less in narrow rows with more lodging and greater potential harvest loss. (Red. 1M--3-74--2041)

Table 1. Grain Sorghum Yields - Redfield - 1973 - Bu/Acre

	Standard Planting Date		Late Planted - May 31			
			Row Spacing - 1973			Increase
Entry	1973	3 Yr. Ave.	12"	30"	Ave.	%
VARIETIES						
SD 106	47	68	64	77	71	51
SD 104	42	49	49	60	54	28
SD 102	29	40	54	73	64	122
HYBRIDS						
RS 506	78	94	98	97	98	26
SD 503	75	93	79	99	89	19
RS 610	72	87	--	--	--	--
SD 451	45	70	--	--	--	--
L.S.D.	17	--	23	16	--	--

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SOYBEAN RESEARCH AND TESTING

REDFIELD, 1973

A. O. Lunden and G. W. Erion,
Associate Professor and Assistant Professor,
Plant Science Department

Soybean research plots at Redfield included Advanced Breeding Tests, Standard Variety Trials and Commercial Yield Tests. Yields were well below the five-year average with the best entries producing only about 25 bushels per acre. Low yields resulted from saline soil conditions in the test plot area and late planting due to field moisture problems. Plots were planted on May 30 and sprinkler irrigated June 25 and July 26 with 2 and 3 inches, respectively. Yields are presented in Table 1.

Entries from seven private seed companies were included to provide information about general adaptation of some of the most important commercial soybean strains. Five of the 16 commercial entries which were also grown in the 1972 test provide yields for two-year averages. It is quite apparent that some of the commercial entries are top producers at these locations but that others are certainly not adapted to the Redfield area. Maturity estimates are based on the relative number of days needed to mature relative to the earliest strain, Peterson 85, which was about three days earlier than Chippewa 64. The range from earliest to latest was only 13 days because of favorable weather for ripening and drying.

Corsoy, which has been an excellent soybean in most of South Dakota is a very good selection for Redfield but Wells, a new variety in 1972, is slightly above Corsoy in yield potential. Wells is nearly identical to Corsoy in maturity but is resistant to Phytophthora root rot. Steele was a top entry in the 1973 test but was probably favored due to late planting.

Four standard varieties were also planted in 12" and 30" rows to study narrow-row response to sprinkler irrigation. The yields from this test, as recorded in Table 2, are better than those of the standard variety test because of better soil conditions in that portion of the field. Narrow rows averaged 32.2 bushels per acre while 30-inch rows produced only 30.9 bushels for these four varieties. Row spacing response was greatest for Hark and least for Wells but these differences were not statistically significant because of excessive field variability.
(Red. 1M--3-74--2111).

(Turn page for Tables 1 and 2)

Table 1. Yield Test Results of Soybean Varieties and Commercial Entries - 1973 - Redfield

Identification of Entry	Relative Days to Maturity	Yield - Bu/Acre 1973	2 Yr. Ave.	5 Yr. Ave.	Plant Height (in.)
Wells	+10	25.2	33.4	—	23
Corsoy	+10	24.3	29.5	34.2	27
Hark	+11	22.9	27.8	29.9	23
Steele	+4	25.2	28.2	—	25
Rampage	+9	21.0	26.9	29.5	22
Wirth	+4	17.6	25.1	28.8	21
Chippewa 64	+3	17.5	23.2	26.0	22
Anoka	+4	20.8	25.1	29.4	21
Provar	+11	24.5	23.2	26.3	26
Amsoy 71	+13	18.4	20.6	25.3	25
AGRIPRO 1120	+6	20.7	26.1	—	18
AGRIPRO 1235	+7	20.1	—	—	20
AGRIPRO Ex4124	+10	25.2	—	—	25
FEL GO 45	+5	20.0	27.3	—	18
FEL PIKE	+5	23.2	—	—	18
MRC Cherokee	+15	24.8	—	—	25
PET 85	0	24.0	—	—	21
PET 100	+11	18.4	—	—	26
SRF 100	+3	22.9	23.4	—	23
SRF 150	+9	19.2	24.2	—	20
SRF 200	+12	19.9	—	—	24
SRF 69-691	+13	21.9	—	—	22
TEW 2D-300-1	+10	20.3	26.1	—	22
TEW 2D-355-1	+8	16.1	—	—	22
TEW XK-125	+8	22.6	—	—	21
Tama S-20	+12	19.8	21.4	—	26
L.S.D.		ns	4.0	3.2	

Table 2. Soybean Yields from Variable Row Spacing, 1973, Redfield

Entry	12-inch rows Bu/A	30-inch rows Bu/A	Ave.
Corsoy	33.0	31.9	32.5
Wells	33.7	33.5	33.6
Hark	31.9	29.1	30.5
Steele	30.2	29.1	29.6
Average	32.2	30.9	
L.S.D.	ns	ns	

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OAT FORAGE EXPERIMENT

Raymond Ward and Dale Reeves
Research Manager and Assistant Professor,
Plant Science Department

Summary

Oats harvested for silage yielded 5.5 tons/acre on a dryland trial. Protein concentration ranged from 10.8 to 12.4% and crude fiber ranged from 24.1 to 27.2%.

Introduction

Oats are sometimes harvested for silage in central South Dakota. When the forage is cut in the dough stage and is ensiled properly it makes a very palatable feed. Some oat varieties have been sold mainly as forage producers. Objectives of this study were to (1) determine yield of oats when cut for silage; (2) compare mid-season and late-maturing varieties; and (3) compare feed values of oat varieties.

Procedure

Oats were seeded at 60 pounds per acre in 6-inch rows. The land was in oats the previous year and was noble bladed in August of 1972 then tandem disked and harrowed in the spring before planting. No fertilizer was applied because the soil tests indicated very high levels of phosphorus and potassium. The nitrate-nitrogen level of this soil was approximately 200 pounds of nitrate-nitrogen in the upper 2 feet of soil. The plots were planted April 12, and harvested July 3, 1973 in soft dough when harvested.

Results and Discussion

Oat growth was very good early in the season because of an adequate supply of soil moisture available at planting time. By late June soil moisture supply was low and the oats ripened faster than expected.

Forage yields of oats are presented in Table 1. There were no significant differences in yields. Chief produced 4.9 tons of green forage per acre while the others yielded 5.5 tons per acre.

Burnett and Chief are medium-maturity oat varieties and Froker and Kelsey are late-maturing varieties. This maturity difference is shown in Table 1 in that Burnett and Chief are significantly greater in dry matter content than Froker and Kelsey.

Crude protein and crude fiber values are listed in Table 1. Protein values ranged from 10.8% in Kelsey forage to 12.4% in Froker forage. Crude fiber was lowest in Chief (24.1%) and highest in Kelsey (27.2%).
(Red. 1M--3-74--2112).

Table 1. The Dry Matter Content and Yield of Forage From Four Varieties of Oats.

VARIETY	FORAGE YIELD* Tons/Acre	DRY MATTER %	PROTEIN %	CRUDE FIBER** %
Burnett	5.5	38.4	11.4	24.4
Chief	4.9	40.3	12.0	24.1
Froker	5.5	34.7	12.4	26.2
Kelsey	5.5	35.9	10.8	27.2
LSD .05	ns	2.7		

*Corrected to 65% moisture in the forage.
**Oven dry basis.

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IRRIGATED SOYBEAN PRODUCTION

Raymond Ward and Robert Sanders,
Research Manager and Technical Assistant,
James Valley Agricultural Research and Extension Center

Summary

Soybean variety, Wells, produced the highest yield although not statistically significant. There appeared to be a yield advantage for sprinkling soybeans. Narrow rows showed no yield advantage.

Introduction

Purpose of the experiment was to determine the effects of variety, irrigation method, and row spacing on yield of soybeans.

Procedure

The land was spring plowed alfalfa ground. It was flooded May 21 to reduce cloddiness of the spring plowing. Treflan was sprayed June 12 and tandem disked twice immediately after. Soybeans were planted June 12 at 60 pounds per acre.

The only cultivation was furrowing for the flood irrigated soybeans. Sprinkle irrigated soybeans received 2 and 3 inches of water on June 25 and July 26 respectively. Furrow irrigated soybeans were watered August 1 with 5 to 6 inches of water.

The soybeans were machine harvested October 31.

Results and Discussion

Wells variety of soybeans produced 32.3 bu/A compared to 27.0 bu/A for Steele, and 30.1 bu/A for Corsoy (Table 1).

Sprinkle irrigated soybeans were higher yielding than the furrow irrigated plot (Table 2), but this may have been due to difference in timing of water application. There was no advantage to growing soybeans in 14 inch rows. (Red. 1M--3-74--2113).

Table 1. Yield of three varieties of soybeans grown under irrigated conditions.

Variety	Yield
Corsoy	30.1
Steele	27.0
Wells	32.3
LSD (.05)	ns
Coefficient of variation = 10.5%	

Table 2. Influence of irrigation method and row spacing on yield of soybeans.

Irrigation Treatment	Row Spacing	Yield, bu/A
Sprinkle	14 inch	31.1
Sprinkle	30 inch	31.0
Flood	30 inch	27.4
LSD (.05)		ns
Coefficient of Variation		11.8%

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EFFECTS OF PLANTING DATE, POPULATION, AND HYBRID ON YIELD OF IRRIGATED CORN

Raymond Ward and Robert Sanders,
Research Manager and Technical Assistant,
James Valley Agricultural Research and Extension Center

Summary

Planting dates of May 16, 23, and 31 had no effect on yield of ear corn, although Pioneer 3780 (105 days) tended to yield lower at the later planting dates. Moisture content was 4.3% higher in corn planted May 31 compared to May 16. The later maturing corn (Pioneer 3780) was 4.7% wetter than the early hybrid (DeKalb XL12).

Populations of 18,000 to 20,000 plants per acre produced more corn than the 12,000 to 14,000 populations. Acco 1901 and Pioneer 3932A did not appear to reach maximum yields with a plant population of 20,000.

Introduction

Irrigated corn production is influenced by a number of cultural practices. This study was proposed to examine the influence of population, planting date, and hybrid on yield of corn.

Procedure

The land was irrigated grain sorghum the previous year. Tillage operations included spring plowing, two tandem diskings, and two harrowings. Corn was planted in 30 inch rows. Twelve gallons of starter fertilizer (8-20-6-5-1) were applied at planting. Anhydrous ammonia at a rate of 180 pounds actual N was applied April 30.

Furadan was applied to control corn root worms. The plot was sprayed with atrazine and oil. It was cultivated twice before furrowing. The corn was irrigated July 5 and July 24 with 3-4 inches of water per application. Yield samples were hand harvested the week of October 22.

Results and Discussion

Ear corn yields are shown in Table 1. Yield differences that are statistically significant are shown by the LSD values. The 30,000 planting rate increased corn yields 13 bu above the 22,000 planting rate. Planting dates (May 16, May 23, May 31) did not affect corn yields on the average, although Pioneer 3780 yields decreased with a delay in planting date. Pioneer 3780 was the highest yielding hybrid (139 bu/acre average). It did not show a yield increase to a thicker planting rate while the other three hybrids produced 10 to 18 bushels more corn at the thicker rate. We observed that Pioneer 3780 produced more ear bearing tillers at the 22,000 seeding rate than the other hybrids which explains why it did not respond to the thicker seeding rate.

Planting date definitely influenced the moisture content of the ear corn as illustrated in Table 2. A delay in planting date from May 16 to May 31 increased ear corn moisture content 4.3% which is 0.3% increase in moisture per day delay in planting date (see date mean). Maturity rating of the hybrids also affects moisture content. DeKalb XL12 maturity is rated at approximately 95 days; Pioneer 3932A and Acco 1901 at approximately 100 days; and Pioneer 3780 at approximately 105 days. The driest corn at harvest was DeKalb XL12 while the wettest corn was Pioneer 3780. This difference averaged 4.7% or 0.5% increase in moisture content for each day the maturity rating was greater than 95 days. These figures can be used to estimate the cost of drying corn for storage or can be used to estimate the amount of fuel that could be saved by planting short maturity hybrids early. Table 1 shows the yield advantage of the late maturing hybrid and Table 2 shows the disadvantage of a late maturing hybrid. Choosing a hybrid will depend on the particular needs of the corn grower.

The emergence of corn seedlings was much lower than one normally expects (Table 3). The low percentage (63%) of final stand was due primarily to a cloddy seedbed. The four hybrids produced similar final stands. The lower stand of the last planting date was related to the poor seedbed and dry soil conditions.

The influence of plant population on yield was found to be different for each hybrid. Acco 1901 showed a small general increase in yield from 12,000 to 20,000 plants per acre (these were the populations found in this experiment). The increase was about 1.7 bushels per 1000 plants above 12,000 plants per acre. Pioneer 3932A showed an increase of 3.4 bushels per 1000 plants above 12,000 plants per acre. Thicker populations than 20,000 plants per acre are needed to find the maximum yield of these hybrids. Pioneer 3780 reached a maximum yield at a plant population of 18,700 and DeKalb XL12 peaked at a population of 21,000 plants per acre. (Red. 1.5M--3-74--2114).

(Turn page for Tables 1, 2 and 3)

Table 1. Effect of Planting Date, Variety, and Planting Rate on Yield of Ear Corn (bushels per acre).[1]

	Date (D)	Acco 1901	DeKalb XL 12	Pioneer 3780	Pioneer 3932A	D X P Mean	Date Mean	Population Mean
		Planting Rate - 22,000 seeds/acre (P)						
	May 16	114	106	147	104	118	125	
	May 23	114	113	137	116	120	126	
	May 31	117	114	131	115	119	125	
V X P	Mean	115	111	138	111			119
		Planting Rate - 30,000 seeds/acre (P)						
	May 16	123	134	147	125	132		
	May 23	124	133	142	129	132		
	May 31	127	136	132	131	132		
V X P	Mean	125	134	140	129			132
Variety	Mean	120	123	139	120			

LSD (.05 level) for population mean = 5 bu/A
LSD (.05 level) for variety mean = 6 bu/A
LSD (.05 level) for V X P mean = 9 bu/A

[1]Corrected to 15.5% moisture in ear corn.

Table 2. Effect of Planting Date, Hybrid, and Planting Rate on Moisture Content of Ear Corn (%).

	Date (D)	Acco 1901	DeKalb XL 12	Pioneer 3780	Pioneer 3932A	D X P Mean	Date Mean	Population Mean
		Planting Rate - 22,000 seeds/acre (P)						
	May 16	24.9	21.7	26.6	23.0	24.1	23.9	
	May 23	24.4	23.8	28.0	22.1	24.6	25.4	
	May 31	28.0	26.8	29.1	27.3	27.8	28.2	
V X P	Mean	25.8	24.1	27.9	24.1			26.2
		Planting Rate - 30,000 seeds/acre (P)						
	May 16	22.4	21.5	26.7	24.3	23.7		
	May 23	25.7	24.6	29.9	24.8	26.2		
	May 31	29.1	26.3	32.3	26.9	28.6		
V X P	Mean	25.7	24.1	29.6	25.3			25.5
Variety	Mean	25.7	24.1	28.8	24.7			

LSD (.05 level) for date mean = 2.8% moisture

Table 3. Effect of Planting Date, Hybrid and Planting Rate on Final Plant Population (plants per acre).

	Date (D)	Acco 1901	DeKalb XL 15	Pioneer 3780	Pioneer 3932A	D X P Mean	Date Mean	Population Mean
		Planting Rate - 22,000 seeds/acre (P)						
	May 16	13,300	14,700	14,100	12,400	13,600	16,500	
	May 23	15,900	16,000	11,900	14,400	14,500	17,300	
	May 31	12,600	14,100	12,000	14,500	13,300	15,300	
V X P	Mean	13,900	14,900	12,700	13,800			13,800
		Planting Rate - 30,000 seeds/acre (P)						
	May 16	19,600	18,700	21,000	18,000	19,300		
	May 23	18,800	19,100	21,200	20,700	20,000		
	May 31	17,500	17,900	15,500	18,300	17,300		
V X P	Mean	18,600	18,600	19,200	19,000			18,900
Variety	Mean	16,300	16,700	15,900	16,400			

LSD (.05 level) for date mean = 1000 plants/A
LSD (.05 level) for population mean = 800 plants/A

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YIELD OF CORN AND SUNFLOWERS WHEN FURROW OR SPRINKLE IRRIGATED

Raymond Ward and Robert Sanders,
Research Manager and Technical Assistant,
James Valley Agricultural Research and Extension Center

Summary

Method of irrigation did not affect yield of corn or sunflowers. Three varieties of corn and sunflowers were planted. Pioneer 3780 produced a significantly higher yield (149 bu/A) than Acco 1901 (136 bu/A). The wettest corn at harvest was Pioneer 3780. Cargill 101 sunflowers yielded 26.7 cwt/A compared to 23.2 cwt/A for Romania HS-52 and 20.6 cwt/A for Peredovik.

Introduction

There is a trend toward more sprinkle irrigation because of labor saving sprinkler equipment. Where soil texture permits either type of irrigation the decision must be based on yield advantage, available labor, capital, and many other factors. The purpose of this experiment was to compare yields from furrow and sprinkle irrigation.

Procedure

In 1972 this land produced corn or silage. Anhydrous ammonia at 180 lbs actual N was knifed-in May 1. The land was tandem disked twice and planted to corn at 27,000 seeds per acre and sunflowers at 32,000 seeds per acre in 30 inch rows. Starter fertilizer, 8-20-6-5-1 ($N+P_2O_5+K_2O+S+Zn$), was applied at 12 gal per acre. Ramrod granules were applied in 14 inch bands over the rows. Furadan was applied to control corn root worms.

Sprinkle irrigated plots were watered July 5 and 31 with 3 inches of water. Furrow irrigation was conducted by watering every row and every other row. Every row was flooded July 11 and August 1 with 4-5 inches of water. Every other row plot was watered July 11 and August 3 with about 3 inches of water.

Sunflowers were hand harvested October 18 and corn was hand harvested November 12.

Results and Discussion

Three corn hybrids were grown under three irrigation methods as shown in Table 1. Statistically, there was no yield difference between the three irrigation methods. Pioneer 3780 yielded significantly more than Acco 1901. Moisture content was significantly higher in the every-other-row treatment than in the other two. Since less water was applied with this treatment the corn was under more moisture stress which delayed maturity. Pioneer 3780 which is a 105 day relative maturity hybrid contained significantly more moisture than DeKalb XL12 or Acco 1901.

Plant populations were recorded at harvest (Table 1). Pioneer 3780 population was about 1200 plants per acre thicker than DeKalb XL12.

Table 2 shows the results of irrigating three varieties of sunflowers by three methods. Irrigation treatment did not influence sunflower yields significantly. Of the three varieties, Cargill 101 was significantly higher yielding (averaging 26.7 cwt/A).

Sunflower populations were less than 50% of the seeding rate but were similar for the three methods of irrigation and three varieties. (Red. 1.5M--3-74--2115).

(Turn page for Tables 1 and 2)

Table 1. Yield of Three Varieties of Corn When Furrow or Sprinkle Irrigated.

VARIETY	IRRIGATION	YIELD Bu/A	MOISTURE %	POPULATION plants/acre
Acco 1901	Sprinkle	131	20.2	18,100
DeKalb XL12	Sprinkle	144	21.6	19,600
Pioneer 3780	Sprinkle	145	23.6	20,400
Acco 1901	Flood every row	143	23.0	19,500
DeKalb XL12	Flood every row	145	20.9	19,400
Pioneer 3780	Flood every row	150	24.2	21,100
Acco 1901	Flood every other row	133	22.7	19,200
DeKalb XL12	Flood every other row	139	24.4	19,400
Pioneer 3780	Flood every other row	151	25.1	20,400
Coefficient of Variation		5.8%	5.9%	4.4%

Table 2. Yield of Three Varieties of Sunflowers When Furrow or Sprinkle Irrigated.

VARIETY	IRRIGATION	YIELD cwt/A	POPULATION plants/acre
Cargill 101	Sprinkle	26.7	11,600
Romania HS-52	Sprinkle	25.1	16,100
Peredovik	Sprinkle	19.9	14,500
Cargill 101	Flood every row	27.0	13,900
Romania HS-52	Flood every row	23.0	14,300
Peredovik	Flood every row	20.8	14,500
Cargill 101	Flood every other row	26.4	13,000
Romania HS-52	Flood every other row	21.6	14,100
Peredovik	Flood every other row	21.3	16,300
Coefficient of Variation		9.1%	13.9%

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NITROGEN RATES FOR SUNFLOWERS

Paul L. Carson and Raymond C. Ward
Professor, Plant Science Department and Research Manager
James Valley Agricultural Research and Extension Center

Summary

Sunflower yields were not increased by side-dressing an application of nitrogen during the 1973 growing season. The reason for no response is attributed mainly to an adequate supply of nitrate-nitrogen in the soil profile. This supply of nitrate-nitrogen ranged from 56 to 120 pounds in the top 2 feet of soil. More work will need to be done to determine the type of response that can be obtained when soil nitrate-nitrogen levels are lower than found in these experiments. Plant populations appeared to be adequate in these experiments to produce maximum yields. Yields were limited because of moisture conditions.

Introduction

Sunflower production has increased substantially in the last two years in northcentral South Dakota. This row crop is potentially an economical crop to be grown in this area because of its adaptation to drier and cooler climates. With a new crop being grown in an area it is important that we know how to fertilize that crop to obtain maximum profit per acre. From fertilizer trials conducted in North Dakota and Minnesota it has been shown that the largest nutrient need is nitrogen. Therefore, nitrogen fertilizer rate experiments were established on five farmer fields in 1973 to measure response of sunflowers to applied nitrogen. Nitrate soil tests were used to measure soil nitrogen availability.

Procedure

Fertilizer was side-dressed June 18, 1973. Source of nitrogen fertilizer was ammonium nitrate (34-0-0). Sunflowers had been cultivated one or two times when the nitrogen was side-dressed. All of the plots were cultivated after the nitrogen fertilizer was applied. Each nitrogen rate was replicated four times. All of the row widths were 38 or 40 inches. Weed control was good at all locations. Locations are described in Table 1.

The sunflower variety, Peredovik, was planted on four of five locations. Ludke-2 location was planted to Romanian hybrid HS-52. Sunflower height at side-dressing time varried from 12 to 18 inches tall at the Williams location to 6 to 10 inches at the Ludke-2 location.

Rainfall records were not kept at the sites, therefore, it is not known exactly how much influence soil moisture and rainfall had on the resulting yields. Table 1a shows the growing season precipitation received at Aberdeen, S.D.

Nitrate-nitrogen levels in the soils of the five locations are shown in Table 2. The nitrate-nitrogen level in the 0-2 foot soil profile varies from 56 pounds of nitrate-nitrogen at the M. Hansen site to 120 pounds of nitrate-nitrogen at the Williams site. The Williams, A. Hanson, and Ludke-2 sites are above the normal expected amount of nitrate-nitrogen in the soil profile. Therefore, the nitrogen fertilizer recommendations on these three locations would be reduced from recommendations that would be given from soil tests of the surface soil. There is a considerable amount of nitrate-nitrogen in the two to four foot soil depth, indicating that more nitrate-nitrogen is available in this part of the soil which could influence the response obtained from nitrogen fertilizer.

The sunflowers were harvested September 10. The LSD or least significant difference at the .05 level is listed for the experiments as well as the coefficient of variation, which indicates the amount of variability that occurred between samples for each treatment.

Results and Discussion

The effects of side-dressed nitrogen fertilizer on the yield of sunflowers are shown in Table 3. There was no significant difference between the yields of the check plot and the nitrogen fertilizer rates which means that there was no (real) response to nitrogen fertilizer side-dressed June 18. There was a tendency for nitrogen to increase sunflower yields at the Williams location. Sunflower yields were increased 3 cwt per acre when 90 pounds of actual nitrogen was applied per acre. This would be an economical response. The yields were quite low at the two Hanson sites because of a lack of moisture during the growing season.

The nitrate-nitrogen level of the soil profiles at these locations indicate that there should be a small yield increase from an application of nitrogen fertilizer. The M. Hanson site was the lowest nitrate-nitrogen content in the soil profile. Yields were low at this location because of a lack of moisture, therefore, the extra nitrogen was not needed for the growth of sunflowers. Three of the locations were quite high in nitrate-nitrogen and a response should not be expected in most years. The results of these five experiments indicate that a nitrate-nitrogen level of more than 60 pounds per acre in the top 2 feet of soil is adequate for the production of sunflowers. More research work will need to be done to determine if a nitrogen response can be obtained when the nitrate-nitrogen soil level is lower than found at these locations.

Sunflower plant populations were taken at the time of harvest to get some idea of the importance of plant population on the yield of sunflowers. These counts are shown in Table 4. Populations varied from 12,000 at the A. Hanson location to 19,000 plants per acre at the Williams location. These plant populations appear to be adequate for the magnitude of yields obtained in these experiments. Yield data indicate that the yields were reduced because of climatic conditions rather than by populations (low or high).

(Red. 1M--3-74--2116).

Table 1. Cooperator, County, Legal Description, and Soil Association of Sunflower Fertilizer Experiment Locations.

Location	Section	Township	Soil Association
Williams	NW¼ 6	Tetonka	Harmony
Ludke-2	NW¼ 7	LaPrairie	Great Bend
A. Hanson	SE¼ 35	Henry	Great Bend - Beotia
M. Hanson	SE¼ 17	Cambria	Great Bend - Beotia
Ludke-1	SW¼ 30	Rondell	Aberdeen

Table 1a. Rainfall Received at Aberdeen, S.D. in 1973.

	MONTH				
Days	May	June	July	August	September
1- 7	0	.62	1.38	.29	1.62
8-14	.02	.03	.02	.39	.24
15-21	.10	.70	.17	0	.63
22-27	.86	.02	.20	.02	1.02
28-31	.02	0	0	.47	0

Table 2. Nitrate-nitrogen Soil Tests for the Sunflower Fertilizer Locations.

	Cooperators				
Soil depth, feet	Williams	M. Hanson	A. Hanson	Ludke-1	Ludke-2
	pounds NO_3-N in soil				
0 - 1	98	41	100	61	65
1 - 2	22	15	15	12	22
0 - 2	120	56	115	73	87
2 - 3	34	26	13	8	12
3 - 4	31	23	9	7	13
0 - 4	185	105	137	88	112

Table 3. Effect of Side-dressed Nitrogen Fertilizer on the Yield of Sunflowers.

	Cooperators				
Nitrogen rate lbs. N/A	Williams	M. Hanson	A. Hanson	Ludke-1	Ludke-2
	Yield, cwt per acre				
0	15.6	9.1	7.0	18.6	12.5
30	17.7	6.7	6.9	18.8	13.3
60	16.8	7.8	6.1	18.3	10.2
90	18.8	8.0	7.0	19.5	12.2
LSD .05	ns	ns	ns	ns	ns
CV	18.2%	23.3%	20.6%	12.9%	21.3%

Table 4. Number of Sunflower Plants Per Acre at Each Location.

	Cooperators				
Nitrogen rate lbs. N/Acre	Williams	M. Hanson	A. Hanson	Ludke-1	Ludke-2
	population per acre				
0	16,900	17,560	12,200	16,450	14,050
30	18,200	17,300	12,200	16,770	16,250
60	18,850	17,100	12,650	14,350	15,800
90	19,050	18,750	12,500	13,700	16,250
LSD .05	ns	ns	ns	ns	ns
CV	8.3%	14.3%	16.9%	12.1%	12.5%

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EFFECT OF FLOOD OR SPRINKLE IRRIGATION ON YIELD OF NAVY AND PINTO BEANS

Raymond Ward and Darrell Pahl
Research Manager and Extension Irrigation Specialist

Summary

Atlas Navy beans produced 2821 lbs per acre when furrow irrigated at Redfield and 3467 lbs per acre at Brookings. Yields were higher at Redfield when furrow irrigated than when sprinkled, except for Pinto beans. The earlier maturing bean, Seafarer, was lower yielding than Atlas at Redfield, but was only slightly lower at Brookings.

Introduction

Navy beans are grown principally in Michigan, but there is interest in producing them under irrigated conditions in South Dakota. The objective of this experiment was to determine the yield of four varieties of Navy beans and one variety of Pinto beans under sprinkle and furrow irrigation.

Procedure

The land was in corn for silage in 1972 and was tandem disked, treated with Eptam, and tandem disked again to incorporate the Eptam. The beans were planted June 1 at 60 lbs of seed per acre in 30 inch rows. Starter fertilizer was applied at 12 gal per acre of 8-20-6-5-1 ($N-P_2O_5-K_2O-S-Zn$). The land had been fertilized with 180 lbs actual N as anhydrous ammonia.

The beans were cultivated twice. Sprinkle irrigated beans were watered June 13, July 11, and August 10 with 1, 2 and 3 inches of water, respectively. The furrow irrigated beans were flooded August 1 with an estimated water application of five inches. Yield samples were taken September 19 by hand harvesting 30 foot of row.

The same varieties of Navy beans were grown at the SDSU Agricultural Engineering Farm, Brookings, on a sandy loam soil in corn the previous year. They were planted May 23 after incorporating either Eptam or Treflan. The plot was cultivated twice. Sprinkler irrigation was used to apply 2 inches of water four times starting in June. The beans were hand harvested.

Results and Discussion

The yields obtained from the four varieties of Navy beans and one variety of Pinto beans are shown in Table 1. The Navy beans yielded significantly more under the flood system than under the sprinkle system. This was not true for the Pinto beans. Atlas variety outyielded the other three varieties of Navy beans. The differences in method of irrigation could be due to timing of the irrigations or from disease susceptibility. Disease occurrence was not recorded.

Yields of Navy beans grown at Brookings are shown in Table 2. Yields were higher than at Redfield. Atlas was the highest yielding. There was no difference in yield between Eptam and Treflan treated areas.

(Red. 1M--3-74--2117).

Table 1. Influence of Flood or Sprinkle Irrigation on Yield of Four Varieties of Navy Beans and One Variety of Pinto Beans.

Variety	* Yield, pounds per acre Sprinkle	Flood	Average
Atlas	2650a	2821a	2736x
Capital	1904c	2654a	2279y
Sanilac	2127bc	2468ab	2298y
Seafarer	1872c	2172bc	2022y
Mean	2138	2529	
U. of Idaho No. 114	2891	2655	2773

*When values are followed by the same letter they are not significantly different (Duncan's new multiple range test at .05 level).

Table 2. Yield of Navy Beans Grown at Brookings Under Sprinkler Irrigation.

Variety	Yield, pounds per acre
Atlas	3467
Sanilac	3137
Seafarer	3124
Capital	2945

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MILLET MANAGEMENT EXPERIMENTS

Raymond Ward and Paul Carson
Research Manager and Professor,
Plant Science Department

Summary

Three seeding rates of millet were tested and there were no yield differences between seeding 10, 20, or 30 pounds of seed per acre. However, there was a tendency for the 20 lb/A seeding rate to produce the highest yield.

Snobird millet produced the highest grain yield. Manta millet produced the highest hay yield. Test weight was similar for the four varieties of millet. The June 14 planting date produced the highest grain yield. June 5 and June 14 produced very similar hay yields. Test weight tended to be higher for these two planting dates.

Introduction

Proso millet has been grown in northcentral South Dakota for a number of years as a late crop and in some cases an emergency crop. During the spring of 1973 a very good market developed for Proso millet in South Dakota. The objectives of this study were (1) to determine the optimum rate of seeding millet under dryland conditions, (2) to estimate the best date to plant millet, and (3) to measure grain and hay yields of four varieties of millet.

Procedure

Planting Rate Experiment: Snobird variety of millet was selected for this study. It was planted June 14 with the seeding rates set according to the seeding rate chart on the drill (International model 620).

Millet Variety and Date of Planting Experiment: The millet was planted at 30 pounds per acre with an International model 620 grain drill with 6 inch spacings between disk openers.

Both experiments were planted on land that had been in irrigated corn the previous year. The millet was not irrigated. The corn ground was spring plowed and disked and harrowed for seedbed preparation. Weed control was good enough that yields could be taken without harvesting problems. Germination and emergence was influenced some by soil and climatic conditions.

After the June 5 planting a high intensity rain storm occurred which crusted the seedbed. The July 5 planting was late and the seedbed was dry which reduced the germination of the millet. No stand counts were taken to determine the severity of the germination problem. No fertilizer was used on this field. Soil tests indicated a high level of phosphate and potash and available nitrates were above average.

The plots were harvested on September 14. The millet was swathed with a field swather one week before combining with a small John Deere combine.

Results and Discussion

Yields of the three planting rates were quite similar as illustrated in Table 1. The 20 pound seeding rate was the highest yielding seeding rate at 21.5 cwt per acre.

Results of the four varieties planted at three different dates are shown in Table 2. Significant differences of the varieties and planting dates are shown by the letters following the yield values. When the same letter is placed behind the values it means that the yields of these varieties are not different. Highest millet grain yields were produced when planted on June 14. The highest yielding variety was Snobird, although there was no significant difference between Snobird, red, and white millet planted on June 14. Manta was significantly lower yielding than the other varieties planted on June 14. For the June 5 planting Manta, Snobird, and white millet were significantly higher yielding than red millet. On July 5 Manta millet was significantly lower yielding than the other three varieties. Test weights were not significantly different for the three planting dates or for the varieties. However, there was a tendency for the July 5 planting to have a lower test weight than the other two plantings.

Highest hay yields were obtained at the June 5 or June 14 planting (Table 2). Manta millet was higher yielding than the other three varieties when planted on June 5, and was significantly higher yielding than red millet when planted on June 14. Millet planted on July 5 produced the lowest amount of hay but the Manta variety was significantly higher in hay yield than Snobird or red.

Table 3 represents the grain yield, hay yields, and test weights of the four varieties of millet when averaged over the three planting dates. Snobird millet was the highest yielding millet, on the average, yielding 20 cwt/A which was significantly higher than

(over)

white millet. White millet was also significantly higher yielding (grain) than red millet and likewise, red millet was significantly higher than Manta millet.

Manta millet yielded significantly more hay than the other three varieties of millet (Table 3). This indicates that Manta (foxtail) millet is a good variety to consider for hay production. There are no significant differences in test weight as shown by the letters following test weight values for the four varieties.

Table 4 illustrates the influence of planting date on the yield of millet when averaged over the four varieties. The maximum yield was produced by planting millet on June 14. This yield was 19.9 cwt/A and was significantly higher yielding than the June 5 planting. The June 5 planting date yielded 17.5 cwt/A and was significantly higher than the 13.2 cwt/A yield for the July 5 planting. Hay yields were not significantly different for the three planting dates. Test weights were not significantly different for the three planting dates, although there was a tendency for the July 5 planting to have a lower test weight.
(Red. 1M--3-74--2118).

Table 1. Yield of Snobird Millet as Influenced by Three Planting Rates.

SEEDING RATE lbs/A	YIELD cwt/A
10	18.8
20	21.5
30	20.4
LSD .05	ns

Table 2. Yield, Test Weight, and Hay Yield of Four Millet Varieties Planted on Three Different Dates.

VARIETY	PLANTING DATE	YIELD* cwt/A	TEST WT.* lbs/Bu	HAY YIELD* tons/A
White	June 5	18.3bc	52.8a	.88bc
Red	June 5	12.9d	50.0a	.64cd
Manta	June 5	17.8bc	50.9a	1.24a
Snobird	June 5	21.0ab	54.0a	.92bc
White	June 14	21.3ab	52.4a	.87bc
Red	June 14	20.2ab	54.4a	.75cd
Manta	June 14	14.7cd	50.4a	1.05ab
Snobird	June 14	23.4a	51.9a	.91bc
White	July 5	15.2cd	46.8a	.68cd
Red	July 5	14.7cd	47.5a	.60d
Manta	July 5	7.4e	47.3a	.90bc
Snobird	July 5	15.5cd	47.9a	.58d

*Any numbers in a column followed by the same letter are not significantly different from each other (Duncan's new multiple range test at .05 level).

Table 3. Hay and Grain Yields of Four Millet Varieties When Averaged Over Three Planting Dates.

VARIETY	GRAIN* cwt/A	HAY* tons/A	TEST WEIGHT* lbs/bu
White	18.3b	.81b	50.6a
Red	15.9c	.67b	50.6a
Manta	13.3d	1.06a	49.5a
Snobird	20.0a	.80b	51.3a

*Any numbers in a column followed by the same letter are not significantly different from each other (Duncan's new multiple range test at .05 level).

Table 4. Influence of Planting Date on the Average Hay and Grain Yields of Four Millet Varieties.

PLANTING DATE	GRAIN* cwt/A	HAY* tons/A	TEST WEIGHT* lbs/bu
June 5	17.5b	.92a	51.9a
June 14	19.9a	.90a	52.3a
July 5	13.2c	.69a	47.3a

*Any numbers in a column followed by the same letter are not significantly different from each other (Duncan's new multiple range test at .05 level).

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EFFECTS OF FERTILIZERS ON YIELDS OF FIVE SPRING WHEAT VARIETIES

Walworth County, 1973

R. C. Ward, P. L. Carson, R. Hoeft, and R. Pylman, Jr.

Summary

Varieties of hard red spring wheat reacted differently to applications of nitrogen fertilizer. The semi-dwarf wheats, Bounty 208 and W.S. 1809, needed larger applications of nitrogen (120 and 80 lbs N/A) to produce near maximum yields while Waldron and Sheridan produced maximum yields at the 40 lbs N/A rate. Of the five varieties Chris produced the highest yields for the no nitrogen treatment. The results indicate that varieties should be selected according to soil fertility level.

Introduction

Results of several variety yield tests have shown some of the semi-dwarf hard red spring wheats yield 4 to 5 bushels per acre more than the adapted tall wheats. Since semi-dwarf yield potentials are higher it implies that they will require more plant food elements. The objective of this experiment was to determine differences in the fertilizer requirements of semi-dwarf and tall wheats.

Procedure

The experiment was conducted on the Don Giese farm southwest of Selby on a silt loam soil (soil association, Agar-Eakin). The field was millet in 1972. It was spring plowed and worked with a disk, field cultivator, and harrow. Wheat was seeded April 23. All of the phosphorus and potassium fertilizer was applied in the seed row. All of the nitrogen except 15 lbs/A applied with the seed was broadcast on the surface May 3. Soil tests on samples taken at time of site selection were: organic matter, 2.7% (medium); phosphorus, 13 lbs P/A (low); potassium, 620 lbs R/A (very high); pH, 7.8 (alkaline); and nitrates, 24 lbs N in 2 feet of soil (low). Harvest was completed August 6 with a small self-propelled combine.

There were 23 fertilizer treatments designed to measure wheat yield response to nitrogen, phosphorus, and potassium fertilizer applications. Rainfall was below normal during the growing season thus reducing the yield possibilities of the wheats. However, enough moisture was available in the soil to provide fair yields. Rainfall at Selby for the growing season was: 0.97 inch in April; 2.03 inches in May; 2.01 inches in June; and 1.13 inches in July for a total of 6.14 inches. Unfertilized wheat used 6.7 inches of water stored in the soil, while the fertilized wheat used 7.7 inches of stored soil water.

Results and Discussion

Yield results are presented in Tables 1, 2 and 3. The treatments have been combined to show response to each element. Table 1 shows the yields of five varieties of spring wheat for five levels of added nitrogen. Waldron, W.S. 1809, and Bounty 208 produced the highest yields when nitrogen was applied. By comparing the yield response of these three varieties, it appears that the semi-dwarf wheats need a greater supply of available nitrogen to produce maximum yields. Waldron reached near maximum yield at 40 lbs N/A, W.S. 1809 at 80 lbs N/A, and Bounty 208 at 160 lbs N/A. Another interesting observation is that Chris produced the most wheat when no nitrogen was applied. These results show that a wheat producer should select varieties that fit his soil fertility and the availability of fertilizer.

The effects of phosphate fertilizer on yields are illustrated in Table 2. The two semi-dwarf wheats (Bounty 208 and W.S. 1809) showed some response to row applied P_2O_5 while the tall wheats did not show response. The effects of added potash are shown in Table 3. Sheridan and Bounty 208 showed a slight response to row applied K_2O. (Red. 1M--3-74--2316)

(Turn page for tables)

Table 1. Effects of applied nitrogen on yield of five spring wheat varieties grown at Selby, South Dakota, 1973.

Nitrogen lbs/A	Chris	Sheridan	Bounty 208	Waldron	WS-1809	Average
			Yield, Bu/A			
0	17.5	11.3	14.7	16.2	15.9	15.1
40	19.7	18.8	21.1	24.3	21.1	21.0
80	20.8	19.3	22.7	24.2	24.6	22.3
120	21.4	18.7	24.9	23.6	25.2	22.8
160	19.8	18.0	22.5	24.2	23.1	21.5
Avg.	19.8	17.2	21.2	22.5	22.0	

Table 2. Effects of applied phosphorus on yields of five spring wheat varieties grown at Selby, South Dakota, 1973.

P_2O_5 lbs/A	Chris	Sheridan	Bounty 208	Waldron	WS-1809	Average
			Yield, Bu/A			
0	20.4	19.0	20.9	24.3	22.3	21.4
17	20.4	19.5	23.1	24.4	22.9	22.1
35	22.3	19.5	23.8	24.4	25.1	23.0
52	20.8	17.9	22.9	23.6	23.4	21.7
69	20.9	17.3	22.8	23.9	23.8	21.7
Avg.	21.0	18.6	22.7	24.1	23.5	

Table 3. Effects of applied potassium on yields of five spring wheat varieties grown at Selby, South Dakota, 1973.

K_2O lbs/A	Chris	Sheridan	Bounty 208	Waldron	WS-1809	Average
			Yield, Bu/A			
0	20.9	17.4	21.6	24.8	23.7	21.7
6	20.3	18.5	21.4	23.7	21.8	21.1
12	20.6	18.4	23.5	23.4	24.7	22.1
18	20.9	18.9	24.5	24.2	24.4	22.6
24	19.4	20.4	22.5	24.7	22.9	22.0
Avg.	20.4	18.7	22.7	24.2	23.5	

LSD .05 level for Tables 1, 2 and 3
for fertilizer 1.9 bu/A
for varieties 2.0 bu/A
for fertilizer X varieties 4.1 bu/A

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EFFECTS OF FERTILIZER ON YIELD OF HARD RED SPRING WHEAT

McPherson County, 1973

R. C. Ward, P. L. Carson, R. Hoeft, and R. Pylman, Jr.

Summary

Hail reduced yields to less than 10 bushel/acre. There was a small response (2.6 bu/A) to 80 lbs N/A. The stiff-strawed semi-dwarf wheat, Bounty 208, produced the highest yields.

Introduction

Yield potential of semi-dwarf wheats is higher than the tall varieties suggesting an increased need for fertilizer. To determine if fertilizer requirements are different for semi-dwarf wheats an experiment was established on the Irwin Krule farm, Eureka, S. D.

Procedure

The soil is a Williams loam and was spring plowed. The crop in 1972 was oats. Wheat was planted April 23. All of the phosphorus and potassium was applied in the seed row. A small amount of nitrogen (15 lbs/acre) was applied in the seed row and the remainder was broadcast May 3. The plot was sprayed for broadleaf weeds. Harvest was completed August 10.

Soil tests were: organic matter, 3.1% (medium); phosphorus, 6 lbs P/A (low); potassium, 430 lbs K/A (high); and nitrates in the upper 2 feet of soil, 26 lbs N/A (low). Rainfall for April was 1.8 inches, May - 1.9 inches, June - 0.8 inches, and July 2.5 inches at Eureka for a total of 7.0 inches.

Five rates of nitrogen, phosphorus, and potassium were applied in various combinations to measure yield response to fertilizer. Although 23 treatments were applied they have been combined so that the yield response can be shown for each element. Rains early in July were accompanied with hail.

Results and Discussion

Yields were very low at this location because of a severe hail storm early in July. The effects of applied nitrogen are shown in Table 1. The very low yields caused by the hail mask the magnitude of response. The 80 pound rate of nitrogen produced a yield large enough to be considered significant. Bounty 208 produced the most yield which probably can be attributed to its straw strength.

The yield response to applied phosphorus was very small for all varieties except Chris. The highest yield increase was 4.7 bu/A when 35 lb rate of P_2O_5/A was applied with the seed (Table 2). The applied potash produced variable results as shown for Bounty 208, Sheridan, and W.S. 1809 (Table 3).

Soil moisture use from planting to harvest was measured. The check plot (no fertilizer) used 2.7 inches of soil water while the well-fertilized plants used 3.3 inches of soil water. (Red. 1M--3-74--2317)

Table 1. Effects of applied nitrogen on yield of five spring wheat varieties grown at Eureka, South Dakota, 1973.

Nitrogen lbs/A	Chris	Sheridan	Bounty 208	Waldron	WS-1809	Average
	Yield, Bu/A					
0	5.1	4.9	7.9	2.6	5.0	5.1
40	7.1	6.7	6.6	5.3	5.7	6.3
80	9.3	6.6	8.4	5.5	8.9	7.7
120	7.6	8.9	9.9	6.3	6.8	7.9
160	6.1	7.2	11.3	4.7	7.4	7.3
Avg.	7.0	6.9	8.8	4.9	6.8	

(Turn page for Tables 2 and 3)

Table 2. Effects of applied phosphorus on yield of five spring wheat varieties grown at Eureka, South Dakota, 1973.

P_2O_5 lbs/A	Chris	Sheridan	Bounty 208	Waldron	WS-1809	Average
			Yield, Bu/A			
0	4.9	6.9	9.4	4.8	8.4	6.9
17	6.8	6.9	8.1	5.8	6.1	6.7
35	9.6	6.6	9.3	5.3	7.4	7.6
52	8.0	8.7	8.4	5.8	6.4	7.5
69	7.9	7.2	11.1	5.2	9.0	8.1
Avg.	7.4	7.3	9.3	5.4	7.5	

Table 3. Effects of applied potassium on yield of five spring wheat varieties grown at Eureka, South Dakota, 1973.

K_2O lbs/A	Chris	Sheridan	Bounty 208	Waldron	WS-1809	Average
			Yield, Bu/A			
0	7.3	6.2	10.0	3.8	7.3	6.9
6	7.2	9.2	7.7	5.7	6.4	7.2
12	7.5	6.5	10.1	6.5	9.1	7.9
18	7.6	6.4	8.8	5.9	6.1	7.0
24	8.3	8.0	9.5	4.6	7.7	7.6
Avg.	7.6	7.3	9.2	5.3	7.3	

LSD .05 level for Tables 1, 2 and 3
for fertilizer 1.7 bu/A
for varieties 1.8 bu/A
for fertilizer X varieties 4.2 bu/A

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Redfield, S. D. 57469

progress report

Agricultural Experiment Station • South Dakota State University • Brookings, S. D. 57006

EFFECTS OF FERTILIZER ON YIELDS

OF HARD RED SPRING WHEAT

Spink County, 1973

R. C. Ward, P. L. Carson, R. Hoeft, and R. Pylman, Jr.

Summary

All varieties of hard red spring wheat responded to fertilizer in the same manner. There were no significant differences among the varieties. Nitrogen fertilizer at the rate of 40 lbs N/A increased yields 6 bushels. There was no yield increases to applied phosphorus and potassium.

Introduction

Semi-dwarf wheats are known to produce well on fertile ground and have been observed to have a 4 to 5 bushel higher yield potential than tall wheats. The objective of this experiment was to measure yield responses of semi-dwarf and tall wheats to applied nitrogen, phosphorus, and potassium. This will determine if more fertilizer should be applied for semi-dwarf wheats than for the tall wheat varieties.

Procedure

Wheat was planted on spring plowed small grain stubble April 23 at the Lowell Styles farm southwest of Brentford, South Dakota. All of the phosphorus and potassium fertilizer was applied in the seed row. A small amount (15 lbs/A) of nitrogen fertilizer was applied with the seed and the remainder was broadcast on the surface May 4. The plot was sprayed with Carbyne to control wild oats and with 2,4-D to control broadleaf weeds. Harvesting was completed August 3 with a small plot combine.

Soil tests on this Harmony silty clay loam were: organic matter, 4.1% (high); phosphorus, 37 lbs P/A (high); potassium, 1000 lbs K/A (very high); nitrates in top 2 feet, 55 lbs N/A (medium). Rainfall at Brentford was about 1.1 inches for April, 1.6 inches for May, 0.5 inches for June, and 1.4 inches for July for a total of 4.6 inches.

Twenty-three fertilizer treatments involving five rates each of N, P, and K in different combinations were applied to five varieties of wheat. The fertilizer treatments were summarized so that the yield response could be shown for each element.

Results and Discussion

Rainfall was below normal for the growing season thus limiting wheat yields. The large amount of available water stored in the subsoil provided enough water to produce yields to 30 bushel per acre. Unfertilized wheat used 5.8 inches of soil water while the more vigorous fertilized plants used 7.0 inches of soil water.

The addition of nitrogen fertilizer significantly increased the yield of all five varietieis of wheat (Table 1). An average yield increase of 6 bu/A occurred from the first 40 lb increment of fertilizer nitrogen. All varieties responded similarly to nitrogen fertilizer.

The yield response to added phosphorus (Table 2) was not large enough generally to pay for the fertilizer. Potassium applications (Table 3) did not affect yields positively.

There was no significant difference among the five wheat varieties as shown by the LSD (least significant difference) values. There was no significant interaction (fert. X var.) meaning that all five varieties of wheat responded to fertilizer in the same pattern. (Red. 1M--3-74--2318)

Table 1. Effects of applied nitrogen on yield of five spring wheat varieties grown at Brentford, South Dakota, 1973.

Nitrogen lbs/A	Chris	Sheridan	Bounty 208	Waldron	WS-1809	Average
			Yield, Bu/A			
0	17.5	22.1	20.6	23.7	19.1	20.6
40	26.1	29.9	24.9	26.3	26.3	26.7
80	26.0	28.0	24.9	24.3	25.3	25.7
120	27.3	26.6	29.9	29.5	25.4	27.7
160	24.4	30.8	27.6	27.6	26.1	27.3
Avg.	24.3	27.5	25.6	26.3	24.4	

(Tables 2 and 3, next page)

Table 2. Effects of applied phosphorus on yield of five spring wheat varieties grown at Brentford, South Dakota, 1973.

P_2O_5 lbs/A	Chris	Sheridan	Bounty 208	Waldron	WS-1809	Average
			Yield, Bu/A			
0	23.0	27.2	24.2	24.6	25.8	25.0
17	26.3	28.0	28.2	26.4	26.5	27.1
35	26.5	29.7	25.9	25.4	24.6	26.4
52	27.1	28.5	26.5	29.7	25.2	27.4
69	25.8	31.4	28.8	28.1	27.2	28.3
Avg.	25.7	29.0	26.7	26.8	25.9	

Table 3. Effects of applied potassium on yield of five spring wheat varieties grown at Brentford, South Dakota, 1973.

K_2O lbs/A	Chris	Sheridan	Bounty 208	Waldron	WS-1809	Average
			Yield, Bu/A			
0	25.8	31.5	29.1	26.6	24.1	27.4
6	27.0	26.8	25.7	25.9	25.0	26.1
12	26.3	29.5	23.0	24.9	26.4	26.0
18	26.4	29.6	29.1	29.9	26.6	28.3
24	23.2	27.3	27.7	26.8	26.6	26.3
Avg.	25.7	28.9	26.9	26.8	25.7	

LSD .05 level for Tables 1, 2 and 3
- for fertilizer 4.1 bu/A
- for varieties ns
- for fertilizer X varieties ns