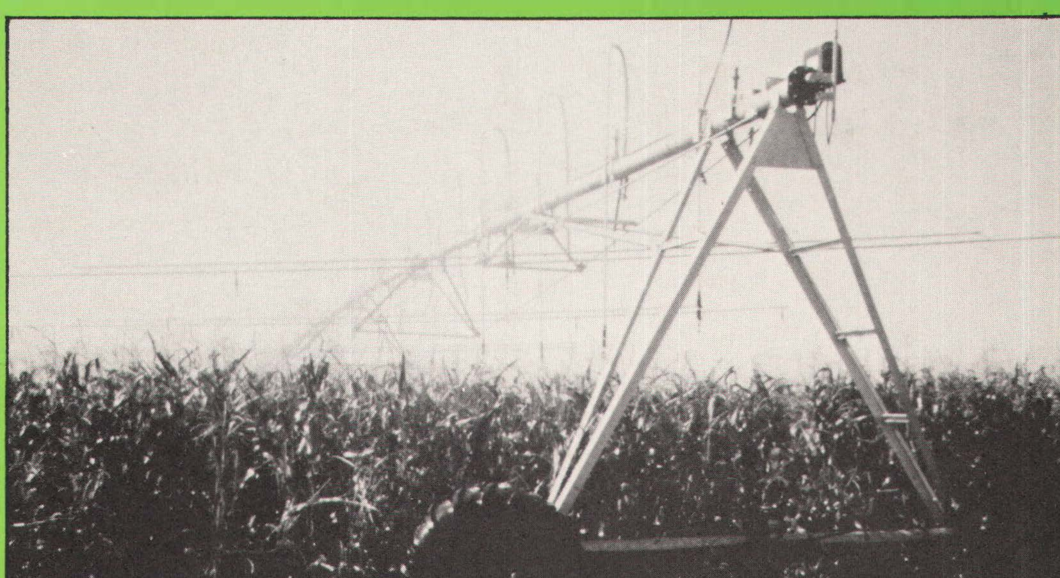
SDSU

Progress Report

1983 Research Results

James Valley Agricultural Research & Extension Center



Agricltural Experiment Station
South Dakota State University

Introduction

The James Valley Agricultural Research and Extension Center is located six miles east and 1/2 mile north of Redfield, South Dakota. The center is operated by the Agricultural Experiment Station at South Dakota State University and provides the facilities and support personnel necessary to perform a wide range of agronomic and livestock research. Several similar centers are located throughout the state with each having unique capabilities and goals. At the present time, the James Valley Center is one of only two stations having irrigation capability and serves as the primary location for agronomic irrigation research in South Dakota.

The role of the James Valley Station was expanded this year to include involvement in irrigation research projects taking place at off-station locations. During 1983, these efforts were predominately directed to work at a 40 acre irrigated site along the Missouri River near Gettysburg. This area is owned by Eldore Halzwarth but has been used since 1981 for the research of Dwayne Beck and Darrell DeBoer on runoff under low pressure sprinklers and tillage for runoff reduction. Results from irrigation research at this site and from other research projects performed in the state that deal with agronomic aspects unique to irrigation will be included in the progress report of the JVAREC.

The research center at Redfield is also the site of a significant amount of dryland research. Some of this research addresses needs specific to the north-central region of the state (i.e. Hessian fly research) while other work, (i.e. head scab control in wheat) has wider applicability. All dryland and livestock research conducted at the station and research conducted in the area of the station having special significance for producers in North-Central South Dakota will also be included in the JVAREC progress report.

The research contained in this progress report represents a large number of hours of work by staff members from the Plant Science, Ag. Engineering and Animal Science Departments and the Water Resources Institute at South Dakota State University, their project employees, the staff at the James Valley Research Center and other personnel from SDSU. Their efforts in performing the research and submitting the results for publication is deeply appreciated.

The primary purpose of the research included in this annual report and much of the other research done at SDSU is to supply information that will be of value to producers and agribusinessmen in South Dakota. Any comments or suggestions for improving the research conducted or the reporting of research results would be appreciated.

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PROGRESS REPORT 1983
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Additional copies of this publication or individual reports are available on request from the Ag. Experiment Station at SDSU or from the James Valley Research Center. These sheets may be removed and used as an order form if desired.

DRYLAND CROPPING RESEARCH

Copies Desired	Report Number	Title
______	JV83-1	Dryland Spring Wheat Breeding Trials
______	JV83-2	Winter Wheat Variety Trial
______	JV83-3	Conventional, Reduced and No-till Planting of Winter Wheat at Two Nitrogen Fertilizer Levels
______	JV83-4	Dryland Flax Breeding Trials
______	JV83-5	Herbicide Screening for Kochia Control in Spring Wheat
______	JV83-6	Post-emergence Herbicides for Kochia Control in Spring Wheat
______	JV83-7	AC 222,293 for Weed Control in Spring Wheat
______	JV83-8	Chlorsulfuron (Glean) for Weed Control in Spring Wheat
______	JV83-9	Chlorsulfuron (Glean) Recropping Study
______	JV83-10	Dryland Corn Variety Trial
______	JV83-11	Hybrid Sunflower Trial
______	JV83-12	Proprietary Alfalfa Variety Trial
______	JV83-13	Performance of Herbicides in Corn, Soybeans and Sunflower.
______	JV83-14	Desmedipham (Betanex) Combinations for Weed Control in Sunflowers
______	JV83-15	Herbicide Screening for Reduced Tillage Sunflowers

Copies Desired	Report Number	Title
______	JV83-16	Sunflower Seed Weevil Insecticide Trials Part I-Aerial Application of Labeled Materials Part II-Screening of Experimental Materials
______	JV83-17	Influence of Sunflower Planting Date on Seed and Stem Weevil Infestation
______	JV83-18	Insecticide Screening for Control of Stem Insects In Sunflowers
______	JV83-19	Effect of Nematode and Fungus Control on Stand Establishment of Alfalfa
______	JV83-20	Effect of Soil Moisture Gradient on Fusarium Root Rot of Soybeans
		LIVESTOCK RESEARCH
______	JV83-21	An Evaluation of Three Feeding Schemes to Winter Replacement Heifers

IRRIGATION RELATED RESEARCH

Copies Desired	Report Number	Title
______	JV83-22	Varieties, Seeding Rate and Water Management of Irrigated Spring Wheat
______	JV83-23	Yield and Morphological Effects of Ethephon (Cerone growth regulator) on Irrigated Spring Wheat
______	JV83-24	Use of Cerone for the Production of Irrigated Malting Barley
______	JV83-25	Control of Tan Spot and Wheat Scab with Fungicides on Irrigated Spring Wheat
______	JV83-26	Nematode Control in Irrigated and Dryland Spring Wheat
______	JV83-27	Irrigated Sorghum Variety Trial
______	JV83-28	Irrigated Soybean Variety Trial
______	JV83-29	Row Spacing Effects on Soybean Yield Under Sprinkler Irrigation
______	JV83-30	Soybean Root Growth and Water Uptake
______	JV83-31	Planting of Corn and Soybeans in Alternate Strips Under a Center Pivot
______	JV83-32	Irrigated Corn Variety Trial
______	JV83-33	Planting Date and Seeding Rate Effects on Irrigated Corn
______	JV83-34	Nitrogen Calibration For Irrigated Corn
______	JV83-35	Reducing Runoff Losses Under Conventional and Low-Pressure Sprinkler Packages
______	JV83-36	Pestigation and Other Methods of European Corn Borer Control
______	JV83-37	Nematode Control in Irrigated Corn
______	JV83-38	Full Season and Double Crop Forage Production

Field Tours and Visitation

Visitors are always welcome at the James Valley Ag. Research and Extension Center located six miles east and one-half mile north of Redfield, S.D. There is usually someone at the station at all times that would be happy to show you the research and demonstration work. A call to the office (472-0258) would assure that someone would be present when you dropped by.

If you drive through the station without a "guide", certain fields will appear to have been managed poorly. This is often intentional since a problem must be created before research on how to solve the problem can be conducted. For instance, if a study of post-emergence grass herbicides on soybeans is to be conducted, a herbicide not effective on grass will be used on the whole area. All plots will be grassy early on. After the post emergence herbicide treatments are applied, plots not receiving herbicide and plots receiving treatments that do not work will look poorly managed.

The satellite site near Gettysburg is located 1/2 mile south of the water treatment plant for the city. This green building is about one mile north and one mile northwest of the 1804 north-212 west junction (12 miles west of Gettysburg). It is on the road to the east Whitlock Bay boat ramp. The most valuable time for a visit to this site would be when the irrigations are taking place. You may arrange this by calling the Redfield office.

The best time to visit either of the sites is for regularly scheduled crop tours. Many of the researchers from SDSU are on hand to discuss their work or to answer questions about your farming operation. We have tentatively scheduled the 1984 tours for the evenings of July 12 and August 30 at 6:30 p.m. at Redfield. No decision has been made on a tour at Gettysburg for 1984. The exact content of these tours and any date or time changes will be announced later.

Two such twilight field tours were held at Redfield and one at the Gettysburg site in 1983. The early summer tour at Redfield on July 7 featured irrigated and dryland wheat experiments, alfalfa varieties, carryover effects of Glean herbicide, Cerone growth regulator effects on small grains and herbicide effects on weed control in row crops. The subsurface tillage tool and micro-diking machine used to reduce run-off were demonstrated in the field.

The tour at Gettysburg was on July 15. It featured irrigated small grains, tillage effects on dryland winter wheat and a walk-in look at the effects of sprinkler packages and tillage on run-off. Following the tour, nearly 100 people were served at a pork barbeque sponsored by the District Six Irrigators Association, the Union Carbide Corporation and the Potter County Crop Improvement Association.

The fall tour, on August 25 at Redfield, included discussions of fertilization on irrigated corn, planting date effects on seed weevil in sunflowers and forage double cropping following irrigated small grain. Participants were given an opportunity to inspect the irrigated soybean and dryland corn and sunflower variety trials, ask questions of SDSU personnel, observe an in-field demonstration of no-till planting of row crops in wheat stubble and watch the filling of silage bags with forage sorghum being chopped for livestock feed.

The Staff of the James Valley Agricultural Research and Extension Center

Dr. Dwayne Beck, Manager, JVAREC/Asst. Prof. Plant Science

Dwayne was born and raised on a grain and livestock farm near Platte, South Dakota. He graduated from Northern State College in 1975 with a degree in chemistry. While teaching high school chemistry in Gettysburg, he was employed by a local fertilizer dealer as a fieldman and worked extensively with dryland farmers and irrigators. In 1978, he became a graduate research assistant of Professor Paul Carson in soil fertility at SDSU. He also spent time at the University of California-Davis. Dwayne conducted a nitrogen fertilization-water management research project in 1979 and 1980 which involved numerous irrigated site located between Pierre and Gettysburg. His research interests in 1981 and 1982 primarily involved work on the tillage-runoff-low pressure sprinkler package project at a site near Gettysburg. In February of 1983, Dwayne was appointed manager of the James Valley Agricultural Research and Extension Center, replacing Alber Dittman who retired. Besides managing the station, he is playing an active role in irrigation research conducted on the station and also in projects such as the tillage-runoff study involving off-station locations. Dr. Beck is available to meet with any group or organization to discuss topics related to either irrigation research in South Dakota and/or research taking place at the JVAREC.

Michael Esser, Ag. Research Tech. II

Mike was raised on a grain and livestock farm not far from the station. Prior to coming to work at the research center in 1975, Mike attended Jamestown College and Northern State College. The mathematics he learned is helpful in the research work since his responsibilities include taking care of the livestock, supervising field and weather data collection, applying chemicals and many other chores.

Miron Fisk, Ag. Research Tech. II

Miron rounds out our crew of farm boys. He was born and raised in the Verdon area. After high school, he spent time working on farms and for a well drilling and irrigation dealership. He has attended service schools on pumps and pivots. His schooling and experience are very valuable to Miron as our chief irrigator. He operates, maintains and repairs the many different systems on the station, makes modifications and repairs to the farm equipment and shares other duties.

Hazel Cartner, Adm. Sec. I

Our girl "Friday" is on hand every day of the week form 8 a.m. until noon. Her main duties are to handle the bookkeeping chores at the station. The knowledge of proper procedure gained over the ten years she has worked at the station often prove valuable to the rookie manager. Hazel and her husband, Ronald Cartner, do an excellent job of preparing and serving the coffee, iced tea and rolls at the field tours. Stop by on July 12 and August 30 and check out Ronnie's iced tea.

Summer Student Employees Sherie and Tracy Robinson, Lynette Hurst and Alan Rubida played a large part in the research this year.

SDSU
James Valley Report

The "Big Gun" Spouts Off

D.L. Beck, Manager

I would like to take this opportunity to say "hello" to both the old friends that have received the progress report from the JVAREC in the past and those of you reading it for the first time.

Several changes have taken place in the past year that directly affect the station. The most obvious one was my appointment as research manager when Al Dittman retired. Each person has a unique style of management and individual skills and interests that influence his decisions. Judgements, such as what type of new and/or replacement equipment should be purchased with the limited money available for this purpose, influence the type of research that can be done and the methods used to do this work.

The purpose of this section is to outline the major improvements that have occurred in the last year and discuss how these will enhance the capabilities of the station. It will also be used to inform you of the changes we hope to achieve in the future and how they will affect the research program.

Some necessary additions were made to the machinery line this year. A Hiniker econo-till planter was purchased. The planter is capable of being quickly converted from no-till and ridge-till systems to planting in conventionally tilled soil. It replaces an old style John Deere finger planter set up to plant in 36 inch rows.

A four-row unit with 30 inch row-spacing was purchased. It is capable of applying starter fertilizer and can band granular herbicides and insecticides simultaneously if desired. The new planter is also equipped with a monitor that senses true ground speed using a radar gun. The four row unit was purchased since the tractors at the station are not large enough to adequately handle a six-row planter of this type. The narrower four row unit also enables us to easily load the tractor and planter on a trailer without being sufficiently over-width to necessitate special permits. This greatly enhances the usefullness of the planter since it can conveniently be transported to off-station research sites.

A four row Lilliston rolling cultivator was also purchased. This machine does a much better job of building the furrows necessary to gravity irrigate our row crops than a conventional cultivator. It also is capable of cultivating row crops planted in heavy residue which would plug the conventional machine. The rolling cultivator was modified by addition of paddle shaped dikers for constructing micro-dikes between corn rows to reduce run-off losses. This is one of the methods under study at the

Gettysburg site.

Another method to reduce runoff being investigated at the Gettysburg site is the use of an inter-row subsurface tillage operation following the last cultivation. A B.C. Submulcher is being used for this work. In the past, we borrowed a machine from neighbors or the company. This year, the B.C. Company from Beaver Crossing, Nebraska gave us a five shank sub-mulcher. The machine was modified in the Ag. Engineering shop at SDSU to allow the outer shank on each side to fold up. This again simplifies transportation and allows us to use either three or five shanks in the field. The 80 horsepower tractor at the station cannot pull five shanks to a depth of 20 inches but can pull five shanks at the 10 to 12 inches we normally use. The five shank setup also lends itself to use at off-station sites where a tractor owned by a farmer-cooperator could be used. The sub-mulcher and cultivator-diker have adjustable row-width capabilities to allow testing of these practices on farmer-owned fields in the future.

New practices and techniques must go through two or three separate steps before they are put into use on a wide scale. The first phase involves the testing of many factors. For reasons of saving space and improving precision, these types of studies are often done in small plots. The most promising techniques in trials must then be tested under field scale conditions either on a research station or in a farmer-cooperator field. The final and most important step is the testing and evaluation done by the producer under his own conditions.

Most of the work done by project leaders from SDSU is in the small plot phase. In the future, much of the research effort by the station personnel will be directed to testing the results from small plot research on more of a field scale basis under a variety of conditions. To do this effectively and to support small plot work taking place at satellite locations, it is necessary to have a machinery trailer and pickup capable of hauling our equipment. These items are our top priority for purchase this year if sufficient funding can be obtained.

On most of the research reports you will see terms such as "LSD at .05," "significant difference at the 5% level," etc., used. The "LSD" term stands for "Least significant difference." This is the amount of difference needed between two of the data values for you to be reasonable sure that the difference was really caused by the treatment, variety, etc. and was not due to natural variability. For instance, if you weighed corn from several strips in a field receiving uniform management the values could easily vary by five to twenty bu/A or more. This is due to natural variability. The trials at the station are all replicated (i.e. each treatment is repeated three to seven times). This provides an estimate of natural variability. The .05 level of significance (LSD .05) means that there is only a 5 percent chance that the differences noted were due to natural variability.

Progress Report JV83-W
The 1983 Growing Season

D.L. Beck and M. Esser
JVAREC Research Staff

The Chinese name each year after an animal. If the same approach was taken for the 1983 growing season in South Dakota, it would have to be known as the year of the bug.

The James River Valley spring wheat growing region experienced the heaviest outbreak of Hessian fly in wheat since 1978. Severe first brood European corn borer infestations were encountered in most areas of the state including northern counties that are usually bothered very little by this pest. Sunflower stem and seed weevil numbers were very high in most areas of the state this year, and soybean and sunflower growers faced invasion by wooly bear catepillars with some economic infestations occurring even in northern counties. The insect and disease pressure that occurred this year gave us an excellent opportunity to evaluate methods for preventing and/or controlling outbreaks.

The growing season itself started out very cool. April, May and June all had temperatures below normal at both Gettysburg and Redfield. July and August were hot having temperatures well above normal. The net effect of the cooler than normal weather early and hotter than normal weather late resulted in a growing season with a nearly normal number of degree days. Open pan evaporation measured at Redfield was the highest recorded in the last five years. Pan evaporation values are not measured at Gettysburg at the present time.

Rainfall in the 1983 growing season was above normal for all months except April and May, in Redfield, and April and June at Gettysburg. This factor, and a good carryover soil moisture supply, produced better than average yields on the dryland crops. Spring and winter wheat produced yields in excess of 40 bu/A in both research and production fields. (Some fields are production cropped to improve their uniformity in preparation for an experiment the following year.) Dryland soybean yields were excellent producing values of near 40 bu/A on two separate fields. The dryland corn produced yields in the 90 bu/A range. The sunflower yields where insects were controlled were in excess of 1500 lbs./A.

The irrigated crops at both Redfield and Gettysburg were a mixed bag this year. The corn yields were lower than expected and less than what is considered normal by at least ten percent. Weigh wagon yields at Gettysburg were in the 150-160 bu/A range compared to the 165-175 bu/A yields obtained at this site in 1981 and 1982. Yields of corn at Redfield were predominately in the 120-140 bu/A range. In the past, yield tests at Redfield were not made using large scale harvesting equipment, so no comparisons can be made. Much of the reduced yield may be due to corn borer damage in conjunction

Table W-1. Temperatures at the James Valley Research Center and the Gettysburg site in 1983.

Month	1983 Max.	1983 Min.	1983 Mean	Long Term Max.	Long Term Min.	Long Term Mean	Deviation from Mean
James Valley Research Center							
January	32.2	11.5	21.9	20.5	-1.6	9.5	+12.4
February	36.7	17.2	27.0	28.0	5.9	17.0	+10.0
March	38.9	25.4	32.2	39.3	17.6	28.4	+3.8
April	51.8	30.8	41.3	58.5	32.0	45.3	-4.0
May	67.3	39.8	53.6	71.3	43.2	57.2	-3.6
June	76.0	53.8	64.9	80.3	53.3	66.8	-1.9
July	87.8	62.9	75.4	87.5	58.6	73.1	+2.3
August	92.2	62.9	77.6	86.4	56.5	71.5	+6.1
September	74.2	47.1	60.7	76.0	45.3	60.7	0
October	58.5	37.1	47.8	63.0	34.0	48.5	-0.7
November	39.2	26.7	32.9	43.0	19.2	31.1	+1.8
December	8.3	-9.1	-0.4	28.3	7.0	17.6	-18.0
Average	55.3	33.8	44.6	56.8	30.9	43.9	+0.7
Gettysburg 16 mi. WSW							
April	53.8	28.0	40.9	56.6	31.9	44.3	-3.4
May	66.4	38.8	52.6	69.5	42.9	56.2	-3.6
June	78.5	51.3	64.9	79.1	53.2	66.2	-1.3
July	90.3	61.9	76.1	87.2	58.4	72.8	+3.3
August	93.3	61.6	77.5	86.2	56.4	71.3	+6.2
September	72.8	45.1	59.0	74.9	45.6	60.3	+1.3

Table W-2. Growing Season Open Pan Evaporation at the James Valley Center.

Month	Yearly Total 1979	1980	1981	1983	1983	Daily Ave. 1983
April	1.04[a]	4.44[b]	7.52	4.34[c]		
May	5.86	8.30	6.65	6.72	6.84	.22
June	7.03	4.88	7.62	7.47	7.65	.25
July	5.12	5.94	9.59	9.65	9.42	.30
August	4.91	5.84	7.36	8.04	10.16	.33
September	5.93	5.92	6.10	5.01	6.05	.20
Annual Total[d]	28.85	30.52	37.32	36.89	40.12	

a 1979 evaporation for last eight days of April.

b 1980 evaporation for last 17 days of April.

c 1982 evaporation for last 19 days of April.

d Total from May through September.

Table W-3. Precipitation in inches recieved at the James Valley Research center and the Gettysburg site during the 1983 growing season.

	Redfield Station			Gettysbrug 16 mi. WSW		
Month	1983	Long term average	Deviation	1983	Long term average	Deviation
April	0.73	2.05	-1.32	0.78	2.05	-1.27
May	2.06	2.94	-0.88	3.26	2.88	+0.38
June	4.95	3.68	+1.27	2.21	3.37	-1.16
July	2.83	2.48	+0.35	4.27	2.04	+2.23
August	3.63	1.97	+1.66	2.75	2.37	-0.38
September	2.59	1.25	+1.34	1.56	1.25	+0.31
Growing Season Totals	16.79	14.37	+2.42	14.83	13.96	+0.87

Table W-4. Growing season growing degree days recieved at the James Valley Research Center and the Gettysburg site in 1983.

	Growing Degree Days			
	Redfield			Gettysburg*
Month	1983	Normal	Deviation	1983
April	78.5	133.8	-55.3	68.5
May	266.0	246.8	-80.0	213.5
June	486.5	510.0	-23.5	434.0
July	734.0	674.6	+59.4	695.5
August	755.5	656.6	+98.9	726.0
September	379.5	385.3	-5.8	353.5
TOTAL	2700.0	2707.1	-7.1	2491.0

* Long term normals are not available for the Gettysburg site.

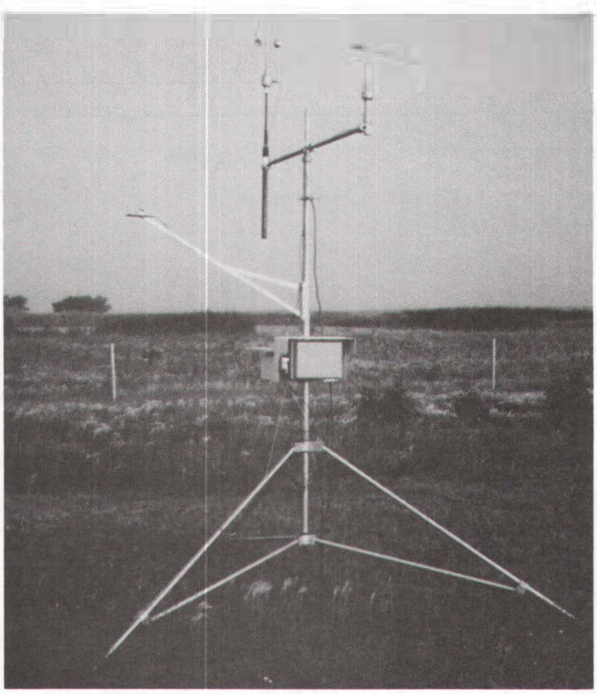
with the hot weather of July and early August. The variability in plant growth stage caused by such things as planting date and variety studies, makes it difficult to properly time application of chemical for corn borer control. The smaller than normal field sizes at the station favored heavy corn borer infestations in 1983.

The irrigated soybean yields were very good running up to 56 bu/A on some weigh wagon tests and averaging in the area of 50 bu/A. Soybeans reach their critical growth stages later than corn, so they may have avoided the effects of the hot weather to a certain extent.

Table W-5. Snowfall recieved at the James Valley Research Center during the period from October 1982 to May 1983.

Month	1982-1983 Snowfall (inches)	Average Snowfall (inches)
October	0	.6
November	5.0	2.8
December	0.5	3.7
January	1.0	4.9
February	1.0	5.8
March	17.0	5.3
April	4.0	1.7
May	0	0.1
Winter 1982-1983	28.5	24.9

Last hard freeze (28°F or less)	May 14	27°F
Last day 32°F or less	May 25	32°F
First frost 32° or less	Sept. 21	27°F
First killing frost (28°F or less)	Sept. 21	27°F



An automatic weather station is pictured on the left. This machine is located at the Gettysburg site, a similar one is set up at the James Valley Research Center. They are connected by telephone line to the computers at SDSU and the Univ. of Nebr. Irrigation scheduling calculations released by the National Weather Service or through the AGNET system will use the data from these stations. They will be fully operational this year.

These machines and others like them in the state should supply both research scientists and producers with excellent weather data.

Progress Report JV83-1
Dryland Spring Wheat Breeding Trials

F. Cholick, K. Sellers and B. Farber
Department of Plant Science

Introduction

Several projects were conducted at the James Valley Agricultural Research Center in 1983 as part of the state-wide program for developing and testing improved spring wheat and triticale varieties. The experiments conducted and their objectives were:

1. Advanced Yield Trial: This is a breeding nursery where the best experimental lines from the SDSU breeding program are compared to a set of standard varieties. The 40 experimental lines are evaluated as potential new varieties. In addition to Redfield, this nursery is grown at eight locations throughout the spring wheat production area each year.

2. Uniform Regional Hard Red Spring Wheat Performance Nursery: Thirty-four experimental lines from breeding programs within the region are evaluated as potential new varieties. Experimental lines in this nursery are submitted from: South Dakota State University, North Dakota State University, University of Minnesota, Montana State University, Washington State University, Northrup King, North American Plant Breeders, Pioneer and Western Plant Breeders.

3. Breeding Nursery: This material represents experimental lines that are in the flow of the breeding program. There were 1000 lines in the nursery. If they demonstrate sufficient potential when uniform, they will become entries in the advanced yield trial.

4. Triticale Advanced Yield Trial: Experimental triticales (a cross between wheat and rye) are evaluated for yield and agronomic characteristics. The 25 entries in this nursery are from breeding programs at South Dakota State University, North Dakota State University, Mexico and Texas. The purpose of the nursery is to evaluate the potential of triticale as a crop in S.D. and determine the progress being made in the first manmade crop.

Methods

All nurseries were planted on April 23, 1983 at a seeding rate of 75 lbs/A. The previous crop was surface irrigated soybeans and surface moisture conditions were excellent. Because the previous crop was irrigated soybeans, this site probably had a greater yield potential than most spring wheat fields in the area. Soil tests indicated adequate levels of phosphorus and potassium for a yield goal of 50 bu/acre. Nitrogen level was not adequate for this yield goal, therefore 60 lbs of N/acre was applied using UAN (28-0-0) before the wheat emerged. Weed control was excellent with the exception of volunteer soybeans. The volunteer soybeans had a greater nega-

Table 1-1. Spring Wheat Breeding Advanced Yield Trial. Redfield-1983.

Variety	Pedigree	Yield 1983	Yield 1982	Test Weight	Planting to Heading	Height	Protein
		bu/A		lbs/bu	days	inches	%
Butte		54.0	53.4	60.9	58	34	16.0
Centa		43.8	55.9	60.6	56	34	15.4
James		48.6	59.9	59.8	57	33	15.9
Oslo		40.0	53.2	55.7	57	28	15.3
Olaf		43.3	48.5	59.2	61	30	15.9
Len		43.5	58.1	59.8	61	34	16.4
Guard		41.3	57.3	60.1	58	28	15.5
Era		45.7	49.1	58.9	62	31	15.3
Marshall		46.3	57.6	59.2	62	30	14.8
Wheaton		36.9	56.8	54.4	62	29	15.2
Angus		43.5	--	60.6	61	32	16.3
Eureka		39.8	49.0	57.2	60	36	17.0
Alex		43.9	57.8	58.7	61	37	17.2
ND 582	(Stoa)	44.3	--	58.1	61	35	16.2
SD 2854	James/SD 2049	47.9	54.5	58.4	58	35	16.3
SD 2861	EE/Prodax	44.6	53.7	58.4	57	31	15.4
SD 2881	PRT/RL 6010	51.2	51.8	60.6	58	33	16.7
SD 2912	PRT/RL 6010//Marshall	46.8	66.4	57.1	58	32	15.6
SD 2925	Butte/James	43.9	56.6	58.4	59	33	15.7
SD 2942	Butte/EE (SD 2835-6)	46.0	56.4	59.2	58	34	16.2
SD 2943	Butte/EE (SD 2837-2)	45.1	53.8	60.3	59	34	16.5
SD 2946	Butte/SD 2271//MN 70181	41.5	63.2	56.7	57	31	15.8
SD 2948	PRT/RL 6010//James	50.1	59.3	57.7	62	33	16.3
PRO 711		41.7	54.3	59.2	60	32	14.5
SD 2952	PRT/RL 6010//Marshall	46.2	61.8	61.1	59	29	16.1
SD 2955	2167/MN 70181//SD 2853	40.6	53.8	57.7	58	31	15.6
SD 2956	Butte/CO 53427//WS 1809	49.4	41.8	59.8	60	31	15.2
SD 2960	MN 7378/SD 2845	46.2		60.6	58	34	14.4
SD 2961	Butte/SD 2700	50.2		58.7	58	33	15.8
SD 2962	SD 2827/5/BGS.../4/CNO	48.1		60.6	57	33	16.0
SD 2963	Era/Olaf//PRT	46.1		57.7	62	34	15.8
SD 2964	E/JM/2094/3/M7083/742191	48.8		58.9	59	32	16.1
SD 2965	Alex/MN 7125	47.6		55.8	61	31	14.7
SD 2966	Alex/MN 7125	40.4		55.4	61	30	14.6
SD 2967	Len/Junco S	37.1		60.6	61	33	16.2
SD 2968	SD 2256/Wheaton	50.4		59.6	62	33	14.9
SD 2969	SD 2700/SD 2818	48.1		60.1	58	34	15.1
SD 2970	2167/MN 70181//SD 2853	47.8		58.9	58	31	15.0
SD 2971	AGT/3/.../4/Butte/5/Len	45.6		59.5	58	29	15.7
SD 2972	SD 2838/MN 7460//PRT	46.0		58.7	58	28	16.0
SD 2973	SD 2847/CGT700//Butte	43.6		55.6	58	30	16.1
SD 2974	SD 2869/SD 74115//Centa	42.4		60.6	61	36	14.9
SD 2975	NK551/SD 2827//Butte	45.6		57.2	59	32	15.9
SD 2976	Coteau/Dawn//2902	49.9		59.8	58	36	15.2
SD 8026	Coteau/Dawn	51.4		59.9	56	34	15.6
SD 8035	Butte^2/65 49-8-101-16	50.2		63.2	57	33	16.1
SD 8036	Butte^2/Arthur 71	56.0		60.9	58	33	15.4
SD 8048	Coteau/Dawn (8026R)	52.0		59.8	56	33	15.6
SD 8049	Guard/SD 2892	42.4		58.7	61	35	15.8
	Mean	45.8					

LSD (0.05) = 3.8 C.V. % = 4.8 %

tive effect on the semi-dwarf varieties than the tall varieties. Harvest was completed on August 2, 1983.

Results

Results from the 1983 Advanced Yield Trial are presented in Table 1-1. Mean grain yields for the nursery was 45.8 bu/A which was similar to the yields for the past three seasons. Butte, as it has for the past three years, was one of the top performing varieties. Plant growth and development was similar to previous years with good test weights and a typical number of days from planting to heading (Table 1-1). In general, the plant height was shorter and percent protein content was higher than in previous years. Due to the variable environmental conditions from site to site and year to year in the spring wheat production area, it is extremely difficult to determine the yield of any variety without multiple site and year evaluations. The yields of the named varieties tested in the advanced yield nursery over years and over sites (state average) are presented in Table 1-2. Competition from volunteer soybeans make it to difficult to assess their performance at Redfield in 1983. Varieties with a good yield record at Redfield also have a good yield record in the state wide average.

Table 1-2. Yields of named varieties at Redfield (1980-82) and state average (1982-83) in bu/A.

Variety	Individual Years				Averaged Over Years			State Average	
	1980	1981	1982	1983	2 yr. 82-83	3 yr. 81-83	4 yr. 80-83	-9-[2] 1982	-9-[2] 1983
Tall									
Alex	--	38.5	57.8	43.9	50.8	46.7	--	37.7	37.3
Butte	46.0	31.6	53.4	54.0	53.7	46.3	46.2	35.7	41.4
Centa	46.6	32.4	45.9	43.8	44.9	40.7	42.2	33.5	36.6
Eureka	42.6	33.3	49.0	39.8	44.4	40.7	41.2	32.9	36.0
James	--	30.6	59.9	46.8	53.4	45.8	--	35.3	37.2
Semi-Dwarf[1]									
Argus	--	--	--	43.5	--	--	--	--	38.3
Era	42.9	34.8	49.1	45.7	47.4	43.2	43.1	31.9	39.4
Guard	--	33.8	57.3	41.3	49.3	44.1	--	37.4	38.8
Len	--	33.5	58.1	43.5	50.8	45.0	--	35.6	38.4
Marshall	--	--	57.6	46.3	51.9	--	--	35.3	40.8
Olaf	47.8	38.1	48.5	43.3	45.9	43.3	44.4	31.9	37.5
Oslo	--	--	53.2	40.0	46.6	--	--	36.3	39.2
Pro 711	--	--	54.3	41.7	48.0	--	--	35.1	37.7

[1]Semi-dwarf variety yields were reduced by volunteer soybeans in 1983.

[2]1982 and 1983 average from 9 sites; Brookings, Redfield, Watertown, Groton, Highmore, Selby, Day County, Bison, and Brookings late planting.

Manager's Comments

The volunteer soybeans germinated after Bromoxynil and MCPA (Bronate) was sprayed for broadleaf weed control. Variability in plant development

stage made respraying unacceptable due to the potential of injuring the germination of the wheat grain produced in the breeding nursury and advanced yield trial (there is only a limited source of seed for these varieties).

The Hessian fly pressure that occurred this year presented an opportunity to evaluate the new variety, Guard, which was developed by S.D. in repsonse to the outbreak of the fly in 1978. This variety has shown resistance in greenhouse screening tests at the USDA laboratory in Manhattan, Kansas. This however was only the second year it faced Hessian fly pressure under field conditions in South Dakota. Guard planted at a normal date in variety trials at Redfield and Groton, where Hessian fly was present, showed good resistance. These trials matured early enough to avoid yield loss from second brood damage.

A very late planting of Guard and Eureka was made on June 17 to evaluate relative infestation levels under extremely heavy pressure from the fly. This was not a full fledged replicated trial but rather a chance to observe this new variety under unnaturally tough conditions. The infestation level on Guard (16%) was lower than on the Eureka (46%) but higher than it was on the earlier planted variety trials. The partial breakdown of the Marquillo type resistance, which Guard possess, is presently being investigated. Marquillo and other types of resistance have been shown to break down to a varying degree when a plant is grown under very warm conditions. Temperatures during the time infestation was occurring in this late planted trial were much higher than under normal conditions.

Only the planting of significant acreages and time will tell for sure but it appears that Guard is doing what it is supposed to do. Any biological resistance can be overcome by a specified set of environmental conditions or due to a change in the pest it protects against. Therefore, it is important that the testing of this variety continue.

Other varieties and techniques such as chemical control, are presently being developed and evaluated for use if needed in the future. Thimet 20 G is the only insecticide treatment currenty registered for Hessian fly control. The application is made at planting through granular applicator attachments or the grass seeder attachment on the drill at 1 lb. a.i./A. The grass seeder tubes should be placed in the seed tube so the insecticide is placed in the seed furrow with the wheat seed. Thimet 20 G control was comparable to Guard in the 1983 late planted test.

James Valley Report

Progress Report JV83-2
Winter Wheat Variety Trial

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Department of Plant Science

Table 2-1. Standard Variety Winter Wheat Trials. Redfield-1983.

Variety	Yield bu/A	Test Weight lb/bu	Height inches	Protein %
Agassiz	48.1	59.5	34	14.0
Agate	41.9	60.2	35	14.0
Archer	45.4	59.3	29	13.3
Baca	48.8	61.4	33	13.6
Bennett	43.5	60.0	32	14.5
Brule	52.6	59.6	34	12.5
Buckskin	33.5	52.8	35	13.0
Centura	35.8	59.5	34	13.8
Centurk 78	48.7	60.9	32	13.7
Dawn	46.8	60.6	30	14.2
Gent	45.1	60.9	34	14.2
Hawk	46.2	59.4	30	13.5
Lancer	50.3	61.8	35	13.4
Larned	45.1	61.2	32	13.6
Nebred	36.9	59.7	35	13.0
Nell	45.7	59.9	33	13.4
Norstar	32.6	57.5	43	12.2
Rita	43.8	57.4	31	14.2
Rocky	51.5	60.9	34	14.0
Rose	41.9	60.3	33	13.1
Roughrider	52.2	61.5	37	14.6
Sage	44.0	60.4	34	13.8
Scout	44.0	60.7	34	13.7
Tam 105	38.9	58.0	27	12.8
Wings	43.2	61.9	30	13.0
Winoka	50.8	62.4	41	13.8
Means (38 entries)	44.8	60.2	33	14.0
LSD (.05)	7.3			
CV-%	11.7			

All data are averages of four replications except protein from a composite of all replications.

Management: Fertilizer: 60 lb. of N/A broadcast in the spring.
Weed control: Bronate (bromoxynil + MCPA) post-emergence.

SDSU
James Valley Report

Progress Report JV83-3
Conventional, Reduced and No-till Planting of Winter Wheat Varieties at Two Nitrogen Fertilizer Levels

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Introduction

In the fall of 1982, a study was established on the Ralph Holzwarth farm in Potter County to determine the effects of three different tillage systems on the survival and yield of 15 common winter wheat varieties. The research was also designed to study the effects of irrigation on winter wheat varieties, but there were insufficient stands for irrigation in the spring of 1983, so this part of the study was changed to evaluate the effect of nitrogen rate on dryland winter wheat production.

Methods

The study was designed so conditions would simulate, as closely as possible, actual farming practices. With this in mind, large equipment was used and large areas tilled for the study. A modified Noble deep-furrow hoe drill was used for seeding. The three tillage systems were as follows:

1. No-till- Winter wheat directly seeded into standing spring wheat stubble; no previous tillage.
2. Minimum tillage- Stubble was bladed with 35 foot Flex-King sweep plow, then seeded.
3. Conventional tillage- Stubble was double disked with 30 foot tandem disk, then seeded.

The fifteen varieties in the study included:

Agate	Centurk 78	Rose
Archer	Dawn	Roughrider
Bennett	Lancer	Scout 66
Brule	Nell	Tam 105
Buckskin	Rita	Winoka

Two fertilizer treatments were applied in late fall 1982 and consisted of 216 and 120 pounds per acre available nitrogen (soil nitrates + applied nitrogen) for a 90 and 50 bushel per acre yield goal, respectively. Ammonium nitrate was the source of applied nitrogen.

Results

As was mentioned, there were insufficient stands for irrigation in the spring of 1983. A visual estimation of all plots was made on May 3. There was a 60 percent stand average on no-till plots, 38 percent on minimum

tilled ground, and a 33 percent stand on conventionally tilled plots. These poor stands may have been due to dry soil conditions at planting, possible seed placement problems, or from soil blowing into the furrows and covering plants. It was a relatively mild winter, so it is unlikely that the poor stands were entirely the result of winter kill. No-till may have been better because of higher soil moisture.

Although stands were thin, winter wheat has tremendous compensating abilities. The wheat in this trial tillered sufficiently so that yields obtained were only slightly lower than undamaged stands in the area. Research has shown that if a uniform 60 percent stand is obtained, the winter wheat has the ability to tiller and fill in enough so that yields will be about 95 percent of the yield of an undamaged stand. Likewise, with 33 and 38 percent stands, you can expect approximately 75 and 80 percent, respectively, of the yield of an undamaged stand. This holds true mainly when stands are thin and will not hold true for spotty stands (i.e. good where snow drifts were; poor where there was no cover).

Actual yields obtained showed that neither tillage system or fertility significatly affected yields, although varieties did produce differently. Mean yields listed below are averaged over tillage and fertility.

	bu/A		bu/A
Brule	57.2	Agate	47.3
Nell	55.7	Archer	46.8
Rose	54.5	Tam 105	46.8
Dawn	53.0	Lancer	46.0
Bennett	52.5	Winoka	46.0
Scout	51.3	Rita	40.5
Roughrider	51.0	Buckskin	40.0
Centurk 78	48.2		
LSD 5%	6.1		
C.V.	11.5		
AVE. Yield	49.1		

Although fertility rates did not sufficiently affect yield, there was a significant increase in grain protein content (from 13.5% to 14.4%) on the higher fertility plots.

Weed control in the study consisted of an application of 1.5 pints of Bronate per acre on May 27.

Manager's Comments

This study was in a continuous cropping rotation. Most other winter wheat in the area was planted on fallow ground. Stubbled in wheat would be expected to be more prone to winter-kill and stand establishment problems. If the winter-kill was due to cold, the major problem that should have expressed itself was a differential amount of kill between varieties that vary in winterhardiness. (Varieties like TAM 105 should have experienced more kill than Roughrider). If dessication (kill due to drying) or germination was the problem, less varietal difference would be expected. The small varietal differences noted indicate that stand losses were probably due to moisture differences between the tillage treatments.

Progress Report JV83-4
Dryland Flax Breeding Trials

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Summary

Two flax trials were grown at Redfield, S.D. in 1983 (Tables 4-1 and 4-2) The South Dakota Tristate consists of the most advanced lines from South Dakota, North Dakota and Minnesota plus commercial varieties. It is from this test that variety recommendations are made to farmers. The highest yielding variety in the tristate was CI3065 which will be released by Canada in late 1983 or early 1984. 'Flor', 'Wisek' and 'Clark' were also among the highest yielding cultivars. Data in Table 4-2 is from a preliminary trial. Entries in this test have had a minimum of testing in previous years. However, it appeared that there are a few experimentals which show some promise such as SD823091.

Manager's Comments

The relatively good yield this year resulted from favorable weather and a good stand of weed free flax. Amiben was applied preemergence and bromoxynil (brominal or buctril) was used post-emergence for weed control.

Table 4-1. Performance of flax cultivars grown in the Tristate trial. Redfield-1983

Identification	Origin Lctn.	Origin Year	Seed Yield- 1983 Redfield (bu/a)	Seed Yield- 1983 State Av. (bu/a)	Relative Maturity	Plant Height (in.)	Pasmo (1-9)
CI 3065	Canada		32.7 a[1]	30.8 a	M	20	
Flor	ND	1981	29.6 ab	28.4 ab	M-E	20	3.0
Wishek	ND	1979	28.4 abcd	26.4 bc	E	19	5.3
Clark	SD	1983	28.2 abcd	27.5 abc	M-E	19	4.0
CI-2943	SD		28.1 abcd	27.3 abc	M	20	4.0
Linott	Can	1966	27.4 bcd	27.7 abc	E	20	5.7
Culbert 79	SD	1979	27.0 bcd	25.2 bc	E	19	5.7
Norlin	Can	1983	26.9 bcd	28.3 abc	M-E	20	6.0
Dufferin	Can	1975	26.0 bcd	27.3 abc	M	18	6.7
Culbert	MN	1975	25.1 bcd	26.1 bc	E	19	6.3
McGregor	Can	1982	24.5 cd	25.6 bc	L	22	4.7
Test average			27.2	26.8		20	4.7
Range			3.7-23.5	30.1-24.0		23-17	7.6-2.0
Coefficient of variation (%)			9	11		6	20
Correlation with seed yield			1.00	--		0.00	-0.12

1-Values followed by the same letter are not significantly different at 5% .
Planted: April 26 Harvested: August 8

Table 4-2. Seed yield, plant height and pasmo of 36 flax lines grown at Redfield, SD in a preliminary yield test in 1983.

Identification	Pedigree	Seed Yield - 1983 Redfield (bu/A)	Redfield Rank	State Average (bu/A)	State Average Rank	Plant Height (in.)	Pasmo 0-9
Wishek		27.8	29	27.5	24	17	4.3
SD823027	Linott/CI2444//Linott/Nored	29.6	18	28.5	12-14	20	2.0
SD823020	Wishek//Raja/B5128	28.4	26	29.0	7-8	13	3.0
Flor		30.2	13-15	30.4	2	20	5.0
SD823102	Nored/CI2543//CI2572	28.6	24	27.3	25	17	4.3
SD823085	CI2912/CI2916	30.3	11-12	28.5	12-14	20	4.0
SD823075	Norstar/CI2444//Linott/Nored	31.6	4	27.9	20	19	4.3
SD823055	BFP/CI2915	30.7	9	28.7	11	20	3.7
Culbert		28.0	28	26.0	32-33	18	4.0
SD823114	M803//Linott/Nored	31.0	8	29.2	6	19	3.3
SD823030	Linott/CI2444//Linott/CI2543	30.5	10	28.4	15	19	5.3
Linott		27.1	33	28.0	18-19	18	5.0
SD823079	N848/BFP	30.2	13-15	29.4	4	18	2.3
SD823013	Linott/CI2444//N848	29.2	20-21	28.3	16	20	3.0
SD823108	N838/N849	29.0	23	27.8	21-22	20	4.3
SD823095	Wishek selection/N849	30.3	11-12	28.2	17	18	2.7
Norlin		27.8	30-31	27.8	21-22	21	4.7
Dufferin		31.6	5	27.6	23	18	6.3
SD823063	BFP/Culbert	27.8	30-31	25.5	35-36	21	4.0
SD823015	Linott/CI2444//N848	31.3	6	29.0	7-8	19	3.3
SD823077	Wishek selection/N849	30.1	16-17	26.8	28	21	3.3
SD823036	Linott/CI2444//Koto/Foster	28.3	27	25.8	34	21	3.7
Culbert 79		29.4	19	26.6	29	19	4.0
SD823074	BFP/Wishek selection	29.2	22	26.2	30	19	4.3
SD823091	BFP/Culbert	32.9	1	29.9	3	19	3.0
SD823004	M803/Culbert 79	30.1	16-17	28.8	10	20	2.3
Clark		31.1	7	29.3	5	20	3.3
SD823010	CI2887//Linott/Nored	31.7	3	28.5	12-14	19	4.3
SD823054	M803//Linott/Nored	30.2	13-15	28.9	9	18	3.0
SD823057	Dufferin//Linott/CI2543	26.7	34	25.5	35-36	18	4.3
Nored		29.3	20-21	27.1	26-27	19	4.3
SD823080	M803/Lisia	27.7	32	26.0	32-33	19	2.7
CI2943	CI2790/N419	32.3	2	31.3	1	19	5.0
McGregor		25.4	36	26.1	31	21	5.3
SD823056	N848/BFP	26.4	35	27.1	26-27	21	4.0
SD823103	BFP/N609	28.5	25	28.0	18-19	20	5.7
Test average		29.4		27.9		19	4.0
Coefficient of variation (%)		6		8		9	21
LSD .10		2.5		3.3		2	1.2
Correlation with seed yield		1.0		-		-0.08	-0.13

Design: Triple Lattice.

Planting date: April 26. Harvest date: August 8.

Progress Report JV83-5
Herbicide Screening for
Kochia Control in Spring Wheat

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Research Methods

This study was established at the James Valley Research Agricultural Research and Extension Center, Redfield, South Dakota in 1983. The experimental area has been in an oats-wheat cropping pattern. Soil on the research site is a silt loam consisting of 6.8 percent sand, 70.2 percent silt and 23.0 percent clay. The site is well drained, contains 2.8 percent organic matter and has a 7.4 pH. Butte spring wheat was planted on April 23, 1983 at a one inch depth in six inch wide rows at 85 pounds per acre. Fertilizer formulation 34-0-0 + 18-46-0 was applied to the experimental area at 60 pounds of N and 30 pounds of P_2O_5 using a spring broadcast application. The study was designed as four replication RCB on plots 10 feet by 30 feet. Treatments were applied on April 22, May 18, May 24 and May 31, 1983. The first application was a pre-plant incorporated. Plant growth stages at the second application were: spring wheat three leaf and kochia 0.25 to 0.5 inches. Plant growth stages at the third application were: spring wheat five leaf and kochia 0.5 to 1.5 inches. Plant growth stages at the fourth application were spring wheat 2-3 tillers and kochia one to three inches. Treatments were applied with a one-wheel bicycle sprayer using Tee Jet 8002 nozzles applying 20 gallons per acre through a ten foot wide boom operated 18 inches high. An area 7 feet by 27 feet was harvested on August 3, 1983 using a small plot combine.

Conclusions

Applications of DS 53208-0303 at the five-leaf stage and at tillering gave the best late season control, reaching 99 percent in all cases. Rates of DS 57614 above 2.1 pounds per acre at the five-leaf stage and all rates at tillering gave late season control exceeding 95 percent. Treatments containing bromoxynil or propanil at the five-leaf stage produced kochia control in excesses of 90 percent. Although DS 53208-0303 gave excellent weed control, crop injury with this compound was moderate to severe and appeared to reduce crop yield. DS 57614 at 1.6 pounds per acre gave only slightly less kochia control than DS 53208-0303 and produced the highest average yield.

Manager's Comments

This study and others like it are used to evaluate the potential of experimental chemicals, new chemical combinations or various application techniques for a specific use. The experimental chemicals generally carry only a letter and number designation and are not available to producers. Most of the chemical combinations and application methods are also not labeled for use at this time. Data from this experiment type is needed to obtain or deny label for these treatments and to develop chemical weed control recommendations.

Table 5-1. Herbicide screening for kochia control in spring wheat. Redfield-1983.

Herbicide	Rate (lb/A)	Application	Percent Control KOCZ 6/16/83	Percent Control KOCZ 7/26/83	Injury 6/16	Injury 7/26	Yield (bu/A)	Test Weight (lb/A)
Trifluralin[1]	0.25	PPI	5	21	0	0	28.6	55.8
Trifluralin	0.38	PPI	21	16	0	0	31.9	56.2
Trifluralin	0.5	PPI	41	16	5	0	26.7	55.9
DS 57614	0.8	5 leaf	65	62	0	0	40.0	57.1
DS 57614	1.2	5 leaf	85	89	0	0	42.7	57.2
DS 57614	1.6	5 leaf	95	96	0	0	43.8	57.3
DS 57614	0.8	Tillering	85	98	6	0	41.1	57.3
DS 57614	1.2	Tillering	91	97	13	0	43.7	57.4
DS 57614	1.6	Tillering	94	98	15	0	36.3	57.4
DS 53208-0303	0.25	5 leaf	92	99	15	0	35.1	56.6
DS 53208-0303	0.5	5 leaf	92	99	20	0	33.2	56.7
DS 53208-0303	1.0	5 leaf	97	99	33	8	31.0	57.7
DS 53208-0303	2.0	5 leaf	99	99	46	40	24.9	58.0
DS 53208-0303	0.25	Tillering	68	99	21	5	33.3	56.1
DS 53208-0303	0.5	Tillering	71	99	31	6	29.0	55.6
DS 53208-0303	1.0	Tillering	78	99	37	15	27.4	55.2
Bromoxynil[2]	0.38	5 leaf	85	93	0	0	40.2	57.4
2,4-D amine	0.5	Tillering	22	53	6	0	36.1	57.6
Propanil[3] + MCPA ester	1.13 +0.25	3 leaf	74	86	0	0	37.6	56.8
Propanil + MCPA ester + bromoxynil	1.13 +0.13 +0.13	3 leaf	78	93	0	0	39.7	56.9
Propanil + MCPA ester +bromoxynil	1.13 +0.25 +0.25	3 leaf	88	95	0	0	38.2	56.7
Weedy Check	---	---	0	0	0	0	16.1	55.2
LSD (5 Percent Level			19.1	18.6	5.5	3.9	8.8	8.8
Coeficient of Variation			19.4	17.0	24.4	83.1	18.1	10.9

1-Treflan
2-Brominal or Buctril
3-Stampede

KOCZ=Kochia

Progress Report JV83-6
Post-Emergence Herbicides for
Kochia Control in Spring Wheat

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Department of Plant Science

Research Methods

The project was established at the James Valley Agricultural Research and Extension Center, Redfield, S.D. in 1983. The experimental area has been in a wheat-oats cropping pattern. Soil on the research site is a silt loam. The site is well drained, contains 2.80% organic matter and has a 7.4 pH. Butte spring wheat was planted on April 23, 1983 at one inch depth in six inch wide rows at 85 pounds per acre. Fertilizer formulation 34-0-0 + 18-46-0 was applied to the experimental area at 60 pounds N + 30 pounds P_2O_5 per acre using a spring broadcast application. The study was designed as a four replication RCB on plots 10 feet by 30 feet. Treatments were applied on May 18, May 25 and May 31, 1983. Plant growth stages at the first application were: spring wheat three leaf and kochia 0.25 inches to 0.5 inches. Plant growth stages at the second application were: spring wheat four leaf and kochia 0.5-1.5 inches. Plant growth stages at the third application were: spring wheat two to three tillers and kochia one to three inches. Treatments were applied with a one-wheel bicycle sprayer using Tee Jet 8002 nozzles applying 20 gallons per acre through a ten foot wide boom operated 18 inches high. An area 7 feet by 27 feet was harvested on August 2, 1983 using a small plot combine.

Results

None of the tested herbicides caused any wheat injury (data not presented). Yields were significantly improved over the weedy check for all herbicides which exceeded 47 percent kochia control in the late season evaluation. Chlorsulfuron or MCPA alone at the tested rates did not satisfactorily control kochia. Bentazon in combination with 2,4-D propylene glycol butyl ether ester, 2,4-D or dicamba, and all treatments containing bromoxynil resulted in good season-long kochia control.

Manager's Comments

This is another study where chemicals are tried experimentally for a different use. Betazon (Basagran) is a chemical labeled for post-emergence control of some broadleaf weeds in soybeans. These types of studies must be repeated several times at various locations before a label is granted and a chemical is recommended. Consult your chemical dealer or county agent for labeled and recommended chemical weed control techniques.

Table 6-1. Postemergence herbicides for kochia control in spring wheat. Redfield-1983.

Herbicide	Rate	Application	% Weed Control KOCZ	% Weed Control KOCZ	Wheat Yield
	(lb/A)		(6/16/83)	(7/26/83)	(bu/A)
Bentazon[a] + 2,4-D[c]	0.5 + 0.4	4 leaf	70	56	46.0
Bentazon[a] + 2,4-D[d]	0.5 + 0.3	4 leaf	87	87	43.8
Bentazon + 2,4-DP[b]	0.5 + 1.0	4 leaf	97	99	50.6
Bentazon + MCPA[a]	0.5 + 0.25	2 tiller	58	67	41.0
Bentazon + MCPA[a]	0.75 + 0.38	2 tiller	55	62	41.4
MCPA	0.5	4 leaf	42	26	41.7
Bromoxynil + MCPA	0.38 + 0.38	4 leaf	93	92	50.1
Bentazon + dicamba[b]	0.5 + 0.06	4 leaf	83	88	38.8
Bentazon[a]	0.75	4 leaf	78	75	44.0
Bentazon + bromoxynil[b]	0.5 + 0.3	4 leaf	93	93	41.6
Bromoxynil	0.25	3 leaf	80	86	45.3
Bromoxynil + MCPA	0.25 + 0.25	3 leaf	88	92	42.0
Cholrsulfuron	0.00063	3 leaf	5	8	32.3
Chlorsulfuron	0.0063	3 leaf	7	5	32.8
Chlorsulfuron	0.013	3 leaf	22	47	32.7
Chlorsulfuron + bromoxynil	0.00063 + 0.25	3 leaf	85	94	43.4
Bromoxynil	0.38	3 leaf	89	97	39.1
Bromoxynil	0.38 + 0.38	3 leaf	93	96	42.5
Weedy Check	-----	--	0	0	29.9
LSD (5 percent)			12.8	19.3	7.3
Coef. of variation			14.0	20.3	12.6

[a]Applied with crop oil concentrate at 1.0 quart per acre.
[b]Applied with crop oil concentrate at 0.5 quart per acre.
[c]Dimethylamine salt.
[d]Propyleneglycol butyl ether ester.
KOCZ=Kochia

Progress Report JV83-7
AC 222,293 for Weed Control
In Spring Wheat

W. E. Arnold, D.E. Auch and B.C. Laube
Department of Plant Science

Research Methods

This project was established at the James Valley Agricultural Research and Extension Center, Redfield, SD in 1983. The experimental area has been in a wheat-oats cropping pattern. Soil in the research site is a silt loam. The site is well drained, contains 2.80 percent organic matter, and has a 7.4 pH. Butte spring wheat was planted on April 23, 1983 at one inch depth in six inch wide rows at 85 pounds per acre. Fertilizer formulation 34-0-0 + 18-46-0 was applied to the experimental area at 60 pounds N + 30 pounds P_2O_5 per acre using a spring broadcast application. The study was designed as a four replication RCB on plots 10 feet by 30 feet. Treatments were applied on May 18, 1983 and May 24, 1983. Plant growth stages at the first application were: spring wheat two leaf and wild oats two leaf. Plant growth stages at the second application were: spring wheat four leaf and wild oats two-three leaf. Treatments were applied with a one-wheel bicycle sprayer using Tee Jet 8002 nozzles applying 20 gallons per acre through a 10 foot wide boom operated 18 inches high. An area 7 feet by 27 feet was harvested on August 2, 1983 with a small plot combine.

Results

AC 222,293 application provided excellent wild oat and kochia control in spring wheat. Kochia tended to be controlled slightly better when applied at the four-leaf growth stage of wheat than at the two-leaf stage. Tank mixtures of 2,4-D and AC 222,293 resulted in less kochia control than AC 222,293 alone at all rates at the two-leaf stage and at the low rate at the four-leaf stage.

Manager's Comments

The experimental chemical in this study shows potential. It will probably receive more testing. Before it is labeled, analysis of residue and grain samples must take place, its carryover potential defined, etc. Consult your county agent or chemical dealer for labeled and recommended chemical weed control techniques.

Table 7-1. AC 222,293 for weed control in spring wheat. Redfield-1983.

Herbicide	Rate	Application	% Weed Control Wioa	% Weed Control KOCZ	Wheat Injury	Wheat Yield	Wheat Test Wt.
	(lb/A)		(7/13/83)		(6/1/83)	(bu/A)	(lb/bu)
AC 222,293	0.38	2 leaf	99	85	0	24.3	53.0
AC 222,293	0.5	2 leaf	99	91	0	28.1	53.6
AC 222,239	0.63	2 leaf	99	93	0	25.1	52.9
AC 222,293	0.75	2 leaf	99	95	0	27.3	52.3
AC 222,293	1.5	2 leaf	99	94	10	23.6	52.5
AC 222,293	0.38	4 leaf	99	97	0	24.7	51.8
AC 222,293	0.5	4 leaf	99	96	0	24.7	52.7
AC 222,293	0.63	4 leaf	99	96	0	25.7	51.8
AC 222,293	0.75	4 leaf	99	98	0	29.3	54.3
AC 222,293	1.50	4 leaf	99	98	10	30.0	53.6
AC 222,293 2,4-D[a]	0.38 + 0.25	2 leaf	98	77	0	22.2	53.7
AC 222,293 2,4-D[a]	0.5 + 0.25	2 leaf	99	82	0	24.5	53.1
AC 222,293 2,4-D[a]	0.63 + 0.25	2 leaf	99	86	0	23.8	54.7
AC 222,293 2,4-D[a]	0.38 + 0.25	4 leaf	99	90	0	31.4	52.8
AC 222,293 2,4-D[a]	0.5 + 0.25	4 leaf	99	91	0	29.4	52.0
AC 222,293 2,4-D[a]	0.63 + 0.25	4 leaf	99	95	0	27.9	52.7
Difenzoquat[1] 2,4-D[a]	0.75 + 0.25	4 leaf	93	87	0	24.5	51.4
Difenzoquat	0.75	4 leaf	91	0	0	20.4	51.7
Diclofop[2]	0.75	4 leaf	94	0	0	20.2	51.1
2,4-D[a]	0.25	4 leaf	0	89	0	28.8	52.6
Weedy Check			0	0	0	14.8	51.5
LSD (5 percent)			1.6	6.8	0.0	4.2	1.7
Coef. of variation			1.3	6.1	0.0	11.8	2.2

[a]Butoxyethyl ester.
[1] Avenge
[2] Hoelon

KOCZ= Kochia
Wioa-Wild oats

Progress Report JV83-8
Chlorsulfuron (Glean) for Weed Control
in Spring Wheat

W.E. Arnold, M.A. Wrucke and M. Anderson
Department of Plant Science

Research Methods

This project was established at the James Valley Agricultural Research and Extension Center, Redfield, South Dakota in 1982. The experimental area has been in a wheat-oats cropping pattern. Soil on the research site is a silt loam consisting of 6.8 percent sand, 70.2 percent silt and 23.0 percent clay. The site is well drained, contains 2.98 percent organic matter and has a 7.4 pH. Butte spring wheat was planted on April 23, 1983 at one inch depth in six inch wide rows at 85 pounds per acre. Fertilizer formulation 34-0-0 + 18-46-0 was applied to the experimental area at 60 lbs. N + 30 lbs. P_2O_5 per acre using a spring broadcast application. The study was designed as a four replication RCB on plots 10 feet by 30 feet. Treatments were applied on November 18, 1982 and April 23, 1983. Plant growth stage at the first application was: spring wheat fall PPI. Plant growth stage at the second application was: spring wheat POPI (post-planting incorporated). On the first spray stage, treatments were applied with an IHC Cub sprayer using Tee Jet 8002 nozzles applying 20 gallons per acre through a 10 foot wide boom operated 18 inches high. On the second spray stage, treatments were applied with a one-wheel bicycle sprayer using Tee Jet 8002 nozzles applying 20 gallons per acre through a 10 foot wide boom operated 18 inches high. An area 7 feet by 27 feet was harvested on August 2, 1983, using a small plot combine.

Results

Yield of spring wheat was limted more by kochia than wild oats in this test. Weed infestation on July 13 was approximately 15 kochia plants and five wild oat plants per square meter. Fall applicaitions of chlorsulfuron controlled kochia significantly better and were significantly higher yielding than the weedy check or the commercial check of trifluralin plus triallate.

Manager's Comment

This trial is designed to study application times and techniques that are are presently not used with the chemicals in the study. Check with your chemical dealer or county agent for labeled and recommended chemical weed control methods.

Table 8-1. Chlorsulfuron (Glean) for weed control in spring wheat. Redfield-1983.

Herbicide	Rate (lb/A)	Application	% Weed Control KOCZ (6/1/83)	KOCZ (7/13/83)	Wioa (7/13/83)	Wheat Yield (bu/A)	Test Wt (lb/bu)
Chlorsulfuron[1]	0.008	FALL	99	99	5	21.7	51.7
Chlorsulfuron	0.016	FALL	99	99	8	25.4	52.6
Chlorsulfuron	0.031	FALL	99	99	30	24.6	52.5
Chlorsulfuron + triallate[2]	0.008 + 1.0	FALL	99	98	25	24.2	51.2
Chlorsulfuron + triallate	0.016 + 1.0	FALL	99	98	25	24.7	52.6
Chlorsulfuron + triallate	0.031 + 1.0	FALL	99	99	25	25.5	53.3
Chlorsulfuron	0.008	POPI[3]	83	74	8	18.4	52.1
Chlorsulfuron	0.016	POPI	85	77	15	23.8	53.7
Chlorsulfuron	0.031	POPI	97	95	2	20.7	51.9
Chlorsulfuron + triallate	0.008 + 1.0	POPI	76	70	43	22.7	53.1
Chlorsulfuron + triallate	0.016 + 1.0	POPI	94	90	45	24.0	52.5
Chlorsulfuron + triallate	0.031 + 1.0	POPI	91	94	36	26.1	53.2
Trifluralin[4] + triallate	0.5 + 1.0	POPI	37	7	35	12.2	52.4
Weedy Check	--	--	0	0	0	13.1	52.7
LSD (5 percent)			9.2	12.6	19.3	4.2	1.35
Coef. of variation			7.8	11.2	62.5	13.4	1.8

1 Glean
2 Fargo
3 Post-plant Incorporated
4 Treflan

KOCZ=Kochia
Wioa=Wild Oats

SDSU
James Valley Report

Progress Report JV38-9
Chlorsulfuron (Glean) Recropping Study

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Department of Plant Science

Introduction

Chlorsulfuron, (Tradename: Glean), is a very effective herbicide which is currently labeled for use in wheat and barley. In order to investigate possible carryover problems, split plot experiments were established at the Northeast Research Station near Watertown and the James Valley Research Center near Redfield.

Methods

In the spring of 1981, four rates of chlorsulfuron (0.0, 0.015, 0.03 and 0.06 lb. active ingredient per acre) were applied post-emergence to oats at the Watertown location and spring wheat at the Redfield location. Flax, sunflowers, corn, soybeans and grain sorghum were planted into the treated areas in the spring of 1982 and crop injury was evaluated by means of visual ratings and crop dry weight samples. Also in 1982, experiments were established at both locations on spring wheat to duplicate those established in 1981. Test crops were planted in all experiments again in 1983. Tables 9-1 and 9-2 show visual crop injury rating for 1982 and 1983.

Results

Crop injury was substantially greater at the Redfield location in both 1982 and 1983. Differences in climate and soil texture between the two locations were small, but differences in soil pH and organic matter appeared to be large enough to explain the higher crop injury at Redfield (pH 7.5, organic matter 3.0%) than at Watertown (pH 6.4, organic matter 4.0%).

A large variation in crop injury at a given herbicide rate was observed within one of the Watertown experiments. In one instance, corn injury from the 0.06 lb/A rate ranged from 10 percent to 95 percent. Soil samples were taken from these areas of varying crop injury and tests of pH and organic matter made. Multiple regression analysis showed a strong correlation between crop injury the year following chlorsulfuron application and soil pH and organic matter. Soil pH appeared to exert an especially strong influence, with crop injury increasing rapidly as pH rose for 6.0 to 7.0.

Manager's Comments

Producers who used Glean on high pH soils in 1981 or 1982 may still face carryover problems in 1984. Before planting this ground to crops other than wheat or barley, the producer should take a soil test to determine the pH. To be safe, he should plant a test strip of the desired crop. Producers considering using Glean should know their soil pH and consider the carryover potential of this product as it affects their crop rotation program.

Table 9-1. Crop injuries for experiments established in 1981.

Crop	Glean Rate (1981)	Watertown 1982	Watertown 1983	Redfield 1982	Redfield 1983
Flax	0.015	0	0	38	- *
	0.03	0	0	54	-
	0.06	5	0	72	-
Sunflowers	0.015	0	0	21	13
	0.03	0	0	38	39
	0.06	8	0	77	34
Corn	0.015	0	0	34	9
	0.03	5	0	59	16
	0.06	8	0	77	39
Soybeans	0.015	0	0	37	23
	0.03	0	0	62	28
	0.06	0	0	89	49
Sorghum	0.015	0	0	44	4
	0.03	0	0	78	12
	0.06	5	0	93	14

*Flax stand in this experiment was poor and injury not evaluated.

Table 9-2. Crop injuries for experiments established in 1982.

Crop	Glean Rate (1982)	% Crop Injury 1983 Watertown	% Crop Injury 1983 Redfield
Flax	0.015	4	33
	0.03	10	55
	0.06	20	84
Sunflowers	0.015	3	43
	0.03	8	74
	0.06	28	92
Corn	0.015	25	60
	0.03	29	72
	0.06	44	88
Soybeans	0.015	5	58
	0.03	13	76
	0.06	30	89
Sorghum	0.015	18	65
	0.03	26	81
	0.06	51	91

Progress Report JV83-10
Dryland Corn Variety Trial

J.J. Bonnemann
Department of Plant Science

Manager's Comment

Soil test P and K were in the high range on this field. A starter was applied to these plots plus 60 pounds of N per acre broadcast. Excellent weed control was obtained with Lasso and Bladex applied pre-emergence followed by Bromxanil (Buctril) early post-emergence for control of volunteer sunflowers. Granular Furadan was applied aerially for corn borer control. Weigh wagon yield checks in this field produced an average yield of 90 bushel per acre for Pioneer 3901 planted at 17 thousand seeds per acre. The researchers used seeding rates of 12 thousand seeds per acre for their study. A row spacing of 30 inches was used.

Table 10-1. Performance of corn varieties under dryland conditions. Redfield-1983.

Brand and Variety	Type and Cross	Yield (bu/A)	PCT Stalk Lodged	Moisture (%)	Performance Score Rating
P-A-G SX 179	E 2X	96.3	4.5	17.8	1
Keltgen KS 1030	M 2X	95.0	8.5	18.1	2
P-A-G SX 195	E 2X	94.9	10.3	17.5	3
Jacques JX 77	E 2X	93.1	12.7	17.4	5
Pioneer 3726	M 2X	93.0	8.4	17.3	4
Seed Tec 7971	M m2X	92.9	16.9	17.3	8
Keltgen KS 95	M 2X	92.4	9.3	18.0	6
Keltgen KS 1020	M 2X	91.9	10.6	17.5	7
Pride X 1073	M 2X	90.6	19.5	17.5	14
Western KX-57	M 2X	90.6	9.3	18.0	9
SDAES Check 4	M 2X	89.5	13.5	18.3	15
Cargill 834	E 2X	89.2	8.6	18.2	12
Pioneer 3901	E 2X	89.0	5.2	17.6	10
Cenex 2106	M 2X	88.9	14.6	17.7	17
SDAES Check 10	M 2X	88.3	6.9	18.0	13
Sigco 3106	M 2X	87.9	9.6	17.8	16
Pride 4422	E 2X	87.7	4.8	17.1	11
Interstate 635	L 2X	87.5	12.0	17.8	18
Pioneer 3906	E 2X	86.5	16.7	17.4	24
Asgrow RX 418	E 2x	86.3	9.8	18.0	21
Pioneer 3747	M 2X	85.7	8.2	17.5	19
Pride X 1033	E 2X	85.3	7.4	17.4	20
Dekalb EXP-340	E 2X	84.9	7.1	17.7	22

(cont. on back of page)

Table 10-1. (Cont.) Performance of corn varieties under dryland conditions. Redfield-1983.

Brand and Variety	Type and Cross	Yield (bu/A)	PCT Stalk Lodged	Moisture (%)	Performance Score Rating
Northrup King PX 9301	M 2X	84.1	9.9	17.1	25
Dekalb XL-8	E 2X	84.1	5.5	17.5	23
Cenex 2096	E 2X	83.0	10.4	17.1	27
Cargill 836	E 2X	82.9	13.0	17.8	28
Top Farm SX 104A	L 2X	82.5	13.4	17.2	29
Top Farm SX 1101	M 2X	82.0	3.6	17.0	26
Pride 5523	M 2X	80.7	10.7	17.7	32
Interstate 434	M 2X	80.4	15.3	17.8	36
Sigco 1300	E 2X	80.3	8.2	17.6	31
Curry SC-1424	M 2X	80.2	5.3	18.0	30
Curry SC-1408	E 2X	79.9	15.1	18.3	39
Western KX-42	M 2X	79.9	13.1	18.0	37
Interstate 468	L 2X	79.7	11.1	17.6	34
Top Farm SX 1105	L 2X	78.6	7.1	17.2	33
Asgrow RX 420	E 2X	78.5	12.8	17.6	41
SDAES Check 9	M 2X	78.4	10.0	17.6	38
Dekalb T950	E 2X	78.3	7.5	17.5	35
Cargill 861	E 2X	77.2	12.5	17.3	44
Pioneer 3732	M 2X	77.2	8.5	17.1	40
Sigco 4300	M m2X	76.9	16.3	17.4	49
Top Farm SX1199	M 2X	76.4	9.1	17.2	43
Pride XA 1052	M 2X	76.3	11.0	18.0	47
Keltgen KS 101	M 2X	76.3	10.2	18.6	48
Asgrow RX 532	M 2X	75.8	8.5	18.0	46
Seed Tec 82126	M 2X	75.8	7.2	17.5	45
Stauffer S3306	M 2X	75.6	13.2	18.1	52
Dekalb DK-484	E 2X	75.5	3.4	17.4	42
Top Farm SX 104	M 2X	75.1	13.3	18.0	53
Jacques JX 97	E 2X	73.8	6.2	17.1	51
P-A-G SX 239	E 2X	72.4	6.0	18.0	54
Curry SC-1420	M 2X	72.4	20.0	17.5	57
Stauffer S 3242	M 2X	72.1	13.4	17.7	55
Jacques JX 47	E 2X	70.2	10.0	17.5	56
Keltgen KS 104	M 2X	68.4	12.5	17.6	58
Cargill 867	E 2X	67.5	13.4	17.2	59
Interstate 452	M 2X	66.7	15.9	17.7	60
Means		81.9	10.4	17.6	
LSD (.05)	N.S.			CV%-20.9	

SDSU

James Valley Report

Progress Report JV83-11
Hybrid Sunflower Variety Trial

Charles Lay and Kathleen Grady
Department of Plant Science

Summary

Seed yield and oil content were generally lower in 1983 than in 1982 due to the high temperatures and somewhat lower rainfall during the growing season. However, moisture at seeding was good, resulting in good stands for most hybrids.

Plots were 33 feet long and consisted of four rows spaced 30 inches apart. The experimental design was a Randomized Complete Block with three replications. Approximately 100 feet square from the two center rows of each plot were harvested for yield. Final plant population and percent lodging were estimated from this same area at harvest. All seed yields are expressed at moisture levels below 10 percent. Plant height was determined at harvest by measuring from ground level to center of the head. Oil content was determined using a Newport NMR on oven-dry samples and are converted to 10 percent moisture basis. Oil yield was calculated from seed yield and oil content at 10 percent moisture data for each plot. Gross income was calculated based on a market price of $13.00 per hundredweight plus a factor for oil. The oil factor was two percent of the market price for each percentage point of oil (graduated in .1% oil) above or below 40.0 percent.

Manager's Comments

Treflan was incorporated, pre-planting, and Amiben was applied preemergence for weed control. Parathion was applied aerially for control of seed weevil. Two applications were made due to variation in flowering dates of the varieties in the trial and the heavy insect pressure.

Hand harvested yields are reported. These yields are probably slightly higher than would be achieved on a field-wide basis or where machine harvesting is used. The numbers do provide a good method of comparing performance under the conditions in 1983.

Table 11-1. Hybrid Sunflower Trial-1983, Redfield.

Identification		Seed Yield		Oil Content				Gross	Plant	Lodging
Company	Hybrid	1983	1982	'83	'82	'83	'82	Income	Height	
		(lb/A)		(%)		(lb/A)		$/A	inches	(%)
Cargill	C 206	2048		39.4		949		309	60	9
Data	82101	2294		37.2		852		281	57	3
Arrowhead	747	2230	3291	41.5	41.8	923	1376	298	58	4
Stauffer	S-3101-A	2163		34.2		740		249	53	7
Cargill	C 207	2159	3464	34.6	36.4	746		250	65	9
DeKalb	DKS 3412	2138		38.9		831		272	60	5
Sigco	Sigco 470	2123		40.1		853		277	61	5
Gro Agri	GA 382	2120	3294	39.2	39.3	828	1295	270	56	2
Keltgen	KO 66	2114		36.3		769		255	61	7
PAG	SF101	2099		39.5		829		270	49	3
PAG	SF102	2056		36.8		758		251	53	4
Sunflo	X 10083	2054		35.8		736		245	63	5
Arrowhead	707-B	2052		36.9		757		250	62	6
Seedtec	X 1108	2044		40.6		830		269	53	7
Seedtec	ST 316	2037	3149	38.1	39.6	776	1247	255	55	9
Interstate	IS 897	2025	3089	38.0	38.7	771		253	60	11
Interstate	IS 7101	2008		37.5		753	1165	248	65	6
Data	82102	1962		39.3		771		252	53	12
DeKalb	DKS 3334	1952		36.8		717		237	63	10
Sokota	SK 4000	1913	3294	37.3	38.2	713	1258	235	56	13
Gro Agri	GA 300-A	1901	3296	41.8	39.2	795	1292	256	63	5
Stauffer	S 1300	1901		35.6		676		225	48	6
Northrup King	NK 265	1899	3402	38.4	39.9	728	1357	239	57	7
Sexauer	S 305A	1881	2805	38.3	37.5	721	1052	236	59	3
Sigco	Sigco 455	1879		35.6		670		223	64	12
Sexauer	S 305A	1875		36.9		693		229	48	9
O's Gold	Exp 8125	1870		37.8		706		232	61	13
Arrowhead	Bonus	1868		37.8		705		232	55	8
Stauffer	S-1888	1860	2851	38.1	39.1	707	1115	232	63	5
Sexauer	S-811	1859	3135	37.3	37.3	694	1169	229	54	6
Dahlgren	Do-705	1843	3213	38.7	40.6	711	1304	233	60	9
O's Gold	OG 614	1817	3110	38.4	38.0	697	1182	228	59	12
Stauffer	S-1830	1813		37.8		686		226	57	21
Seedtec	ST-315	1813	2737	35.6	35.7	645	977	215	60	8
Sigco	Sigco 488	1812		36.0		653		217	75	2
DeKalb	DKS-37	1810	3110	38.9	38.5	704	1197	230	56	8
Gro Agri	GA-378	1794		39.2		703		229	60	12
Chick	Hybrid 894	1781	3215	38.5	37.6	632		210	55	12
Jacques	J 503	1771		35.6		632		210	67	10
Sokota	SK 82-2200	1767		34.8		613		205	59	4
Northrup King	NK 254	1757	2938	37.3	37.8	658	1111	217	59	4
Jacques	J 311	1631	2846	36.4	37.5	593	1067	197	57	13
Sokota	SK 2057	1587	2963	37.2	37.9	591	1123	195	56	12
Keltgen	KO 704 XL	1573	2984	36.8	37.9	580	1131	192	61	13
Chick	400 x 299	1545		38.2		589		193	52	24
Test Average		1930	3109	37.7	38.4	728	1194	239	58	8
LSD .10		270		1.2		105		34	5	7
Coeficiant of Variation (%)		10		2		11		11	7	63
Correlation with Yield		1.00		0.08		0.95		0.96	0.13	-0.46

Planting Date June 8. Harvest Date October 13. Population at harvest 15,500 plants per acre.

Progress Report JV83-12
Proprietary Alfalfa Variety Trial

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Department of Plant Science

Methods

A four-replicate dryland alfalfa trial consisting of 24 proprietary varieties was planted on May 13, 1981. Two public varieties, Agate and Baker, were included as checks. Replicates one and two were planted at 12 pound pure live seed per acre, while replicates three and four were planted at a six pounds pure live seed per acre rate. Plots were harvested for forage yield on June 10 and July 28, 1982 and June 21 and August 3, 1983. The average yields in 1982 and 1983 and two-year average total yields are presented for each variety in Table 12-1. Statistically significant differences in forage yield were noted for years ($p<.01$), but not varieties. The average yields, considering all varieties, in 1982 and 1983 were 2.9 and 4.4 tons per acre, respectively.*

Results

Some observations to date are:

(1) All varieties produced acceptable stands and no differences in persistence are evident at this point.

(2) No advantage in second and third year forage production was found for the heavier planting rate.

(3) Yields of grazing-type varieties (Spredor II and SX-10) have been comparable to hay-type varieties under a two-cut system.

Manager's Comments

A third crop could have been harvested this year. The authors plan to begin a three cutting schedule next year. Increased emphasis will be put on forage related experiments in the future, since this resource is so important to the livestock industry in South Dakota.

* No significant difference was found between two-year average forage yields of the two planting rates.

Table 12-1. Proprietary Alfalfa Variety Trial. Redfield-1983

Variety	1982	1983	2 Year Total
	Dry Matter Forage Yield		
	--------------------tons/acre--------------------		
532	2.9	5.0	7.9
DeKalb 130	3.3+	4.6	7.9
Baker	3.0+	4.8	7.8
526	3.2	4.6	7.8
Spredor	2.9	4.8	7.7
524	3.0	4.7	7.7
Hy Phy	2.7	4.9	7.6
545	3.1	4.4	7.5
C/W 8032	3.1+	4.4	7.5
DeKalb 123	2.9+	4.5	7.4
C/W 61	2.9	4.5	7.4
DeKalb 117	2.9	4.5	7.4
C/W 8042	2.8	4.5	7.3
SX-10	2.9+	4.4	7.3
Spectrum	2.9	4.4	7.3
DeKalb 120	3.0	4.3	7.3
Super 721	2.8	4.5	7.3
DeKalb 131	2.9+	4.3	7.2
SX-418	3.0+	4.1	7.1
Thor	2.9	4.0	6.9
Agate	26+	4.2	6.8
Duke	2.8	3.9	6.7
Df 44	2.9	3.8	6.7
SX-208	2.5	4.1	6.6
KN 33	2.7	3.8	6.5
N/K-919	2.5+	3.9	6.4

+ Some missing values (data from 2 or 3 replications).

Location: Redfield,S.D.	Plot Size: 4' x 21'
Design: RCB	Planting Date: May 13, 1981
Method of Seeding: V-Belt Drill	Replications: 4
Soil Type: Beotia Silt Loam	Years: 1982-1983

James Valley Report

Progress Report JV83-13
Performance of Herbicides in Corn, Soybeans and Sunflowers

W.E. Arnold and L.J. Wrage
Department of Plant Science

Introduction

Demonstration plots provide side-by-side comparison of herbicides. Treatments included are those presently labeled and those which may be approved in the near future. Demonstration plots are the final step in the herbicide evaluation programs. Rates and application methods are based on results obtained in separate screening tests.

Methods

Pre-plant and pre-emergence treatments were applied May 4, for corn, and May 18, for soybean and sunflower plots. A plot sprayer delivering 20 gpa water at 40 psi pressure was used. Pre-plant incorporated treatments were incorporated immediately with two tandem diskings (set to cut five to six inches deep). Shallow pre-plant incorporated treatments were incorporated with one pass of the disk set at three inches deep. The disk was a light-weight, finishing model with small blades.

Corn plots were planted May 4 and the soybean and sunflower crops were planted May 18. Pre-emergence treatments were applied immediately after planting. Early post-emergence and post-emergence treatments were applied June 1 and 8, respectively, for corn and June 1 and 15 for sunflowers and soybeans.

Total rainfall the first seven days after application was 0.59 inches and 1.31 inches during the second week for corn and 0.04 inches the first week and 0.08 inches the second week after planting of sunflowers and soybeans. The sunflower and soybeans plots were harrowed ten days after planting with a spring-tine harrow. This procedure is recommended if rainfall is not sufficient to activate pre-emergence herbicides. Weed pressure was moderate to heavy. Green foxtail was the predominant grass species. Redroot pigweed, russian thistle, kochia and lambsquarters were the predominant broadleaves.

Results

The performance of the treatments is presented in the following tables. Evaluations are based on two visual ratings per plot on July 6. A three year average for early season weed control for corn and a two year average for soybeans and sunflowers are included for those treatments in the test each year.

Excellent weed control was obtained with most herbicides in the soybean and sunflower plots. However, only four treatments in the corn plots had

over 90% weed control for both grass and broadleaf weeds. All four of these treatments were tank-mixes of two or three chemicals. Heavy pressure from kochia and pigweed made it possible to obtain very critical evaluation of broadleaf control.

Manager's Comments

The herbicide demonstration plots need to be viewed in person in order for you to gain full value from them. We have started to cultivate four rows of the eight in each plot. (The numbers reported are for the uncultivated rows). This allows you to see the many combinations of chemical and mechanical weed control. The plots lie just to the north of the station headquarters and usually have signs identifying treatments in place following the last cultivation (probably in the second week of July). If the signs are not in place or you want to ask questions stop at the office and one of the staff will show you around. These plots are planted in strips separated by an oats crop. After harvest, the small grain area is allowed to produce weeds and go to seed. This insures that the weed pressure on the herbicide 'demos' rotated to this area the following year will be high.

Performance of the herbicides on the sunflowers and soybeans was better than on the corn. The later planting date of these crops allowed mechanical control of weeds that germinated prior to May 18 when these crops were planted. Since rainfall in the first ten days after planting was not sufficient to activate pre-emergence chemicals, a flextine harrow was used. It is doubtful if the pre-emergence herbicides would have worked well if the harrow had not been used. Irrigators could have activated these chemicals with their center-pivots.

Table 13-1. Performance of Corn Herbicides. Redfield-1983

Treatment	lb/A act.	Percent Weed Control 1983 Gr	1983 Bdlf	3 Yr. Avg. Gr	3 Yr. Avg. Bdlf
PRE-PLANT INCORPORATED					
Check	--	0	0	--	--
Eradicane	4	97	10	95	51
Eradicane+atrazine	3 + 1	95	98	96	96
Eradicane+Bladex	3 + 1 1/2	80	92	89	92
Sutan+	4	90	5	90	29
Sutan++atrazine	4 + 1	92	96	92	94
Sutan++Bladex	4 + 1 1/2	88	92	91	91
Sutan++Bladex+atrazine	4 + 1 1/2 + 1/2	92	98	95	98
SHALLOW PRE-PLANT INCORPORATED					
atrazine	2 1/2	68	98	73	88
Lasso	3	96	22	86	44
Dual	2 1/2	97	5	89	19

(Cont. on next page.)

Table 13-1. (Continued) Performance of Corn Herbicides. Redfield-1983

Treatment	lb/A act.	Percent Weed Control 1983 Gr	1983 Bdlf	3 Yr. Avg. Gr	3 Yr. Avg. Bdlf
PRE-EMERGENCE					
atrazine	2 1/2	84	98	80	97
Bladex	3	70	80	70	82
Lasso	3	72	22	83	51
Dual	2 1/2	78	10	87	23
propachlor	6	96	55	80	37
Mon-097	2 1/2	90	20	94	51
Lasso+atrazine	2 + 1	62	52	84	81
Lasso+Bladex	2 + 1 1/2	75	75	87	87
Dual+atrazine	2 + 1	82	65	90	84
Dual+Bladex	2 + 1 1/2	70	50	85	80
Lasso+Bladex+atrazine	2 + 1 1/2 + 1/2	28	72	72	88
Dual+Bladex+atrazine	2 + 1 1/2 + 1/2	50	80	--	--
Lasso+Bladex+Sencore/Lexone	2 + 1 1/2 + 1/4	96	94	96	97
EARLY POST-EMERGENCE					
Prowl+atrazine	1 1/2 + 1	97	83	92	85
Prowl+Bladex	1 1/2 + 1 1/2	90	58	87	78
POST-EMERGENCE					
atrazine+crop oil	1 1/2 + 1 qt.	40	96	65	87
Bladex 80W+X-77	1 1/2 + 1/2%	72	94	75	85
Tandem+atrazine+Bladex 80W	1/2 + 3/4 + 3/4	68	96	--	--
PRE-EMERGENCE & POST-EMERGENCE					
propachlor&Banvel	4 & 1/4	92	88	78	87
propachlor&2,4-D amine	4 & 1/2	92	68	75	70
Check	--	0	0	--	--

Evaluated: 7/7/83
PPI & PRE: 5/4/83 EARLY POST: 6/1/83 POST: 6/8/83
Planting Date: 5/4/83
BDLF: Moderate kochia, lambsquarters, Russian thistle
GR: Light green foxtail
Rainfall: First week= .59 inches
Second week= 1.31 inches

Table 13-2. Performance of Soybean Herbicides. Redfield-1983.

Treatment	lb/A act.	Percent Weed Control* 1983 Gr	1983 Bdlf	2 Yr. Avg.** Gr	2 Yr. Avg.** Bdlf
PRE-PLANT INCORPORATED					
Check	-	0	0	--	--
Treflan	3/4	99	93	98	93
Basalin	1				
Prowl	1 1/2	98	90	98	78
Vernam	2 1/2	98	76	98	61
Treflan+Sencor/Lexone	3/4 + 3/8	97	94	98	93
Treflan+Amiben+Sencor/Lexone	3/4 + 2 + 1/4	99	96	98	96
SHALLOW PRE-PLANT INCORPORATED					
Lasso	3	96	81	97	52
Dual	2 1/2	96	71	97	41
Prowl	1 1/4	97	88	98	57
PRE-PLANT INCORPORATED & PRE-EMERGENCE					
Treflan&Sencor/Lexone	3/4 & 1/2	98	96	98	98
PRE-EMERGENCE					
Amiben	2	82	76	89	67
Lasso	3	92	68	95	48
Dual	2 1/2	92	62	95	36
Lasso+Sencor/Lexone	2 + 1/2	88	86	93	93
Dual+Sencor/Lexone	2 + 1/2	89	86	94	91
Lasso+Amiben	2 + 2	89	76	94	82
Lasso+Lorox	2 + 1	92	86	95	81
Lasso+Modown	2 + 1 1/2	93	82	96	88
PRE-EMERGENCE & POST-EMERGENCE					
Lasso&Bassagran	2 & 1	92	94	95	88
Lasso&Blazer	2 & 1/2	99	96	98	95
Lasso&Tackle	2 & 1/2	99	95	98	96
POST-EMERGENCE					
Poast+Blazer +Basagran+oil	1/5 + 1/4 + 1/2 + 1 qt.	99	96	--	--
Fusilade+Blazer +Basagran+oil	1/4 + 1/2 + 1/2 + 1 qt.	98	92	--	--
Check	--	0	0	--	--

Evaluated: 7/6/83
PPI & PRE: 5/18/83
Planting Date: 5/18/83
BDLF: Moderate kochia, lambsquarters, Russian thistle
GR: Light green foxtail
Rainfall: First week= .04 inches
Second week= .08 inches

*Average 2 ratings per plot.
**Average of 1982 and 1983 data.

Table 13-3. Performance of sunflower herbicides. Redfield-1983.

Treatment	lb/A act.	Percent Weed Control 1983* Gr	Percent Weed Control 1983* Bdlf	Percent Weed Control 2 Yr. Avg. Gr	Percent Weed Control 2 Yr. Avg. Bdlf
PRE-PLANT INCORPORATED					
Check	--	0	0	--	--
Eptam	3	91	75	92	55
Basalin	1	92	86	92	89
Treflan	3/4	92	90	92	90
Prowl	1 1/4	94	94	94	94
Treflan+Amiben	3/4 + 2	97	96	96	96
Treflan+Eptam	1/2 + 3	97	92	--	--
Eptam+Amiben	2 1/2 + 2	93	92	94	90
SHALLOW PRE-PLANT INCORPORATED					
Lasso	3	93	88	90	59
Dual	2 1/2	92	85	90	48
Prowl	1 1/4	96	93	--	--
Prowl+Amiben	1 1/4 + 2	98	92	--	--
PRE-PLANT INCORPORATED & PRE-EMERGENCE					
Treflan&Amiben	3/4 & 2	98	97	98	98
PRE-EMERGENCE					
Amiben	3	91	82	78	82
Lasso	2 1/2	96	84	90	64
Dual	2 1/2	92	76	92	58
Prowl	1 1/4	88	82	76	80
Lasso+Amiben	2 + 2	92	90	--	--
Check	--	0	0	--	--

Evaluated: 7/6/83 *Average of 2 ratings per plot.
PPI & PRE: 5/18/83
Planting Date: 5/18/83
GR= Light Green foxtail
BDLF=Moderate kochia, lambsquarters, Russian thistle
Rainfall: First week= .04 inches
Second week= .08 inches

Progress Report JV83-14
Desmedipham (Betanex) Combinations for Weed Control in Sunflowers

W.E. Arnold, M.D. Anderson and M.A. Wrucke
Department of Plant Science

Methods

This project was established at the James Valley Research Center in 1983. The experimental area has been in a sunflowers-fallow cropping pattern for one year. The area was fallowed last year. Soil on the research site is a silt loam consisting of 6.8 percent sand, 70.2 percent silt and 23.0 percent clay. The site is well drained, contains 2.80 percent organic matter and has a 7.4 pH. Sokota 4000 sunflowers were planted on May 19, 1983 at 1.5 inch depth in 36 inch wide rows at 17,000 plants per acre. The study was designed as a four replication RCB on plots 10 feet by 30 feet. Treatments were applied on May 18, June 15, June 22 and July 7, 1983. Plant growth stages at the first application were: sunflowers PPI. Plant growth stages at the second application were: sunflowers 4-6 leaf, redroot pigweed 4-6 leaf, common lambsquarter 6-lf and yellow foxtail 1-3 inches. Plant growth stages at the third application were: sunflowers 8-10 leaf, redroot pigweed 1-4 inches, common lambsquarter 3-4 inches and yellow foxtail 6 inches. Plant growth stages at the fourth application were: sunflowers 12-14 leaf, redroot pigweed 6-12 inches, common lambsquarter 6-10 inches and yellow foxtail 8-16 inches.

On the first spray stage, treatments were applied with an IHC cub sprayer using Tee Jet 8002 nozzles applying 20 gallons pre acre through a 10 foot wide boom operated 18 inches high. On the other spray stages, treatments were applied with a one wheel bike sprayer using Tee Jet 8002 nozzles applying 20 gallons per acre through a 10 foot wide boom operated 18 inches high. PPI's were incorporated immediately with two tandem diskings at right angles. No yields were taken due to heavy weed infestation.

Results

Redroot pigweed and common lambsquarter control was significantly better with all combinations of desmedipham compared to the grass herbicide applied alone. Sunflower injury tended to increase and height tended to decrease as desmdipham rate increased. Desmedipham injury on sunflowers may be more severe when applied to sunflowers previously treated with some pre-plant incorporated grass herbicides.

Manager's Comment

Poast is an herbicide presently labeled for post-emergence grass control in soybeans. Betanex is labeled for control of certain broadleaf weeds in sugarbeets. The treatments in this study are mostly not labeled in South Dakota (or elsewhere) for use on sunflowers. Consult your county agent or chemical supplier for advice on labeled herbicide treatments.

Table 14-1. Desmedipham combinations for weed control in sunflowers. Redfield-1983

Herbicide	Rate	Growth Stage	% Weed Control Yeft	Rrpw	Colq	Injury	Sunflower Height
	(lb/A)		rated	on	7/7/83		(in)
EPTC[1]	3.0	PPI	87	73	76	1	39
EPTC + desmedipham[2]	3.0 + .75	PPI + 8-lf	94	94	96	16	31
EPTC + desmedipham	3.0 +1.0	PPI + 8-lf	94	97	97	28	28
EPTC + desmedipham	3.0 + 1.25	PPI + 8-lf	94	95	95	30	28
Trifluralin[3]	.75	PPI	88	90	91	0	41
Trifluralin + desmedipham	.75 + 1.0	PPI + 8-lf	91	98	96	12	33
Trifluralin + desmedipham	.75 + 1.0	PPI + 8-lf	96	98	98	18	32
Trifluralin + desmedipham	.75 + 1.25	PPI + 8-lf	90	97	96	21	32
Sethoxydim[4]	.25	12-lf	--	0	0	0	42
Sethoxydim + desmedipham	.25 + .75	12-lf + 4-lf	--	94	95	10	36
Sethoxydim + desmedipham	.25 + 1.0	12-lf + 4-lf	--	76	76	3	38
Sethoxydim + desmedipham	.25 + 1.25	12-lf + 4-lf	--	90	91	11	36
LSD (5 percent)			14	7	8	8	3

1-Eptam
2-Betanex
3-Treflan
4-Poast

Yeft-Yellow Foxtail
Rrpw-Redroot Pigweed
Colq-Common Lambsquarter

Progress Report JV83-15
Herbicide Screening for
Reduced Tillage Sunflowers

W.E. Arnold, M.A. Peterson and S.R. Gylling
Department of Plant Science

James Valley Report

Research Methods

This study was established at the James Valley Agricultural Research and Extension Center, Redfield, S.D. in 1983. The experimental area has been in a sunflowers-fallow cropping pattern for one year. The previous crop was fallow. Soil on the research site is a silt loam consisting of 6.8 percent sand, 70.2 percent silt and 23.0 percent clay. The site is well drained, contains 2.80 percent organic matter, and has a 7.4 pH. Sokota 4000 sunflowers were planted on May 19, 1983 at 1.5 inch depth in 36 inch wide rows at 17,000 plants per acre. The study was designed as a four replication RCB on plots 10 feet by 30 feet. Treatments were applied on May 18; May 19 and June 8, 1983. Plant growth stages at the first application were: sunflowers PPI. Plant growth stages at the second application were: sunflowers pre-emergence. Rainfall was .04 inches the first week after application and .08 inches the second week after application. Plant growth stages at the third application were: sunflowers 2-4 leaf, redroot pigweed 2-4 leaf, yellow foxtail 2-inches and common lambsquarter 1-2 inches. Treatments were applied with an IHC Cub sprayer using Tee Jet 8002 nozzles applying 20 gallons per acre through a 10 foot wide boom operated 18 inches high. PPI's were incorporated immediately with two tandem diskings at right angles. No yields were taken due to heavy weed infestation.

Results

Limited rainfall before and after planting greatly reduced weed control with pre-plant incorporated and pre-emergence treatments in this experiment. Best yellow foxtail control was achieved with the four leaf applications of sethoxydim (Poast). Best broadleaf weed control was ith the pre-plant incorporated treatments of chloramben plus trifuralin (Amiben + Treflan). Slight injury was observed with R-40244 plus sethoxydim applied at the four leaf stage.

Manager's Comment

The "fallow" in 1982 consisted of allowing weeds to go to seed to assure heavy weed pressure. No primary tillage was performed other than the two shallow diskings to incorporate PPI treatments. Some of the treatments are labeled, some are experimental. See progress report JV83-13 for an evaluation of labeled treatments under weed pressure more typical of producer fields.

Table 15-1. Herbicide screening for reduced tillage sunflowers. Redfield-1983.

Herbicide	Rate	Application	% Weed Control Yeft*	% Weed Control Brlf**	Injury
	(lb/A)		7/7/83	7/7/83	7/7/83
R-40244 +	0.50	Pre			
pendimethalin[1]	1.25	Pre	30	28	0
R-40244 +	0.50	Pre			
sethoxydim[2] +	0.25	4 leaf			
crop oil conc.	1 qt.	4 leaf	82	25	2
R-40244 +	0.125	4 leaf			
sethoxydim	0.25	4 leaf	77	21	6
Chloramben +	2.00	PPI			
trifluralin[3]	0.75	PPI	58	60	0
Chloramben[4] +	2.00	Pre			
alachlor[5]	2.00	Pre	40	25	0
Chloramben +	2.00	Pre			
pendimethalin	1.25	Pre	26	26	0
Weedy Check	--	--	0	0	0
LSD (5 percent)			20	19	3

1-Prowl
2-Poast
3-Treflan
4-Amiben
5-Lasso

*Yeft= Yellow foxtail
**Brlf= Broadleaf weeds

James Valley Report

Progress Report JV83-16
Sunflower Seed Weevil Insecticide Trial

J. Gednalske and D.D. Walgenbach
Department of Plant Science

Introduction

Two sunflower seed weevil insecticide trials were conducted in the Redfield area, this year. One trial was performed at the JVAREC using a hi-boy sprayer; the other on the Lester Dennis farm near Mellette using aerial applications of insecticides.

I. AERIAL APPLICATION TRIAL

Methods

On the study near Mellette, four insecticides were applied aerially on July 22, 1983 because of heavy infestations of gray seed weevils. Weevils were feeding heavily on sunflower buds. Weevil counts on July 25 indicate the success of the insecticides used (Table 16-1). The field was reinfested by weevils again within one week, this time primarily by red weevils.

A second application was made on August 6, 1983 with three insecticides. Furadon 4F and Parthion appeared to offer the best control based on weevil count in the field following application (Table 16-2).

Results and Conclusions

Based on damaged seeds,(mean % seed infested), parathion offered the best control showing 19.8% of the seed damaged compared to 51.0% in the untreated area (Table 16-1).

Present recommendations call for insecticide control when eight to ten seed weevils are found per plant. Insecticide applications should begin at 20-30 percent bloom (two or three plants out of 10 showing ray petals and at least one row of disc flowers). In instances of reinfestations by weevils, a second application may be necessary to improve control. Applications are not recommended after the ray petals begin to drop. The early application used on this field, in the bud stage, did not show evidence of increasing yield in 1983. However, research will be continued in 1984 on damage caused by gray seed weevils.

Management parameters associated with the study involving Aerial Application of Seed Weevil Insecticides were:

Location: Mellette, South Dakota — Lester Dennis, cooperator

Sunflower Hybrid: Interstate 907
Planted 5/31/83 — Harvested 10/19/83

Treatments were applied aerially in 1 gallon of water per acre by Thorsen Aviation of Aberdeen, South Dakota.

First Application 7/22/83 Pre-spray weeevil counts 50+ gray weevils/plant

Table 16-1. Post-spray counts of seed weevils following first application. Mellette-1983

Treatment	Rate lbs. a.i./A.	Mean no. weevils/hd. Date 7/25	8/1
Untreated		8.5	25+
Sevin XLR	1.0	4.6	20
Lorsban 4E	.5	5.6	20
Furadan 4F	.5	1.9	20
Parathion	.75	.3	25+

Second application 8/6/83 - 20% bloom

Prespray weevil counts: budding plants-12 red weevils/plant
blooming plants-50 red weevils/plant

Table 16-2. Postspray counts of seed weevils following second application. Mellette-1983.

Treatment	Rate lbs. a.i./A.	Mean no. weevils/hd. 8/9
Untreated		50+
Lorsban 4E	1.0	24.3
Furadan 4F	.5	4.4
Parathion	.75	4.7

Table 16-3. Harvest counts of seed weevil damage. Mellette-1983.

Treatment	Mean % Seed Infested Combine Samples*	Head Samples**
Untreated	28.5	51.0
Sevin/Lorsban	36.5	--
Lorsban	22.8	29.9
Furadan	22.6	24.8
Parathion	11.2	19.8

*Combine samples taken from grain tank at harvest.
**Head samples - heads removed from treated area prior to harvest and hand threshed.

II. INSECTICIDE SCREENING AT THE JAMES VALLEY RESEARCH CENTER:

Methods

At the James Valley Research Center, six insecticides were applied at two bloom periods to test for their ability to control seed weevil damage in 1983. Insecticide applications were made to separate plots at 10 percent bloom and 80 percent bloom.

Insecticides were applied to two 30 inch spaced rows 100 feet long and replicated three times. A Hahn Hyboy with a CO_2 sprayer was used to apply treatments. Seed weevil numbers averaged 15 per plant in both spray stages with about 60 percent red weevils and 40 percent gray weevils.

Plots were harvested on October 4, 1983. The percent of seed damaged is based on head samples removed from the plots.

Table 16-4. Seed weevil damage on early bloom treatments. Redfield-1983.

	Insecticide Applied at 20% Bloom		
Treatment	Rate lbs. a.i./A	% Seed Damage *	
Untreated		31.8	A
Pounce	.05	18.8	B
Pay Off	.02	18.0	B C
Pounce	.1	16.7	B C
Ammo	.04	16.2	B C
Pydrin	.1	13.5	B C
Pay Off	.08	13.2	B C
Lorsban	.5	12.0	B C
Furadan	.5	11.1	B C
Ammo	.02	9.9	B C
Pay Off	.04	8.7	C
Lorsban	.75	8.7	C

*Means followed by the same letter are not signifcantly different.

Table 16-5. Seed weevil damage on late bloom treatments. Redfield-1983.

	Insecticide Applied at 80% Bloom		
Treatment	Rate lbs. a.i./A	% Seed Damage *	
Untreated		21.2	A
Pay Off	.04	16.3	A B
Pay Off	.02	13.0	B C
Lorsban	.5	11.3	B C
Ammo	.02	8.7	C D
Ammo	.04	8.1	C D
Pounce	.05	7.3	C D
Pydrin	.1	7.0	C D
Furadan	.5	6.8	C D
Pay Off	.08	6.5	D
Pounce	.1	5.8	D
Larsban	.75	5.4	D

*Means followed by the same letter are not significantly different

Summary

Most insecticide treatments, in both early and late sprayed plots, gave a significant reduction in damage when compared to the untreated check. No difference is shown between early and late bloom treatments in 1983. Late treatments have slightly fewer damaged seeds than early treatments, however, if you compare the untreated areas, you can see this is characteristic of the plot and not the time of the treatment.

Lorsban, at .75 lbs./acre, gave the best control in both early and late treatments. Furadan and synthetic pyrethroids, like Pay Off, Pounce, Ammo and Pydrin, also seem to offer some promise for future registration for use on sunflower seed weevils.

Yields were not statistically different in either late or early treated plots. However, yields ranged from and high of 1,400 pounds/A, in the best treated plots, down to 850 pounds/A, in the untreated areas.

Manager's Comments

Screening of new insecticides for use on seed weevils and other insects must be performed under carefully controlled conditions. The EPA requires analysis of the seeds for residues before a chemical or tehnique is registered for use by producers. Production from areas treated with non-labeled insecticides or by non-labeled methods must be buried or burned. For this reason, these types of research are usually performed on a research station while labeled treatments are evaluated at both on and off-station locations.

SDSU
James Valley Report

Progress Report JV83-17
The Influence of Sunflower Planting Date on Seed and Stem Weevil Infestation

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Department of Plant Science

Introduction

Experiments conducted at the James Valley Station and other locations have indicated that seed weevil emergence reaches a maximum at approximately the same time most sunflowers planted after June 1 begin to flower. It was thought that seed weevil infestation levels could be reduced significantly if flowering took place prior to the time whem maximum weevil emergence occurred. Both planting date and variety affect the date of flowering so four sunflower varieties were planted on three dates in 1983. These plots were not chemically treated for seed weevil control to allow evaluation of damage as affected only by variety and planting date.

Methods

Four sunflower hybrids were planted on three dates in 1983. Sunflowers were planted in four row plots with 30 inch spacings 100 feet long and replicated six times. Sunflowers were evaluated for stem weevil infestations in September and seed weevil damage at harvest on October 6, 1983. Stem insect damage was evaluated by splitting stalks and seed weevil damage was determined by removing 100 seed samples and counting seeds infested before and after combine harvest.

Table 17-1. Seed yield and stem insect damage as affected by variety and planting date*. Redfield-1983.

Planting Date	Hybrid	Yield lbs/A	**	% Moisture	Avg. No. Stem weevils/plant
June 10	894	1142	a	14.1	10.4
June 10	Sigco 432	1103	a	12.8	10.0
June 10	Sokota 2057	1094	a	12.8	9.8
June 10	Interstate 7101	958	ab	14.0	10.2
May 19	Interstate 7101	736	bc	8.1	9.4
May 5	Interstate 7101	697	c	7.0	8.6
May 19	894	687	c	9.0	8.6
May 19	Sokota 2057	678	c	8.1	9.6
May 19	Sigco 432	561	cd	6.9	9.0
May 5	Sokota 2057	552	cd	6.8	9.6
May 5	894	542	cd	6.7	7.8
May 5	Sigco 432	397	d	6.9	8.6

*Major yield differences caused by lodged plants in earlier dates due to delayed harvest.

** Yields followed by same letter are not significantly different.

Table 17-2. Seed weevil damage as affected by variety and planting date. Redfield-1983.

Planting Date	Hybrid	Mean Percent of Seed Damaged * Head Samples **	Combine Samples ***
June 10	894	56.2 a	43.0
June 10	Sigco 432	53.2 a	28.1
June 10	Interstate 7101	45.8 ab	42.8
June 10	Sokota 2057	40.1 bc	40.0
May 19	894	30.2 cd	26.2
May 19	Sokota 2057	28.6 cd	17.8
May 5	894	26.6 d	20.2
May 19	Interstate 7101	26.5 d	16.0
May 5	Interstate 7101	18.2 de	7.9
May 19	Sigco 432	18.0 de	9.1
May 5	Sokota 2057	13.0 e	5.2
May 5	Sigco 432	10.0 e	9.6

* Means followed by the same letter are not significantly different.
** Head samples- head removed prior to harvest and hand threshed.
*** Combine samples taken from grain tank at harvest.

Results

The early planting of sunflowers in 1983 again showed a dramatic reduction in seed weevil damage compared to later planting dates. The key aspect of this sunflower-seed weevil relationship is that the flowers that bloom prior to or around August 1, escape the peak egg laying period of the weevils. The cool, wet spring delayed the development of the earliest planting date and tended to group the damage of the first two dates more than in 1982. The comparison of seed damaged between the head samples and combine samples indicates that seed weevil losses are considerably greater than the percent infestation of combine harvested seed indicates. Seeds that are blown through the combine represent a total loss and can account for a significant invisibe loss.

Yields of early planted sunflowers have at times shown a disadvantage compared to later planting dates. Part of this loss had been caused by harvesting all planting dates at the same time, when the later planted plots are ready. Even then, we have much to learn about fertility and hybrid interactions at the early dates.

Stem weevil infestations in 1983 showed no difference between early or later planted flowers, infesting all dates and hybrids at the same level.

Manager's Comments

The concept of avoiding seed weevil damage through early planting is interesting. The yield decrease noted at the early planting date may be due to factors other than date alone, in 1983. The planter used for the May 5 date was an old planter owned by the station since the new planter was not available to plant sunflowers on May 5. This planter did a much poorer job of planting than what was done with the new planter on May 19 and June 10. Starter fertilizer and soil applied insecticides were not used on any of the planting dates since they could not be used with the old planter on May 5. Starter fertilizer is probably needed on early planted sunflowers.

Progress Report JV83-18
Insecticide Screening for Control of
Stem Insects in Sunflowers

J. Smolik
Department of Plant Science

Summary

Furadan at several rates and formulations provided very good control of stem insects in sunflower at four locations. Nematode populations were also substantially reduced at three of the four locations. Stem insects wer evaluated only in mid-August at the Ashton locations and harvest at the Roscoe locations. It appears the harvest evaluations provide more information and in addition separation of stem weevils was greatly facilitated since it was possibel to count Apion exit holes and after splitting the stalks to count numbers of Cylindrocopturus larvae.

Control of stem insects also resulted in very good control of stalk rot (Table 18-1). The Roscoe I plot was located entirely within an "early dead" area and none of the treatments prevented early death of the plants. It would thus appear that stem insects, stalk rot and nematodes are not the principal causes of early dying in sunflower in this area.

Sunflower yields and 100 seed weights were lowest in the early dead (Roscoe I) plot, however oil contents in the Roscoe I and II plots were not significantly different (Table 18-2). Yields, oil content and 100 seed weight were all significantly higher in the Ashton plots. The analysis of variance revealed no significant treatment by location interaction indicating the effects of the Furadan teatments were similar at all locations. All of the Furadan treatments significantly increased sunflower yields 15-24 percent, however, differences in oil and 100 seed weight were not significant. The greatest economic return after deducting chemical costs occurred with the one and two pound rates of Furadan 15 G applied at planting.

One of the objectives of this year's research was to study the causes of early dying in sunflower. In addition to insect, nematode and stalk rot studies the possible role of nutrients was also investigated. Soil cores were removed in early dead and adjacent non-affected areas from fields at four locations in late August. These samples were tested for N, P, K, organic matter pH, salts, Zn, Fe, Cu and B. There did not appear to be any soil property or nutrient level measured that was consistently associated with early dying. The levels of N, P and K tended to be higher in the early dead areas, which might be expected since plants in these areas had ceased growth several weeks prior to sampling.

Table 18-1. Effect of insecticide/nematicide treatments on stem insect and Nematode populations. Roscoe and Ashton-1983.

		Stem Insects and Stalk Rot/Plant					
		Mid-August		Harvest			
Location	Treatment	Dectes	Stem Weevils	Dectes	Apion	Cylindro- copturus	Stalk rot
Roscoe I	Check	0.8[a]	11.5	0.9[b]	4.5	4.1	2.95[c]
(Early Dead)	1 lb Furadan[d]	0.3	0.8	0.3	0.5	0	1.40
	2 lb Furadan[d]	0.5	1.0	0.3	0	0.3	1.35
	4 pt Furadan 4F (4 wks Post Plant)	0.3	0.5	0.4	0	0.05	1.25
Roscoe II	Check	0.5	6.3	1.0	5.1	3.8	2.85
	1 lb Furadan[d]	0	0.3	0.4	0.1	0.1	1.25
	2 lb Furadan[d]	0.5	1.2	0.3	0.1	0	1.25
	4 pt Furadan 4F (4 wks Post Plant)	0	0.3	0.3	0	0.3	1.00
Ashton I	Check	0.8	3.5				
(Early Dead)	1 lb Furadan[d]	0.3	0.8				
	2 lb Furadan[d]	0.8	0.8				
	4 pt Furadan 4F (4 wks Post Plant)	0.5	0.3				
Ashton II	Check	0.5	3.0				
	1 lb Furadan[d]	0.3	0.3				
	2 lb Furadan[d]	0.3	0.3				
	4 pt Furadan 4F (4 wks Post Plant)	0.3	0.3				

		Number of Plant Feeding Nematodes/100 cc Soil		
Location	Treatment	Pre-treat	Mid-season	Harvest
Roscoe I	Check	187	329	785
(Early Dead)	1 lb Furadan[d]		243	100
	2 lb Furadan[d]		353	235
	4 pt Furadan 4F (4 wks Post Plant)		106	251
Roscoe II	Check	158	385	664
	1 lb Furadan[d]		105	235
	2 lb Furadan[d]		143	101
	4 pt Furadan 4F (4 wks Post Plant)		155	220
Ashton I	Check	71	243	285
(Early Dead)	1 lb Furadan[d]		80	100
	2 lb Furadan[d]		13	235
	4 pt Furadan 4F (4 wks Post Plant)		16	258
Ashton II	Check	75	97	185
	1 lb Furadan[d]		10	16
	2 lb Furadan[d]		9	16
	4 pt Furadan 4F (4 wks Post Plant)		4	85

a and b/ Average of 4 reps (five stalks/rep).
c/ Rot scale: 1=none to slight 2=moderate to heavy 3=severe
d/ applied in 7" band at planting.

Progress Report JV83-19
Effect of Nematode and Fungus Control
on Stand Establishment of Alfalfa

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Introduction

Establishing a good uniform stand of alfalfa is one of the most difficult tasks most producers undertake. This experiment was designed to investigate the role that nematodes and fungi play in stand failures in alfalfa.

Summary

Both nematicide and fungicide treatments significantly increased alfalfa stands at two locations (Table 19-1). These results in combination with those obtained in prevous years' studies provide additional evidence that nematodes and fungi are involved in alfalfa stand failures.

Table 19-1. Effect of nematicide and fungicide treatments on alfalfa stands at two locations.

Location	Treatment	No. of plants/ 2 ft. (June)	No. of plant feeding Nematodes/100 cc soil pre-treat
	Check	18.5	50
Highmore	2 pt. Furadan 4F	49.5*	
	Ridomil Seed Treat	55.5*	
	Captan Seed Treat	47.3*	
	Furadan + Ridomil	73.5*	
	Check	6.8	63
Oral	2 pt. Furadan 4F	15*	
	1 lb. Ridomil	17*	
	Furadan + Ridomil	10.5*	

* Indicates significant increase at .05 level. Average of four reps.

Progress Report JV83-20
Effect of Soil Moisture Gradient
on Fusarium Root Rot of Soybean

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Introduction

Root rot of soybean seedlings in South Dakota is a little understood crop disorder. The causal agent appears to be Fusarium oxysporum, through proof of its pathogenicity has not been established. Also, certain physical conditions of the soil appear to predispose plants to the disease. It is believed that soil moisture stress is a primary predisposing factor.

As explained by Nyvall, et.al. Fusarium root rot of soybean is caused by the common soil borne fungus, Fusarium oxysporum (Schlect.) emend. Snyd. & Hans. Infected seeds have poor germination resulting in either pre- or post-emergence damping off or late emergence and stunted plants. The fungus causes dark brown lesions that are confined to roots and the lower portions of stems. Root systems of severely infected plants may be completely destroyed. Wilting is most frequently observed on seedlings or young plants when roots are rooted and soil moisture is low. They recover turgidity at night or when moisture becomes adequate. This reduces yield significantly.

Hanks et.al. presented design details for a line source sprinkler plot irrigation system which produces a water application pattern which is uniform along the length of the plot and continuously but uniformly variable across the plot. By establishing subplots at right angles to the water variable, various treatments can be compared to uniformly equal water regimes. Within each subplot, a full gradient of soil moisture conditions from more than adequate to dry conditions can be compared.

Materials and Methods

Twenty-four 30 inch rows were planted to Corsoy 79 soybeans on either side of a line-source irrigation system used to establish a soil moisture gradient upon the test plot. Two such plots were planted. The first, planted May 24, had two treatments: soil inoculated with Fusarium oxysporum, and soil not inoculated. The second, planted July 8, had the same two treatments plus an additional pre-plant fumigated non-inoculated soil treatment. Treatments were repeated once on the opposing side of the line source and in a random order in both experiments. These sub-plots were 20 feet long, separated by five-foot alleys. However, soil moisture data at 15-foot intervals in a perpendicular line to either side of the line source was recorded at weekly intervals. Seedlings from one-foot samples of alternate rows were collected from each treatment replicate. Plant length, stage of development and number of lesions on roots were recorded for each plant. Also, a disease index for each plant was made. The July plot was terminated 40 days after planting. The May plot, however, was harvested at maturity 113 days after planting and yield data collected.

Results and Discussion

Using a stepwise regression analysis, it was found that 7.8 percent of the variability in disease index could not be attributed to the variables: treatment, soil moisture, planting date and date of data collection. Twelve point five percent of the variability in number of lesions recorded could be attributed to the four variables: date of data collection, treatment, planting date and soil moisture.

Sixty-six point one percent of the variability in plant length recorded could be attributed to the variables: date of observation, planting date, total soil moisture and treatment.

The lack of contribution to the variability due to the above variables of disease index and lesion size was probably due to the unusually wet spring and summer, and to a sporadic irrigation schedule. Because of these factors a satisfactory soil moisture gradient was not successfully established during the course of either experiment. This resulted in no clear differential of water stress on plants, and hence conveyed no environmental advantage to the fungus.

Future experiments will be conducted under more controlled conditions to optimize fungus-plant interaction.

Manager's Comments

The main significance of this research is to dryland soybean producers since irrigators can apply water if dry soil conditions exist. The irrigation system was used here to, in theory, allow evaluation of conditions from wet to dry at the same site. Several "line source" type experiments are mentioned in the progress reprots. One line source is made by using a single set of hand move lines having a sprinkler spacing of 20 feet. This close spacing provides triple overlap of water patterns so that the water applied is uniform at every point along the line and decreases with distance from the line. In other words, every spot five feet from the pipes will receive the same amount of water. The amount of water applied at every spot 20 feet from the line will be uniformly less than that received at five feet. No water is applied at about 60 feet from the line. These systems can only be operated when there is no wind to distort the pattern. Rain and periods of windy weather can interfere with obtaining proper water management with these systems. When funds become available we hope to design a drip irrigation system that could be used for these types of studies. This would eliminate the wind effect problems associated with line source systems.

Progress Report JV83-21
An Evaluation of Three Feeding Schemes To Winter Replacement Heifers

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Introduction

Many different feeding practices have been used to grow out replacement heifers. The goal for replacement heifers is to overwinter at gains so that they will be 60 percent of mature body weight by breeding. This should be done as efficiently as possible meeting all nutrient requirements. This study was designed to evaluate three methods of growing replacement heifers as to economic efficiency and animal performance.

Methods

In 1982, the Ninety-three Simmental-Angus crossbred heifers were purchased at weaning and placed on trial at the James Valley Research and Extension Center at Redfield, S.D. The heifers were divided into two groups, light and heavy (average of 510 lb. and 600 lb. respectively). Each group was divided randomly into three groups, receiving one of the following rations: (1) .28 Mcal of net energy for gain per pound of dry feed, fed free choice (low energy ration, free choice); (2) the same diet as in one but with intake limited to 13 lb. of dry feed per head per day or (3) .36 Mcal of net energy for gain per pound of dry feed (high energy ration) intake limited to 13 lb.of dry matter per head per day. Composition of the diets is shown in Table 20-1. The cattle were weighed and treatments initiated February 4, 1982. The heifers were artificially inseminated in early June and dietary treatments were terminated resulting in a 144-day feeding period. Cattle were weighed every 28 days and feed measured on a pen basis each day. Subsequently, cattle were placed on pasture at Cottonwood, South Dakota. In 1983, a similar group of cattle were treated in the same manner except the energy levels in the rations were (1) .31 Mcals of net energy for gain per lb. of dry feed, (2) .31 and (3) .40 (Table 1). The feeding period was shortened to 126 days.

Analysis of data included calculation of weight gain, average daily gain, feed consumption and feed cost per treatment group. The reproductive performance of the heifers will be monitored in future years.

Results

Data representing total weight gain, average daily gain, total feed consumption, pounds of feed per pound of gain and feed cost for both years are presented in Table 20-2. For 1982, the average daily gains and feed efficiencies, higher or lower, were lower than what might be expected in all pens because of a month of severe weather compounded by recurring water problems. The most satisfactory overall performance was achieved by the high energy limit-fed group. They gained the most with the lowest feed cost per

Table 21-1. Ration composition[a], energy level and daily intake level for each of the diets. Redfield-1982 and 1983.

	Low energy Free Choice		Low energy Limited-fed		High energy Limited-fed	
Composition, %[b]	1982	1983	1982	1983	1982	1983
Corn, shelled	65	-	65	-	77	10
Corn, silage	-	35	-	35	-	63
Prairie hay	34		34		22	
Alfalfa hay	-	65	-	65	-	24
Protein supplement	1	-	1	-	1	-
Energy, NEg Mcal/lb	.28	.31	.28	.31	.36	.40
Lb intake per head/day	14.5	10.8	12.5	11.1	12.7	10.8

[a] All rations included free access to mineralized salt.
[b] All numbers are on a dry matter basis.

pound of gain. In 1983, the animals in the low energy free-choice group consumed the highest amount of feed and had the poorest feed efficiency. They also had the highest total feed cost as well as feed cost per pound of gain. The low energy limit-fed group was more efficient than the low energy-free choice group but had the lowest gain rate. The limit-fed high energy group performed the best in total weight gain, average daily gain and feed conversion. They are also the most economical in feed cost per pound of gain. Limit feeding seems to decrease feed costs, but the energy level in the ration must be relatively high to sustain adequate gains.

Table 21-2. Feedlot performance[a] of Simmental-Angus crossbred replacement heifers. Redfield-1982 and 1983.

Item	Low energy Free Choice		Low energy Limit-fed		High energy Limit-fed	
	1982	1983	1982	1983	1982	1983
Total wt. gained (lb)	189	192	171	162	195	207
ADG,lb/day	1.31 ±.12	1.52 ±.12	1.22 ±.04	1.28 ±.01	1.39 ±.03	1.64 ±.07
Total lb feed consumed[b]	2099	1371	1810	1417	1839	1271
Feed efficiency (lb feed, DMB/lb gain)	11.24 ±1.22	7.18 ±.61	10.64 ±.77	8.69 ±.03	9.43 ±.07	6.15 ±.21
Total feed cost/hd ($)	73	38	63	39	65	37
Feed cost, $/lb gain	.39	.20	.37	.24	.33	.18

[a] Values are averages on an individual basis.
[b] Dry basis.

Summary

Three feeding schemes for intering replacement heifers were evaluated in terms of cost and animal performance for two years. Ninety-three Simmental-Angus crossbred heifers were divided into three groups of 31 head and fed the following diets in 1982: (1) .28 Mcal of net energy for gain per pound of feed, fed free choice; (2) .28 Mcal of net energy for gain per pound of feed limit fed to 13 lb. dry matter per head per day and (3) .36 Mcal of net energy for gain per pound of feed limit fed to 13 lb. of dry feed per head per day. The third diet (higher energy) was the best scheme, resulting in the best gains and the lowest feed costs per pound of gain. Ninety-three head of Simmental-Angus crossbred heifers were divided into similar groups for 1983 and fed the following diets (1) .31 Mcal of net energy for gain per pound of feed, fed free choice; (2) .31 Mcal of net energy for gain per pound of feed, limit fed to 11 lbs. of dry matter per head per day and (3) .40 Mcal of net energy for gain per pound of feed limit fed to 10 lbs. of dry feed per head per day. The third diet provided the best gains, the most efficient gains and the least cost per lb. of gain.

Manager's Comment

Each pen of hiefers was split in two groups in the spring of 1983. One group was heat sycronized with Leutylase and the other with Syncromate B. All heifers were then artificially inseminated on the same day. Results of the effects of diet and sycronization method on conception and calving rate etc., will be included in next year's annual progress report after these heifers have calved.

James Valley Report

Progress Report JV83-22
Varieties, Seeding Rate and Water Management of Irrigated Spring Wheat

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Introduction

Several experiments at Redfield and Gettysburg were conducted to evaluate the response of spring wheat with irrigation. Experiments were planted at Gettysburg on April 20 and at Redfield on April 22. Plots were fertilized for a yield goal of 90 bu/A so that available (NPK) would not be limiting. Weed competition was not a factor influencing yield (grass weeds were controlled with Ramrod or Treflan and broadleaf weeds with Bronate).

Water Management Study

Spring wheat's response to various irrigation treatments was evaluated in the water mangement study at Redfield using two varieties, Len and Butte. Treatments varied in the amount of water applied and time of water application during the growing season. Irrigation was done using three line sources that established a gradient of water. One line was established for early season water application from seedling stage to heading, a second from heading through grain filling and the third for full season irrigation. Soil water status was monitored throughout the growing season using a neutron probe. Plots were scheduled for irrigation when 40-50% of the available water in the top foot had been removed (Tensiometer at 1 foot depth near the line source had a reading of 35 centibars). Observations were made on growth stage development, tillering and heading through out the growing season. Yield components were taken just prior to harvest and plots were evaluated on test weight, 1000 kernel weight, protein and yield. This information should hopefully give insight into the relationship between irrigation management practices and spring wheat yield in South Dakota.

Variety Trial (Hard Red Spring and Durum)

Twenty-five spring wheat varieties and experimental lines were tested. At Gettysburg the yield range was 66.3 to 43.2 bu/A and at Redfield 51.0 to 29.7 bu/A. The yields at Redfield were reduced by a severe infection of Head Scab. The highest yielding named varieties at Gettysburg were Oslo, Marshall, Guard and Erik and at Redfield: Oslo, Guard, James, Marshall, Erik and WS1890. An experimental line, SD2956, produced the highest grain yield at both sites and was 8.8 and 6.1 bu/A greater than the best named variety at Redfield and Gettysburg, respectively. In a similar experiment grown in 1982, yields ranged from 62.4 to 47.7 bu/A with the top yielding varieties being Marshall, James, Guard, Len, Oslo, 711 and Olaf. The variety Butte lodged in all tests and appears to have insufficient straw strength for full season irrigation. Era, even though it has produced high yields in other areas, does not respond to irrigation in South Dakota.

In the durum trial, six varieties were grown. The yields at Gettysburg ranged from 55.6 to 48.0 bu/A with no significant differences among the varieties. At Redfield, the range was 44.2 to 28.7 bu/A with the tall varieties (Edmore, Rugby, Vic and Ward) yielding more than the semi-dwarfs (Lloyd and Cando). This response was probably due to a greater susceptibility of these semi-dwarfs to Head Scab compared to the tall varieties.

Seeding Rate Study

Four varieties were grown at seeding rates of 94, 125, 156 and 187 lbs/A. The effects of seeding rate on yield were not significant, however,the low rate of 94 lbs/A produced 5 bu/A less than the higher rates. This preliminary data indicates that seeding rates between 2 and 3 bu/A should be sufficient for irrigated spring wheat. It should be noted that seeding rates have a significant effect on lodging. As seeding rates were increased, so was the severity of lodging. Some lodging was observed in the varieties with excellent straw strength at the highest seed rate.

Conclusions

1. The yields from irrigated spring wheat experiments have been disappointingly low with the highest yield obtained being 66 bu/A. The factor limiting yields may have been the correct water scheduling. In these experiments, the plots were irrigated when 40 to 50 percent of the available water in the top 1.5 foot has been removed (Tensiometer readings of 35-40 centibars).

2. Head Scab can severely reduce yields under irrigation as it did in the Redfield experiments. At the present time, neither resistant varieties nor chemical control treatments are available, therefore the management practices of not following corn and not irrigating at flowering (4-7 days after heading) are the only tools available to reduce this disease.

Manager's Comment

The two years of trials at Gettysburg and the studies at Redfield this year were all planted around the 20th of April. This is a later planting date than preferred. Weather and soil conditions the last two years have prevented planting at an early or at least "normal" time. Later than normal planting in conjunction with the slowing of plant development caused by irrigation has led to the grain filling period occurring relatively late both years. This late grain filling period occurs during warm weather thus shortening the time from heading to maturity. Areas that produce wheat yields under irrigation well in excess of 100 bu/A have grain filling periods of about 60 days. On these trials, the grain filling period has been 30 days or less beginning after June 20. If planting could have taken place the first week of April, heading may occur ten days earlier during the cooler period early in June. Research in future years under more favorable conditions will allow evaluation of planting date effects.

Varieties developed to do well under dryland conditions in South Dakota or under irrigation in other areas do not appear to have the yield potential that some of the experimental varieties being tested have under these conditions. Hopefully further testing of breeding material will lead to the development and release of a variety adapted to irrigated conditions in South Dakota.

Progress Report JV83-23
Yield and Morphological Effects of Ethephon (Cerone) on Irrigated Spring Wheat

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Introduction

Ethephon, (Tradename: Cerone), a plant growth regulator, is currently being evaluated for wheat and barley. Field experiments were conducted in 1983 near Gettysburg and at the James Valley Research Center near Redfield. Ethephon's effect on lodging, height, yield and test weight of three spring wheat varieties grown under irrigation were investigated.

Methods

Two semi-dwarf varieties, Len and Marshall, and a normal height variety, Butte, were treated with .25 lb. a.i./acre at late tillering, .25 lb. a.i./acre at jointing and .25 lb. a.i./acre and .50 lb. a.i./acre at flag leaf emergence. An applicaion of .125 lb. a.i./acre at late tillering and again at jointing was also included. Only Butte and Marshall were planted at Gettysburg. All three varieties were used at Redfield.

Results and Conclusions

Application of ethephon, at flag leaf emergence, significantly reduced lodging in all varieties when the untreated check lodged. The normal height variety Butte lodged at both locations. Lodging was not a problem with the semi-dwarf varieties at Redfield, but Marshall lodged at Gettysburg. This reduction in lodging was correlated to height reduction of the wheat associated with the application of ethephon. No significant yield loss from lodging was observed possibly because the small combine used for harvest was able to pick up all the lodged wheat. Ethephon caused yield reduction on Marshall at Gettysburg and Len at Redfield when the .5 lb. a.i./acre rate was applied (Tables 23-1 and 23-2). The effect of ethephon on test weight was variable among varieties and location.

Manager's Comment

Cerone received an experimental use permit for small grain in South Dakota in 1983. The EUP called for .25 to .5 lb/A of active ingredient applied at flag leaf stage. The data in this report indicates that cerone does shorten plant size and consequently will reduce lodging if a problem exists. The semi-dwarf varieties seemed to respond differently than the tall variety. In fact, the high rate of Cerone at (0.5 lbs/A) at flag leaf significantly reduced yields of the semi-dwarf varieties from the yields achieved with 0.25 lbs/A at flag leaf. These shorter varieties may require less chemical than standard height varieties. More calibration work is needed. This product may allow the use of very high seeding rates etc. under irrigation as an attempt is made to push yield levels to 100 bu/A.

Table 23-1. Heights, lodging, yields and test weights of varieties as affected by Cerone. Redfield-1983.

Variety	Treatment	Height[1] (cm)	Lodging[1] (%)	Yield[1] (bu/A)	Test Weight[1] (lb/bu)
Butte	Check	81.1 a	15 a	54.4 a b	53.4 a b
	.25 lb/A tillering	82.5 a	28 a	51.7 b	60.0 c
	.125 lb/A tillering and jointing	80.5 a b	0 c	58.8 a	52.7 a b
	.25 lb/A jointing	80.3 a b	8 b c	59.2 a	52.3 b
	.25 lb/A flag leaf	76.4 b c	0 c	56.6 a b	53.7 a
	.50 lb/A flag leaf	72.8 c	3 c	52.3 b	53.8 a
Marshall	Check	74.2 a	0	55.6 c	52.5 *
	.25 lb/A tillering	74.0 a	0	59.6 a b	52.5 *
	.125 lb/A tillering and jointing	72.5 a	0	61.6 a b	53.5 *
	.25 lb/A jointing	71.8 a b	0	62.8 a	54.3 *
	.25 lb/A flag leaf	69.1 b	0	56.6 b c	53.7 *
	.50 lb/A flag leaf	63.8 c	0	50.2 d	54.0 *
Len	Check	77.4 a	0	50.0 a	52.4 *
	.25 lb/A tillering	76.7 a	0	51.5 a	52.8 *
	.125 lb/A tillering and jointing	71.2 b c	0	49.6 d	52.7 *
	.25 lb/A jointing	72.6 a b	0	49.3 a	51.1 *
	.25 lb/A flag leaf	67.4 c d	0	49.0 a	52.5 *
	.50 lb/A flag leaf	63.2 d	0	40.6 b	53.3 *

[1]Means within a column and variety followed by the same letter are not significantly different at the 5% level using Waller-Duncan K-ratio test.

* Nonsignificant at the 5% level.

The reason for the differences noted between the Gettysburg and Redfield studies can be tied to water management. Due to equipment problems at Redfield, the Gettysburg plots were maintained at a higher moisture level early in the season (prior to heading) than were the plots at the James Valley Station.

Table 23-2. Heights, lodging, yields and test weights of varieties at Gettysburg, 1983.

Variety	Treatment	Height[1] (cm)	Lodging[1] (%)	Yield[1] (bu/A)	Test Weight[1] (lb./bu)
Butte	Check	85.8 a	68 a	56.2 a b	59.3 a b
	.25 lb/A tillering	80.4 b	70 a b	52.2 b	58.6 b c
	.125 lb/A tillering and jointing	83.1 a b	60 a b	59.9 a	59.5 a
	.25 lb/A jointing	79.9 b	63 a	55.9 a b	58.4 c
	.25 lb/A flag leaf	79.7 b	35 b c	57.6 a b	59.2 a b
	.50 lb/A flag leaf	80.9 a b	25 c	61.3 a	58.8 a b c
Marshall	Check	75.3 *	23 a b	75.6 a	58.1 c
	.25 lb/A tillering	71.1 *	25 a	71.5 a b	58.7 b c
	.125 lb/A tillering and jointing	74.6 *	13 a b c	75.4 a	59.4 a b
	.25 lb/A jointing	73.0 *	20 a b c	74.9 a	59.9 a
	.25 lb/A flag leaf	71.8 *	3 b c	72.3 a	59.7 a
	.50 lb/A flag leaf	70.5 *	0 c	66.6 b	59.8 a

1Means within a column and variety followed by the same letter are not significantly different at the 5% level using Waller-Duncan K-ratio test.

* Nonsignificant at the 5% level.

Progress Report JV83-24
Use of Cerone (Ethephon) for Production
of Irrigated Malting Barley

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Introduction

A study was conducted at the JVAREC to evaluate the ability of Cerone (Ethephon) to reduce lodging in irrigated barley. Cerone is a growth regulator that is capable of reducing the height of certain crops.

Many irrigators in South Dakota are looking for a small grain crop to serve as an alternative or as a compliment to corn under irrigation. The reason for their interest varies from producers wanting to tow systems to those pumping from the James River that periodically face water shortages in July and August. Barley could be a viable choice for some growers especially if malting quality could be consistently achieved and lodging under irrigation could be reduced.

Methods

Morex barley was planted (using a conventional press drill) in 60 inch beds to allow gravity irrigation. Beds were made by forming irrigation furrows spaced 60 inches apart using an Orthman bedder. Management parameters are shown on Table 24-1.

Table 24-1. Management inputs for irrigated malting barley, Cerone Study. Redfield-1983.

	NO_3-N	P	K
Soil Tests	40lbs/A	32 lbs/A	760 lbs/A
Fertilizer	N	P_2O_5	K_2O
Pre-plant	60 lbs/A	0 lbs/A	0 lbs/A
Starter	15 lbs/A	35 lbs/A	0 lbs/A
Post-emergence	20 lbs/A	0 lbs/A	0 lbs/A
Planting Date	4/21/83	Harvest Date	7/20/83
Seeding Rate	120 lbs. of Certified Morex Barley per acre.		
Irrigations	Three inches of water were applied (using gravity techniques) when a tensiometer placed 12 inches deep had a reading approaching 50 centibars.		
Weed Control	Bromoxynil + MCPA (Bronate) 1.5 pt./A on May 22.		

Cerone was sprayed at a rate of .38 lbs/A (1.5 pts./A) with 20 gallons of water when the barley was in the flag leaf stage (June 15). The material was sprayed in four replicate 60 foot wide strips using a conventional ground sprayer. Replicated 30 foot strips were left as unsprayed checks.

The barley was combined straight at 16 or 17 percent moisture using a standard 45 John Deere combine. The center 12 feet of each strip was combined and weighed using a weighing wagon. The barley was dried for storage.

Fig. 24-1. The cerone treated barley on the right is 4 to 6" shorter than the untreated strip on the left. Miron Fisk has just checked the tensiometers.

Results and Conclusions

Cerone reduced the height of Morex barley by approximately four to six inches on this irrigated trial (Fig. 24-1). This decrease in height reduced lodging significantly (See Table 24-2).

A significant difference in yield was also evident. The eight bushel per acre yield increase noted on the cerone treated strips was probably due to a decrease in harvest loss.

The quality of the barley grain was sufficient to make malting grade (See Table 24-3) even though several days of very warm temperatures occurred during the ripening process.

More years of study will be required before it can be determined if malting grade can be achieved consistently under irrigated conditions in this area.

Table 24-2. Yield and lodging of irrigated Morex barley. Redfield Cerone Study-1983.

Treatment	Yield	Lodging
Cerone*	85 bu/A	3%
Check	77 bu/A	40%

*0.38 pounds per acre applied of flag leaf stage.

Table 24-3. Quality of irrigated Morex barley, Cerone Study. Redfield-1983.

Protein	13.5%
Plumps	69%
Thins	4%
Test Weight	47 lbs/bu

Manager's Comment

Great care was taken to assure that this barley had sufficient water during the ripening period which is so critical to obtaining the malting quality. The crop was watered for the last time just two weeks prior to harvest. The fact that gravity irrigation was used for this study makes direct application of these results to a center-pivot irrigated field difficult but not impossible. Pivot irrigators would be applying less water in each irrigation so soil water status could be kept at a more constant level. This should give an advantage to the pivots. Some method of careful water scheduling, tensiometers are probably best for most situations, should be used since the quality of the barley which is so important depends heavily on water and nitrogen management. A deep soil test for Nitrate-N is a must for malting barley.

The amount of lodging under center-pivots may be higher than on this experiment using gravity irrigation due to the physical effect of the water droplets. The use of a growth regulator, such as Cerone, may therefore show even more advantage than seen here. This substance will usually be applied aerially in producer fields to avoid the crop loss from wheel tracks made by ground rigs at this late growth stage. The late growth stage at which this material can be applied to reduce plant height also makes this compound useful to dryland producers under certain conditions. By the time small grain reaches flag leaf stage a grower will know if there is a high potential for lodging to occur in certain fields due to the planting of a weak strawed variety, good moisture conditions and/or high levels of nitrogen. This material will allow him to reduce the lodging potential significantly for under $10 per acre.

Diseases may be more of a problem on barley grown under center-pivots in some years. Head scab does affect barley, so the same precautions should be used as when irrigating wheat. Avoid following corn, if possible, or if this is not possible, use some sort of clean tillage to remove residue from the soil surface. Do not water during flowering if it can be avoided since this is when infection occurs. It is important that water be scheduled so the profile is full prior to flowering allowing the machine to be down during this period without causing water stress. (See Progress Reports JV83-23 and JV83-25 for more information).

James Valley Report

Progress Report JV83-25
Control of Tan Spot and Wheat Scab
With Fungicides on Irrigated Spring Wheat

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Introduction

Tan spot and wheat scab (head blight) have caused serious losses in South Dakota spring wheat over the past several years. Tan spot is usually most severe when wheat follows wheat, especially under high residue tillage systems. Scab is typically severe when wheat follows corn. Both diseases develop rapidly during wet weather and thus may be more severe in the moist microclimate induced by irrigation.

At present, spring wheat cultivars do not have adequate resistance to control either of these diseases, but fungicide sprays provide an alternative method of control. The fungicide Mancozeb is registered for wheat, and has given good control of tan spot in previous tests, but has not been very effective against scab. The experiments reported here were conducted to evaluate several fungicides in controlling tan spot and scab under irrigated conditions at the Redfield station and at the Gettysburg site.

Redfield Study

Plots were established in a field of Len spring wheat growing on land cropped to corn in 1982. Plots four feet by twenty feet were arranged in a randomized complete block design with five replications. Fungicides were applied on June 23, when the wheat was about 75 percent headed and again on July 8, at the early milk stage. The application was with a hand carried, CO_2 plot sprayer calibrated to deliver 23 GPA. At each spray date and again on July 19 (dough stage), ten leafy culms were removed from each plot and the heads were rated for scab and each of the top three leaves were rated for tan spot severity.

Against tan spot, the systemic fungicides, Tilt and Rovral, were effective faster than Mancozeb, both had significantly reduced the disease on flag and second leaves on July 9, sixteen days after the first spray. By July 19, none of the fungicides had controlled disease on the flag leaf. Tilt and Rovral were somewhat effective on second leaves and only Rovral had an effect on third leaves. None of the fungicides significantly controlled scab (Table 25-1).

In this test, fungicides did not result in increased yields, although all treatments increased kernel weight. The lack of good disease control in this study was probably due to the long period between spray applications; frequent heavy rains during this period made it physically impractical to maintain the planned spray schedules.

Table 25-1. Effect of foliar fungicides on tan spot, scab, yield and kernel weight of irrigated Len wheat. Redfield-1983.

	Tan Spot in %					
	July 8			July 19		
Fungicide	Flag leaf	2nd leaf	3rd leaf	Flag leaf	2nd leaf	3rd leaf
Unsprayed*	2.0 c	7.0 bc	24 ab	38 a	93 b	99 a
Tilt (0.11 lb/A)	0.4 a	1.2 a	15 a	25 a	63 a	98 a
Dithane M-45 (2 lb/A)	1.2 bc	3.0 ab	28 ab	30 a	80 ab	98 a
Difoatan 80W (1¼ lb/A)	1.2 bc	10.0 c	38 b	25 a	86 ab	99 a
Rovral 50W (2 lb/A)	0.4 a	2.0 a	20 ab	18 a	63 a	93 b

	Scab in %		Yield	Wt./seed
Fungicide	July 9	July 15	(bu/A)	(mg.)
Unsprayed*	0.3 a	36 a	53.5 a	28.3 a
Tilt (0.11 lb/A)	0.2 a	42 a	55.9 a	29.2 ab
Dithane M-45 (2 lb/A)	0.3 a	36 a	48.8 a	30.1 b
Difoatan 80W (1¼ lb/A)	0.1 a	36 a	49.9 a	30.1 b
Rovral 50W (2 lb/A)	0.1 a	42 a	53.2 a	29.2 ab

* Numbers in a column with the same letter do not differ significantly at the 5% level.

Gettysburg

This study was conducted in a similar fashion to the one previously described with some modifications. The 4 foot by 20 foot subplots were planted with a planter designed for small plots. Three cultivars and three fungicide treatments (including the check) were arranged in a split-plot design with cultivars as subplots. The experiment was replicated four times.

Fungicides were applied on June 21 and on July 4. At the first spray date, the early cultivar, SD 2861, was partly headed and averaged 0.2, 0.2, 1.1 and 2.7 tan spot lesions on flag, second, third and fourth leaves respectively. The late cultivar, Marshall, was in the early boot stage and averaged 0, 0.1, 0.2 and 1.1 tan spot lesions on the top four leaves.

Overall, the systemic fungicide Tilt provided excellent control of tan spot and increased yield by 7.2 bu/A over the unsprayed checks (Table 25-2). M-45 also significantly controlled scab, but was inferior to Tilt in both instances. Yield was increased by only 3.7 bu/A, not quite significant at the five percent level.

The cultivar by fungicide interactions were not statistically significant overall. However, some strong trends were evident (Table 25-3). For example, on tan spot, Dithane M-45 was as effective as Tilt on the cultivar Marshall, but less effective on the other two cultivars. Against scab, M-45 gave no control on Marshall but was equal to Tilt on SD 2861. The yield interactions tended to follow tan spot control; M-45 was equal to Tilt on Marshall, intermediate on SD 2861 and did not improve yields of Len. These trends have considerable impact on management recommendations for irrigated wheat and will be subject to further study.

Table 25-2. Main effects of cultivars and fungicides on desease and yield of spring wheat. Cultivar x Fungicide study. Gettysburg-1983.

Fungicide Means	Tan Spot on Flag Leaf July 19	% on Heads with scab July 19	Scab Severity July 19	Yield
	% severity [a]		% [a]	bu/A
Dithan M-45 , 2 lb/A	13.5	48.8	37.5	43.8
Tilt , 0.11 lb/A	0.1	40.8	31.7	47.3
Unsprayed	64.6	59.2	42.1	50.1
LSD (.05)	12.9	9.7	7.6	4.0
Cultivar Means				
Marshall	15.2	30.0	26.3	49.1
Len	30.0	55.0	40.0	37.5
SD 2861	33.0	63.8	45.0	44.5
LSD (.05)	12.9	11.2	7.7	2.9

Table 25-3. Cultivar x Fungicide interactions in an irrigated wheat study. Gettysburg-1983.

Treatment		Tan Spot on Flag Leaf July 19	% on Heads with scab July 19	Scab Severity July 19	Yield
Fungicide	Cultivar				
		% severity [a]		% [a]	bu/A
Dithan M-45	Marshall	0.6	32.5	27.5	50.6
	Len	18.8	57.5	42.5	36.2
	SD 2861	21.3	56.3	42.5	44.5
Tilt	Marshall	0.1	25.0	25.0	51.5
	Len	0.1	40.0	27.5	41.6
	SD 2861	0.1	57.5	42.5	48.7
Unsprayed	Marshall	45.0	32.5	26.3	45.1
	Len	71.3	67.5	50.0	34.7
	SD 2861	77.5	77.5	50.0	40.4
	LSD (.05)	21.2	19.4	13.4	5.2

[a] % severity = % of leaf area or head area with tan spot or scab.

Fungicides applied on June 21 and July 4.

Manager's Comment

On studies of the type where the researcher needs to have disease occur in order to evaluate methods of controlling the disease, management practices that would not be recommended for use by a producer are employed to increase the chance of a disease outbreak. The studies at both Redfield and Gettysburg were planted on areas in corn the previous year. At Redfield, the stalks were chopped and a small bladed tandem disk was used to prepare the seedbed. Sixty pounds per acre of N was broadcast as ammonium nitrate. Len wheat was planted with a standard press drill at 105 pounds of seed per acre. A starter delivering 15 pounds of nitrogen and 37 pounds of P_2O_5 per acre was placed with the seed. Treflan was applied postplanting and incorporated with two perpendicular passes of a flex tine harrow. Bronate (Bromoxynil + MCPA) was used for post-emergence control of broadleaf weeds. Irrigation water was applied with a big gun traveling sprinkler. Watering was scheduled to produce maximum conditions for disease.

At Gettysburg, the corn stalks were disked with a large heavy-bladed tandem. Plots were planted with a small plot drill seeding 115 pounds of seed per acre and applying a starter delivering 20 pounds of P_2O_5, 20 pounds of N and 10 pounds of K_2O per acre. Nitrogen was broadcast as urea to produce a total N (Fertilizer N + Nitrate-N) level of 216 pounds per acre which is the rate recommended for 90 bushels per acre of wheat. Irrigation was applied using one span of the linear-move irrigation machine at Gettysburg. Application of one inch of water was made when tensiometers placed one foot deep had a reading approaching 35 centibars. Ramrod was applied pre-emergence and Bronate post-emergence for weed control.

If you are considering irrigated wheat, try to avoid the wheat-wheat or wheat-corn rotations. If these cannot be avoided, some sort of clean tillage should be used. Care must be taken to assure that the soil profile is full just prior to flowering so irrigations can be avoided during this period to minimize the potential of head scab. Be ready to apply a fungicide for tan spot control.

Progress Report JV83-26
Nematode Control
In Irrigated and Dryland Spring Wheat

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Summary

Nematicide treatments significantly increased yields of both irrigated and dryland spring wheat (Table 26-1). Both compounds provided season-long control of plant parasitic nematodes at both locations. Nematode populations consisted primarily of stunt, dagger and pin nematodes. The economic return for nematicide treatment of spring wheat at current prices is questionable, however, alternative control techniques such as tillage practices, crop rotation and resistant varieties may be worthy of increased study.

Table 26-1. Effect of nematicide treatments on yield of irrigated and dryland spring wheat. Cavour 1983.

Location	Treatment	Yield (bu/A)	No. of plant feeding nematodes/ 100 cc soil: Pre-treat	Harvest
Irrigated	Check	41.7	321	651
	3 lbs. Mo Cap[a]	45.3		133
	6 lbs. Mo Cap	46.4*		225
	2 lbs. Furadan	52.3*		165
	FLSD (.05) =	4.4		
Dryland	Check	37.2	1164	855
	3 lbs. Mo Cap	43.4*		171
	6 lbs. Mo Cap	41.2*		276
	2 lbs. Furadan	44.0*		305
	FLSD (.05) =	2.8		

[a] Broadcast rate, ai/A. Average of 4 reps.
* Indicates significant increase at .05 level.

Manager's Comment

Nematodes (extremely small worm shaped pests) are capable of causing significant damage in some cases. This was a preliminary study to evaluate the effects of nematodes in S.D. Some work will be done at Gettysburg next year.

James Valley Report

Progress Report JV83-27
Irrigated Sorghum Variety Trials

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Manager's Comment

This field was in irrigated corn in 1982. The stalks were chopped in the spring, the field disked once with a large bladed tandem and chiseled with straight points when applying 120 lbs. of N/A as anhydrous ammonia. A small-bladed tandem disk was used prior to planting on May 25. Rows were marked and a 30-30-0 starter was applied using the station's planter.

Plots were planted with a two row planter and cone seeder. Sorghum yields were higher than the three year average even though stands in the variety trial were not as good as preferred. A Ramrod-Bladex tank mix was applied pre-emergence and gave good weed control. The trial was gravity irrigated with two inches of water whenever tensiometers, placed 18 inches deep, had a reading of 50 centibars. Weigh wagon checks of production portions of this field produced yields in the 6700 pounds per acre range.

Table 27-1. Irrigated Sorghum Variety Trials.
Redfield-1983.

Brand	Variety	Height, Inches	Percent Moisture	Test Weight (lb/bu)	Yield 1983 (lb/A)	Yield 3 yr. (lb/A)
Asgrow	Corral	53	23	55	6954	5423
DeKalb-Pfizer Gen.	DK-38	50	19	56	8217	6118
DeKalb-Pfizer Gen.	DK-18	44	18	58	6554	
SeedTec	652G	52	23	55	7066	5462
Northrup King	2018	45	20	60	7552	5497
Northrup King	1210	42	20	58	7199	
PAG	2250	44	18	57	5572	
Pioneer	894	39	18	58	5761	
Pioneer	8790	44	19	58	7358	
Pioneer	8855	42	18	59	7163	
Triumph	Two-54YG	54	22	54	7087	5603
Triumph	Two-50YG	50	19	56	6585	5429
Cargill	30	49	20	58	7701	5068
Cargill	22	41	18	58	7813	
Cargill	40	48	21	55	7634	
Pride	P-508GB	43	21	64	6908	5591
Pride	P-812GB	47	21	55	6278	
Western	WS 205	48	18	58	7337	
Warner	W-545T	39	18	58	7378	5597
Warner	W-564T	48	20	59	7962	
Warner	W-655T	52	19	55	6954	5546
Warner	WX 83107	47	20	57	7634	
Warner	WX 83108	42	19	58	7542	
GroAgri	E110	46	19	58	7629	
GroAgri	GSA1060	46	19	57	7962	
Means		46	19.7	57.3	7191	5533
LSD (.05)					N.S.	164
CV-%					19.0	8.9

Seeded-May 25. Harvested-October 9.

James Valley Report

Progress Report JV83-28
Irrigated Soybean Variety Trial

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Methods

These plots were planted on May 25 with the same two row planter used for the other variety trials. The field had been in dryland wheat in 1982 and was fall chiseled. It was disked with a small bladed tandem and field cultivated just prior to planting. A very good stand of soybeans was obtained. The plots were harvested with a plot combine on October 6.

Manager's Comments

The very good yields obtained in this study and others on the station as well as on production fields, inidicates that soybeans have potential under irrigation in north-central areas of the state.

Soil tests indicated no need for broadcast fertilizer, a 30-30-0 starter was used. A Lasso-Amiben-Sencore tank mix was applied pre-emergence and gave excellent weed control. The field was gravity irrigated with two inches of water whenever tensiometers placed 18 inches deep had a reading of 50 centibars. Weigh wagon tests of production Wells II soybeans in this field produced yields of 45-47 bushels per acre. The seeding rate used by the researchers was 180 thousand seeds per acre in 30 inch rows. The production field was at 200 thousand seeds per acre in 30 inch rows.

Table 28-1. Irrigated Soybean Variety Trials.
Redfield-1983

Brand	Entry	Mat. Group	Date Mature	Height (inches)	Lodging[a] Rating	Gr. Wt.[b] 100 k.	Yield 1983 (bu/A)	Yield 3yr (bu/A)
Arrowhead	9010	0	9/9	31	1	13.5	41	
	McCall	00	9/10	32	1	14.9	42	
	Ozzie	0	9/13	33	1	14.8	45	
	Dawson	0	9/17	33	1	15.0	52	
	Evans	0	9/21	38	1	14.0	52	34
Arrowhead	9144	0	9/21	36	1	14.5	53	
	Simpson	0	9/22	34	1	13.1	52	
Cenex	1018	I	9/22	37	1	13.1	52	
	Swift	0	9/23	41	1	14.4	49	34
SFR	101	I	9/25	36	1	12.9	51	
	Hodgson 78	I	9/25	39	2	14.0	56	38
Northrup King	S 09-90	I	9/25	41	2	14.6	55	
Hi-Vigor	Hardy	0	9/25	35	2	14.0	53	
Northrup King	S 14-60	I	9/26	36	1	15.1	59	
	Lakota	I	9/27	48	2	14.4	58	
Arrowhead	2188	I	9/27	41	2	14.7	61	
	Weber	I	9/28	43	2	12.0	59	43
	Hardin	I	9/28	45	2	13.3	60	
Cenex	2430	I	9/28	44	2	14.7	53	
DeKalb-Pfizer	CX 155	I	9/29	46	2	13.9	57	40
	Corsoy 79	II	9/30	45	2	13.5	56	39
	Harcor	II	10/1	46	2	12.8	60	42
DeKalb-Pfizer	EX35	I	10/3	41	2	16.1	53	
	Nebsoy	II	10/4	44	1	14.8	48	38
	Wells II	II	10/5	45	1	14.7	51	39
	Gnome	II	10/6	35	1	12.1	42	
	Amcor	II	10/6	50	2	12.2	51	38
	Platte	II	10/7	44	1	12.6	49	
Means			9/26	40	1.4	13.9	52	38
LSD (.05)							6.3	1.3
CV-%							8.3	10.5

Seeded- May 25. Harvested- October 6.

[a] 1-almost all plants erect.
2-almost all plants leaning slightly or a few plant down.

[b] Weight in grams of 100 beans.

Progress Report JV83-29
Row Spacing Effects on Soybean Yield
Under Sprinkler Irrigation

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Introduction

Farm magazines have devoted a large number of articles to the planting of soybeans in narrow rows. This practice has become more popular recently because of the availability and effectiveness of good chemical weed control programs. One factor that is seldom mentioned when narrrow row soybeans are discussed is the effect the type of soybean planted may have on the amount of yield increase expected from narrow-row planting.

The soybeans commonly planted in South Dakota may be classified in three general catagories: branching, upright and semi-dwarf. The variety Corsoy 79 is a member of the first catagory since its growth habit allows it to send out lateral branches from the main stem. These branches can at least partially fill the inter-row spaces. Wells II soybeans do not form branches but, like the Corsoy 79 soybeans, are a conventionally sized plant which produce enough leaves to shade a good deal of the inter-row area later in the season. Wells II soybeans are typical of an upright type. Semi-dwarf soybeans, like the Gnome variety, are shorter than the other types and do not fill in inter-row areas as readily. It is recommended that they be planted 10 percent heavier than conventional varieties. It is also recommended that all soybeans planted in rows narrower than 30 inches be planted 10 percent heavier than in 30-36 inch rows.

A study was conducted in 1982 and 1983 to determine what effect the planting of branching, upright and semi-dwarf soybeans in narrow rows would have on yield as compared to planting them in 30 inch rows. This study was conducted at the satellite research area in Potter County (Gettysburg) under sprinkler irrigation.

Methods

Corsoy 79, Wells II and Gnome soybeans were planted at approximately 180, 180 and 200 thousand seeds per acre in 30 inch rows and at 200, 200 and 220 thousand seeds per acre in narrow rows respectively. A conventional planter was used for the 30 inch rows both years. In 1982, a five foot plot drill was used to plant six-inch rows for the narrow row treatment. A conventional planter was used in 1983 to plant 15 inch rows for the narrow row treatment by doubling back 30 inch row planting. This modification was made since stands achieved with the drill in 1982 were unsatisfactory. Other management factors are listed in Table 29-1.

Table 29-1. Management Parameters for the Irrigated Soybean Type X Row-Spacing Study- Gettysburg 1982-1983

	1982	1983
Soil Type	Lowry	Lowry
Soil Tests	O.M.-2% P-35 lbs/A K-680 lbs/A	
Fertilizer		
Broadcast	None	None
Starter	None	None
Herbcide	Treflan-PPI +Amiben Pre-emergence	Lasso-Amiben Pre-emergence
Irrigation	One inch of water was applied whenever the reading on a tensiometer at an 18 inch depth approached 35 centibars.	
Planting	5/20/82	5/26/82
Harvest	10/16/82	10/8/83

Fig. 29-1. Mike Esser inspects Wells II soybeans planted in 30 inch rows.

Results

Fairly good yields were obtained both in 1982 and 1983, with the Corsoy 79 soybeans. The Gnome variety has not yielded well either year because it requires too long of a growing season. A shorter season semi-dwarf soybean variety is nearing release and will be substituted for the Gnome variety as soon as seed is available.

Table 29-2. Irrigated soybean yield as affected by plant type and row spacing, Gettysburg- 1982-1983

Variety	1982		1983	
	Wide 30 in.	Narrow 6 in.	Wide 30 in.	Narrow 15 in.
Corsoy 79 (branching type)	45	50 *	47	50*
Wells II (upright type)	43	39	41	50 **
Gnome (semi-dwarf)	43	45	44	43

* Significant increase in yield at .10 level.
** Significant increase in yield at .05 level.

The data points out the importance of using good seeding equipment when moving to rows narrower than 30 inches. The drill used in 1982 had poor depth control capability and resulted in an average reduction in yield for the narrow row soybeans due to inadequate stand. The Corsoy 79 soybeans were capable of compensating for the thin stand because of their branching ability. Drills are available that can do an adequate job of seeding in narrow rows, but such a machine was not available for use at Gettysburg in 1982.

The results from the 1983 season demonstrate the trend anticipated. The Corsoy 79 variety did not respond to narrow rows as dramatically as the Wells II variety since Corsoy can branch to fill inter-row areas. The Gnome variety should show more response to narrow row planting than either the Corsoy or Wells soybean. This variety has a maturity seven days longer than Corsoy 79 and six days longer than Wells II, and was hurt badly by frosts both in 1982 and 1983. It is the shortest season semi-dwarf available at the present time but probably has too late of a maturity for this area.

Manager's Comments

New weed control techniques such as the post-emergence herbicides for soybeans make the switch to narrow-row soybeans more tempting. These herbicides allow a producer to rescue a crop of soybeans if pre-plant and pre-emergence herbicides fail to perform adequately. The first requirement before a producer goes to narrow rows is for him to evaluate his present weed control program and to develop a plan for use on narrow rows which includes rescue measures to be used, if necessary. This is important since control of weeds by cultivation is very limited or eliminated with narrow row systems.

Another factor the producer should evaluate is the ability of the seeding equipment to be used. If he is uncertain how good of a stand he can obtain using his equipment under his conditions, it would be best to limit acreage. The same reasoning applies to weed control; if in doubt about your ability to limit weed competition, try a smaller acreage first. There appears to be a real advantage to planting soybeans in narrow rows, but stand or weed control problems could easily off-set the advantages if care is not exercised.

Producers with all-crop headers may opt to remain in wider rows for harvestng purposes. Narrow row soybeans require a hume reel with a flex head or a floating cutter bar for proper harvesting. The advantage of narrow rows could easily be offset by harvesting losses if improper equipment is used.

Progress Report JV83-30
Soybean Root Growth and Water Uptake

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Department of Plant Science

Summary

The rooting density and water uptake profiles of soybeans were again observed at Redfield on Great Bend silt loam and at Gettysburg on Lowry silt loam. The results are very similar between locations and years. Root density decreased with depth, rapidly through the upper foot to about 0.3 centimeters of root per cm^3 of soil, remained about this value into the fourth foot with some bulges along the way, and then tapered off to about zero at four and a half feet in depth.

Water was most rapidly withdrawn from the upper horizons early in the season and then from lower positions. Major uptake was occurring from the third foot during the beginning of August and from the fifth foot by early September. It was interesting to note that very significant amounts of water were withdrawn from the five foot depth when no roots were observed there. Either roots too thin to be observed with a magnifying glass or too sparce to be sampled were present or else significant quantities of water moved up in response to a water potential gradient. In either case, these soils can be considered to have a rooting depth of four and a half or five feet for soybeans under both dryland and irrigated conditions unless the crop is kept very wet through midseason; in which case rooting is more shallow. The data indicate that the Lowry profile holds about five and a half inches of available water while the Great Bend holds about ten inches of plant available water for soybeans.

Manager's Comment

It is presently recommended that tensiometers be placed at depths of 18 inches and three feet in soybeans to schedule water on soils with deep profiles like the ones studied. Roots will not penetrate into soils which are dry or where aeration is limited by soils being too wet. The deep tensiometer allows evaluation of the moisture status of the subsoil so the irrigator can schedule water to favor deep rooting. This gives a measure of insurance against water stress during hot and dry periods and/or if system breakdown occurs since the plant will be able to use the deep water when the surface soil becomes drier than preferred.

Progress Report JV83-31
Planting of Corn and Soybeans in Alternate Strips Under a Center-Pivot

D.L. Beck, M. Fisk, M. Esser and A. Rubida
JVAREC Research Staff

Introduction

Planting of alternate strips of corn and soybeans has received a great deal of coverage in magazine articles the past few years. These strips are usually one or two planter widths in size. The articles claim increased corn yields since the light exposure on the corn rows next to the soybean strip is much greater than if they bordered another corn row. These strips also add a degree of erosion protection to a field since the residue left after corn harvest would reduce wind erosion of the soybean strips.

Methods

One-half of a center-pivot, located on the station at Redfield, was planted to alternate twenty foot strips of corn and soybeans. The field was in soybeans in 1982. It was tandem disked twice in the spring of 1983.

Table 31-1. Management parameters for the irrigated corn-soybean strip study, Redfield, 1983.

	Corn		Soybeans	
Variety	Pioneer 3732		Corsoy 79	
Planting Date	4/30/83		5/18/83	
Seeding Rate	30,200 seeds/acre		200,000 seeds/a	
Soil Test Results	Nitrate-N 50 lb/A	P 18 lb/A	K 750 lb/A	Zn 0.83 PPM
Fertilizer	(N-P_2O_5 K_2O-Zn lbs/A)		(N-P_2O_5-K_2O-Zn lbs./A)	
Pre-plant	0-0-0-0		0-0-0-0	
Starter	15-40-0-5		15-40-0-5	
Sidedress	120-0-0-0		0-0-0-0	
Herbicide	Lasso-2 lbs/A + Bladex-1.5 lbs/ A Pre-emergence		Lasso-2 lbs/A + Amiben-2 lbs/A Pre-emergence	
Irrigation	One inch of water was applied when the reading on a tensiometer placed 18 inches deep in the corn strip approached 40 centibars.			
Cultivated	June 9		June 9 and June 16	
Harvested	October 7, 1983		October 14, 1983	

Since these rows were planted in an east-west direction, the southern two rows of each corn strip should receive much more light and yield more than rows in the center of or on the north side of the strip.

This center-pivot was the one at the station where pestigation research could be performed most safely (see Pestigation and Other Methods of European Corn Borer Control, JV83-36). Therefore, when the corn borer infestation occurred, it was decided to use the half where this experiment was located as part of the check area receiving no chemical treatment. For this reason, the corn yields were reduced substantially from expected values.

Corn was harvested using a standard 45 John Deere combine with a two row corn head. The southern two rows, two center rows and the north two rows from each strip were harvested separately and weighed in a weighing wagon (See Table 31-2).

Results

Table 31-2. The effect of sunlight exposure on yield and moisture of corn grown in alternate strips with soybeans. Redfield-1982.

	Yield* (bu/A)	Moisture* (%)
Southern Two Rows	135 A	18.6 A
Middle Rows	119 B	19.1 B
Northern Two Rows	113 B	19.2 B

* Values in the same column followed by the same letter do not differ at the 5% level of significance.

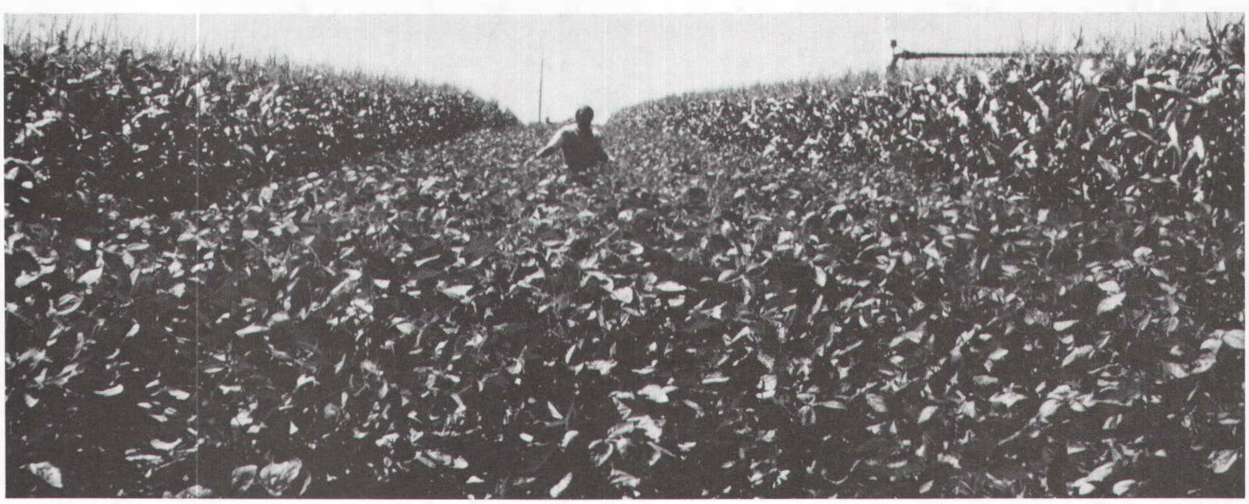

Fig. 31-1. Corsoy 79 soybeans grown in alternate 20 foot wide strips with corn under a center pivot. These soybeans exhibited lush growth and yielded more than any other soybeans at the station.

The soybean strips were harvested with the John Deere 45 combine using a 10 foot header equipped with a floating culterbar and hume reel. Since it was not possible to harvest only two rows with this header, each strip was harvested separately and weighed with the weigh wagon. Yields were very good averaging 52 bu/A based on 12 percent moisture. One strip yielded 58 bu/A.

Conclusions

Planting corn and soybeans in strips did increase the yield of corn and decreased moisture in the southern two rows of each strip in 1983. The effect of increased sunlight seemed to largely disappear on the center rows of the strip and was not evident on the northern rows. Since part of this area was not treated for corn borer control, we cannot be sure what response would have occurred under normal management. The bean yields were the highest achieved on a field scale basis at the farm this year. It is hard to make yield comparisons to the other fields since this was the only place where the Corsoy 79 variety was sprinkler irrigated at Redfield in 1983. Due to the size of the combine header, it was not possible to determine if the shading noticed on the southern two rows of each soybean strip caused yield reductions. This factor will be investigated next year. One other effect of the corn strips on the soybeans is to reduce wind speed. The soybeans in strips were very tall and lush but did not lodge. It cannot be proven that reduced wind speed enhanced growth or reduced lodging but this may be a possibility. Hopefully research can be designed in the future to determine if this factor is important.

Manager's Comment

Present plans are to continue this experiment by ridge-planting corn in the soybean strips and vice-versa. There are some problems with management of strips. The most obvious problem concerns application of weed control chemicals. At the present time, most weed control chemicals labeled for both corn and soybeans do not have a wide enough spectrum to be used alone. This requires treating the strips separately and eliminates the use of post-emergence chemicals such as Banvel and 2-4 D due to drift hazards. Great care has to be used with other chemicals. Strip planting also requires special management of fertilizer additions, especially nitrogen, and probably limits the feasibility of applying chemicals or fertilizers aerially or through the irrigation system. With proper equipment, harvesting presents few problems. This technique does show potential but, as with most innovations, requires that each operator evaluate its positive and negative aspects in relation to his program.

James Valley Report

Progress Report JV83-32
Irrigated Corn Variety Trials

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Manager's Comments

Variety trials were established under gravity irrigation. This trial included entries from commercial seed corn companies and standard check varieties. Two seeding rates, 26 and 30 thousand seeds per acre, were planted on May 18 using a two row planter equipped with a cone seeder. Rows were marked and starter fertilizer applied (20-50-0-5) using the station's planter with the planting units disengaged. The stands that were harvested were extremely poor due to inherent problems encountered when planting high seeding rates with a cone seeder, difficulty with planting in the seedbed, cultivation difficulties caused by the two row planter and a heavy stand of volunteer millet. Harvest populations varied a great deal and were very low (an average of 17,800 plants/A). This can be seen in the data (C.V. of 26% and no significant differences in yield). The variability in stand, etc., had more to do with variation in yield than the variety itself. This data has little value for use in selecting a variety but was included since some information on a variety's adaptability to the Redfield area can be gained. Moisture and lodging data can be used. Varieties that yielded poorly in this study may need to be planted heavier than those with higher yields. All varieties needed a better stand to reach their potential. The planting date-population study (JV83-33) received the same management and was in the same field as this trial. The data from that study indicates that better yields required higher populations than in this trial. (For more details, see progress report JV83-33).

Table 32-1. Performance of corn varieties under gravity irrigation. Redfield-1983.

Brand and Variety	Type and Cross	Yield (bu/a)	PCT Stalk Lodged	Moisture (%)	Performance Score Rating
Cargill 861	E 2X	110.1	6.6	18.0	1
Curry SC-1450	M 2X	105.7	4.0	17.8	2
Keltgen KS 104	M 2X	104.6	5.9	17.8	3
Cargill 836	E 2X	104.4	3.2	19.1	5
P-A-G SX 179	E 2X	102.9	2.4	17.2	4
Curry SC-1455	L 2X	102.3	3.3	19.5	9
Northrup King PX 9353	M 2X	101.6	2.7	17.5	6
Curry SC-1420	M 2X	101.4	3.5	17.8	8
DeKalb DK-484	E 2X	101.2	3.4	17.1	7
Pioneer 3726	M 2X	99.4	4.2	17.9	10
P-A-G SX 193	E 2X	98.8	4.9	17.9	12
Curry SC-1424	M 2X	98.2	4.1	18.2	14
Top Farm SX 1101	M 2X	98.2	5.3	17.3	13

(Continued on back of page)

Table 32-1. (Cont.) Performance of corn varieties under gravity irrigation. Redfield-1983.

Brand and Variety	Type and Cross	Yield (bu/a)	PCT Stalk Lodged	Moisture (%)	Performance Score Rating
Top Farm SX 1100	M 2X	98.2	3.1	17.3	11
P-A-G SX 239	E 2X	97.5	3.9	17.8	15
Top Farm SX 104A	L 2X	96.9	2.5	18.0	16
Cenex 2108	M 2X	95.9	4.0	17.9	18
McCurdy 81-54	M 2X	95.4	3.5	18.1	19
Keltgen KS 1030	M 2X	94.7	4.3	14.6	17
Western 5400	M 2X	94.5	2.5	17.7	21
O'Gold 2330	M 2X	94.2	4.9	16.1	20
Seed Tec X 82126	M M2X	93.9	4.3	17.2	22
Asgrow	E 2X	93.8	3.0	17.8	23
Northrup King PX 9415	M 2X	93.4	4.8	17.9	25
Interstate 268	L 2X	93.2	1.7	18.1	24
Cenex 2106	M 2X	91.7	3.4	17.3	26
Stauffer X 5602	M 2X	91.6	6.9	18.0	29
Sigco 2405	M 2X	91.2	4.6	17.6	28
Northrup King PX 9405	M 2X	91.0	2.1	17.9	27
Cenex 2110	L 2X	89.9	5.3	18.0	30
Interstate 635	L 2X	89.7	2.5	19.1	31
Pioneer 3732	M 2X	89.6	5.9	17.9	32
Pioneer 3747	M 2X	88.6	4.4	17.8	33
McCurdy 4855	M 2X	88.3	5.9	17.5	35
Keltgen KS 95	M 2X	87.2	1.3	17.4	34
Interstate 434	M 2X	86.9	3.4	17.6	36
Stauffer S 4402	E 2X	86.2	5.3	17.4	39
Keltgen KS 101	M 2X	85.8	4.1	17.1	37
DeKalb XL-6	E 2X	85.4	4.1	16.8	38
Sigco 1300	E 2X	85.2	7.9	17.3	40
Keltgen KX 1020	M 2X	85.1	5.3	18.2	41
McCurdy 80-71	E 2X	83.9	3.8	17.8	42
DeKalb EXP 342	E 2X	83.6	5.7	16.9	43
Asgrow RX 532	M 2X	83.0	6.3	17.4	45
SDAES Check 2	L 2X	82.6	7.4	18.4	46
DeKalb XL-8	E 2X	81.7	1.4	17.1	44
Top Farm SX 1105	L 2X	80.7	8.8	17.8	50
SDAES Check 4	M 2X	80.3	2.5	18.1	47
Cargill 867	E 2X	79.2	3.6	17.6	49
Top Farm SX 104	M 2X	77.9	4.7	17.1	52
Interstate 452	M 2X	77.9	3.0	17.1	51
Cargill 834	E 2X	77.0	1.2	17.3	53
Pioneer 3906	E 2X	76.4	1.9	14.5	48
O'Gold 1170A	M 2X	75.0	1.5	17.9	54
DeKalb T950	E 2X	75.0	3.1	17.3	55
Asgrow TX 418	E 2X	75.2	4.7	16.7	56
Pioneer 3901	E 2X	67.3	5.8	17.1	57
Asgrow RX 420	E 2X	59.4	4.7	16.9	58
SDAES Check 10	M 2X	53.4	15.0	17.0	59
MEANS		89.0	4.3	17.5	
LSD (.05)		N.S.		CV%-26.0	

Progress Report JV83-33
Planting Date and Seeding Rate Effects
on Irrigated Corn

D.L. Beck, M. Fisk, M. Esser and A. Rubida
JVAREC Research Staff

Introduction

An experiment was established under gravity irrigation to study the effects of planting date and seeding rate on the yield and harvest moisture of corn.

In recent years, very little research work has been done on corn plant population and planting date effects under irrigation in South Dakota. Many of the corn varieties presently preferred for use in an irrigated environment have characteristics quite different from those used for early experiments. For instance, Modern varieties generally have a greater amount of heartiness under cool soil conditions and many have single ear and non-prolific (non-tillering) habits. These types of varieties were developed to tolerate or excel under early planting and high population conditions.

Research Methods

Pioneer 3732 was planted in four row strips at seeding rates of 24,000, 30,000 and 36,000 seeds per acre on both April 30 and May 15 at the JVAREC near Redfield. Each planting date-seeding rate combination was replicated four times. The field was in proso millet in 1982 and was fall plowed. Anhydrous ammonia was applied in the spring, the land was field cultivated once and planted with a Hiniker planter having 30 inch row spacing. Harvesting was accomplished using a standard John Deere 45 combine with a two-row corn head with harvest weights being determined using a weigh wagon (the center two rows of each strip were weighed). Other management parameters are shown on Table 33-1.

Table 33-1. Management inputs for the Planting Date x Seeding Rate Study. Redfield-1983.

Soil Test Results	Nitrate-N	P	K
	60 lb/A	30 lb/A	760 lb/A
Fertilizer	$N-P_2O_5-K_2O-Zn$ (in lb/A)		
Preplant	120-0-0-0		
Starter	20-50-0-5		
Herbicide	Lasso-2 lb/A + Bladex-1½ lb/A applied pre-emergence.		
Irrigation	Two inches of water was applied when tensiometers 18 inches deep approached a reading of 50 centibars.		
Cultivation: June 8, 1983	Harvest: October 5 and 6, 1983		

Results and Conclusions

Table 33-2. Effect of planting date and seeding rate of yield and harvest moisture of irrigated corn. Redfield-1983.

	Planting Date					
	April 30		May 15		Average	
Seeding Rate	Yield	Moisture	Yield	Moisture	Yield	Moisture
	(bu/A)	(%)	(bu/A)	(%)	(bu/A)	(%)
24,000	116 a	19.4 a	109 a	21.5 b	113	20.5
30,000	120 a	19.4 a	120 a	21.1 b	120	20.0
36,000	137 b	19.5 a	136 a	21.5 b	137	20.5
Average	124	19.4	122	21.4		

Values followed by the same letter are not significantly different at 5%

The yields obtained were not at the level hoped due to the high temperatures encountered in August and the problems encountered in trying to accurately time corn borer control in the field with two stages of corn maturity present. The data does present some interesting trends and useful information.

Planting date did not affect yield this year. The very cold weather during May and early June of 1983 may have masked the effect of planting date, or May 15 might be early enough in this area. The answer to this question will become evident only after this study is repeated several years. The earlier planting did significantly reduce harvest moisture. The two point reduction in moisture from early planting translates to a savings of $6.80 per acre for the 36,000 seeds per acre planting rate (figuring 2.5¢ per point for drying). Since no reduction in yield was associated with early planting, the philosophy of most irrigators in the state, to plant as early as soil condition will allow after April 25, seems to be valid.

The effect of seeding rate on yield was suprising. Yields increased as population increased even at a seeding rate of 36,000 seeds per acre. This indicates that with Pioneer 3732, under the conditions that existed on this experiment in 1983, that seeding rates greater than 30,000 seeds per acre were needed to reach maximum yield. Since a rate greater than 36,000 was not included in 1983 it is impossible to tell if maximum yields were reached. A seeding rate of 42,000 seeds per acre will be included next year to determine if maximum yields are reached at 36,000 seeds per acre.

Manager's Comments

In general, the light intensity on a clear day becomes greater as you go west in South Dakota. Plants grown in intense light will be smaller and less "leafy" than the same plants grown under lower intensity light (if all other conditions are kept constant). Since the idea of growing crops is to harvest as much sunlight as possible, without stressing the plant excessively by overcrowding. The 1983 growing season had very high light intensities during July when most vegetative growth was taking place. In other years or locations, this variety may not have responded as much to the high population. It must also be remembered that this study was planted in 30 inch rows. Producers using a wider row spacing may not be able to use very high seeding rates without increasing the danger of overcrowding. Other varieties may respond quite differently. Ask your seed supplier.

James Valley Report

Progress Report JV83-34
Nitrogen Calibration for Irrigated Corn

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Department of Plant Science

Introduction

A long term experiment designed to provide additional information on the nitrogen (N) needs of irrigated corn was established on the James Valley Research Center in 1983. The objectives of the study are to:

1) Provide calibration data for the nitrate soil test for irrigated corn,
2) Determine the usefulness of plant analysis employing sufficiency levels and the DRIS method of interpretation for predicting the N status of corn.

Methods

The experiment was located under the center pivot east of the farmstead. The soil series at the site was a Zell silt loam (Udorthentic haploborol). Zell soils are deep, well drained, moderately permeable soils formed in glacial lacustrine sediments. Results of soil tests from the site at planting time are reported in Table 34-1.

Table 34-1. Soil test results for the irrigated corn N study, Spring 1983 James Valley Research Center.

NO_3-N 0-24"	NO_3-N 24-42"	Organic matter	Bray phosphorus	Exch. potassium	pH	1:1 salts	DTPA Zn
---lbs/A---		%	--------lbs/A---------			mmhos/cm	ppm
43	39	3.1	18	750	7.5	0.5	0.83

The field which was in wheat in 1982, was fall chiseled and disked in the spring prior to planting. Pioneer 3732 was planted on April 30 at a rate of 30,000 seeds/acre in 30" rows. Harvest population was 26,800 plants/acre. Lasso + Bladex herbicide was applied pre-emergence and Lorsban through the system was used for corn borer control. A starter fertilizer was applied with the planter at a rate of 16 lbs N/A plus 40 lbs P_2O_5/A plus 5 lbs Zn/A. Plots were 6 rows (15') wide and 50' long. The experimental design was a randomized complete block with 4 replications. Nitrogen fertilizer treatments were topdressed on May 3 as ammonium nitrate. Approximately 15 leaves (opposite and below the top ear) were collected from the center 4 rows of each plot at silk initiation (July 28). Four soil subsamples for nitrates were collected from the center 3 rows of each plot and composited on the same day the leaf samples were taken. Depth increments used were 0-6", 6-12", 12-24", 24-36" and 36-48".

Grain yield was determined by hand picking 20' of the center 2 rows

of each plot. Stover yield was determined by cutting out 10' of the center 2 rows of 3 reps after the ears had been picked. Silage yields were calculated by adding together the ear corn yield and stover yield. The plots were harvested on Sept. 29. Grain and stover samples were collected for moisture and N determination, but the N analysis is not yet completed and is not reported here.

The site was irrigated using a center pivot system and managed such that 1" of water was applied whenever 18" tensiometers reached 35 cb. The growing season was quite favorable for irrigated corn growth at this site. The study looked excellent through mid to late August. However, late in the season a heavy infestation of corn borers decreased the yield potential at this site. Counts taken in the same field on August 22 showed 0.9 cavities/plant. Additional borer activity may have occurred after this date.

Results

The N fertilizer additions significantly increased nitrate concentration in the soil profile (Fig. 1). By silking, the highest N concentration was found at about 18" for the 4 highest N rates. Nitrate concentration was also elevated in the 2-3' increment and to a much lesser extent in the 3-4" increment. This emphasizes the importance of deep sampling for nitrates for irrigated corn.

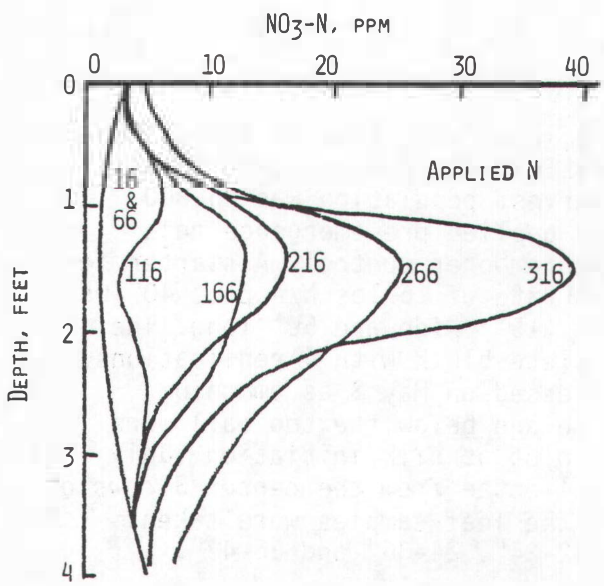

FIG. 1. INFLUENCE OF APPLIED N ON NITRATE CONCENTRATION IN THE SOIL PROFILE AT SILKING, REDFIELD, 1983.

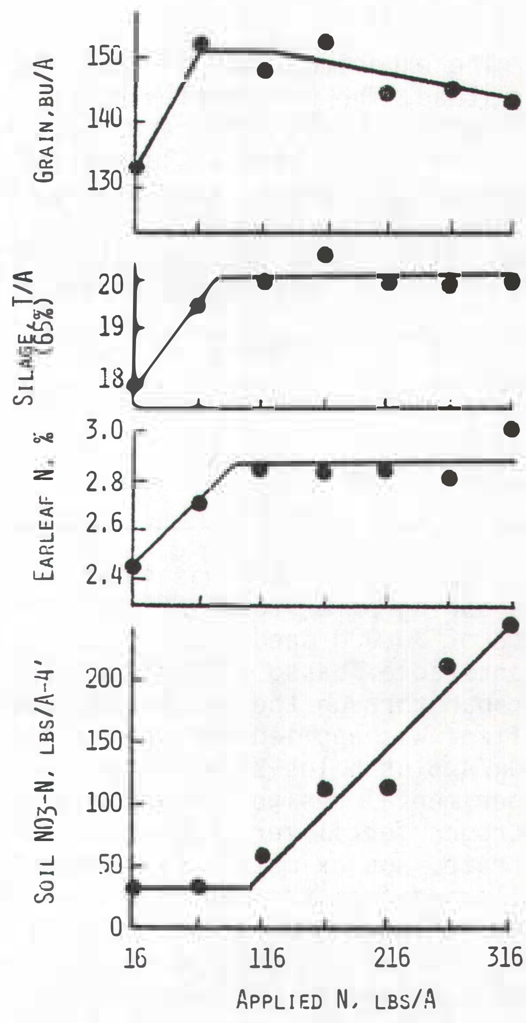

FIG. 2. INFLUENCE OF APPLIED N ON SOIL NO3 AT SILKING, EARLEAF N%, AND THE YIELD OF CORN GRAIN AND SILAGE AT REDFIELD, 1983.

Total nitrate to a depth of 4 feet is graphed at the bottom of Fig. 2. Nitrogen rates above about 100 lbs N/A resulted in elevated soil nitrate at silking. The equation for this line is -57 + 0.95 (Fert. N) with r^2=0.93. This indicates that once the N uptake requirement for the corn was met, the nitrate soil test recovered 93% of the fertilizer N applied.

Earleaf N concentration at silking is also graphed in Fig. 2 and reported in Table 34-2. Concentrations increased up to a fertilizer N rate of 95 lbs N/A after which it remained constant at 2.9% N. A difference of 200 lbs of fertilizer N did not significantly increase N concentration in the earleaf.

Table 34-2. Grain yield, silage yield, grain moisture, harvest index and ear leaf N in irrigated corn study, Redfield 1983.

Fertilized N applied	Yield		Grain moisture	Harvest index[3]	Earleaf N
	Grain[1]	Silage[2]			
lbs/A	Bu/A	T/A	----	%	----
16	132	17.9	18.8	49.6	2.47
66	152	19.6	17.0	52.4	2.71
116	148	20.0	16.3	51.0	2.86
166	153	20.6	16.9	51.4	2.84
216	145	20.0	16.8	50.7	2.86
266	145	20.0	16.8	48.6	2.80
316	143	20.0	16.7	48.0	3.01
Sign. of F test	0.12	0.11	0.23	0.09	--
CV, %	6.8	5.0	0.9	3.5	--

[1]15.5% water [2]65% water

[3]Grain dry matter/total dry matter * 100

Silage yield was maximized at 80 lbs. of applied N/acre and remained constant at 20 T/A as N increased above this level. Grain yield reached a maximum of 150 bu/A at a slightly lower rate of 65-70 lbs applied N per acre and eventually declined as fertilizer N increased above about 200 lbs N/acre. The statistical analysis of harvest index reported in Table 34-2 indicate that this yield decline was significant at the 9% probability level.

Generally, the break points in the earleaf N, silage yield and grain yield curves coincide with the fertilizer N level where soil nitrates were beginning to accumulate at silking time. Also, the sufficiency level

currently used by the SDSU Soil and Plant Analysis Laboratory of 2.75% N in the earleaf at silking accurately divided the N sufficient from the N insufficient treatments.

It is also interesting to note that at silk initiation the corn in the 16 lb. treatment was quite yellow with considerable necrosis (browning) on the lower leaves. The corn in the 66 lb. treatment had yellowing on several of the lower leaves while the corn in the 116 lb. treatment showed yellowing on only a few of the lower leaves. The other treatments showed no deficiency symptoms. However, a month later, the 166 lb. and 216 lb. treatments were beginning to show some N deficiency symptoms on the lower leaves. The 266 lb. and 316 lb. treatments still showed no visual symptoms of N deficiency.

The fertilizer N required to reach maximum yield in this study was about 70 lbs N/A which is considerably less N than would have been predicted from current N recommendations based on the nitrate soil test. However, this is the first year of this long term experiment and no conclusions should yet be drawn from it.

Manager's Comments

This research reinforces much work on irrigated and dryland fields in the past that indicates the importance of using the deep nitrate test for corn. There was at least 82 pounds of nitrogen per acre already available for plant use in the top four feet of this soil. At the present time, producers are allowed to subtract one pound of fertilizer N for every pound of Nitrate-N in the top two feet of soil (43 lb. of N/A in the top two feet on this field) . At twenty cents per pound for N, this would mean a savings of $8.60 per acre on this field. If the cost of sampling and analysis of a 130 acre pivot were in the area of $20, ($7 for analysis and $13 for sampling) a net savings of $1,098 could be realized. Soil testing is one of the best ways to save money and assure adequate fertility for good yields on both irrigated and dryland fields. Studies of this type are used to improve the recommendations made from soil test results. Don't guess-soil test.

In the objectives portion of this report the term DRIS was used. DRIS is a new technique in plant analysis that uses nutrient ratios in plant parts to diagnose nutrient deficiencies instead of using sufficiency levels as is presently done. This technique needs much work before it is ready for use in South Dakota. It has some advantages and some disadvantages as compared to the system presently used.

James Valley Report

Progress Report JV83-35
Reducing Runoff Losses Under Conventional and Low-Pressure Sprinkler Packages

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Introduction

The energy price rise that has occured in the last ten years and the prospect of price increases in the future has created a substantial amount of interest in sprinkler packages that are designed to operate at pressures lower than the 70-80 psi (at the pivot) required for most conventional center-pivot sprinkler packages. The potential energy savings associated with the use of reduced pressure sprinklers can easily be offset if runoff losses occur. Excessive runoff losses can lead to increased water usage, reduced yields and other management problems such as deep wheel tracking.

A study was begun in 1980 and 1981 to develop management techniques that will allow use of reduced pressure sprinkler packages in situations where excessive runoff would occur if present practices were employed.

Background

As everyone knows, surface ponding occurs when the rate at which water is applied exceeds the infiltration rate of the soil. The average application rate under a center-pivot depends on the capacity of the system, the wetted diameter of the sprinkler package used (distance the water pattern spreads out in front and behind the system) and the distance from the pivot point. The distance from the pivot point and the system capacity values are often combined in a term called specific capacity. Specific capacity is the number of gallons of water being discharged per minute for each foot of system length at the point being considered. The specific capacity of the outside span of a center pivot is four times the specific capacity of the span one-half way between the end of the system and the pivot point. (The amount of land watered by the outside span is four times the amount covered by the center span). If the wetted diameters of the sprinkler used on these spans is the same, (this is true for many low pressure packages), the application rate under the outside span would be four times as high as under the center span. If the wetted diameter of the spinklers on the outside span is twice as large as that of the sprinklers on the center span, (the bigger sprinklers near the outside), the average application rate would still be twice as large under the outside span of the system.

The outside span of a seven tower, one-fourth mile, system covers almost one-third of the acres in the field. The actual average application rate that occurs under the outside tower of a system therefore becomes the value that must be used when comparing application rate to the soil's infiltration rate. The actual average application rate increases as

specific capacity increases and/or wetted diameter decreases.

A center-pivot must be able to apply enough water to meet the crop's needs during periods of peak water use. Total system capacity is therefore determined by the crop water use characteristics and the number of acres under the system. For instance, a 130 acre center pivot must have a capacity of 900 gpm to apply a little under .40 inches of water a day by running continuously. This is barely enough water to match water use by corn during peak periods in central South Dakota. Specific capacity of the outside span of this system would be about 1.2 gpm/ft. This value cannot be changed.

Once the specific capacity of the outside span of a center-pivot is determined, the average application rate can be estimated from the wetted diameter of the sprinkler package. A conventional 130 acre system with high pressure sprinklers having a wetted diameter of 125 feet and a specific capacity of 1.2 gpm per foot would have an average application rate of about 1.3 inches per hour. A 10 psi spray nozzle with a wetted diameter of 38 feet would be expected to have an average application rate of 4.3 inches per hour. (Like a one inch rain in less than 15 minutes)

Once system length and capacity have been determined and the sprinkler package chosen, nothing can be done to change application rate. Speeding up the system simply applies less water in less time but the ratio remains the same. This technique sometimes reduces runoff because a soil's ability to absorb water is greater when it is dry. Use of this method is limited when application rates are very high and also increases the proportion of water applied that is lost by evaporation from plant leaves and the soil surface (decreases irrigation efficiency).

The problem is more complex than this explanation makes it sound since the instantaneous application rate (rate over short periods) may vary a great deal within a sprinkler pattern. A sprinkler with average application rates of 1.3 inches per hour could have, at any given time, areas in the pattern with rates of four inches per hour and areas with almost no water. The size of water droplets produced could also affect runoff since large droplets can smooth the surface of certain soils and reduce their ability to absorb water.

So far we have dealt with the irrigation system. The other factor that must be considered is the infiltration rate of the soil. A soil's ability for water intake varies with texture, slope, tillage, surface residue, wetness and many other factors. Some of these are set and very little can be done to change them; others can be modified by changing management practices.

In South Dakota, a majority of the irrigated and potentially irrigatable soils are medium textured and gently rolling. Runoff losses on these soils are more likely than in areas with flat and/or sandy soils. Many of the soils also have wind blown loess or glacial drift surface layers. Wind blown material is poorly sorted for size (most particles are similar in size) which makes them prone to forming surface crusts or sealing when large water droplets are applied. These soil factors, combined with an environment (hot and dry) that requires relatively large system capacities

(750-950 gpm for 130 acres), leads to runoff problems under many conventional systems when certain management practices are employed. This problem can be made much worse by low pressure sprinklers if management practices designed to reduce runoff are not employed.

Objectives

The ultimate goal of this project is to develop guidelines and techniques that will allow a majority of the irrigators in South Dakota to use reduced pressure without experiencing management problems caused by surface runoff. To do this it is necessary to:

(1) Evaluate several different types of commercially available reduced pressure sprinkler packages in terms of application rate (both average and instantaneous), application uniformity and drop size distribution

And

(2) Develop, modify and/or test chemical and mechanical (tillage) methods designed to reduce runoff under these reduced pressure sprinkler packages.

Methods

A forty acre field owned by Eldore Holzwarth and located west of Gettysburg, South Dakota has been used for most of this study. It has a Lowry silt loam soil (typing Haplustoll Coarse-Silty, mixed, mesic). This soil is medium in texture but since it developed from loess, is prone to surface sealing. Slopes on the test areas of the field range from two to six percent. The field is watered with a 600 foot long (four tower) Valley Linear. (This machine is exactly like a center-pivot only it moves straight down the field and receives water through a drag-hose.) A linear move system is used since every sprinkler on the system discharges the same amount of water. The sprinkler outlets on the machine were equipped with quick couplers that allow the various types of sprinklers being evaluated to be changed quickly. The discharge rate of all sprinklers was chosen to produce a specific capacity (gross water discharge) of 1.2 gpm per foot when operated at the proper pressure. This value (1.2 gpm per foot) is approximately the specific capacity of the outside span of a 1320 foot center-pivot having a capacity of 900 gpm. All sprinklers (except the high pressure impact sprinklers) were equipped with pressure regulators so the sprinkler packages could be tested side by side (one span with six psi sprinklers, one with 25 psi sprinklers and one with high pressure sprinklers, etc).

Various forms of post-emergence, inter-row tillage and a chemical amendment have been tested under each type of sprinkler package in one part of the field where one tandem disking was used as the primary tillage. On another part of the field, primary tillage treatments were evaluated both with and without an inter-row sub-surface tillage operation under one type of reduced pressure sprinkler package. (There is not enough room to test the primary tillage treatments under all sprinkler types since large farmer-owned equipment is used for tillage purposes.) Runoff is measured on each area by routing all the runoff water through a measuring flume (H-S type) connected to a stage recorder.

A preliminary study was begun in 1980, before we had our linear move. This involved numerous farmer-cooperator fields watered with conventional pressure center-pivots. Plots were established under the outside span of these systems. One-half of the plots were treated as the farmer normally

would. On the other plots, a flat-soled, straight shank was operated 12-14 inches deep between each corn row following the last cultivation.

Results

The runoff and yields obtained on irrigator-cooperator fields during the preliminary study in 1980 are shown on Table 35-1.

Table 35-1. Effect of inter-row subsurface tillage on yield, runoff and soil moisture in Farmer Cooperator Fields (Potter, Sulley and Hughes Counties, 1980).

	Yield (bu/A)		* Runoff (%)		** Soil Water (in.)	
Site	Inter-row Tilled	Check	Inter-row Tilled	Check	Inter-row Tilled	Check
1	161	116	1	23	6.5	3.6
2	177	164	5	36	5.0	4.3
3	113	97	0	10	6.1	4.3
4	153	142	16	37	6.5	5.0
5	166	153				
6	204	156				
7	105	91				
Average	155	131	5.3	26	6.0	4.3

* Runoff expressed as a percent of the water applied.

** Total soil water in the surface three feet of soil on July 20-21. (Three to four weeks after subsurface tillage).

The 1980 growing season was hot and dry along the river front. Any water lost to runoff could not be replaced since irrigators were having trouble keeping up with water usage when no runoff occurred.

The preliminary study on the farmer-cooperator fields indicated that the sub-surface inter-row tillage operation could substantially reduce runoff losses. Yields were increased where runoff losses resulted in the check plots becoming too dry.

The inter-row tillage operation and conventional management were tested under six sprinkler packages at the research site in 1981. The number of the sprinkler packages was reduced to four in 1982. (Two packages from 1981 were kept, two were modified and two were eliminated). This allowed increasing the number of soil treatments under two of the sprinkler packages to four. Three treatments were used under one package and two treatments under the other. The switch to 30 inch rows in 1983 allowed the use of five soil treatments under each of the four sprinkler packages tested. Three of the packages used in 1982 were used again in 1983; one new package was added. Table 35-2 shows a summary of the sprinklers tested and the soil treatments used on the sprinkler study portion of the field each year.

This area of the field was all disked once prior to planting using a large bladed tandem. No other tillage was used. It was planted with a modified JD max-emerge planter in 1982 and with a Hiniker planter in 1981 and 1983. Fertilizer was applied according to soil test recommendations. A 10-40-10-5 starter was used in 1981 and 1982. A 15-40-0-5 starter was used in 1983. Lasso-Atrazine or Lasso-Bladex tank mix was applied pre-emergence and watered for activation. Corn-Borers were treated with granular Furidan in 1983.

Irrigations on this area of the field were scheduled using tensiometers placed 18 and 36 inches deep in all plots. The field was irrigated when the average readings of these instruments reached 30 to 35 centibars. Since plots where a great deal of runoff occurred were dry and ones where no runoff occurred were very wet (sometimes too wet) the yield responses on this study may be hard to interpret. If the field would have been watered only when the plots with the least runoff needed it, there would have been very distinct yield reductions on plots with much runoff. This approach was not taken because the total amount of runoff that would occur under each sprinkler package, if water was scheduled for maximum economic yield, is the value of most importance to producers making decisions about sprinkler packages and management systems.

Yields were recorded to allow evaluation of possible detrimental effects of the soil treatments such as plots where the inter-row tillage was performed to a depth of 18 to 20 inches as compared to the normal depth of 12 to 14 inches. The deep treatment reduced yields significantly in 30 inch rows. This reduction in yield was not due to soil moisture or runoff effects but probably due to physical damage to the plant or roots. This phenomena has never occurred where the machine was operated 12"-14" deep.

The 1981 yields did not differ although soil moisture and runoff varied substantially. The IRT plots were a little too wet and the check plots were a little dry. This balanced out in equal yields. In 1982, The no-runoff checks (hand constructed dikes) became very wet which reduced yields. The IRT plots were about right for moisture and the check and surfactant plots were dry enough to limit yields.

An interesting trend is beginning to emerge in this study. For five years prior to 1981, this field was spring plowed then planted to corn and irrigated with a big gun. A disk (Tandem-one pass) has been used in the spring for the last three years leaving much residue on the surface. It appears that runoff is decreasing with time under the sprinklers that have been used all three years. It is difficult to tell at this time since more irrigations were measured in 1982 than either 1981 or 1983 and other factors may be the cause of this reduction. It is possible however, that the large volume of residue left on the surface each year is beginning to stabilize the surface structure and reduce surface sealing to a certain extent. The next few years of this study should indicate whether this trend is real or not.

The machine constructed micro-dikes were made with commercially available dikers attached to the rear of a Lilliston cultivator. These are designed for use on conventionally tilled seed beds having a maximum of two percent slope. It was not possible to set the machine to construct dikes sound and/or deep enough to hold under 1983 conditions.

Table 35-2. Runoff losses under various sprinkler packages as affected by subsurface inter-row tillage and other soil treatments.

1981
(Measurements taken during 10 irrigations with a total of 10.3 in. of water applied.)

Sprinkler Package	Inter-Row Tillage	Check	No Runoff Check	Wetting Agent	Deep IRT
	(surface runoff in %)				
Low-Angle Impact- 50 psi	1 A	14 C			
Rain-Bird CDS- 25 psi (square-orifice Impact)	4 B	23 D			
Vortex (raindrop)- 20 psi	10 B	24 D			
Spray-360° - 20 psi (flat-smooth plate)	7 B	31 E			
Spray-360° - 6 psi on 45 foot boom (flat-smooth plate)	9 B	32 E			
Spray - 360° - 6 psi (flat-smooth plate)	15 C	32 E			
1981 Average					
Runoff (%)	8	39			
Yield (bu/A)	202	202			

1982
(Measurements taken during 16 irrigations with a total of 14.5 in. of water applied.)

Sprinkler Package	Inter-Row Tillage	Check	No Runoff Check	Wetting Agent	Deep IRT
	(surface runoff in %)				
Low-Angle Impact-50 psi	1 A	15 C	0 A		
Rain-Bird CDS)-25 psi (square-orifice impact)	4 B	20 E	0 A		
Spray - 360° - 15 psi on 45 foot boom (concave serrated plate)	4 B	21 E	0 A	22 E	
Spray - 360° - 15 psi (concave serrated plate)	7 C	29 F	0 A	28 F	
1982 Average					
Runoff (%)	4	21	0	25	
Yield (bu/A)	203	193	193	194	

Table 35-2 (Cont.)

1983

(Measurements taken during 12 irrigations with a total of 11 in. of water applied.)

Sprinkler Package	Inter Row Tillage	Check	No Runoff Check	Machine Micro-Dikes	Deep IRT
		(surface runoff in %)			
Low-Angle Impact-50 psi	<1 B	1 B	0 A	4 C	0 A
Rain-Bird CDS - 25 psi (Square-Orifice Impact)	2 C	3 C	0 A	4 C	<1 B
Spray - 360°- 15 psi (concave serrated plate)	2 C	13 D	0 A	10 D	>1 B
Spray - 360° - 6 psi on adjustable drop (serrated concave plate)	7 D	11 D	0 A	15 D	5 CD
1983 Average					
Runoff (%)	3	7 C	0 A	8 C	<2 B
Yield (bu/A)	188 A	189 A	181 A	186 A	173 B

Inter-Row Tillage - Flat-solid straight shank operated 12"-14" deep between each corn row following the last cultivation (6-8 leaf stage of growth in late June)

Check - Normal management (one tandem disking prior to planting).

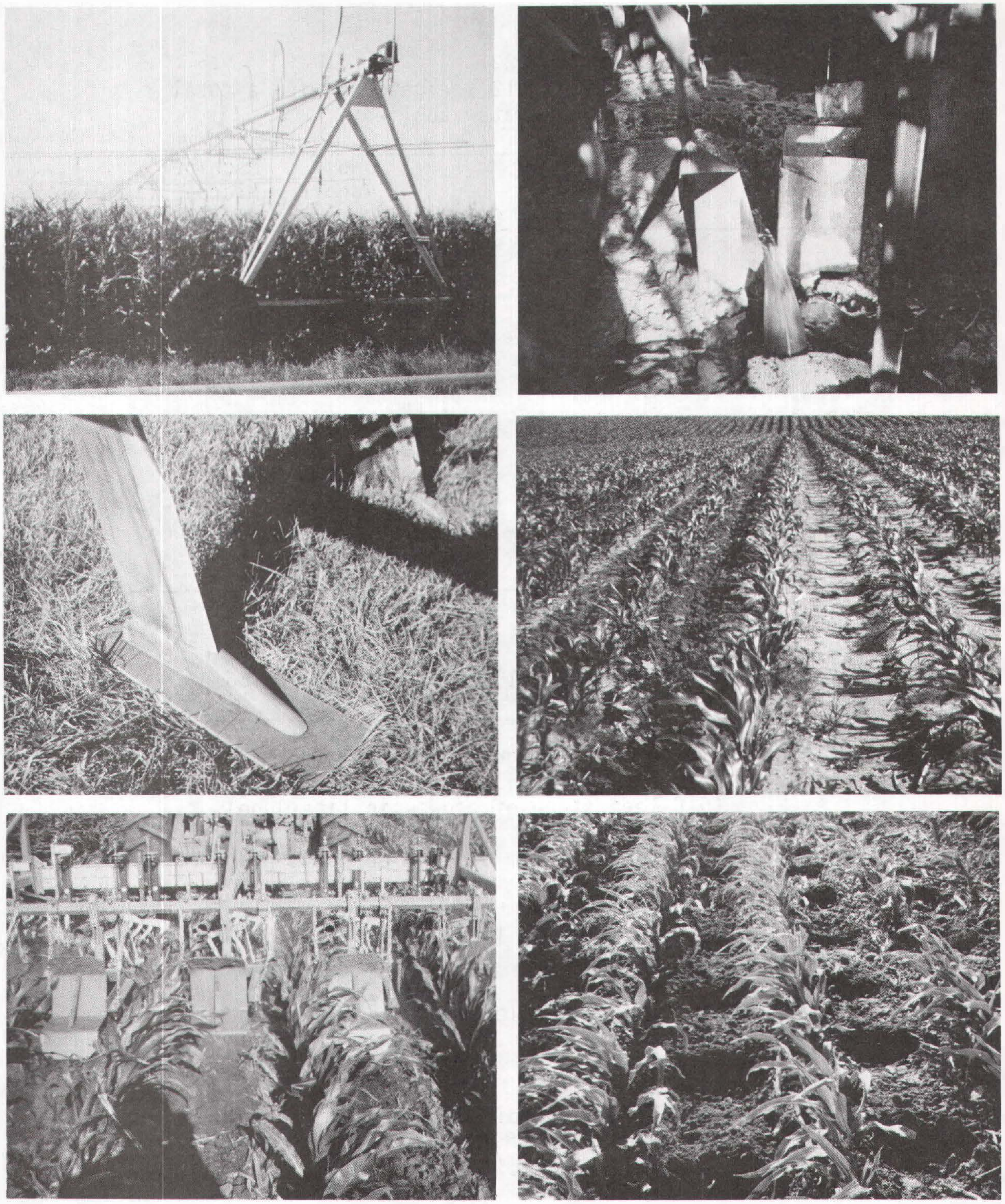
No-Runoff Check - Dams or dikes were hand constructed at 3 ft intervals between corn rows. This holds surface ponded water in place until it can infiltrate.

Wetting Agent - Commercially available non-ionic surfactant claimed to increase infiltration. (Applied at recommended rate and time.)

Machine Micro-Dikes - Small dams or dikes constructed across the corn row at intervals of about 3 feet using an attachment behind the cultivator.

Deep Inter-Row Tillage - The inter-row tillage tool was operated at a depth of 18-20 inches instead of the normal depth of 12-14 inches.

In each year runoff values followed by the same letter are not significantly different at the .05 level, (i.e. runoff percentages in 1982 followed by an A are significantly less than those followed by a B. Do not compare 1981 data to 1982 data.)



The linear-move system with 15 psi spray nozzzles in operation is pictured top left. The adjustable drops and 45 foot booms are also visible. Runoff is being measured with a flume (top right). The recorder is not visible. The middle set of photos shows the flat-soled shank operated between each corn row at a depth of 12-14 inches on the left with the effects of this operation pictured on the right. The bottom set indicates how micro-dikers were attached to the rear of a lilliston cultivator to produce the dams or dikes on the right.

The runoff from plots where breakout occurred, in general, exceeded runoff from check plots because flow was channelled by the dikes. Breakout was more likely to occur as slope and/or the application rate of the sprinkler package used increased. This machine will be modified before use next year.

Another portion of this field was used to assess the impact of primary tillage on runoff under reduced pressure sprinklers as affected by inter-row tillage. Three primary tillage treatments were used: spring plow, tandem-disk and ridge-plant. Each primary tillage treatment was included both with and without inter-row tillage being used at the six to eight leaf stage of corn growth. All tillage was done with farmer owned equipment (4430 JD and six bottom plow; 8430 JD and 30 ft. Tandem). This area was managed like the other portions of the field except that all water was applied using one reduced pressure sprinkler package. The six psi spray nozzles were used in 1981 and the 25 psi CDS (square orifice impact) sprinklers in 1982 and 1983. Yield and runoff results are shown on Table 35-3.

Table 35-3. Primary tillage study results. Average yield and runoff. Gettysburg 1981-1983.

Primary Tillage	Inter-row tillage (12-14 in. deep)	Check
Plow		
Runoff (%)*	12 B	27 C
Yield (bu/A)	178 A	163 B
Disk		
Runoff (%)	6 A	17 B
Yield (bu/A)	182 A	172 AB
Till-Plant		
Runoff (%)	9 A	25 C
Yield (bu/A)	181 A	180 A

* Values followed by the same letter do not differ significantly at the .05 level.

The till-planted plots on the right had a great deal of residue remaining after cultivation. Plowing shown on the left buried most of the residue.

Conclusions

At this point in time, the inter-row tillage operation is the best method of those tried for reducing runoff losses. This method consistantly reduced runoff by at least 50 percent. The very high application rates under some of the low pressure packages caused excessive runoff even when IRT was used. The runoff numbers speak for themselves. The micro-diking technique has potential but more work needs to be done before recommendations on dike height and spacing can be made. These types of machines were used on dryland fields in Kansas, Oklahoma and Texas during the 40's and 50's. They lost favor because of the difficulty they caused in harvesting with the small equipment used at the time. Neither the hand or machine constructed dikes in this study bothered harvesting with a 6620 JD combine but did hamper harvesting with a two-row corn picker. This technique has more promise on dryland row crops than the IRT methods.

The 1982 study indicated that a commercially available non-ionic surfactant did not reduce runoff or increase yields under two low pressure packages.

In terms of runoff, the primary tillage portion of the study favors the one disking operation if IRT was not used. Plowing and till-planting with no IRT was much worse. The IRT operation significantly reduced runoff on all types of tillage. The best treatments were disking and till-planting with IRT. Disking was used to represent one type of high residue tillage. Use of a chisel or soil saver set to leave similar amounts of residue on the surface should produce similar results.

Yields were equivalent for all primary tillages with IRT and till-planting without IRT. Soil moistures followed yield. The higher soil moisture evident on the till-planted area as compared to plowed or disked plots where no IRT was used probably stems from surface shading effects and less moisture loss since the soil was not disturbed. Remember the runoff for till-plant with no IRT was equal to the plowing, but the soil remained moist. Management problems caused by water moving form one area of the field to another makes till-planting with no IRT unacceptable even though yields were not reduced.

Manager's Comments

In time, it may be possible to use very low pressure sprinkler packages for most applications in South Dakota. At present, the runoff losses that occur when some of these sprinklers are used on most sloping soils could easily offset the energy saved on pressurization. This is due to management problems, potential yield reductions and/or the increased costs of pumping more water to the field. This is especially true in areas with high lifts For instance, if we compare the low angle 50 psi impact sprinkler and the best spray nozzle used to date (15 psi spray with a serrated concave plate) pressure at the pivot would decrease by 25 psi from 65 to 40 psi. Low pressure packages need to be equipped with pressure regulators on rolling land to assure uniform distribution of water. The system pressure must be about 10 psi higher than output pressure to assure proper operation of the regulators. Friction loss in a pivot is about 15 psi. So a 50 psi package plus 15 psi for friction loss equals 65 psi. A 15 psi package plus 15 psi for friction and 10 psi for regulators equals 40 psi.

A reduction of 25 psi is equivalent to less than 60 feet of total dynamic head (lift + friction + pressurization). For a producer with 300 feet of lift this is approximately a 12 percent reduction or less. Runoff was increased by 14 percent in 1982 where no inter-row tillage was used. (The analysis ignores the other problems associated with runoff and with trying to keep up when runoff occurs.) When IRT was used, this sprinkler looks feasible from a pumping cost standpoint. Retro-fitting an existing system is costly. This may not allow the producer to fully realize potential savings if motors and pumps are not replaced or make conversion uneconomical if present pumping plants must be changed. Producers planning new irrigation development should consider using some sort of reduced pressure package if possible.

The bottom line is to approach reduced pressure sprinklers like you would any major decision. Be sure to seek professional advice from several sources if you are not positive they will work on your soils. Darrel DeBoer and I would be glad to help you any way we can.

This work dealt with only row crops. Producers considering using low pressure packages should be aware that runoff and methods of reducing runoff have not been evaluated under non-row crop conditions such as small grains or drilled soybeans. We plan to begin some work on this in the near future, however, for the time being, an irrigator's flexibility in crop selection may be limited.

As is evident from the data, reducing runoff does not automatically result in increased yields. Runoff losses can, to a certain extent, be offset by pumping more water. These practices should therefore be viewed as a means of reducing costs and the management problems associated with runoff losses (wheel tracking, systems stuck in low spots, water standing in low spots, etc.). Runoff reduction results in a yield increase whenever runoff losses would have prevented an irrigator from maintaining adequate soil moisture for maximum economic yield. Yield increases are a bonus since in most cases the reduction in runoff will pay for the cost of the operation. Even under the high pressure (50 psi sprinklers) there was an average savings of at least 1.2 inches of water. The pumping costs (270 feet of lift) saved the estimated $4 per acre costs associated with fuel, labor, the tractor and tillage tool for IRT. Where lower pressure packages were used, savings were more dramatic. Irrigators with low lifts may no be able to pencil this out as well on water savings alone since pumping costs are less. The amount and degree of management problems associated with runoff in their fields will determine if practices to reduce runoff are economical.

It is time to brag a little for irrigation research in South Dakota. This project, which has been funded primarily by the Water Resources Institute with much help from the Ag. Experiment Station and many private companies, is some of the most advanced field scale testing with sprinklers and tillage combinations in the world. The direct benefits it has for present and future water development in times of escalating energy prices cannot be over-stated.

James Valley Report

Progress Report JV83-36
Pestigation and Other Methods
of European Corn Borer Control

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Introduction

European corn borer infestations were very heavy in most areas of the state this year. This provided an opportunity to evaluate several methods of application and to screen experimental chemicals for their ability to control first generation corn borers. Experiments on irrigated fields included application of granular formulations aerially and with a hi-boy and application of liquid formulations aerially, through center-pivots (pestigation) and from the ground. A summary of the methods and results of the five experiments are as follows:

Experiment I

Aerial Application of Granular and Liquid Formulations

Location: Platte, South Dakota

Application date: July 1, 1983, with a fixed wing aircraft. Wind 0-5 miles per hour.

Treatments: Lorsban 4E, Lorsban 15G, (20 acres each). Dyfonate 20G (10 acres) Lorsban 4E applied in 3 gpa of water.

Management data: Planting date May 3, 1983, Pioneer 3541 in 38 inch rows, furrow irrigated. First brood infestation evaluated 8/10/83. Yields taken on 9/10/83.

Results

Chemical	Rate (lbs. a.i./A)	Cavities per plant	Yield (bu/A)
Lorsban 15G	1.0	1.1	147
Dyfonate 20G	1.0	4.0	143
Lorsban 4E	1.0	4.1	134
UTC	-	6.2	118

* Hand Harvested

Experiment II

Application of Granular Formulations with a Hi-Boy

Location: Platte, South Dakota.

Application: July 10, 1983. Treatments were applied with 95 percent of the plants showing leaf feeding damage and two larvae per whorl.

Treatments: Granular formulations of labeled and experimental chemicals. John Deere Highboy, chain driven applicators. (Insecticides dropped into whorl.)

Management data: Pioneer 3541, planted May 1, 1983, 36 inch row spacing, 26,000 plants per acre, furrow irrigated. Ten stalks were split per treatment and cavities enumerated on August 18, 1983. No yields were taken.

Results

Treatment	Rate lbs. a.i./A	Average number of cavities/plant
Furadan 15G	0.5	1.4
Dyfonate 20G	1.0	0.9
Lorsban 15G	1.0	0.5
Lorsban 15G	0.5	2.4
LS 5877 15G	1.0	0.5
LS 5877 15G	2.0	0.8
LS 5877 15G	0.5	1.2
1100W	0.1	1.4
1100W	0.05	1.2
1100W	0.075	0.9
UTC	-	6.1

Location: Armour, South Dakota

Application: July 3, 1983.

Treatments: Furadan 15G at 4 lb./A (.6 lbs a.i./A) applied with a hi-boy applicator.

Management Data: See Experiment IV

Results

Treatment	# of cavities per plant
Pioneer 3541 UTC	6.4
Pioneer 3707 UTC	6.3
Pioneer 3541 4# Furadan 15G	1.6
Pioneer 3707 4# Furadan 15G	0.2

Experiment III

Ground Application of Labeled and Experimental Liquid Formulations

Location: Armour, South Dakota.

Application date: July 9, 1983. Treatments were applied with 70 percent of the plants showing leaf feeding damage and at least one larvae per whorl.

Treatments: Liquid formulations of labeled and experimental chemicals. (Applied with a hand carried sprayer, one 8003 flat fan nozzle per row; 20 gpa applied to the whorl.)

Management data: DeKalb 1100, planted May 3, 1983 in 38 inch rows at a population of 25,500 plants per acre. Ten stalks were split per treatments and cavities enumerated on August 17, 1983.

Results

Treatment	Rate (lbs. a.i./A)	Average number of cavities per plant
UTC	-	3.1
Lorsban 4E	1.0	0.2
Lorsban 4E	0.5	0.3
Cymbush 3E	0.02	4.1
Cymbush 3E	0.04	2.1
Cymbush 3E	0.06	0.8
Sevin XLR	2.0	0.4
UCSF-40	2.0	0.4
Ammo 2.5E	0.06	0.7
Ammo 2.5E	0.08	0.1
Pounce 3.2	0.15	0.1
FMC 54800	0.02	0.0
FMC 54800	0.04	0.1

Experiment IV

Pestigation With Liquid Lorsban

Location: Armour, South Dakota.

First Application date: June 30, July 1, 1983. Seventy-three percent infestation of 1-3 day old larvae in the whorl. Egg masses on 64 percent of the plants and ovipositing females throughout the field.

Treatment: Lorsban 4E applied at 1.5 pints per acre to three-fourths of the field with one quart of non-emulsifiable crop oil per acre. Approximately one-fourth of the field was treated with 2.0 pints of Lorsban 4E and one quart of crop oil. Two acres were left untreated. The center pivot was calibrated to apply approximately 0.25 inches of water per acre with the insecticide.

Management data: DeKalb 1100, Pioneer 3707, Pioneer 3541. Planted 5/3/83, 38 inch rows, 25,500 plants per acre.

Results of first application, June 11, 1983:

Treatment	Percent plants infested 1st and 2nd instar	3rd instar
Lorsban 4E 1.5 pt/A with 1 qt. crop oil	31	12
Lorsban 4E 2 pt/A with 1 qt. crop oil	25	7
UTC	89	16

Second Application date: July 13, 1983.

Treatment: Lorsban 4E 2 pt/A
with 1 qt./ac of non-emulsifiable crop oil

Results of second application:

Treatment	#of cavities per plant	Yield bu/A
Lorsban 4E 2 pt./A with 1 qt./ A crop oil		
DeKalb 1100	0.7	160
Pioneer 3707	0.4	153
Pioneer 3541	0.9	151
UTC	6.3	106

* Yield from hand harvested plots.
** Rated 9/10/83

Experiment V

Pestigation with Lorsban and Pydrin

Location: James Valley Irrigation Center.

Application date: July 12, 1983. Plants 95 percent infested, average of three larvae per plant, first to third instar. Ten percent of the plants with midrib feeding.

Treatments: Lorsban 4E at one pt/acre (0.5 lbs. a.i.) and Pydrin 2.4 EC applied at eight oz/acre (0.15 lbs. a.i./A) were applied through a center pivot with 0.2 inches of water.

Management data: Pioneer 3732, planted 4/30/83, 30 inch rows, at a population of 30,500 plants per acre. Cavity counts were taken on 8/22/83 and yields on 9/29/83.

Results

Treatment	Rate lb. a.i./A	Cavity count	Yield bu/A
Lorsban 4E	0.5	0.9	155
Pydrin 2.4 EC	0.15	2.0	138
UTC	-	3.0	144

* Hand harvested two rows 20 feet in length. Four reps within treatments.

Manager's Comment

Present recommendations for first brood European Corn Borer control include only the granular formulations. The rate applied can be halved if the chemical is applied with a hi-boy dropping the granules directly into the whorl. The limited number of acres that can be covered with a hi-boy or poor field conditions may make aerial application preferrable in many cases.

Pestigation is a promising technique but GREAT CARE must be taken when using this proceedure. Seek some advice before you try it. At the present time, only Lorsban 4E has an experimental label for pestigation in South Dakota. Don't use an unlabeled chemical.

The January 21, 1984 issue of The Dakota Farmer Magazine has a good article on corn borers and pestigation written by Gil Gullickson after visiting with Dave Walgenbach, Ben Kanatack, Red Pahl and me. Remember, Lorsban must be diluted at least 14:1 with water to allow use with normal injection equipment due to the fire hazard of the solvent now used in this formulation.

The chemicals used at the JVAREC did not seem to provide as much residual control as the granular formulations used on other fields. A relatively low rate was used without non-emulsifiable oil. The oil is supposed to increase the residual of Lorsban applied by pestigating. A second trip was not made but probably should have been.

James Valley Report

Progress Report JV83-37
Nematode Control In Irrigated Corn

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Department of Plant Science

Summary

The effects of Furadan at several rates and times of application were compared on continuously cropped corn (Table 37-1). None of the treatments consistently reduced lesion nematode populations. Also there were no significant differences in yield between treatments. The number of nematodes was sufficiently high that it is probable that their control would have substantially increased corn yields.

Table 37-1. Effect of nematicide treatment on yield of irrigated corn. Oral, S.D.-1983.

Treatment	Yield (bu/A)	Number of lesion nematodes/100 cc soil		
		Pre-treat	Mid-season	Harvest
1 lb. Furadan (7" band)	93.8		2602	2782
2 lb. Furadan (7" band)	100.0		1588	4037
1 lb. Furadan (with first tillage)	102.1		1836	2134
2 lb. Furadan (with first tillage)	92.9		2658	3124
Check	98.2	84	3252	3402

Application rates are in lb. a.i./A
Sokota TS62A in 38" rows

Manager's Comment

The population of nematodes here is quite high since 100 cc is about as much volume as a coffee cup half-full. Rotations can generally be used to break the life cycle of nematodes if the problem becomes serious. Other methods of control are being developed and evaluated.

Progress Report JV83-38
Full Season and Double Crop Forage Production

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JVAREC Research Staff

Introduction

Like most other producers in the state, the James Valley Research Center must produce forage for the feeding of livestock. Since the feeding trials required low energy rations again this year, forage sorghum and a sorghum-sudan cross were used to produce most of the cattle feed. Some higher quality forage was required for use when the feeder heifers arrived and to blend with the low energy feed. Alfalfa and oatlage were produced for this purpose.

Production of forage for the cattle enabled us to evaluate several management alternatives. These included a replicated study of the potential of Lancer oats versus an experimental triticale variety for silage production and an unreplicated evaluation of double cropping sorghum-sudan following oatlage harvest and barley grain harvest. A full season forage sorghum was also conventionally grown.

Methods and Results

The forage production of oats was excellent, yielding over 3.5 tons of dry matter per acre. The triticale developed good height but yielded only two tons of dry matter per acre. The replicated strips were planted April 22 on 60 inch beds which allowed gravity irrigation. A conventional windrower was used to cut the center 14 feet from each strip on July 12. This was harvested with a silage cutter and weighed in a weighing forage wagon prior to being pressed into a silage bag.

The beds were reshaped with the lilliston cultivator and sorghum-sudan planted with a conventional grain drill. Approximately two to three tons of dry matter per acre were harvested on August 25 from this double crop.

Sorghum-sudan was also no-till planted into barley stubble immediately following grain harvest. The Hiniker planter was used. This left the irrigation bed undisturbed. The July 20 planting date still allowed harvest of 1.5 to 2 tons of dry matter per acre following the first frost in mid-September.

The full season forage sorghum was planted in rows on May 25. It was harvested at the first sign of heading (August 25) using a silage cutter and weighed with the weighing forage wagon. Yields were in excess of six tons of dry matter per acre.

All forage fields were fertilized according to recommendations from the soil testing laboratory. Irrigations were scheduled with tensiometers. Weed

control was excellent with Ramrod plus Bladex being used on the full season crop, Bronate on the oats and triticale and bromoxynil on double cropped sorghum-sudan.

The quality of the forage crops are listed on Table 38-1. (Triticale quality samples were not taken.)

Fig. 38-1. Irrigated Lancer oats yielded 3.5 tons of dry matter when cut for silage in the milk stage on July 12.

Fig. 38-2. Forage sorghum-sudan cross planted after oatlage harvest yielded an additional 2.5 tons of dry matter when cut on August 25.

Conclusions

The double cropping was quite successful following oatlage. The 30 inch rows that were used following barley were too wide to produce maximum yields. The extremely heavy stubble would have prevented no-till planting of narrow rows with equipment at the station. The double crop oats + sorghum-sudan produced nearly as much dry matter as the full season forage sorghum. Overall quality of the double crops were better. The costs of management were higher on a per acre and per ton basis for the double crop.

Table 38-1. Yield and quality of oatlage, full season forage sorghum and double cropped sorghum-sudan cross (dry matter basis)

Forage	Crude Protein	Crude Fiber	Ether Extract	Ash	N-free Extract	Calcium	Phosphorus	Dry-Matter Yield
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(Tons/A)
Oatlage	9.7	31.0	3.5	10.5	45.5	0.25	0.28	3.5
Sorghum Sudan	11.7	30.2	2.0	23.2	32.9	0.63	0.26	2.5
Full Season Forage Sorghum	9.0	40.7	2.5	9.4	38.3	0.27	0.19	6.5

Table 38-2. Seasonal total production from double and full season forage crops.

Forage System	Total Production						
	Crude Protein	Crude Fiber	Ash	Calcium	Phosphorus	Dry Matter	Silage @ 60% Moisture
	(lb/A)	(lb/A)	(lb/A)	(lb/A)	(lb/A)	(Tons/A)	(Tons/A)
Double Crop (oatlage + sorghum sudan)	1261	3680	1894	49	34	6.0	15.0
Full Season Forage Sorghum	1167	5291	1225	35	25	6.5	16.3

The full season forage sorghum which grew to hieghts in excess of 12 feet was cut with a conventional silage cutter and weighed with a weigh wagon.

Manager's Comments

Some experimentation has been done with sorghum-sudan and soybeans broadcast seeded into standing small grain prior to harvest. A water attracting seed coating and frequent sprinkler irrigations were required to make this system work. This can increase disease incidence in the small grains. Aerial seeding in "relay" would provide three or more extra weeks for growth of the second crop. Results from these studies are only preliminary in nature with few satisfactory or dependable results obtained to date. More work is planned on this concept.

These are a few of the "wild and crazy" things we are trying. The results of most of this work can only be evaluated subjectively since they were not true experiments. They should give us an indication if these ideas will work or not. Research into recommended procedures will be conducted on promising techniques.

Forage production following a small grain may provide the flexibility needed by some producers facing uncertain water supplies late in the season (i.e. the James River) or for purposes of electrical load management. Soybeans are grown following small grain forage in southern South Dakota. Relay cropping techniques may allow two grain crops in the southern counties and/or enabel northern producers to use the forage-soybean combination.

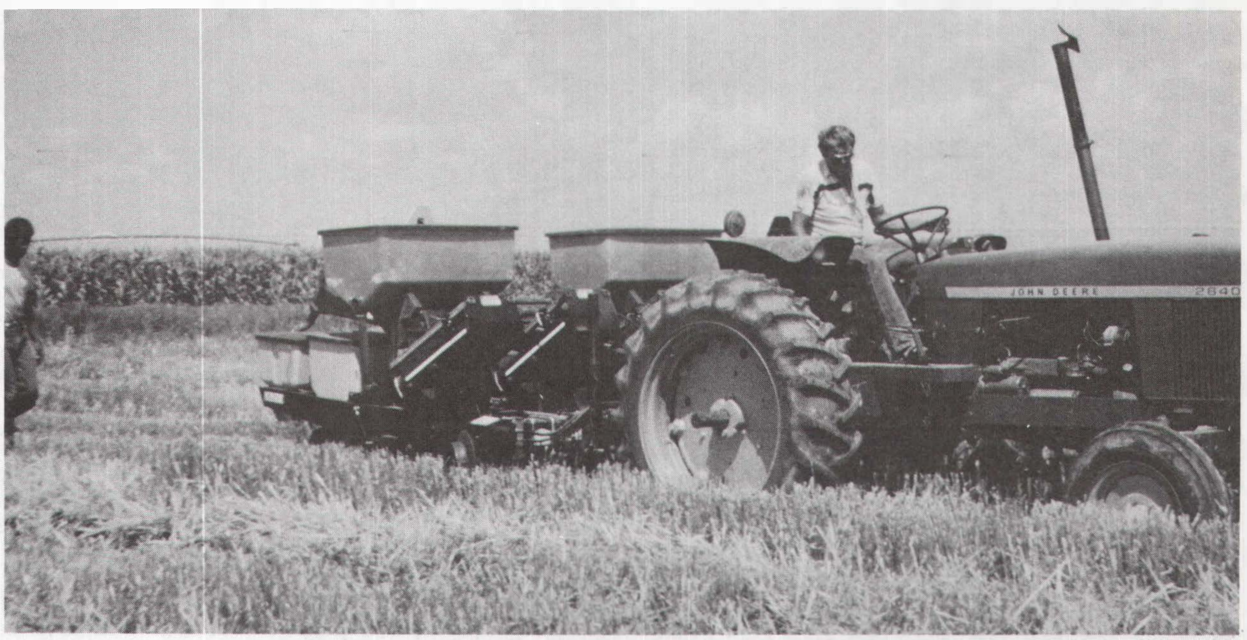

Fig. 38-5. Sorghum-sudan cross being no-till seeded into barley stubble immediately following harvest.

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