Progress Report 1977

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

Agricultural Experiment Station
South Dakota State University

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South Dakota State University

PR-1-77

1976 WEATHER

JAMES VALLEY AGRICULTURAL RESEARCH AND EXTENSION CENTER

Climate conditions of 1976 are shown in the table. Precipitation was extremely limited during the growing season. The lack of topsoil or subsoil moisture restricted proper germination of crop seed and induced stress in the crops early in their growth. This limited moisture coupled with extended periods of high velocity southerly winds and daily temperatures above normal during the summer months limited plant growth seriously. Moisture received in September allowed for good germination of fall seeded grains.

Water supply in the James River was adequate for irrigation until July 17, at which time the water level dropped so low that pumping had to be discontinued. Difficulty with irrigation equipment during the first part of June contributed to the moisture stress on irrigated experiments. Therefore, yields of some experimental plots were reduced because of less than adequate irrigation.

Table 1. Precipitation, Temperature and Evaporation Data for the James Valley Agricultural Research and Extension Center for 1976.

Month	Precip. inches	Departure	Temp. (°F)	Departure	Evap. open pan inches
Jan.	0.64	+0.29	10.5	+0.3	—
Feb.	0.95	+0.59	29.5	+11.8	—
March	0.39	-1.08	29.6	+1.3	—
April	0.62	-2.57	49.6	+5.8	6.30
May	0.53	-2.00	55.5	-1.6	8.50
June	3.72	-1.13	70.4	+3.6	11.61
July	1.41	-1.08	75.3	+3.0	11.79
Aug.	0.54	-1.59	75.5	+4.7	12.97
Sept.	1.76	+0.14	61.0	+0.5	8.28
Oct.	1.00	-0.22	43.6	-5.1	—
Nov.	0.00	-0.59	27.0	-5.3	—
Dec.	0.27	-0.12	15.6	-3.3	—
Total	11.83	-9.36		15.7	59.45

Last frost: May 17 (31°F)
First frost: Sept. 23 (26°F)
Frost free days: 128

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EFFECT OF TILLAGE ON YIELD OF FURROW IRRIGATED CORN

Joseph F. Giles and Robert A. Sanders

This experiment was to compare the yield of corn on land that was fall plowed and spring disked to that on land which was spring disked only. These two conventional tillage methods were also supplemented with a bedding system to facilitate preemergence irrigation.

Procedure

The land in 1975 was in corn which was harvested for grain. Following stalk chopping half of the area was plowed with a moldboard plow. On May 18 both the plowed area and disked half were tandem disked. Trojan TX102 was planted on May 19 at a population of 27,100 seeds per acre in 36 inch rows. Half of the plowed and disked area was planted with a conventional planter with the remaining half being planted with a bedding system. This system combines the bed-shaping, furrow-forming and seed-planting into one operation. Mocap insecticide (7.5 lbs/A) and Lasso herbicide (20 lbs/A) were banded over the row at planting time. Due to the extreme dry conditions, the bedded areas of the field were irrigated on June 1 with approximately 3 inches of water being applied on June 14, the conventional planted areas were rotary hoed to break the soil crust. The bedded areas were cultivated on June 23, and the fall plowed conventional planted corn was cultivated on June 28. Nitrogen was applied as anhydrous ammonia at 180 lbs actual N per acre to all the tillage areas on July 7. Three inches of water were applied to the bedded areas on July 8. Following a cultivating-hilling operation, on the conventional planted areas on July 14, a 3 inch application of water was put on all tillage areas. Corn yields were hand harvested on November 2.

Results and Discussion

Yield, moisture content of ear corn, and plant population for each of the tillage treatments are given in Table 1. Yields given are based on 15% moisture content. The yields reflect the order in which the corn germinated and the growth difference visually observed during the growing season between the tillage treatments. The bed planted yield was significantly greater than the conventional planted on both the fall plow and spring disk tillage. Because of the irrigation furrow formed at the time of planting with the bedder, a preemergence irrigation was possible. This application of water resulted in an early seed germination. The fall plowing was significantly higher yielding than the spring disking regardless of the method of planting. There was no significant difference between the spring disk-bed yield and the fall plow-conventional although the spring disk-bed received three times more the amount of water.

The ear corn moisture content reflect the stage of maturity the plants were at when soil profile moisture became limited due to lack of irrigation water. Moisture contents decreased very slowly following a killing frost because of immature grain. There was no difference in plant population among the tillage treatments.

During the dry spring the residue left by the disking operation was a disadvantage. The double disk openers could not penetrate the excess surface residue and a more uniform planting depth resulted with many shallow on surface seedings. Removal of the surface residue with the bedder resulted in a uniform seed placement depth.

Table 1. Effect of Tillage on Yield, Moisture Content and Population of Corn.

Tillage Treatment	Yield Bu/A	Moisture %	Population Plants/A
Fall plow-conventional	44.6	32.40	19,900
Fall plow-bed	77.4	26.51	20,600
Spring disk-conventional	12.9	49.21	18,800
Spring disk-bed	50.9	32.95	20,300

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PRODUCTION OF NAVY BEAN VARIETIES UNDER LIMITED IRRIGATION

Joseph F. Giles and Robert A. Sanders

Navy beans are grown principally in Michigan and Minnesota, but there is interest in producing them under irrigated conditions in South Dakota. The objective of this study was to determine the yield of seven varieties of navy beans under furrow irrigation.

Procedure

The land was in spring wheat in 1975 and was fall plowed, tandem disked, treated with treflan and tandem disked again to incorporate the treflan. The beans were planted June 2 at 40 lbs of seed per acre in 30 inch rows.

The beans were cultivated twice. The plants were very small at time of second cultivation due to the lack of moisture; therefore, furrows were made on every other row. Only one application of water was possible because of shortage of irrigation water. An estimated water application of 3 inches was made on July 17. Yield samples were taken Sept. 17 by hand harvesting 30 feet of row. Final yields were adjusted to 14% moisture.

Results and Discussion

The yields obtained from the seven varieties are shown in Table 1. The later maturing varieties were higher yielding than the early varieties. Due to the wide variability of harvest samples within each variety, there was no statistical significance between the varieties although the yields differ greatly.

Table 1. Yield of Navy Beans Under Limited Irrigation Conditions.

Variety	Yield lbs/A
Black Turtle	1424
Upland	968
Sanilac	846
Snow Bunting	831
Sea Farer	778
Snow Flake	588
Charity	568

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BI-LEVEL DRAINAGE EVALUATION

Shu Tung Chu and Darrell W. DeBoer

Water table levels and drain line discharge data were collected during the summer under fallow cropping conditions. The data will be used to evaluate the accuracy of a bi-level drainage theory. Bi-level drainage, as shown in Figure 1, is where subsurface drain lines are at two different depths below the soil surface.

The experimental area was irrigated during the early part of June to raise the water table to the soil surface. Field measurements were made from early June to early August as the water table dropped from the soil surface to the deep drain line evaluation.

Approximately 4.5 inches of rainfall was received during the testing period. The fluctuation of the water table after a rainfall event will be used to determine the amount of ground water recharge.

The top view and the profile of the drainage plot including water table levels at selected time along the west line of observation wells are shown in Figure 1. The water table fluctuations and drain line flow are listed in Tables 1 and 2.

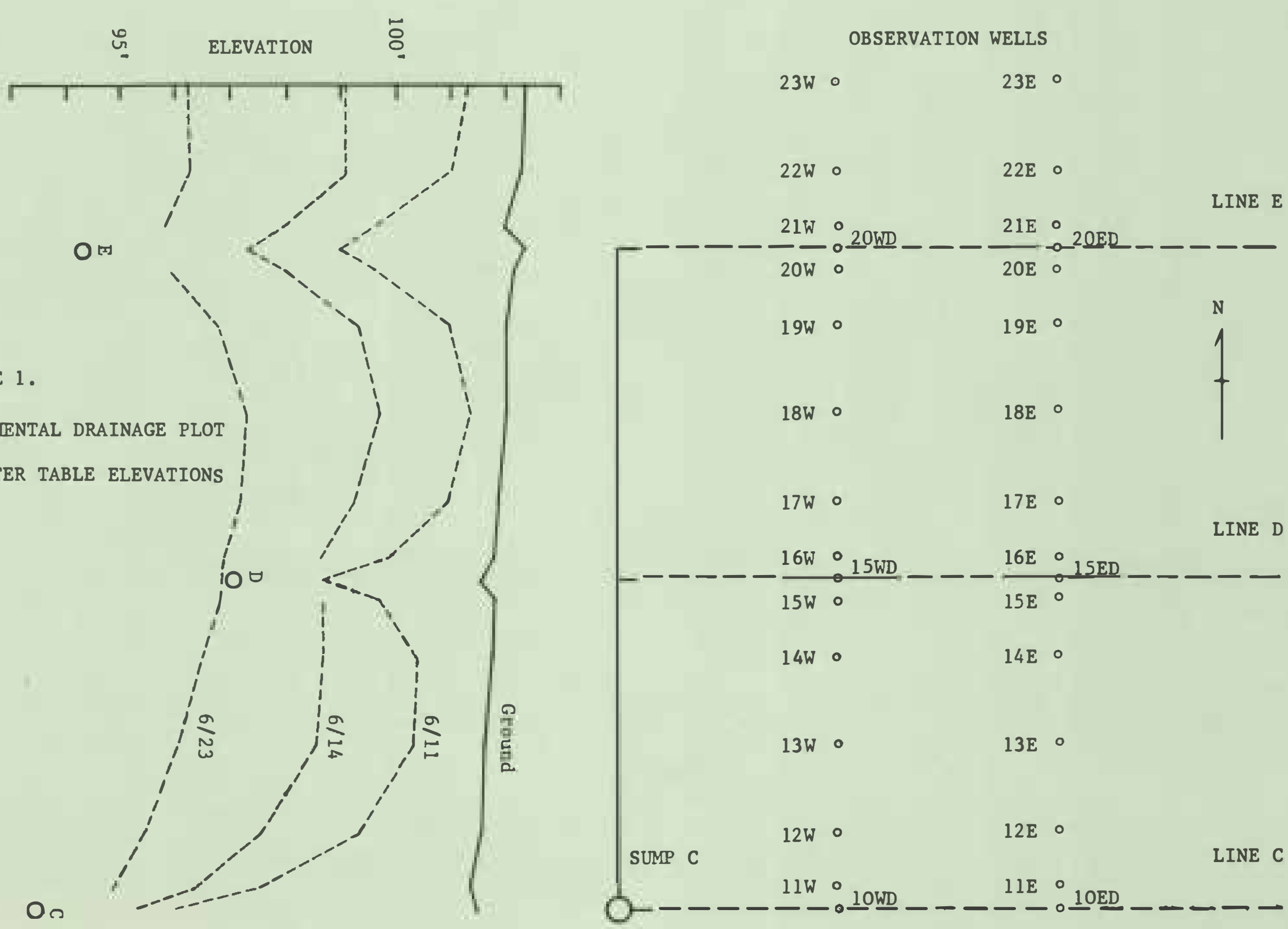

FIGURE 1.

EXPERIMENTAL DRAINAGE PLOT AND WATER TABLE ELEVATIONS

TABLE 1: WATER TABLE ELEVATIONS (NORTH DRAINAGE PLOT, REDFIELD, 1976), in feet

Well #	6/10	6/11	6/14	6/15	6/16	6/17	6/18	6/21	6/22	6/23	6/24	6/25	6/28	6/29	6/30	7/1	7/2	7/6	7/9	7/16	7/20	7/23	7/27	7/30	8/3
10ED	97.94	97.49	96.29	95.94	95.89	95.64	95.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11E	99.21	98.66	97.06	96.71	96.66	96.31	96.06	95.66	95.56	95.46	95.56	96.16	95.96	95.76	95.66	95.51	95.41	95.06	94.96	-	-	-	-	-	-
12E	101.22	100.42	98.32	97.67	97.57	97.17	96.97	96.42	96.22	96.12	96.82	97.42	96.87	96.62	96.52	96.27	96.17	95.62	95.32	-	-	-	95.02	-	-
13E	101.49	101.34	99.29	98.84	98.69	98.29	97.99	97.29	97.09	96.94	98.64	98.69	97.94	97.49	97.49	97.19	96.99	96.29	95.84	95.29	95.04	95.04	94.99	94.79	-
14E	101.21	101.41	99.31	98.96	98.81	98.51	98.26	97.66	97.51	97.36	98.76	98.96	98.36	98.06	97.91	97.66	97.51	96.56	96.26	95.56	95.51	95.46	95.46	95.51	-
15E	100.27	100.02	98.87	98.47	98.47	98.37	98.07	97.62	97.47	97.32	98.47	98.62	99.17	98.02	97.87	97.72	97.47	96.82	96.32	95.62	95.57	95.42	95.27	95.17	-
15ED	98.86	98.86	98.81	96.96	96.96	96.86	96.56	96.11	95.96	95.81	96.96	97.11	97.66	96.51	96.36	96.21	95.96	95.31	94.81	94.11	94.06	93.91	93.76	-	-
16E	100.78	100.33	98.93	98.58	98.58	98.33	98.18	97.73	97.53	97.33	98.68	98.78	98.33	98.03	97.88	97.73	97.58	96.88	96.38	95.73	95.68	95.43	95.23	95.13	-
17E	101.51	101.76	99.41	99.01	99.01	98.76	98.51	98.01	97.71	97.61	99.06	99.21	98.61	98.31	98.16	97.96	97.71	96.76	96.31	95.71	95.66	95.66	95.66	95.46	-
18E	102.16	101.46	99.71	99.36	99.26	99.26	98.76	98.16	97.81	97.46	99.06	99.26	98.66	98.31	98.06	97.91	97.71	96.81	96.61	95.76	95.66	-	95.56	95.31	-
19E	101.57	101.27	99.52	99.12	98.97	98.47	98.27	97.32	97.37	97.17	97.97	98.47	98.02	97.62	97.47	97.32	97.17	96.37	-	-	95.27	95.22	95.17	94.97	-
20E	101.27	100.67	98.97	98.57	98.17	97.97	97.77	97.17	96.92	96.77	97.22	97.97	97.47	97.22	97.02	96.92	96.72	96.02	95.92	95.17	95.12	95.07	95.12	95.37	-
20ED	100.58	100.03	98.33	97.93	97.78	97.48	97.18	96.63	96.43	96.28	96.48	97.23	96.83	96.63	96.48	96.33	96.23	95.73	95.48	94.88	94.93	94.88	94.73	95.58	-
21E	101.63	100.38	98.63	98.18	98.03	97.63	97.33	96.78	96.53	96.33	96.53	97.33	96.98	96.73	96.58	96.43	96.28	95.73	95.48	94.83	94.78	94.83	94.78	94.58	-
22E	101.84	100.63	98.78	98.38	98.13	97.68	97.33	96.63	96.33	96.13	96.23	97.13	96.78	96.53	96.38	96.18	96.03	94.93	-	-	-	-	-	-	-
23E	101.13	101.18	98.93	98.43	98.18	97.43	97.33	96.63	96.38	96.18	96.03	96.93	96.78	96.53	96.38	96.23	96.08	95.38	95.13	-	-	-	-	-	-
10WD	96.36	95.96	95.26	95.06	95.06	94.96	94.96	94.96	94.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11W	97.91	97.51	96.31	96.26	95.91	95.81	95.61	95.36	95.01	94.81	94.71	94.86	94.91	94.81	94.81	94.76	94.66	94.51	94.41	94.16	94.76	94.56	94.41	94.26	94.26
12W	99.97	99.27	97.52	97.02	96.72	96.47	96.22	95.72	95.52	95.37	95.27	95.57	95.62	95.52	95.42	95.37	95.27	94.97	94.82	94.47	94.82	94.87	94.72	94.52	94.37
13W	100.86	100.31	98.51	97.86	97.66	97.31	97.06	96.41	96.21	96.01	95.91	96.46	96.41	96.26	96.21	96.06	95.96	95.56	95.31	95.01	95.21	95.21	95.06	94.86	94.71
14W	100.94	100.34	98.64	98.14	97.89	97.64	97.44	96.84	96.54	96.44	96.34	97.19	96.94	96.74	96.64	96.54	96.39	95.89	95.64	95.29	95.39	95.34	95.29	95.04	94.94
15W	100.08	99.68	98.43	98.18	97.98	97.83	97.58	97.13	96.93	96.78	96.83	97.38	97.18	97.08	96.98	96.93	96.78	96.18	95.93	95.53	95.58	95.58	95.48	95.13	94.98
15WD	98.62	98.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16W	100.55	99.85	98.60	98.30	98.20	97.90	97.75	97.25	97.05	96.85	96.95	97.70	97.35	97.20	97.00	96.95	96.90	96.25	96.05	95.60	95.65	95.60	95.55	95.20	95.10
17W	101.43	100.93	99.18	98.83	98.73	98.38	98.13	97.53	97.23	97.13	97.38	98.03	97.63	97.38	97.28	97.18	96.98	96.48	96.13	95.63	95.63	95.58	95.58	95.43	95.23
18W	101.16	101.36	99.66	99.31	99.16	98.76	98.56	97.76	97.46	97.26	97.61	98.21	97.66	97.41	97.31	97.16	97.06	96.56	96.21	95.61	95.61	95.56	95.51	95.26	95.11
19W	101.37	100.97	99.27	98.77	98.57	98.17	97.87	97.17	96.97	96.77	96.72	97.37	97.07	96.87	96.82	96.62	96.52	96.12	95.87	95.32	95.32	95.37	95.22	94.97	94.82
20W	100.27	99.62	98.02	97.57	97.42	97.07	96.72	96.22	96.02	95.92	95.82	96.32	96.22	96.02	95.92	95.87	95.72	95.42	95.22	94.77	94.87	94.77	94.67	94.42	94.42
20WD	99.68	98.98	97.28	96.83	96.68	96.33	96.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21W	100.31	99.61	97.96	97.51	97.31	96.81	96.61	96.11	95.96	95.81	95.71	96.11	96.06	95.91	95.76	95.66	95.61	95.31	95.21	-	-	-	-	-	-
22W	101.55	101.00	99.10	98.55	98.25	97.80	97.40	96.70	96.40	96.25	96.10	96.60	96.50	96.45	96.20	96.05	96.00	95.55	95.30	-	94.75	-	-	-	-
23W	101.68	101.28	99.08	98.53	98.18	97.73	97.38	96.58	96.38	96.23	96.08	96.48	96.43	96.18	96.13	95.98	95.83	95.38	95.03	-	-	-	-	-	-

TABLE 2. DRAIN LINE FLOW (in cubic feet per day)

Drain length = 150'

Time		Drain Line B	Drain Line C	Drain Line D
6/8	9:45	301	-	1541
	10:23	295	-	1520
	11:45	259	-	1174
	4:35	136	700	492
6/9	4:10	29	387	195
6/10	3:45	76	472	345
6/11	4:10	48	389	257
6/14	8:50	4	236	96
	3:35	5	224	114
6/15	1:30	3	196	83
6/16	3:20	2	140	67
6/17	1:30	0	157	60
6/18	4:00	0	152	58
6/21	3:35	0	104	14
6/22	2:40	0	71	9
6/23	1:30	0	70	0
6/24	3:00	0	54	37
6/25	8:55	0	97	74
	3:40	0	60	58
6/28	3:55	0	77	28
6/29	3:55	0	76	25
6/30	2:55	0	74	28
7/1	3:45	0	54	8
7/2	2:55	0	58	0
7/6	4:10	0	83	0
7/9	4:35	0	51	0
7/16	3:40	0	25	0
7/27	4:55	0	55	0
7/30	4:55	0	45	0
8/3	4:00	0	39	0

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PERFORMANCE OF HERBICIDES IN CORN AND SOYBEANS

W. E. Arnold and L. J. Wrage

Herbicide demonstration plots are the final step in the herbicide testing program. These plots include those treatments that have been labeled and are available to producers. Rates and application methods for each treatment are based on results obtained in previous year's screening tests.

Methods

Preplant and preemergence herbicides were applied on corn and soybean plots on May 25. All treatments were made with a plot sprayer using 20 gpa water. Preplant treatments were incorporated immediately with two tandem diskings set to cut 5-6 inches deep (except Cobex--3-4 inches) and harrowed. Plots were planted in 30-inch rows on May 25. There was .12 and .07 inches of rain one and two weeks after planting, respectively. Post-emergence herbicides were applied

Table 1. Corn Herbicide Demonstration Plots

		Percent Weed Control					
		Not Cult.		One Cult.		3-Yr. Avg.	
Treatment	lb/A a.i.	Gr	Bdlf	Gr	Bdlf	Gr	Bdlf
PREPLANT INCORPORATED							
Check	---	0	0	60	50	0	0
Eradicane	3	84	75	90	90	--	--
Eradicane	4	94	80	96	95	96	87
AAtrex/Atrazine	2½	82	95	95	96	92	97
Sutan+	4	85	75	90	80	87	78
Sutan+ + Atrazine	3+1	92	95	98	99	94	95
Sutan+ + Bladex	3+1½	90	94	96	98	90	91
PREEMERGENCE							
AAtrex/Atrazine	2½	70	94	75	95	79	94
Bladex	3	60	90	75	95	70	80
Cycle	3	45	75	85	85	--	--
Prowl	2	65	70	80	80	75	79
Ramrod/Bexton	5	90	70	95	92	92	79
Lasso	3	95	70	96	95	93	81
Dual	3	86	60	90	88	--	--
Lasso + Atrazine	2+1	65	88	88	90	85	92
Lasso + Bladex	2+1½	70	90	90	96	84	93
Lasso + Banvel	2+½	80	92	95	98	88	93
Ramrod + Atrazine	3+1	70	86	92	96	84	91
Ramrod + Bladex	3+1½	70	90	95	98	85	91
POST-EMERGENCE							
AAtrex/Atrazine + oil	1½+1 gal.	80	96	88	96	73	98
Bladex	1½	84	98	88	96	63	98
Cycle	1½	70	95	95	98	--	--
PREEMERGENCE & POST							
Ramrod & 2,4-D amine	5&½	96	98	98	98	--	--
Ramrod & Banvel	5&¼	96	95	98	98	--	--

Gr = annual grasses
Bdlf = annual broadleaved weeds

when annual grasses were 1-1.5 inches and broadleaves 1-2 inches tall.

Weed pressure was moderate. Annual grasses included green and yellow foxtail. Annual broadleaves most common were rough and prostrate pigweed and lambsquarters. Half of each plot was cultivated once.

Results

The performance of several corn and soybean herbicide treatments in 1976 is presented in the following tables. A 3-year (1974, 1975, 1976) average for uncultivated plots is included as a comparison. Plots were evaluated July 5. Visual ratings reported for each treatment are shown as percent control compared to an untreated plot.

Weed control varied considerably, ranging from poor or marginal to excellent. Nearly all preplant incorporated treatments provided very good control of susceptible species. Preemergence treatments generally were less satisfactory. The lack of sufficient rainfall explains most of the variation.

One cultivation tended to improve weed control, especially if control was poor or marginal. Cultivation appeared to improve broadleaved weed control more than for grasses. This is probably because many of the herbicides are most effective on grasses.

The 3-year average weed control ratings compare treatments over a range of conditions. Those herbicides most effective on grasses or broadleaves provided a high degree of grass or broadleaved control, respectively. Combination or overlay treatments provided a high degree of control for grasses and broadleaved weeds.

Table 2. Soybean Herbicide Demonstration Plots

		Percent Weed Control			
		7/5/76		3-Yr. Avg.	
Treatment	lb/A a.i.	Gr	Bdlf	Gr	Bdlf
PREPLANT INCORPORATED					
Check	—	0	0	0	0
Treflan	3/4	95	98	94	97
Cobex	½	93	97	94	94
Tolban	1	95	95	94	93
Basalin	1	96	95	—	—
Vernam	2½	95	98	85	94
Treflan + Sencor/Lexone	3/4+3/8	94	92	—	—
PREPLANT INC. AND PRE					
Treflan & Sencor/Lexone	3/4&3/8	96	99	98	99
Treflan & Lorox	3/4&1	96	98	98	99
PREPLANT INC. & POST					
Treflan & Basagran	3/4&1	96	96	95	97
PREEMERGENCE					
Amiben	3	88	88	91	87
Lasso	3	94	75	94	82
Lasso + Sencore/Lexone	2+3/8	92	70	94	80
Lasso + Maloran	2+1½	90	55	—	—
Lasso + Lorox	2+1	88	72	92	85
Lasso + Modown	2+2	88	82	—	—
Lasso + Premerge	2+3	88	78	—	—
Lasso + CIPC	2+3	88	92	—	—
Sencore/Lexone	½	70	95	76	96

Gr = annual grasses
Bdlf = annual broadleaved weeds

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HERBICIDE CARRYOVER

L. J. Wrage and W. E. Arnold

The residual activity (carryover) of herbicides is important when planning crop rotations or when selecting the herbicide treatment for a specific rotation. Treatments are evaluated for carryover potential as part of the herbicide screening and demonstration program each year. Residual activity is evaluated by planting a sensitive crop such as oats over the previous year's row-crop herbicide plots. The carryover effect is evaluated by visual rating or grain yield. Herbicide carryover is an important consideration for the 1976-77 season.

CROPPING SEQUENCE SUGGESTIONS
Drought Conditions - 1976-77

Unusually dry conditions may result in carryover from herbicide treatments that normally would not cause problems. Also, effects may be greater than usual from treatments which normally result in some carryover.

Dry conditions have resulted in changes in intended crop rotations. Fall or spring grain may be planted instead of the usual row crops. Carryover from 1976 herbicides is an important consideration. Some extreme conditions (1-4 inches total rainfall since application) have been reported.

Late fall or early spring moisture is less effective for herbicide degradation due to low temperatures. Herbicide rate, soil texture, soil pH and tillage are also important factors. Moldboard plowing prior to planting 1977 crops reduces the potential for crop injury from most herbicides having carryover potential under dry conditions.

These guidelines are based on information available from other states, industry data and experience in South Dakota. Some suggestions are speculative and conservative and are offered with the intent that, where alternatives exist, carryover risk can be eliminated or reduced. Data based on unusually dry conditions are not available for some treatments. These suggestions pertain only to situations in South Dakota for the 1976-77 season.

HERBICIDE IN 1976	SUGGESTIONS
atrazine (AAtrex, Atrazine)	Do not plant small grain, grass or alfalfa in the fall of 1976. Crop choices for 1977 without risking plant injury are limited to corn, sorghum and millet. Some injury from 1975 applications may be observed on sensitive crops planted in 1977, particularly where high rates, spraying overlap, clay knolls or high pH are associated.
cyprazine (Fox-4, Outfox)	Do not plant small grain, grasses or alfalfa in fall of 1976. Crop choices for 1977 without risking plant injury are limited to corn, sorghum and millet.
chlorbromuron (Maloran, Bromex)	Little risk of injury on fall-seeded wheat or rye. Injury may occur on fall-seeded grasses or small-seeded legumes. No injury expected on spring-planted crops.
linuron (Lorox)	Little risk of injury on fall-seeded wheat or rye. Injury may occur on fall-seeded grasses or small-seeded legumes. No injury expected on spring-planted crops.

cyanazine (Bladex)	Little risk of injury to fall-seeded wheat or rye. Injury may occur on fall-planted small-seeded legumes and grasses. No injury expected on spring-planted crops.
picloram (Tordon) (on small grain)	Do not plant alfalfa in fall of 1976. Do not plant soybeans, sunflowers, dry beans or alfalfa in 1977.
metribuzin (Sencor, Lexone)	Some injury potential for fall-seeded small grain grasses or legumes. Injury from carryover has been observed on oats and may occur in 1977 in extreme situations. Problems can be expected on high pH soils or overlapping application. Some injury may occur on small grain planted in potatoe fields treated in 1976.
trifluralin (Treflan)	Do not plant small grain or grasses the fall of 1976. Based on label restrictions and residue tests on soil samples taken in adjacent states this fall, the following suggestions are offered: Do not plant oats or sorghum in 1977. If 3/4 lb/A was used and there was less than 7 inches of rain or if 1 lb/A was used with less than 11 inches of rain during the season, don't plant crops other than soybeans, sunflowers or dry beans unless the field is deep (moldboard) plowed. If the field is plowed, problems on corn planted in 1977 are not anticipated. Corn injury has been reported in some states where fields were chisel plowed, disked or field cultivated without moldboard plowing.
dinitramine (Cobex) profluralin (Tolban) fluchloralin (Basalin) penoxalin (Prowl)	Do not plant small grain or grasses in the fall of 1976. There are no label restrictions for crops to plant in 1977, suggesting that crop injury from carryover is not anticipated based on current label data. However, the same 1977 crop suggestions as for trifluralin are offered as a precautionary measure for extremely dry conditions.
propazine (Milogard)	Do not plant small grain, grasses or legumes in fall of 1977. Sorghum may be planted in 1977 without risk of injury.
alachlor (Lasso) propachlor (Ramrod, Bexton) chloramben (Amiben)	No injury anticipated for fall-planted wheat or rye. Granules may persist longer than spray formulations. Suggest tillage across the bands prior to fall-planted crops unless most extreme drought conditions. No injury expected on spring-planted crops.
butylate (Sutan+) EPTC (Eradicane) vernolate (Vernam)	No injury anticipated for fall-planted wheat or rye. However, the Sutan+ label states soil residues will be dissipated by time of crop harvest under normal growing conditions. No injury anticipated for spring-planted crops.
2,4-D dicamba (Banvel)	No injury for fall or spring crops from rates applied in crops during 1976.

(TO BE REVISED WHEN ADDITIONAL DATA BECOME AVAILABLE) 9/76, Revised 12/76.

Progress Report 1977

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

Agricultural Experiment Station
South Dakota State University

PR-7-77

RECLAMATION AND IMPROVEMENT OF GLOSSIC UDIC NATRIBOROLLS (ALKALI CLAYPAN SOILS)

L. O. Fine and P. D. Weeldreyer

The experiments concerned with the modification and improvement of claypan soils of the Lake Dakota basin were continued at the site leased from Glenn Mager 5 miles northwest of the Center.

General Operations

All plots were spring plowed to a depth of 7-8 inches about April 15. Wet soil conditions resulted in clod formation in several areas. The areas normally irrigated were planed slightly by using an Eversman level on April 30. Ammonium nitrate was broadcast to supply 157 lbs of N per acre. On May 4 the plots were double-disked and harrowed three times. The soil surface was lightly rototilled on May 13 to break up the larger clods.

A major modification was used in planting corn this season; an "Orthman Tribedder" with 4 uniboxes using double disk openers, mounted on the rear, was used. This machine forms dikes and furrows parallel to plant rows and is useful in surface irrigation of soils which have not been leveled. Each row has a furrow on one side and a dike on the other for water control. Sokota hybrid SS-51 was planted May 18 at a rate of approximately 28,000 seeds per acre. Pre-emergent weed control was accomplished by banding Lasso II at 20 lbs/A (treated area); and corn root worm control, by MoCap at 7.5 lbs/A (treated area). Additionally, 1.2 lbs/A of Atrazine with oil was applied on June 16 to aid in grass control. Severe grasshopper migration from adjacent areas required spraying the borders with Malathion on July 23 and with Toxaphene on July 26.

Extremely dry surface conditions and very poor germination indicated the need for irrigation to obtain an adequate stand. We irrigated the entire experiment May 25-28, thus the formerly nonirrigated area received this irrigation. There were no dryland plots this year. Without the use of the "Tribedder" this irrigation would have been impossible. We also used a water meter on our main line to measure our irrigation water. This first irrigation was 4.7 inches of water. This approximated bringing the whole site to field capacity. On June 21 and 22 we thinned the corn stand on the plots we did not plan to irrigate again (the normally dryland plots). We removed alternate plants except where one was missing. Final stand counts were made on Sept. 20 with the full season irrigated plots averaging 22,420 plants per acre and the other plots averaging 15,100 plants per acre. The corn was also cultivated once on June 29.

Due to the extreme drought experienced again in July and August the corn on the plots irrigated only once experienced severe drought, though production was much higher than the dryland of 1975. Without the initial irrigation our dryland plots would have yielded very little grain.

Irrigations - Rainfall

A total of five irrigations were accomplished, using the furrow technique. The first one, May 25-28, covered the complete area. The following four (July 8, 9, 12 and 13, July 21-23, July 30-Aug. 16 and 20, Aug. 20-30) were applied to the areas normally irrigated. A total of 19.66 inches was applied with the five irrigations. The James River went completely dry and we were unable to pump water from Aug. 1-15. For this reason the fourth irrigation was spread out over a 22-day period. This was unfortunate as this was also the critical period of tasseling and ear set. Rainfall after planting May 18 amounted to .1 inch in May, 3.15 inches in June, .60 inch in July, .28 inch in August, and 1.81 inches in September.

Table 1. James River Irrigation Water Quality

Date of Sampling	E.C. Micro mhos/cm	Sodium Adsorption Ratio
May 26, 1976 (Irrig. -1)	590	1.53
July 9, 1976 (Irrig. -2)	770	1.70
July 21, 1976 (Irrig. -3)	830	2.74
Aug. 16 & 20, 1976 (Irrig. -4)	1170 (avg.)	2.82 (avg.)
Aug. 24 & 30, 1976 (Irrig. -5)	1350 (avg.)	3.25 (avg.)
Oct. 22, 1976 (End of season)	1360	Not determined

Drainage

The pump was installed March 30 and drainage was initiated. Drainage due to natural precipitation continued until about May 10. The flowage started again May 27 after the initial irrigation and continued until about August 1; though it reached a very low flow condition prior to the July 8 irrigation. Sufficient water was not pumped to reinitiate drainage after the last two irrigations. Table 2 contains the information on drainage water quality and quantity.

Table 2. Drainage Water Observations, 1976

Date	Water pumped since previous reading, cu. ft.	EC micro-mhos/cm	Sodium adsorption Ratios
March 30	100	1100	2.71
April 30	2307	2970	6.27
May 4	81	3310	5.89
May 28	294	1740	2.94
June 4	378	2650	4.78
June 10	1676	2790	4.98
June 16	893	3310	5.47
June 22	354	4240	5.94
June 29	771	3090	4.81
July 2	307	3230	4.97
July 9	53	4480	5.32
July 12	865	3480	4.93
July 16	388	4630	6.80
July 21	1127	5130	7.76
July 23	396	4850	6.31
July 26	711	5180	6.78
Aug. 4	553	5480	8.54
(no flow)			
Season total	11,254		

Total drainage was equivalent to 0.29 inches of water from the 10.8 acres of the site.

The drainage system was not designed for the measurement of total drainage but rather as an access to the soil water solution present in the root zone. It is believed it does give a good representation of drainage water quality that will be experienced with the Oahe Project in similar circumstances.

Again this year the water quality in the drain lines was highest at the beginning of flowage or during periods of high volume flow and gradually deteriorated as the flow diminished. Also the salinity became quite high toward the end of flowage, probably due in part to the higher salinity of the James River Irrigation water.

Yields

The corn yields for 1976 produced and harvested as average of four replications are summarized below in Bu/A of corn at 15% moisture.

Deep-Plowed		Shallow Plowed	
5 Irrig.	1 Irrig.	5 Irrig.	1 Irrig.
121.7	62.8	102.2	50.3

Plans

This experiment has been extended one year and will be terminated after the 1977 crop year. Infiltration tests will be completed and soil samples will be taken. Some of the final soil sampling and infiltration work has been done. All plots will again be planted to corn in 1977.

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1976 PERFORMANCE TRIALS OF WINTER SMALL GRAINS, CORN AND GRAIN SORGHUM

J. J. Bonnemann

Performance trials with winter small grains, corn and grain sorghum were seeded at the James Valley Agricultural Research and Extension Center for the 1976 crop year. The serious drouth was not favorable for row crop production.

Germination and survival of the fall seeded small grain was good for adapted varieties. Several winter wheat varieties, especially some experimental lines from southern states, suffered varied losses from winter kill. Overall, conditions were very favorable and excellent yields of winter wheat were obtained. The rye yields were not outstanding but the test weight was good. The small grain trials were on a dryland portion of the station, fallowed in 1975, and the field did not receive any supplemental water in 1976.

All small grain yields are averages of four replications. The trials were seeded Sept. 11, 1975 and harvested July 13, 1976. The trials were seeded as 6-row plots, 10-inch spacings between the rows, 14 feet long. Approximately 60 lbs per acre of 18-46-0 fertilizer were applied down the tube with the seed.

Performance trials of corn were seeded on both dryland and irrigated areas of the Center. The dryland corn trial was seeded on May 17. The irrigated corn and grain sorghum trials were seeded on May 18. Custom built 31-cell cone seeders mounted above commercially built flexi-planter units with double disc openers were used for seeding all row crops.

The row spacing was 36 inches for corn and grain sorghum. Recommended insecticides and herbicides were banded over the row at the time of seeding. Anhydrous ammonia applications supplied 110 lb/A of actual N to the irrigated trials. The dryland trial received 40 lb/A of anhydrous ammonia. The analyses of soil samples taken prior to seeding indicated ample supplies of P and K were available from the soil. Because pumping for irrigation was halted from the James River in mid-July, the corn and grain sorghum trials received only one irrigation, about 2 inches, in early July.

Germination was slow and uneven, especially in the dryland corn trial. The dryland trial kernels germinated at about four different times from mid-May to late June. Crusting was a problem just as the first emergence was taking place and the fields were rotary-hoed to break the crust. The uneven germination and losses from crusting reduced the final populations from those desired. It was originally planned to thin this to populations of 18,000 and 22,000 plants per acre in the irrigated corn trial. Final populations were 16,335 and 19,055 plants per acre for the same intended stands, respectively. The dryland trial was to have a stand of 12,000 plants per acre and the final count averaged 11,295.

Considering the dry year and long periods of hot temperatures the loss of stand may have been beneficial. However, even where two populations were used there was no significant difference in favor of the lower, or higher, population of the irrigated trial.

The yields from the irrigated grain sorghum trial ranged from 6395 down to 3035 lbs per acre. The mean yield for all sorghum entries was 4955 lbs per acre. Generally, the later maturing varieties produced the higher yields. Yields reported are the average of three replications. The trials were harvested on Sept. 29, 1976.

The corn trial yields spanned a broad range and the germination problems caused widespread variability (note the high CV percentages) within a plot and between varieties. The mean yield for the irrigated trials was 74.2 B/A and the mean percent moisture was 22.3. The upper and lower limits of the irrigated corn trial yields and percent moisture ranged from 99.5 to 41.7 B/A and 30.9 to 16.3 percent moisture, respectively. Dryland yields were much lower and the percent moisture in the corn much higher than in the irrigated trial. The dryland yields ranged from only 10.4 B/A to 39.9 (the mean, 23.4) and the moisture in the corn varied from 25.3 up to 40.5%, the mean being 32.1%. The irrigated trial yields are the average of six replications and the dryland yields the average of five replications.

The results presented in the tables are for 1976 only. Additional data on the trials is found in Performance Trial publications for all of these crops available from the SDSU Agricultural Experiment Station or your County Extension Office.

Table 1. 1976 Standard Variety Winter Wheat Trial Yields and Available Averages, Redfield

Variety	Bushels/acre 1974	Bushels/acre 1976	Bushels/acre 2 yr	Test Wt., lb/bu 1974	Test Wt., lb/bu 1976	Test Wt., lb/bu 2 yr
Nebred	13.4	61.9	37.7	52	63	57
Lancer	20.7	57.0	38.8	54	63	58
Scout 66	37.7	61.5	49.6	55	63	59
Winoka	19.3	50.5	34.9	57	63	60
Bronze	17.3	56.4	24.6	53	60	56
Eagle	30.5	63.5	47.0	54	63	58
Centurk	23.9	68.7	46.3	53	62	57
Baca		60.4			63	
HiPlains	22.3	54.7	38.5	57	62	59
Buckskin	31.3	60.9	46.1	54	62	58
Homestead	35.4	57.6	46.5	54	62	58
Sentinel	36.2	61.1	48.6	54	62	58
Cloud	34.2	63.1	48.6	57	62	59
Kirwin		60.1			63	
Sage	31.0	62.7	46.9	54	63	58
Gent	32.7	62.3	47.5	56	62	59
Lancota		58.9			62	
Rall (OK)	28.0	63.4	45.7	54	63	58
Agate (NE)		65.2			63	
Lindon (CO)		59.7			63	
Mean, B/A		61.1				
CV - %		15.7				
LSD (.05)		13.5				

Table 2. 1976 Standard Variety Rye Trial Yields and Available Averages, Redfield

Variety	Bushels/acre 1974	Bushels/acre 1976	Bushels/acre 2 yr	Test Wt., lb/bu 1974	Test Wt., lb/bu 1976	Test Wt., lb/bu 2 yr
Cougar	23.5	58.5	41.0	51	57	54
Puma	23.6	43.4	33.5	54	57	55
Rymin	32.2	48.8	40.5	53	57	55
SD Sel 75		46.8			58	
Mean, B/A		49.4				
CV - %		13.3				
LSD (.05)		N.S.				

Table 3. Corn Performance Trial, Area C1 (Irrigated), Redfield, 1976

Brand & Variety	Type & cross	Yield Bu/A	% root lodged	% stalk lodged	% ears dropped	% moisture	Performance score rating
SDAES Ex 105	2x	99.5	0.0	0.8	0.0	20.4	1
Check=2	2x	96.6	0.0	0.4	0.0	23.8	2
Fontanelle 400	2x	94.2	0.0	0.0	0.0	24.2	4
Pioneer 3780	2x	93.4	0.0	0.0	0.0	20.9	3
Funks G-4444A	2x	92.2	0.0	0.8	0.0	24.9	5
O's Gold 1100	2x	91.3	0.0	0.4	0.0	24.8	9
Trojan TXS 102	2x	91.2	0.0	0.0	0.0	24.0	7
Sokota TS-67	2x	91.1	0.0	1.2	0.0	24.2	8
Pride 4404	2x	89.0	0.0	0.0	0.0	20.4	6
Check=3	2x	86.4	0.0	0.0	0.0	19.5	10
Funks G-4288	3x	84.3	0.0	0.9	0.0	22.0	12
Trojan TXS 94	2x	84.1	0.0	0.0	0.0	20.3	11
P-A-G 534	3x	83.8	0.0	0.8	0.0	23.5	15
Cargill 863	2x	83.8	0.0	0.0	0.0	23.4	13
O's Gold 1107	2x	82.9	0.0	0.0	0.0	23.9	17
Sokota SS-51	M2x	81.5	0.0	0.0	0.0	20.3	14
ACCO UC 2901	2x	81.2	0.0	0.9	0.0	20.0	16
Pioneer 3710	2x	80.0	0.0	0.0	0.0	22.7	18
ACCO UC 3301	2x	79.7	0.0	0.4	0.0	27.5	23
SDAES PP204A	M2x	79.6	0.0	1.7	0.0	23.6	19
Funks G-4321A	2x	77.4	0.0	0.0	0.0	24.4	24
SDAES PP204	2x	76.6	0.0	0.0	0.0	29.2	31
McCurdy MSP 111	3x	75.9	0.0	0.0	0.0	21.5	21
Payco SX775	2x	75.8	0.0	0.4	0.0	22.5	26
Pride R-200A	2x	75.1	0.0	0.0	0.0	21.3	25
Payco SX680	2x	74.7	0.0	0.0	0.0	21.1	27
P-A-G SX 177	2x	74.6	0.0	0.4	0.0	18.3	20
Funks G-4180	3x	74.4	0.0	0.0	0.0	19.2	22
McCurdy MSP 333	3x	73.8	0.0	0.0	0.0	23.8	30
Western KX-55	2x	73.8	0.0	0.4	0.0	26.0	34
Sokota SS-67	M2x	72.9	0.0	0.0	0.0	25.0	35
McCurdy MSX 24	2x	72.5	0.0	0.0	0.0	19.1	29
McCurdy MSX 44A	2x	72.3	0.0	0.0	0.0	25.0	36
ACCO UC 1151	2x	72.1	0.0	0.0	0.0	18.0	28
Sokota TS-46	2x	70.4	0.0	0.9	0.0	20.1	33
Asgrow RX2222	2x	70.0	0.0	0.0	0.0	19.5	32
Sokota SS-59A	M2x	69.1	0.0	0.0	0.0	24.4	42
Cargill 848	2x	68.8	0.0	0.4	0.0	21.9	38
Sokota TS-49	2x	68.5	0.0	0.0	0.0	20.9	37
Cenex 2116	M2x	68.3	0.0	0.4	0.0	22.0	39
Fontanelle 365	3x	67.2	0.0	0.0	0.0	30.9	50
Agsco 4XC	4x	67.2	0.0	1.2	0.0	20.4	40
Check=5	4x	65.7	0.0	0.0	0.0	20.8	44
McCurdy MSX 46	2x	65.5	0.0	0.0	0.0	23.0	46
Pride 3315	2x	65.0	0.0	0.0	0.0	17.6	41
Cenex 2125	2x	64.6	0.0	0.0	0.0	21.8	47
Kaltenberg KX42	2x	64.3	0.0	0.9	0.0	21.2	48
Pride 2206	2x	63.3	0.0	0.0	0.0	19.0	45
Funks G-4141	2x	63.0	0.0	0.4	0.0	16.3	43
Cargill 830	2x	58.9	0.0	0.0	0.0	17.4	49
Kaltenberg KX65	2x	58.2	0.0	0.0	0.0	25.9	51
Payco SX865	2x	57.8	0.0	0.0	0.0	26.0	52
P-A-G 220	2x	51.3	0.0	0.0	0.0	26.5	54
Funks G-4195	3x	50.2	0.0	0.4	0.0	19.2	53
SDAES EX106	M2x	47.2	0.0	1.2	0.0	21.3	55
Kaltenberg KX68	2x	41.7	0.0	0.0	0.0	25.9	56
Mean		74.2		0.3		22.3	
LSD-.05		17.3				C.V.-20.5%	

Table 4. Corn Performance Trial, Area C1 (Dryland), Redfield, 1976

Brand & Variety	Type & cross	Yield Bu/A	% root lodged	% stalk lodged	% ears dropped	% moisture	Performance score rating
Pioneer 3965	3x	39.9	0.0	1.2	0.0	25.3	1
Payco SX680	2x	37.5	0.0	0.0	0.0	29.3	2
SDAES PP199	3x	36.9	0.0	2.1	0.0	28.8	3
SDAES PP147	4x	34.9	0.0	1.3	0.0	27.8	4
Trojan TXS 99	2x	31.3	0.0	0.0	0.0	28.4	5
Funks G-4141	2x	31.1	0.0	0.0	0.0	29.4	6
Sokota SS-51	2x	31.1	0.0	0.0	0.0	31.3	9
Check=4	2x	30.8	0.0	0.0	0.0	30.0	8
Cenex 3015	3x	30.4	0.0	0.0	0.0	27.8	7
ACCO UC 1901	2x	30.0	0.0	0.0	0.0	30.0	11
Agsco 3XB	3x	29.8	0.0	1.9	0.0	27.8	10
Pioneer 3710	2x	29.0	0.0	0.0	0.0	34.3	13
Trojan TXS 94	2x	28.5	0.0	0.0	0.0	31.5	12
ACCO UC 2301	2x	28.3	0.0	0.7	0.0	31.6	14
ACCO UC 1151	2x	27.7	0.0	0.0	0.0	31.1	15
SDAES EX104	2x	27.7	0.0	0.7	0.0	33.0	17
Agsco 4XC	4x	27.1	0.0	0.0	0.0	30.4	16
Check=5	4x	26.3	0.0	0.0	0.0	33.8	20
Funks G-4195	3x	25.8	0.0	1.9	0.0	29.5	19
Funks G-4180	3x	25.5	0.0	0.0	0.0	28.9	18
Kaltenberg KX42	2x	25.5	0.0	0.0	0.0	31.2	21
Pride 3315	2x	24.4	0.0	0.0	0.0	30.4	22
ACCO UC 147	4x	24.3	0.0	1.4	0.0	30.1	23
Pride 2206	2x	24.1	0.0	0.0	0.0	31.2	24
SDAES EX103	2x	23.0	0.0	0.0	0.0	33.0	26
Pride 4404	2x	22.1	0.0	0.0	0.0	29.3	25
Funks G-4321A	2x	21.3	0.0	0.0	0.0	35.6	27
Cenex 2116	2x	20.0	0.0	0.0	0.0	35.8	31
Payco SX775	2x	19.7	0.0	2.1	0.0	33.4	30
Sokota TS-67	2x	19.3	0.0	0.0	0.0	36.6	32
SDAES EX106	2x	19.0	0.0	0.6	0.0	30.2	29
Check=8	2x	18.6	0.0	1.7	0.0	27.7	28
Sokota SS-67	2x	18.6	0.0	0.0	0.0	35.6	33
Fontanelle 365	3x	18.5	0.0	0.0	0.0	36.6	35
Funks G-4288	3x	18.3	0.0	3.1	0.0	33.8	34
Payco SX865	2x	17.3	0.0	0.0	0.0	35.7	37
Kaltenberg KX442	3x	17.0	0.0	0.0	0.0	30.7	36
Trojan TXS 102	2x	16.5	0.0	0.0	0.0	35.7	38
Curtis 443	2x	16.1	0.0	2.3	0.0	37.3	39
Fontanelle 400	2x	14.9	0.0	0.0	0.0	35.1	40
Curtis A-201	2x	14.9	0.0	2.4	0.0	35.4	41
Funks G-4444A	2x	12.9	0.0	0.0	0.0	34.9	42
Western KX-55	2x	12.7	0.0	0.0	0.0	40.5	44
Pride R-200A	2x	12.6	0.0	0.0	0.0	34.2	43
Payco 3X811	3x	10.6	0.0	0.0	0.0	35.2	45
Kaltenberg KX68	2x	10.4	0.0	0.0	0.0	38.0	46
Mean		23.4		0.5		32.1	
	LSD-.05	7.8				C.V.-26.6%	

Table 5. 1976 Grain Sorghum Performance Trial, Area C1 (Irrigated), Redfield

Brand & Variety	Yield, lb/A	Test Wt. lb/B	Height, inches	Percent Moisture, 9/21/76	Date Headed
Northrup-King NK 180	6395	58	46	15.8	7/31
ACCO R1019	6145	56	42	26.1	8/6
Asgrow Dorado E	6135	59	44	22.4	7/30
SDAES RS 610	5825	55	48	24.0	8/3
Pride P570	5795	58	45	15.8	7/29
Northrup-King X3171	5765	58	43	19.9	7/30
Funks G-393	5650	57	44	18.7	7/31
Funks G-520GBR	5520	57	47	32.3	8/7
SDAES RS 506	5380	56	51	15.9	7/24
ACCO R1014	5380	55	42	23.7	8/2
Northrup-King NK 233A	5230	59	44	19.7	8/2
Funks G-404	5220	51	35	33.0	8/9
Northrup-King NK 129	5125	59	47	19.6	7/29
Asgrow H6944A	5025	55	39	24.6	8/3
Western WS 201	4965	55	43	14.7	7/21
ACCO R920	4655	55	44	20.7	7/22
Warner W-501	4545	54	47	14.2	7/17
Pride P500A	4540	55	48	16.9	7/24
SDAES SD 75003	4295	55	41	17.7	7/16
SDAES SD 75005	4295	54	42	16.4	7/18
P-A-G 269	4050	57	42	14.6	7/18
Funks G-251	3930	57	36	16.7	7/26
SDAES SD 75004	3840	55	43	16.6	7/15
SDAES Exptl. (455)	3740	55	47	15.3	7/21
SDAES SD 106	3350	55	38	14.2	7/21
SDAES SD 75001	3035	55	41	20.5	7/16
Mean	4955				
LSD-.05	1010			C.V.-12.5%	

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1976 SOYBEAN PERFORMANCE TRIAL

J. J. Bonnemann and G. W. Erion

Soybean trials have been conducted at the Center for several years and have shown considerable potential as a profitable crop if properly managed and irrigation water is available. Production on dryland is not recommended.

The trial at Redfield was to have been irrigated in 1976 but the drouth and lack of rainfall greatly curtailed any additional moisture. Germination was uneven and soil crusting followed. The crust was broken using a rotary hoe and this also reduced the stand. Stands were quite variable within and among plots and quite uneven in height depending upon when they germinated.

Soybean Performance Trial, Redfield, 1976

Identification of Entries[1]			1976 Field Data			Average Yield in Bu/acre					
			Maturity Date (mo.-day)	Plant Height (inches)	Potential Shatter Loss[4]	1973	1974	1975	1976	1973-76	75-76
Standard Varieties:											
Entry	Maturity Group[2]	Days to Mature[3]									
Evans	0	- 2	9-27	27	2		28.8	31.0	22.4		26.7
Harlon	I	- 1	9-28	27	4			25.8	16.9		21.3
Swift	0	0	9-28	23	3		25.3	25.2	15.6		20.4
Grande	0	+ 1	9-29	23	1				18.5		
Steele	I	+ 6	10-2	26	2	25.2	28.3	28.6	18.8	25.2	23.7
Anoka	I	+ 6	10-3	23	2	20.8	24.2	25.6	18.0	22.2	21.8
Hodgson	I	+ 5	10-5	24	2		28.0	28.0	22.5		25.3
Corsoy	II	+12	10-5	30	1	24.3	26.5	31.9	26.1	27.2	29.0
Coles	I	+11	10-8	27	1				20.1		
Hark	I	+13	10-9	28	1	22.9	23.5	29.4	23.2	24.8	26.3
Harcor	II	+14	10-9	28	1			31.6	23.0		27.3
Wells	II	+14	10-11	30	1	25.2	21.9	30.2	28.7	26.5	29.4
Proprietary Entries:											
Brand	Entry										
Pfizer-Clemens	CX282		9-28	28	1				18.6		
Peterson-Pioneer	85		9-30	24	1			25.8	21.1		23.5
Pfizer-Clemens	12E		10-2	26	1				18.9		
Northrup King	S1244		10-4	26	2			29.8	20.2		25.0
Peterson-Pioneer	118-11		10-4	23	1				21.6		
Northrup King	S1346		10-6	20	1			31.8	18.7		25.3
Peterson-Pioneer	P61-22		10-7	28	1				24.8		
Pfizer-Clemens	EC-936		10-7	28	1				22.9		
Peterson-Pioneer	3100		10-8	26	1			30.8	20.4		25.6
Pfizer-Clemens	CX114		10-8	29	1				23.0		
						Mean, B/A			21.1		
						CV - %			15.4		
						LSD (.05)			5.3		

1 - Listed in order of 1976 maturity.
2 - Maturity Group from USDA classification: 0=early, I=early to midseason, II=midseason to late at Redfield.
3 - Expected relative maturity at this site compared to Swift when not exposed to killing frost.
4 - Shattering potential: 1=no loss; 2=up to 5%; 3=5-10%; 4=10-20%, 5=20% or more.

The trial was seeded on May 28 and harvested on Oct. 13. Proprietary entries are the choice of the participating companies as they paid a nominal fee to help defray testing expenses. Row spacing was 30 inches between rows. A recommended herbicide was banded over the row at seeding time to aid in weed control. The drouth induced stresses caused shattering, especially of the early maturing soybeans.

Corsoy and Wells have the best yield records of the standard varieties. The yield advantage of Corsoy is only slightly above Wells while Wells is considered the more lodging resistant of the two varieties. Evans may be considered a good early maturity variety. Several of the commercial varieties have fine yield records and merit consideration.

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SUNFLOWER STUDIES IN SOUTH DAKOTA

The sunflower studies in South Dakota were carried on at four locations in the northeast one-fourth of the state. The area covered is north of Highway 14 and west to the Missouri River. Specific sites were located at Highmore, Groton, Redfield and Watertown. The Groton site is located on the David Sueltz farm 5 miles west and 1.5 miles south of Groton. The other three sites are located on Research Stations near the towns mentioned. Sunflower work, crop sequence and insect studies will be continued on these locations in 1977.

Sunflower yields were taken from the plantings on the Redfield Research Station. Poor germination was a factor when considering plant heights, flowering and final stand. Final stand and yield were the only factors considered in 1976. Insects and drought were the main detrimental factors up to the period of plant dry down. Wind and birds created losses until harvest time. Soil moisture was below field capacity in the spring and had reached wilt point at harvest time.

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SUNFLOWER INSECT AND MANAGEMENT EXPERIMENTS

Q. S. Kingsley and R. J. Walstrom

OBJECTIVE: To provide information about economic thresholds for use in future monitoring programs for sunflower head moth (Homeosoma electellum).

CROP YEAR HISTORY:
Planted: May 25
Variety: InterState 894
Replications: Four
Herbicide: Tolban, 1 qt/A disked in
Plant population: 16,000 plants per acre, 36 inch rows
Harvested: Oct. 21
Fertilizer: 60-20-0
Soil preparation: Chisel plow
Insecticide: Supracide, 1 qt/A or 1/2 #/A
Cultivations: One
Soil type: Beotia-Great Bend-Harmony
Rainfall: May 0.53; June 3.72; July 1.41; Aug. 0.54; Sept. 1.76; Oct. 1.00. Total 8.96 inches
Temperatures: Average May 72; June 85.7; July 91.6; Aug. 91.7; Sept. 78.3. First killing frost Sept. 23.

RESULTS:

Table 1. Sunflower Head Moth Study (Homeosoma electellum), Redfield, 1976

Number of Insecticide Treatments*	Percent Oil	Pounds per acre
None	47.9	119.6
1 spray**	46.4	111.8
2 sprays	47.6	113.2
3 sprays	46.6	98.7

*Supracide applied at 1/2 pound per acre per spraying.
**Dates of spraying: 1 spray, Aug. 3; 2 sprays, Aug. 3 & 8; 3 sprays, Aug. 3, 8 & 13.
Statistically no significant difference.

DISCUSSION:

The effect of spraying insecticide at 5% ray flower and then at five-day intervals for a maximum of three sprayings did not significantly affect yields.

Herbicide treatment was effective and only one cultivation was necessary to maintain the field. Buffalo bur was not controlled in the row and some kochia appeared late in the season.

This study is cooperatively supported by the Sunflower Association of American and South Dakota State University.

Insecticide Applications to Dryland Sunflower Plantings at Redfield - 1976

R. J. Walstrom

Sample Number	Plant Head Diameter in inches	% Damage *Homoeosoma electellum*	Damage by *Cylindrocopturus adspersus* LeConte	Damage by *Smicronyx sordidus* LeConte	% Bird Damage
		Check Plots - No Insecticides Applied			
1-1	4.00	0	None	Heavy	70.0
1-2	5.50	0	None	Present	5.0
1-3	6.00	0	None	None	95.0
1-4	3.25	0	Present	Heavy	20.0
1-5	6.50	0	None	Present	65.0
1-6	6.25	0	None	None	20.0
1-7	6.00	1.0	Present	Present	10.0
1-8	5.25	0	None	None	15.0
1-9	5.50	0	Present	Present	5.0
1-10	6.75	0	Present	Present	90.0
Average	5.50	0.1	40% Present	70% Present	39.5
		One Insecticide Application (August 3)			
2-1	5.00	0	Present	None	95.0
2-2	3.50	0	Present	None	15.0
2-3	4.75	0	None	Present	20.0
2-4	5.75	0	None	Present	5.0
2-5	5.00	0	None	Present	0.0
2-6	6.50	0	None	None	80.0
2-7	4.50	0	None	Present	85.0
2-8	6.50	0	None	None	85.0
2-9	4.50	2.0	None	Heavy	15.0
2-10	5.00	5.0	Present	Present	70.0
Average	5.10	0.7	30% Present	60% Present	45.0
		Two Insecticide Applications (August 3, 8)			
3-1	5.25	0	None	None	85.0
3-2	4.25	0	None	Present	75.0
3-3	5.00	0	None	None	90.0
3-4	6.75	0	None	None	30.0
3-5	4.50	0	Present	Present	40.0
3-6	4.00	0	None	Present	60.0
3-7	6.00	0	None	None	45.0
3-8	3.50	0	Present	Present	10.0
3-9	4.00	0	Present	Heavy	55.0
3-10	5.25	0	None	None	80.0
Average	4.85	0	30% Present	50% Present	57.0
		Three Insecticide Applications (August 3, 8, 13)			
4-1	8.50	0	None	None	20.0
4-2	6.50	0	None	Present	60.0
4-3	4.75	0	None	Present	65.0
4-4	7.00	0	None	Present	25.0
4-5	9.00	0	None	None	5.0
4-6	6.25	0	None	None	0.0
4-7	7.50	2.5	Present	None	10.0
4-8	6.25	5.0	None	Present	15.0
4-9	8.00	0	None	Present	0.0
4-10	8.50	0	None	Present	85.0
Average	7.23	0.75	10% Present	60% Present	28.5

CONCLUSIONS: The presence of damaging insect populations in these plots was negligible and did not reflect measureable seed reductions.

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POPULATION, FERTILITY AND PLANTING METHOD, REDFIELD, 1976

Q. S. Kingsley

OBJECTIVES: Determine the most favorable plant population and fertility per acre using conventional and listing methods of planting.

CROP YEAR HISTORY:
- Planted: May 25 — Harvested: Oct. 21
- Variety: InterState 894 — Replications: Four
- Plant populations: 12,000; 16,000; 20,000 in 36" rows
- Fertility: 0-0-0; 0-20-0; 40-20-0; 80-20-0 (all starter)
- Herbicide: Tolban 1 qt/A disked in
- Cultivations: One
- Rainfall: May 25 to Oct. 21 8.96 inches
- Soil type: Beotia-Great Bend-Harmony

RESULTS:

Table 1. Population, Fertility and Planting Method, Redfield, 1976

Treatment Lbs/A $N - P_2O_5 - K_2O$	Conventional Planter % Oil	Conventional Planter Yield lbs/A	Lister Planter % Oil	Lister Planter Yield Lbs/A
0 - 0 - 0	34.8	398.2	36.0	542.0
0 - 20 - 0	36.1	466.7	34.6	412.0
40 - 20 - 0	35.9	414.1	35.7	641.8
80 - 20 - 0	34.7	465.7	34.9	491.6
Average		436.2		521.9

Lister method of planting was significant at .05.

DISCUSSION:

The area of the study had been irrigated once in 1975 but germination was not uniform and the desired populations were not achieved. Analysis was performed using fertility and planting methods.

Some response was received from the use of fertilizer but it was not statistically significant. The method of planting had a significant difference. Lister planting, in a dry year, seems to be the better method.

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SUNFLOWER VARIETY TRIALS

Q. S. Kingsley

OBJECTIVE: To test various sunflower varieties grown in the state for yield, maturity and oil content.

CROP YEAR HISTORY: Same as for Sunflower Head Moth study except confection varieties had a population of 12,000.

RESULTS:

Table 1. Sunflower Variety Trials, Redfield, 1976

Oil Seed Variety		Percent Oil	Test Weight	Yield Lbs/A
Sunbred	212	50.9	36.0	284.1
USDA	893	46.5	36.0	213.6
Inter State	891	51.4	35.0	210.4
USDA	913	48.0	35.0	196.8
Sun-Gro	380	52.4	36.0	192.8
DO	514	48.3	33.0	186.4
NAPB	6501	47.1	35.0	180.0
Sun-Hi	304	47.5	34.0	179.2
Peredovik	66	46.4	32.0	178.4
Sun-Hi	301	46.7	36.0	176.8
DO	410	47.5	33.0	172.8
Sputnik	71	44.8	37.0	158.4
Hi Sun	1	48.3	34.0	147.2
USDA	8941	48.6	36.0	142.4
USDA	894	43.1	34.0	133.6
USDA	903	44.7	35.0	132.0
Cargill	204	49.1	34.0	131.2
USDA	8903	50.8	35.0	125.6
USDA	914	44.6	34.0	124.8
USDA	904	47.6	34.0	114.4
Inter State	8944	47.2	35.0	108.0
Sun-Gro	372	50.5	35.0	99.2
USDA	241	49.1	35.0	98.4
Sunbred	223	46.8	33.0	92.0
USDA	244	46.8	34.0	88.0
USDA	243	48.8	34.0	73.6
NAPB	4701	44.0	32.0	71.2
Peredovik		49.6	35.0	60.0
NAPB	5000	50.7	34.0	47.2
Mean				142.0
Confection Variety				
Sundak		32.6		128.0
DO	613	40.2		82.4
DO	508	37.8		73.6

Significant difference at .05.

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CROPPING SEQUENCES

Q. S. Kingsley and J. Giles

OBJECTIVE: To determine what effect sunflowers have on succeeding crops of corn, wheat and oats when planted in a cropping sequence.

RESULTS:

1. Corn 74, Sunflowers 75, Corn 76
   Silage yield tons/A 12% moisture 1.04; wet (48.5%) 1.8
2. Millet 74, Sunflowers 75, Oats 76
   Oat yields Bu/A 8.3 Test weight 32.0
3. Millet 74, Sunflowers 75, Wheat 76
   Wheat yield Bu/A 6.8 Test weight 50.5
4. Millet 74, Oats 75, Wheat 76
   Wheat yield Bu/A 6.5 Test weight 47.8
5. Millet 74, Sunflowers 75, Corn 76
   Silage yield tons/A 12% Moisture 0.70; wet (71.9%) 3.3

DISCUSSION:

The yields of corn, wheat and oats are low and part of this is due to weed competition that occurred after corn cultivations and when the small grains were growing slowly. Soil moisture was low throughout the growing season and near wilt point at harvest time.

SUMMARY:

Considering the drought as a major deterrent for crop production, insects, birds and weeds also have adverse effects.

The stem weevil activity alone accounted for losses that forced many farmers to abandon whole fields or try to salvage some for silage. Those farmers with fields with a sunflower yield potential of 1500 or more lbs/acre threshed out 200-400 lbs/acre. Sunflowers, growing with low moisture only, did produce heads from 4 to 8 inches across. The stem lengths varied from 12 to 36 inches in some areas and taller in other areas. Stem diameter seemed to affect standability. Those with diameters of one inch or less, with stem weevil infestation, tipped over on contact or from the wind. Larger stemmed plants stand fairly well until harvest time and then many broke over during combining. Sprays are used for control of the Head Moth but it will require a systemic type chemical to control the weevils. Whether the stem and seed weevils are more disastrous in dry years than wet years remains to be seen.

Cropping sequences are of importance when using sunflowers as one of the crops.

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SOLAR-ELECTRIC DRYING BIN

William H. Peterson and Milo A. Hellickson

The solar-electric drying bin was used again in the fall of 1976 with good results. Filling began on Sept. 24 and was completed on Oct. 25. Moisture content ranged from 33.4% to 17.1%, with the average of all corn loads at 25.4%. Final moisture averaged 12.18% with water removal of 13.22 "points."

The fan used 4442 kilowatt-hours and the electric heater 1342 kilowatt-hours. The heater was used the last part of the drying period, only during times of cold and cloudy weather.

The amount of corn dried, calculated by volume, was 1108 bushels. Electricity used was 5.22 kilowatt-hours per bushel for removal of 13.22 "points," or 0.394 kilowatt-hours per bushel per "point" removed. This is slightly more than in 1975 when the figure was 0.32 KWH/bu-point.

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CONVENTIONALLY-DRIED, SOLAR-DRIED AND ACID-TREATED CORN FOR FINISHING BEEF CATTLE

R. M. Luther, L. B. Embry and J. F. Giles

Recent concern about costs and availability of energy for drying corn grain at harvest has led to a search for alternative methods of drying or preserving corn. The use of solar energy for drying or preservation with organic acids appear to be economical ways of handling wet corn in the storage structure. Limited information is available as to the nutritional value of corn subjected to these treatments and fed to fattening beef cattle.

An experiment was initiated at the James Valley Research and Extension Center, Redfield, during the summer of 1976 to determine the value of corn grain dried or preserved by different methods. A portion of the trial dealt with methods of administering vitamin A and these results will be reported at a later time.

Procedure

Seventy-eight crossbred steers averaging 750 lb. were purchased through a livestock auction for the experiment. The cattle were from one owner. The steers were ear tagged, weighed and allotted to 6 pens of 13 steers each. Initial and final weights were recorded following an 18-hour overnight stand without feed and water. The steers were vaccinated against IBS (Rednose) and Clostridium spp. (blackleg, malignant edema) and implanted with 36 mg zeranol at the start of the trial.

The ration treatments were methods of drying and/or preserving whole corn grain. Whole shelled corn harvested from the 1975 crop was stored in 1000-bushel quantities in separate bins.

Moisture content of corn at harvest was 24% for the solar-dried and 17% for the conventionally-dried corn and acid-treated corn. The corn was harvested between Nov. 3 and 10. Differences in moisture content were due to corn varieties with differing maturity dates and dates of harvest. Conventionally-dried corn was dried with natural gas at a local elevator. Solar-dried corn was stored in an experimental bin designed for drying with solar energy and equipped with a fan and motor. The acid-treated corn was prepared by applying Grain Storer P at the rate of 1.3 gallon per ton (36 bu.). This product supplied propionic acid in an amount to permit safe storage up to 1 year. Acid-treated corn was stored in a granary bin of wood construction.

The cattle were fed chopped hay and oats grain for about a month prior to the start of the trial. During the first 2 weeks of the trial the cattle were gradually shifted to a full feed of whole shelled corn with limited hay. Hay consumption was reduced from 11.5 lb. to 2 lb. of good quality, chopped alfalfa-bromegrass hay per head daily during this period. Hay consumption over the 106-day trial averaged 2.67 lb. per steer daily. Each corn treatment was replicated with two pens of cattle. The cattle in one replication received 1 lb. of pelleted (1/4-inch) supplement containing ground corn, ground limestone, trace mineral salt and vitamin A to provide 20,400 International Units (IU) of vitamin A per steer per day. In the second replication, the cattle received no supplement but were allowed a free-choice mineral composed of ground limestone and trace mineral salt with added vitamin A to provide 34,000 IU per ounce. It was assumed, based on a previous experiment at this location, that the cattle would consume about 1/3 of an ounce of mineral (8 grams) for a daily intake of about 9,600 IU of vitamin A per steer daily.

Results

The results of the experiment are presented in table 1.

Steer gains for the three types of corn were essentially the same with the gains of cattle fed solar-dried corn being only slightly lower than the other treatments. Cattle fed solar-dried corn and acid-treated corn consumed more feed than cattle fed conventionally-dried corn. Differences in feed required per unit of gain were small with the lowest requirements obtained with steers fed conventionally-dried corn.

The corn treated with propionic acid was at a lower moisture level than was desired for this treatment. Therefore, the benefits observed in feeding high-moisture corn, either untreated or acid-treated, which often result in improved feed efficiency over dry corn were not observed in this experiment.

The weather at this location during the feeding period was extremely dry, resulting in a natural decline in moisture content of the feeds fed. For example, the corn (all treatments) checked in early August contained 7 to 8% moisture. The whole corn appeared to be hard and tough and may have resulted in reduced consumption. However, corn consumption was in the order of 20 lb. per steer. A considerable quantity of whole corn kernels were observed to pass through the animals. The gains were in the order of 3 lb. per steer and this along with feed consumption indicate satisfactory performance for yearling cattle. Feed requirements of less than 8 lb. per pound of gain indicate efficient utilization of the whole corn.

Summary

A feeding experiment with yearling beef steers was conducted to compare the value of conventionally-dried corn, solar-dried corn and acid-treated corn. Steer gains were about the same for the three types of corn with the gains of cattle fed solar-dried corn being only slightly lower than the other treatments. Differences in feed consumption and feed efficiency between corn storage treatments were relatively small.

Table 1. Conventionally-Dried, Solar-Dried and Acid-Treated Corn for Finishing Steers (May 25 to September 8, 1976--106 days)

	Conventionally-dried corn	Solar-dried corn	Acid-treated corn
No. animals	26	25[a]	26
Avg. initial wt., lb.	776	773	776
Avg. final wt., lb.	1083	1071	1090
Avg. daily gain, lb.	2.90	2.81	2.96
Avg. daily feed, lb. (as fed basis)			
Whole corn	19.31	19.52	20.16
Chopped hay	2.67	2.67	2.67
Mineral	0.027	0.085	0.052
Total	22.007	22.275	22.882
Feed/100 lb. gain, lb.			
Whole corn	648	677	663
Chopped hay	92	95	90
Supplement	17	18	17
Mineral	1	3	2
Total	758	793	772

[a]One steer died of unknown causes.

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EFFECTS OF METHOD OF SUPPLEMENTING VITAMIN A ON FEEDLOT PERFORMANCE AND BLOOD AND LIVER VITAMIN A LEVELS IN FEEDLOT CATTLE

R. M. Luther, L. B. Embry and J. F. Giles

Rations consisting of corn grain and limited hay appear to be satisfactory for fattening beef cattle from about 700 lb. to slaughter weights without additional protein supplementation. The intake of carotene, a precursor of vitamin A, could be relatively low under these conditions, and, therefore, a vitamin A supplement would likely be needed. In a previous experiment, pronounced signs of vitamin A deficiency became evident after about 6 months in cattle fed corn grain with about 4 lb. of a low-carotene hay and no supplemental vitamin A.

Methods other than through a daily supplement may provide a more practical and economical means of administration. Feeding vitamin A in a high potency supplement at 2- to 3-week intervals, in a free-choice mineral supplement or administering the vitamin as a large one-time injection offer certain convenience and labor saving advantages to the cattle feeder.

The objective of this experiment was to study the effects of method of administering vitamin A on the performance of feedlot cattle. The vitamin A status in terms of blood plasma level and liver storage was determined along with weight gain and feed efficiency in a trial conducted at the James Valley Research and Extension Center near Redfield during the summer and fall of 1975.

Procedure

Sixty-five Hereford steers averaging 735 lb. were purchased through a livestock auction for the experiment. The steers were from one ranch in central South Dakota. Wintering rations indicated liberal intakes of vitamin A and carotene. During a 60-day preliminary period prior to the start of the trial, the cattle were fed whole oats or corn grain with about 2 lb. of low quality, legume-grass hay. This low-carotene ration was expected to result in some depletion of initial body stores of vitamin A and carotene. Following this preliminary period, the cattle were ear tagged, weighed and allotted to 5 pens of 13 steers each. The steers were implanted with 36 mg zeranol at the start of the trial.

Experimental treatments were as follows:

1. Control--no vitamin A, mineral free choice
2. Conventional--daily supplement with vitamin A and mineral
3. Intermittent--vitamin A supplement top-dressed on the ration every 2 weeks, mineral free choice
4. No supplement--vitamin A in mineral free choice
5. No supplement--vitamin A injected at start of trial, mineral free choice

Each pen of cattle was given a full feed of whole shelled corn and 2 lb. of chopped average-to-poor quality alfalfa-bromegrass hay per head daily. The composition of the mineral mixtures and supplements with vitamin A is shown in table 1. The mineral mixtures were composed of ground limestone and trace mineral salt. The conventional supplement and the supplement fed intermittently were made into 1/4 inch pellets. The daily supplement (treatment 2) was fed at the rate of 1 lb. per steer daily. In the case of the top-dressed supplement (treatment 3), the cattle received the 1 lb. rate but with a level of vitamin A equal to 14 days of the daily feeding level at one time at the beginning of each 2-week period. For the injected group, vitamin A was administered by intramuscular injection at the beginning of the feeding period in the amount of 3 million International Units (IU). Free-choice mineral was placed in boxes equipped with a partial cover with vitamin A in the mix for treatment 4.

Table 1. Composition of Mineral and Supplement Mixtures

	Free-choice mineral mixture[a]		Vitamin supplements	
	Without vitamin A	With vitamin A	Conventional	Intermittent
	%	%	%	%
Ground corn	---	---	86.65	97.90
Ground limestone	74.43	74.42	10.00	---
Trace mineral salt	25.57	24.47	3.20	---
Vitamin A premix[b]	---	1.11	0.15	2.10

[a]Formula based on expected mineral consumption of 60 grams/head/day.
[b]Premix contained 15,000 IU vitamin A palmitate/gram by analysis.

The cattle were weighed initially and after 18 hours without feed and water at the start of the 145-day trial. Final weights were taken at slaughter following a 4-hour transit period. Samples of the supplements and feeds were collected periodically during the trial and analyzed for carotene and vitamin A.

Samples of blood were taken initially (July 16) and at 93 days (October 17) from the jugular vein. Blood and liver samples were collected when the cattle were slaughtered on December 9 (145 days). Carotene and vitamin A analyses were performed on all samples.

Average carotene content of the whole corn and feed supplements was 0.66 mg/pound. The poor-quality hay contained 0.70 mg carotene per pound. Vitamin A analyses were performed on the primary premix, supplements and the mineral mix at the State Chemical Laboratory, Vermillion.

The vitamin A primary premix was manufactured in 1974 with a listed concentration of 30,000 IU per gram. Analysis of the product revealed a concentration of about 15,000 IU/g following storage under atmospheric conditions for slightly more than 1 year. The analyzed concentration was used in calculating vitamin A concentration in the free-choice mineral mix and the supplements. Samples of the primary premix, supplements and the mineral mix taken later during the experiment indicated essentially no further loss in vitamin A potency from the initial concentrations. Studies have indicated substantial losses in vitamin A activity in primary premixes and mixed feeds following several months of storage. This would emphasize the importance of relatively fresh sources of feeds or that level of supplementation may need to be increased to take care of possible losses in activity.

Results

Feedlot Performance. Results of feedlot performance are presented in table 2. One pen of 12 steers is of limited value in evaluating effects of the method of vitamin A supplementation on weight gain and feed data. Variation in weight gains of considerable magnitude may exist between pens of this number when treated in the same manner. Other research has shown that weight gains of cattle fed rations low in vitamin A and carotene are not affected to any appreciable extent until body stores are essentially depleted and feed intake decreases.

Steers fed the ration without supplemental vitamin A gained at the lowest rate. They also had lower feed intake and thus the highest feed requirements.

Table 2. Feedlot Performance and Methods of Vitamin A Supplementation (July 17 to December 8, 1975--145 days)

	Method of vitamin A supplementation				
	Control (None)	Daily supplement	Supplement at 2-week intervals	Free-choice in minerals	Injection 3 million IU
No. steers	13	12[a]	12[a]	12[a]	13
Avg. initial wt., lb.	735	739	738	738	734
Avg. final wt., lb.	1047	1167	1099	1127	1151
Avg. daily gain, lb.	2.16	2.95	2.49	2.68	2.88
Avg. daily ration, lb.					
Whole corn	16.95	19.20	18.25	18.94	19.51
Chopped hay	1.99	1.99	1.99	1.99	1.99
Supplement	---	0.993	0.076	---	---
Minerals	0.036	0.006	0.028	0.016	0.002
Total	18.976	22.189	20.344	20.946	21.502
Feed/100 lb. gain, lb.					
Whole corn	786	651	733	707	679
Chopped hay	92	67	80	74	69
Supplement	---	34	3	---	---
Minerals	2	0	1	1	0
Total	880	752	817	782	748
Avg. daily carotene intake, mg	12.6	14.7	13.5	13.9	14.3

[a]Losses from experiment unrelated to dietary treatments.

Considerably higher rates of gain and greater feed intake were obtained when the ration was supplemented with a daily level of about 10,200 IU of vitamin A in a feed supplement. Weight gains and feed consumption would indicate no problem from lack of vitamin A even though the level fed was only about one-half of the recommended level for growing and finishing steers within the weight range in this experiment.

Cattle supplemented with vitamin A one time each 2 weeks, but at the same average daily level as those supplemented daily, had a lower rate of gain in comparison to those supplemented daily. Feed intake was also lower resulting in higher feed requirements.

Steers offered vitamin A in the free-choice mineral supplement received only a small amount of the vitamin (average about 1,200 IU daily) because of the low mineral consumption. They gained at a lower rate than steers supplemented daily but more than steers supplemented at 2-week intervals. They also had a lower feed intake than steers supplemented daily.

Steers injected with 3 million IU of vitamin A at the beginning of the experiment had similar performance as those supplemented daily. This amount of injected vitamin A was about twice the total units over the 145 days as for the daily supplemented group.

Blood and Liver Vitamin A and Carotene. Blood and liver vitamin A and carotene values for each treatment group are shown in table 3. Initial carotene values in blood plasma ranged from 54 to 78 mcg/100 milliliters. At subsequent bleedings, the carotene content of the blood was higher for each treatment group than that observed at the initial sampling. The highest values for plasma carotene were observed at the last sampling after 145 days on the low-carotene rations.

The carotene content of the rations (table 2) resulted in an average daily intake of about 1.5 mg per 100 lb. of average body weight during the experiment. This level represents about 25% of the recommended level to meet needs for vitamin A of growing and finishing cattle. Carotene levels in the blood are affected by dietary intake and values considerably in excess of those observed in this experiment are encountered with high-carotene rations. Liver carotene values obtained at slaughter would indicate low body stores. Initial liver storage was not determined.

Initial plasma vitamin A ranged from about 28 to 39 mcg/100 milliliters. Values of this magnitude are considered to represent adequate vitamin A nutrition. After 93 days, plasma vitamin A had dropped markedly (from 33 to 20 mcg/100 ml) in the control group and remained at this level during the remainder of the experiment. While a value of 20 mcg/100 ml is not generally associated with visible signs of vitamin A deficiency, these cattle had somewhat lower rates of gain and feed intake than those which received supplemental vitamin A. Liver vitamin A at slaughter for the control group indicates body storage was severely depleted.

A marked increase in plasma vitamin A values at 93 days resulted from the daily supplementation of about 10,200 IU. Values had decreased from the 93-day level after 145 days. The final plasma value and liver storage at slaughter would indicate that this level of vitamin A supplementation plus the small amount of ration carotene were sufficient to maintain adequate blood levels and body stores of the vitamin under conditions of the experiment. However, such values do not represent major liver storage of the vitamin.

Supplementing vitamin A at 2-week intervals in amounts to equal the same average daily level as daily supplementation gave similar results as measured by plasma levels and liver stores. Thus, blood and liver data indicated no appreciable difference between the two methods even though weight gains were lower for the cattle supplemented at 2-week intervals.

The low intake of the free-choice mineral supplement resulted in a low level of vitamin A supplementation (about 1,200 IU daily). While the plasma vitamin A level at 93 days was fairly high, there was a marked reduction after 145 days. This reduction along with the lower liver value in comparison to those for other

Table 3. Blood Plasma and Liver Concentrations of Carotene and Vitamin A

Item	Control (None)	Daily supplement	Supplement at 2-week intervals	Free-choice in minerals	Injection 3 million IU
Blood carotene, mcg/100 ml					
July 16, 1975--initial[a]	54.15	57.00	62.58	64.00	77.69
October 17, 1975--93 days	87.31	120.92	115.42	136.42	119.08
December 9, 1975--145 days	112.31	146.58	113.83	123.50	145.23
Blood vitamin A, mcg/100 ml					
July 16, 1975--initial	33.28	27.78	28.06	30.26	39.28
October 17, 1975--93 days[b]	20.38	47.89	44.98	46.02	59.08
December 9, 1975--145 days[b]	20.90	35.12	36.12	25.78	39.80
Liver carotene, mcg/g[c]	2.39	2.48	2.10	3.02	2.81
Liver vitamin A, mcg/g[b,c]	0.78	3.43	4.67	1.71	5.63

[a]Significant difference between treatments ($P<.05$).
[b]Significant difference between treatments ($P<.01$).
[c]Collected at slaughter.

vitamin A supplemented groups indicated the cattle were not receiving adequate amounts of vitamin A to maintain proper levels in the blood and body stores. Variable voluntary intake of free-access minerals would appear to be a serious disadvantage to this method of vitamin A supplementation.

Injection of vitamin A appeared to be an effective way of providing vitamin A. There was no major difference between this method and the daily supplementation as measured by blood values. However, the injected level was about twice the total level supplemented daily over the 145-day experiment. The higher injected level did result in larger liver stores at the end of the experiment.

Summary

Yearling steers were fed a low-carotene ration during a 60-day preliminary period and a 145-day finishing experiment to compare methods of vitamin A supplementation. The experimental ration consisted of whole corn grain and 2 lb. per head daily of a low-carotene hay. The ration furnished an average of about 1.5 mg of carotene per 100 lb. of body weight during the experiment. This level of carotene was not sufficient to support adequate vitamin A nutrition as indicated by lower weight gains, less feed consumption and the plasma and liver vitamin A values at the end of the experiment in the group receiving no vitamin A.

Supplementing the ration with a daily level of 10,200 IU of vitamin A or an equivalent total amount but at 2-week intervals gave similar results as measured by plasma and liver vitamin A values. This level of vitamin A plus the small amount of ration carotene appeared to result in adequate plasma and liver vitamin A values under conditions of the experiment but without major liver stores.

Voluntary intake of a free-choice mineral supplement was quite low and cattle supplemented in this way received a low level of the vitamin. Blood and liver values at the end of the experiment indicated the method was unsatisfactory in comparison to other methods of supplementation. Variable voluntary intake of free-choice minerals would appear to be a serious disadvantage for this method of vitamin A supplementation.

Injection of 3 million IU of vitamin A at the beginning of the experiment maintained similar blood levels of the vitamin as daily supplementation even though the injected level provided about twice as much of the vitamin over the experiment. The higher level of vitamin A by injection did result in larger liver storage.

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GRASS -- ALFALFA VARIETY TEST

J. F. Giles and J. G. Ross

Introduction

The objective of this experiment was to obtain information on the relative yielding capacity of varieties of adapted species under irrigation with and without a mixture of alfalfa and under an intensive cutting program. The particular interests in this experiment are the comparative yields of SD 101 creeping foxtail with Garrison and SD 5 bromegrass with Lincoln.

Materials and Methods

The following grasses were seeded at 10 lbs. of pure live seed (pls) per acre and in mixture with alfalfa at 8 lbs. pls of grass seed and 8 lbs. pls of Iroquois alfalfa seed on Aug. 20, 1974 in four replicates of 8' x 20' plots in rows 6 inches apart.

Garrison and SD 101 creeping foxtail
Lincoln and SD 5 bromegrass
Oahe and Slate intermediate wheatgrass
Nordstern orchardgrass
Commercial reed canarygrass

In the fall of 1974, this experiment was irrigated to obtain a good established stand. No winter injury on the alfalfa was noted the next spring.

On April 15, 1976, 50 lbs. of nitrogen (N) as ammonium nitrate was applied only to the grass plots. The first cutting was made June 8 after which 50 lbs. of N was again applied. The second cut was made on July 15 and the third cut on Aug. 24. Irrigations were made as follows: 1.80 inches - June 4, 3.00 inches - June 18, 2.60 inches - July 8. Because of unavailability no water was applied after the second cutting.

The plots were harvested with an 8-foot self-propelled windrower, the forage weighed, moisture samples taken and forage weights adjusted to 12% moisture.

Results and Discussion

The yields obtained from the three cuttings and averages of these are shown in Table 1. Because of the difficulties in obtaining all of the forage of lodged plots variabilities among plots tended to cover

Table 1. Redfield Irrigation Grass-Legume Experiment, 1976. Four replicates, plots 8'x20', rows seeded 6" apart.

	Cuttings			
	6/8	7/15	8/24	Total
	Tons/acre			
Smooth Bromegrass				
Lincoln with alfalfa	2.69	3.15	0.69	6.53
alone	2.68	1.90	0.02	4.60
SD 5 with alfalfa	3.93	2.54	0.99	7.46
alone	3.09	2.75	0.00	5.84
Creeping foxtail				
Garrison with alfalfa	1.89	2.46	0.99	5.34
alone	1.18	2.05	0.02	3.24
SD 101 with alfalfa	2.39	2.80	1.42	6.61
alone	2.90	1.75	0.13	4.78
Intermediate wheatgrass				
Slate with alfalfa	3.62	2.86	1.38	7.84
alone	3.46	1.68	0.38	5.52
Oahe with alfalfa	2.56	2.88	1.67	7.11
alone	2.64	1.57	0.67	4.88
Reed canarygrass				
Commercial with alfalfa	2.33	3.52	1.43	7.27
alone	2.13	3.67	0.22	6.02
Orchardgrass				
Nordstern with alfalfa	2.89	2.83	1.08	6.80
alone	2.57	2.25	0.12	4.94
Mean				
with alfalfa	2.79	2.88	1.21a*	6.87a*
alone	2.58	2.20	0.20b	4.98b

*Yields followed by different letters differ significantly.

up yield differences among varieties. Therefore, no significant differences were found among varieties. The trends, however, were the same as found in 1975. SD 5 bromegrass yielded more than Lincoln at both the first and second cuttings so that the total yield for the season was 1.24 T/A more. SD 101 creeping foxtail yielded 1.54 T/A more than Garrison for the season's total when grown alone. The highest total season's yields for grass alone were reed canarygrass, 6.02 T/A; SD 5 bromegrass, 5.84 T/A; and Slte intermediate wheatgrass, 5.52 T/A. The second cutting yields were highest for reed canarygrass, 3.61 T/A, followed by SD 5, 2.75 T/A.

After the second cutting nitrogen was not applied because irrigation water was not available. The deeper rooted grasses such as Slate and Oahe intermediate made some growth as did alfalfa which has a deep root system. The differences, between the grass with alfalfa and alone, were very small for the first two cuts, because the grass was receiving optimum fertility and moisture. Because the alfalfa was able to make use of deeper soil moisture, the third cutting was almost wholly alfalfa, except in the case of the intermediate wheatgrasses and to a lesser extent with reed canarygrass. With alfalfa the highest yielding grasses were Slate intermediate wheatgrass, 7.84 T/A, SD 5 smooth bromegrass, 7.46 T/A, and reed canarygrass, 7.27 T/A.

From this year's results as well as those in 1975, SD 5, which was selected for regrowth, has been superior to Lincoln bromegrass and has been exceeded only by reed canarygrass in the overall test. SD 101 creeping foxtail has likewise outyielded Garrison in both 1975 and 1976. This variety has been selected for greater seed retention. From the standpoint of yield and palatability SD 5 smooth bromegrass indicates a potential for producing high yields of animal products in irrigated pastures.

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PRE-HARVEST DESICCATION OF SUNFLOWERS

Joseph F. Giles and Robert A. Sanders

The objectives of this study were to determine if the application of a pre-harvest desiccant to sunflowers would reduce the yield losses to pests and weathering, by allowing an earlier, faster and cleaner harvesting and at what percentage of mature plants should the desiccant be applied for maximum production. Since the peak population of migrating black birds occurs in late September, which coincides with the development of mature sunflower seed, being able to harvest at that time should reduce the losses. Even with the planting of hybrid seed, not all of the plants reach physiological maturity at the same time, thus at which percentage of mature plants should the desiccant be applied.

Procedure

Sunflower plots were established under both irrigated and dryland conditions. The irrigated land was corn in 1975. The land was spring plowed after fall disking of corn stalks and tandem disked again to incorporate herbicide (Treflan 1 lb/A) prior to planting on May 27. A planter which formed an irrigation furrow at the time of planting was used. The planting rate was 35,000 seeds per acre. Three inches of water were applied on June 3. Due to a shortage of irrigation water after mid-July, no further water was applied.

Dryland

Sunflowers were planted May 25 on dryland corn land that had been spring plowed, tandem disked twice and harrowed. Herbicide (Treflan, 1 lb/A) was applied prior to the second disking; planting rate was 19,900 seeds per acre. The sunflowers were cultivated once. Paraquat was applied to both the irrigated and dryland plots when approximately 25, 50 and 75% of the heads had turned from green to yellow on the back. A ground application was used to apply the pint/acre rate over the top of the plants. Twenty gallons per acre of water was used as a carrier. A temperature of 26° F occurred on Sept. 26. Yields were taken by hand when the plots appeared visually ready for harvest.

Results and Discussion

Yields and plant populations at harvest for the four treatments on both the irrigated and dryland plots are presented in Table 1. Because of the lack of spring moisture, the dryland plots germinated approximately 30 days later than the irrigated plots. With a higher plant population on the irrigated plots, a lower yield resulted from the lack of adequate irrigation water. Both sets of plots were infested with stalk weevil, which resulted in erratic and decreasing populations between harvest dates, particularly in the irrigated plots. This weevil infestation caused the stalks to break and the heads fall to the ground on contact or from the wind. Results show that with all but one variety the treated yields, regardless of spraying date, are higher than the untreated yields. The percentage of maturity at which to apply the desiccant was dependent on variety. The higher yield occurred on various spraying dates on the irrigated plots; the yield was higher dependent on the plant population.

Table 1. Yield of Sunflowers Harvested at Various Dates from Pre-harvest Desiccant. Plots under limited irrigated and dryland conditions.

IRRIGATED				
Date of Spraying	8/25	8/30	9/6	Un-treated
Date of Harvest	9/7	9/9	9/20	9/28
Variety	Yield, lbs/A			
Peredovik	735	778	940	446
HySun #1	444	599	406	576
Interstate #8941	239	362	247	212
	Actual Population of Harvest Plants per Acre			
Peredovik	21,200	25,300	17,700	14,500
HySun #1	12,300	18,500	12,700	17,400
Interstate #8941	20,100	19,800	12,900	11,500

DRYLAND				
Date of Spraying	9/6	9/14	9/20	Un-treated
Date of Harvest	9/24	10/4	10/7	10/12
Variety	Yield, lbs/A			
Peredovik	1032	669	683	524
HySun #1	725	530	623	494
Interstate #8941	794	815	778	653
	Actual Population at Harvest Plants per Acre			
Peredovik	13,600	12,700	12,700	14,500
HySun #1	11,500	11,000	12,300	12,100
Interstate #8941	16,000	16,300	15,700	15,300

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ALFALFA YIELDS UNDER IRRIGATION

Joseph F. Giles and Robert A. Sanders

The objective of this experiment was to obtain information on the relative yielding capacity of three newer varieties of alfalfa during the fourth year of production under irrigation.

Procedure

The alfalfa was seeded in May, 1973. The varieties were not fertilized, as soil test for phosphorus and potassium were high. Water was supplied as needed from May until mid-July with an overhead sprinkler system. On July 16, irrigation water became limited and irrigation ceased. A total of approximately 5.5 inches of water was applied.

The alfalfa was harvested with a self-propelled swather, the forage weighed and moisture samples taken. Yields were converted to tons of 12% moisture hay per acre.

Results and Discussion

Yields of the three varieties of alfalfa are illustrated in Table 1. The yields of the first cutting were reduced by a frost which occurred on May 17, which did moderate damage and delayed growth. The cuttings were taken at the 1/10 bloom stage of development. No water was applied after the second cutting was taken. There was no significant difference between the varieties at any of the harvest dates nor in total production.

Table 1. Yield of Three Varieties of Alfalfa Under Irrigation

	Cutting			
Variety	June 7	July 15	Aug. 24	Total
	Yield, Tons/acre			
Vernal	3.04	1.92	0.63	5.59
Iroquois	3.00	1.74	0.83	5.57
Saranac	3.03	2.09	0.66	5.78

LSD (.05) = 0.47 T/A

Iroquois and Saranac alfalfa varieties were selected because of their regrowth characteristics. After each cutting these two varieties observed to grow back at a more rapid rate than did Vernal. This increased growth could be observed for about three weeks after cutting.

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INCREASING WATER USE EFFICIENCY OF SMOOTH BROMEGRASS THROUGH PLANT SELECTION

James G. Ross

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 six acres of irrigated land. The next spring alfalfa was over-seeded and in subsequent seasons harvested to give maximum yield.

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. In 1976, 100 lbs of N was placed on the field in early April and the bromegrass plants allowed to reach maturity. The general plant characteristics including seed set were noted and clonal samples from the best 90 of these transplanted in two replicates to a nursery at Brookings. The best five plants were totally removed from the field at Redfield and placed in a crossing block at Brookings, to produce seed for testing for regrowth and ability to survive with alfalfa. All these genotypes will be evaluated for agronomic characteristics under the same conditions at Brookings and then the best combined to form synthetic varieties for testing.

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EFFECT OF TWO FOLIAR FERTILIZERS ON THE YIELD OF IRRIGATED SPRING WHEAT, IRRIGATION RESEARCH FARM, 1976

R. Jay Goos, Paul Carson, Paul Fixen, Robert Nettleton and Joe Giles

Summary

Irrigated spring wheat was treated with two experimental foliar fertilizers in separate experiments at the Irrigation Research Center, near Redfield.

One experimental fertilizer solution (formulated at South Dakota State University using materials provided by the Tennessee Valley Authority) was applied to wheat foliage at various rates on three different dates. Foliar applications of this fertilizer solution caused small yield increases.

A second fertilizer solution, provided by Allied Chemical, Inc., was applied to wheat foliage at two different dates. Application of this proprietary material also caused small yield increases.

The small yield increases found in these two experiments may be a trend but are not large enough to be considered statistically significant. Weeds and poor water distribution increased plot variability in both experiments, making the results difficult to interpret.

Introduction

Techniques for achieving high yields of irrigated spring wheat are needed to make the production of this crop more economically feasible under irrigation. Researchers in other states have produced increases in soybean yields with applications of fertilizer solutions to the plant foliage. These fertilizer solutions contained nitrogen, phosphorus, potassium, and sulfur in proportions approximately equal to the proportions that these elements are found in the soybean seed. The purpose of these experiments was to test the effect of two foliar fertilizers on wheat yields.

Procedure

A. General. The experiments were located in the same field on the Irrigation Research Farm, near Redfield. On May 4, spring wheat variety Olaf was planted. Seeding rate was 1.25 bushels per acre. Sixty pounds of nitrogen (as ammonium nitrate) were top-dressed after the wheat had emerged.

The experiments were irrigated with a center pivot sprinkler irrigation system. Precipitation and irrigation water applied during the growing season was as follows:

Date	Precipitation inches	Date	Irrigation inches
May	0.53	May 31	0.80
June	3.72	June 4	0.80
July	1.41	9	0.80
Aug. 1-10	0.25	18	1.00
		July 8	1.00
		15	1.00
TOTAL	5.86		5.40

Total growing season irrigation and precipitation was equal to 11.26 inches.

Application of both foliar fertilizers was made with a hand sprayer equipped with a 3-nozzle boom. Individual plots were 5 feet by 25 feet in size. Randomized complete block design with four replications was used in each experiment.

Because of weed growth, both experiments were sprayed with Paraquat (2 qts/acre) after wheat maturity. Both experiments were harvested Aug. 10 with a small-plot combine. The seed harvested from each plot was cleaned, weighed, and the yield per acre of each plot estimated.

B. The ratio of $N:P_2O_5:K_2O:S$ in spring wheat grain is 6:2.3:1.8:.5, respectively. Using materials provided by the Tennessee Valley Authority, a foliar fertilizer solution was mixed. This solution contained approximately 9.5% nitrogen, 3.5% P_2O_5, 3.5% K_2O, and .75% sulfur. The analysis of this solution approximates the ratio of $N:P_2O_5:K_2O:S$ in wheat grain.

Foliar applications were made on June 29, July 8, and July 15, of 14.5 and 29.0 gallons of solution. The wheat on June 29th was in the post-anthesis stage of growth. On July 8th, the developing wheat kernels were watery-ripe, and on July 15th the developing wheat kernels were milky-ripe and entering the dough stage of growth.

The 14.5 gallons per acre rate provides: 12.5 lb/acre of N, 4.7 lb/acre of P_2O_5, 4.8 lb/acre of K_2O and 1 lb/acre of sulfur. A single 29 gallon/acre provides twice the amount of these nutrients.

The three application dates (June 20, July 8 and July 15) combined with three possible application rates (0 gal/acre, 14.5 gal/acre, 20 gal/acre) at any of the three application dates. This gives the following treatments used in this experiment:

Treatment Number	Application Date June 29	July 8	July 15
	(gal/acre)		
1 (check)	0	0	0
2	14.5	0	0
3	29.0	0	0
4	0	14.5	0
5	0	29.0	0
6	0	0	14.5
7	0	0	29.0
8	14.5	14.5	0
9	14.5	29.0	0
10	29.0	14.5	0
11	29.0	29.0	0
12	14.5	0	14.5
13	14.5	0	29.0
14	29.0	0	14.5
15	29.0	0	29.0
16	0	14.5	29.0
17	0	14.5	14.5
18	0	29.0	14.5
19	0	29.0	29.0
20	14.5	14.5	14.5
21	14.5	29.0	14.5
22	14.5	14.5	29.0
23	14.5	29.0	29.0
24	29.0	14.5	14.5
25	29.0	14.5	29.0
26	29.0	29.0	14.5
27	29.0	29.0	29.0

C. The experiment using the foliar fertilizer provided by Allied Chemical, Inc. Analysis and source of nutrients in this solution was not made known to us. Applications of 6, 12 and 18 gallons/acre were made on both June 29 and July 8 (see above for stage in growth at the time of application). The following is a list of treatments used:

Treatment Number	Application Date June 29	July 8
	(gal/acre)	
1	0	0
2	6	0
3	0	6
4	12	0
5	0	12
6	18	0
7	0	18
8	12	6

Results and Discussion

A. Results of application of SDSU-formulated foliar fertilizer from materials supplied by TVA. A summary of yield data for this experiment is presented in Tables 1 and 2. Table 1 shows the yields associated with total amount of foliar fertilizer applied, irrespective of application date. This table shows a possible upward trend in yields as total foliar application is increased from 0 to 25 lbs per acre of nitrogen. Yield levels drop off with higher applications.

Table 1. Effect of Total Foliar Application on Spring Wheat, SDSU Formulated Fertilizer Solution. Irrigation Research Farm, 1976.

Total foliar nutrients applied disrespective of application time. N	P_2O_5	K_2O	S	Average Yield
lbs/A				Bu/A
0	0	0	0	20
12.5	2	4	1	22
25	4	8	2	24
37.5	6	12	3	21
50	8	16	4	22
62.5	10	20	5	23
75	12	24	6	20

LSD (.05) = 4.5 Bu/A C.V. = 19.4%

There are no statistically significant differences in these yields.

B. Results of application of foliar fertilizer provided by Allied Chemical, Inc. A summary of yield data for this experiment is found in Table 3. There were no yield increases or decreases that were not within the experimental error for this experiment.

As in the other experiment, weeds and water distribution limited yields somewhat and added another source of experimental error. The application of this material did not cause noticeable leaf injury.

The results of these two experiments do not provide conclusive proof for or against the use of foliar fertilizers on irrigated wheat in South Dakota. More research will be done in this area.

Table 2. Effect of a Single Foliar Application on Spring Wheat, SDSU Formulated Fertilizer Solution. Irrigation Research Farm, 1976.

Nutrients Applied N	P_2O_5	K_2O	S	Date Applied June 29	July 8	July 15
lbs/A					Bu/A	
0	0	0	0	20	20	20
12.5	4.7	4.8	1	18	24	23
25.0	9.4	9.6	2	22	22	25

LSD (.05) = 5.5 Bu/A C.V. = 17.3%

There are no statistically significant differences in these yields.

Effects of a single application of foliar fertilizer (treatment numbers 1-7) are presented in Table 2. Applications made on July 15 produced an upward trend in yield. This trend was less pronounced with July 8 applications. June 29 applications affected yield the least.

Table 3. Time and Rate of Application of Effect of Foliar Fertilizer* on Irrigated Spring Wheat, Irrigation Research Farm, 1976.

Date Applied (gal/acre)		Average Yield
June 29	July 8	(Bu/Acre)
0	0	15
6	0	16
0	6	14
12	0	16
0	12	18
18	0	14
0	18	19
12	6	14

LSD (.05) = 6 Bu/Acre C.V. = 24%

*Fertilizer supplied by Allied Chemical, Inc.

There are no statistically significant differences in these yields.

Although these two tables show yield trends, these yield increases are not large enough to be considered statistically significant. More research is needed to see if these yield trends can be repeated.

A slight leaf "burn" (less than 10% of the leaf area) was caused by the first application. Subsequent applications caused no leaf injury. It is not fully known what causes this leaf "burn." Our experience has shown that leaf injury due to foliar fertilization is minimized if evening applications are made rather than morning or afternoon applications.

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EFFECTS OF FOLIAR FERTILIZER ON YIELDS OF DRYLAND AND IRRIGATED SOYBEANS

R. Jay Goos, Paul Carson,
Robert Nettleton and Joe Giles

Summary

Applications of a fertilizer solution (containing nitrogen, phosphorus, potassium and sulfur) to the foliage of dryland and irrigated soybeans produced no detectable yield increases or decreases. Slight leaf burning was created by these applications.

Introduction

Workers in other states have produced increases in soybean yields from the application of foliar fertilizer during seed-fill period of growth. The foliar fertilizer contained nitrogen, phosphorus, potassium, and sulfur in a 10:1:3:.5 ratio, respectively. The purpose of this experiment was to test this technique under South Dakota dryland and irrigated conditions, and observe yield response from this fertilizer practice.

Procedure

The soybean variety Wells was planted June 2 on the Redfield Irrigation Research Center on both irrigated and non-irrigated sites. Planting rate in both instances was 57 lbs of seed per acre. Treflan for weed control was applied preplant at 1 lb/acre. The dryland site was cultivated on June 29, and was also hand-weeded. The irrigated site was cultivated on June 29, cultivated and hilled for furrow irrigation on July 15, and hand-weeded on August 17.

A fertilizer solution of 10% nitrogen, 2.4% P_2O_5, 4.0% K_2O and .6% sulfur was mixed using water, urea potassium polyphosphate liquid, and sulfate of potash. The fertilizer was supplied by the Tennessee Valley Authority and the American Potash Institute. On Aug. 28 and Sept. 2, this solution was applied at a rate of 20 gallons/acre.

Application was made with a high clearance sprayer provided courtesy of Wilson Brothers of Redfield. A ground speed of 3 miles per hour and an approximate pressure of 35 psi was employed.

Some plots received a 20 gallon/acre application at both treatment dates, and some only a single application. The check plots received no foliar fertilizer. The treatments were as follows:

Treatment No.	Gallons/Acre of Foliar Fertilizer Applied On: Aug. 28	Sept. 2
1	0	0
2	20	0
3	0	20
4	20	20

A randomized complete block design was employed. Eight replications were used on the dryland site, but only four of these replications went into the determination of yield due to soil variations. Ten replications were used on the irrigated site.

Results

A summary of yield data for the dryland site is found in Table 1, and for the irrigated site in Table 2. In both cases, there were no detectable yield increases or decreases. Any numerical differences in yield were within the experimental error for this trial.

Both applications caused a slight leaf "burn" (5-10% of the leaf area). This is less than the amount of "burn" seen in other experiments. Both the Aug. 28 and the Sept. 2 applications were made after 8:00 p.m. This may have contributed to the low amount of "burn." It has been observed in several experiments that leaf burn is least with evening applications, greater with morning applications and greatest for afternoon applications.

Up to this point we have not been able to reproduce the yield responses to foliar fertilizer that have been reported in other states. We attribute much of this to the fact that in 1976 our yield potentials were limited by other factors (heat, water stress, etc.) that the possible benefit of foliar fertilizer could not be realized. Under favorable growing conditions there may be a place for foliar fertilizer in South Dakota. Research on this subject will be continued.

Table 1. Effect of Foliar Fertilization on Yields of Dryland Soybeans, Redfield Research Farm, 1976.

Treatment No.	Date of Application Aug. 28	Sept. 2	Average Yield
	(Gallons/A)*		(Bu/Acre)
1	0	0	17
2	20	0	16
3	0	20	19
4	20	20	16

LSD (.05) = 5 Bu/A.

*Each gallon contained 10% N, 2.4% P_2O_5, 4.0% K_2O and .6% sulfur.

Table 2. Effect of Foliar Fertilization on Yields of Irrigated Soybeans, Redfield Research Farm, 1976.

Treatment No.	Date of Application Aug. 28	Sept. 2	Average Yield
	(Gallons/A)*		(Bu/Acre)
1	0	0	34
2	20	0	33
3	0	20	33
4	20	20	34

LSD (.05) = 4 Bu/A.

*Each gallon contained 10% N, 2.4% P_2O_5, 4% K_2O and .6% sulfur.

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FOLIAR FERTILIZATION OF IRRIGATED CORN

R. Jay Goos, Paul Carson, Robert Nettleton
and Joe Giles

Summary

Irrigated corn yields were not increased, and in one case were significantly decreased by applications of foliar fertilizer (applied on leaves) during seed-fill period of growth. Yields were limited because of unfavorable growing conditions and a lack of irrigation water (plots received 3 inches of irrigation water on July 13).

Introduction

Workers in other states have reported yield increases for soybeans when solutions containing nitrogen, phosphorus, potassium, and sulfur were applied to the plant foliage during the seed-fill period of growth. This experiment was conducted at the Irrigation Research Center to determine if similar yield increases could be obtained with foliar fertilizer applications on irrigated corn.

Procedure

The fertilizer solution used contained water, urea, potassium polyphosphate and ammonium sulfate. Analysis of fertilizer solution was 8.9% nitrogen, 3.9% P_2O_5, 3.7% K_2O, and .8% sulfur. On Aug. 17, Aug. 28 and Sept. 2, applications of this solution were made at a rate of 30 gallons/acre. A single 30 gallon application contains approximately 25 lbs of nitrogen, 11 lbs of P_2O_5, 10 lbs of K_2O and 2 lbs of sulfur. The fertilizer was supplied by the Tennessee Valley Authority.

Some plots received a 30 gallon application at all of the application dates, some received a 30 gallon application at only a single application date. Applications were also made at combinations of application dates. The check received no foliar fertilizer. The applications were as follows:

Treatment No.	Gallons of Foliar Fertilizer Applied On: Aug. 17	Aug. 28	Sept. 2
1	0	0	0
2	30	0	0
3	0	30	0
4	0	0	30
5	30	30	0
6	30	0	30
7	0	30	30
8	30	30	30

Applications were made with a high-clearance sprayer, courtesy of Wilson Brothers, Redfield.

The seed bed was prepared, the crop planted and tended by the personnel from the James Valley Research and Extension Center.

The variety of corn was Funk's G-4444, planted on May 21, at the rate of 27,800 plants per acre. The corn was planted with a conventional planter. Lasso was used as the herbicide at the rate of 20 lbs/acre applied in a band. Mocap was used as the insecticide at 7.5 lbs/acre and was applied in a band. The corn was cultivated on June 28, cultivated and hilled for furrow irrigation on July 13. Three inches of irrigation water was applied on July 13.

A randomized complete block design was employed with four replications. The plots were harvested by hand as ear corn, weighed, moisture samples were taken, and shelled corn yield per acre was estimated for each plot.

Results and Discussion

The yields as influenced by the foliar applied fertilizer treatments are reported in Table 1. There were no yield increases caused by the treatments and only one yield depression was large enough to be considered statistically significant.

Rainfall was well below normal and the corn suffered some hail damage. Irrigation was limited to 3 inches of water applied on July 13. Water for irri-

gation was not available for the rest of the summer. In spite of low rainfall and the lack of irrigation water, the corn yielded 66 to 90 bushels/acre. The variation in yield between plots receiving similar treatments was high. This makes it difficult to evaluate the results.

The first foliar application, made on Aug. 17, "burned" approximately 10% of the leaf area. Subsequent applications burned less than 5% of the foliage. The Aug. 17 application was made during the forenoon (9:30-10:00 a.m.). The Aug. 28 and Sept. 2 applications were made after 8:00 p.m. It appears that evening applications are absorbed with less leaf damage than morning applications.

Application of nutrients to the leaves of plants growing under stressed conditions can cause additional stress within the plant. It now seems that when yields are already being significantly lowered by other factors (heat stress, water stress, etc.), the application of foliar fertilizer will be of limited benefit.

Table 1. Effect of Foliar Fertilizer on Irrigated Corn Grown at the Redfield Research Farm, 1976.

Treatment No.	Date of Application[1] Aug. 17	Aug. 28	Sept. 2	Avg. Yield of Shelled Corn
	Gallons Applied			Bu/A
1	0	0	0	90
2	30	0	0	87 NS
3	0	30	0	84 NS
4	0	0	30	80 NS
5	30	30	0	66 *
6	30	0	30	74 NS
7	0	30	30	77 NS
8	30	30	30	82 NS

LSD (.05) = 21 Bu/A

[1]Material applied contained 8.9% N, 3.9% P_2O_5, 3.7% K_2O and .8% sulfur.
NS = Not significantly different from check.
*This treatment is significantly lower than the check (.05 level).

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EARLY SEASON ALFALFA IRRIGATION

Darrell W. DeBoer, Shu T. Chu
and Albert C. Dittman

Alfalfa plots were established in a Beotia silt loam soil in 1974. The objective of the 1976 research effort was to evaluate the effect of different amounts of irrigation water on alfalfa yields; however, limited irrigation water altered the management of the research plots. The soil water content of the alfalfa plots was raised to field capacity (10 inches of available water in a four foot soil profile) at the end of May. Six inches of irrigation water was applied during the first part of July. Total rainfall for June, July and August was 5.7 inches. Thus a condition existed where most of the alfalfa water requirements during August came from water stored in the soil profile.

Table 1 summarizes the average alfalfa yields (tons dry matter per acre) collected from 14 plots. The third cutting started to show the effect of moisture stress. No soil water samples were collected at the end of the harvest season.

1976 Alfalfa Yields

Cutting	Cutting Date	Yield Ton/A
1	June 10	2.0
2	July 15	1.9
3	Sept. 9	1.3
	TOTAL	5.2

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EFFECT OF TILLAGE PRACTICES ON DISEASES OF SPRING WHEAT AT REDFIELD IN 1976

G. W. Buchenau, J. D. Smolik and D. E. Miller

Introduction

Crop residue on the soil surface reduces wind and water erosion, improves the water-catching capability of the land and reduces water lost to evaporation.

Certain diseases of wheat, however, are more serious under high levels of residue, due to the fact that propagules of pathogens carried on straw are not decomposed as rapidly at the soil-straw interface as they are when buried. Pyrenophora trichostoma, the cause of yellow leaf spot of wheat, is such a pathogen. This disease is rarely seen in plow-disk-harrow operations, but can destroy 30% or more of the crop under stubble-mulch practices.

Other wheat diseases may become more serious on surface residue culture. Among those suspected but not definitely known to be aggrevated by surface residues are septoria leaf spot, common root rot, and root feeding nematodes.

The experiments reported here are the second seasons results from a study to clarify the influence of surface residue on these diseases and to control them in stubble-mulch culture of spring wheat.

Materials and Methods

The four tillage practices, chosen to leave a range of surface residue, were applied to 30-foot strips 150 feet long. The order of tillage was randomized within replications of a randomized complete block design of four replications. Fungicide or nematicide treatments were superimposed across the blocks, and were assigned at random to plots with the block. This arrangement, with tillage treatments in strips going in one direction, with fungicide-nematicide treatments superimposed across them in another direction, is known as a split-block or stratified split-plot design.

Fall tillage in 1975 followed the harvest of Era spring wheat. Spring tillage was completed prior to planting on April 19, 1976. Furadan was applied as a pre-plant treatment with a small fertilizer spreader at a rate of 12 lb active ingredient per acre. Era spring wheat was then planted at 1 bu/A with a standard grain drill. A post-emergence Benomyl spray was applied to designated plots on May 19 at a rate of 4 lbs/A. Due to the extreme drouth and consequent lack of foliage disease, no foliage fungicides were applied.

Root disease, nematode counts, foliage disease and soil moistures were monitored at planting, mid-season and at harvest. Harvest was completed on July 28 using a small-plot combine.

Results

Noble blade treatments left significantly higher levels of residue on the soil surface than did the other cultural practices (Table 1). Soil moisture was not affected until late in the season when residue was directly correlated with moisture.

Table 1. Effect of Cultural Practices on Surface Residue and Soil Moisture

Cultural Practices	Preplant Residue (g/m^2)	Soil Moisture (%) May 19	June 16	July 28
1. Noble F,S	105.3	19.8	13.3	21.5
2. Chisel F, Disc S	42.0	19.8	12.6	18.1
3. Chisel F,S	35.7	19.5	14.9	16.1
4. Disc F,S	14.3	19.9	12.3	11.4
LSD (.05)	22.6	N.S.	N.S.	7.1

Neither cultural practices nor fungicide-nematicide treatments significantly affected yield (Table 2). Test weight, however, was significantly lower in fall chiseled plots than in disked plots (Table 3). Noble blade treatment produced intermediate test weight. Benomyl post-emergence sprays also resulted in test weights significantly higher than those of untreated plots.

Table 2. Effect of Cultural Practices and Fungicide-Nematicide Treatment on Yield of Era Spring Wheat

Fungicide-Nematicide Treatment	CP 1 Noble F,S	CP 2 Chisel F Disc S	CP 3 Chisel F,S	CP 4 Disc F,S	Fungicide-Nematicide Mean
			Yield, Bu/A		
Furadan Preplant	7.0	4.5	5.3	5.1	5.5
Furadan + Benomyl Preplant & Post E.	6.3	7.9	6.8	7.0	7.0
Benomyl Post E.	4.7	4.7	4.8	4.3	4.6
Untreated	5.7	6.8	5.7	5.7	6.0
CP Mean	6.0	6.0	5.7	5.5	

Table 3. Effect of Cultural Practices and Fungicide-Nematicide Treatments on Test Weight of Era Spring Wheat

Fungicide-Nematicide Treatment	CP 1 Noble F,S	CP 2 Chisel F Disc S	CP 3 Chisel F,S	CP 4 Disc F,S	Fungicide-Nematicide Mean
			Test wt. (lb/bu)		
Furadan	52.7	51.5	52.2	52.6	52.2[ab]
Furadan + Benomyl (Post E.)	52.5	51.0	52.3	52.9	52.2[ab]
Benomyl Post E.	52.9	53.3	51.1	54.6	53.0[b]
Untreated	52.1	51.8	49.4	52.4	51.5[a]
CP Mean	52.5[bc]	51.9[ab]	51.2[a]	53.2[c]	

Crown rot was lightest in noble bladed plots, although isolation data indicated that most of the crowns in all treatments were infected with <u>Helminthosporium sativum</u>, the fungus that causes dryland foot rot of wheat (Table 4).

Table 4. Effect of Cultural Practice on Common Root Rot of Era Spring Wheat and Toxin (Patulin) Production

Cultural Practice	Crown Rot Index[1]	% Crowns with H. sativum June 16	Patulin Index[2]
1. Noble F,S	34	78	12.5
2. Chisel F, Disc S	40	89	0.5
3. Chisel F,S	45	85	2.3
4. Disc F,S	39	90	0
LSD (.05)	7	NS	10.0

[1]June 16 rating
[2]Percent reduction in height of indicator plant (corn).

Laboratory bioassays indicated that the high residue plots (noble) were potentially greater producers of a toxin (patulin) that is known to reduce the growth and vigor of wheat. Under the very dry field conditions it is doubtful if toxic levels of patulin were actually produced.

Root feeding nematodes (microscopic roundworms) were significantly lower under high residue (noble) than under other cultural practices. Furadan effectively controlled nematodes in all treated plots.

Table 5. Effect of Cultural Practices and Nematicide Treatment on Root Feeding Nematodes

Cultural Practice	No. of root feeding nematodes per 200 cc (½ pt) of soil[a] Untreated Preplant	Untreated Harvest	Furadan Treated Preplant	Furadan Treated Harvest
1. Noble F,S	485	188	485	29
2. Chisel F, Disc S	459	397	459	67
3. Chisel F,S	543	479	543	79
4. Disc F,S	291	272	291	62
Means	445	366	445	59

[a]Total plant feeding nematodes, mainly <u>Tylencorhynehus</u> spp., the stunt nematode.

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