This forty-fourth annual report of the research program at the Southeast South Dakota Research Farm has special significance for those engaged in agriculture and the agriculturally related businesses in the ten county area of Southeast South Dakota. The results shown are not necessarily complete or conclusive. Interpretations given are tentative because additional data resulting from continuation of these experiments may result in conclusions different from those based on any one year.

Trade names are used in this publication merely to provide specific information. A trade name quoted here does not constitute a guarantee or warranty and does not signify that the product is approved to the exclusion of other comparable products. Some herbicide treatments may be experimental and not labeled. Read and follow the entire label before using.

South Dakota Agricultural Experiment Station
Brookings, SD 57007

Dr. Charles McMullen, Interim Dean | Dr. Kevin Kephart, Director

Southeast Research Farm
29974 University Road
Beresford, South Dakota 57004

The purpose of this page is to grab your attention and convince you to join the Southeast Experiment Farm Corporation. The Southeast Farm Corporation consists of people just like you from southeast South Dakota and the surrounding area.

Around 1955, a group of progressive farmers began efforts to create an association that would be concerned with agricultural research in southeast South Dakota. On May 3, 1956, a non-profit organization, the Southeast Experiment Farm Corporation, was formed. The purpose of the corporation was to acquire and disseminate information concerning crop and livestock production.

The business affairs of the corporation are handled by a very active Board of Directors. Members of the board are elected for a two-year term from each participating county. An annual meeting is held each year to allow members to review the activities of the corporation and hear reports on progress of research projects and make suggestions on research that may need to be added to solve upcoming problems. Because the corporation is non-profit, all funds generated by the corporation are used to advance research through improvement of buildings and facilities located at the station.

We are currently working to add more new members to the Southeast Experiment Farm Corporation. Lifetime memberships to the corporation are $25. You will not be asked for more than that. This is a one-time $25 membership. These memberships are also transferable, so if you know of someone who has retired from farming and is a member, that membership can be transferred to you or anyone else.

This membership to the corporation is not a large amount, but it helps us in many ways. If you become a member, you will automatically receive our annual report, right off the press, in January; as well as letters during the year to keep you informed of activities at the farm and what dates and times tours will be held. Another important benefit is the more members we have demonstrates strong support and proof that there is a great deal of interest and need for agricultural research throughout southeast South Dakota.

We hope if you are not a member that you will join us. If you decide to join, send a check to the Southeast Farm Corporation for $25 to the above address. If you have a membership that needs to be transferred, clip this page out on the line and fill out the information needed on the other side. We will be glad to process your certificate and add you to our permanent mailing list. Thanks.

Southeast Experiment Farm Corporation
29974 University Road
Beresford, South Dakota 57004
January 2005

Subject: Transfer of Membership

The Board of Directors would like to see existing memberships, that are not active, transferred to a relative or an interested party participating in agriculture located in the same county, if possible. The reason for this transfer, is that a county must maintain a certain number of voting shares in order to elect a director. The directors look after the business affairs of the research farm, make known the research needs of each county, and participate in management decisions of the farm. It is important that each county maintain their representation in order to participate in these affairs.

If this transfer meets with your approval, please enter the name of the party you wish to transfer the membership to, sign your name in the proper blanks below and send this letter, together with the membership share, if possible, to the address listed above.

If there are no interested relatives, you may wish to use Option # 2, and delegate the responsibility to the Board of Directors to locate any interested party in the same county.

Option #1:
Please transfer membership to: ________________________________

Address: ________________________________

____
Signature

Address: ________________________________

Option #2:
I wish to transfer this membership to the Board of Directors, authorizing them to give this voting membership to an interested party within the county.

____
Signature

Address: ________________________________

THE SOUTHEAST SOUTH DAKOTA EXPERIMENT FARM CORPORATION
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Bruce Jurgensen, Equipment Mechanic
Adam Wiebesiek, Ag Technician

Brad Rops, Research Assistant
Ruth Stevens, Statistical Assistant
Garold Williamson, Ag Technician
Mike Lind, Summer Ag Technician

SOUTHEAST SOUTH DAKOTA EXPERIMENT FARM
44th ANNUAL PROGRESS REPORT

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1500 copies of this document were printed by the Southeast Research Farm at a cost of $2.77 per document.

INTRODUCTION --- Robert K. Berg

Welcome to our 44th Annual Progress Report! It is published by the South Dakota Agricultural Experiment Station and Cooperative Extension Service at South Dakota State University in cooperation with the Southeast South Dakota Experiment Farm Corporation.

Congratulations to Garold Williamson, one of our station's Agricultural Technicians, for receiving his 30-year Career Service Award this year. Dr. Leon Wrage, Extension Weed Specialist, retired this fall after more than three decades of outstanding service throughout the entire state of South Dakota. It was a privilege to meet the rest of his family at his farewell events this fall. I want to express my deepest appreciation for the opportunity to work with him for the past 11 years conducting hundreds of research trials, hosting many field tours, and touching the lives of thousands of people in our area in remarkable ways.

I want to welcome Gerald Warmann as the new Associate Dean and Director of our Cooperative Extension Service. Dr. Fred Cholick, Dean of the College of Agriculture and Biological Sciences, accepted an administrative challenge at Kansas State University. I would like to wish him the best and express my appreciation for his many years of excellent service during his career at SDSU.

Research Highlights

This year's report contains 30 crop and livestock research and demonstration summaries of projects conducted at Southeast Research Farm in 2004. This year's cattle report describes a project that compares feeding dried distillers grains to other oilseed supplements for wintering cows on ground corn stalks. Our crop reports show results of the many weed control projects that were conducted here as well as variety trial results and breeder evaluations for oat, corn, soybean, and forages. Several soil fertility research projects focused on strip/zone till, amending soils with gypsum, nutrient management associated with livestock manure, fertilizer placement, and other topics. Insects, soybean cyst nematodes, and other pests continue to challenge crop production in our region and work in several of these areas is presented.

One report features the results of our first attempt to raise field peas and then use them in grow/finish swine rations for integrated crop/livestock enterprises. Our tillage and crop rotation project continued and its indigenous soil nematode populations were characterized again this year. Several new cropping system experiments continued testing alternative crop rotation strategies and systematically evaluating Aerway® conservation tillage. Deep tillage trials designed to see if crop production benefits when nutrients are placed within the soil profile along with deep tillage and to monitor the effects of adding organic residues to increase the storage of carbon in the soil profile were continued. We continued testing a wide range of row spacings for soybean.

Performance of almost all crops was generally above average to excellent this season. Some of our better corn yields reached more than 200 bu/ac and a few soybean plots yielded in the low to mid 70 bu/ac. Oat yields of 75 to 175 bu/ac were observed in our small grain nursery. Spring wheat and field pea yields averaged 55 to 65 bu/ac. Established alfalfa produced up to 9 ton/ac of forage on a dry matter basis. Grasshopper, bean leaf beetle, first-generation corn borer, soybean cyst nematode, and bean pod mottle virus pressures were relatively light to moderate. Second-generation corn borer and western bean cutworm activity was a little lighter than we've seen in recent years. Soybean aphid populations were relatively widespread again this year, but their numbers varied greatly in different fields. Some crop and livestock markets saw relatively high prices at times during the year.

A wealth of information can be readily accessed from South Dakota State University through the Internet (*http://www.abs.sdstate.edu*). Crop performance and variety trials, daily corn borer populations throughout the season, weather information for many of our research stations, marketing information, several years of our annual research progress reports, and much more are readily available on at least two SDSU websites.

- **http://sdaes.sdstate.edu/aes_website/centers.cfm?title=Southeast**
- **http://plantsci.sdstate.edu/southeastfarm/**

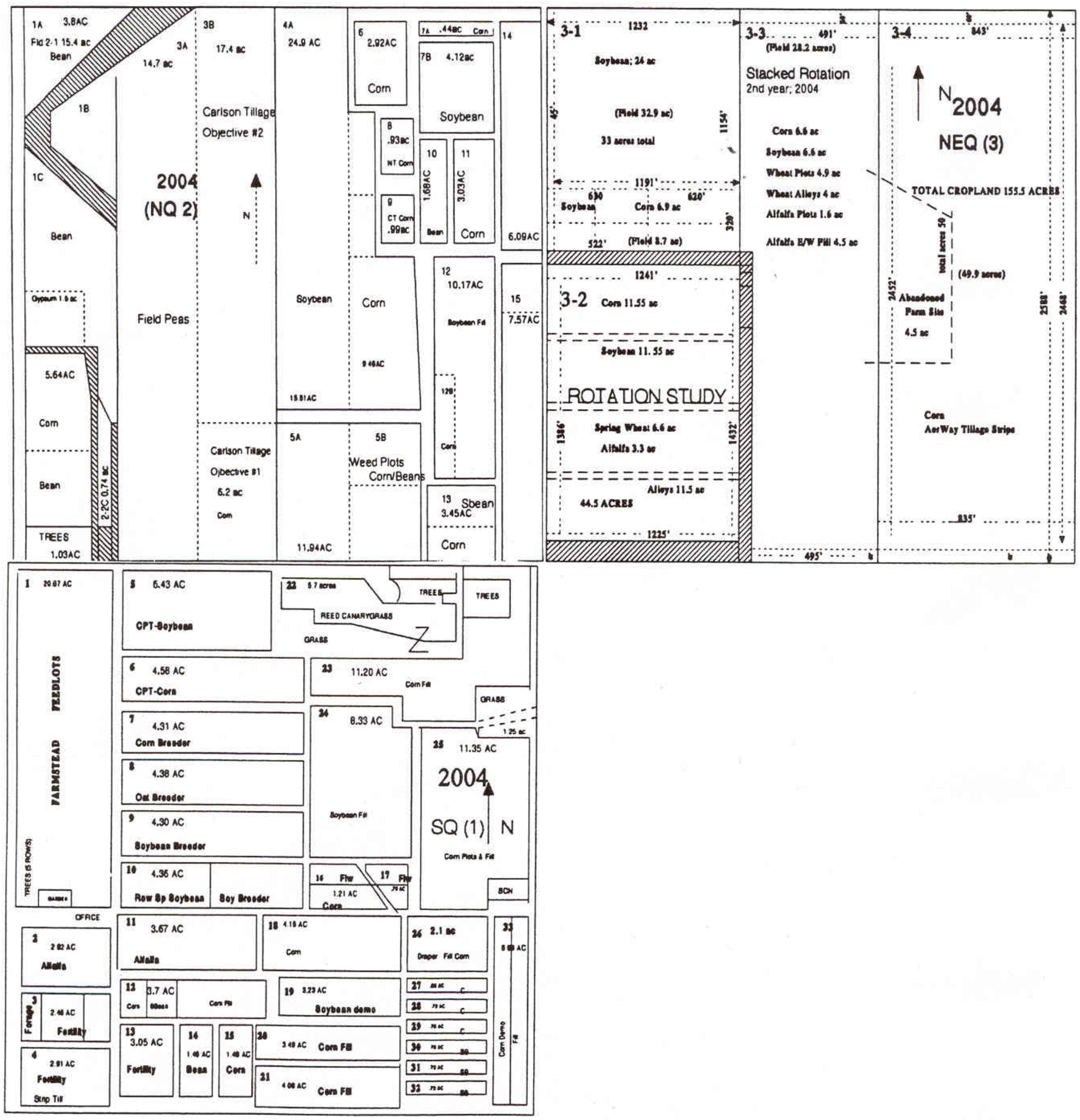
Please feel free to stop by and visit whenever you can. Let us know if you need additional copies of our report or if we can be of further assistance in any way. We can be reached by electronic mail, regular mail, or telephone at:

Southeast Research Farm
29974 University Road
Beresford, SD 57004
Phone: 605-563-2989
FAX: 605-563-2941
se.farms@sdstate.edu

2004 LAND USE MAP

SOUTHEAST RESEARCH FARM

BERESFORD, SOUTH DAKOTA



Weather and Climate Summary

Robert Berg, Ruth Stevens, and Adam Wiebesiek

Our climate for 2004 is summarized in tables and graphs beginning on page 5. Growing season precipitation was a little above normal, but annual precipitation was normal this year. We received almost 25.6 inches of annual precipitation, which is 0.5 inches above our long-term average (101%). Our growing season precipitation measured from April through September was 19.6 inches (105% of normal, + 0.9 inches). Precipitation was normal or above for eight months of the year. Every dormant season month received below-normal precipitation (32 to 75%). Our annual snowfall was 26 inches and all but a trace of it arrived during the first half of the year.

The growing season was cooler than normal with a total of 2,950 heat units (92% of our normal). The coldest temperature of the year was -18°F on January 27 and the hottest high temperature recorded was 95°F on June 8 giving a 113-degree temperature range. Our frost-free season was 141 and 152 days on a 32°F and 28°F-basis, respectively. The average annual high temperature was 59°F and our average annual low temperature was 36°F. Evaporation exceeded rainfall received by 1 to 7 inches per month during the growing season. We lost twice as much moisture by open pan evaporation as we gained by rainfall with a total of nearly 38 inches of water evaporated from May through September while receiving 18 inches of precipitation.

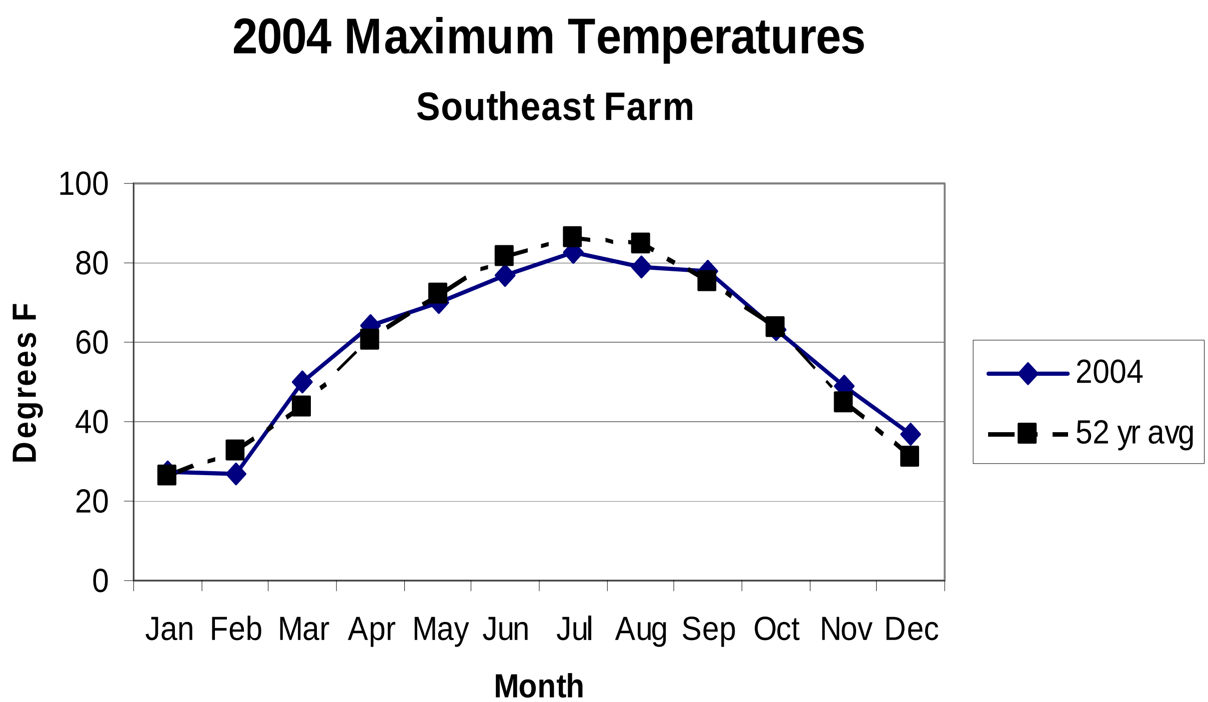
Table 1. Temperatures[a] at the Southeast Research Farm - 2004

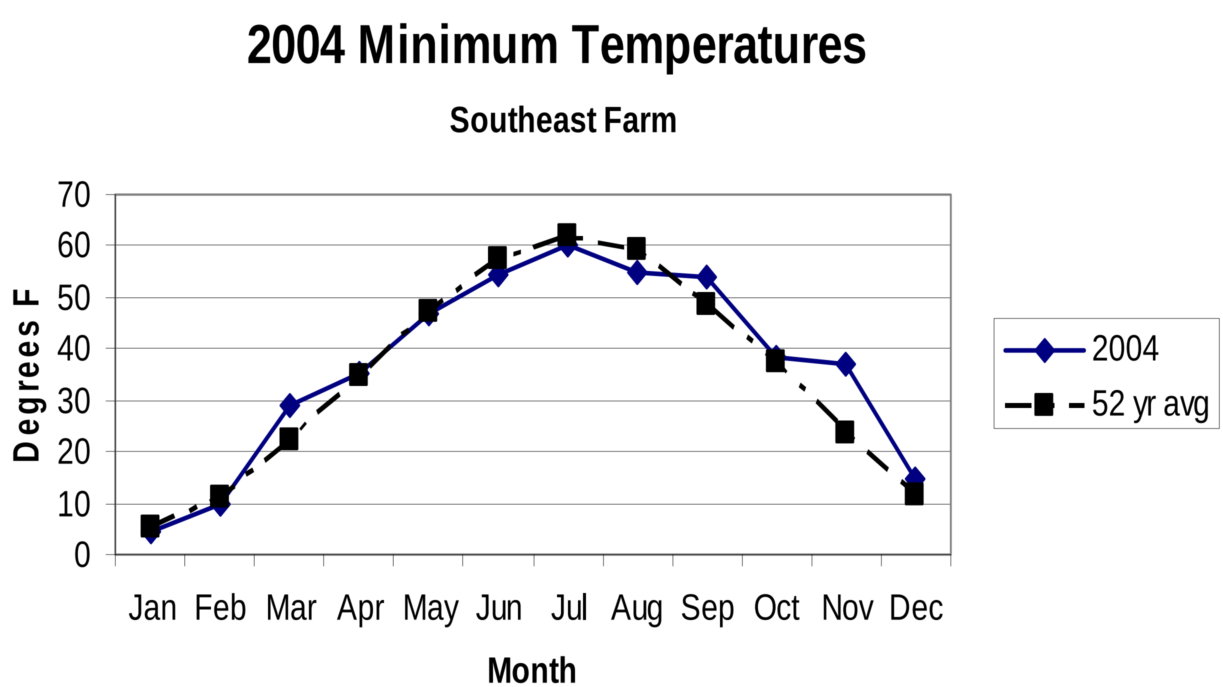
	2004 Average Air Temps. (°F)		52-year Average Air Temps. (°F)		Departure from 52-year Average	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
January	27.2	4.5	26.4	5.2	+0.8	-0.7
February	26.7	9.7	32.5	11.2	-5.8	-1.5
March	49.9	28.8	43.7	22.5	+6.2	+6.3
April	64.3	35.2	60.3	35.0	+4.0	+0.2
May	69.8	47.0	72.3	47.3	-2.5	-0.3
June	77.1	54.5	81.6	57.4	-4.5	-2.9
July	82.5	60.0	86.1	61.9	-3.6	-1.9
August	79.1	54.7	84.5	59.3	-5.4	-4.6
September	77.9	54.0	75.5	48.8	+2.4	+5.2
October	63.1	38.4	63.9	37.6	-0.8	+0.8
November	49.1	26.9	44.8	23.6	+4.3	+3.3
December	36.8	14.7	31.0	11.5	+5.8	+3.2

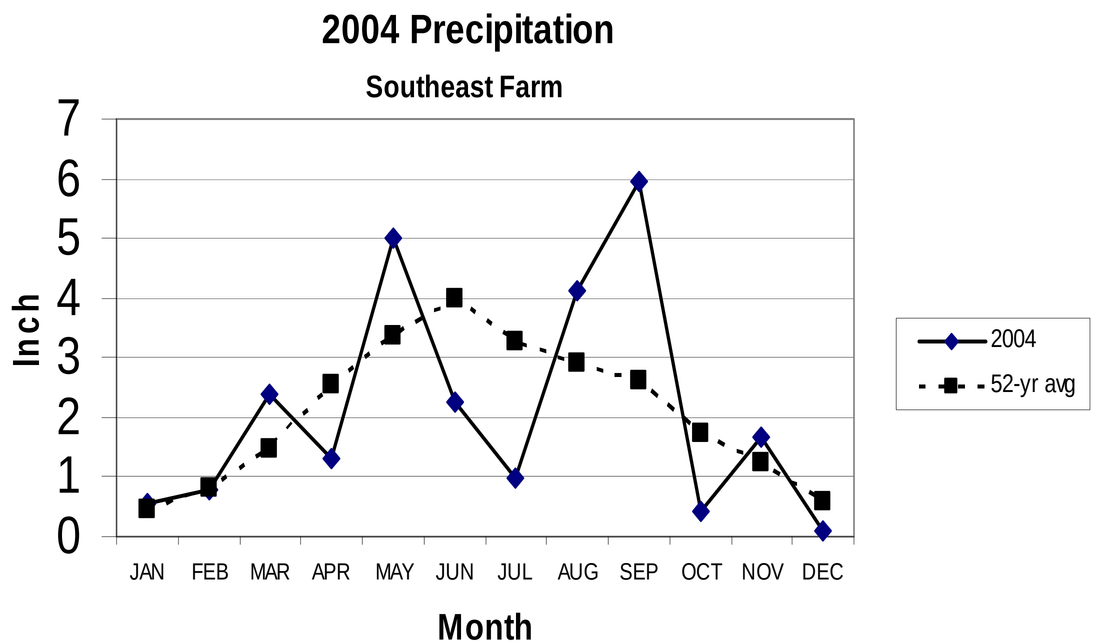
[a]Computed from daily observations

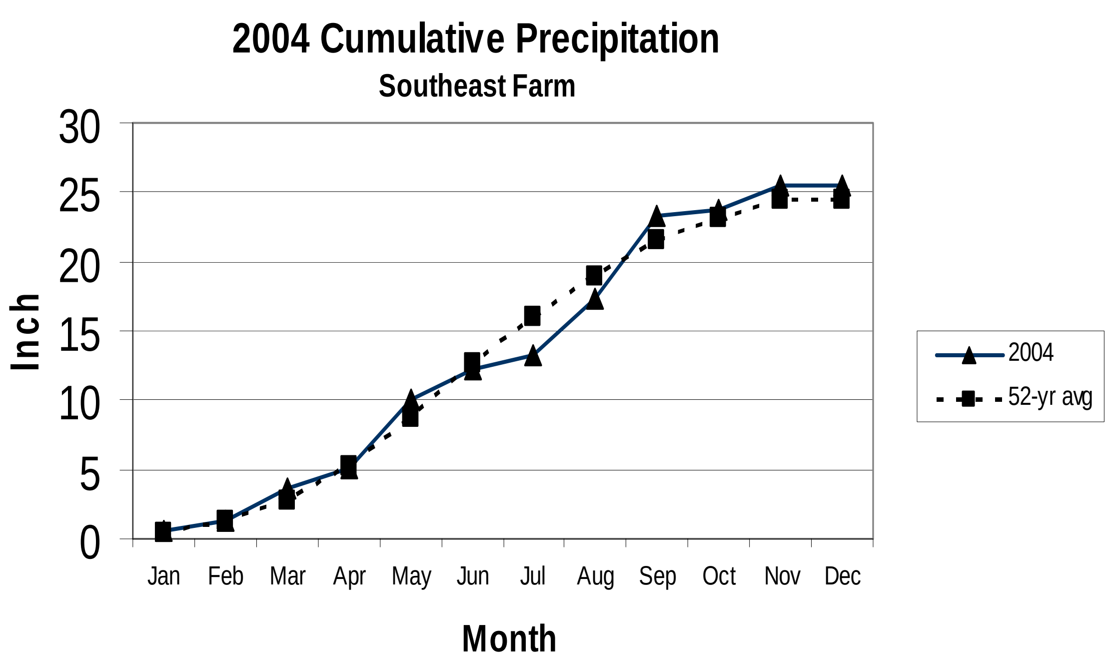
Table 2. Precipitation at the Southeast Research Farm - 2004

Month	Precipitation 2004 (inches)	52-year Average (inches)	Departure from Avg. (inches)
January	0.54	0.46	+0.08
February	0.78	0.83	-0.05
March	2.39	1.48	+0.91
April	1.32	2.54	-1.22
May	4.99	3.38	+1.61
June	2.26	4.00	-1.74
July	0.99	3.29	-2.30
August	4.12	2.90	+1.22
September	5.95	2.62	+3.33
October	0.44	1.73	-1.29
November	1.67	1.24	+0.43
December	0.10	0.58	-0.48
Totals	25.55	25.05	+0.50


2004 Maximum Temperatures
Southeast Farm
100
80
60
40
20
0
Degrees F
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Month
2004
52 yr avg

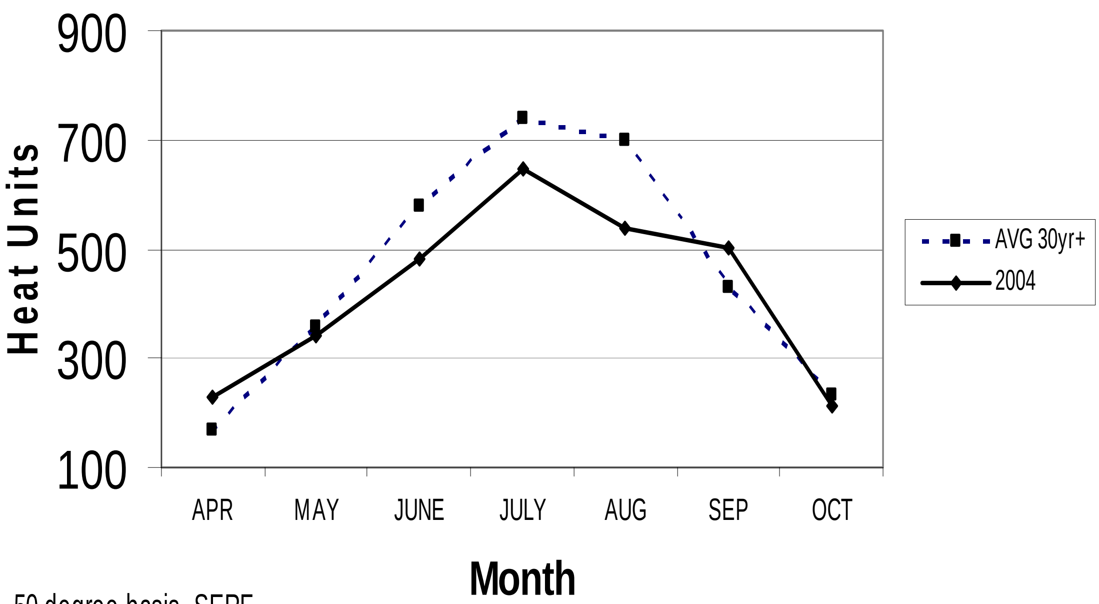

2004 Minimum Temperatures
Southeast Farm
70
60
50
40
30
20
10
0
Degrees F
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Month
2004
52 yr avg


2004 Precipitation
Southeast Farm
Inch
0
1
2
3
4
5
6
7
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Month
2004
52-yr avg


2004 Cumulative Precipitation
Southeast Farm
Inch
0
5
10
15
20
25
30
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
2004
52-yr avg

2004 Growing Degree Units (GDU)

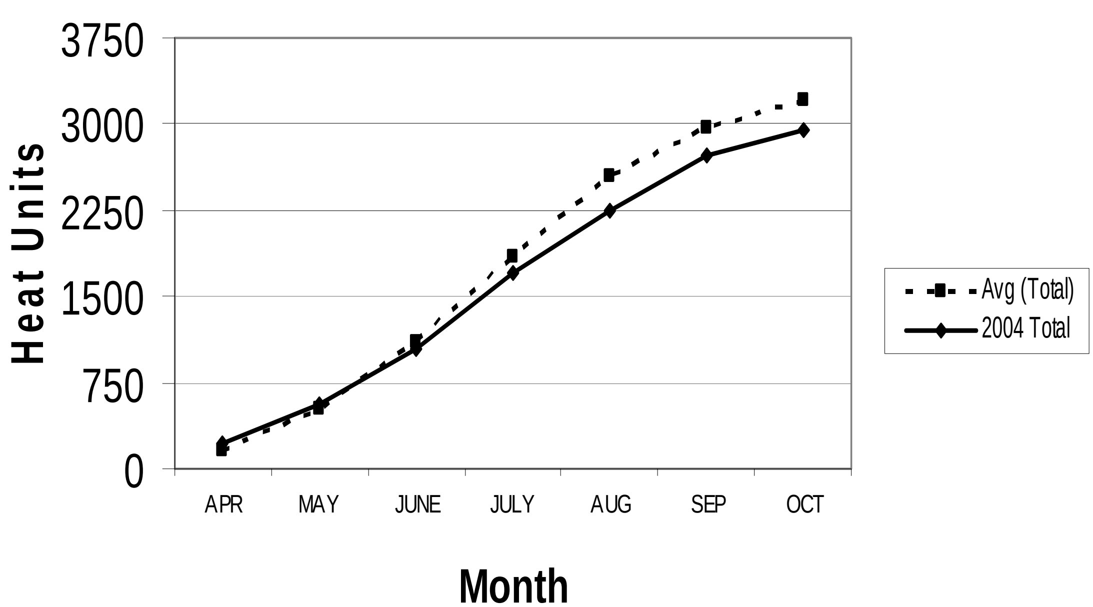
Southeast Farm



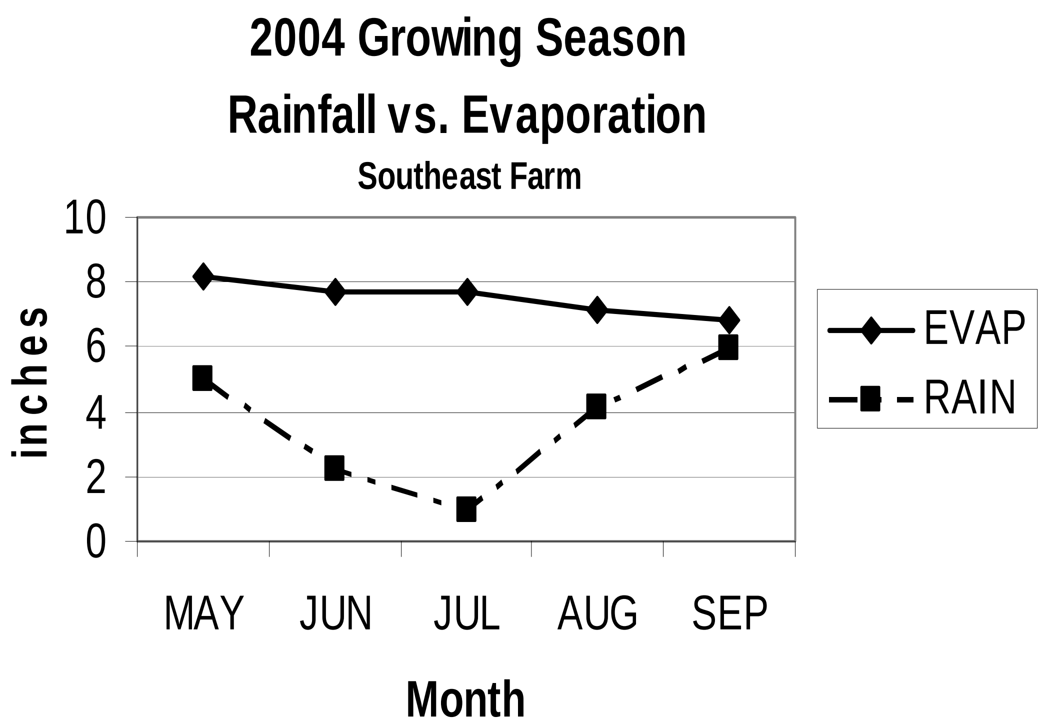
50 degree basis, SERF

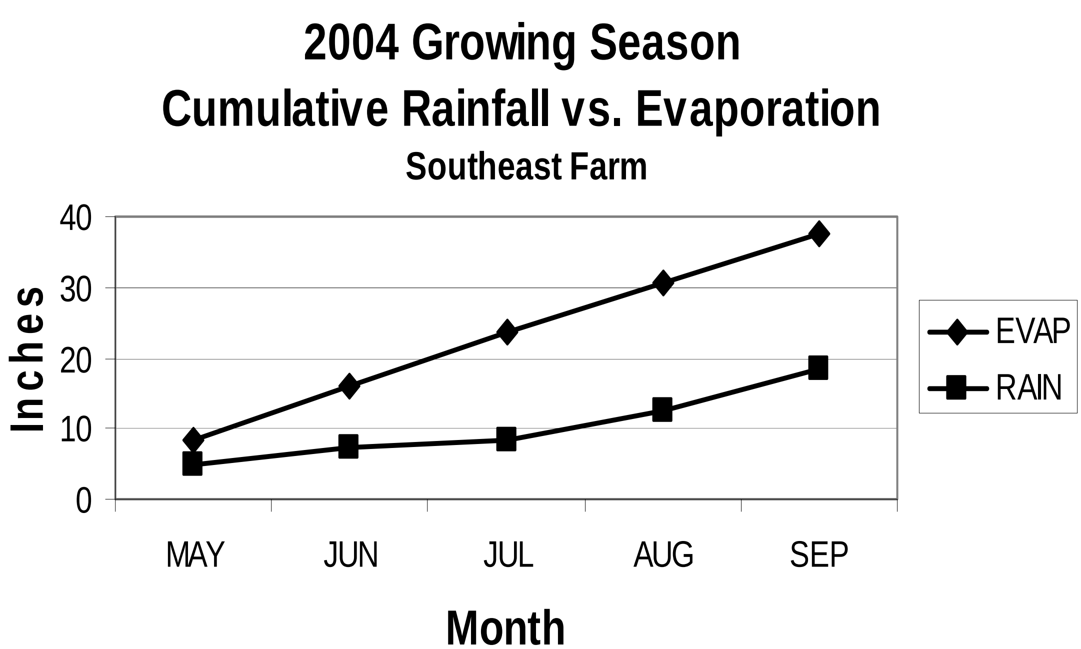
2004 Cumulative GDU Data

Southeast Farm



50 degree basis, SERF


2004 Growing Season
Rainfall vs. Evaporation
Southeast Farm
10
8
6
4
2
0
inches
MAY
JUN
JUL
AUG
SEP
Month
EVAP
RAIN


2004 Growing Season
Cumulative Rainfall vs. Evaporation
Southeast Farm
40
30
20
10
0
Inches
MAY
JUN
JUL
AUG
SEP
Month
EVAP
RAIN

2004 CLIMATE SUMMARY
SOUTHEAST RESEARCH FARM

Annual Precipitation (inch)	25.55	101%*
Growing Season Precip (inch)	19.63	105%
Jan-Mar	3.71	134%
Apr-Jun	8.57	86%
Jul-Sep	11.06	126%
Oct-Dec	2.21	62%
Snow (inch)	25.5	25.5 / T
Growing Degree Units (GDU)	2,950	92%
Minimum / Maximum Temp	-18° F, Jan 27	95° F, June 8
Last Spring Frost	29° F, May 14	26° F, May 3
First Fall Frost	23° F, Oct 2	23° F, Oct 2
Frost Free Period (days); 32º / 28º basis	141 days	152 days
Average Annual High & Low	59 / 36	+0.1 / + 0.6

*% of normal

TILLAGE AND CROP ROTATIONS FOR EASTERN SOUTH DAKOTA

R. Berg, R. Stevens, B. Jurgensen,
A. Wiebesiek, and G. Williamson

Southeast Farm 0401

INTRODUCTION

This research project was established in 1990 to evaluate how crop rotations and tillage methods affect the long-term production and economics of cropping systems in southeast South Dakota. Results from the six no-till and conventionally tilled systems tested in 2004 are summarized in this report.

Three separate companion studies were also directly or indirectly associated with this project in 2004 (Aerway® Tillage System Comparison,_page 32; *Effect of Crop Rotation and Tillage on Nematode Populations,* page 94 and *Alternative Crop Rotations,* page 21).

METHODS

The total project has seven cropping systems that compare no-till and conventional tillage in two-, three-, and four-crop rotations and measures how Aerway® tillage performs in a corn-soybean rotation (Table 1). Conventionally tilled (CT) wheat, soybean, and corn residues were field cultivated at least once before planting. Both CT row crops were cultivated once during the season. After harvest all corn stalks were chopped with a flail shredder, precipitation then prevented any additional fall tillage in the Aerway (AT) and CT systems.

Liquid fertilizer was broadcast in the spring before planting all plots and incorporated in AT and CT systems. Rates were based on soil test recommendations for average treatment yield goals of 50-bu/ac soybean and wheat, 160-bu/ac corn, and 5-ton/ac alfalfa (SDCES Fertilizer Recommendations Guide, EC 750).

Table 1. Tillage and rotation systems evaluated at Southeast Research Farm; Beresford, SD; 2004.

System	Tillage	Crop Rotation
NT2	No-Till	Corn-Soybean (C-S)
AT2	Aerway	
CT2	Conventional	
NT3	No-Till	Corn-Soybean-Wheat (C-S-W)
CT3	Conventional	
NT4	No-Till	Corn-Soybean-Wheat+Alfalfa (C-S-W+A)
CT4	Conventional	

Extra 10-34-0 fertilizer was applied to all crops to help increase soil P levels this year. Additional nitrogen needed for corn and wheat was broadcast separately as 28-0-0. Corn was also side dressed in early June by injecting liquid 28-0-0 between alternate rows.

Soil samples were collected after harvest in 2004 from every plot to help determine next year's fertilizer requirements and monitor soil nutrient levels.

Spring wheat was drilled in 7.5-inch row widths with corn and soybean planted in 30-inch rows. 'Forge' spring wheat was planted at approximately 1,290,000 seeds/ac (110 lb/ac) on April 6 and 7. DeKalb DKC58-24 corn was planted at about 27,900 seeds/ac on April 23 and Prairie Brand PB2141RR soybean at 166,400 seeds/ac on May 11. Pioneer 5454-N221 alfalfa was drilled without a nurse crop in 2001.

Alfalfa was swathed on June 4, July 12, August 14, and October 13 then baled on June 8, July 17, August 30, and October 19. Third cutting windrows were raked before baling. Large round bales of sun-cured forage from entire plots were weighed then samples collected for quality laboratory analyses at every cutting from each plot that was baled.

Stand counts were measured for annual crops as well as mature plant height for wheat and soybean. Grain crops were harvested using a combine with yield based on weigh wagon data from the middle of each plot. Wheat was straight cut without baling straw on July 27, soybean on October 4, and corn on October 26.

Whole farm performance is based on total harvested dry matter production. Grain moisture content and test weight were measured on one subsample per plot. Protein, and/or oil concentrations were also determined for all wheat and soybean plots. All crop nutrient levels are reported on a dry matter basis. Grain yields reported for individual crops are adjusted to standard moisture and test weights of 15%, 56 lb/bu for corn; 13%, 60 lb/bu for soybean; and 13.5%, 60 lb/bu for wheat.

Gross revenue reflects posted hay auction (forage) or local elevator (grain) prices at harvest. Prices for 2004 are $1.68/bu for corn, $4.83/bu for soybean, $3.15/bu for wheat, and $65/ton for alfalfa. Partial economic returns are based on sun-cured large round bales and fresh weight grain yields by plot, less variable expenses for inputs (seed, fertilizer, pesticide), dockages (if any), and field operations (2004 Commercial Field Operation Rate Survey, SD Ag Statistics Service). Whole farm systems reflect one section (640 ac) of dryland crop enterprises with acreage equally divided among each crop.

These six cropping systems consist of 18 crop, tillage, and rotation combinations that are each replicated four times. All crops are raised in each system every year in 0.4-ac plots (60 ft x 300 ft). Statistical comparisons are based on analysis of variance in SAS (Statistical Analysis Software) with the General Linear Model using Least Significant Differences (LSD) at the 90% probability level to compare treatment means. Whole farm systems were analyzed using a split-split plot design with rotation as the main plot, tillage as the subplot, and crop as the sub-sub plot. Analyses shown for each grain crop were tested as a split plot design. Long-term tillage effects for alfalfa were determined using a randomized block design (RBD).

RESULTS AND DISCUSSION

Crop production was good to excellent for all crops this year and averaged from 8 to 49% greater than their respective yield goals (alfalfa, 149%; wheat, 122%; soybean, 114%; and corn, 109%).

Differences among rotations influenced whole farm dry matter yield but not for individual crops. Yield differences between tillage methods were observed for wheat and soybean yields. Tillage effects were consistent among rotations for whole farm and all crop yields except soybean.

Market prices at harvest were relatively good for wheat and alfalfa and low for corn and soybean. Market prices were above the USDA/FSA loan rate for wheat but below loan rates for both row crops.

The mixture of crops within a rotation had a tremendous impact on whole farm net economic return but not on the profitability of individual crops. Method of tillage affected both whole farm and wheat profitability. Soybean net economic return was also influenced by tillage practices, but only within the four-crop rotation.

Whole Farm

Total dry matter produced by these systems ranged from approximately 2,100 to 3,100 tons on a whole farm basis (640 acres, Figure 1). All cropping systems generated a positive whole farm net economic return that ranged from $35,000 to 85,000/system ($55 to 136/ac) (Figure 2).

Overall system yields were affected more by the types of crops grown (rotations) than by whether or not they were tilled in 2004. Total production harvested and net economic returns were greatest in four-crop rotations and lowest for three-crop systems. There was also a trend for conventional tillage to be more profitable than no-till.

Four-crop systems ($129/ac) were the most profitable. This rotation had $40 more net economic return than the C-S rotation and $60/ac more than the C-S-W. Whole farm input costs were about $20/ac higher for NT systems which needed higher fertilizer N for corn and wheat and averaged at least $15/ac less for four-crop rotations because fewer inputs were needed for alfalfa. No-till systems typically had $5/ac lower field operation costs than the CT systems. The net economic return averaged across all six systems was about $96/ac.

Whole farm input costs averaged $106/ac across all systems (corn, $156/ac; soybean, $89/ac; wheat, $85/ac; and alfalfa $47/ac). Whole farm field operation costs averaged $70/ac across all systems (corn, $81ac; soybean, $48/ac; wheat, $53/ac; and alfalfa, $143/ac). Corn and wheat had dockage costs of $28 and 18/ac, respectively for moisture and/or low protein.

By Crop

Average dry matter yields were 9 ton/ac for alfalfa, 6 ton/ac for corn, and nearly 2 ton/ac for soybean and wheat (Figure 3). Soybean and wheat were the only crops whose yield was significantly affected by tillage in 2004.

All crops generated positive net economic returns (Figure 4). Alfalfa was the most profitable crop with a net economic return of $295/ac, followed by soybean at $129/ac, then corn and wheat at $36/ac.

Soybean Even though soybean had somewhat lower yields it was the second most profitable crop overall and by far the most profitable grain crop. A trend for better soybean performance with no-till management was detected, but not consistently among rotations. No-till increased soybean yield by 8 bu/ac in the C-S-W+A systems, but not in the other rotations (Table 2). This resulted in $36/ac more gross income and $22/ac more net income for NT4 vs. CT4 systems.

Alfalfa This cool season perennial forage legume had the greatest yield and was by far the most profitable crop this year (Table 3). The first cutting yielded more than 3 ton/ac with 2 ton/ac at each of the second and third cuttings, and about 1.4 ton/ac at the fourth cutting late this fall. Total production for the season yielded 3 ton/ac more dry matter than corn and four times more than soybean or wheat. Previous tillage history had almost no effect on forage performance this season.

Alfalfa generated more than $485/ac in gross income with expenses of $47/ac for inputs and $143/ac for field operations leaving a net return of $295/ac. This was twice as profitable as soybean and produced eight times more net income than corn or wheat.

Wheat Tillage and rotation practices did not significantly impact wheat performance. Yield of this cool season grass crop averaged more than 60 bu/ac across the four systems tested (Table 4).

Corn Corn performance was not significantly affected by tillage and rotation practices. This warm season grass crop was the second highest yielding crop and averaged 174 bu/ac across all six systems (Table 5).

Crop Quality

Grain and forage nutrient levels are summarized in Table 6 except for corn which was not tested this year. Soybean grain dry matter protein and oil concentrations were 36 and 20%, respectively.

Dry matter protein content of wheat averaged 16%. Our wheat was about 1% wetter than the standard threshold for moisture and nearly half of the samples tested had less than 14% protein on a fresh weight basis at harvest. Together these factors resulted in dockage costs of about $18/ac.

Alfalfa was harvested four times this season. Windrows received 0.54 inches of rain while the first cutting cured, none for the second cutting, and 0.24 inches on the third cutting, and a trace on the fourth cutting. Forage moisture levels ranged from 12 to 18% when baled.

Alfalfa crude protein ranged from 16 to 21%, crude fat averaged 2%, and non-fiber carbohydrate levels were from 26 to 36%. Total digestible nutrients averaged 59 to 65%, relative feed values (RFV) were 115 to 156, and relative feed quality (RFQ) was 123 to 173.

Forage quality based on RFQ ratings were fair for the spring cutting, good for the second cutting, and premium for the third and fourth cuttings. Corresponding grades based on RFV ratings were fair for the first two cuttings, good for the third cutting, and premium for the late fall harvest.

<u>SUMMARY</u>

- All four crops had excellent yields and generated positive net economic returns this season. As a result whole farm performance was better than average for the six cropping systems tested.

- Whole farm systems produced between 2,150 and 3,000 tons of harvested dry matter based on 640 acres of cropland.

- The C-S-W+A rotation produced more biomass and net economic return than the C-S rotation and C-S-W was the least productive and least profitable rotation on a whole farm basis. Rotation differences among individual crops were not detected.

- No-till management was better for raising soybean, but only for the four-crop rotation. Wheat performance was consistently better when it was conventionally tilled. Overall the whole farm net economic return was higher with conventional tillage than for no-till.

- Alfalfa was clearly the most profitable crop. Soybean was the most profitable crop grown for grain. Alfalfa was two times more profitable than soybean and six times more profitable than wheat and corn. Soybean produced three times more net economic return than corn or wheat.

- The best performing cropping systems in 2004 were generally either four-crop rotations or conventionally tilled systems.

CONCLUSIONS

This growing season was cooler than normal with adequate moisture, forage prices were good with relatively low grain markets at harvest, and all crops had good yields. With these conditions the most profitable cropping systems were those that maximized the use of cool and warm season legumes (alfalfa and soybean) with the grain crops being conventionally tilled. No-till cropping systems with a larger proportion of warm and cool season grass crops (corn and wheat) still performed well but were a little less successful under these conditions.

Federal farm program benefits like loan deficiency or direct payments could also provide revenue to help cover remaining variable and fixed costs that were not included in this economic strategy.

ACKNOWLEDGEMENTS

Support for this project was provided by the South Dakota Agricultural Experiment Station and the Southeast South Dakota Experiment Farm Corporation. Laboratory analyses for soybean and wheat were provided by Kevin Kirby and Jesse Hall, Plant Science Department and alfalfa was analyzed by the Oscar E. Olson Biochemistry Laboratory, at South Dakota State University in Brookings, SD.

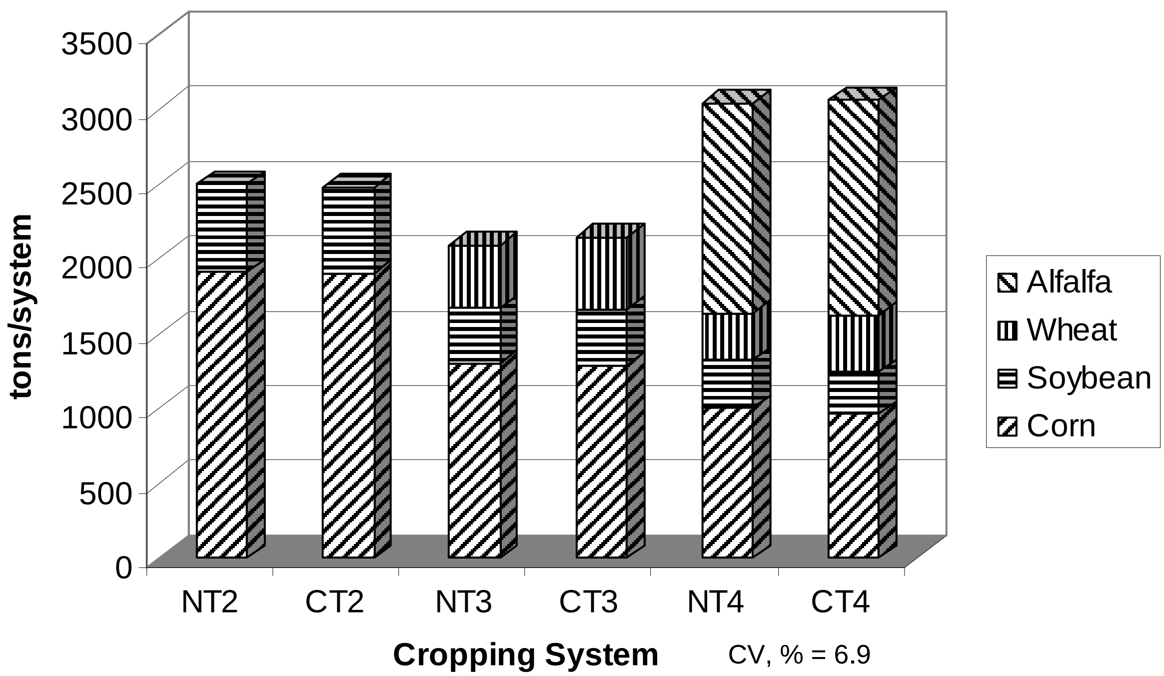


Figure 1. Total dry matter production for tillage cropping systems study. Southeast Research Farm; Beresford, SD; 2004.

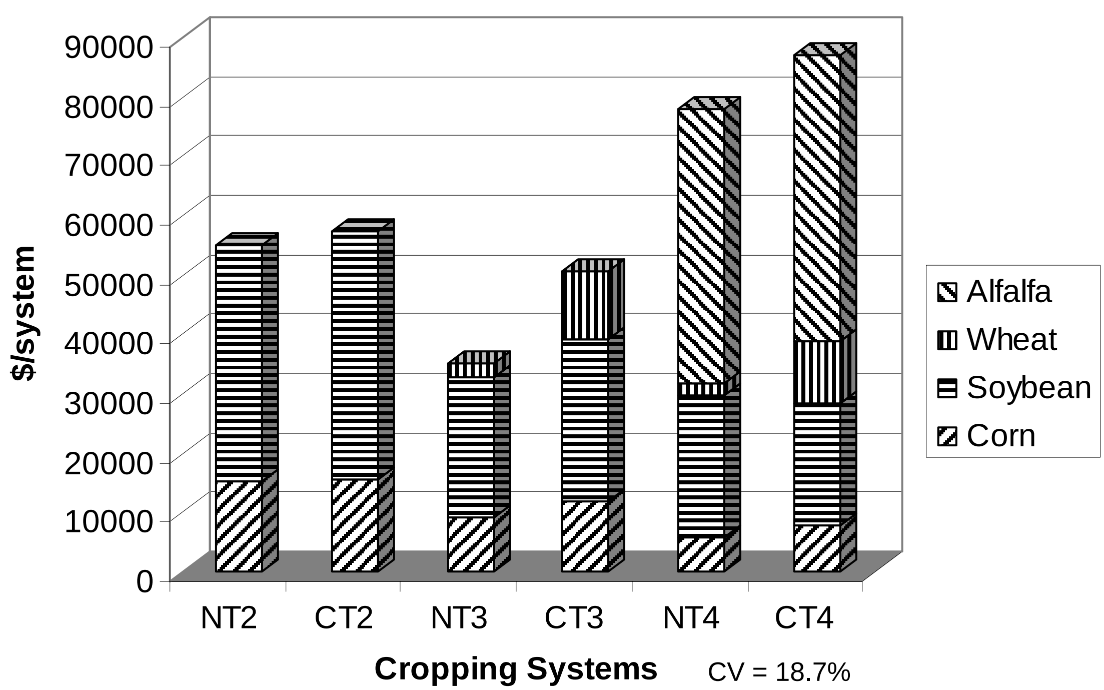


Figure 2. Whole farm net economic return for tillage cropping systems study. Southeast Research Farm; Beresford, SD; 2004.

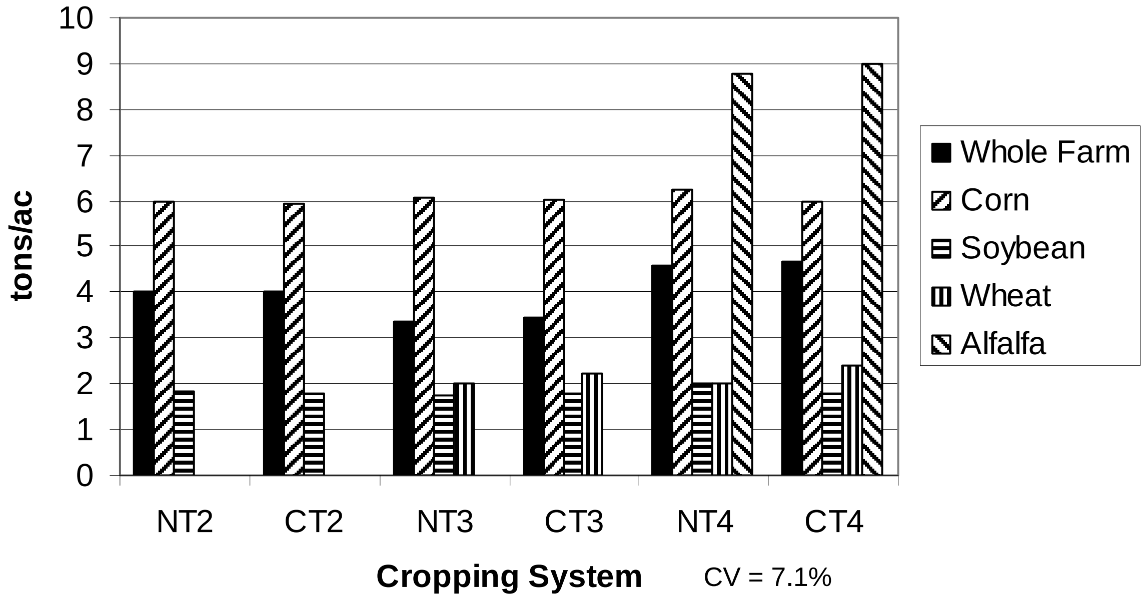


Figure 3. Dry matter yield by crop for tillage cropping systems study. Southeast Research Farm; Beresford, SD; 2004.

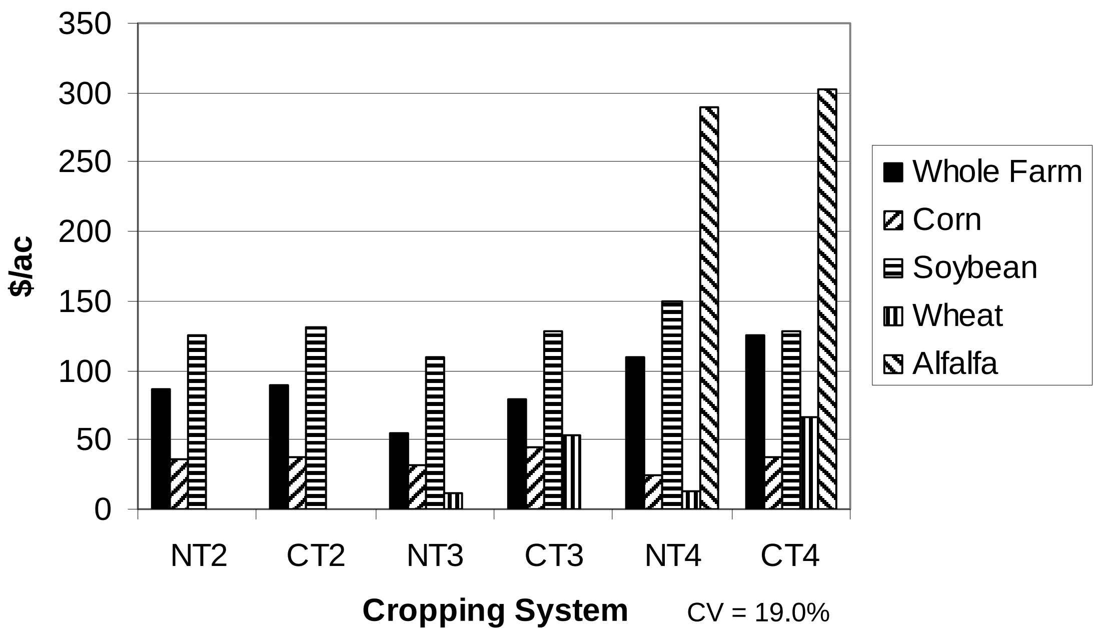


Figure 4. Net economic return by crop for tillage cropping systems study. Southeast Research Farm; Beresford, SD; 2004.

Table 2. Effect of rotation and tillage on soybean performance in tillage cropping systems study; Southeast Research Farm; Beresford, SD; 2004.

Rotation	Tillage	Plant Height	Plant Population	Grain Yield[1]	Moisture	Test Weight	Gross Income	Net Economic Return
		inch	plants/ac	bu/ac	%	lb/bu	---------$/ac--------	
C-S	**NT**	27.1	147,700	58	9.3	57.6	268	125
	CT	28.8	144,100	56	9.3	57.3	261	131
C-S-W	**NT**	25.3	149,000	55	9.2	57.1	254	110
	CT	26.1	140,400	55	9.3	57.3	258	128
C-S-W+A	**NT**	27.9	136,200	63	9.3	57.3	294	150
	CT	25.8	139,200	55	9.4	57.3	258	128
Pooled	**Avg.**	26.8	142,800	57	9.3	57.3	265	129
LSD $_{(0.10)}$		NS [2]	NS	3	NS	NS	15	15
CV,%		7.8	8.7	4.3	0.7	0.5	4.3	8.9

[1] Grain yield at 13% moisture and 60-lb/bu test weight.
[2] NS = not significant

Table 3. Effect of tillage on alfalfa[1] performance; tillage cropping systems study. Southeast Research Farm; Beresford, SD; 2004.

Rotation	Tillage	1st cut	2nd cut	3rd cut	4th cut	Total	Gross Income	Net Economic Return
		-------------------------ton/ac--------------------					---------$/ac --------	
C-S-W+A	**NT**	3.34	2.10	1.84	1.50	8.78	477	289
	CT	3.43	2.28	2.02	1.27	9.00	494	302
	Avg.	3.38	2.19	1.93	1.39	8.89	485	295
LSD $_{(0.10)}$		NS [2]	NS	NS	0.03	NS	NS	NS
CV, %		6.2	11.8	11.3	3.0	3.7	3.6	5.3

[1]Dry matter yield
[2] NS = not significant

Table 4. Effects of tillage and crop rotation on wheat performance in tillage cropping systems study. Southeast Research Farm; Beresford, SD; 2004

Rotation	Tillage	Plant Height	Tiller Density	Grain Yield[1]	Moisture	Test Weight	Gross Income	Net Economic Return
		inch	tillers/ft^2	bu/ac	%	lb/bu	- - - $/ac - - -	
C-S-W	**NT**	36.6	83	56	14.4	55.8	177	12
	CT	38.4	78	63	14.8	56.4	198	53
C-S-W+A	**NT**	39.8	82	56	14.4	56.8	177	13
	CT	40.0	78	67	14.6	56.9	212	66
Pooled	**Avg.**	38.7	80	61	14.5	56.4	191	36
LSD $_{(0.10)}$		NS [2]	NS	NS	NS	0.4	NS	NS
CV,%		7.7	11.8	4.9	1.1	0.5	4.9	23.3

[1] Grain yield at 13.5% moisture and 60-lb/bu test weight
[2] NS = not significant

Table 5. Effect of tillage and crop rotation on corn performance in tillage cropping systems study. Southeast Research Farm; Beresford, SD; 2004.

Rotation	Tillage	Plant Population	Grain Yield[1]	Moisture	Test Weight	Gross Income	Net Economic Return
		plants/ac	bu/ac	%	lb/bu	- - - - $/ac - - - -	
C-S	**NT**	24,000	173	17.1	58.4	297	36
	CT	20,400	171	17.6	58.2	295	38
C-S-W	**NT**	22,900	176	17.2	58.5	303	32
	CT	24,500	174	17.3	58.2	299	45
C-S-W+A	**NT**	22,200	177	18.1	57.3	306	25
	CT	22,800	171	17.7	58.0	296	38
Pooled	**Avg.**	22,800	174	17.5	58.1	299	36
LSD $_{(0.10)}$		2,500	NS[2]	0.3	0.4	NS	NS
CV,%		8.4	4.9	1.1	0.6	5.0	36.1

[1] Grain yield at 15% moisture and 56-lb/bu test weight.
[2] NS = not significant

Table 6. Crop quality for tillage cropping systems study (dry matter basis[1]); Southeast Research Farm; Beresford, SD; 2004.

Crop		Protein	Oil				
		%	%				
Soybean	**Avg**	35.5	19.7				
	Range	1.6	1.0				
	Std. Dev.	0.4	0.3				
Wheat	**Avg**	16.2	---				
	Range	1.5	---				
	Std. Dev.	0.4	---				
Alfalfa[2]		**Crude Protein**	**Crude Fat**	**Non Fiber Carbo-hydrate**	**Total Digestible Nutrients**	**Relative Feed Value**	**Relative Feed Quality**
		%	%	%	%		
1st cut	**Avg**	16.3	1.8	26.5	58.6	115	123
	Range	2.2	0.7	4.8	4.1	19	18
	Std. Dev.	0.8	0.2	1.9	1.3	5.7	5.7
2nd cut	**Avg**	19.0	1.8	25.7	59.4	122	131
	Range	5.6	0.6	6.0	6.5	49	53
	Std. Dev.	1.6	0.2	1.8	2.0	13.9	15.5
3rd cut	**Avg**	21.0	2.1	29.1	63.4	146	162
	Range	2.0	0.6	2.2	1.9	19	21
	Std. Dev.	0.6	0.2	0.9	0.7	6.0	6.5
4th cut	**Avg**	17.2	2.2	35.8	65.4	156	173
	Range	2.8	0.5	2.3	3.1	32	33
	Std. Dev.	0.9	0.2	0.8	1.1	10.3	12.7

[1] Dry matter contents: 94.2% for soybean, 24 observations; 86.8% for wheat, 16 observations; 83.0% for 1st cut, 88.3% for 2nd cut, 82.1 for 3rd cut, and 82.8% for 4th cut alfalfa, 8 observations per cut; corn not tested.
[2] Precipitation on alfalfa while curing in windrow: 1st cut, 0.54"; 2nd cut, 0.00"; 3rd cut, 0.24", and 4th cut, trace.

SE FARM REPORT
SDSU

ALTERNATIVE CROPPING SYSTEMS

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Southeast Farm 0402

INTRODUCTION

Diversifying rotations by adding crops or altering the intervals between crop types may help cropping systems perform more efficiently. Even though crop yields were good in 2004 they seem to have reached a plateau in many areas the past few years. Adding small grains profitably can be challenging, but they may help prevent, or at least better manage, pest problems in some crop rotations.

Demand for corn is still increasing to supply ethanol for our nation’s energy needs. As a result it is important to look at the impact of growing corn more often than we have in the past. Crop quality is also increasingly important to those who utilize our crops.

To help address these issues we established a new field trial in 2003 to evaluate the long-term performance of several alternative cropping systems. Various combinations of four warm and cool season grass and legume crops (corn, soybean, wheat, and alfalfa) are evaluated to see how changing the cropping patterns from a traditional corn-soybean rotation effects whole-farm production, crop quality, and profitability for farmers in eastern South Dakota.

A modified corn-soybean rotation simply looks at adding another year of corn to the system. A three-crop “stacked” rotation plants each crop for two years in a row. This may reduce pest problems and provide other benefits by not returning to the same crop for four consecutive years. Another system is designed to document whether soybean performs better when grown after a small grain than it does following corn. Monocultures of each crop are also tested.

It will take six years for the stacked rotation to complete one cycle – so we plan to continue this project at least through the 2008 cropping season. Preliminary results from the second year of this establishment phase are outlined in this report.

METHODS

The eight cropping systems established in 2003 were planted to their second year crops as outlined in Table 1. This experiment is located adjacent to and has similar research protocols as our long-term Tillage and Crop Rotation trial (pg 11-20).

Table 1. Alternative cropping systems research study; Southeast Research Farm; Beresford, SD**.**

Cropping System	Six-year Sequence[1]	Cycles[2]
Corn - Soybean	C – **S** – C – S – C - S	1.0
	S – **C** – S – C – S - C	
Wheat - Soybean	S – **W** – S – W – S - W	1.0
	W – **S** – W – S – W - S	
Modified Corn - Soybean	C – **C** – S – C – C - S	0.67
Stacked	C – **C** – S – S – W - W	0.33
	S – **S** – W – W – C - C	
	W – **W** – C – C – S - S	
Continuous Corn	C – **C** – C – C – C - C	2.0
Continuous Soybean	S – **S** – S – S – S - S	2.0
Continuous Wheat	W – **W** – W – W – W - W	2.0
Continuous Alfalfa	A1 – **A2** – A3 – A4 – A5 – A6	2.0

[1]Bold underlined letters indicate crops measured during the 2004 growing season for each system (2002 crop soybean).
[2] Completed rotation cycles per system 2003 to 2004

All crops received broadcast applications of phosphorus and/or nitrogen fertilizers as 10-34-0 and/or 28-0-0 before planting. Amounts applied reflect treatment averages based on soil test recommendations measured from each plot for yield goals of 50 bu/ac soybean and wheat, 160 bu/ac corn, and 5 ton/ac alfalfa. Extra phosphorus was applied to all crops to increase soil P levels and corn was side dressed in early June.

Spring wheat and soybean were Aerway tilled once in the spring before planting. Corn planted on soybean stubble (C-S system) was field cultivated once, whereas, the other three systems where corn was grown for the second consecutive year were field cultivated two times ahead of planting. Soil samples were collected from every plot after harvest to monitor nutrient levels in these soils and provide fertilizer recommendations for next year. All corn stalks were then shredded with a flail chopper and Aerway tilled one time along with all soybean and wheat plots.

Plant population was measured for each grain crop as well as plant height for wheat and soybean. Yield was measured at maturity by harvesting grain from the center 20 ft of plot for soybean and wheat and 30 ft for corn with a Case-IH 2144 combine and weighed with a weigh wagon. Test weight and moisture content were recorded using a grain subsample from each plot the day it was harvested.

Four cuttings of alfalfa were swathed, then sun-cured and baled as large round bales. Windrows were only raked before baling in August and yield at each cutting was measured from the entire plot.

Crop quality was tested in the laboratory for every plot after harvest and is expressed on a dry matter basis. Representative samples were analyzed for protein, and oil, by NIRS analysis including alfalfa forage quality from bales sampled after every cutting.

Whole-farm productivity is expressed as tons of dry matter harvested using a farm size of 640 acres per system. Grain yields by crop are standardized to uniform moisture contents of 13.5% for wheat, 13% for soybean, and 15% for corn and 60 lb/bu test weight, except corn (56 lb/bu). Every crop in each system is grown annually (except the C-C-S rotation) and field sizes are divided equally among crops.

A partial net economic return was calculated on a fresh weight basis using local market prices at harvest and subtracting a few variable costs for inputs like seed, fertilizer, and herbicide; dockages, if any; and field operation costs (2004 Commercial Field Operation Rate Survey, SD Ag Statistics Service). Aerway tillage was charged at $10/ac.

Each treatment was replicated four times in a split-plot design with crop rotation as the main plot and individual crops within each system as subplots. Plot is the experimental unit with dimensions that are 60-ft wide by 310-ft long (0.42 ac). Responses measured are shown as simple summary statistics for this report. Additional management information is summarized in Table 2.

Table 2. Second year management information for alternative crop rotation trial. Southeast Research Farm; Beresford, SD; 2004.

	Soybean	**Wheat**	**Alfalfa**	**Corn**
Variety/Hybrid	Prairie Brand 2141RR	‘Forge’	Garst 6420	Pioneer 34N42
Traits	Roundup Ready	Spring	perennial	Herculex – Liberty Link
Planting Date	May 11	April 8	May 8, 2003	April 26
Seeding Rate	166,400 seeds/ac	110 lb/ac	17 lb/ac	27,900 seeds/ac
Fertilizer (N-$P_2 0_5$-$K_2 0$, lb/ac)	34-124-0	113-84-0	31-112-0	99-196-0 (C-S = 48-176-0)
Pesticide[1]	Roundup, post (2) Proaxis, post	Roundup, AH (2)	None	Liberty, post (2)
Harvest Date(s)	October 4	July 27	June 4, July 17 Aug 14, Oct 13	October 26
Market Price @ Harvest	$4.83/bu	$3.15/bu	$65/ton	$1.68/bu

[1]Herbicide except Proaxis (insecticide); Post = post emerge, AH = after harvest; (2) = two applications during the growing season

RESULTS AND DISCUSSION

After harvest 75% of the cropping systems had completed at least one full rotation (Table 1). Because this project is still in the establishment phase it is a little early to make very meaningful comparisons among some systems.

Whole Farm

Whole farm (640 acre) total dry matter production averaged 1,600 tons/system and ranged from 1,100 tons for the continuous soybean rotation to 6,000 tons for alfalfa (Figure 1). Second-year alfalfa produced 240%, the two second-year corn systems 140%, and the stacked rotation 83% of the total tons made in the corn-soybean rotation (control). Cropping systems comprised of wheat and/or soybean without corn produced 45 to 60% of the C-S rotation (1,100 – 1,500 tons).

Six of the eight cropping systems generated a positive net economic return that ranged from + $22,000 to 206,000/system (Figure 2). Continuous alfalfa was seven times and the W-S and continuous soybean systems were nearly two times more profitable than the C-S system. The stacked rotation and continuous wheat were about 80% as profitable as the control.

Variable costs exceeded gross income for corn partly because of the extra P fertilizer that was applied to all systems this year. Without the benefit of other crops that were more profitable, two of the systems that relied entirely on second year corn (C-C-S and continuous corn) lost approximately $30,000 to $44,000, respectively.

By Crop

In general, production was very good for alfalfa and wheat and was average or a little better for soybean and corn (Tables 3-6). All crops met or exceeded their targeted yield goals (alfalfa, 157%; wheat, 132%; soybean, 106%; and corn, 98%; crop average, 123%).

Alfalfa produced the largest dry matter yield (9 ton/ac), followed by corn (5-6 ton/ac), then wheat and soybean (2 ton/ac) as shown in Figure 3. Wheat out yielded soybean this year by a little more than 0.5 ton/ac (2.3 vs. 1.7 ton/ac).

Growing soybean after wheat instead of corn (Table 4) increased grain yield by 6% (3 bu/ac). Three corn systems were second-year corn and all yielded between 9 and 27 bu/ac (5-16%) less than corn in the C-S system (Table 6).

All crops except corn had positive net economic returns (Figure 4). Alfalfa generated $320/ac, soybean $90/ac, and wheat $45/ac in net economic return, but second-year corn lost an average of $35/ac averaged across all systems.

Per acre input costs this year ranged from $40 to 175 (alfalfa, $40;

wheat, $82; soybean, $97, and corn, $175). Field operation costs were $50/ac for soybean, $67/ac for wheat, $100/ac for corn, and $147/ac for alfalfa. Drying and/or dockage expenses came to $14/ac for wheat and $36/ac for corn.

Crop Quality

Grain and forage nutrient compositions are summarized in Table 7. Soybean dry matter protein and oil concentrations were 34 and 20%, respectively. This oil concentration is similar to the recommended levels preferred for soybean processors and foreign export, but protein levels are nearly 6% lower. Our station recorded heat units this season that were 92% of normal which probably contributed to the low protein level in soybean.

The dry matter protein for wheat appears good (16.4 %), but about 40% of the samples were below the 14% threshold used to dock for low protein on a fresh weight basis. Drying costs were incurred for corn which was harvested at three to four points above the local elevator threshold for moisture content. Test weights among grain crops were all well above the dockage criteria for grain density. Bushel weights were heaviest for wheat at 61 lb/bu and 57 to 58 lb/bu for soybean and corn.

Alfalfa hay was harvested four times this year. Its quality was good for the late spring and early summer cuttings and high for the late summer and fall harvests. Moisture contents ranged from 13 to 19%.

Crude protein contents were 17 to 21% and crude fat averaged about 2%. Non-fiber carbohydrate contents were 25 to 29% for the first three cuttings then increased to 37% in the fall. Total digestible nutrients ranged from 57 to 67%.

Relative feed values (RFV) averaged 119 to 171 and relative feed quality (RFQ) averaged 126 to 185. Quality grades for alfalfa were good for the first two cuttings, premium for the third, and supreme in the fall based on RFQ values. Comparable ratings using RFV criteria were fair to good for the first three cuttings and premium in the fall.

SUMMARY

The second year of establishing eight new cropping systems continued in 2004. The value of a cool season perennial forage legume like alfalfa was remarkable this year. The stacked rotation (C-C-S-S-W-W) produced 85% as much crop and was 75% as profitable as the C-S control system. Soybean performance was as good as or slightly better when it was grown following wheat than corn by the end of its first complete rotation cycle.

Six cropping systems (75% of those tested) generated positive whole farm net economic returns. Alfalfa and soybean were the most profitable crops this year. Two systems had negative whole farm net economic returns and they were both essentially monocultures of second-year corn. Profitability was somewhat low overall, partly because extra phosphorus fertilizer was applied to all systems to help build soil test levels during this phase of the study.

ACKNOWLEDGEMENTS

The South Dakota Soybean Research and Promotion Council and the South Dakota Wheat Commission both provided grant funds in 2003 to help establish this study.

Additional support to initiate this project in 2003 and continue it in 2004 was provided by the South Dakota Agricultural Experiment Station and the Southeast South Dakota Experiment Farm Corporation. Laboratory analyses this year for soybean and wheat were conducted by Kevin Kirby and Jesse Hall, Plant Science Department and alfalfa was done at the Oscar E. Olson Biochemistry Laboratory at South Dakota State University in Brookings SD.

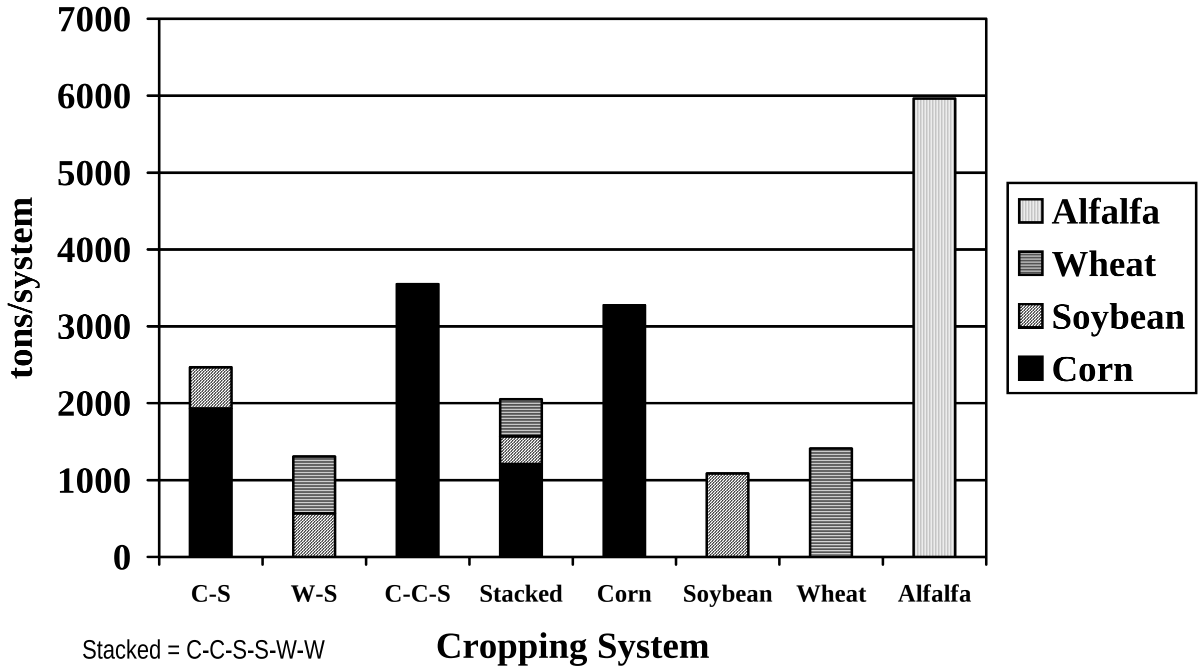

Figure 1. Second year whole farm dry matter crop production for alternative cropping system study. Southeast Research Farm; Beresford, SD; 2004.

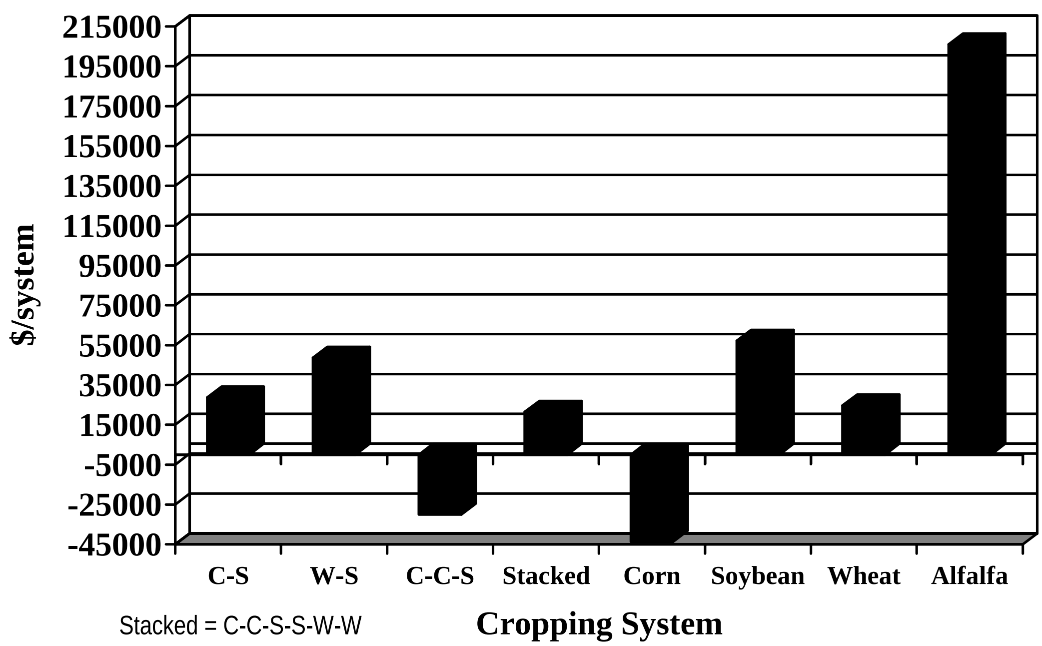

Figure 2. Second year whole farm net economic return for alternative crop rotation system study. Southeast Research Farm; Beresford, SD; 2004.

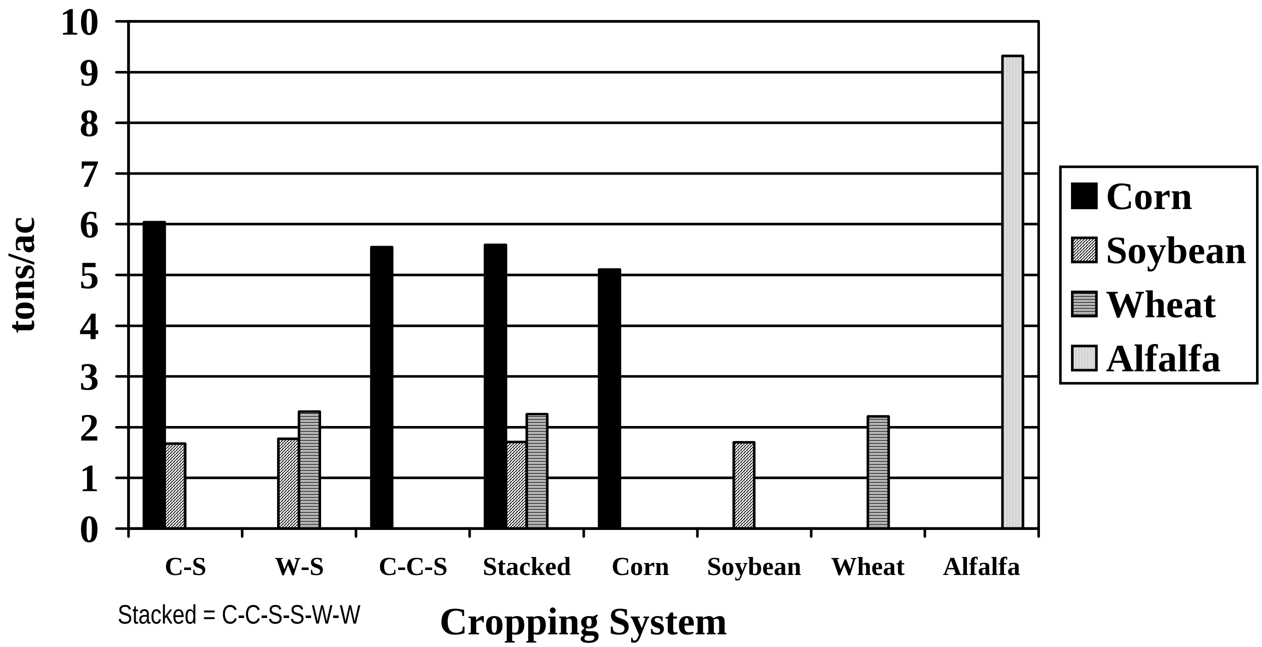

Figure 3. Second year dry matter production by crop for alternative cropping systems. Southeast Research Farm; Beresford, SD; 2004.

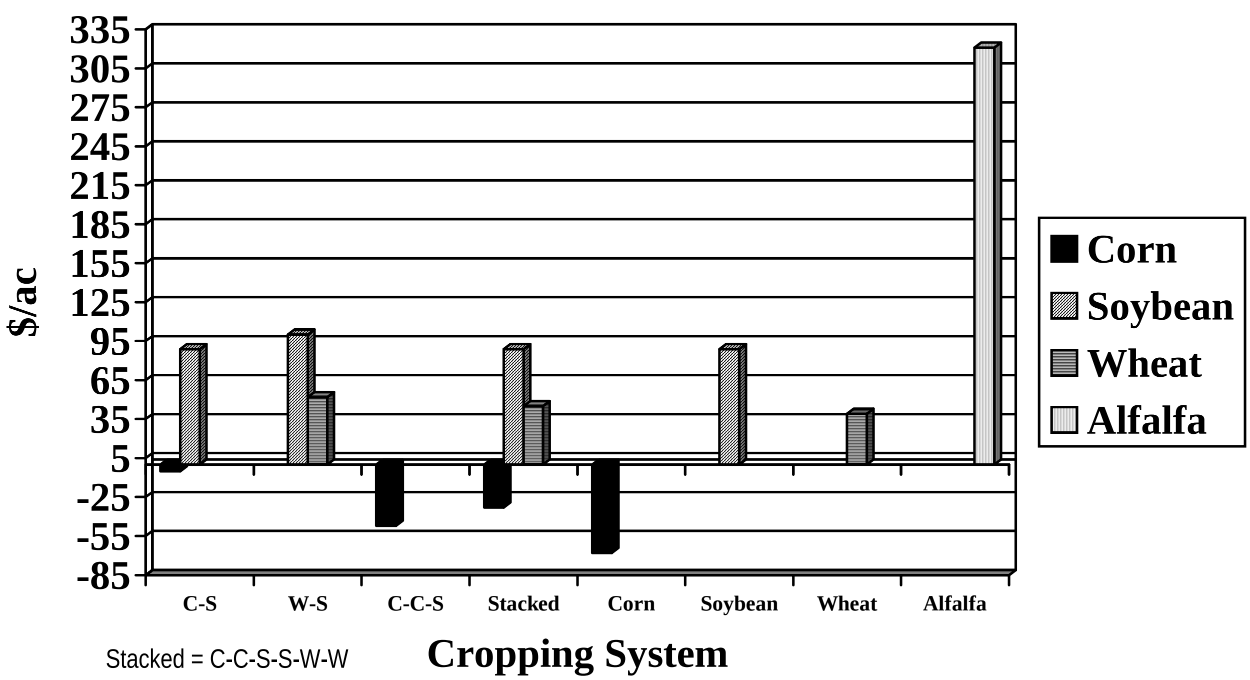

Figure 4. Second year net economic return by crop for alternative cropping systems study. Southeast Research Farm; Beresford, SD; 2004.

Table 3. Alfalfa performance in second year of alternative cropping systems study; Southeast Research Farm; Beresford, SD; 2004.

Rotation	Total DM Annual Production [1]	Average Moisture Content	Gross Income	Net Economic Return
	ton/ac	%	- - - - - -$/ac - - - - -	
Continuous Alfalfa – Avg.	9.30	16.2	509	322
Range	2.02	11.7	101	101
Std. Dev.	0.90	3.0	44	44

Previous crop (2003) = alfalfa; Count = 4 observations
[1] At 0% moisture (total of four cuttings)

Table 4. Soybean performance in second year of alternative cropping systems study; Southeast Research Farm; Beresford, SD; 2004.

Rotation	Plant Height	Plant Population	Grain Yield [1]	Moisture	Test Weight	Gross Income	Net Economic Return
	inch	plants/ac	bu/ac	%	lb/bu	- - - - -$/ac - - - - -	
Corn - Soybean	22.1	136,000	52	9.6	56.7	244	87
Soybean - Wheat	23.1	143,000	55	9.6	57.3	257	100
Stacked [2]	22.7	148,000	53	9.5	57.2	246	89
Continuous Soybean	24.5	145,000	53	9.6	57.0	247	89
Avg	23.1	144,000	53	9.6	57.1	249	91
Range	5.1	54,000	12	0.2	1.4	58	58
Std. dev.	1.6	14,000	3	0.1	0.4	16	16

Previous crop (2003) = Corn-Soybean = Corn; Soybean-Wheat = Wheat; Continuous soybean and Stacked = soybean;   Count = 16 observations
[1] At 13% moisture and 60 lb/bu
[2]Stacked = Corn–Corn–Soybean–Soybean–Wheat-Wheat

Table 5. Wheat performance in second year of alternative cropping systems study; Southeast Research Farm; Beresford, SD; 2004.

Rotation	Plant Height	Tiller Density	Grain Yield	Moisture	Test Weight	Gross Income	Net Economic Return
	inch	tillers/ft^2	bu/ac	%	lb/bu	- - - - - $/ac - - - - -	
Soybean-Wheat	38	79	66	12.8	61.3	207	47
Stacked [2]	39	83	68	12.7	60.7	215	50
Continuous Wheat	40	83	65	12.8	61.2	204	39
Avg	39	82	66	12.8	61.0	208	45
Range	5	15	15	0.4	2.0	46	43
Std. dev.	2	5	4	0.1	0.7	12	11

Previous Crop (2003) Soybean-Wheat = Soybean; Stacked & Continuous Wheat = Wheat
Count = 12 observations
[1] At 13.5% moisture and 60 lb/bu
[2] Stacked = Corn-Corn-Soybean-Soybean-Wheat-Wheat

Table 6. Corn performance in second year of alternative cropping systems study; Southeast Research Farm; Beresford, SD; 2004.

Rotation	Plant Population	Grain Yield [1]	Moisture	Test Weight	Gross Income	Net Economic Return
	plants/ac	bu/ac	%	lb/bu	- - - - -$/ac - - - - -	
Corn-Soybean	24,400	169	18.7	57.5	295	(19)
Corn-Corn-Soybean	22,900	155	18.8	57.8	270	(42)
Stacked [2]	25,200	160	18.2	58.2	278	(28)
Continuous Corn	23,600	142	19.2	56.8	248	(63)
Avg	24,000	156	18.7	57.6	273	(38)
Range	4,800	69	1.5	2.7	121	105
Std. dev.	1,300	17	0.5	0.8	29	29

Previous crop (2003) = Corn – Soybean = Soybean; Corn-Corn-Soybean, Stacked and Continuous Corn = Corn;   Count = 16 observations
[1] At 15% moisture and 56 lb/bu
[2] Stacked = Corn-Corn-Soybean-Soybean-Wheat-Wheat

Table 7. Crop quality for alternative cropping systems study (dry matter basis[1]); Southeast

Research Farm; Beresford, SD; 2004.

Crop		Protein	Oil				
		%	%				
Soybean	**Avg**	34.3	19.9				
	Range	1.8	1.1				
	Std. Dev.	0.5	0.3				
Wheat	**Avg**	16.4	---				
	Range	1.1	---				
	Std. Dev.	0.3	---				
Alfalfa[2]		**Crude Protein**	**Crude Fat**	**Non Fiber Carbo-hydrate**	**Total Digestible Nutrients**	**Relative Feed Value**	**Relative Feed Quality**
		%	%	%	%		
1st cut	**Avg**	17.4	1.7	28.5	59	126	126
	Range	0.7	0.4	4.4	2.8	12	10
	Std. Dev.	0.3	0.2	1.8	1.2	5	4
2nd cut	**Avg**	19.1	1.9	25.4	56.9	119	126
	Range	2.4	0.4	3.4	4.1	20	21
	Std. Dev.	1.1	0.2	1.5	1.8	9	10
3rd cut	**Avg**	20.5	2.0	28.6	62.0	140	152
	Range	1.9	0.2	1.9	3.2	17	24
	Std. Dev.	0.8	0.1	0.8	1.5	8	11
4th cut	**Avg**	18.4	2.4	36.9	66.9	171	185
	Range	1.2	0.4	4.3	5.0	32	29
	Std. Dev.	0.5	0.2	1.9	2.2	14	12

[1]Dry matter contents: 94.8% for soybean, 16 observations; 87.4% for wheat, 12 observations; 84.1% for 1st cut alfalfa, 87.4% for 2nd cut alfalfa, 81.1% for 3rd cut alfalfa, 82.7% for 4th cut alfalfa, 4 observations; corn not tested.

[2] Precipitation on alfalfa while curing in windrow: 1st cut, 0.54”; 2nd cut, 0.00”; 3rd cut, 0.24”, and 4th cut, trace.

AERWAY® TILLAGE SYSTEM COMPARISON

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INTRODUCTION

Two experiments have evaluated the Aerway® conservation tillage system at Southeast Research Farm the past two years. This report directly compares Aerway tillage with no-till and conventional tillage systems for 2004 showing whole farm and each crop's agronomic and economic performance for C-S rotation systems. The second experiment tests whether the season that Aerway tillage is done affects crop performance and is reported separately (*Aerway Tillage Timing Study*, p. 38).

METHODS

This experiment is a companion study based on the two-crop (C-S) rotation systems in our long-term tillage and crop rotation trial (*Tillage and Crop Rotations for Eastern South Dakota*, page 11).

All corn stalks were chopped in the fall after the 2003 harvest. Corn and soybean were both Aerway tilled (AT) last fall and again just before planting this spring. Soil was not disturbed in the no-till (NT) system, except slightly during planting. Conventionally tilled (CT) corn and soybean were disked and chisel plowed in the fall, field cultivated before planting this spring, and cultivated in June.

Liquid fertilizer (10-34-0 and/or 28-0-0) was applied for yield goals of 50 bu/ac for soybean and 160 bu/ac for corn based on 2003 soil test results collected from each plot last fall with extra phosphorus applied to increase soil P levels (Table 1). Phosphorus was broadcast before planting for both crops as well as part of the N needed for corn then incorporated in the AT & CT systems. The remaining N for corn was injected as a side dress application in early June.

Seed was planted in north-south rows spaced 30 inches apart with a 5700 White six-row planter. Grain was harvested at maturity using a Case/IH 2144 combine with a 20-ft wide soybean head and a 15-ft wide corn head from the center of each plot to avoid possible border effects from adjacent plots and measured with a weigh wagon.

Test weight and moisture content were recorded for one grain sample from each plot the day it was harvested. Soybean samples were later sent for laboratory analysis to determine dry matter, protein, and oil. Grain yields were standardized to a uniform moisture content of 13% for soybean and 15% for corn. Plant populations at harvest for both crops and soybean plant height were also measured.

Net economic return was calculated on a fresh weight basis using local market prices at harvest of $4.83/bu for soybean and $1.68/bu for corn less variable costs of inputs (seed, fertilizer, and herbicide), moisture dockage, and field operation costs. Rates charged were $5/ac for each broadcast application of herbicide or fertilizer and for field cultivating, $6/ac for disking and cultivating rows, $7.50/ac for side dressing N, $8/ac for chisel plowing, $10/ac for Aerway tillage, and $20/ac for shredding stalks (2004 Commercial Field Operation Rate Survey, SD Ag Statistics Service).

Plot size was 60 ft wide by approximately 300 ft long (0.42 ac/plot). Each treatment was replicated four times as a split-plot design with tillage as the main plot and crop as the subplot. Inferences were based on analysis of variance by crop using the General Linear Model in SAS (Statistical Analysis Software). Differences among treatment means were compared using Least Significant Difference (LSD) at the 90% probability level. Additional management information is summarized in Table 1.

RESULTS AND DISCUSSION

Differences in crop performance among tillage methods were minor again this season. Crop responses were typically more dramatic than tillage effects and no major crop by tillage interactions were noted among the traits measured.

Whole Farm

Total whole farm dry matter harvested was about 2,500 ton per system and was 76% corn (Figure 1). Total net economic return was nearly $52,000 per system with 78% generated by soybean (Figure 2). These three C-S rotations produced an average gross income of $282/ac. Input costs were $121/ac with field operation expenses of $67/ac and $13/ac drying costs, leaving a net economic return of $88/ac (data not shown).

By Crop

Soybean yield averaged 58 bu/ac and net economic return was $128/ac (Table 2). Aerway tillage was comparable to both NT and CT systems for every soybean response measured. Gross income for soybean averaged $269/ac with input costs of $91/ac and field operation charges of $50/ac.

Corn yield averaged 171 bu/ac with a net economic return of $48/ac (Table 3). Aerway and NT systems had about 2,000 more corn plants per acre than when conventionally tilled. Gross income for corn averaged $295/ac with input costs of $151/ac, moisture dockage of $25/ac, and $83/ac in field operation charges.

Input costs were typically at least $10/ac less for the conventional system mainly because reduced tillage corn had higher fertilizer N recommendations. Field operation charges for the no-till systems were $5/ac lower than conventional systems and 10/ac lower than Aerway tillage for these crops.

SUMMARY

This study detected little or no benefit associated with Aerway tillage compared to no-till or conventional tillage on a whole-farm basis or in either crop of a C-S rotation. Both crops yielded well, even though the corn populations were a little low.

On a whole farm basis these systems produced an average of 4 ton/ac of dry matter grain with a net economic return of $88/ac. Corn produced three times more grain and had $25/ac more gross income than soybean, but soybean was nearly $80/ac more profitable.

Time and energy spent performing Aerway or conventional tillage operations did not enhance crop production or profitability compared to no-till management in 2004. Claims that Aerway conservation tillage performs better than no-till or conventional tillage were not confirmed during the second year of this experiment.

ACKNOWLEDGEMENT

Support for this project was provided by the South Dakota Agricultural Experiment Station and the Southeast South Dakota Experiment Farm Corporation. Laboratory analyses for soybean and wheat were provided by Kevin Kirby and Jesse Hall, Plant Science Department and alfalfa was analyzed by the Oscar E. Olson Biochemistry Laboratory, at South Dakota State University in Brookings, SD.

Table 1. Management summary for Aerway® tillage C-S rotation study (3-2). Southeast Research Farm, Beresford, SD; 2004.

2004 Crop		Soybean	Corn
Variety/Hybrid		Prairie Brand 2141RR	DKC58-24
Seeding Rate		166,400 (seeds/ac)	27,900 seeds/ac
Planting Date		May 11	April 23
Fertilizer [1]	**NT**	24-88-0	149-217-0
	AT & CT	24-88-0	127-189-0
Tillage:	**NT**	None	None
	AT	April 19 (10º angle, 6.5 mph)	April 19 (10º angle, 6.5 mph)
	CT	Field cultivate on April 19 Cultivate rows on June 21	Field cultivate on April 19 Cultivate rows on June 21
Herbicide		Roundup, Post	Roundup, Post
Insecticide		Proaxis, Post	None
Harvest Dates		October 4	October 26
Soil Test[2]		0 to 6 inch depth: Organic matter = 3.3%, Olsen P = 10 ppm, K = 302 ppm, pH = 5.9, salts = 0.3 mmho/cm 0 to 24 inch depth: $N0_3$-N = 38 lb/ac	

[1] N – P2O5 – K2O in lb/ac;
NT = no-till, AT = Aerway® till, CT = conventional tillage
[2] Fall 2002

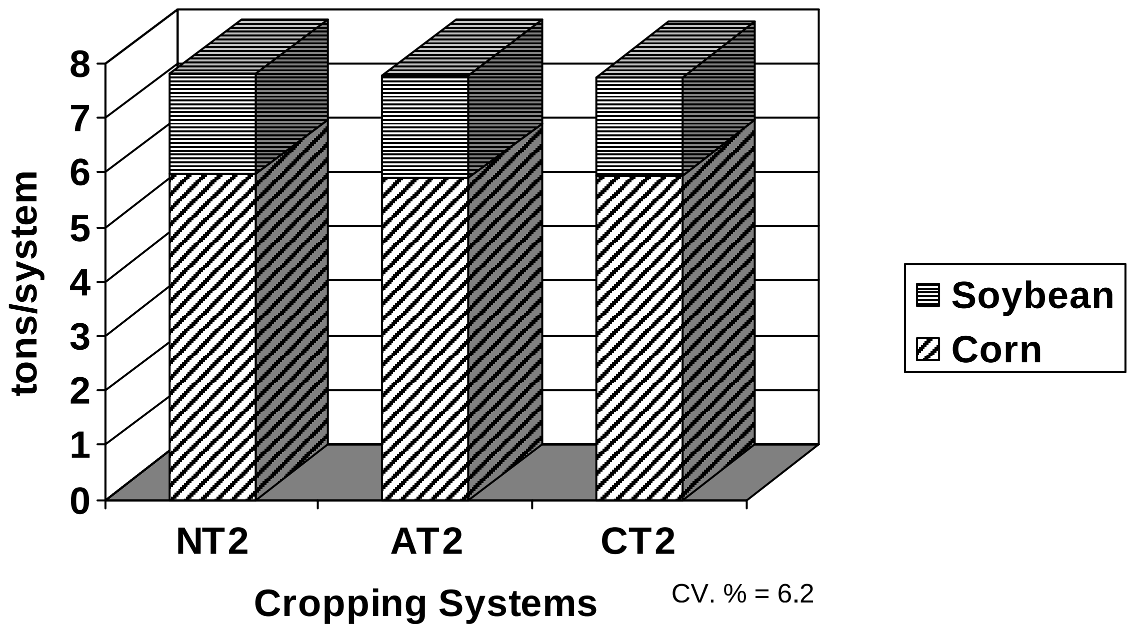

Figure 1. Total whole farm dry matter production for three tillage systems. Southeast Research Farm; Beresford, SD; 2004.

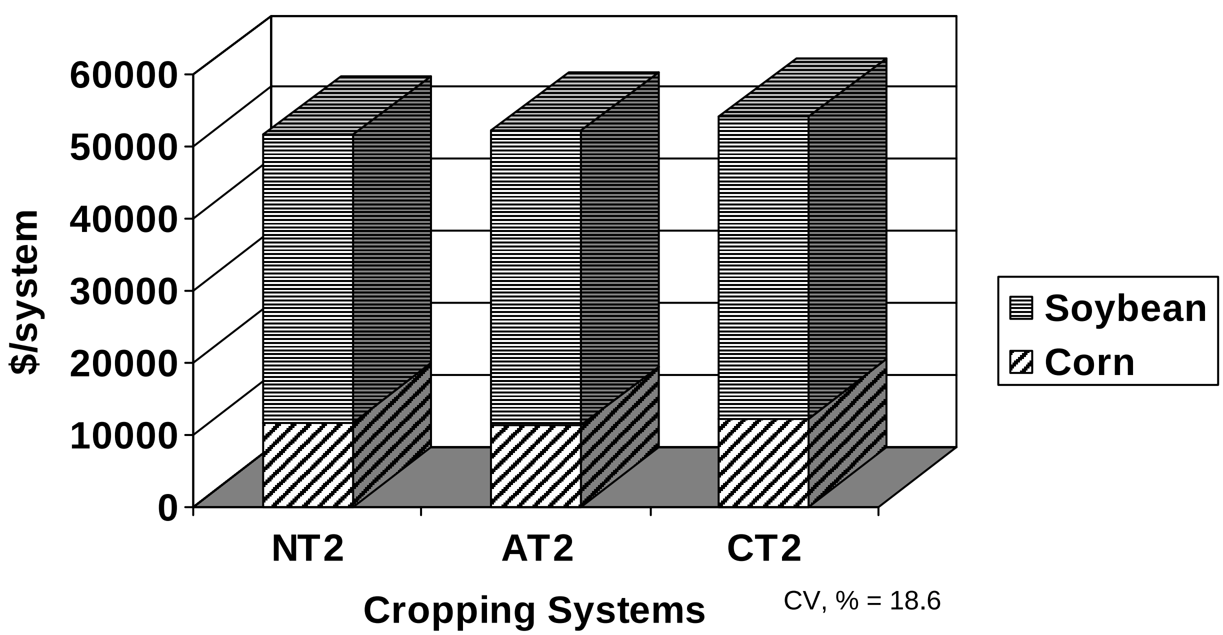

Figure 2. Whole farm net economic return for three tillage systems. Southeast Research Farm; Beresford, SD; 2004.

Table 2. Effect of three tillage systems on soybean performance. Southeast Research Farm; Beresford, SD; 2004.

Tillage	Plant Height	Plant Population	Grain Yield[1]	Moisture	Test Weight	Gross Income	Net Economic Return
	inch	plants/ac	bu/ac	%	lb/bu	- - - - -$/ac - - - - -	
NT	27	148,000	58	9.3	57.6	268	125
AT	31	131,000	60	9.4	57.7	279	128
CT	29	144,000	56	9.3	57.3	261	131
Avg.	29	141,000	58	9.4	57.5	269	129
LSD $_{(0.10)}$	NS[2]	NS	NS	NS	NS	NS	NS
CV,%	12.9	9.3	4.2	1.1	0.5	4.1	8.7

[1] Grain yield at 13% moisture and 60-lb/bu test weight.
[2] NS = not significant

Table 3. Effect of three tillage systems on corn performance. Southeast Research Farm; Beresford, SD; 2004.

Tillage	Plant Population	Grain Yield[1]	Moisture	Test Weight	Gross Income	Net Economic Return
	plants/ac	bu/ac	%	lb/bu	- - - - - -$/ac- - - - -	
NT	24,000	173.1	17.1	58.4	297	36
AT	23,600	170.0	17.3	58.5	292	35
CT	20,400	170.9	17.6	58.2	295	38
Avg.	22,700	171.3	17.3	58.4	295	37
LSD $_{(0.10)}$	NS[2]	NS	0.3	NS	NS	NS
CV,%	12.2	6.0	1.4	1.1	6.1	43.6

[1] Grain yield at 15% moisture and 56-lb/bu test weight.
[2] NS = not significant

AERWAY® TILLAGE TIMING WITH AND WITHOUT SOYBEAN INSECT CONTROL

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INTRODUCTION

The Aerway® conservation tillage system uses a tillage implement with adjustable rows of heavy metal shatter tines to aerate and fracture the topsoil. This reportedly enhances the productivity of field and vegetable crops, pastures, orchards, vineyards, and golf courses. It can also incorporate agricultural chemicals and livestock manure and may help correct problems with soil compaction (AerWay Inc.).

The performance of this tillage system on a field scale corn-soybean rotation in 2004 is summarized in this report. This study is designed to measure the long-term impact of using this implement in the fall, spring, both seasons, and not at all on grain production, quality, and profitability of each crop and on a whole farm basis. It also monitors efforts to control insects in the soybean field during the growing season.

We also conduct another study to show how the Aerway system compares directly with conventional and no-till systems on a smaller scale (*Aerway® Tillage System Comparison*, page 32).

METHODS

Two fields (24 and 50 acres) with a history of no-till or modified ridge-till production as a corn-soybean rotation for more than a decade are used for this project.

Each field is divided into 14 plots 60 ft wide by approximately 1,200 (field 3-1A) and 2,500 ft long (field 3-4). End rows and the outside perimeter plots are considered fill or border areas (data not shown). The middle 12 research plots were specifically assigned to four tillage treatments - each replicated three times as a completely randomized block design.

Fall Aerway tillage treatments were first established for both fields on November 21, 2003. Spring treatments were done on April 14 and 15, 2004. Tillage first started in the spring of 2003 in field 3-4. Seed was planted in 30-inch rows with a 5700 White six-row planter.

Insecticide was commercially applied to the soybean field in alternating 60-ft wide strips using 0 or 15 gal/ac of total volume on August 12, 2004 to protect against light to moderate levels of bean leaf beetle, soybean aphid, and grasshoppers.

Grain was harvested at maturity using a Case/IH 2144 combine with a 20-ft wide soybean head and a 15-ft wide corn head. Every harvest pass was tracked as separate loads then averaged by plot (three loads per plot for soybean and four loads per plot for corn). The middle harvest pass of each soybean plot was a 50% blend (±) of sprayed (+) and nonsprayed (-) areas.

Yield and moisture data were spatially recorded and continuously measured during harvest at one-second intervals using an AFS Universal Yield Monitor with DGPS signal correction. Grain yields were standardized to uniform moisture contents of 13% for soybean and 15% for corn, then averaged for whole farm yield on a 100% dry matter basis.

Sub samples of grain were collected from one harvest pass in each plot to monitor grain quality. One sample was collected for each corn plot. Four samples were collected while harvesting the middle load of each soybean plot. Test weight and moisture content were measured for sub samples of both crops. Protein and oil concentrations for soybean were later determined with Near Infrared Reflectance Spectroscopy.

Partial economic return was calculated using local USDA/FSA loan rates for the market prices ($4.88/bu for soybean and $1.80/bu for corn) on a fresh weight basis. Variable costs were subtracted for seed, fertilizer, and pesticide inputs – including application charges for spraying – and commercial field operation costs (2004 Commercial Field Operation Rate Survey, SD Ag Statistics Service) for tillage, planting, spraying, combining, and soil sampling. A cost of $10/ac was charged each time an area was Aerway tilled.

Inferences are based on analysis of variance using the SAS (Statistical Analysis Software) General Linear Model as a completely randomized block design for whole farm and both crop enterprises. Crop by tillage interactions were also tested. Soybean data were analyzed for tillage by spray treatment interactions. Differences among treatment means were compared based on Least Significant Difference (LSD). Grain quality responses are shown using simple summary statistics.

Additional management information is summarized in Table 1.

RESULTS AND DISCUSSION

This is the first year that all four tillage treatments were fully established in these fields with both crops grown at this scale in the same year. Last year we established the spring Aerway tillage treatments in the spring and fall + spring areas on corn stalks in field 3-4 before planting soybean in 2003 (Berg, et al., 2003).

Production: Grain production was excellent for both crops this year with average yields of 173 bu/ac for corn and 61 bu/ac for soybean (Table 2). These whole farm systems produced an average of three tons/ac of grain on a dry matter basis.

Some Aerway tillage treatments increased whole farm grain yield compared to no-till (p=0.052). Corn that was tilled in either the spring or both fall and spring before planting yielded 5 to 10 bu/ac more grain than corn that was not tilled or tilled only in the fall (p=0.042). In soybean a similar pattern produced 2 to 3 bu/ac more grain, but was not significantly different than the no-till system (p=0.386).

Spraying for insects increased soybean grain yield by about 2 bu/ac ($p < 0.0003$, Table 3).

Post emerge application of Liberty herbicide killed some off-type corn plants scattered randomly throughout this field. Our corn population at harvest averaged 23,300 plants/ac. This is approximately 84% of our seeding rate and likely prevented maximum corn production in this field.

Some parts of the corn field have very high soil test P and K levels from livestock manure applied decades ago while soil P status in the soybean field is low (Table 1).

There were no significant crop by tillage interactions or any significant tillage by spray treatment interactions for the soybean responses measured.

Economics: No-till systems were just as profitable as Aerway tillage treatments for each crop and on a whole farm basis (Figure 1). Net economic return for soybean was similar whether insects were controlled or not (+ vs. -).

Both crops generated about $300/ac of gross income, but soybean was nearly $70/ac more profitable than corn in terms of net economic return.

Quality: Corn grain contained nearly 20% moisture at harvest and ranged from 20 to 22% (Table 4). This resulted in moisture dockage for corn of about $30/ac. Soybean grain moisture averaged 9.5% at harvest and ranged from 9.1 to 12.6%. Test weights were similar for these crops at 56 to 58 lb/bu.

Soybean protein and oil concentrations averaged 35% and 20%, respectively on a dry matter basis. The range in these concentrations was 5% for protein and 2% for oil.

SUMMARY

This is the first growing season that all Aerway tillage timing treatments were fully established for these two fields. Both crops in this corn-soybean rotation yielded above average this year.

Timing this type of tillage in the either the spring or both fall and spring increased corn yield by 5% and enhanced whole farm grain production, but had little or no effect on soybean yield.

Raising soybean was more profitable than corn this year.

Spraying insecticide increased soybean grain yield by 3%. Spraying was just as profitable as not spraying. Field scouting indicated that low to moderate soybean insect pest levels were present. We could have gotten by without spraying insecticide on this field this year, but doing so provided a cost effective way to protect against a potentially damaging threat.

Our simple economic strategy only accounts for some of the revenue and variable costs associated with these enterprises. Fixed costs for land and equipment as well as additional federal farm program benefits have not been considered in this analysis.

ACKNOWLEDGEMENTS

This project was sponsored by the Southeast South Dakota Experiment Farm Corporation and the SD Agricultural Experiment Station. Soybean laboratory analysis was performed by Jessie Hall and Kevin Kirby of the Plant Science Department at South Dakota State University in Brookings, SD.

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Table 1. Management summary for Aerway® tillage timing study. Southeast Research Farm, Beresford, SD; 2004.

Crop (Field)	Soybean (3-1A)	Corn (3-4)
Variety	Prairie Brand 2141RR	PIO 34N42 Herculex/LL
Seeding Rate	64 lb/ac (approximately 166,400 seeds/ac)	27,900 seeds/ac
Planting Date	May 19, 2004	April 28, 2004
Fertilizer, lb/ac $N-P_2O_5-K_20$	18-46-0 (as 18-46-0)	120-75-0 (as 18-46-0 & 28-0-0)
Herbicide	Roundup, Post (2 applications)	Harness Xtra, Pre; Liberty, Post
Insecticide	Proaxis, Post	BT+
Harvest Dates	September 30, 2004	October 29, November 2 & 3, 2004
Soil Test[1] 0 to 6 inch depth: 0 to 24 inch depth:	Olsen P = 4 ppm, K = 251 ppm, pH = 6.2, salts = 0.7 mmho/cm, texture = medium; $N0_3$-N = 27 lb/ac	Olsen P = 81 ppm, K = 561 ppm, pH = 6.5, salts = 0.4 mmho/cm, texture = medium; $N0_3$-N = 34 lb/ac

[1]Fall 2003

Table 2. Effect of Aerway® tillage timing on crop grain yield [1]. Southeast Research Farm; Beresford, SD; 2004.

Tillage	Whole Farm	Soybean	Corn
	ton/ac	bu/ac	bu/ac
No Till	2.99 [2]	59	168
Spring	3.14	62	176
Fall	3.04	61	170
Fall & Spring	3.18	62	178
Avg	3.08	61	173
LSD $_{(0.10)}$	0.11	NS [3]	6
CV, %	2.3	2.1	3.3

[1] Whole farm at 100% dry matter, soybean at 13% moisture and 60 lb/bu, and corn at 15% moisture and 56 lb/bu.
[2] Values are means of three observations per tillage treatment for each crop.
[3] NS = not significant

Table 3. Effect of spraying for insect control on soybean performance regardless of tillage treatments. Southeast Research Farm, Beresford, SD; 2004.

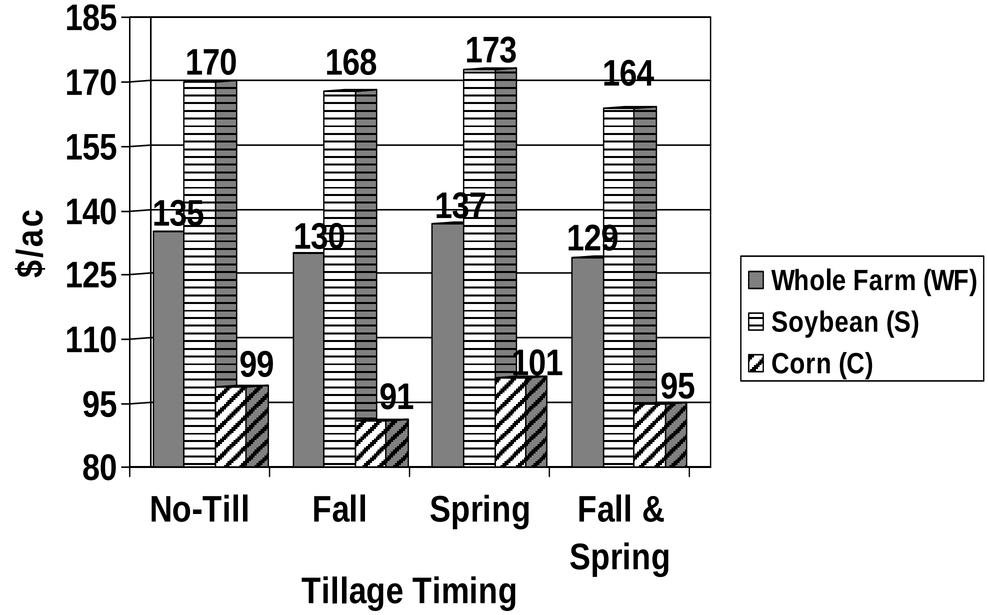
Spray	Grain Yield [1]	Net Economic Return [2]
	bu/ac	$/ac
–	59 [3]	165
+	61	166
LSD $_{(0.10)}$	1	5

[1] Grain yield at 13% and 60-lb/bu test weight
[2] Gross income at loan rate less variable costs for inputs and field operations marketed on fresh weight basis.
[3] Values are means of 12 observations per spray treatment

Table 4. Grain quality for Aerway tillage timing study. Southeast Research Farm, Beresford, SD; 2004.

	Moisture	Test Weight	DM [1] Protein	DM Oil
	%	lb/bu	- - - - % - - - -	
Soybean, Field 3-1A				
Average	9.5	57.5	34.8	19.6
Maximum	10.1	58.2	37.7	20.9
Minimum	9.3	55.9	31.7	18.7
Std. Dev.	0.2	0.4	0.9	0.4
Count	42	112	112	112
Corn, Field 3-4				
Average	20.4	57.3	ND [2]	ND
Maximum	21.7	58.1		
Minimum	19.9	55.6		
Std. Dev.	0.4	0.8		
Count	48	11		

[1] DM = 100% dry matter basis
[2] ND = not determined



LSD $_{(0.10)}$ = C= NS, S= NS, WF=NS CV (%): C=6.8, S=5.7, WF=2.2

Figure 1. Effect of Aerway tillage timing on the profitability of a corn-soybean rotation. Southeast Research Farm; Beresford, SD 2004.

FIELD PEA AS A CROP ENTERPRISE

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INTRODUCTION

Field pea is a versatile cool-season legume crop that grows well over a wide area including the northern Great Plains and upper Midwest. In addition to storing atmospheric nitrogen in the soil, field pea provides an excellent source of protein for human and livestock consumption. It can help diversify crop rotations including moving from a corn-soybean rotation into winter wheat and works well as a green manure crop. Field pea seedlings also tolerate freezing temperatures extremely well and dry peas are eligible for federal farm program benefits.

A field was established this year to evaluate field pea for integrated crop and livestock operations. Peas we raised this summer were fed in several swine research trials that are still being conducted and include treatments that compare it with distillers grains. Preliminary results from cropping field pea at our station in 2004 are briefly outlined in this report.

METHODS

Fifteen acres of ‘Toledo’ field pea were no-till planted into soybean stubble. Seed was inoculated with *Rhizobium leguminosarum* (Becker Underwood, Inc.; Ames, IA) and planted at approximately 300,000 seeds/ac (200 lb/ac). Seed and inoculant were provided by Dakota Lakes Research Station near Pierre, SD.

Grain was harvested with a combine at maturity and weighed for the entire field to measure yield. Grain samples were submitted for laboratory analysis to help determine its quality. The entire crop was used to prepare swine grow-finish rations for several research trials being conducted here at our station and at the SDSU campus.

Net economic return for this phase of the crop enterprise was calculated using the federal loan rate ($3.53/bu) without any loan deficiency payment (LDP). Costs were deducted for field operations at $10/ac for planting, $5/ac for spraying, and $15/ac for combining (2004 Commercial Field Operation Survey, SD Ag Statistics Service). Crop input costs were $35/ac for seed, $2/ac for inoculant, and $40/ac for herbicide.

Additional management information is summarized in Table 1.

Table 1. Management practices for the cropping phase of the field pea demonstration; Southeast Research Farm; Beresford, SD; 2004.

Variety	'Toledo'
Traits	green seeded, semi-leafless, determinant
Planting Date	April 5 & 6, 2004
Tillage System	No-till into soybean stubble
Fertilizer ($N-P_20_5-K_20$, lb/ac)	None
Herbicide *	Roundup + Dual II Magnum, PRE; and Roundup, AH
Harvest Date	July 23
2004 Fall Soil Test	0-6": pH = 7.4, Olsen P = 93 ppm, K = 539 ppm, salts = 0.6 mmho/cm, texture = medium; 0-24": NO3-N = 121 lb/ac, chloride = 60 lb/ac

* PRE = pre-emerge; AH = after harvest burn down

RESULTS AND DISCUSSION

This field was planted early, emerged well, and looked great throughout the early part of the season. Grass control was excellent; however, broadleaf weeds were common especially in a low spots and drainage ways where some peas drowned out during spring rains. Weed control looked very good in many parts of the field, but deteriorated a week or two after the peas bloomed in some areas. Downy mildew and bacterial blight were observed on some plants, but appeared late enough in the season that they probably had very little effect on yield.

Grain yield for the entire field averaged 55 bu/ac. Plants were generally 35 to 45 inches tall. Moisture content of the grain at harvest was 12.3% and test weight ranged from 54.5 to 57 lb/bu. They also averaged 25% protein, 1% fat, 3.7% ash, 6.8% fiber, and 64% nitrogen-free extract on a dry-matter basis (Table 2). Gross receipts amounted to $194/ac and field operations and input costs were $112/ac resulting in a positive net economic return of $82/ac.

Table 2. Field pea quality at Southeast Research Farm; Beresford, SD; 2004.

	Moisture	Protein	Fat	Ash	Fiber	N-free extract
	%	%	%	%	%	%
Average	12.3	24.9	1.0	3.7	6.8	63.6
Range	1.9	1.1	0.1	0.3	0.8	0.9
Standard deviation	0.6	0.4	0.04	0.1	0.3	0.4

Based on six observations and 100% dry matter basis)

Our soil test this fall indicates that the fertility is very good including enough residual soil nitrogen to produce almost 50 bu/ac wheat or 100 bu/ac corn. Livestock manure was last applied to this field in 1999 and we planted winter wheat in it this fall.

It is interesting to note that if the field size is adjusted to reflect the area actually harvested by subtracting a couple of places that were too weedy to combine, our pea yield was 68 bu/ac. This increases gross income by an additional $46/ac and gives a net economic return of $128/ac for this area.

Controlling broadleaf weeds better, marketing peas for human consumption, or collecting a federal loan deficiency payment would also improve the profitability of growing field peas.

Value can be added by feeding the crop to livestock, especially when the cost of protein like soybean meal is high. Previous research has shown that feedlot cattle and swine in South Dakota both perform well when fed rations containing field peas. Grow-finish swine trials currently being

conducted should help refine and provide additional information for swine enterprises.

SUMMARY

This study demonstrated that field pea was successfully grown in southeast South Dakota in 2004. The cool, wet weather this spring provided nearly ideal conditions for raising this pulse crop with a conservative yield estimate of 55 bu/ac and potential for 70 bu/ac or more with improved weed control. Pea yield was generally comparable to spring wheat and as good as or better than soybean. Growing field pea was also profitable this year even though parts of the field drowned out and was weedy in places.

We plan to repeat this study again next year and present the results of our winter wheat and swine research trials currently under way in future reports.

ACKNOWLEDGEMENTS

Support for this research was provided by the South Dakota Agricultural Experiment Station and the Southeast South Dakota Experiment Farm Corporation. Quality analyses for our field pea were conducted by the Oscar E. Olson Biochemistry Laboratory at South Dakota State University in Brookings, SD. Marty Draper Extension Plant Pathologist at SDSU characterized diseases in this field. Robert Thaler and Hans Stein are currently conducting several grow-finish swine research trials using the field pea produced from this project.

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SE FARM REPORT SDSU

SOYBEAN ROW SPACING STUDY

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Southeast Farm 0406

INTRODUCTION

This experiment measures the performance of soybean grown at five uniformly spaced row widths for the second consecutive year. It was designed to help answer some of the crop row spacing questions our station receives each year. Previous research has shown that soybean often exhibits a 10% yield increase when grown in narrow rows spaced six to 15 inches apart in our area as long as diseases or other factors are not limiting.

METHODS

Soybean was planted at approximately 162,000 pure live seed per acre in five row widths (7.5, 15, 22.5, 30, and 37.5 inches) with a John Deere 750 drill. Plot size was 20 ft wide by 176 ft long. Each treatment was replicated four times as a randomized block design.

Grain was harvested at maturity from a 12.5 ft wide strip in the middle of each plot with a John Deere 3300 plot combine that has an electronic scale and load cell to weigh grain. Plant height, population, grain moisture content, test weight, protein, and oil were also measured for each plot.

Inferences are based on analysis of variance using the General Linear Model in SAS (Statistical Analysis Software) as well as linear regression. Differences among treatment means were also compared with Least Significant Difference (LSD) at the 90% probability level. Additional management information is summarized in Table 1.

Table 1. Management practices for soybean row spacing study; Southeast Research Farm; Beresford, SD; 2004.

Previous Crop	Corn
Tillage System	Conventional
Variety	Sands of Iowa SOI 226RR
Planting Date	May 20
Herbicide	Dual II, pre; Roundup & Select; post
Insecticide	None
Date Harvested	October 5

RESULTS AND DISCUSSION

Overall soybean production was very good and significant differences among row widths apparently influenced grain yield and plant population this season. Soybean grain production increased in a linear manner as the distance between rows widened (Figure 1). This amounted to a 5 bu/ac (10%) yield increase from the narrowest to the widest row spacing. Plant height and grain quality responses were not affected by row widths in this study (Table 2).

Plant population was consistent but relatively low at approximately 100,000 plants/ac for the 7.5 to 30 inch spacings, then increased about 25% for the 37.5-inch rows (Figure 2). The yield increase associated with the widest row spacing suggests that low plant density limited grain production in the other row widths. This is also evident by the effect of plant population directly on grain yield (Figure 3).

In 2004 many plants in the mid to late vegetative stages had moderate to strongly puckered leaves. This lasted the rest of the season and was especially obvious in the western part of this trial, although it generally affected nearly all the plots to some extent. This symptom was not rated for every plot, but it did not seem to vary by row spacing. Tissue samples tested negative for bean pod mottle virus. Possible causes may have been pesticide drift, residual contamination in a sprayer, or some other disease or environmental effect.

The same variety had a 40% yield increase this season compared to last year and did so with 25% fewer plants (Table 3). The first year plant population was 88% of the seeds planted compared to about 66% in 2004.

Protein level in 2004 was considerably lower than last year (36 vs. 41%) and the oil concentration increased moderately about one percentage point from 18% last year to 19.4% in 2004. Most of this seasonal variation reflects climatic differences the past two years as well as possible nutrient or other soil factors between the two fields being used for this experiment.

SUMMARY

Soybean production was excellent this year even though the plant population may have been somewhat inconsistent among treatments and relatively low for optimum crop performance. Enhanced grain production for soybean grown in wider rows is exactly the opposite response we would expect in this study. Last year's trend was more typical with at least a 15% yield benefit from drilling soybean in 7.5-inch rows compared to the other widths. Plant populations were also greater and more consistent among row spacings in 2003.

Results this year emphasize the tremendous ability of soybean to compensate in terms of yield at moderately low plant populations. It also underscores the differences that can occur in crop performance between growing seasons.

By using the same piece of equipment to establish all treatments in this study we prevent potentially confounding results that could occur by seeding with more than one type of planter as is sometimes reported in the literature for research experiments like this.

ACKNOWLEDGEMENTS

Support for this project was provided by the South Dakota Agricultural Experiment Station and the Southeast South Dakota Experiment Farm Corporation. Soybean laboratory analyses were provided by Kevin Kirby and Jesse Hall, Plant Science Department at South Dakota State University. Bean Pod Mottle Virus testing was provided by Marie Langham's staff. The W.E.E.D. project evaluated plant symptoms.

Table 2. Effect of row spacing on soybean plant population and quality. Southeast Research Farm; Beresford, SD; 2004.

Row Spacing	Plant Population	Grain Moisture	Test Weight	DM[1] Protein	DM Oil
inch	plants/ac	%	lb/bu	- - - - % - - - -	
7.5	110,000	10.1	56.6	35.2	19.6
15	93,000	9.5	56.7	35.8	19.3
22.5	102,000	9.7	56.7	35.9	19.3
30	100,000	9.7	57.0	35.3	19.5
37.5	135,000	9.7	57.1	36.0	19.3
Avg.	108,000	9.7	56.8	36.1	19.4
LSD $_{(0.10)}$	14,000	NS[2]	NS	NS	NS
CV,%	10.5	3.3	0.5	2.4	1.4

[1] DM = 100% dry matter basis
[2] NS = Not significant
Mean values each based on four observations

Table 3. Effect of growing season on the performance of SOI 226RR soybean at Southeast Research Farm; Beresford, SD (2003 – 2004).

Year	Plant Height	Plant Population	Grain Yield	Grain Moisture	Test Weight	DM[1] Protein	DM Oil
	inches	plants/ac	bu/ac	%	%	%	%
2003	35.6	142,000	39	9.8	56.8	41	18
2004	33.8	108,000	55	9.7	56.8	36	19
%[2]	0.95	0.76	1.41	0.99	1.00	0.88	1.06

[1]DM = 100% dry matter basis
[2]2004 divided by 2003

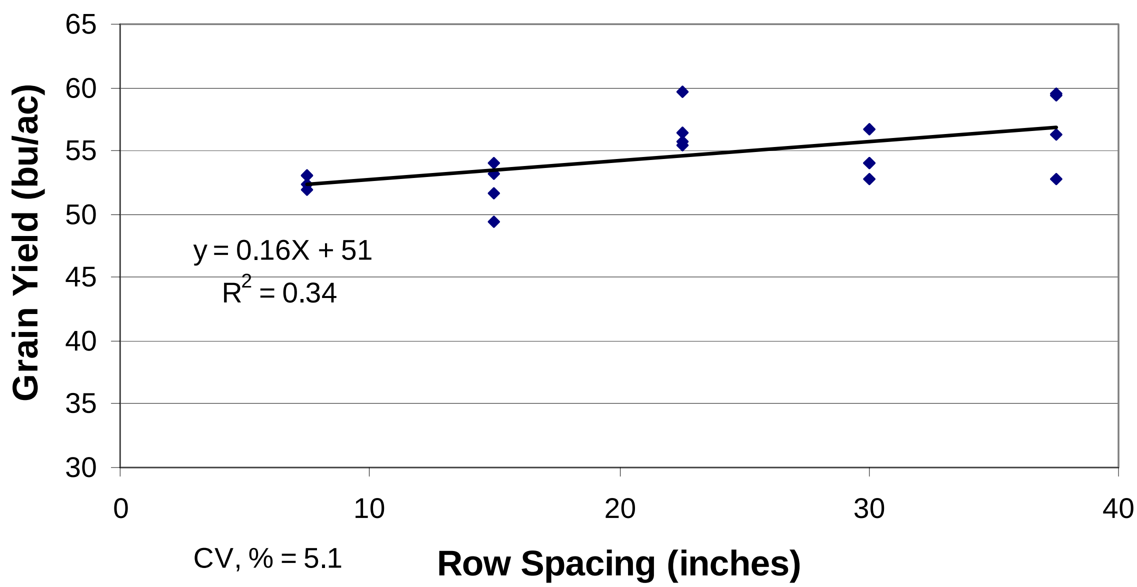

Figure 1. Effect of row spacing on soybean grain yield. Southeast Research Farm; Beresford, SD; 2004.

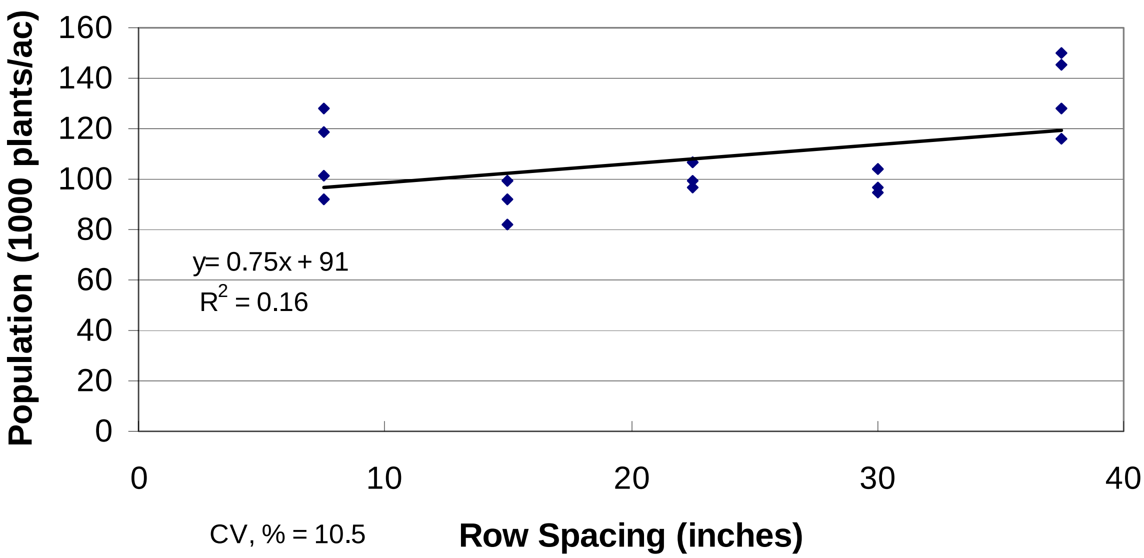

Figure 2. Effect of row spacing on soybean plant population.
Southeast Research Farm; Beresford, SD; 2004.

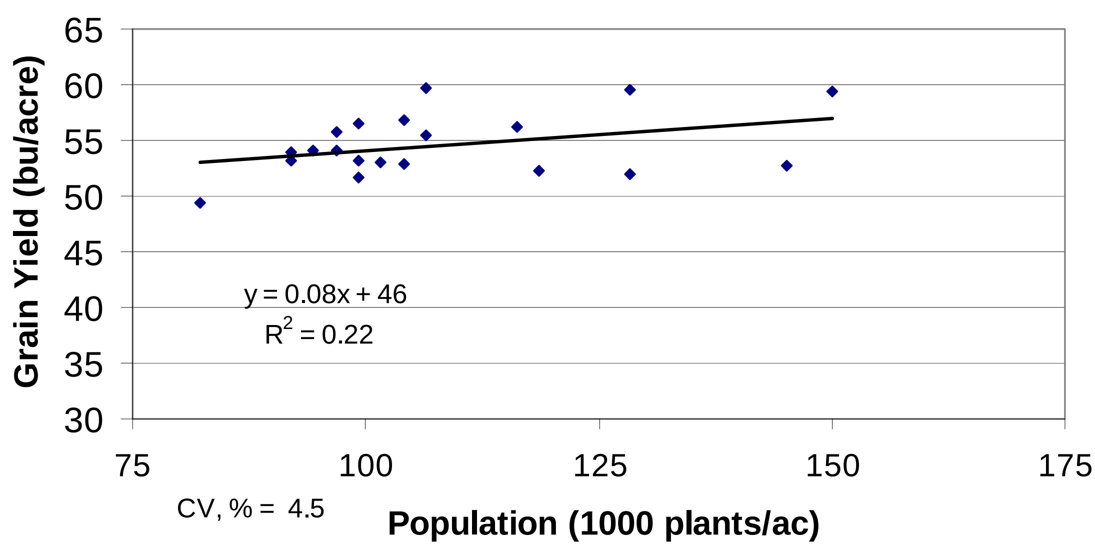

Figure 3. Effect of plant population on soybean grain yield.
Southeast Research Farm; Beresford, SD; 2004.

NITROGEN APPLICATION TIMING INFLUENCE ON CORN GRAIN YIELD AND RESIDUAL SOIL NITRATE-N, BERESFORD, 2004

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Plant Science 0407

INTRODUCTION

Many opportunities for application of nitrogen occur during the year. It can be applied from the fall after soybean harvest until side-dress when corn has six leaves. During this time, conditions for N leaching and/or denitrification can occur. These losses reduce N availability to corn and may reduce yield potential. A research project was initiated to measure the affect of N application timing on N availability to corn in a corn soybean rotation.

MATERIALS AND METHODS

A site was selected on the Southeast Research Farm near Beresford SD. Five application timings and a 0 N check were included in a randomized complete block plot design with four replications. The intended N application timings were: 1) soon after soybean harvest (early fall = EF), 2) after soil temps cooled below 50 degrees F (late fall = LF), 3) during March or April (early spring = ES), 4) immediately before planting (late spring = LS), or 5) when the corn was at the six leaf stage (side dress = SD). Application dates for each timing treatment can be found in Table 1. No Tillage was done after the LF and ES urea applications, but all plots were tilled after the EF and LS applications that prevented volatilization losses from those timings. Urea was used for all treatments except the side dress treatment. Ammonium nitrate was used in the side dress treatment to prevent volatilization losses since plots were not cultivated. It was assumed that cool conditions during the LF and ES application times would minimize volatilization losses of N from these treatments. The nitrogen rate for all timings was 140 pounds per acre. The previous crop was soybeans. Roundup ready corn was planted on April 28, 2004 at 30,000 seeds/ac. Plots were harvested with a field plot combine. Soil samples were taken to a depth of 36 inches on June 19, 2003. Plot replications were composited for soil nitrate analysis.

RESULTS AND DISCUSSION

Nitrogen application increased grain yield (Table 1) from 143 bu/ac where no N was applied to an average of 174 bushels in the nitrogen treated plots. N application timing, however, did not significantly influence grain yield. The dry winter and spring conditions likely prevented any leaching and or denitrification losses. Soil samples taken on June 3 (Table 2) confirmed little or no N loss or movement below the top foot of soil. Little rain and snow in winter and early spring (table 3) did not result in conditions conducive to N losses this year.

ACKNOWLEDGEMENTS

Funding for this study provided by various sources including the South Dakota Agricultural Experiment Station, the South Dakota State University Plant Science Department, the Cooperative Extension Service, and the South Dakota State University Soil Testing Lab.

Table 1. N Application Timing Effect on Corn Grain Yield at the Southeast Research Farm; Beresford, SD; 2004.

N Application Timing	Date	Corn Yield
		bu/ac
Check	None	143
Early Fall (EF)	10/15/03	169
Late Fall (LF)	11/13/03	169
Early Spring (ES)	4/2/04	176
Late Spring (LS)	4/22/04	177
Side-dress (SD)	6/16/04	178
Pr>F		0.01
CV%		7.4
LSD $_{(.05)}$		19

Table 2. June Soil Nitrate Levels from Nitrogen Timing Study, Southeast Research Farm, Beresford; 2004.

Sample	N Application[1] Date				
Depth	None	10/15/03	11/13/03	4/2/04	4/22/04
Inches	lb NO_3-N[2]				
0-12	48	152	168	184	168
12-24	32	80	40	48	48
24-36	16	40	24	24	24
Total	96	272	232	256	240

[1]140 lb N

[2]sampled 6/3/03

Table 3. Rainfall at the Southeast Research Farm, Beresford, Nov.1, 2003 to Oct.31, 2004.

Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct
inches											
0.39	0.41	0.54	0.78	2.39	1.32	4.99	2.26	0.99	4.12	5.92	0.44

CROP NUTRIENT MANAGEMENT USING MANURE FROM RATIONS CONTAINING DISTILLERS GRAIN

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Plant Science 0408

INTRODUCTION

The rapid growth of the ethanol industry in South Dakota has a benefit of producing large amounts of a feedstuff in the form of distillers' grain. Utilization of the wet distillers grain (WDG) may lead to concentrated animal feeding operations (CAFOs) near the ethanol plants. Feeding of dry distillers grain (DDG) could lead to more feeding operations (especially ruminants) through out the state.

Distillers' grain is essentially corn with the starch removed resulting in a higher concentration of phosphorus (P) when compared to the original grain. Research has shown as dietary P increases above the animals P needs, excreted P increases. Therefore, manure from animal diets utilizing distillers' grain may be higher in P.

Manure has been shown to be an excellent source of plant nutrients. However, over application of manure near some CAFOs can lead to ground water (nitrate-N) and surface water (P) contamination. South Dakota has regulated land application of manure from CAFOs for a number of years based on crop nitrogen needs. Since the ratio of N to P in manure is much narrower than in grain, this can lead to over application of P because more P will be applied than is needed by the crop. Recently (December, 2002), the EPA has directed states to also consider P management in land application of manure.

There is a need to agronomically evaluate the SD Department of Environment and Natural Resources (DENR) rules (February, 2003) pertaining to manure application rates that are based on nitrogen and phosphorus. The producer needs to be assured that these rates will not limit yields when compared to commercial fertilizer application. In addition, buildup of soil nitrate-N and soil test P needs to be monitored.

Purpose:

To agronomically evaluate rates of distiller's grain derived manure based on nitrogen and phosphorus crop needs.

Objectives:

1) To determine if manure rates applied according to rules set by the SD DENR for CAFOs meet crop nutrient needs (grain yield and crop growth) as compared to commercial fertilizer.
2) To compare P buildup rates when manure is applied according to either the N or P needs of the crop.
3) To compare nitrate-N carryover from manure and commercial fertilizer.

METHODS

Two field sites were established to evaluate the study objectives. A site is located on an Egan soil just south of the office building at the Southeast Farm near Beresford on which beef feedlot manure was applied. The other site is located on the east Agronomy Farm at Brookings on Vienna-Lamoure soils (Range D-1) on which daily-scrape solid dairy cow manure was applied.

Beginning soil tests can be found in Table 1. The P soil test from the P manure treatment was used to calculate the manure needed for that treatment. If the P soil test is high enough where no P recommendation would be made, the average crop P removal was used to calculate manure P rate. Similarly, the nitrate-N soil test from the N manure treatment was used to calculate the manure needed for that treatment. Both the P and nitrate-N soil tests were used from the fertilizer treatment to make the phosphate and N recommendations for the fertilizer treatment.

The manure was applied on October 26, 2004 and incorporated with a disc within a few hours at the Beresford site and applied on October 16, 2004 and incorporated with a disc after five days at Brookings. The analysis of the beef feedlot manure and the dairy barn manure are given in Table 2. The treatments established and nutrients applied are listed in Table 3. Treatments were arranged in a randomized complete block design with four replications.

At Beresford, Asgrow 2403 soybeans were planted on May 28 in 30 inch rows. Harvest was completed with a plot combine on October 5. At Brookings, Producers Hybrid PH5613RR was planted in 30 inch rows on May 5 at 27,900 plants/ac. Harvest was completed with a plot combine on October 28.

RESULTS

In general, measurements for both sites trended higher (although not always significantly) with the manure treatments as compared to the fertilizer treatment (Table 4). Soybean grain yield was not significantly different due to treatment at Beresford. At Brookings, corn grain was significantly higher in the 2N manure treatment as compared to the fertilizer treatment. It is not yet clear why this result occurred.

Post-harvest soil tests at both sites indicate increases in nitrate-N, sulfate-S, Olsen P, K, and zinc with the higher two rates of manure (Table 5).

CONCLUSIONS

A number of years will be needed to draw conclusions for each of the objectives. The first two year's data indicate the manure rates were equivalent or higher than recommended fertilizer rates in producing grain yield. Soil test P increases are consistent with rate of applied P at both sites. Carryover nitrate-N levels were lower than expected on the high manure rate at the corn site (Brookings), probably because of the excellent yields.

ACKNOWLEDGEMENTS

These studies were funded in part by the South Dakota Corn Utilization Council.

Table 1. Soil tests[1] after first year of manure studies, 2004.

Treatment	O.M.	NO_3-N	SO_4-S	Olsen P	K	Zinc	pH	salts
Beresford site								
	%	-lb/ac in 2 feet-		------- ppm -------				mmho/cm
Check		30	24	5	225	0.75	6.7	0.5
Fert		32	24	6	216	0.67	6.0	0.3
P		36	26	5	231	1.33	6.0	0.3
N		61	64	10	284	1.45	6.4	0.4
2N		61	60	17	284	1.24	6.5	0.5
Brookings site								
Check		36	52	25	156	1.3	7.5	0.4
Fert		30	62	17	138	0.9	7.6	0.4
P		38	86	23	156	1.1	7.7	0.4
N		54	128	30	199	1.4	7.7	0.4
2N		61	84	25	223	1.2	7.7	0.4

[1] Samples taken 10/2/2003

Table 2. Manure nutrient analysis for manure studies, 2004.

Analysis	units	Manure[1] (as-is-basis): Beef (from apron)	Dairy (daily scrape with straw bedding)
Total N	lb/ton	18.1	9.7
Ammonia-N[2]	lb/ton	0.2	2.3 (0.5 avail because of tillage)
Organic-N[3]	lb/ton	17.9	7.4
Total Available-N[4]	lb/ton	9.1	4.2
P_2O_5	lb/ton	16.6	4.3
K_2O	lb/ton	12.3	5.8
Moisture	%	21	76

[1] Applied and analyzed in Fall, 2003.
[2] Percent ammonia-N retained is 90% and 20% if broadcast and incorporated within 24 hours and five days, respectively.
[3] Availability estimated at 33, 50 and 67% for year 1, year 2 and year 3 of application, respectively
[4] (Organic N * 0.5) + available ammonia N.

Table 3. Treatments and nutrients applied for manure studies, 2004.

Treatment	Manure applied[1]	Fertilizer N-P_2O_5-K_2O applied	Manure N-P_2O_5-K_2O applied
	ton/ac	---------------------- lb/ac ----------------------------	
		----------------------------- Beresford site (soybean) ---------------------------------	
check	0	0-0-0	0-0-0
Fertilizer	0	0-36-0	0-0-0
Manure – P[2]	0.5	0-0-0	4-8-6
Manure – N[3]	15.5	0-0-0	141-257-191
Manure - 2N[4]	31.0	0-0-0	282-514-382
		--------------------------- Brookings site (corn) -----------------------------	
check	0	0-0-0	0-0-0
Fertilizer	0	103-0-0	0-0-0
Manure – P[2]	12.8	44-0-0	54-55-74
Manure – N[3]	19.2	0-0-0	81-83-111
Manure - 2N[4]	38.2	0-0-0	162-166-222

[1] Applied Fall 2003

[2] P manure rate based on P recommendation from soil test or on P removal from crop, which ever is greater. An error was made on the calculation of the Beresford P manure treatment. The manure rate was based on P soil test rather than the replacement P rate.

[3] N manure rate is based on N requirement of 1.2 lb/bu for corn or 3.8 lb/bu for beans minus soil test nitrate-N and legume credit.

[4] 2N manure rate of twice the N rate above.

Table 4. Influence of manure and fertilizer on corn and soybean growth and yields, 2004.

	----------------------- Site					----------------------		
	Beresford – soybean					Brookings - corn		
	R1 leaf nutrient conc.[1]					V7		Grain
Treatment	N	P	K	Mg	Grain yield	weight	V12 height	yield
	------------ % ----------				bu/ac	grams	inches	bu/ac
Check	4.4	0.32	1.86	0.47	41	25.2	55.3	147
Fertilizer	4.1	0.32	1.79	0.38	45	28.7	58.8	151
Manure – P	4.6	0.35	1.87	0.38	44	30.3	59.5	152
Manure – N	4.6	0.37	1.98	0.45	47	32.7	63.9	166
Manure – 2N	4.5	0.36	2.05	0.42	48	30.6	65.4	172
LSD	0.28	0.03	0.18	0.065	5.0	2.4	2.6	18.2
Pr>F	0.02	0.04	0.07	0.02	0.14 (NS)	0.0001	0.0001	0.04
C.V %	4.1	6.5	6.2	7.1	7.4	11.4	6.0	7.5

[1] Only significant (Pr>F <0.10) nutrient concentrations presented.

Table 5. Soil tests[1] after second year of manure studies, 2004.

Treatment	O.M.	NO_3-N	SO_4-S	Olsen P	K	Zinc	pH	salts
				Beresford site				
	%	-lb/ac in 2 feet-		------- ppm -------				mmho/cm
Check	3.7	12	19	3	255	0.78	6.4	0.3
Fert	3.5	11	13	7	233	0.72	6.2	0.3
P	3.7	14	31	6	275	1.15	6.2	0.3
N	3.7	31	42	20	319	2.02	6.4	0.3
2N	3.7	48	61	35	407	1.88	6.6	0.3
				Brookings site				
Check	3.0	34	53	23	135	1.36	7.9	0.3
Fert	2.9	42	63	19	133	1.45	7.7	0.3
P	2.9	36	89	22	147	1.53	7.9	0.4
N	3.2	68	81	38	199	2.26	7.9	0.4
2N	3.3	63	99	48	223	2.53	7.9	0.4

[1] Samples taken 9/20/2004 and 10/19/2004 for Beresford and Brookings, respectively.

HOW FAR CAN BANDED PHOSPHORUS FERTILIZER BE PLACED FROM THE CORN ROW?

R. Gelderman, A. Bly, and J. Gerwing

Plant Science 0409

INTRODUCTION

With the advent of strip-till, some producers are applying their phosphorus (P) in the fall with the strip-till operation from 4 to 6 inches below the soil surface. When planting, the corn row is not always located directly over the previously applied fertilizer. In addition, some growers are applying starter P fertilizer at planting. However, because of interference of the fertilizer openers with the seed bed, some producers are moving the fertilizer openers away from the planting unit. In both cases the distance of the P fertilizer may be more than the standard recommendation of a 2 inch deep by 2 inch to the side of the row (2 x 2).

The objective of this study is to answer the question of “how far is too far” for banded P from the corn row by measuring P distance influence on early growth and grain yield.

METHODS

To answer the above question, two sites were established; one at the Southeast Research Farm near Beresford, and the other near Bushnell, SD. Some selected properties of each site are found in Table 1. Placement treatments of P included 2 x 2”, 2 x 4”, 2 x 6”, 2 x 10”, with the seed (0”), and a no P treatment. The P was placed relative to the seed by using single disk fertilizer openers fitted with both dry and liquid fertilizer tubes behind the shank. The seed-placed P treatment was applied directly in the seed furrow. Application rate was 40 lb P_2O_5/ac as either a liquid (10-34-0) or dry (11-55-0) (MAP) treatment. Plot size was 10’ (4 rows) by 50’. Plots were arranged in a split-plot design with fertilizer as the main plot and distance as the split. Measurements included V6 plant weight (dry), plant height at V12, and grain yield.

RESULTS – Beresford site

Plant early growth (V6 weight) was significantly increased when P was placed closer to the corn row (Table 2). The largest plants occurred when P was placed in the seed furrow. Type of fertilizer did not significantly influence early growth. However, type of fertilizer did influence the response of plants to the distance of the P from the row (Fig. 1).

Plant height response to distance of placed P followed the same trend as V6 growth but the differences between treatments were not as great

(Table 2). Fertilizer type did not significantly influence growth although it did influence the plant height response to the distance of the P from the row (Fig. 2).

Grain moisture averaged about 2.0% less if the P was placed with the seed compared to 10" away from the row (Table 2). The dry P fertilizer treatment produced slightly drier grain than the liquid fertilizer (data not shown).

There was a significant grain yield response (20 bu/ac) to the added P at this site (Table 2). However, placement of P had no effect on yield. Apparently, the plant made up for the poor early growth and obtained enough soil P to produce equivalent yields.

RESULTS – Bushnell site

Early plant growth was increased the closer (up to 2") P was placed to the corn row at the Bushnell site (Table 3). Placing P with the seed significantly decreased early growth as compared to the 2 x 2 placement at this site. Plant height at V12 was also increased the closer (up to 2") the P was placed to the seed but relative differences between treatments were not as great as at V6.

Ear moisture was about 1% less when P was placed at 2 x 2" compared to 2 x 10" (Table 3). Similar to the Beresford site, the early growth differences did not translate into grain yield differences at this site (Table 3). There was a significant grain yield response (~ 10 bu/ac) to added P but distance did not influence the response. However, there was a 6 bu/ac decrease (not significant) when P was placed at 10" away from the row compared to the 2" placement. Fertilizer or the fertilizer x distance interaction did not influence response to any of the growth factors measured at this site.

CONCLUSIONS

Early corn plant growth was increased by placing P within 2 inches of the row however; corn grain yield was not influenced by distance from the seed. The type of P fertilizer did not impact corn grain yield. Two similar studies will again be established next year.

ACKNOWLEDGEMENTS

These studies were funded in part by Deere and Company, the SDSU Plant Science Department, the Southeast Research Farm, and the South Dakota Agricultural Experiment Station.

Table 1. Site properties at the P distance studies, 2004.

Property	--------------- site ------------------	
	Beresford	Bushnell
Tillage	long-term no till	1st year no till
Soil texture	silty clay loam	loam
Previous crop	soybean	soybean
P soil test, ppm	6 (low)	3 (low)
Planting conditions	wet, high residue	ideal, low residue
Planting date/variety	4/27/04 DKC 58-24	5/4/04 DKC 47-10
Harvest	10/26/04, machine, 90'	10/14/04, hand, 40'

Table 2. Influence of distance of P band from corn row, Beresford, 2004.

Placement	V6 weight	V12 height	Grain moisture	Grain yield
	gms/8 plants	inches	%	bu/ac
No P	18	47	23.0	153
2" deep x 10"	18	50	22.5	171
" " 6"	22	54	21.9	174
" " 4"	28	57	21.7	174
" " 2"	35	59	21.0	174
(in furrow) 0"	48	61	20.6	176
$L.S.D_{(.05)}$	5.6	3.3	0.86	9.4
Pr> F				
Distance	0.0001	0.0001	0.006	0.81(NS)
Fertilizer	0.28(NS)	0.88(NS)	0.02	0.64(NS)
Dist. X Fert.	0.03	0.0001	0.10 (NS)	0.06(NS)
C.V. %	13.4	5.6	1.8	4.1
Sign. of P application	yes	yes	yes	yes

Table 3. Influence of distance of P band from corn row, Bushnell, 2004.

Placement	V6 weight	V12 height	Ear moisture	Grain yield
	gms/8 plants	inches	%	bu/ac
No P	36	51	25.9	190
2" deep x 10"	35	52	25.0	194
" " 6"	38	53	24.5	201
" " 4"	42	55	24.0	199
" " 2"	48	57	23.9	201
(in furrow) 0"	42	55	24.6	201
L.S.D$_{(.05)}$	4.0	1.8	0.79	9.3
Pr> F				
Distance	0.0002	0.0007	0.06(NS)	0.43(NS)
Fertilizer	0.83(NS)	0.38(NS)	0.17(NS)	0.74(NS)
Dist. X Fert.	0.81(NS)	0.97(NS)	0.34(NS)	0.58(NS)
C.V. %	12.7	16.7	4.0	4.9
Sign. of P application	yes	yes	yes	yes

Figure 1. Fertilizer and distance from row influence on V7 corn weight, Beresford, 2004

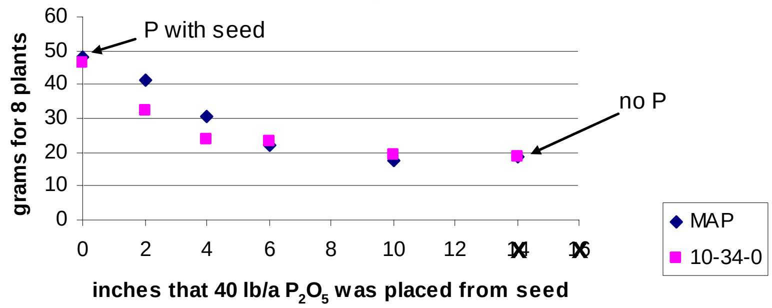
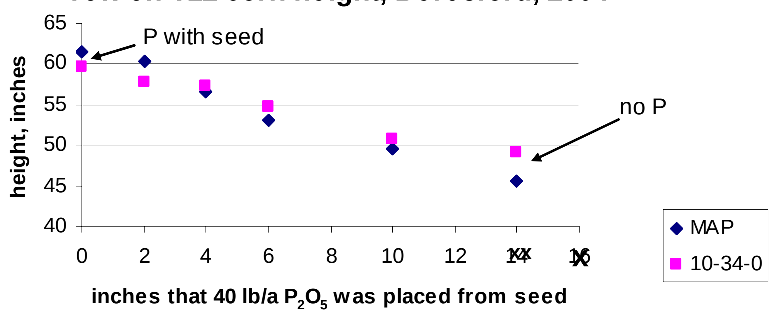


Figure 2. Influence of fertilizer and distance from row on V12 corn height, Beresford, 2004



LONG-TERM RESIDUAL PHOSPHORUS STUDY

R. Gelderman and J. Gerwing

Plant Science 0410

INTRODUCTION

This study was established in 1994 on a phosphorus (P) study site that was begun in 1964. The low soil test P treatment of this experiment has not received fertilizer P for 40 years.

The objectives of this study are:

1. To determine optimum P soil test level under residual P management and under management where P is added each year.

2. To determine maintenance levels of P as affected by initial P soil test levels.

3. To compare the influence of annual P placements (broadcast vs. band) upon crop yields.

METHODS

Four soil test levels (low, medium, high, and very high) were established by broadcasting phosphorus fertilizer (10-34-0) in the spring of 1993 and were incorporated with a chisel plow. Four replications with soil test P level as main blocks and annual P application rates (banded) as the split block were established. Another medium (M) soil test level was established to compare placement (broadcast vs. band) effects for annually applied P rates. Soybeans were planted in 1993. The stubble was moldboard plowed in the fall to further incorporate the applied P.

In 1994 the annual P rates for the medium broadcast block were incorporated before planting. Since that time they have been broadcast on the surface after planting. In 1994 five lb/ac zinc (as zinc sulfate) was applied on all plots. A no-till corn and soybean rotation has been established since 1995. In 1997 soybeans were drilled in 7.5 inch rows and the P row treatments were applied with the seed. Previously, soybeans had been planted on 30 inch rows with the banded P applied 2 x 2.

Dekalb DKC 58-24 RR2/YGCB corn was planted on April 27, 2004 at 30,100 seeds/ac with a plot planter. Annual band P treatments (0, 20, 40, 60 lb P_2O_5/ac) were applied at planting in a 2 x 2 placement. Broadcast P rates were hand applied to the soil surface immediately after planting. Plot size is 10' X 45'. The P fertilizer used for all treatments was 0-46-0. Nitrogen was broadcast before planting on April 16 as 28% at 150 lb N/ac.

Weed control consisted of pre-emerge Harness (1 qt/ac) applied on

April 5 and 21 oz of Roundup applied on June 21. Harvest was completed by harvesting three middle rows with a plot combine on October 25.

RESULTS AND DISCUSSION

Phosphorus soil tests have stayed almost constant or have slightly decreased since the fall of 1994 on the lower soil test level treatments. Phosphorus tests have fallen since 1994 for the two high soil test treatments, although there was a slight increase for the 2001 sample (Table 1). This decline is because of grain removal of P with no additions of fertilizer P.

Phosphorus soil tests appear to be increasing with annual broadcast applications of 40 or 60 lb P_2O_5/ac (Table 2) until about 2000. The P soil test levels have stabilized since that time at a medium and very high category for the 40 and 60 lb rate, respectively.

Although corn yields were good they were not as good as adjacent plots. The reason for this is not clear. Phosphorus rates significantly increased corn yields in 2004 (Table 3). Soil test level treatment also increased corn grain yields. This is most apparent with the zero annual rate (Table 3). Placement of P (band vs. broadcast) had no influence on corn grain yield (Table 3).

This is the last year for this study. A summary report will follow next year.

ACKNOWLEDGEMENTS

Support for this research is provided by the SDSU Plant Science Department, the South Dakota Agricultural Experiment Station, and the Southeast Research Farm.

Table 1. Phosphorus soil tests[1] from no annual P soil test treatments of the long-term P study, Southeast Farm, Beresford, SD. (Project no. 0604)

Soil Test Level	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
		---------------------------------Olsen P, ppm	---							
1	3	3	3	3	3	3	2	4	2	2
2	5	4	4	3	4	3	3	4	2	1
3	8	7	8	7	6	6	6	9	4	3
4	15	13	14	10	11	8	7	12	6	5

[1] Sampled (0-6") in the fall of each year from zero rate of each soil test level except for 1999 and 2000 which were sampled in the spring of following year.

Table 2. Phosphorus soil tests[1] from broadcast rates of the long-term P study, Southeast Farm, Beresford SD. (Project no. 0604)

P_2O_5 rate	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
lb/ac	---------------------------------Olsen P, ppm --									
0	6	5	5	4	4	3	4	5	3	2
20	6	8	9	8	7	6	9	11	6	7
40	7	8	12	11	13	12	11	20	15	11
60	8	12	16	16	18	16	19	26	22	21

[1] Sampled (0-6”) in the fall of each year from each annual rate of the broadcast treatment except for 1999 and 2000 which were sampled in the spring of following year.

Table 3. Corn yield as influenced by P soil test, annual P application rate and placement from the long-term P study during 2004 at Southeast Farm, Beresford SD. (Project no. 0604)

	---------------- annual P_2O_5 rates - lb/ac -------------------				
Soil test category[1]	0	20	40	60	mean
	------------------------------- Yield, bu/ac ----------------------------------				
1 (band)	125	167	175	164	158
2 (band)	138	168	172	170	162
2 (bct.)	166	164	178	164	168
3 (band)	141	172	177	166	164
4 (band)	152	175	181	169	169
mean	139	170	176	167	

[1]1,2,3,4,and 5 (Olsen P in 2003)= 2 ppm (v. low), 1 ppm (v.low), 2 ppm (v.low), 3 ppm (v.low), and 5 ppm (low), respectively.

Pr >F: All treatments but broadcast. Soil test level = 0.03; annual rate = 0.002; soil test x rate = 0.85 (NS). C.V=8.1%.

Pr>F: Treatments 2 and 3. Placement = 0.51(NS); annual rate = 0.02; placement x rate = 0.25(NS). C.V.= 10.3%

HOW NEAR TO THE CORN ROW CAN NITROGEN FERTILIZER SAFELY BE PLACED?

R. Gelderman, A. Bly, and J. Gerwing

Plant Science 0411

INTRODUCTION

Common nitrogen fertilizers (urea, UAN) can form ammonia and have a high salt index – both effects can be detrimental to seed germination. It has long been recognized that these fertilizers should not be placed in contact with the seed because of these detrimental effects.

Some producers are applying large amounts of band applied N and P with air units while planting corn. Their goal is to have plants make satisfactory use of P while keeping the nitrogen at a safe distance to prevent germination damage. Other producers have been applying large amounts of fertilizer (N, P, K) in strip-till bands and planting directly over the fertilizer band. In both cases, the question becomes "how close is too close?" in placing nitrogen near the seed. The objective of these studies is to answer how near to the seed can N fertilizer safely be placed.

METHODS

Two sites were established to answer the above question. One site was located at the Southeast Research Farm near Beresford and another at the Plant Science Agronomy Farm near Brookings. Some selected properties at each site are found in Table 1.

Treatments consisted of five N rates (0, 30, 60, 90, and 120 lb N/ac); two nitrogen sources (urea-dry, UAN-liquid); and five placement distances (0", 1", 2", 3", and 4") from the row. The N was placed directly in the seed furrow in the 0" treatment. Other placement distances were achieved by placing the fertilizer horizontally from the seed (same depth as seed) with single disc fertilizer openers fitted with both liquid and dry fertilizer tubes behind the shank. Plot size was 5' (2 rows) by 40'. Plots were arranged in a split-split plot design with four replications. Fertilizer was the main plot, distance the first split, and rate of N was the final split. A non-limiting nitrogen application was applied for the entire plot to ensure grain yields were not affected by rate of N.

Measurements included plant emergence counts. Plants were counted in two 10' segments of row within each plot. If any part of the plant was seen above the soil surface it was counted as emerged. Counts began when emergence had just started and continued every 2-3 days until it was judged that all plants had emerged.

Only the final stand count is presented here. Grain yields were also measured.

Results – Beresford site

All treatment factors and their interactions significantly impacted final plant stands at Beresford (Table 2). Plant stands with the urea treatments were less than those with UAN (Table 3). This would be predicted as UAN has only 50% urea and thus lower capacity to produce ammonia compared to urea. Average stands were decreased with rate of urea N fertilizer more than with UAN. The distance of N from seed decreased average stands at 1 inch or less (Table 4). Urea had more effect on stand than did the UAN at the closer distances. Rate of N decreased average final plant stand only at the 0" distance and at the 120 lb N/ac rate for the 1" placement (Table 5). However, urea influenced plant stand at all rates when placed with the seed and at the 90 and 120 lb N/ac rate at 1" placement (Table 6). UAN decreased plant stand at 60 N/ac or greater at the 0" placement only. Grain yields were very good averaging about 190 bu/ac. The influence of treatment on yield (data not shown) was almost identical to that of plant stand.

The results from this site indicate UAN is safe to apply at least 1" or further away from the seed whereas urea is safe at 2" and further.

Results – Brookings site

Significant influences of treatments and interactions for the Brookings site are shown in Table 2. Fertilizer did not influence overall plant stands at this site. As rate of N increased stand decreased (up to the 90 lb N/ac rate) (Table 7). However, N only decreased stand when placed with the seed (0") at this site (Table 7). Urea was more detrimental than UAN at the 30 lb N/ac rate (Table 8). Higher N rates produced similar plant stands between the two fertilizers (Table 8). Grain yields at the Brookings site were very good averaging about 200 bu/ac. The influence of treatments on yield (data not shown) was almost identical to that of plant stand.

The results from this site suggest urea or UAN is safe to apply at 1" or further from the seed.

CONCLUSIONS

UAN should be placed at least 1 inch or further from the seed whereas urea should be placed at least 2 inches from the seed on medium or finer textured soils.

ACKNOWLEDGEMENTS

These studies were funded in part by Deere and Company, the SDSU Plant Science Department, the Southeast Research Farm, and the South Dakota Agricultural Experiment Station.

Table 1. Site properties at the N distance studies, 2004.

Property	--------------- site ------------------	
	Beresford	Brookings
Tillage	conventional	conventional
Soil texture	silty clay loam	silt loam
Previous crop	soybean	soybean
Soil moisture	15 % (dry)	20 % (good)
Planting date/variety/pop.	4/28/04 DKC 58-24/30,000	5/5/04 DKC 47-10/30,000
Harvest	11/03/04, machine, 70'	10/27/04, machine, 70'

Table 2. Significance of treatments and interactions on final plant stand, N distance studies, 2004.

	Beresford	Brookings
Factor	Pr > F	Pr > F
Fertilizer	0.0018	0.38(NS)
N Rate	0.0001	0.0001
Distance	0.0001	0.0001
Fertilizer x rate	0.02	0.023(NS)
Fertilizer x distance	0.0001	0.17(NS)
Rate x distance	0.0001	0.0001
Fertilizer x rate x distance	0.0001	0.0002
C. V. %	7.3	7.3

Table 3. Influence of N fertilizer and N rate on corn plant stand, Beresford, 2004.

Rate of nitrogen	Urea	UAN	mean
Lb N/ac	-----------------plants x 1000 = plants/ac -----------------		
0	28.1	29.7	28.0
30	25.3	30.2	27.7
60	24.0	28.7	26.3
90	23.0	28.2	25.6
120	23.3	26.8	25.1
mean	24.7	28.7	

Table 4. Influence of N fertilizer and distance from row on corn plant stand, Beresford, 2004.

Distance	Urea	UAN	mean
inches from row	---------------------plants x 1000 = plants/ac -----------------		
0	5.9	24.9	15.4
1	28.6	29.8	29.2
2	28.7	29.8	29.6
3	29.4	29.1	29.3
4	30.3	29.9	30.1

Table 5. Influence of N rate and distance from row on corn plant stand, Beresford, 2004.

Rate of nitrogen	---------------Distance from row, inches ---------------- 0	1	2	3	4
lb N/ac	---------------------plants x 1000 = plants/ac -----------------				
0	27.3	29.9	29.1	28.7	29.7
30	17.9	30.0	30.4	29.6	30.8
60	13.4	29.5	29.5	29.4	29.7
90	10.0	29.0	29.6	28.7	30.6
120	8.5	27.7	29.6	29.7	29.7

Table 6. Influence of N fertilizer, N rate, and distance from row on corn plant stand, Beresford, 2004.

	---------------------------Distance from row, inches -------------------------									
Rate of	--0 --		--1 --		--2 --		--3 --		--4 --	
nitrogen	Urea	UN	Urea	UN	Urea	UN	Urea	UN	Urea	UN
lb N/ac	---------------------------------plants x 1000 = plants/ac ----------------------------									
0	30.5	30.9	29.2	30.5	28.7	29.4	29.6	27.9	29.6	29.9
30	5.6	30.1	29.6	30.3	30.3	30.5	29.4	29.9	29.4	30.3
60	0.2	26.6	30.3	28.8	29.0	30.1	30.3	28.6	30.1	29.4
90	0	20.0	27.3	30.8	28.3	30.9	28.7	28.7	30.8	30.5
120	0	17.0	26.4	29.0	31.2	28.1	28.7	30.8	30.1	29.4

Table 7. Influence of N rate and distance from row on corn plant stand, Brookings, 2004.

Rate of nitrogen	Distance from row, inches 0	1	2	3	4	mean
lb N/ac	plants x 1000 = plants/ac					
0	30.5	30.3	31.4	30.5	29.9	30.5
30	14.9	29.4	28.5	30.1	30.2	26.6
60	9.8	31.0	30.1	30.6	29.7	26.2
90	6.0	31.1	29.2	30.3	29.2	25.1
120	5.9	30.2	30.5	31.4	30.5	25.7
mean	13.4	30.4	29.9	30.6	29.9	

Table 8. Influence of N fertilizer, N rate, and distance from row on corn plant stand, Brookings, 2004.

	Distance from row, inches									
Rate of	--0 --		-- 1 --		--2 --		--3 --		--4 --	
nitrogen	Urea	UN	Urea	UN	Urea	UN	Urea	UN	Urea	UN
lb N/ac	plants x 1000 = plants/ac									
0	30.0	31.0	31.0	29.6	31.1	31.6	29.4	31.6	29.4	30.5
30	8.9	20.8	29.9	28.3	29.7	29.9	30.3	29.9	30.5	29.9
60	10.4	9.1	30.5	31.6	30.5	29.6	30.7	30.5	30.5	29.0
90	6.1	5.9	31.6	30.7	27.9	30.5	29.8	30.7	29.8	28.5
120	7.6	4.1	30.7	29.6	30.3	30.7	31.1	31.6	30.7	30.3

N FERTILIZER RATE INFLUENCE ON CORN HYBRID GRAIN YIELDS AT BERESFORD, SD IN 2004

A. Bly, G. Reicks, and H. Woodard

Plant Science 0412

INTRODUCTION

Nitrogen (N) application recommendations for corn have been well documented with years of field studies measuring yield response to applied N rates. It is good to evaluate these recommendations occasionally to determine if the new hybrids are responding to N rates as in the past. A study was conducted at the Southeast Research Farm near Beresford, South Dakota, to evaluate the influence of applied N rate on six hybrids that have been recently released.

MATERIALS AND METHODS

A site was selected on the Southeast Research Farm that had been managed as a corn and soybean rotation. The previous crop was soybeans. The soil series at this site is Chancellor silty clay loam, with 0-2% slopes. Pre-season soil samples from the 0-6 and 6-24 inch depths were obtained on April 16, 2004 for determination of nitrogen (N) and other nutrient recommendations.

On May 7, 2003, 100 lbs P_2O_5/ac was applied by broadcasting 0-46-0 and incorporated twice with a field cultivator. Soybean was planted in 2003 to prepare for no-till planting of these corn plots in 2004. Six Monsanto hybrids (Table 1) were selected and planted in a Randomized Complete Block (RCB) plot design with hybrid as the main plot and N rate as the split. The hybrids were planted at a rate of 30,100 seeds/ac on April 30, 2004. Three N rates were broadcast surfaced applied as urea before planting on April 23, 2004. The N rates which included a check were 40, 80, and 160 lbs N/ac. These rates represented 0.5, 1.0, and 2.0 X the N recommendation for a corn yield of 160 bu/ac. The 80 lb N/ac rate is the recommended rate obtained from EC 750, which is the fertilizer recommendation guide for South Dakota (Gerwing and Gelderman, 2001). Throughout the growing season the plots were monitored for weeds and other pests. Roundup Ultra Max was sprayed on the plots twice for weed control. A composite grain sample was obtained by harvesting grain from each replicate plot. Grain was harvested with a small plot combine and adjusted to 15 percent moisture basis for yield determination on October 26, 2004. Yield means were calculated and statistically analyzed with SAS.

RESULTS AND DISCUSSION

Crop growth was slowed by cooler than normal growing conditions in 2004. The hybrids did not reach physiological maturity until late

September and into October. The longer maturity hybrids did not reach natural physiological maturity and ceased growing on September 30 due to a killing frost. The DKC 47-10 and DKC 44-46 hybrids reached 20 percent grain moisture prior to October 7, and DKC 50-73 on October 7, DKC 53-34 on October 12, DKC 55-51 and DKC 58-24 on October 19 (Table 1).

Grain yields were very high (Table 2). Hybrid and N rate significantly influenced grain yield. The hybrid X N rate interaction (Pr>F=0.40) did not significantly influence grain yield. Grain yield significantly increased with N rate up to the highest rate (Figure 1). Grain yield from the highest N rate was significantly greater than the recommended rate. We conclude that the maximum yield was not obtained with the recommended N rate.

ACKNOWLEDGMENTS

This project partially funded by the Monsanto Company and the South Dakota Agricultural Experiment Station.

REFERENCES

Gerwing J. and R. H. Gelderman. Fertilizer Recommendation Guide. 2001. South Dakota State University. CES/AES EC 750.

Table 1. Corn hybrids, relative maturity, and grain moisture at selected dates before harvest from the nitrogen influence on corn study at the Southeast Research Farm, Beresford, SD; 2004.

Hybrid	RM[1]	Sample date 10-7	10-12	10-19
		------------ % grain moisture[2] -----------		
DKC 44-46	94	18.7	na	na
DKC 50-73	100	20.6	na	na
DKC 53-34	103	23.3	20.2	na
DKC 47-10	97	18.0	na	na
DKC 55-51	105	26.3	23.0	19.1
DKC 58-24	108	28.2	26.7	22.0

[1] relative maturity (days)
[2] composite sample of 4 replications from the recommended N rate (80 lbs/ac)
na – not available

Table 2. Grain yield of six corn hybrids from the N influence on corn study at the Southeast Research Farm, Beresford, SD; 2004.

Hybrid (Pr>F = 0.005)	RM[1]	Grain yield[2]
		bu/ac
DKC 44-46	94	172.4 abc
DKC 50-73	100	164.2 d
DKC 53-34	103	177.3 a
DKC 47-10	97	166.3 cd
DKC 55-51	105	170.3 bcd
DKC 58-24	108	172.8 ab
LSD (.05)		6.2

[1] relative maturity (days)
[2] adjusted to 15 %
Hybrid X N rate Pr>F = 0.40

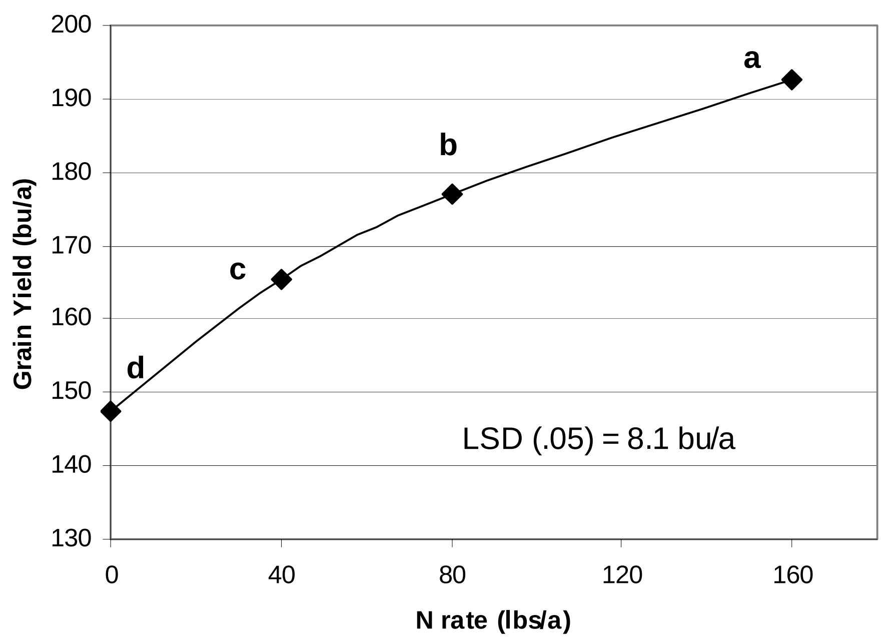


Figure 1. Mean corn grain yield of 6 corn hybrids as influenced by N fertilizer rate at South East Farm in 2004.

SE FARM REPORT SDSU

INFLUENCE OF TILLAGE METHOD AND PREVIOUS CROP ON SOIL TEMPERATURE, FINAL PLANT POPULATION, GROWTH, AND YIELD FOR CORN AT THE SOUTHEAST RESEARCH FARM IN 2004.

A. Bly, R. Gelderman, J. Gerwing, and R. Berg

Plant Science 0413

INTRODUCTION

Farmers are confronted with many different tillage and planting method choices. Reducing crop input costs is contributing to the discussions about reducing field operations, which reduces input costs and increases efficiency by enabling the farmer to cover more acres in the same amount of time. Changes that a farmer makes need to improve their bottom line. Even if a change doesn't result in a yield increase, efficiencies and cost savings can still lead to more profit. Therefore, a research study was initiated to determine the influence of tillage systems on corn production.

MATERIALS AND METHODS

This research was continued at a site established in 2002 on the Southeast Research Farm that included two crop rotations (corn-soybean and corn-soybean-wheat) and three tillage methods (conventional tillage (CT), no-till (NT), and strip-till (ST)). The CT plots were fall chisel plowed and spring cultivated. Strip-till was completed on selected plots October 27, 2003. There were two ST methods with one receiving 46 lbs P_2O_5 as 0-46-0 with tillage in the fall, and one received P in the spring. The ST-P was applied approximately 7 inches beneath the soil surface. The NT plots had residue moved out of the row at planting with residue managers.

The plot design was Randomized Complete Block (RCB) with previous crop as the main block and tillage methods as the sub-blocks. Plots were 12-30 inch rows wide (30 feet), 48 feet in length, and included four replications. A two-row planter to match the rows created by the 4-row strip till implement was used to plant plots on April 27, 2004 with DKC 58-24 at 30,100 seeds/ac. At planting, 46 lbs/ac P_2O_5 was applied with the seed as 0-46-0 to all treatments in the corn-soybean rotation, except the ST plots that received P_2O_5 in the fall. There was no fertilizer comparison in the corn-soybean-wheat rotation.

Soil temperature probes (Onset data loggers) were installed in the NT, ST and CT plots of 4 replications on April 6. The probes were used to measure temperatures at the 2.0 inch depth. Nitrogen (150 lbs N/ac) was broadcast surface applied as 28-0-0 on April 16.

Two 10-foot sections of plot row were marked and corn plants were counted to determine final plant population. Ten plants from the corn after soybean plots were randomly selected at the V-6 growth stage (June 16, 2004), dried and weighed to determine the dry matter weight. Grain from three center rows of each plot was harvested with a plot combine for determining yield. Dependent variable statistics was completed by SAS.

RESULTS AND DISCUSSION

Soil temperatures were measured for 12 weeks and weekly means were calculated to simplify data presentation. In general, soil temperatures in the ST plots were warmer compared to the NT plots where wheat was the previous crop (Table 1). Mean soil temperatures from plots where soybeans were the previous crop were very similar. There was much more residue cover on the wheat plots as compared to the soybean plots. The difference between mean soil temperatures of the ST and NT on previous crop wheat was probably due to greater soil surface cover on the NT plots prior to planting (Table 1).

Corn was planted on the last day of soil temperature measurement week 3. The soil temperatures after week 3 are very similar indicating that the residue removal during planting of NT corn increased soil temperature to that of the ST treatment plots (Table 1). The average CT soil temperatures were higher or equal to the other tillage methods (Table 1).

Tillage method and previous crop did not significantly (0.05) influence final plant population (Table 2) although the NT treatment was almost significantly (0.065) lower. However, when statistics were applied to evaluate the previous crop influence separately, the NT treatment had significantly lower final plant population where soybeans had been grown as the previous crop. No visual or measured explanation could be given for this difference.

The V-6 plant sample weights reflected what was seen in the field. There were no large visual differences in plant size between the tillage methods (Table 3).

Grain yields for all tillage methods and previous crop exceeded 200 bu/ac. Tillage method did not significantly influence grain yield with either soybeans or wheat as the previous crop (Table 4).

ACKNOWLEDGEMENTS

Soil Temperature probes were provided by the West River Research and Extension Center (John Rickertsen). This project was partially funded by the South Dakota Agricultural Experiment Station and the SDSU Soil Testing Lab.

Table 1. Influence of previous crop and tillage method on 2 inch soil temperature at Southeast Research Farm, Beresford, SD; 2004.

	Previous Crop					
	Soybeans			Wheat		
	Tillage Method					
Week[A]	ST	NT	CT	ST	NT	CT
	°F					
1	51	51	53	54	52	56
2	65	64	68	67	65	69
3	59	58	61	62	59	63
4	61	62	63	63	63	64
5	72	72	73	74	73	75
6	58	59	60	61	60	61
7	63	64	65	66	65	66
8	70	71	71	73	73	72
9	78	79	78	80	79	80
10	78	79	78	81	79	83
11	68	69	68	71	69	71
12	70	71	70	74	71	75
means	66	67	67	69	67	70

[A] Measurement from 4/6/04 to 6/29/04.
CT=conventional, ST=strip till, NT=no-till

Table 2. Corn final stand as influenced by tillage method and previous crop at the Southeast Research Farm, Beresford SD; 2004.

Tillage	Previous Crop	
Method	Soybean	Wheat
	plants/ac	
CT	29167 a	28070
ST	28880 a	29057
NT	26316 b	29167
$LSD_{(.05)}$	2318	NS
Means	28564	28837
$LSD_{(.05)}$ (previous crop)	NS	

CT=conventional, ST=strip till, NT=no-till
NS = non significant

Table 3. Corn V6 dry weight grown after soybeans as influenced by tillage method and P application timing at Southeast Farm, Beresford, SD; 2004.

Tillage Method	P application[1]	V6 dry weight
		g/10 plants
CT	spring	92.2
ST2	spring	83.9
ST1	fall	77.3
NT	spring	79.5
LSD $_{(.05)}$		NS

CT = conventional tillage
ST = strip tillage, Oct. 27, 2004.
NT = no-till
[1] applied at 46 lbs P_2O_5/ac as 0-46-0, applied with strip till applicator in fall or with seed at planting in the spring.
Olsen P soil test 10 ppm (0-6 inch)
NS = non-significant

Table 4. Corn grain yield as influenced by tillage method and previous crop at the Southeast Research Farm in 2004.

	Corn Grain Yield[1]	
Tillage	Previous Crop	
Method	Soybean	Wheat
	bu/ac	
CT	204	207
ST1	208	na
ST2	204	214
NT	205	208
LSD$_{(.05)}$	ns	ns

CT=conventional till, ST1=strip till fall applied P, ST2=strip till spring applied P, NT=no-till
[1] adjusted to 15 % grain moisture
na = not available because of mis-application of P fertilizer.

FERTILIZER POTASSIUM, SULFUR, ZINC, PHOSPHORUS, BORON AND LIME EFFECTS ON CORN YIELD ON HIGH TESTING SOIL

J. Gerwing, R. Gelderman, A. Bly and R. Berg

Plant Science 0414

INTRODUCTION

Some farmers in South Dakota are using phosphorus, potassium, sulfur, zinc, or lime on soils with high soil tests. Research by soil fertility staff at South Dakota State University during the last 30 years has not shown consistent economical responses to these fertilizer nutrients or lime when soil test levels are high. Therefore, the SDSU Soil Testing Lab does not recommend fertilizer nutrient application unless soil test levels are lower. The studies reported here were established in 1988 and 1990 to determine the effects of each of these commonly used nutrients and lime on corn and soybean yields and soil test levels when applied to high testing soils.

MATERIALS AND METHODS

Two experimental sites were established, one at the Southeast Experiment Farm near Beresford in 1988 and another on the Agronomy Farm near the SDSU campus in Brookings in 1990. Fertilizer treatments have continued at each location on the same plots since establishment. A corn-soybean rotation was followed at both locations. Corn was the 2004 crop. The soil at the Southeast Farm site is an Egan silty clay loam. Egan soils are well drained soils formed in silty drift over glacial till. The soil at the Brookings Agronomy Farm is classified as a Vienna loam. Vienna soils are well drained medium textured loam and clay loam soils formed from glacial till. Both soils are typical upland soils for their respective areas in the state. Fertilizer treatments were 50 lbs K_2O, 25 lbs sulfur (as gypsum at Brookings and ammonium sulfate at Beresford), 5 lbs zinc (as zinc sulfate) and lime at both locations (Table 1). In addition, the Brookings site had a 40 lb P_2O_5 treatment and the Beresford site a boron treatment (2 lb/ac). The fertilizer treatments were applied each spring since the establishment year (1988 at Beresford and 1990 at Brookings) on the same plots. An exception is location and twice (1990 & 1992) at Brookings. One hundred twenty pounds of nitrogen was broadcast at Beresford and 150 pounds at Brookings prior to planting. All fertilizer treatments were broadcast and followed by either disking or field cultivation. Herbicides were applied as needed at both locations. A randomized complete block design with four replications was used at both sites. Plot size was 15 by 65 feet at Beresford and 20 by 40 feet at Brookings. Harvest was done with a field combine at Beresford and a plot combine at Brookings.

RESULTS AND DISCUSSION

Soil test results from soil samples taken before 2004 fertilizer applications are presented in Table 2. Potassium soil tests were in the very high range at Beresford and Brookings. Adding 50 lb/ac of K_2O per year since 1988 at Beresford and 1990 at Brookings raised the K soil test by 117 and 29 ppm respectively.

The sulfur soil test in the check plots was low at Beresford and medium at Brookings. Adding 25 lb/ac sulfur each year has had a residual effect, raising soil test 50 lb/ac at Beresford and 24 lb/ac at Brookings.

The zinc soil test in the check was high at Beresford (0.96 ppm) and very high at Brookings (1.15). Applying 5 lb/ac zinc each year raised the soil test to 9.20 and 8.19 ppm at Beresford and Brookings respectively.

The lime treatments made during this study had residual effect on soil pH. The check pH at Beresford was 6.0 and where lime was applied it was 6.7. At Brookings the check pH was 6.3 and limed treatments 6.7.

The phosphorus soil test level at the Brookings site was 11 ppm without the phosphorus applications. The 40 lb/ac annual phosphorus applications raised the Olson soil test level to 33 ppm. There was no phosphorus treatment at Beresford and all plots receive phosphorus as needed.

The 2 lb/ac boron treatment started at Beresford in 1997 raised the boron soil test from 0.99 ppm to 9.20 ppm. The check soil test was in the high range (>0.50 ppm) and no boron would have been recommended.

Corn yields averaged 173 bushels per acre at Beresford (Table 3). No treatment significantly increased yield over the check. At Brookings corn yields averaged 168 bushels per acre (Table 4) and similar to Beresford, none of the treatments increased yield over the check. Since soil tests were generally high for the nutrients tested at these locations, little or none of the nutrients in question would have been recommended and little or no response was expected.

Yield results and soil test levels from previous years for these two studies can be found in the Southeast Farm Progress Reports (1988-2003) and in the 1988-2003 SDSU Plant Science Department Soil/Water Science Research annual report, Technical Bulletin Nos. 97 or 99.

ACKNOWLEDGEMENTS

Support for this research provided by various sources including the South Dakota Agricultural Experiment Station, the SDSU Plant Science Department, the Cooperative Extension Service, and the SDSU Soil Testing Lab.

Table 1. Fertilizer Treatments, Fertilizer and Lime Demonstration, Beresford and Brookings, 2004.

Treatment	Fertilizer Rates	
	Beresford[1]	Brookings[2]
	- - - - - - - - - - - - - - - lb/ac - - - - - - - - - - - - - - - - -	
Check	0	0
Phosphorus (P_2O_5)	-----[3]	40
Potassium (K_2O)	50	50
Sulfur	25	25
Zinc	5	5
Boron	2	-----[3]
Lime	-----[4]	-----[5]

[1] Applied each spring, 1988-2004 except boron applied only since 1997.
[2] Applied each spring, 1990-2004.
[3] Not a treatment at this location.
[4] 4000 lb and 3800 lb $CaCO_3$ equivalent applied spring 1988 and 2003 respectively.
[5]2500 lb and 2400 lb $CaCO_3$ equivalent applied spring 1990 and 1992 respectively.

Table 2. Soil Test Levels, Fertilizer and Lime Demonstration, Beresford and Brookings.

	Soil Test Level			
	Beresford[1]		Brookings[2]	
Soil Test	Check	Treatment	Check	Treatment
Potassium ppm	231	348	164	193
Sulfur, lb/ac, 0 - 6 in	4	20	12	10
lb/ac, 6 - 24 in	12	48	18	54
Zinc, ppm	0.96	9.20	1.15	8.19
pH	6.0	6.7	6.3	6.7
Olson Phosphorus, ppm	23[3]	-----	11	33
Boron	0.99	2.24	-----	-----
NO_3-N, lb/ac 2 ft	42	-----	51	-----
Organic Matter, %	3.7	-----	3.0	-----
Salts, mmho/cm	0.3	-----	0.5	-----

[1]Sampled 11/07/02
[2]Sampled 11/04/02
[3]160 lb P_2O_5 applied 11/19/01 and 4/01/03

Table 3. Fertilizer Effects on Corn Yield, Beresford, 2004.

Fertilizer Treatment	Yield	Moisture
	bu/ac	%
Check	173 a b	17.6
Potassium	179 a	18.0
Sulfur	165 b	17.6
Zinc	168 b	17.9
Boron	168 b	17.3
Lime	182 a	17.7
Prob of > F	0.02	0.70
C.V. %	3.9	3.7
LSD $_{.05}$	10.3	NS

Table 4. Fertilizer Effects on Corn Yield, Brookings, 2004.

Fertilizer Treatment	Yield	Moisture
	bu/ac	%
Check	174	21.4
Phosphorus	164	20.2
Potassium	170	22.7
Sulfur	166	20.4
Zinc	167	21.1
Lime	167	20.7
Prob of > F	0.82	0.47
C.V. %	6.2	8.8
LSD $_{.05}$	NS	NS

NITROGEN MANAGEMENT IN A CORN SOYBEAN ROTATION

J. Gerwing, R. Gelderman, A. Bly, and R. Berg

Plant Science 0415

INTRODUCTION

There is increasing concern about the effects of nitrogen (N) fertilizer on the environment, especially ground water quality. This concern has been intensified by reports of NO_3 - N of greater than 10 ppm in several locations in eastern South Dakota, especially where aquifers are shallow and soils are very coarse. In some instances, nitrogen fertilizer moving below the root zone has been implicated.

This nitrogen management experiment was established to study the effects of N rates in a corn-soybean rotation on nitrogen movement below the root zone. The typical rooting depth of corn, soybeans and wheat in South Dakota is four to five feet. In most situations in South Dakota, if nitrogen moves below the root zone it stays there and only rarely moves back up. Therefore, once out of reach of crop roots, nitrate has the potential to move down to the groundwater with percolating water during wet periods.

MATERIALS AND METHODS

This nitrogen management experiment was established on the Southeast South Dakota Experiment Farm near Beresford in 1988. It is located on an Egan silty clay loam soil. Egan soils are well drained soils formed in silty drift over glacial till.

Corn was planted on the site in even numbered years since 1988 and soybean was planted in the odd numbered years. The rates and timing of nitrogen fertilizer applied to the corn in 2004 are listed in Table 1. The treatments included a check (no N), the recommended rate applied in fall, spring or split between spring and 6 leaf stage and 200 and 400 lb rates spring applied regardless of the previous soil test. These treatments were applied to the same plots each year that corn was planted in the rotation. The recommended rate was adjusted according to the NO_3 - N soil test level and for credit given because of the previous years' soybeans (1 lb N credit for 1 bushel beans). The recommended nitrogen rate was 123, 62, 90, 95, 95, 110, 125, 90, and 100 lb/ac respectively for the even numbered years 1988 through 2004. Nitrogen was broadcast as urea and immediately incorporated by tillage except the fall application was not incorporated until the following spring. The June portion of the split application was surface broadcast ammonium nitrate. Ammonium nitrate was used for this treatment to prevent volatilization losses. Years when soybeans were planted (odd numbered years) no nitrogen fertilizer was applied.

Phosphorus, potassium and pH soil test levels at the site are 17 and 247 ppm and 5.7 respectively. One hundred sixty pounds P_2O_5 was broadcast in the fall of 2001 and spring 2003 as 0-46-0 to raise the phosphorus soil test. A randomized complete block design was used on the experiment with four replications. Plot size was 15 feet by 65 feet. On April 28 roundup ready corn was planted in 30 inch rows after tillage with a disc. No fertilizer was applied at planting. Plots were harvested with a field combine. Soil samples were taken to a depth of six feet in one foot increments on October 26, 2004. Only the 0, spring recommended (100 lb rate), 200 and 400 lb/ac N rates were soil sampled.

RESULTS AND DISCUSSION

Adequate moisture mid and late season (Table 3) and a cool summer resulted in excellent corn yields of nearly 200 bushels per acre (Table 2). Even the check where no nitrogen has been applied since the beginning of the study in 1988 yielded 119 bushels per acre. Fall applied nitrogen at 100 lb per acre increased yield 37 bu/ac. However the same rate of N applied in spring and incorporated just before planting increased yield 55 bu/ac. Since the fall applied N was not incorporated until spring and precipitation was minimal over winter and early spring, it seems likely volatilization losses contributed to the difference in response to N. Split applying the N did not increase yield, indicating leaching was not a significant issue in 2004.

The 200 and 400 lab N rates yielded 193 and 195 bushels per acre. They were significantly higher than the 174 bushels from the recommended rate of 100 lb N per acre. The 100 lb recommended rate, however, was based on a 150 bushel yield goal while the yield potential was 195. If the yield goal had increased to 195 bushels, the recommended rate would have been 155 lb N/ac.

Nitrate soil tests taken in October of 2003 and 2004 are listed in Table 4. Increasing the N rate from 100 to 200 or 400 lb per acre increased the fall 2004 carryover nitrogen levels to 144 and 278 lb/ac in the top two feet from 51 lb/ac in the 100 lb treatment. The majority of the carryover N was in the top foot of soil. Deeper samples down to 6 feet showed no increases in nitrate over 2003 indicating leaching was not a factor in nitrogen losses this year. The fall soil tests follow an earlier sampling on June 17 that showed 84% of the nitrate in the top 2 feet of soil was still in the top foot in the 400 lb treatment (Table 5). The lack of early season moisture this year minimized movement of nitrate below the topsoil. Late season moisture was used by the big crop and therefore not available to move down through the soil profile and carry nitrate with it. The October soil sampling revealed dry soil in the 3 to 4 foot depths even though August and September rainfall was just over 10 inches.

These plots will be rotated back to soybeans in 2005 and soil samples taken in the fall to a depth of 6 feet to determine carryover N levels and possible losses by leaching. Corn and soybean yields and soil tests from previous years of this study can be found in the Southeast Farm Progress Reports and in the annual Plant Science Department Soil/Water Science Research Reports.

ACKNOWLEDGEMENTS

Support for this research provided by various sources including the South Dakota Agricultural Experiment Station, the SDSU Plant Science Department, the South Dakota Cooperative Extension Service, and the SDSU Soil Testing Lab.

Table 1. Nitrogen Fertilizer Treatments Applied in 2004, Nitrogen Fertilizer Management Study, Southeast Experiment Farm; Beresford, SD.

	Time of Application		
Treatment	Spring[1]	Split[2]	Fall[3]
No.		------ lb N/ac ------	
1	0	-----	-----
2	100	-----	-----
3	30	70	-----
4	-----	-----	100
5	200	-----	-----
6	400	-----	-----

[1] April 23, 2004
[2] June 17, 2004
[3] November 13, 2003

Table 2. Nitrogen Management Study Corn Yields, Southeast Experiment Farm; Beresford, 2004.

Nitrogen		-----------Corn-----------	
Time	Rate	Yield	Moisture
	lb/ac	bu/ac	%
Check	0	119 a	17.7 a b
Fall[1]	100	156 b	17.4 a
Spring[2]	100	174 c	17.5 a b
Split[3]	100	166 b c	17.3 a
Spring	200	193 d	18.1 b c
Spring	400	195 d	18.8 c
Pr > F		.0001	.003
CV%		3.8	2.5
LSD .05		9.6	0.68

[1] Fall = 11/13/04
[2] Spring = 4/23/04
[3] Split = 30 lb 4/23/04, 70 lb 6/13/04

Table 3. Rainfall at the Southeast Experiment Farm; Beresford; Nov. 1, 2003 to Oct. 31, 2004.

Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct
-----	-----	-----	-----	-----	-----	inches	-----	-----	-----	-----	-----
0.39	0.41	0.54	0.78	2.39	1.32	4.99	2.26	0.99	4.12	5.95	0.44

Table 4. Fall Nitrate Soil Test Levels, Nitrogen Management Study, Southeast Experiment Farm; Beresford, SD.

	Fertilizer N Applied, lb/ac, even years, 1988 through 2004							
	- - - - 0 - - - -		Recommended[1]		- - - 200 - - -		- - - 400 - - -	
Depth	2003	2004	2003	2004	2003	2004	2003	2004
feet	- - - - - -	- - - - - -	- - - - - -	Soil NO_3 - N, lb/ac[2]	- - - - - -	- - - - - -	- - - - - -	- - - - - -
0 – 1	34	18	38	34	28	116	46	208
1 - 2	28	10	22	17	18	28	26	70
2 – 3	25	6	25	9	33	17	67	23
3 – 4	20	6	27	6	41	19	70	45
4 – 5	18	7	30	12	49	22	115	52
5 - 6	18	14	32	18	58	35	142	68

[1] Rates applied were 123, 62, 90, 95, 95, 110, 125, 90 and 100 lb N/ac in spring of even years 1988 - 2004 respectively, yield goal 1988 – 96 = 130 bu/a, 1998 – 2002 = 145, 2004 = 150.
[2] Soil sampling dates: Oct 15, 2003, Oct 26, 2004.

Table 5. Nitrate Soil Test Level for the 400 Pound Nitrogen Treatment, N Management Study, Southeast Experiment Farm; Beresford, 2004.

Sample	SampleDate[1]	
depth	10/15/03	6/17/04
feet	------------------lb/ac	--------------------
0-1	46	288
1-2	26	56
2-3	67	24

[1]400 lb N applied 4/23/04

FOLIAR NUTRIENT APPLICATION INFLUENCE ON SOYBEAN YIELD AT AURORA AND BERESFORD SD IN 2004

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Plant Science 0416

INTRODUCTION

Foliar application of macronutrients such as nitrogen, phosphorus and potassium on soybeans has been tried numerous times in experiments without consistent success. In recent years, however, there has been renewed interest by growers in foliar nutrient applications, especially micronutrients. The interest is likely fostered, in part, by the movement to Roundup Ready soybeans. With the Roundup program, the producer will probably have to spray his soybeans a second time anyway, making the addition of nutrients to the spray appealing since there would be no real cost for the application, only for the added nutrients. In some cases, the materials come as a package, consisting of two or more micronutrients and are applied regardless of soil test levels for the nutrients in the material or an identified need. The objective of the study was to determine if one of these materials would have an effect on soybean yield.

MATERIALS AND METHODS

A site on each SDSU Experiment Farm near Aurora and Beresford was selected. Both sites were in a corn soybean rotation. Soil at the Aurora site was medium to coarse textured overlying gravel at four feet. It is typical of the irrigated soils in Brookings County, however this experiment was not irrigated. Soil at Beresford was fine textured heavy soil typical of upland glacial till derived soil in southeast South Dakota. Composite soil samples from the 0-6 inch depth were taken from adjacent sites and analyzed for P, K, pH, salts, zinc (Zn), iron (Fe), manganese (Mn), copper (Cu), calcium (Ca), magnesium (Mg), sodium (Na), boron (B) and cation exchange capacity (CEC). Asgrow 1401 RR soybeans were no till planted with a drill at Aurora. The site at Beresford was fall chiseled and finished with field cultivation in spring prior to planting Asgrow 2403 RR soybeans in 30-inch rows. All plots at both locations were sprayed with Roundup at the V1-V2 stage for early weed control. Foliar micronutrients were not applied at this time since very little foliage was present to intercept the fertilizer.

Micronutrient foliar treatments were applied at V4 growth stage which was July 13 at Aurora and June 29 at Beresford. The micronutrient fertilizers used were MAX-IN beans, a product sold by Agriliance and TJ Micro Mix for beans. The MAX-IN beans contained 3.20% manganese, 2.10% zinc, 0.30% iron, 0.20% boron, and 0.01% molybdenum and was sprayed at a rate of 2 qt/ac. TJ Micro Mix for beans was applied at 1 qt/ac and contained 0.7% calcium, 0.3% magnesium, 0.1% boron, 0.3% copper, 0.6% iron, 0.5%

manganese, and 0.9% zinc. Two common fertilizers (9-18-9 and 7-21-7) were also included in the treatments and applied at 1.5 gpa. Nutryx (Precision Labs Inc.) an amine polymer was added at 16 oz/100 gallon of spray to various treatment combinations to enhance uptake. At the Aurora site an additional treatment of blending all combinations was applied in one application. Treatments were applied in the afternoon at both locations with a hooded sprayer using 20 psi with a 12 gallon per acre spray rate. Water was the carrier for all treatments. Air temperatures were in the mid to upper 70's to lower 80's with a clear sky. Soil moisture was adequate and no visual plant stresses were noted. Plots at Beresford were harvested with a field combine. At Aurora, the middle five feet of each plot was harvested with a plot combine. Plot size was 15 feet by 55 feet at Beresford and 15 feet by 35 feet at Aurora. All treatments were replicated four times in a randomized complete block design.

RESULTS AND DISCUSSION

Soil test results did not reveal any nutrient that would severely limit soybean growth and yield except P at Aurora (Table 1). The probability of a yield response to applied P is higher at the Aurora site, because the P soil test was in the very low soil test category (Table 1). Applications of 7-21-7 and 9-18-9 could result in increased soybean yield at the Aurora site because they contain P.

Visual observation in the weeks following the foliar nutrient applications did not reveal any obvious increases in plant growth or changes in plant color. No injury from the applications was noted. Soybean grain yields averaged 47 bushels per acre at Beresford and 20 at Aurora (Table 2) and were not influenced by the foliar application of nutrients at either location. A hard freeze at the Aurora site on August 21 severely limited potential productivity by killing the top half of the plant.

ACKNOWLEDGMENTS

This project funded by the South Dakota Agriculture Experiment Station, the South Dakota Cooperative Extension Service, and the SDSU Soil Testing Lab.

Table 1. Soil test results for 0-6 inch soil samples from the foliar feeding research projects at the Southeast Farm (Beresford) and Aurora in 2004.

Site	Soil Parameter[a] pH	EC	Olsen P	K	Zn	Ca	Fe
		mmho/cm	ppm				
Beresford	6.6	0.5	19 VH[b]	533 VH	0.99 H	2030 VH	93 H
Aurora	5.4	0.4	3 VL	147 H	0.90 H	1697 VH	77 H

Site	Soil Parameter Mn	Cu	Mg	Na[c]	B	CEC[c]
	ppm					
Beresford	43 H	1.2 H	444 VH	5	0.74 H	20
Aurora	38 H	0.9 H	414 VH	5.8	0.58 H	21

[a] adjacent site sampled in 2003.
[b] VL=very low, H=high, VH=very high soil test categories
[c] no soil test category

Table 2. Influence of foliar nutrient application on soybean yield, near Beresford and Aurora, SD, in 2004.

Treatment[1]	Grain Yield Beresford	Aurora[7]
	bu/ac	
Check	49	19
TJ micro-Beans[2]	48	18
TJ[2] + Nutryx[3]	47	20
TJ[2] + Nutryx[3] + 9-18-9[4]	49	19
9-18-9[4] + Nutryx[3]	--	19
9-18-9[4]	48	--
7-21-7[5] + Nutryx[3]	--	21
MAX-IN Beans[6]	48	19
All of them	--	18
Statistics:		
Pr>F	0.98	0.93
LSD .05	NS	NS

[1] all treatments applied in 12 gpa water separately from Roundup application.
[2] 1 qt/ac
[3] 16 oz/100 spray
[4] 1.5 gpa
[5] 1.5 gpa
[6] 2 qt/a
[7] hard freeze on August 21 kill approximately 50% of top half of plant.

SE FARM REPORT
SDSU

INFLUENCE OF GYPSUM ON CROP YIELDS

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Plant Science 0417

INTRODUCTION

Gypsum, calcium sulfate ($CaSO_4 .2H_2O$), is a naturally occurring mineral that is mined for many purposes. Gypsum has a calcium content of 23% and a sulfur content of 19%. In agriculture it is used for treating sodium affected soils. The calcium in the applied gypsum will displace sodium on the soil cation exchange capacity. This is a mass action process; therefore large amounts of calcium are required. Drainage within the soil profile must also occur for the displaced sodium to be leached out of the soil profile. Sodium is part of soil salt compounds (NaCl, Na_2SO_4 and Na_2CO_3). Many other forms of soil salts also exist (KCl, $MgCl_2$, $CaCl_2$, $MgSO_4$, and $CaSO_4$). Gypsum can also be used to supply sulfur although this is usually an expensive source. Questions about the effectiveness of gypsum in alleviating salt effects are common as well as it's efficacy for typical soils. Therefore this study was conducted to determine if gypsum could significantly increase crop yields on saline and non-saline soils.

MATERIALS AND METHODS

SE Farm – West Site; soybean:

A research site was selected on the northwest quarter of the Southeast Experiment Farm located near Beresford, SD. This is the third year for the experiment, previous crop was corn. Conventional tillage practices have been used on this site whenever possible. Areas of this site have wet soils in some years and there is significant white salt formation on the soil surface of the lower areas when the soil dries. During some years, crop emergence is affected by the salty soil conditions. Gypsum rates including a control were randomized in four replications. The gypsum rates were 0, 300, and 1500 lbs/ac applied in a pellet form with a Gandy Orbit Air applicator and incorporated with a field cultivator in 2002. In spring of 2003 and again in 2004, the 300 lb/ac gypsum treatment was reapplied. Because of wet soil conditions at this site in early spring, soil samples were taken after the gypsum treatments had been applied. Soil samples from each replicate were taken at the 0-3, 3-6, and the 6-9 inch soil depths. No phosphorus or potassium was applied, because soil tests indicated these nutrients were not limiting. Asgrow AG2403 soybean was planted on May 7 at 64 lb seed/ac.

The whole plot was harvested with a field scale combine on September 29. The salt effect on plant growth was extremely variable and resulted in many areas where little or no soybean grain was produced especially in reps 3 and 4 (east side).

SE Farm – East Site; corn:

A research site was selected on the northeast quarter of the Southeast Experiment Farm located near Beresford, SD. This site has been managed as a corn - soybean rotation. Conventional tillage practices have been used on this site that consists of chisel plowing in the fall and field cultivation in the spring. There is some white salt formation at the soil surface after the surface dries. Gypsum rates including a control were randomized in three replications. The gypsum rates were 0, 300, and 1500 lbs/ac applied in a pellet form with a Gandy Orbit Air applicator and incorporated with a field cultivator in 2002. In spring of 2004, (before gypsum application) composite soil samples from the 0-6, and 6-12 inch soil depths were obtained to compare effects of previous treatments on selected soil tests. The corn variety Dekalb DKC 58-24 RR2/YGCB was planted at 30,200 seeds/ac in 30 inch rows on April 28. No phosphorus or potassium was applied because soil tests were not limiting for these nutrients. Plot size was 15 x 42.5 feet. The center three rows of the plot were harvested with a field scale plot combine on October 26.

RESULTS

Gypsum application increased soil sulfate levels in the Southeast - east site. No other soil test effects are seen with these gypsum applications (Table 1). Sodium in the 0-6 inch depth was not high enough to be a problem (SAR > 15) at either site. Added gypsum would not be expected to lower sodium levels as calcium levels are already very high. The problem at the west site is a high water table which keeps sodium from moving down and out of the soil profile.

Soybean grain yield was not influenced by added gypsum (Table 2). Yields were poor and variable on this poorly drained area. In addition, there was no influence of added gypsum on corn yield (Table 2). Yields were excellent at this well-drained site. The lack of response to added gypsum in 2004 agrees with the results of eight previous sites in 2002 and 2003.

CONCLUSIONS

Gypsum applications are not recommended for typical soils or for salt-affected soils. For gypsum to be effective for sodium affected soils, adequate subsurface drainage must be present.

ACKNOWLEDGEMENTS

Support for this research is provided by the SDSU Plant Science Department, the South Dakota Agricultural Experiment Station, and the Southeast Research Farm.

Table 1. Influence of gypsum treatments on selected soil tests, Beresford, SD, 2004.

Gypsum Rates	Soil Test[1] Parameter				
	pH	Salts[2]	SAR[3]	Calcium	Sulfate-S
lb/ac		mmho/cm		ppm	lbs/ac in 2'
		------------ SE Farm – West ------------			
0	7.6	2.1	2.7	2427	401
300	7.6	2.2	2.6	2747	388
1500	7.6	2.5	2.7	2545	415
		------------ SE Farm – East -----------			
0	6.0	0.4	0.3	2151	24
300	6.2	0.6	0.3	2126	58
1500	6.3	0.5	0.2	2247	54

[1] 0-6 inches, sampled on 6/2/04 and 4/2/04 for West and East sites, respectively.
[2] saturated paste method (electrical conductivity)
[3] sodium adsorption ratio

Table 2. Influence of gypsum rate on corn and soybean grain yield near Beresford, SD in 2004.

Gypsum Rate	SE - West Soybean grain yield	SE - East Corn grain yield
lbs/ac	--------bu/ac -------	
0	21	185
900[1]	21	174
1500[2]	20	180
Statistics		
Pr > F	0.97	0.57
LSD (.05)	NS	NS
C. V. %	31.4	6.1

[1] 300 lb applied in 2002, 2003, and 2004
[2] applied in 2002

SE FARM REPORT
SDSU

EFFECT OF CROP ROTATION AND TILLAGE ON NEMATODE POPULATIONS

J.D. Smolik

Plant Science 0418

For the fourth consecutive year, soil samples were collected in the fall from all crops in replications one and three. Nematodes were extracted from soil by the Christie-Perry method, identified, and counted. The first six taxa listed in Table 1 include the plant parasites, the next taxonomic grouping (dorylaims) are primarily predaceous, and the last group (microbial feeders) are associated with decaying organic material. The latter two taxa are generally considered to be beneficial. The predaceous nematodes aid in regulating populations of other soil animals including plant parasitic nematodes, and the microbial feeders aid in the breakdown of crop residue and the recycling of nutrients.

Crop rotation appeared to have little consistent effect on spiral or pin nematodes (Table 1). Dagger nematode populations were again higher in the rotations that include alfalfa. Populations of dagger nematodes in excess of 100 per 100 cm^3 soil cause substantial plant injury, and it is likely that several of the crops in the four-year rotations were damaged by this nematode. Lesion nematode numbers were consistently higher on corn in the two-year rotations. Crop rotation had no consistent effect on populations of dorylaims or microbial feeders.

The highest populations of spiral nematodes occurred in the no-till rotations (Table 1), whereas the highest numbers of pin and Tylenchinae occurred in conventional tillage. Tillage had little consistent effect on dorylaim populations, but populations of microbial feeding nematodes were generally higher in the CT rotations.

Acknowledgement

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Table 1. Fall nematode populations, October 12, 2004

		Nematode taxa							
Rotation[a]	Crop	Stunt	Spiral	Pin	Tylenchinae	Dagger	Lesion	Dorylaims	Microbial feeders
NT 2	corn	0[b]	850	8	0	16	158	67	250
	soybean	0	450	16	58	0	0	135	858
AT 2	corn	16	508	0	16	0	241	142	500
	soybean	0	751	0	75	0	16	140	1091
CT 2	corn	0	526	0	425	16	250	351	1150
	soybean	92	85	232	230	0	16	140	432
NT 3	corn	0	310	25	0	43	58	124	100
	soybean	16	1160	8	51	16	68	193	900
	sp. wht	0	1585	8	8	62	62	142	866
CT 3	corn	16	32	16	67	92	32	132	525
	soybean	0	168	332	316	16	42	160	668
	sp. wht	0	275	42	92	42	0	235	576
NT 4	corn	0	16	142	0	293	0	117	385
	soybean	0	1366	16	16	0	0	125	466
	sp. wht	0	450	608	35	0	0	150	730
	alfalfa	0	0	0	16	110	0	35	408
CT 4	corn	0	50	391	160	142	16	185	933
	soybean	0	375	1318	32	142	16	132	841
	sp. wht	42	425	400	115	151	16	250	1141
	alfalfa	0	0	2566	16	376	0	0	324

[a]/ NT= No till, AT= Aerway till, CT= Conventional tillage
[b]/ Average of two replications, number of nematodes per 100 cm^3 soil.

SE FARM REPORT
SDSU

SOYBEAN CYST NEMATODE STUDIES, 2004

James D. Smolik

Plant Science 0419

<u>Objectives</u>

Determine distribution of soybean cyst nematode (SCN) in South Dakota.
Determine effect of SCN on soybean yields in small plot and field-scale tests.
Determine crop rotation effects on SCN population densities.
Measure reproduction of SCN on resistant, susceptible, and experimental soybean lines and assist SDSU soybean breeder in development of SCN-resistant lines.

Figure 1. Distribution of SCN in South Dakota and year in which SCN was detected.

RESULTS

Survey: Approximately 1100 soil samples were processed for SCN in 2004, and nearly 45% of the samples were positive for SCN. The number of samples received was 50% higher than the previous year and the infestation rate was the highest ever recorded in our surveys. The SCN was detected in Hutchinson County for the first time bringing to nineteen the number of counties where SCN has been found (Figure 1). Most of samples were received from southeastern SD, however, several fields with severe SCN damage were detected in Brookings and Deuel Counties.

Meckling Fertilizer submitted samples from 50 fields in which two samples had been obtained. One of the samples was from the field entryway and the other from the remainder of the field. Sampling procedures for SCN recommend obtaining samples from the entryway because it is a likely area for introduction of SCN. Thirty-one of the fields were infested with SCN. The average number of SCN eggs per 100 cm^3 soil in the entryway was 913, which was only slightly higher than the 887 eggs per 100 cm^3 soil in the rest of the field. There were seven instances in which SCN was present only in the entryway and ten instances where SCN was present only in the remainder of the field.

Table 1. Soybean yields and SCN populations- irrigated Tri-Ag Plot, Turner County.

Entry	Response to SCN	Yield (Bu/ac)	No of SCN eggs + J-2 per 100 cm^3 soil at harvest\[a]
Pioneer 92B74	S	27.2\[b]	20,450
Pioneer 92M70	R	44.7	533
Pioneer 93M10	R	49.6\[c]	550
Prairie Brand 2606	R	44.4	50
Pioneer 92B95	R	42.1	400
Garst 2612	R	41.8	100
Pioneer 92M50	R	41.6	750
Garst XP23N59	R	41.4	1100
Prairie Brand 2183	R	40.3	300
DeKalb 20-52	R	39.2	500
Garst 2312	R	38.3	0
Asgrow 2107	R	36.4	50
Krueger K277	R	34.1	900
		lsd.05= 3.7\[d]	

[a]/ Population density of SCN at planting was 370 eggs + J-2 per 100 cm^3 soil.
[b]/ Average of three replications.
[c]/ Non-replicated entries.
[d]/ Based on the replicated entries.

These results indicate the importance of sampling the entryway, but also the importance of including a representative sampling from the rest of the field.

A field-scale irrigated strip test was conducted in a cooperator's field in Turner County. This field had been planted to corn in each of the previous two years. Yields of the resistant varieties were 26 to 80% higher than the susceptible (Table 1). Population densities of SCN at harvest were much lower on the resistant varieties.

A second irrigated strip test in Turner County was designed to compare SCN-resistant and susceptible soybeans with and without insecticide treatments. There were four insecticide treatments: 1) apply insecticide when 7+ bean leaf beetles per foot of row are present at full bloom; 2) apply insecticide when 3 soybean aphids per plant are detected at full bloom; 3) apply insecticide when bean leaf beetle is first detected and at 3 week intervals until end of July; 4) apply insecticide when 200 soybean aphids per plant are detected at full bloom. Only treatments 2 and 3 met the threshold levels and were initiated.

Yield of the resistant variety was significantly higher than the susceptible and population density of SCN was much lower on the resistant variety at harvest (Table 2). The insecticide treatments did not increase soybean yields.

Table 2. Soybean yields and SCN populations in irrigated strip trial with and without insecticide treatments.-Tri-Ag Plot, Turner County.

Entry	Response to SCN	Yield (Bu/ac)	No. of SCN eggs + J-2 per 100 cm^3 soil at harvest
Pioneer 92B74	S	41.7/[a]	20,770\[b]
Pioneer 92M70	R	46.7	820
		lsd.05= 1.8	

Insecticide Treatments

	Control (No insecticide)	Asana applied when 3 aphids per plant present at full bloom\[c]	Asana applied at first detection of bean beetle and at 3 week intervals until late July
Yield: (Bu/ac)	44.6	43.9	43.3

[a]/ Average of 10 replications.
[b]/ Population density of SCN at planting was 950 eggs + J-2 per 100 cm^3 soil.
[c]/ Asana XL applied at 5.8 oz in 20 gal water per acre.

Table 3. Soybean yields and SCN populations –Ray Hall test, Clay County.

Entry	Response to SCN	Yield (Bu/ac)	No. of SCN eggs+ J-2 per 100 cm^3 soil at harvest\[a]
DeKalb 25-51	S	64.6\[b]	3900
Garst 2612	R	56.9	167
DeKalb 26-52	R	56.7	2280
Latham 688	R	64.6\[c]	4400
Pioneer 92M80	R	63.7	1600
Asgrow 2107	R	63.5	1550
NK 28-L9	R	61.4	1800
Latham 547	R	60.0	2950
Asgrow 2405	R	60.0	1750
Pioneer 92M70	R	60.0	1300
Prairie 2483	R	59.9	1250
Great Lakes 2704	R	59.7	4550
N K X 326 R	R	57.8	2300
Pioneer 92M91	R	57.6	1150
Latham 2610RX	R	57.3	1050
Asgrow 2801	R	56.4	1000
Garst 2312	R	56.3	750
Latham 2700RX	R	55.9	50
SOI 2842	R	51.9	950
Great Lakes 2819	R	51.8	2100
Kaystar 2495T + Gusto	S	51.7	7950
Kaystar 2495T	S	48.4	3650
		lsd .05 = ns\[d]	

[a]/ Average population density of SCN at planting was 315 eggs + J-2 per 100 cm^3 soil.
[b]/ Average of three replications.
[c]/ Non-replicated entries.
[d]/ lsd based on the replicated entries was not significant at the .05 level.

Soybean yields and SCN populations were measured in a dryland strip trial in Clay County. There were no significant differences in soybean yield. This plot was established in a different location than originally planned due to excessive spring soil moisture. The SCN populations in the new location were generally low and poorly distributed, which resulted in comparatively low SCN population densities at harvest and a general lack of yield differences

A study in Turner County is continuing to measure the effect of rotating to alfalfa on SCN population densities. A SCN-infested field was planted to alfalfa in 2003 and the population of SCN has declined from 2530 eggs per 100 cm^3 soil in October 2003 to 275 eggs per 100 cm^3 soil in October 2004.

In cooperation with Roy Scott, SDSU soybean breeder, a small plot test was established in an irrigated field in Turner County. The test included SD lines that had been identified as promising for SCN resistance based on results of 2004 winter greenhouse evaluations. Several of the SD lines appear to possess a useful degree of SCN resistance.

ACKNOWLEDGEMENT

This research was supported in part by the South Dakota Soybean Research and Promotion Council.

Table 4. Soybean yields and SCN populations - irrigated small plot test, Turner County.

Test I			Test II		
Entry	Yield (Bu/ac)	No. of SCN	Entry	Yield (Bu/ac)	No. of SCN
Dekalb 20-52	45.1\[a]	33\[b]	Asgrow 2801	44.3	117
SDX02R-584	38.6	2900	LD01-11496	43.5	50
SDX00R-026-42	36.2	183	DeKalb 26-52	42.8	800
SDX00R-026-32	32.1	183	LD01-11462	42.4	250
SDX00R-020-41	31.5	133	DeKalb 20-52	42.0	117
SDX02R-597	31.3	150	LD00-9276	40.9	100
SDX00R-046-29	30.5	167	SD01-589R	38.7	967
MN1803RR	30.3	8866	SDX00R-046-22	38.5	100
SDX00R-020-12	28.6	333	SDX00R-046-28	36.5	850
SDX02R-1017	27.7	267	SDX00R-032-34	34.8	850
SDX00R-026-43	26.2	2000	SDX00R-032-40	34.4	167
M99-113168	24.2	8233	SD01-2329R	34.1	950
SDX00R-020-51	21.9	3800	SDX00R-046-7	30.1	8133
SDX00R-026-49	21.9	4033	SDX00-032R-23	20.7	15,583
SD1091RR	19.7	3633	Asgrow 2302	19.8	16,667
Asgrow 1602	19.0	13,400	SD01-2319R	19.0	16,483
SDX00R-046-27	17.4	8117			
	lsd.05= 6.2			lsd.05= 4.1	

[a]/ Average of three replications.
[b]/ Number of SCN eggs + J-2 per 100 cm^3 soil at harvest. The population of SCN at planting was 250 eggs + J-2 per 100 cm^3 soil.

NEW BT-CORN PERFORMANCE AGAINST WESTERN BEAN CUTWORM AND BIVOLTINE ECOTYPE EUROPEAN CORN BORER IN SOUTHEASTERN SOUTH DAKOTA

M. Catangui and R. Berg

Plant Science 0420

INTRODUCTION

Bt-corn has been grown in South Dakota since 1996. The main reason for planting Bt-corn in South Dakota has been to preserve the yield potential of corn by preventing injuries due to the European corn borer. Corn borers are insects that bore into the stalks, ear shanks, and ears of the corn plant and can cause significant yield losses if present in high numbers. To combat corn borers, most of the Bt-corn grown in South Dakota expresses the Cry 1Ab toxic Bt protein through the YieldGard Corn Borer gene.

Recently, various seed companies have introduced new Bt corn hybrids that are resistant to insects other than European corn borers. In 2002, for example, corn hybrids containing the Herculex I gene and expressing the Cry 1F toxic protein was introduced to corn growers. Cry 1F protein is toxic to corn borers, black cutworms, and western bean cutworms.

In 2003, new Bt-corn hybrids containing the YieldGard Rootworm gene that enables the corn plant to express Cry 3Bb1 toxic proteins in the corn roots were first commercially grown in South Dakota. Corn rootworm larvae that ingest these toxic proteins die of gut paralysis.

This new Bt-corn is called “Bt-rootworm” to identify it from the “Bt-corn borer” hybrids that have been available to South Dakota corn growers since 1996.

No Bt-corn is perfect. Each kind has its own strengths and limitations. For example, “Bt-corn borer” corn hybrids do not control corn rootworm larvae. Conversely, “Bt-rootworm” corn does not control corn borers or western bean cutworms. Corn rootworm larvae live in the soil and feed on roots. European corn borers tunnel into the stalks, ear shanks, and ear. Western bean cutworms feed on developing kernels in the corn ear.

In 2004, Bt-corn hybrids containing both the YieldGard Corn Borer and YieldGard Rootworm genes became available for commercial production in South Dakota. However, even this stacked-gene corn is still be vulnerable to the western bean cutworm because only the Herculex I gene (expressing Cry 1F protein) works against western bean cutworm larvae in South Dakota. The Herculex I gene and the YieldGard genes are owned and marketed by separate biotechnology companies.

The Bt-rootworm corn, although protected against corn rootworm larvae, also is vulnerable to secondary soil insect pests such as white grubs, wireworms, seedcorn maggots, and seedcorn beetles. Thus, all Bt-rootworm corn also comes treated with seed treatments such as Guacho (imidacloprid), Poncho (clothianidin) or Cruiser (thiamethoxam) for protection against secondary soil insect pests. Current insecticidal seed treatments are systemic neonicotinoids (i.e., derived from nicotine) that are coated onto the seed corn before planting.

This research was conducted to evaluate the performances of new Bt-corn hybrids against their target insect pests, and to obtain detailed agronomic and economic data, to better understand the potential benefits and limitations of growing transgenic Bt-corn hybrids in South Dakota.

MATERIALS AND METHODS

All experiments were conducted at SDSU's Southeast Experiment Farm near Beresford during the 2004 growing season. The different corn hybrids were planted on a field that was on continuous corn since 2001 (fourth-year corn). The experimental design was a randomized complete block with each treatment replicated four times.

The corn seeds were planted using a 6-row White 5700 planter on May 4, 2003. Plant population was at 27,900 per acre. Each experimental unit was composed of six rows of corn plants spaced 30 inches apart, 50 feet long. Two rows per plot was destroyed and dissected for corn borer injuries. Three rows were kept intact then harvested at the end of season (October 25, 2003). Ten consecutive plants on one row were examined from September 20-29 for injuries in the ears due to western bean cutworm and European corn borer larvae.

Data were analyzed using SAS (Statistical Analysis Software) after appropriate data transformations to normalize the data (Gomez and Gomez .1984).

Activities of corn borer and western bean cutworm moths at night were monitored with a light trap equipped with a 15-watt "black light" fluorescent bulb. An insecticide-impregnated rubber strip (dichlorvos) was placed in the collection container of the trap to quickly kill all insects attracted to the light trap. The light trap operated 24 hours a day from May 14 to September 14 during the growing season. Corn borer moths collected by the trap were counted regularly.

RESULTS AND DISCUSSION

Moth flights

The first-brood European corn borer moth flight peaked on June 8 while the second brood moth flight peaked on August 9 (Figure 1). The peak first-brood moth number of 30 European corn moths was lower than the 160 moths per night recorded the previous season (2003).

The number of western bean cutworm moths peaked on July 29 at 26 moths per night (Figure 2). This peak number also was relatively lower than the 2003 western bean cutworm peak moth flight which was at 196 on July 26.

Historical moth flights at the Southeast Research Farm can be found online at the Extension Entomology Web site (http://plantsci.sdstate.edu/ent).

Yield

In 2004, the overall highest yield of 219 bushels per acre was attained not by a Bt-corn, but by a conventional corn hybrid treated with an insecticide (Figure 3A). Among the Golden Harvest hybrids, the conventional hybrid (H 8906) treated with Mustang MAX yielded 16.5 bushels per acre more than the untreated equivalent. H 9006Bt with the YieldGard Corn Borer gene yielded 11 bushels less than then untreated conventional hybrid.

Within the Dekalb corn hybrids, the conventional DK 537 seed-treated with Poncho 1250 yielded 25.1 bushels more than the untreated DK 537. The different kinds of Bt-corn hybrids also performed differently (Figure 3A). DKC 5329 with the YieldGard Rootworm gene improved yield by 17.8 bushels. The stacked and Poncho-treated Bt-corn hybrid (DKC 5321) containing genes for resistance to both corn borers and rootworms yielded 15.4 more bushels than the untreated DK 537. DKC.

DKC 5332 containing the YieldGard Corn Borer gene failed to significantly improve yield. Likewise, the Bt hybrids in the Syngenta and Pioneer hybrids did not significantly improve yields. P34N42 with the Herculex I gene did not perform significantly better than the untreated conventional P34N43 (Figure 3A).

Insect injuries

In general, the injuries due to corn borers and western bean cutworms were lower in 2004, matching the low number of moths caught in the light traps. However, western bean cutworms were again able to infest most of the ears of the Bt-corn hybrids (Figure 3B). About 35% of the corn ears of the Bt-corn DKC 5321 (with YieldGard Plus gene and Poncho 250) was infested with western bean cutworm larvae. Both of the Bt-corn hybrids from Pioneer (one with the Herculex I gene and the other with the YieldGard Corn Borer gene) did not show western bean cutworm infestations.

All of the Bt-corn hybrids containing the YieldGard Corn Borer and YieldGard Plus genes were free of corn borers in the ears, and almost all were free of corn borers in the stalks (Figure 3D). The Bt-corn hybrid containing the YieldGard Rootworm gene (DKC 5329) was infested with corn borers both in the ears and stalks.

ACKNOWLEDGMENTS

This study supported in part by the South Dakota Agricultural Experiment Station and the SDSU Plant Science Department. Corn seeds and insecticides were provided by their respective companies. The staff at the Southeast Research Farm and the entomology summer crew provided agronomic and technical support. Thank you very much.

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Figure 1. European corn borer moth flight at the SE Research Farm during the 2004 season.

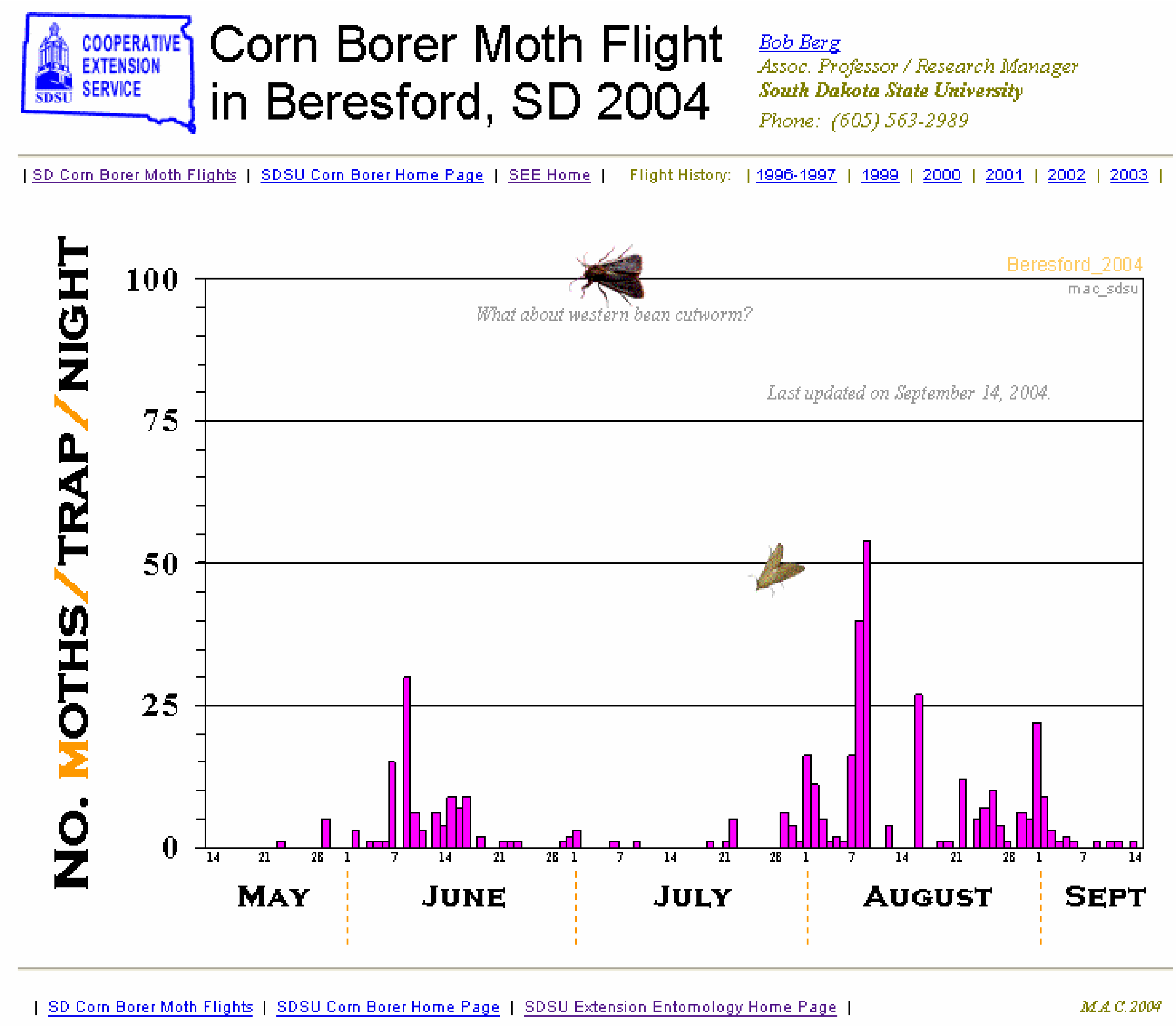


Figure 2. Western bean cutworm flight at the SE. Research Farm during the 2004 season.

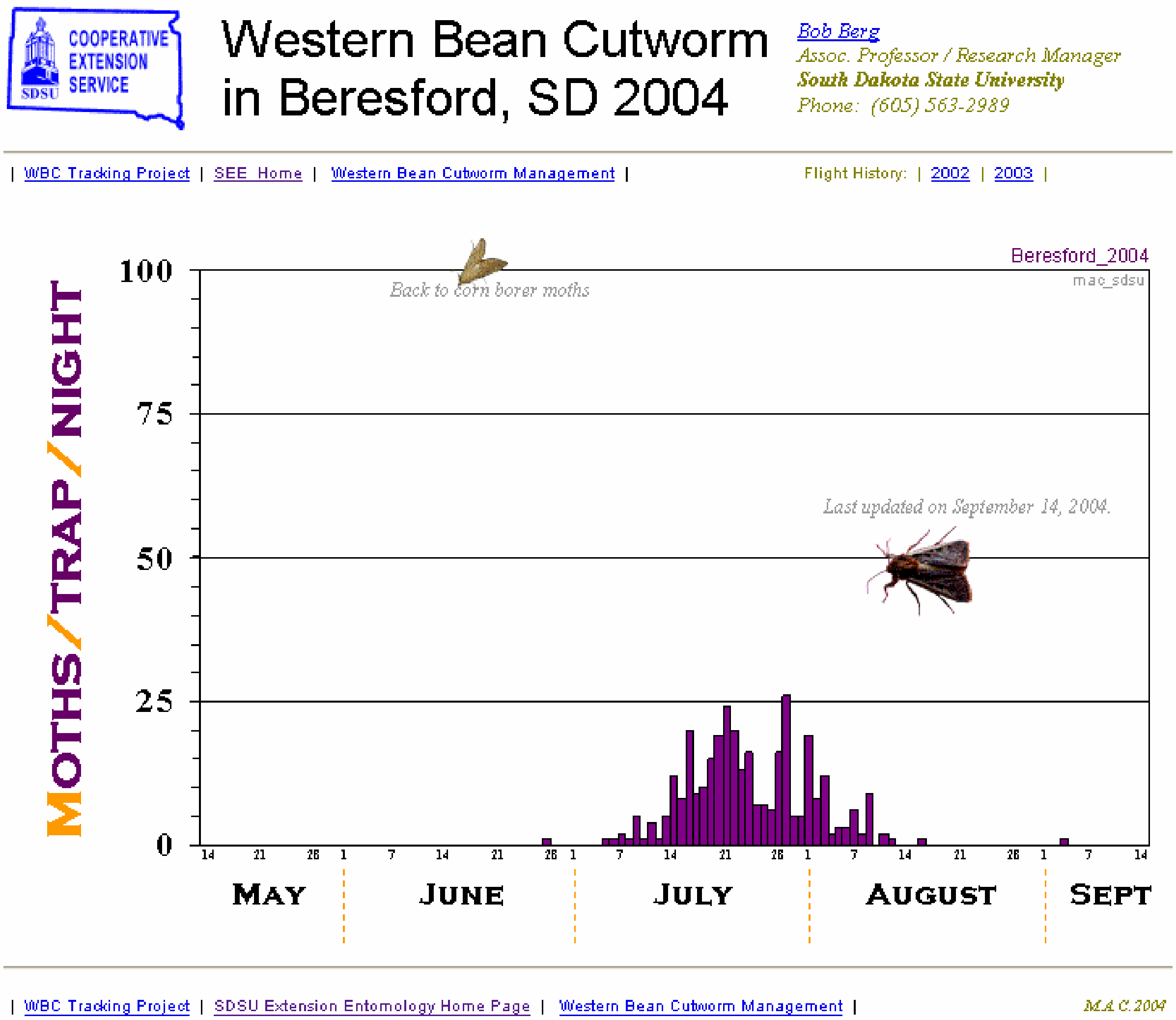


Fig. 3. Performances of Bt-corn and various insecticides against the bivoltine ecotype European corn borer and the western bean cutworm at the SE Research Farm during the 2004 season.

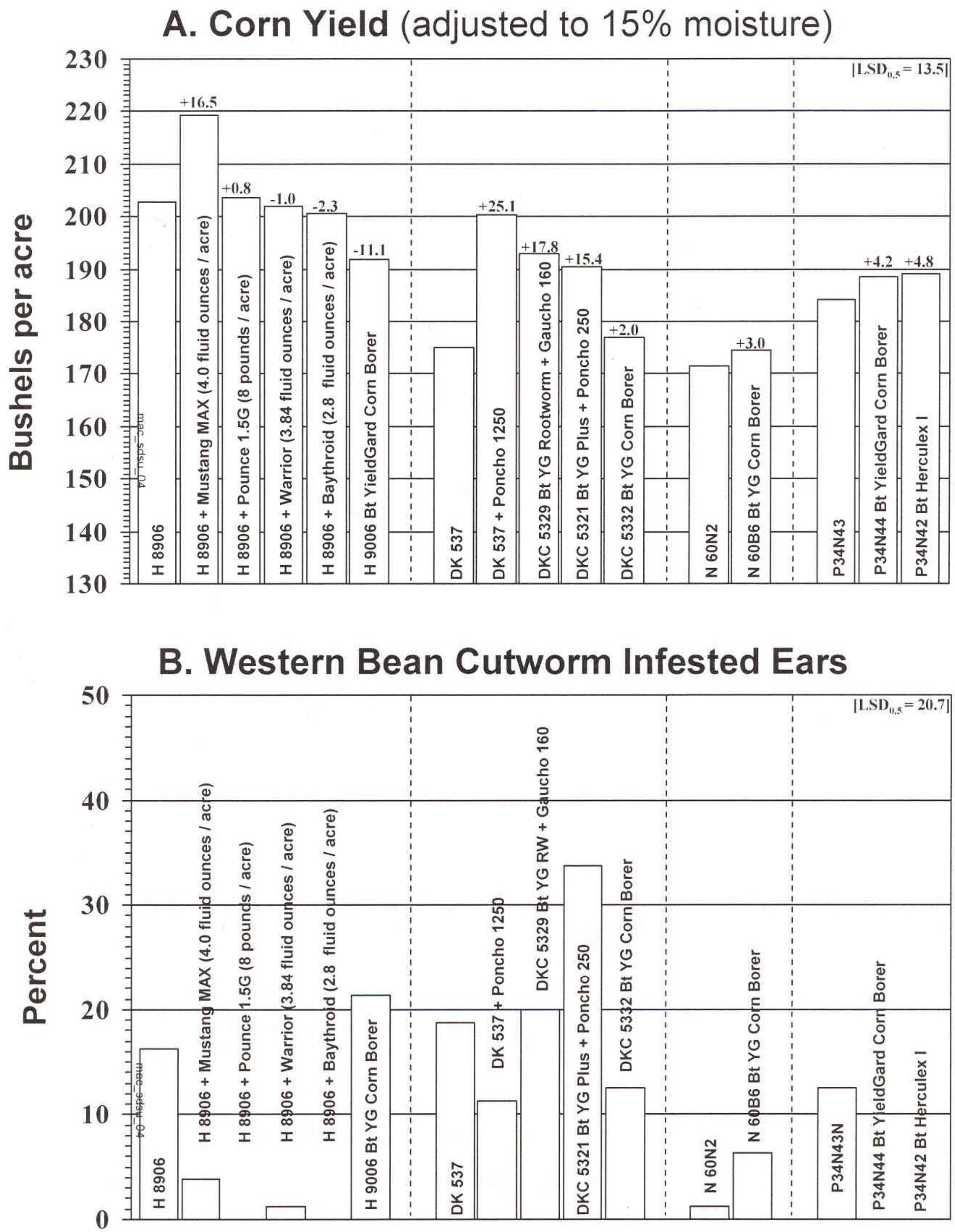
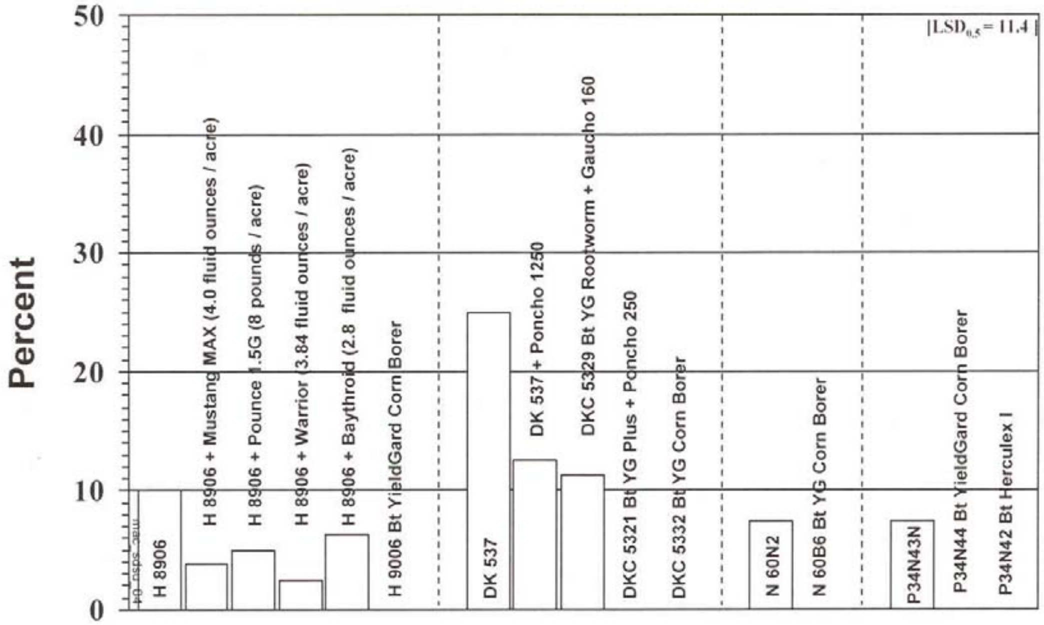
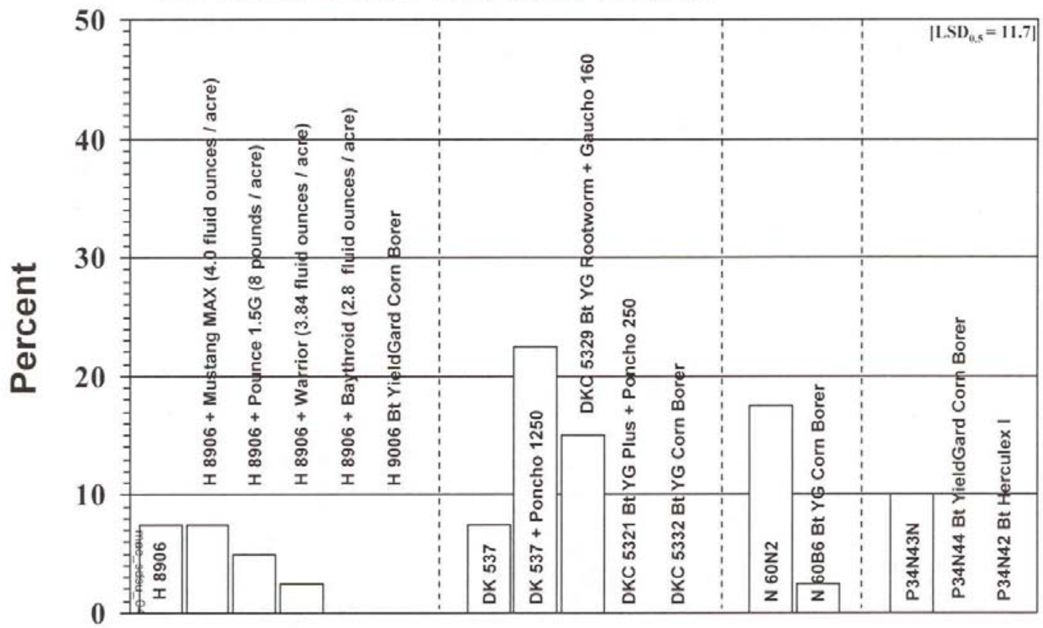


Fig. 3. Performances of Bt-corn and various insecticides against the bivoltine ecotype European corn borer and the western bean cutworm at the SE Research Farm during the 2004 season.

C. Corn Borer Infested Ears



D. Corn Borer Infested Stalks



SE FARM REPORT
SDSU

DIFFERENTIAL YIELD INCREASES IN SOYBEANS AFTER TREATMENT WITH INSECTICIDES FOR SOYBEAN APHIDS (*Aphis glycines*)

M. Catangui, S. Swanson, R. Jons, and R. Berg

Plant Science 0421

INTRODUCTION

The soybean aphid is currently the most destructive insect pest of soybeans in South Dakota. It damages soybeans by feeding on the sap of the soybean plant and can cause up to 30% yield loss. A relatively new pest of soybeans in the United States, soybean aphids were first detected in Wisconsin in 2000, and by the fall of 2001, it was detected in eastern South Dakota. As of the 2004 growing season, soybean aphids had been detected in 35 SD counties with Lyman County as the most recent county reporting the insect. The soybean aphid is probably now present in the entire soybean growing areas of South Dakota.

During the 2002 growing season, we noticed that application of various insecticides resulted in different increases in soybean yields at harvest (Catangui et al. 2002). Some of the insecticides, although very efficacious against the aphids, did not necessarily produce the highest yields at harvest. This research was therefore conducted to verify and further evaluate the performances of several insecticides in increasing soybean yield and efficacy against the aphids.

MATERIALS AND METHODS

All experiments were conducted at the Southeast South Dakota Experiment Farm near Beresford during the 2004 growing season. Two separate replicated trials were performed. The insecticide treatments were applied on July 30 on R2 (full bloom) stage soybeans and on August 12 on R3 (beginning pod) stage soybeans. The chemicals were applied using a Hudson-X-Pert compressed air sprayer calibrated to apply 20 gallons per acre of water spray mixture at 25 p.s.i. pressure. The experimental design was a randomized complete block with each treatment replicated four times. Each experimental unit was a plot of soybean plants measuring 10 feet wide by 30 feet long. The variety of soybean utilized in the research was Asgrow 2403RR (a Roundup Ready variety) planted in 30-inch rows on June 10, 2004.

The aphid population was monitored by taking whole plant samples, placing them in the freezer, then thoroughly inspecting the soybean plants for aphids. Three soybean plants were inspected per plot and the total number of aphids counted using a tally counter.

Soybean yields were taken from the two intact inner rows of each plot on October 15, 2004 using a precision combine used in crop performance trials.

RESULTS AND DISCUSSION

Aphid Infestation: Soybean aphid counts have not been completed at this time. However, the average aphid count in the untreated plots on August 16 was 1,278 aphids per plant.

Effect on Yield: Yield advantages ranging from 4.7 to 9.6 bushels per acre over the untreated soybeans were observed in Insecticide Trial 1 (Figure 1A). As in the 2002 study, the different insecticides again produced different advantages in soybean yields.

Between 9.0 to 13.1 bushels per acre yield increase was observed in Insecticide Trial 2 (Figure 1B). Combining insecticides with another insecticide or an additive did not appear to improve the yields further.

Delaying the spray application from R2 (July 30) to R3 (August 12), using the same insecticide and rate, resulted in yield penalties of 0.2 bushel per acre in Baythroid, and 1.3 bushels per acre in Warrior.

ACKNOWLEDGMENTS

This study was supported in part by the SD Soybean Research and Promotion Council, Bayer CropSciences, Dow AgroSciences, DuPont, FMC, Syngenta, and Wilbur-Ellis. We thank the staff at the Southeast Research Farm for agronomic and technical support. Thanks also to Kevin Kirby (SDSU Crop Performance) for harvesting the soybeans.

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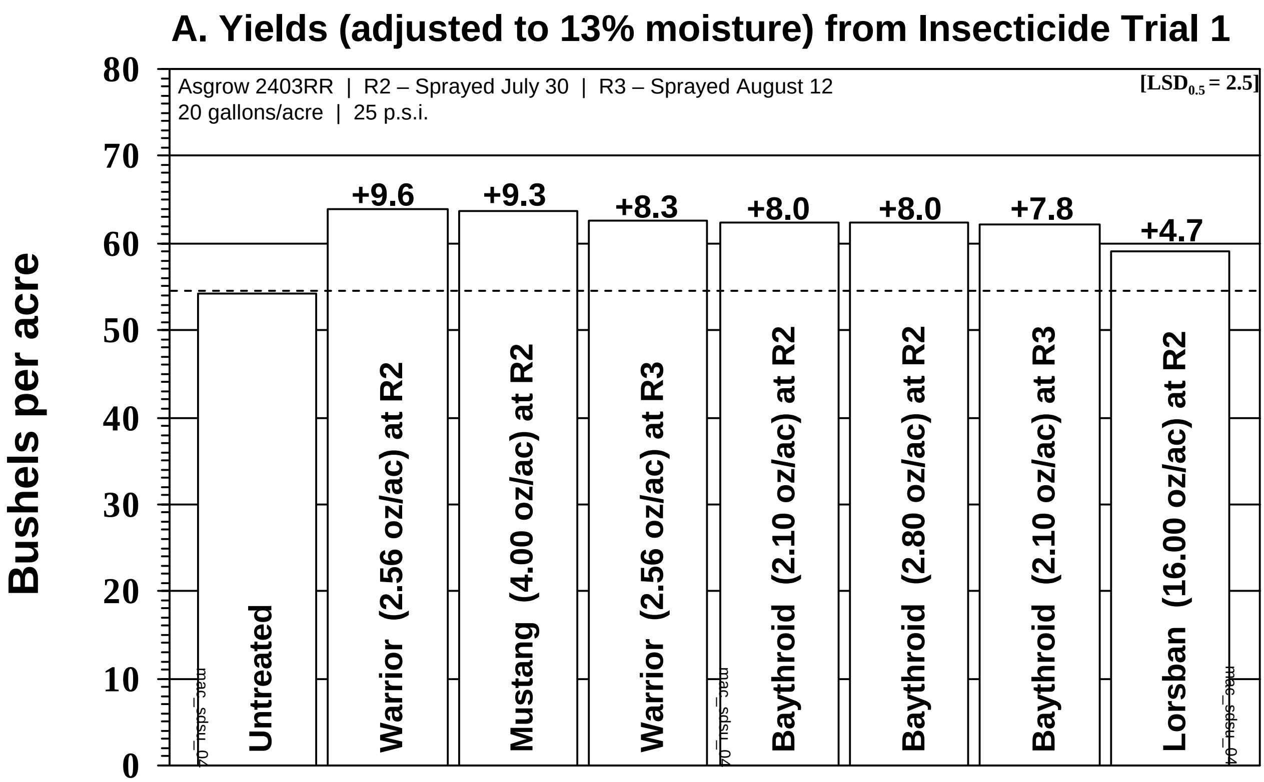
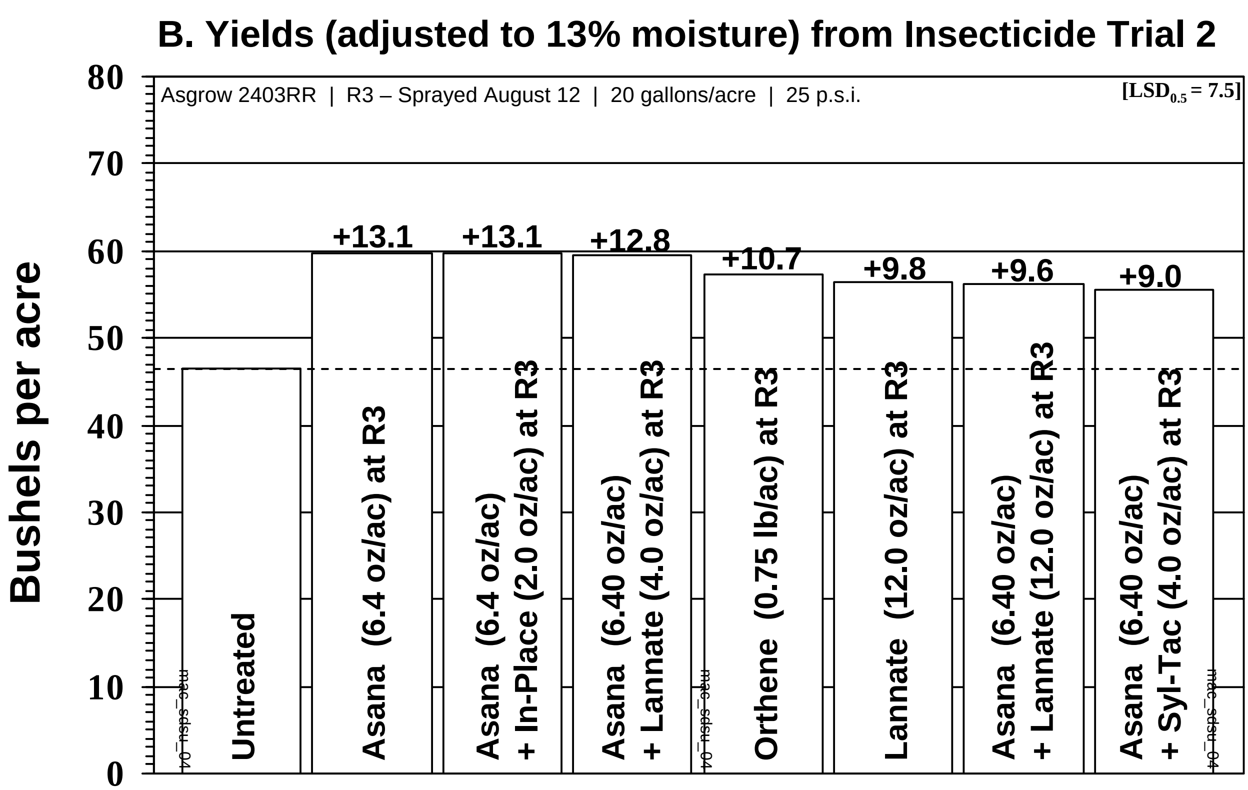
Fig. 1. Soybean yields resulting from insecticide treatments against the soybean aphid (*Aphis glycines*) at the SE Research Farm during the 2004 season.





SE FARM REPORT SDSU

OAT RESEARCH

Lon Hall

Plant Science 0422

Yield, yield stability, and test weight are the most important characteristics associated with the identification and eventual release of oat varieties. There are, however, several additional factors that contribute to the expression of these primary characteristics. Resistance to lodging, Barley Yellow Dwarf Virus (BYDV), stem rust, and crown rust all affect yield potential and test weight. Other traits that are considered prior to varietal release include: hull, protein, and oil percentages, as well as maturity, hull color, plant height, and whether it is hulled or hulless.

Consumers desire different characteristics for specific needs. Millers generally want oats with high protein, high beta-glucan content, and low oil, whereas, livestock producers prefer tall varieties with high levels of protein and oil. The racehorse industry demands a high quality, white-hulled or hulless oat variety. Tall varieties, such as Loyal, are popular forage oats.

The main emphasis of the oat breeding programs is development of hulled varieties. Market demand for milling and feed oats isn't affected by hull color; however, the racehorse industry desires white-hulled varieties. Therefore, emphasis is placed on development of white-hulled varieties with desirable traits for milling and/or feed. Recently there has been interest in hulless oats for feed and other specialty uses; therefore, we have increased our effort to develop a high oil hulless oat.

Plant breeding is a long drawn out process. The bulk breeding method takes, on average, at least 10 years from the initial cross to variety release. This process may be shortened by two to three years by using a modified single seed descent method, which involves two extra generations in the greenhouse, and a winter increase in New Zealand. Each year there are approximately 37,000 non-segregating plants and head rows observed within this program. In 2004, there were 3862 unique non-segregating lines yield tested. Out of a project total of 6870 yield plots, 960 were grown at the Southeast Research Farm.

Data collected from regional nurseries provides valuable information for variety release and germplasm selection for crossing in our program. The Tri-State regional nursery is made up of 30 hulled lines and 6 checks. The 30 lines consist of 10 advanced lines each from Minnesota, North Dakota, and South Dakota. Advanced increase lines are entered in the Uniform Early Nursery, Uniform Midseason Nursery, Quaker Uniform Oat Nursery, and/or

South Dakota Standard Variety Oat Trials (SVO). Hulless lines are tested in the Cooperative Naked Oat Trial and/or SVO.

SD000366-15 and SD000366-36 are sister lines that have been approved to increase for intent to release. If approved for variety release, one of these lines will be available to the producers for the 2006 growing season. They are white-hulled oat lines with a high test weight, good disease resistance, and yield potential. When averaged over 13 tests, SD000366-15 yielded 7.6 bushels more and had a 1.1 lb test weight advantage over Jerry. SD000366-36 yielded 14 bushels more and had 0.9 lb test weight advantage over Jerry. They are slightly taller and head one and two days later than Jerry respectively. Limited data shows both lines have adequate stem rust and lodging resistance; however, crown rust rating from field and buckthorn nursery evaluations indicate both lines have excellent crown rust resistance. Barley Yellow Dwarf resistance appears to be good; however, there was only one evaluation in 2003. SD000366-15 and SD000366-36 will be evaluated next year in Crop Performance Testing and the Uniform Midseason Oat Nursery (UMO). UMO data is collected from 16 locations in the USA and Canada is very useful for seed quality and disease evaluations. UMO disease data is collected in buckthorn nurseries, inoculated tests, and field infections. Yield data from the UMO is considered; however, emphasis is placed on Crop Performance Trials and breeder data.

Production research included a naked oat herbicide and fertilizer test at the Brookings location and a dormant seeding test at Brookings and Dakota Lakes Research Stations. Rye varieties and lines are also tested in Brookings.

ACKNOWLEDGEMENTS

This research is funded in part by annual grants from ‘The Quaker Oats Company’. We also appreciate the financial support provided by the South Dakota Agricultural Experiment Station, the Crop Improvement Association, and the SDSU Plant Science Department.

EVALUATION OF BINARY MIXTURES OF COOL-SEASON GRASSES WITH ALFALFA

P. Jeranyama and V. Owens

Plant Science 0423

Grass and legume mixture research has received very little attention in the North Central Region because alfalfa has dominated forage research in the past and present. There are some notable benefits of grass and legume mixtures that include their potential to supply more consistent forage yields across a wide range of environments compared with monocultures of either grass or legume (alfalfa). Other ecological advantages of mixtures are N_2 fixation by the legume, improved drying time for hay and reduced insect damage.

There is little production information on the suitability of diverse cool season grass species in binary mixtures with alfalfa to help farmers make informed decision on which species to plant in hay or grazing systems. The objective of this study is to evaluate binary mixtures of cool-season grasses with alfalfa for forage yield, compatibility, regrowth potential and forage quality.

In this study established at the Southeast Experiment Farm, seven perennial cool season grasses were planted in binary mixtures with a traffic tolerant alfalfa. Alfalfa cultivar Ameristand 403T was planted in four replications in spring to evaluate forage yield, forage quality, compatibility and regrowth potential after cutting. Forage yield and quality data were not taken in the establishment year (2004). Data will be collected from this trial in spring 2005 onwards. The grasses included in the trial are; intermediate wheatgrass, smooth bromegrass, meadow bromegrass, hybrid bromegrass, orchardgrass, timothy, and tall fescue.

Table 1. Species, cultivars and seeding rates in pure live seed (PLS) used in the experiment.

Species	Cultivar	Lb of PLS/acre
Smooth bromegrass	VNS Lincoln type	5
Meadow bromegrass	Hakari Mountain, NZ	6
Hybrid bromegrass	AC Knowles, Canada	5.5
Intermediate wheatgrass	Oahe	6
Orchardgrass	Pennlate	3
Tall fescue	Fawn	4
Timothy	Climax	3
Alfalfa (in mixture)	Ameristand 403T	8
Alfalfa (alone)	Ameristand 403T	16

SE FARM REPORT
SDSU

CORN BREEDING

Z. W. Wicks, III *and* D. M. Gustafson

Plant Science 0424

INTRODUCTION

The South Dakota State University's corn breeding and genetics program primary foci are to conduct applied research in corn breeding and to train graduate students. Specific objectives that we would like to achieve are to: 1) develop and release inbred lines and improved populations that can be used to develop hybrids for livestock feed, grain production or other value added products. Emphasis will be placed on yield, adaptation, stress tolerance, and pest resistance, 2) evaluate and select corn adapted to South Dakota for phosphorous and nitrogen content to be used as a compliment/supplement to DGs/co-product feed, 3) develop open-pollinated corn varieties, populations, and synthetics for sustainable agricultural operations (i.e. organic farmers) and conventional farming and, 4) continue to develop white corn as an alternative crop*.*

ACCOMPLISHMENTS

This year, the Southeast Research Station had beautiful growing conditions. With prime environmental conditions, we were able to select corn inbreds that hold great promise for this area.

The corn breeding studies/trials conducted at the Southeast Research Station during the 2004 growing season included:

1. Evaluation of a yellow hybrid yield trial. Approximately 200 early generation and advanced lines were crossed to testers last year for yield evaluations in 2004. Yield is the primary selection criteria. However, lines are evaluated for stress tolerance, disease resistance, lodging, and overall plant health as well.

   Based on preliminary data, several yellow inbred testcrosses were superior at the Southeast Research station in terms of yield and lodging. Yields for the check hybrids ranged from 180.0 bushels/acre to 199.3 bushels/acre, while the yellow inbred testcrosses ranged from 57.6 bushels/acre to 248.7 bushels/acre. The superior inbred lines will be advanced for testing to determine the relative merit of release to interested breeders.

2. We also evaluated a white hybrid yield trial consisting of approximately 200 entries. This trial, as well as the yellow hybrid

yield trial, included lines that originated in the South Dakota State University (SDSU) corn breeding program, a few lines that were released from other public breeding programs, and lines from the private sector. The white inbreds, ranging from 52.5 bushels per acre to 201.7 bushels per acre, did not out perform the check hybrids. However, a few of the white hybrids performed above the check hybrid average (191.1 bushels per acre). These white inbreds could prove as useful germplasm sources.

3. The Northern Central Region (NCR-167) corn performance nursery consisted of 29 advanced inbred testcrosses from Wisconsin, Iowa, North Dakota, Ontario, and Ottawa. At the Southeast Research Station, 7 out of the 29 entries yielded superior to the check hybrid and had comparable lodging. These lines are in the final stages of testing to determine the relative merit of release to interested breeders.

4. Our MS graduate student conducted a study on nitrogen (N) and phosphorous (P) concentration in silage corn. Increased ethanol production will mean increased distillers grain (DG), which is a feed source to livestock. Phosphorous and nitrogen content in DG is approximately three times greater than the content found in corn grain, resulting in losses to the environment. As a result, the phosphorous and nitrogen requirement must be balanced when feeding DGs to livestock. Our overall goal is to select adapted corn hybrids and make recommendations for low-phosphorous and low-nitrogen concentration for South Dakota producers.

   Specific objectives include quantifying N an P concentration, detection of variance factors (environment, location, and year) for N and P content, identification of the relationship between N and P content and tonnage yield, and identifying the effect of plant population in N and P concentration. In 2004, three replications of 10 hybrids from various private companies were planted at two population densities at three locations. We are currently processing samples for P and N concentration analysis.

ACKNOWLEDGEMENTS

This research was sponsored by the South Dakota Corn Utilization Council. We also appreciate the financial support provided by the SDSU Agriculture Experiment Station, and the SDSU Plant Science Department.

We would also like to thank Bob Berg, Manager of the Southeast Research Station, for establishing and maintaining the corn nursery and for his readiness to aid our project.

SOYBEAN BREEDING SUMMARY

Project Leader: Roy Scott
Supporting: Steve Stein, Matt Caron, Curt Reese

Plant Science 0425

In 2004 we tested both conventional and Roundup Ready soybean breeding lines at Southeast Research Farm (SRF). The wet spring, combined with the August cold weather, caused problems in development and maturity of some trials. After statistical analyses we determined that the data from the conventional field was not useful for selection, and will be ignored in this summary.

We tested 130 advanced and 300 new Roundup Ready group II lines at SRF in 2004. We also tested SCN lines at SRF in non-infested and Hurley infested sites, as well as other lines in the Northern Uniform Regional Trials and Uniform Quality Traits Trials. We will not report on the SCN and Uniform Trials in this summary.

<u>Advanced Lines:</u>

The mean yield of 100 lines tested was 61 bushels per acre (bu/ac) at SRF, with a range of 44-75 bu/ac. The same group of lines tested at Aurora farm near Brookings averaged 37 bu/ac yield, with a range of 25-43 bu/ac. In this group, 5 SD lines and 2 commercial checks yielded above 70 bu/ac at SRF, with 30 SD lines and 2 additional checks yielding 65-70 bu/ac. Fifteen lines that ranked in the top 30 at SRF also ranked in the top 25% at the Aurora site, indicating that some lines were consistently high yielding, and warrant continuation in the breeding program as potential varieties.

<u>New Lines:</u>

These 300 lines were tested in 3 separate trials of 100 per trial, replicated twice. In one trial, 30 lines and 3 commercial checks yielded between 60-75 bu/ac, with a trial range of 44-75 bu/ac. In addition to the SRF site, the other two trials were also tested at the Aurora site. In trial 2, 22 lines and the 4 commercial checks yielded between 64-75 bu/ac at SRF, with 11 of these and the 4 checks ranking in the top 22 lines at Aurora. Yield ranges across all lines in this trial were 44-75 bu/ac at SRF and 20-46 bu/ac at Aurora. Trial 3 ranged from 46-72 bu/ac at SRF and 23-41 bu/ac at Aurora. There were 30 lines and 3 commercial checks yielding between 65-70 bu/ac at SRF, with 11 of these ranking in the top 30 at Aurora. This indicated consistency of some high yielding lines, which merit continuation to advanced yield testing in 2005.

We had many poor tests at several sites in 2004, the data from which will not be useful for selection. Although the conventional data at SRF was not useful for yield selection, we recorded other useful data, such as maturity, plant height and lodging. Protein and oil data also will be analyzed. We had good data on most Roundup Ready trials, and will make selections for continuation in 2005.

SE FARM REPORT
SDSU

2004 OAT VARIETY PERFORMANCE TRIAL

R. G. Hall, K. K. Kirby, and L. Hall

Plant Science 0426

This paper reports the 2004 Southeast Research Farm performance trial for oat varieties and experimental lines. This trial was seeded and harvested by L. Hall, Research Associate, SDSU Oat Breeding Project.

Experimental Procedures

Ten oat varieties and eight experimental lines from the South Dakota State University Oat Breeding project were tested. Each entry consisted of four seeded plots measuring 5 X 20 feet that were later cut back to 5 x12 feet at harvest. A cone drill seeder with seven seed tubes spaced on 7-inch seed rows was used for planting. Plots were seeded at 1.2 million pure-live-seeds per acre on April 5, 2004 into a Trent silt loam previously cropped to soybeans. Weed control consisted of one application of Bronate at 1.0 pint per acre. Yield (bu/a) values were adjusted to 13.5% moisture (dry-matter basis) and a bushel weight of 32 pounds.

Performance trial results

As indicated in Table 1 the average yield for 2004 was 148 bu/acre and for the longer 3-year period it was 98 bu/acre. In 2004, varieties had to yield 154 bu/acre to be in the top performance group for yield; and for the 3-year period varieties had to average 96 bu/acre to qualify for the top performance group for yield. The top performance group for yield in 2004 included two varieties (Morton and HiFi) and all of the SD experimental lines. For the longer 3-year period the top performance group for yield included the varieties Jerry, Don, HiFi, Reeves, Morton, and Loyal. In both 2004 and for the longer 3-year period none of the hull-less varieties (Buff, Stark, or Paul) were in the top performance group for yield. Buff had a higher yield than Paul for both 2004 and for 3-years.

In 2004, the average bushel weight was 42 lbs the average grain protein was 17.8%, and the average plant height was 44 inches. In 2004, varieties with a bushel weight of 50 lbs or higher were in the top performance group for bushel weight. This included only one variety, the hull-less variety Paul. Among the standard varieties, the top performance group for bushel weight included the two varieties Hytest (43 lbs) and Jerry (42 lbs) and the SD experimental lines SD 366, SD366-7, SD010062, SD 366-15, and SD 366-23 at 42 lbs. The varieties Hytest, Buff (hull-less), Stark (hull-less), Paul (hull-less), and the SD experimental line SD011226 tended to have the high grain protein. In 2004, entries had to attain a height of 46 inches or more to be in the top performance group for maximum plant height. This group included the variety Loyal and the SD experimental lines SD010062 and SD 366-23. In contrast, entries had to attain a height of 42 inches or less to be in the top performance group for minimum plant height. This group included the varieties Don and Buff (hull-less).

Research funding & support sources: The SD Agricultural Experiment Station and testing fees obtained from the SD Crop Performance Testing Program makes these research results possible.

Table 1. Oat yield results- SE Research Farm, 2003-2004.

	Agronomic Performance Averages				
Variety (Hdg.)*	Bu/A 2004	Bu/A 3-Yr	Bu.Wt. Lb.	Prot. %	Ht. in.
Standard types:					
Don (1)	153	114	40	15.9	40
Reeves (2)	147	106	41	18.3	44
Hytest (4)	112	86	43	19.8	44
Jerry (5)	154	116	42	17.9	44
Morton (7)	161	105	38	16.4	45
Loyal (8)	146	103	38	18.1	46
HiFi (8)	161	109	38	16.2	44
Hull-less types:					
Buff Hls (3)	113	88	51	20.5	42
Stark Hls (6)	112	.	43	18.9	44
Paul Hls (7)	76	53	46	21.1	43
Experimentals:					
SD 366 (-)	171	.	42	16.6	45
SD 366-7 (-)	164	.	42	17.3	44
SD010062 (-)	161	.	42	17.0	48
SD011226 (-)	173	.	40	18.2	44
SD011315 (-)	156	.	37	14.9	44
SD 366-15 (-)	161	.	42	17.7	45
SD 366-23 (-)	171	.	42	17.8	47
SD 366-36 (-)	174	.	41	17.3	46
Test avg.:	148	98	42	17.8	44
Lsd(.05):	20	20	1	.	2
# TPG-value:	154	96	50	.	46
C.V.:	9	8	2	.	4

* Heading, relative difference in days compared to Don.
\# Minimum value required for the top performance group.

2004 SOYBEAN VARIETY PERFORMANCE TRIALS

R. G. Hall and K. K. Kirby

Plant Science 0427

This reports the 2004 Southeast Research Farm performance trials for both non-Roundup-Ready and Roundup-Ready soybean varieties conducted by the South Dakota State University Crop Performance Testing (CPT) program.

Research funding & support sources: The SD Agricultural Experiment Station and testing fees obtained from the SD Crop Performance Testing Program .

Experimental Procedures

Entries were placed into either a maturity group-I or group-II test trial according to maturity ratings reported by a given seed company. **NOTE**: Each company selects the appropriate maturity group trial (0,I, or II) for their entries at a location. Generally, each company has one or more maturity group checks for the varieties they market. However, there are no standard regional or national check varieties for maturity. Consequently, a late group-I variety from one company may be similar in maturity to an early group-II variety from another company because they use different check varieties for maturity. As a result, this testing program can not guarantee that all entries are placed in the proper maturity trial. In some trials, borderline entries with maturity group ratings at or near the arbitrary breaks between the late group-I's and early-group-II's may crossover.

Entries were seeded in three replications with each variety randomly located within a replication. Plots consisted of four 30-inch rows, 20 feet long. Plots were seeded on May 19, 2004 into a Trent silt loam previously cropped to soybeans. A Monosem precision row crop planter was used for seeding and delivered 165,000 seeds per acre, regardless, of seed quality and germination percentage. Granular Nitragin brand Soybean Soil Implant metered down the seed tube was used for seed inoculation.

Except for weed control the experimental procedures described above apply both to the non-Roundup Ready and the Roundup Ready trials. In the Roundup Ready trials two post emergence applications of Roundup Ultra (32 oz/acre) were applied. The first when weeds were 2-4 inches tall, followed by a second application when weed growth was again 2-4 inches tall. In the non-Roundup Ready test trials, post-emergence weed control consisted of a tank mix of Dual II (2 pt./ac)/Python (1.33 oz. /ac) on May 14.

Yield values (bu/ac) are an average of three replications, adjusted to 13% moisture (dry-matter basis) and a bushel weight of 60 pounds. Yield, least significant difference (Lsd), and minimum top-yield values are rounded off to the nearest whole bushel per acre. The reported protein and oil values are for the current season. Three replicate samples of every variety in each trial was combined into one composite sample and tested for protein and oil using a FOSS TECATOR Model Infratec 1229 grain analyzer. Plant Height was measured from the soil surface to the top node of the main stem. Lodging scores are an average of how erect the main stem of all the plants are at maturity. 1 = all plants erect, 2 = slight lodging, 3 = lodging at a 45^{o} angle, 4 = severe lodging, and 5 = all plants flat.

Measurements of Performance

Check for the "least significant difference" (Lsd) value at the bottom of each column of data values. The reported Lsd values can be used in two ways. First, the Lsd value indicates how much a variable such as yield must differ between two varieties before there is a real yield difference. For example, in the early non-Roundup Ready test (Table 1), the year 2004 Lsd value of 5 bu/a can be used to compare the yields of any two varieties in trial. If variety A yields 69 bu/ac and variety B yields 67 bu/ac the yield difference is 2 bu/ac (69 - 67 = 2). In this case the two varieties do not differ in yield because their yield difference of 2 bu/ac is less than the reported Lsd value of 5 bu/ac. In contrast, if variety C yields 59 bu/ac the yield difference between variety A and variety C would be 10 bu/ac (69-59 = 10). In this case the yield difference of 10 bu/ac is more than the reported Lsd value of 5 bu/ac; therefore, variety A has a significantly higher yield than variety C.

The second use for the Lsd value is to identify the top group for the current year yield, two-year yield, and lodging percentage. For example, in Table 1 the highest current year yield was 69 bu/ac. To determine if it is the only top yielding variety in this trial use the Lsd value of 5 bu/ac at the bottom of the 2004 yield column. In order for varieties to be in the top performance group for yield they must yield 64 bu/ac (69-5 = 64) or higher. Technically, a yield of 65 bu/ac is in the top yield group while a yield of 64 bu/ac is not be in the top yield group. However, since all yields and Lsd values are rounded to the nearest whole number. We can say 64 bu/ac, because of the rounding-off, is the more appropriate minimum value for top yield varieties in this test trial. Top yield varieties for 2004 are those varieties that are equal or higher than the minimim top yield group value. In addition, the minimum top yield group value is indicated for the 2 yr. (2003-04) average unless there were no significant yield differences. The minimum yield required to qualify for the top performance group for yield are listed at the bottom of each yield column (TPG-value).

Similarly, the top group for lodging can be determined. For example, in Table 1, the minimum lodging percentage was 2%. In Table 1 current year yields must equal 64 bu/ac or higher, two-year yields must equal 52 bu/ac, and lodging must be equal to 2 or less to be in the top performance group for these factors. Since only one sample was tested for
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protein and oil content statistical analysis was not used to determine variety differences in these two variables.

Performance Trial Results

General: This was a very good test year for soybeans at this location. In both, the non-Roundup Ready and Roundup Ready test trials, the 2004 yield averages were about 10% higher than for the two-year 2003-04 yield averages.

Non-Roundup Ready varieties: Results for year 2004 and for two-years (2003-04) are listed below:

Maturity Group-I soybean test, Table 1**.** The 2004 and two-year test yield averages were **59 and 55** bushels per acre, respectively**.** Varieties had to average 64 bushels or higher to be in the top yield group for 2004. Likewise, varieties had to average 52 bushels or higher to be in the top yield group for two years. Variety yield averages had to differ by 5 bushels in 2004 and 9 bushels for two years to be significantly different. The 2004 protein, oil, and lodging score test averages were **33.1%, 17.1%, and 2**, respectively**.** Lodging score averages had to be 2 or lower to qualify for the top performance group, therefore, varieties with lodging score averages of 3 or higher were significantly more prone to lodge.

Maturity Group-II soybean test, Table 2**.** The 2004 and two-year test yield averages were **62 and 55** bushels per acre, respectively**.** Varieties had to average 63 bushels or higher to be in the top yield group for 2004. Likewise, varieties had to average 52 bushels or higher to be in the top yield group for two years. Variety yield averages had to differ by 7 bushels in 2004 and 8 bushels for two years to be significantly different. The 2004 protein, oil, and lodging score test averages were **32.9%, 17.3%, and 2**, respectively**.** Lodging score averages had to be 2 or lower to qualify for the top performance group, therefore, varieties with lodging score averages of 3 or higher were significantly more prone to lodge

Table 1. Non-Roundup Ready maturity group-I soybean variety performance averages- SE Research Farm, Beresford, SD, 2003-04.

Brand/Variety (by 2-Yr & 2004 yield)	Agronomic Performance Averages Bu/Acre 2004	Bu/Acre 2-Yr	Protein %	Oil %	Lodging* (1-5)	DTM^
LATHAM/EXP-E1840T	69	61	33.2	17.1	2	123
LATHAM/280	68	59	33.7	17.1	1	123
THOMPSON/T-3189	67	59	34.3	16.3	2	123
THOMPSON/T-3182	59	54	30.7	17.4	2	124
PUBLIC/STRIDE	54	51	30.9	17.6	2	120
PUBLIC/SD96-135-3EX	51	48	33.3	18.1	2	119
NUTECH/NT-180	69	.	33.4	17.0	1	123
LATHAM/EXP E1863	68	.	31.7	16.7	2	121
NUTECH/NT-170	67	.	31.2	16.9	2	121
PUBLIC/SD00-307EXP	61	.	30.6	18.1	2	120
PUBLIC/SD00-735EXP	58	.	33.8	16.8	3	124
PUBLIC/SD00-622EXP	56	.	31.7	18.1	1	124
PUBLIC/SDX98-74331E	55	.	37.6	15.6	3	122
PUBLIC/SD00-533EXP	54	.	32.5	17.1	4	119
PUBLIC/SDX98-82302E	44	.	37.9	15.3	4	116
PUBLIC/SD00-1638EXP	43	.	32.5	17.6	3	121
Test avg.:	59	55	33.1	17.1	2	121
Max. avg.:	69	61	37.9	18.1	4	124
Min. avg.:	43	48	30.6	15.3	1	116
# Lsd (.05):	5	9			1	
## TPG-value:	64	52			2	
@ Coef. Var.:	5	7			31	
No. Entries:	16	6	16	16	16	

* Lodging, 1= all plants erect, 5= all plants flat.
^ DTM= days from seeding on May 19, 2004 to maturity.
# Lsd,(.05)= amount values in a column must differ to be significantly different. NS- differences among column values are non-significant.
Minimum value required to qualify for the top performance group.
@ Coef. Var.= a measure of trial experimental error.

Table 2. Non-Roundup Ready maturity group-II soybean variety performance averages- SE Research Farm, Beresford, SD, 2003-04.

Brand/Variety (by 2-Yr & 2004 yield)	Agronomic Performance Averages					
	Bu/Acre 2004	Bu/Acre 2-Yr	Protein %	Oil %	Lodging* (1-5)	DTM^
JACOBSEN/J826	70	60	33.5	16.8	1	126
COYOTE/9723	69	58	32.8	16.9	2	126
JACOBSEN/J814	67	58	32.9	16.9	2	126
SANDS/SOI 288	69	57	32.4	17.2	2	129
SANDS/SOI 256	64	56	32.5	17.8	1	126
THOMPSON/T-3288	62	55	32.2	17.2	4	131
COYOTE/9525	58	51	31.0	18.0	2	129
PUBLIC/TURNER-SCN	53	47	32.1	18.1	2	126
COYOTE/EX525	68	.	31.5	17.5	4	131
THOMPSON/T-3222	67	.	33.7	16.7	3	125
PUBLIC/SD98-99-2EXP	67	.	32.0	18.1	2	123
MUSTANG/M-2255	66	.	31.2	17.5	3	131
NUTECH/NT-282 SCN	66	.	34.0	17.4	3	131
NUTECH/NT-242 SCN	65	.	32.6	17.7	3	130
PUBLIC/SD00-732EXP	65	.	33.8	17.0	2	123
LATHAM/EXP-E2980	64	.	33.5	17.4	3	132
PUBLIC/SD00-746EXP	64	.	33.7	17.1	2	124
LATHAM/EXP E2380	63	.	33.2	17.2	3	131
SANDS/SOI 228N	62	.	33.2	17.3	3	131
GOLD COUNTRY/5329CY	62	.	33.6	17.4	3	129

Table 2. Non-Roundup Ready maturity group-II soybean variety performance averages (continued).

Brand/Variety (by 2-Yr & 2004 yield)	Agronomic Performance Averages					
	Bu/Acre 2004	Bu/Acre 2-Yr	Protein %	Oil %	Lodging* (1-5)	DTM^
PUBLIC/SD00-632EXP	59	.	32.1	16.6	3	123
GOLD COUNTRY/6024FG	57	.	34.9	16.9	3	128
PUBLIC/SD00-1587EXP	56	.	33.0	17.2	4	125
PUBLIC/SD00-314EXP	51	.	31.2	17.9	4	124
PUBLIC/SD00-377EXP	44	.	35.2	17.4	2	121
Test avg.:	62	55	32.9	17.3	3	127
Max. avg.:	70	60	35.2	18.1	4	132
Min. avg.:	44	47	31.0	16.6	1	121
# Lsd (.05):	7	8			1	
## TPG-value:	63	52			2	
@ Coef. Var.:	7	6			17	
No. Entries:	25	8	25	25	25	

* Lodging, 1= all plants erect, 5= all plants flat.
^ DTM= days from seeding on May 19, 2004 to maturity.
# Lsd,(.05)= amount values in a column must differ to be significantly different. NS- differences among column values are non-significant.
Minimum value required to qualify for the top performance group.
@ Coef. Var.= a measure of trial experimental error.

Performance Trial Results (continued)

Roundup Ready varieties: Results for year 2004 and for two-years (2003-04) are listed below:

Maturity Group-I soybean test, Table 3. The 2004 and two-year test yield averages were **61 and 56** bushels per acre, respectively**.** Varieties had to average 67 bushels or higher to be in the top yield group for 2004. Likewise, varieties had to average 55 bushels or higher to be in the top yield group for two years. Variety yield averages had to differ by 5 bushels in 2004 and 6 bushels for two years to be significantly different. The 2004 protein, oil, and lodging score test averages were **32.2%, 17.8%, and 2**, respectively**.** Lodging score averages had to be 2 or less to be in the top performance group. In addition, lodging scores had to differ by 1 in order to be significantly different from one another.

Maturity Group-II soybean test, Table 4. The 2004 and two-year test yield averages were **64 and 57** bushels per acre, respectively**.** Varieties had to average 68 bushels or higher to be in the top yield group for 2004. Likewise, varieties had to average 54 bushels or higher to be in the top yield group for two years. Variety yield averages had to differ by 5 bushels in 2004 and 8 bushels for two years to be significantly different. The 2004 protein, oil, and lodging score test averages were **32.9%, 17.2%, and 2**, respectively**.** Lodging score averages had to be 2 or less to be in the top performance group. In addition, lodging

scores had to differ by 1 in order to be significantly different from one another
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Table 3. Roundup Ready maturity group-I soybean variety performance averages- SE Research Farm, Beresford, SD, 2003-04.

Brand/Variety (by 2-Yr & 2004 yield)	Agronomic Performance Averages					
	Bu/Acre 2004	Bu/Acre 2-Yr	Protein %	Oil %	Lodging* (1-5)	DTM^
THOMPSON/T-7205RR	67	61	31.7	18.0	1	124
STINE/S1918-4	65	60	31.4	18.1	1	125
KRUGER/223+RR	67	59	31.5	18.1	1	124
KRUGER/211+RR	65	59	32.5	17.9	1	126
THOMPSON/T-7214RR	65	58	31.9	18.0	1	125
KRUGER/223RR	63	57	32.1	18.0	1	121
KRUGER/191RR	65	56	31.2	18.0	1	124
ZILLER/BT 7193R	63	54	34.0	17.3	2	127
SODAK GENETICS/SD1151RR	51	48	32.8	17.6	3	122
PUBLIC/MN-1803RR	53	46	33.5	17.4	4	128
TOP FARM/E3M321RR	72	.	32.2	17.9	1	126
ASGROW/AG1903	68	.	31.6	17.4	1	122
TECH. DIRECT/TD-199RR	68	.	32.1	17.7	1	125
NUTECH/NT-1909RR	67	.	32.2	18.1	2	126
NUTECH/NT-2002RR	67	.	31.7	18.1	1	125
PRAIRIE BR./PB-1954RR	67	.	32.0	17.7	2	123
NK BRAND/S19-R5	66	.	31.9	17.6	1	122
TOP FARM/E34904RR	65	.	32.0	18.1	1	126
THOMPSON/T-7234RR	65	.	32.0	17.9	1	125
TECH. DIRECT/TD-202RR	64	.	32.5	17.8	1	125
KRUGER/192RR	64	.	31.5	18.2	1	124
LATHAM/EXP-E1936R	64	.	32.1	18.0	1	125
NUTECH/NT-1901RR	63	.	33.0	17.0	2	127
NUTECH/NT-2202RR	62	.	32.5	17.9	1	126
KALTENBERG/KB153RR	61	.	30.6	17.8	1	121
KRUGER/155+RR	59	.	31.7	17.7	1	119
TOP FARM/E34714RR	58	.	32.2	17.5	1	120
PUBLIC/SD96-170RR-28L	58	.	30.8	18.3	2	117
PUBLIC/SD01-1120R	57	.	32.2	18.3	3	128
PUBLIC/SDX00-053R-46	55	.	31.6	18.0	4	128
PUBLIC/SDX00R-035-59	52	.	32.9	17.5	1	121
PUBLIC/SD01-3387R	51	.	32.6	17.3	2	119
PUBLIC/SD01-3402R	51	.	36.1	16.1	3	122
PUBLIC/SDX00R-022-66	50	.	31.0	18.6	4	119

Table 3. Roundup Ready maturity group-I soybean variety performance averages (continued).

	Agronomic Performance Averages					
Brand/Variety (by 2-Yr & 2004 yield)	Bu/Acre 2004	Bu/Acre 2-Yr	Protein %	Oil %	Lodging* (1-5)	DTM^
PUBLIC/SD00-236R	50	.	33.6	17.7	3	118
PUBLIC/SD01-1792R	46	.	32.9	17.3	2	119
PUBLIC/SDX00-022R-23	45	.	31.4	18.6	3	116
Test avg.:	61	56	32.2	17.8	2	123
Max. avg.:	72	61	36.1	18.6	4	128
Min. avg.:	45	46	30.6	16.1	1	116
# Lsd (.05):	5	6			1	
## TPG-value:	67	55			2	
@ Coef. Var.:	5	6			28	
No. Entries:	37	10	37	37	37	

* Lodging, 1= all plants erect, 5= all plants flat.
^ DTM= days from seeding on May 19, 2004 to maturity.
# Lsd,(.05)= amount values in a column must differ to be significantly different. NS- differences among column values are non-significant.
Minimum value required to qualify for the top performance group.
@ Coef. Var.= a measure of trial experimental error.

Table 4. Roundup Ready maturity group-II soybean variety performance averages- SE Research Farm, Beresford, SD, 2003-04.

Brand/Variety (by 2-Yr & 2004 yield)	Agronomic Performance Averages					
	Bu/Acre 2004	Bu/Acre 2-Yr	Protein %	Oil %	Lodging* (1-5)	DTM^
SANDS/SOI 2143RR	70	62	31.7	17.7	1	127
LATHAM/497RR	71	61	31.2	17.5	1	126
PRAIRIE BR./PB-2421RR	70	61	32.5	17.6	1	129
LATHAM/L2136R	66	61	31.7	17.7	1	126
MUSTANG/M-201RR	73	60	32.3	17.6	1	126
MUSTANG/M-284RR	73	60	33.7	17.2	2	130
DEKALB/DKB25-51	70	60	30.7	18.0	2	129
ASGROW/AG2403	69	60	31.4	17.6	1	127
COYOTE/9524RR	68	60	31.2	18.0	1	129
PRAIRIE BR./PB-2243RR	67	60	32.6	17.5	1	126
MUSTANG/M-243RR	71	59	31.2	17.9	1	129
PRAIRIE BR./PB-2343RR	71	59	33.6	16.7	1	126
PRAIRIE BR./PB-2643RR	67	59	31.7	17.8	2	131
STINE/S2116-4	65	59	32.2	17.6	1	126
MUSTANG/M-203RR	65	58	31.4	17.4	1	126
JACOBSEN/J733R	64	58	31.9	17.6	1	126
EXCEL/8236NRR	68	57	34.1	17.1	1	127
RENK/RS253RR	66	57	33.3	17.3	1	129
SANDS/SOI 226RR	62	57	32.8	17.2	2	127
DAIRYLAND/DSR-234/RR	67	56	33.3	17.3	1	126
RENK/RS223RR	62	55	31.9	17.6	1	125
KRUGER/270RR	61	55	33.0	17.3	4	132
JACOBSEN/J828R	62	54	32.6	18.1	3	129
KALTENBERG/KB275RR	60	54	32.8	17.7	3	130
THOMPSON/T-7243RR	67	53	32.5	17.5	1	121
ASGROW/AG2801	60	52	34.8	16.0	2	130
SANDS/SOI 2872RR	58	51	33.3	17.5	4	131
SANDS/SOI 2642NRR	53	50	34.0	16.9	3	132
PUBLIC/SD93-828R	55	47	31.4	17.1	2	118
ZILLER/BT 7215R	73	.	31.8	17.7	1	127
SANDS/SOI 2754RR	72	.	32.1	17.3	1	132
STINE/S2103-4	72	.	31.3	17.9	1	126
PRAIRIE BR./PB-2141RR	71	.	31.8	17.6	1	128
DAIRYLAND/DSR-2500/RR	70	.	32.9	17.3	2	128
COYOTE/4527RR	69	.	32.6	17.4	1	130

Table 4. Roundup Ready maturity group-II soybean variety performance averages (continued).

Brand/Variety (by 2-Yr & 2004 yield)	Agronomic Performance Averages: Bu/Acre 2004	Bu/Acre 2-Yr	Protein %	Oil %	Lodging* (1-5)	DTM^
FARM ADVANTAGE/7264	69	.	31.9	17.5	1	131
TOP FARM/E34104RR	69	.	33.1	17.2	2	127
JACOBSEN/J730NR	69	.	31.5	18.1	1	124
COYOTE/EX325RR	68	.	35.0	16.6	2	128
TECH. DIRECT/TD-255RR	68	.	34.3	16.6	1	128
KRUGER/EXP268RR	68	.	30.7	18.1	1	127
KRUGER/233+RR	68	.	33.9	17.1	2	128
TOP FARM/E3M278RR	68	.	32.0	17.7	1	132
THOMPSON/T-2707+RR	68	.	33.3	16.9	2	128
RENK/RS234RR	68	.	32.4	17.2	1	127
NK BRAND/S27-T7	67	.	32.2	17.4	1	128
SANDS/SOI 2151NRR	67	.	31.4	18.1	1	126
KRUGER/200RR	67	.	32.6	17.2	3	125
LATHAM/L2900R	67	.	32.9	17.0	1	133
TOP FARM/E34520RR	67	.	33.4	17.1	1	130
THOMPSON/T-2422RR	67	.	33.7	17.3	1	127
PUBLIC/SD01-2509R	67	.	30.8	16.9	2	129
MUSTANG/M-264RR	66	.	32.0	17.6	1	131
MALLARD/EXP RR2411	66	.	33.5	16.6	1	128
DEKALB/DKB22-52	66	.	31.8	17.9	1	126
SANDS/SOI 2169RR	66	.	31.7	17.3	2	127
NUTECH/NT-2550RR	66	.	33.0	17.5	1	127
LATHAM/738RR	66	.	33.0	17.5	1	129
KALTENBERG/KB203RR	66	.	32.4	17.4	1	127
PRAIRIE BR./PB-2443RR	66	.	33.9	17.3	1	126
THOMPSON/T-2404+RR	66	.	33.7	16.5	2	129
MUSTANG/M-255RR	65	.	35.3	16.4	1	129
SANDS/EXP 2669RR	65	.	32.9	17.1	1	128
NUTECH/NT-2790+RR	65	.	31.9	16.6	4	131
KRUGER/EXP257RR	65	.	32.9	17.1	2	128
PRAIRIE BR./PB-2534RR	65	.	34.3	16.6	1	128
COYOTE/4523RR	64	.	33.4	16.9	2	128
NUTECH/NT-2404RR	64	.	33.3	16.8	2	129
TECH. DIRECT/TD-233RR	64	.	33.7	16.4	2	130
KRUGER/289+RR	64	.	31.8	17.5	2	132

Table 4. Roundup Ready maturity group-II soybean variety performance averages (continued).

Brand/Variety (by 2-Yr & 2004 yield)	Agronomic Performance Averages					
	Bu/Acre 2004	Bu/Acre 2-Yr	Protein %	Oil %	Lodging* (1-5)	DTM^
STINE/S2404-4	64	.	34.2	16.2	1	129
STINE/S2403-4	64	.	33.0	16.9	2	130
PRAIRIE BR./PB-2374RR	64	.	32.7	16.8	3	129
TECH. DIRECT/TD-266RR	63	.	31.5	16.7	4	131
KRUGER/268+RR	63	.	34.2	16.9	1	128
KRUGER/252RR	63	.	33.5	16.5	2	129
STINE/S2783-4	63	.	35.1	16.7	2	131
THOMPSON/T-2343RR	63	.	33.6	17.1	1	127
MUSTANG/M-223RR	62	.	32.4	17.6	1	125
NUTECH/NT-2505RR	62	.	34.4	16.6	1	128
NUTECH/NT-2707RR	62	.	33.4	17.0	2	128
TECH. DIRECT/TD-262RR	62	.	32.8	17.4	2	129
KRUGER/273RR	62	.	33.0	17.3	2	129
LATHAM/EXP-E2635R	62	.	33.0	17.2	1	128
LATHAM/EXP-E2646R	62	.	32.3	17.0	2	129
GOLD COUNTRY/EXP-325RR	62	.	31.4	16.9	1	126
TOP FARM/E34412RR	62	.	31.6	17.7	1	125
PRAIRIE BR./PB-2474RR	62	.	33.3	17.0	2	130
JACOBSEN/J744NR	62	.	33.8	17.3	1	125
THOMPSON/T-2790+RR	62	.	32.2	16.4	4	131
ASGROW/AG2203	61	.	34.1	16.9	2	124
LATHAM/EXP-E2450R	61	.	33.4	16.8	2	129
THOMPSON/T-2505+RR	61	.	34.9	16.3	1	128
KRUGER/EXP287RR	60	.	35.0	17.0	1	128
LATHAM/L2857R	60	.	34.1	17.6	3	132
PUBLIC/SDX00R-039-42	60	.	30.4	17.1	3	129
PUBLIC/SD01-5R	60	.	31.4	17.2	1	125
PRAIRIE BR./PB-2934RR	59	.	33.4	17.5	2	132
KRUGER/277+RR/SCN	58	.	34.6	16.9	1	130
PUBLIC/SDX00R-014-50	58	.	32.6	17.6	2	124
PUBLIC/SD01-76R	57	.	31.0	17.0	2	124
RENK/RS244NRR	56	.	34.4	16.5	2	129
TOP FARM/E3M245RR	55	.	34.1	16.5	3	128
FARM ADVANTAGE/7254N	54	.	34.6	16.9	3	131
KALTENBERG/KB245RR	54	.	35.2	16.8	3	130

Table 4. Roundup Ready maturity group-II soybean variety performance averages (continued).

Brand/Variety (by 2-Yr & 2004 yield)	Agronomic Performance Averages					
	Bu/Acre 2004	Bu/Acre 2-Yr	Protein %	Oil %	Lodging* (1-5)	DTM^
PUBLIC/SD01-3603R	54	.	33.7	16.8	4	134
PUBLIC/SD01-2961R	53	.	34.0	16.7	3	131
Test avg.:	64	57	32.9	17.2	2	128
Max. avg.:	73	62	35.3	18.1	4	134
Min. avg.:	53	47	30.4	16.0	1	118
# Lsd (.05):	5	8			12	
## TPG-value:	68	54			2	
@ Coef. Var.:	5	6			30	
No. Entries:	107	29	107	107	107	

* Lodging, 1= all plants erect, 5= all plants flat.
^ DTM= days from seeding on May 19, 2004 to maturity.
# Lsd,(.05)= amount values in a column must differ to be significantly different. NS- differences among column values are non-significant.
Minimum value required to qualify for the top performance group.
@ Coef. Var.= a measure of trial experimental error.

SE FARM REPORT SDSU

2004 PRECISION-PLANTED CORN HYBRID PERFORMANCE TRIALS

R. G. Hall and K. K. Kirby

Plant Science 0428

This reports the 2004 Southeast Research Farm performance trials for both non-Roundup-Ready and Roundup-Ready corn hybrids conducted by the South Dakota State University Crop Performance Testing (CPT) program.

Research funding & support sources: The SD Agricultural Experiment Station and testing fees obtained from the SD Crop Performance Testing Program.

Experimental Procedures

Entries were placed into either an early or late maturity trial according to ratings reported by a given seed company. The break between the early and late test was 110-day for both the non-Roundup Ready and Roundup Ready hybrid trials. Entries were seeded in three replications with each hybrid randomly located within a replication. Plots consisted of four 30-inch rows, 20 feet long. Plots were seeded on May 4, 2004 into a Trent silt loam previously cropped to soybeans. A Monosem precision row crop planter was used for seeding plots. During seeding a starter fertilizer of 100 pounds/acre of 37-18-00 was applied 2” below and 2” to the side (2x2) of the seed row. The precision planter was calibrated and delivered 27,878 seeds per acre, regardless, of seed quality and germination percentage. Therefore, the harvest population is an indication of initial seed quality and the ability of the seed to cope with the production environment. Force insecticide was applied down the seed tube at its label rate for corn rootworm control. In addition, Pounce granular was applied at its label rate down the whorl with a tractor mounted granular applicator prior to canopy closure.

Except for weed control the experimental procedures described above apply both to the non-Roundup Ready and the Roundup Ready hybrid trials. In the Roundup Ready trials two post emergence applications of Roundup Ultra (32 oz/acre) were applied. The first when weeds were 2-4 inches tall, followed by a second application when weed growth was again 2-4 inches tall. In the non-Roundup Ready test trials, post-emergence weed control consisted of a tank mix of Dual II (2 pt/ac)/Python (1.33 oz /ac) on May 14.

Measurements of Performance

Yield values are an average of three replicates (plots), and are expressed as bushels per acre, adjusted to 15.5% moisture on a dry-matter basis and a bushel weight of 56 pounds. Moisture content is expressed as the percentage of moisture in the shelled grain at harvest.

Check for the "least significant difference" (Lsd) value at the bottom of each column of data values. The reported Lsd values can be used in two ways. First, the Lsd value indicates how much a variable such as yield must differ between two hybrids before there is a real yield difference. For example, in the early non-Roundup Ready test (Table 1), the year 2004 Lsd value of 15 bu/ac can be used to compare the yields of any two hybrids in the early maturity trial. If hybrid A yields 259 bu/ac and hybrid B yields 245 bu/ac the yield difference is 14 bu/ac (259 - 245 = 14). In this case the two hybrids do not differ in yield because their yield difference of 14 bu/ac is less than the reported Lsd value of 15 bu/ac. In contrast, if hybrid C yields 243 bu/ac the yield difference between hybrid A and hybrid C would be 16 bu/ac (259-243 = 16). In this case the yield difference of 16 bu/ac is more than the reported Lsd value of 15 bu/ac and therefore hybrid A would have a significantly higher yield than hybrid C.

The second use for the Lsd value is to identify the top group for the current year yield, two-year yield, bushel weight, grain moisture at harvest, and stalk lodging below the ear percentage. For example, in the non-Roundup Ready hybrid early maturity trial (Table 1) the highest current year yield was 259 bu/ac. To determine if it is the only top yielding hybrid in this trial use the Lsd value of 15 bu/ac at the bottom of the 2004 yield column. In order for hybrids to be in the top performance group for yield they must yield 244 bu/ac (259-15 = 244) or higher. Technically, a yield of 245 bu/ac would be in the top yield group while a yield of 244 bu/ac would not be in the top yield group. However, since all yields and Lsd values are rounded to the nearest whole number. We can say 244 bu/ac, because of the rounding-off, is the more appropriate minimum value for top yield hybrids in this early maturity test in 2004. Top yield hybrids for 2004 are those hybrids that are equal or higher than the minimim top yield group value. In addition, the minimum top yield group value is indicated for the 2 yr. (2002-04) average unless there were no significant yield differences. The minimum yield required to qualify for the top performance group for yield is listed at the bottom of each yield column (TPG-value).

Similarly, the top group for other performance factors like bushel weight, grain moisture at harvest, and stalk lodging below the ear percentage can be determined. For example, in the early maturity test (Table 1), the minimum bushel weight value to qualify for the top group was 59 lbs. Bushel weights of 62 lbs. or higher are in the top group for bushel weight. Note that yield and bushel weight values needed to qualify for the top group are reported as a minimum top group value. In contrast, the grain moisture and lodging below the ear percentages needed to qualify for the top-group are reported as a maximum top group value. In other words, yield and bushel weight top-group values must exceed a certain percentage while grain moisture and lodging below ear percentages must be equal to or less than certain percentage to qualify for the top group depending on the performance factor measured. In Table 1 current year yields must equal 244 bu/ac or higher, bushel weight must be 62 lbs. or higher, grain moisture must be 18% or lower, and stalk lodging below the ear must be 5% or less to be in the top group for these factors .

Performance Trial Results

General: This was an exceptional year at this location. The non-Roundup Ready trials this year out yielded the 2003 trial by 10%. In turn, the Roundup Ready trials in 2004 out yielded the 2003 trials by about 15%. In most cases, the average bushel weight of all the trials was 56 to 60 pounds and the grain moisture content at harvest averaged between about 18 to 22% moisture.

Non-Roundup Ready hybrids: **Results for year 2004 and for two-years (2003-04) are listed below:**

Early maturity corn test, Table 1**.** The test trial yield average was 235 bu/ac for year 2004 and 210 bu/ac for two years (2003-04). Hybrids that yielded 244 bu/ac or more in 2004 qualified for the top yield group. Since there were no significant differences in yield in hybrids tested for two years, even the lowest yield of 205 bu/ac qualified for the two-year top yield group. Hybrids had to differ in yield by 15 bu/ac in 2004 to be significantly different from one another, while there was no significant yield differences for hybrid tested two years. In 2004, bushel weights averaged 60 lbs, grain moisture averaged 19%, lodging averaged 1% and the final plant population averaged 27,429 ppa. In order for a hybrid to be in the top performance group for these factors they had to equal 62 lbs. or higher in bushel weight, 18% or less in grain moisture, 5% or less in stalk lodging, and 27,021 ppa in final population. The top performance final population of 27,021 ppa was 97% (27,021/27,878) of the population delivered at planting.

Late maturity corn test, Table 2**.** The test trial yield average was 244 bu/ac for year 2004 and 213 bu/ac for two years (2003-04). Hybrids that yielded 247 bu/ac or more in 2004 qualified for the top yield group. Since there were no significant differences in yield in hybrids tested for two years, even the lowest yield of 208 bu/ac qualified for the two-year top yield group. Hybrids had to differ in yield by 14 bu/ac in 2004 to be significantly different from one another, while there was no significant yield differences for hybrid tested two years. In 2004, bushel weights averaged 58 lbs, grain moisture averaged 23%, lodging averaged 2% and the final plant population averaged 27,388 ppa. In order for a hybrid to be in the top performance group for these factors they had to equal 59 lbs. or higher in bushel weight, 21% or less in grain moisture, 4% or less in stalk lodging, and 25,700 ppa in final population. The top performance final population of 25,700 ppa was 92% (25,700/27,878) of the population delivered at planting.

Table 1. Non-Roundup Ready early maturity corn performance results-
SE Research Farm, Beresford, SD, 2003-2004.

Brand/Hybrid (By 2-Yr then 2004 yield)	Agronomic Performance Averages Bu/Acre 2004	Bu/Acre 2-Yr	2004 Bu. wt. Lb.	2004 H20 %	2004 Ldg. %	2004 PPA	RM*
MIDWEST/G 7716 B	250	215	58	22	2	27,588	110
DAIRYLAND/STEALTH-1507BT	232	212	59	19	1	27,443	108
WENSMAN/W 5437BT	242	210	59	21	0	27,007	110
HEINE/H745YGCB	225	210	61	19	1	27,297	104
CROW'S/438 B	227	208	59	19	2	27,443	108
WENSMAN/W 5417BT	233	205	59	20	0	27,152	107
GOLD COUNTRY/110-07CB	259	.	58	22	1	26,862	110
NUTECH/EX.607 YGCB	252	.	60	19	0	28,023	105
HEINE/H820YGCB	252	.	59	22	2	27,588	109
AGSOURCE SEEDS/5883	249	.	59	21	2	27,588	109
TOP FARM/TFSX 2300	248	.	61	18	0	28,169	103
DEKALB/DKC60-14 (YGPL)	245	.	60	20	0	27,588	110
KRUGER/5207YGCB	245	.	60	20	0	27,443	110
TOP FARM/E34110DCB	244	.	59	21	1	27,152	110
KRUGER/5208YGCB	243	.	61	19	2	27,878	110
JACOBSEN/4358CB	243	.	60	20	1	27,733	105
NUTECH/2202 HX	241	.	60	18	4	27,443	100
HEINE/H748YGCB	241	.	60	20	1	27,878	105
KRUGER/5407YGCB	240	.	60	18	2	27,588	107
TOP FARM/TFSX 2405	239	.	61	18	3	27,297	102
ACCESS/EXP 5405YGCB	239	.	61	19	0	27,443	105
NUTECH/4403 YGCB	238	.	61	17	1	27,443	103
NUTECH/4407 YGCB	237	.	60	20	5	27,588	107
SANDS/SOI 110YGCB	237	.	59	21	2	25,991	110
NUTECH/0313	236	.	61	21	3	27,878	105
HEINE/H728YGCB	236	.	61	19	0	27,588	103
TOP FARM/E34110BCB	234	.	59	20	0	27,007	109
HEINE/H793YGCB	234	.	59	19	3	27,878	107
KRUGER/0510	233	.	60	19	1	27,443	108
HEINE/H760YGCB	233	.	60	21	0	27,152	105
NUTECH/EX.308 YGCB	232	.	60	20	1	28,169	107
DEKALB/DKC54-51 (YGCB)	230	.	62	17	5	27,733	104
HEINE/H761	229	.	63	19	1	26,571	106
NUTECH/4202 YGCB	228	.	62	19	1	27,588	100
SANDS/SOI 107YGCB	227	.	61	19	0	27,443	107

Table 1. Non-Roundup Ready early maturity corn performance results-
SE Research Farm (continued).

Brand/Hybrid (By 2-Yr then 2004 yield)	Agronomic Performance Averages Bu/Acre 2004	Bu/Acre 2-Yr	2004 Bu. wt. Lb.	2004 H20 %	2004 Ldg. %	2004 PPA	RM*
TOP FARM/E34105CB	227	.	61	19	0	27,297	105
HEINE/H821YGCB	226	.	59	21	3	27,878	110
KRUGER/8407HX	225	.	60	20	2	25,265	107
KRUGER/5210YGCB	225	.	60	20	2	27,443	109
NUTECH/EX.205 YGCB	223	.	59	17	1	28,169	105
KRUGER/5305YGCB	215	.	60	18	2	27,298	105
TOP FARM/E34107CB	214	.	59	18	1	27,443	107
ACCESS/EXP 5910YGCB	213	.	62	19	2	27,733	110
SANDS/SOI 103YGCB	212	.	60	17	0	27,298	103
Test avg.:	235	210	60	19	1	27,429	
Max. avg.:	259	215	63	22	5	28,169	
Min. avg.:	212	205	58	17	0	25,265	
# Lsd (.05):	15	NS	1	1	NS	1,148	
## TPG-value:	244	205	62	18	5	27,021	
@ Coef.Var.:	4	4	1	3	148	3	
No. Entries:	44	6	44	44	44	44	

* RM= relative maturity reported by seed company. Seeded on May 4, 2004
# Lsd= amount values in a column must differ to be significantly different.
NS indicates differences among values in a column are non-significant.
Minimum or maximum value required to qualify for top performance group.
@ Coef. of variation= measure of trial experimental error.

Table 2. Non-Roundup Ready late maturity corn performance results-
SE Research Farm, Beresford, SD, 2003-2004.

Brand/Hybrid (By 2-Yr then 2004 yield)	Agronomic Performance Averages						
	Bu/Acre 2004	Bu/Acre 2-Yr	2004 Bu. wt. Lb.	2004 H20 %	2004 Ldg. %	2004 PPA	RM*
AGSOURCE SEEDS/6183	261	218	57	24	4	27,878	112
JACOBSEN/4757CB	257	215	57	24	2	27,443	112
KRUGER/9212YGCB	258	214	58	22	1	27,152	112
MIDWEST/G 8125 B	259	212	57	25	1	27,733	112
KRUGER/9115YGCB	256	212	57	24	1	26,572	115
CROW'S/5366 B	252	211	57	25	2	27,007	112
DEKALB/DKC63-79 (YGCB)	240	208	59	22	1	28,169	113
HEINE/H8600YGCB	261	.	57	24	2	28,314	113
JACOBSEN/4637CB	255	.	59	21	1	26,572	111
DAIRYLAND/STEALTH-5611	254	.	59	21	3	27,733	112
NUTECH/EX.713 YGCB	253	.	59	21	1	26,862	114
AGSOURCE SEEDS/6163	251	.	59	22	3	27,878	111
NUTECH/4213 YGCB	250	.	58	23	1	26,862	115
KRUGER/8513HX	250	.	58	23	1	27,007	113
KRUGER/5211YGCB	249	.	58	22	2	27,443	112
KAYSTAR/KX-8615BT	247	.	57	21	7	27,298	112
KRUGER/5717YGCB	246	.	55	24	0	27,878	117
KRUGER/5512YGCB	245	.	58	22	3	26,717	114
KRUGER/9111YGCB	243	.	59	20	3	28,169	113
KRUGER/5615YGCB	239	.	57	23	4	27,733	116
KRUGER/5516YGCB	239	.	58	24	0	27,007	116
KRUGER/5815YGCB	238	.	53	26	1	28,169	114
NUTECH/4013 YGCB	237	.	59	21	2	28,169	112
KRUGER/5416YGCB	237	.	57	23	0	27,152	115
KRUGER/5315YGCB	235	.	57	26	5	27,588	115

Table 2. Non-Roundup Ready late maturity corn performance results-
SE Research Farm (continued).

Brand/Hybrid (By 2-Yr then 2004 yield)	Agronomic Performance Averages						
	Bu/Acre 2004	Bu/Acre 2-Yr	2004 Bu. wt. Lb.	2004 H20 %	2004 Ldg. %	2004 PPA	RM*
KRUGER/5514YGCB	235	.	59	21	2	27,733	116
NUTECH/EX.317 YGCB	234	.	56	25	1	27,007	111
KRUGER/8413HX	233	.	57	23	4	28,169	113
NUTECH/EX.539 YGCB	229	.	59	20	2	27,152	111
NUTECH/2414 HX	229	.	57	21	2	27,007	114
ASGROW/RX718YGPL	227	.	61	20	2	27,152	111
SANDS/SOI 113YGCB	217	.	60	21	1	25,700	113
Test avg.:	244	213	58	23	2	27,388	
Max. avg.:	261	218	61	26	7	28,314	
Min. avg.:	217	208	53	20	0	25,700	
# Lsd (.05):	14	NS	2	1	4	NS	
## TPG-value:	247	208	59	21	4	25,700	
@ Coef.Var.:	4	6	2	4	111	3	
No. Entries:	32	7	32	32	32	32	

* RM= relative maturity reported by seed company. Seeded on May 4, 2004
# Lsd= amount values in a column must differ to be significantly different.
NS indicates differences among values in a column are non-significant.
Minimum or maximum value required to qualify for top performance group.
@ Coef. of variation= measure of trial experimental error.

Performance Trial Results (continued)

Roundup Ready hybrids: Results for year 2004 and for two-years (2003-04) are listed below:

Early maturity corn test, Table 3. The test trial yield average was 220 bu/ac for year 2004 and 190 bu/ac for two years (2003-04). Hybrids that yielded 229 bu/ac or more in 2004 qualified for the top yield group. Since there were no significant differences in yield in hybrids tested for two years, even the lowest yield of 183 bu/ac qualified for the two-year top yield group. Hybrids had to differ in yield by 15 bu/ac in 2004 to be significantly different from one another, while there was no significant yield differences for hybrid tested two years. In 2004, bushel weights averaged 60 lbs, grain moisture averaged 19%, lodging averaged 1% and the final plant population averaged 27,270 ppa. In order for a hybrid to be in the top performance group for these factors they had to equal 60 lbs. or higher in bushel weight, 18% or less in grain moisture, 3% or less in stalk lodging, and 27,266 ppa in final population. The top performance final population of 27,266 ppa was 98% (27,266/27,878) of the population delivered at planting.

Late maturity corn test, Table 4. The test trial yield average was 229 bu/ac for year 2004 and 200 bu/ac for two years (2003-04).

Hybrids that yielded 227 bu/ac or more in 2004 qualified for the top yield group. Since there were no significant differences in yield in hybrids tested for two years, even the lowest yield of 192 bu/ac qualified for the two-year top yield group. Hybrids had to differ in yield by 19 bu/ac in 2004 to be significantly different from one another, while there was no significant yield differences for hybrid tested two years. In 2004, bushel weights averaged 57 lbs, grain moisture averaged 22%, lodging averaged 1% and the final plant population averaged 27,401 ppa. In order for a hybrid to be in the top performance group for these factors they had to equal 58 lbs. or higher in bushel weight, 19% or less in grain moisture, 2% or less in stalk lodging, and 26,572 ppa in final population. The top performance final population of 26,572 ppa was 95% (26,572/27,878) of the population delivered at planting.

Table 3. Roundup Ready early maturity corn performance results- SE Research Farm, Beresford, SD, 2003-2004.

Brand/Hybrid (By 2-Yr then 2004 yield)	Agronomic Performance Averages						
	Bu/Acre 2004	Bu/Acre 2-Yr	2004 Bu. wt. Lb.	2004 H20 %	2004 Ldg. %	2004 PPA	RM*
CHANNEL/7806RB	226	195	58	21	0	27,007	110
KALTENBERG/K5711RR	220	194	61	19	0	26,426	105
KALTENBERG/K6788RR	200	189	59	18	1	27,588	108
CHANNEL/7624RB	199	183	59	18	1	27,588	108
HEINE/H748RR	244	.	61	18	2	27,588	105
DEKALB/DKC60-19RR2YGCB	242	.	60	21	1	26,862	110
PFISTER/2656 RR-BT	242	.	57	21	3	27,588	110
DAIRYLAND/STEALTH-1606	239	.	59	18	2	27,007	107
HEINE/H750RR/YGCB	238	.	60	20	0	27,588	105
JACOBSEN/4637RBT	233	.	56	21	0	26,717	110
ACCESS/EXP 2506RRYGCB	232	.	61	19	0	27,878	106
KRUGER/9208RR/YGCB	229	.	60	18	1	27,007	110
TOP FARM/9305RY	228	.	60	19	1	28,169	104
KRUGER/9208RR	228	.	60	18	0	27,152	108
WENSMAN/W 6422BTRR	228	.	59	19	0	27,152	107
DEKALB/DKC58-80RR2YGCB	224	.	60	19	0	27,588	108
ASGROW/RX718RR/YG	224	.	62	19	3	27,297	110
KRUGER/1006RR	224	.	61	21	6	27,297	106
HEINE/H793RR/YGCB	222	.	59	19	2	27,152	108
KRUGER/1806RR	219	.	61	18	0	26,427	106
TOP FARM/E34102BRCB	216	.	60	17	0	27,733	110
INTEGRA/INT 6504RRYGCB	216	.	61	20	0	27,443	106
SANDS/NGS 1100RR	213	.	59	19	0	27,588	110
TOP FARM/8403RR	213	.	60	17	0	27,297	102
SANDS/NGS 1030RR/YGCB	210	.	60	18	0	27,007	103

Table 3. Roundup Ready early maturity corn performance results-
SE Research Farm (continued).

Brand/Hybrid (By 2-Yr then 2004 yield)	Agronomic Performance Averages Bu/Acre 2004	Bu/Acre 2-Yr	2004 Bu. wt. Lb.	2004 H20 %	2004 Ldg. %	2004 PPA	RM*
JACOBSEN/4358R	210	.	61	20	0	27,152	105
NUTECH/5702 RR/YGCB	209	.	62	17	1	28,169	103
HEINE/H728RR/YGCB	208	.	61	20	0	27,297	100
TOP FARM/E34102RR	206	.	61	18	1	27,298	102
TOP FARM/E34110RCB	205	.	60	18	0	27,297	110
AGSOURCE SEEDS/5286CBRR	205	.	62	19	0	27,297	106
DAIRYLAND/STEALTH-7507	197	.	58	19	1	25,991	109
Test avg.:	220	190	60	19	1	27,270	
Max. avg.:	244	195	62	21	6	28,169	
Min. avg.:	197	183	56	17	0	25,991	
# Lsd (.05):	15	NS	2	1	3	903	
## TPG-value:	229	183	60	18	3	27,266	
@ Coef.Var.:	4	8	2	4	223	2	
No. Entries:	32	4	32	32	32	32	

* RM= relative maturity reported by seed company. Seeded on May 4, 2004
# Lsd= amount values in a column must differ to be significantly different.
NS indicates differences among values in a column are non-significant.
Minimum or maximum value required to qualify for top performance group.
@ Coef. of variation= measure of trial experimental error.

Table 4. Roundup Ready late maturity corn performance results-
SE Research Farm, Beresford, SD, 2003-2004.

Brand/Hybrid (By 2-Yr then 2004 yield)	Agronomic Performance Averages						
	Bu/Acre 2004	Bu/Acre 2-Yr	2004 Bu. wt. Lb.	2004 H20 %	2004 Ldg. %	2004 PPA	RM*
AGSOURCE SEEDS/6166	236	208	57	22	1	28,024	111
CHANNEL/8127RB	237	203	57	24	1	27,443	112
CHANNEL/8075RB	225	197	57	24	1	26,717	112
KRUGER/9115RR/YGCB	232	192	56	24	0	26,572	117
HEINE/H851RR/YGCB	246	.	57	24	1	27,443	113
KRUGER/2613RR/YGCB	240	.	58	24	0	27,297	113
KRUGER/9212RR/YGCB	238	.	57	21	1	27,007	115
DEKALB/DKC63-81RR2YGCB	234	.	59	22	2	27,588	113
JACOBSEN/4757RBT	232	.	55	25	1	27,443	112
HEINE/H8600RR/YGCB	232	.	57	23	1	27,007	112
KRUGER/9412RR/YGCB	229	.	60	20	7	27,152	112
NUTECH/5212 RR/YGCB	227	.	57	22	1	27,733	115
KRUGER/9308RR/YGCB	202	.	58	18	0	28,024	111
NUTECH/5808 RR/YGCB	199	.	58	18	1	28,169	114
Test avg.:	229	200	57	22	1	27,401	
Max. avg.:	246	208	60	25	7	28,169	
Min. avg.:	199	192	55	18	0	26,572	
# Lsd (.05):	19	NS	2	15	2	NS	
## TPG-value:	227	192	58	19	2	26,572	
@ Coef.Var.:	5	5	2	2	114	2	
No. Entries:	14	4	14	14	14	14	

* RM= relative maturity reported by seed company. Seeded on May 4, 2004
# Lsd= amount values in a column must differ to be significantly different.
NS indicates differences among values in a column are non-significant.
Minimum or maximum value required to qualify for top performance group.
@ Coef. of variation= measure of trial experimental error.

WEED CONTROL DEMONSTRATIONS and EVALUATION TESTS for 2004

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Plan Science 0429

INTRODUCTION:

Experiment stations have an important role in the Weed Evaluation and Demonstration Program. Plots provide weed control data for the area served by the Southeast Experiment Farm. The station is the major site for corn and soybean weed control studies. Tests at the station focus on common waterhemp, velvetleaf, cocklebur, lambsquarters, and foxtail.

2004 TESTS:

Spring precipitation was optimal for early soil applied herbicides. Cold conditions slowed crop and weed development. Early postemergence treatments were delayed 7-10 days later than normal. Weed densities were considerably less, especially after mid-season. Weed ratings are generally higher than most years.

Preemergence control of waterhemp was excellent and held into the season.

NOTE: ***Data reported in this publication are results from field tests that include product uses, experimental products or experimental rates, combinations or other unlabeled uses for herbicide products. Tradenames of products used are listed; there frequently are other brand products available in the market. Users are responsible for applying herbicide according to label directions. Refer to the appropriate weed control fact sheet available from county extension offices for herbicide recommendations.***

Studies listed below are summarized in the following tables. Information for each study is included as part of the summary.

1. Corn Herbicide Demonstration
2. Herbicide Tolerant Corn Demonstration
3. No-Till Corn Demonstration
4. Cocklebur Control in Corn
5. Velvetleaf Control in Corn

6. Field Sandbur Control in Corn
7. Pre and Post Programs in Corn
8. Roundup/Priority Combinations in Corn
9. Glyphosate Programs
10. Define SC and Axiom Preemerge on Corn
11. Weed Control with Balance Pro
12. Glyphosate Tank-Mixes - Antagonism
13. Glyphosate Tank-Mixes - Injury
14. Glyphosate Residue in Corn
15. 1X and 2X Corn Rates - Postemerge
16. 2003 Soybean Herbicide Carryover to Corn 2004
17. Soybean Herbicide Demonstration
18. Herbicide Tolerant Soybean Demonstration
19. Weed Control in STS/RR Soybeans
20. No-Till Soybean Demonstration
21. Soybean Demonstration - Late Timing
22. Cocklebur Control in Soybeans
23. Velvetleaf Control in Soybeans
24. Common Waterhemp Control in Soybeans
25. Late Waterhemp Control in Soybeans
26. Weed Control Programs - Pre/Post
27. Soybean Yield Response - Late Rescue
28. Blanket Followed by Buccaneer on RR Soybeans
29. Volunteer RR Corn Control in Soybeans
30. Volunteer RR Corn Control in Soybeans - Time and Yield
31. Volunteer RR Corn Control in Soybeans - Clump vs. Plant
32. 1X and 2X Soybean Rates - Preemerge
33. 2003 Corn Herbicide Carryover to Soybean 2004

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Program input and partial support for field programs is also acknowledged.

South Dakota Soybean Research and Promotion Council
South Dakota Corn Utilization Council
South Dakota Oilseed Council
National Sunflower Association
Crop Protection Industries

Table 1. Corn Herbicide Demonstration

Demonstration
Planting Date: 4/28/04
Variety: DeKalb DKC 58-24
PRE: 4/28/04
LPRE: 5/6/04
EPOST: 6/2/04; Corn 2-5 lf;
Grft 1-2 lf, 1-2"; Colq .5-1"
POST: 6/10/04; Corn V4, 8";
Grft 1-3 lf; Colq 2-4"

Precipitation:

PRE:	1st week	0.04 inches
	2nd week	0.32 inches
LPRE:	1st week	0.64 inches
	2nd week	0.32 inches
EPOST:	1st week	0.47 inches
	2nd week	1.12 inches
POST:	1st week	1.20 inches
	2nd week	0.40 inches

Grft=Green foxtail
Colq=Common lambsquarters

COMMENTS: Moderate weed pressure. Conventional tillage. Excellent preemergence activity. Post programs provided excellent lambsquarters control. General weed control in 2004 was more favorable than in some years.

Treatment	***Rate/A***	***% Grft 7/25/04***	***% Colq 7/25/04***
Check	----	0	0
LATE PREEMERGENCE			
Harness Xtra	2.1 qt	98	65
Harness	2.3 pt	98	30
PREEMERGENCE			
Harness	1.5 pt	99	25
Harness	2.3 pt	99	65
Surpass	2.5 pt	98	82
Dual II Magnum	2 pt	98	67
Stalwart C	2 pt	98	74
Outlook	21 oz	98	64
Degree	4.25 pt	96	71
Define SC	21 oz	98	79
Balance Pro	2.25 oz	87	90
Epic	13 oz	96	97
Balance Pro+Define SC+atrazine	2.25 oz+12 oz+.75 qt	98	99
Lumax	3 qt	97	99
Python+Surpass	1.25 oz+2.5 pt	99	99
Bicep Lite II Magnum	2 qt	98	96
Stalwart Xtra	2.1 qt	96	98
G-Max Lite	3.5 pt	96	98
Harness Xtra	2.1 qt	98	99
Keystone LA	2.2 qt	95	99
Check	----	0	0

Table 1. Corn Herbicide Demonstration (Continued . . .)

Treatment	***Rate/A***	***% Grft 7/25/04***	***% Colq 7/25/04***
PREEMERGENCE & POSTEMERGENCE			
Dual II Magnum&Callisto+COC+28% N	1.67 pt&3 oz+1%+2 qt	95	99
Balance Pro&Callisto+COC+28% N	2.25 oz&3 oz+1%+2 qt	84	99
Balance Pro&Option+MSO+28% N	2 oz&1.5 oz+1.5 pt+2 qt	80	93
Outlook&Distinct+NIS+28% N	21 oz&6 oz+.25%+2 qt	85	98
Outlook&Distinct+atrazine+ NIS+28% N	21 oz&4 oz+1.5 pt+ .25%+2 qt	98	99
Outlook&Marksman+NIS+28% N	21 oz&2 pt+.125%+2 qt	95	98
Surpass&2,4-D amine	2.5 pt&1 pt	98	98
Surpass&Aim EW+atrazine+ COC+28% N	2.5 pt&.5 oz+1 qt+ 1%+2 qt	97	99
Surpass&Stinger+Starane	2.5 pt&4 oz+8 oz	99	99
Keystone LA&Hornet WDG+Clarity+ NIS+AMS	2 qt&3 oz+4 oz+ .25%+2.5 lb	94	99
Surpass&Hornet WDG+Callisto+ COC+AMS	2.5 pt&3 oz+.75 oz+ 1%+2.5 lb	96	98
Surpass&Accent+atrazine+ COC+28% N	1.25 pt&.67 oz+1.5 pt+ 1%+2 qt	97	99
Dual II Magnum&Northstar+atrazine+ NIS+28% N	1.67 pt&5 oz+1.5 pt+ .25%+2 qt	98	99
Dual II Magnum&Callisto+atrazine+ COC+28% N	2 pt&3 oz+1 pt+ 1%+2 qt	96	99
Cinch&Steadfast+Callisto+ atrazine+COC+AMS	.67 pt&.75 oz+2 oz+ 1 pt+1%+2.5 lb	95	99
Cinch&Steadfast+Marksman+ COC+28% N	1 pt&.75 oz+1 pt+ 1%+2 qt	94	99
Harness&Yukon+NIS+AMS	2.3 pt&4 oz+.25%+2 lb	92	99
Check	----	0	0
EARLY POSTEMERGENCE			
Option+MSO+28% N	1.5 oz+1.5 pt+2 qt	80	68
Option+atrazine+MSO+28% N	1.5 oz+1.5 pt+1.5 pt+2 qt	90	98
Option+Callisto+MSO+28% N	1.5 oz+2 oz+1.5 pt+1.5 qt	84	99
Define SC+Option+Callisto+ MSO+28% N	12 oz+1.5 oz+1 oz+ 1.5 pt+2 qt	92	99
Define SC+Option+Distinct+ MSO+28% N	12 oz+1.5 oz+4 oz+ 1.5 pt+2 qt	97	99
Option+Distinct+MSO+28% N	1.5 oz+4 oz+1.5 pt+2 qt	89	98
Option+Northstar+MSO+28% N	1.5 oz+3 oz+1.5 pt+2 qt	90	94
Option+Priority+MSO+28% N	1.5 oz+1 oz+1.5 pt+2 qt	85	87

Table 1. Corn Herbicide Demonstration (Continued . . .)

Treatment	***Rate/A***	***% Grft 7/25/04***	***% Colq 7/25/04***
Steadfast+atrazine+COC+28% N	.75 oz+1.5 pt+1%+2 qt	94	99
Steadfast+Priority+atrazine+ COC+AMS	.75 oz+1 oz+1 pt+ 1%+2.5 lb	87	99
Cinch ATZ Lite+Steadfast+Callisto+ NIS+AMS	2 pt+.75 oz+2 oz+ .25%+2.5 lb	98	99
PREEMERGENCE & EARLY POSTEMERGENCE			
Atrazine&Steadfast+atrazine+ Callisto+COC+AMS	1.25 qt&.75 oz+.5 pt+ 2 oz+1%+2.5 lb	96	99
EARLY POSTEMERGENCE			
Lumax+Steadfast+COC+AMS	1.5 qt+.75 oz+1%+2.5 lb	99	99
Steadfast+atrazine+Callisto+ COC+AMS	.75 oz+3 pt+2 oz+ 1%+2.5 lb	97	99
Accent+COC+28% N	.67 oz+1%+2 qt	81	94

Table 2. Herbicide Tolerant Corn Demonstration

Demonstration
Planting Date: 4/28/04
Variety: Roundup Ready - Dekalb DKC 58-24
Liberty Link - Pioneer 36N72
Clearfield - Pioneer 36R12
PRE: 4/28/04
EPOST: 6/9/04; Corn V4, 8";
Grft 2-4 lf, 1-5"; Cowh 1-3"
POST: 6/14/04; Corn V5, 15";
Grft 3-6"; Cowh 2-5"
Soil: Silty clay loam; 3.2% OM; 5.9 pH

Precipitation:

PRE:	1st week	0.04 inches
	2nd week	0.32 inches
EPOST:	1st week	1.12 inches
	2nd week	0.32 inches
POST:	1st week	0.92 inches
	2nd week	0.08 inches

Grft=Green foxtail
Cowh=Common waterhemp

COMMENTS: Conventional tillage. Comparison of Roundup Ready, Liberty Link, and Clearfield herbicide programs. Systems included have provided highly effective, consistent control.

Treatment	***Rate/A***	***% Grft 7/25/04***	***% Cowh 7/25/04***
LIBERTY LINK - Pioneer 36N72			
Check	----	0	0
EARLY POSTEMERGENCE			
Liberty+atrazine+AMS	32 oz+1 pt+3 lb	95	98
POSTEMERGENCE			
Liberty+atrazine+AMS	32 oz+1 pt+3 lb	97	99
EARLY POSTEMERGENCE & POSTEMERGENCE			
Liberty+atrazine+AMS& Liberty+AMS	24 oz+1 pt+3 lb& 24 oz+3 lb	98	99
PREEMERGENCE & POSTEMERGENCE			
Define SC&Liberty+atrazine+AMS	12 oz&32 oz+1 pt+3 lb	97	99
Balance Pro+Liberty+atrazine+AMS	1.5 oz&32 oz+1 pt+3 lb	97	99
CLEARFIELD - Pioneer 36R12			
Check	----	0	0
EARLY POSTEMERGENCE			
Lightning+Marksman+NIS+28% N	1.28 oz+2 pt+.25%+2 qt	96	99
PREEMERGENCE & POSTEMERGENCE			
Outlook&Lightning+Distinct+ NIS+28% N	12 oz&1.28 oz+3 oz+ .25%+2 qt	99	99

Table 2. Herbicide Tolerant Corn Demonstration (Continued . . .)

Treatment	Rate/A	% Grft 7/25/04	% Cowh 7/25/04
	ROUNDUP READY - DeKalb DKC 58-24		
Check	----	0	0
EARLY POSTEMERGENCE			
Roundup UltraMax II+AMS	22 oz+2.5 lb	96	97
POSTEMERGENCE			
Roundup UltraMax II+AMS	22 oz+2.5 lb	98	97
EARLY POSTEMERGENCE & POSTEMERGENCE			
Roundup UltraMax II+AMS& Roundup UltraMax II+AMS	22 oz+2.5 lb& 22 oz+2.5 lb	99	96
PREEMERGENCE & POSTEMERGENCE			
Atrazine&Roundup UltraMax II+AMS	1.5 qt&22 oz+2.5 lb	99	98
Harness&Roundup UltraMax II+AMS	2.3 pt&22 oz+2.5 lb	99	99
Harness&Roundup UltraMax II+AMS	1 pt&22 oz+2.5 lb	97	98
EARLY POSTEMERGENCE			
Harness+Roundup UltraMax II+AMS	2.3 pt+22 oz+2.5 lb	99	99
PREEMERGENCE & POSTEMERGENCE			
Dual II Magnum&Touchdown Total+AMS	1.67 pt&23 oz+2.5 lb	99	98
Keystone LA&Exp+AMS	1.1 qt&24 oz+2.5 lb	98	99
Outlook&Roundup UltraMax II+AMS	12 oz&22 oz+2.5 lb	99	99
EARLY POSTEMERGENCE			
Outlook+Roundup UltraMax II+AMS	21 oz+11 oz+2.5 lb	99	98
PREEMERGENCE & POSTEMERGENCE			
Cinch ATZ&Roundup UltraMax II+AMS	2 pt&22 oz+2.5 lb	99	97
Outlook&Roundup UltraMax II+Clarity+ NIS+AMS	21 oz&22 oz+8 oz+ .25%+2.5 lb	99	98
Check	-----	0	0
EARLY POSTEMERGENCE			
Roundup UltraMax II+Clarity+AMS	22 oz+8 oz+2.5 lb	93	92
Roundup UltraMax II+atrazine+AMS	22 oz+1 qt+2.5 lb	99	98
Roundup UltraMax II+Priority+ NIS+AMS	22 oz+1 oz+ .25%+2.5 lb	97	98
Roundup UltraMax II+Prowl H_2O+ Distinct+AMS	22 oz+2.5 pt+ 3 oz+2.5 lb	99	99
Roundup UltraMax II+Basis+ atrazine+AMS	22 oz+.5 oz+ 3 pt+2.5 lb	98	99

Table 2. Herbicide Tolerant Corn Demonstration (Continued . . .)

Treatment	Rate/A	% Grft 7/25/04	% Cowh 7/25/04
EARLY POSTEMERGENCE			
Roundup UltraMax II+Aim EW+ Atrazine+AMS	22 oz+.5 oz+ 1 pt+2.5 lb	98	99
Roundup UltraMax II+Resource+AMS	22 oz+4 oz+2.5 lb	91	98
Roundup UltraMax II+Callisto+AMS	22 oz+3 oz+2.5 lb	95	98
Roundup UltraMax II+2,4-D amine+AMS	22 oz+.5 pt+2.5 lb	90	94
CoStarr+NIS+AMS	3.5 pt+.25%+2.5 lb	98	98
Buccaneer Plus+Volley+ Atrazine+AMS	32 oz+1.5 pt+ 1 pt+2.5 lb	98	97

Table 3. No-Till Corn Demonstration

Demonstration
Planting Date: 5/6/04
Variety: DKC58-24 and Garst 468
FALL: 11/19/03
EPP: 4/8/04
PRE: 5/6/04
EPOST: 6/14/04; Corn V4, 10"
POST: 6/21/04; Corn 12-15"
Soil: Silty clay loam; 3.4% OM; 6.4 pH

Grft=Green foxtail
Cowh=Common waterhemp

Precipitation:

FALL:	1st week	0.08 inches
	2nd week	0.00 inches
EPP:	1st week	0.04 inches
	2nd week	0.44 inches
PRE:	1st week	0.64 inches
	2nd week	0.32 inches
EPOST:	1st week	0.92 inches
	2nd week	0.08 inches
POST:	1st week	0.08 inches
	2nd week	0.08 inches

COMMENTS: Demonstration. No-till corn into soybean stubble. Excellent foxtail control. Treatment responses for waterhemp. Treatments with a postemerge application provided the most effective waterhemp control.

Treatment	***Rate/A***	***% Grft 8/5/04***	***% Cowh 8/5/04***
Check	----	0	0
FALL			
Dual II Magnum+atrazine	3 pt+1.5 qt	88	89
Dual II Magnum	3 pt	88	82
Harness	3 pt	82	68
Degree	5.5 pt	88	75
Outlook	21 oz	92	55
Define	21 oz	95	40
EARLY PREPLANT			
Dual II Magnum	3 pt	97	85
Harness	3 pt	96	69
Degree	5.5 pt	92	90
Outlook	21 oz	88	50
Define	21 oz	96	50
FALL & POSTEMERGENCE			
Atrazine&Roundup UltraMax+AMS	1.5 qt&26 oz+2 lb	99	99
EARLY PREPLANT & POSTEMERGENCE			
Atrazine&Roundup UltraMax+AMS	1.5 qt&26 oz+2 lb	99	99
PREEMERGENCE & POSTEMERGENCE			
Dual II Magnum&Northstar+ Atrazine+COC+28% N	2 pt&4 oz+ 1 pt+1%+2 qt	99	99
Epic&Distinct+atrazine+COC+28% N	11 oz&4 oz+1 pt+1%+2 qt	99	99
Keystone LA&Liberty+atrazine+AMS	2.2 qt&24 oz+1 pt+3 lb	99	98
Balance Pro&Liberty+atrazine+AMS	2.25 oz&24 oz+1 pt+3 lb	99	99

Table 3. No-Till Corn Demonstration (Continued . . .)

Treatment	***Rate/A***	***% Grft 8/5/04***	***% Cowh 8/5/04***
Check	----	0	0
EARLY POSTEMERGENCE			
Liberty+Define SC+atrazine+AMS	32 oz+21 oz+2 pt+3 lb	99	99
EARLY POSTEMERGENCE & POSTEMERGENCE			
Liberty+atrazine+AMS&	24 oz+1.5 pt+3 lb&		
Liberty+AMS	28 oz+3 lb	99	99
PREEMERGENCE			
Bicep Lite II Magnum	3 pt	92	90
G-Max Lite	3 pt	98	70
Keystone LA	2 qt	92	79
Harness Xtra	2.3 qt	95	72
Lumax	2.75 qt	96	85
Dual II Magnum+Callisto	2 pt+6 oz	90	86
PREEMERGENCE & POSTEMERGENCE			
Python&Glyphomax Plus+AMS	1 oz&32 oz+2.5 lb	99	99
Outlook&Distinct+NIS+28% N	21 oz&4 oz+.25%+2 qt	98	95
POSTEMERGENCE			
Roundup UltraMax II+AMS	22 oz+2.5 lb	99	99
EARLY POSTEMERGENCE			
Roundup UltraMax II+AMS&	11 oz+2.5 lb&		
Roundup UltraMax II+AMS	11 oz+2.5 lb	99	99
PREEMERGENCE & POSTEMERGENCE			
Harness Xtra&	1.2 qt&		
Roundup UltraMax II+AMS	22 oz+2.5 lb	99	99
Harness Xtra&	2.3 qt&		
Roundup UltraMax II+AMS	22 oz+2.5 lb	99	99
EARLY POSTEMERGENCE			
Steadfast+Callisto+atrazine+	.75 oz+3 oz+1 pt+		
COC+28% N	1%+2 qt	99	99
Option+Distinct+atrazine+	1.5 oz+4 oz+1 pt+		
COC+28% N	1%+2 qt	99	99
Check	----	0	0

Table 4. Cocklebur Control in Corn

RCB; 2 reps
Planting Date: 4/28/04
Variety: Garst 468LL
PRE: 4/28/05
POST: 6/8/04; Corn V3-4, 5-7";
Cocb 4-6"; Vema 3-6"
Soil: Loam; 2.9% OM; 6.8 pH

Precipitation:

PRE:	1st week	0.04 inches
	2nd week	0.32 inches
POST:	1st week	0.48 inches
	2nd week	0.88 inches

Cocb=Cocklebur
Vema=Venice mallow

COMMENTS: Conventional tillage. Very heavy cocklebur. Lumax was the most effective preemergence treatment. All post programs exceeded 90% cocklebur control. Atrazine improved Venice mallow control. Yields reflected weed control.

Treatment	*Rate/A*	*% Cocb 7/14/04*	*% Vema 7/14/04*	*Yield bu/A*
PREEMERGENCE				
Check+Surpass	2.75 pt	0	0	90
Python+Dual II Magnum	1.25 oz+1.67 pt	30	90	128
Lumax	3 qt	90	94	159
Harness+atrazine	2.5 pt+1 qt	30	93	132
PREEMERGENCE & POSTEMERGENCE				
Surpass&Buctril/Atrazine	2.75 pt&2.25 pt	93	96	162
Surpass&Marksman+28% N	2.75 pt&2.75 pt+2 qt	96	94	155
Surpass&Yukon+NIS+AMS	2.75 pt&4 oz+.25%+2.5 lb	92	45	159
Surpass&Priority+NIS+28% N	2.75 pt&1 oz+.25%+2 qt	93	50	156
Surpass&Hornet WDG+ NIS+28% N	2.75 pt&3 oz+ .25%+2 qt	95	84	155
Surpass&Stinger+Starane	2.75 pt&4 oz+8 oz	97	70	160
Surpass&Northstar+NIS+28% N	2.75 pt&5 oz+.25%+2 qt	94	78	164
Surpass&Distinct+NIS+28% N	2.75 pt&4 oz+.25%+2 qt	92	89	157
Surpass&Callisto+COC+28% N	2.75 pt&3 oz+1%+2 qt	97	85	160
Surpass&Liberty+atrazine+AMS	2.75 pt&32 oz+1.5 pt+3 lb	91	98	169
LSD (.05)		*5*	*17*	*19*

Table 5. Velvetleaf Control in Corn

RCB; 2 reps
Planting Date: 4/28/04
Variety: Garst 468LL
PRE: 4/28/04
POST: 6/24/04; Corn 15";
Vele 2-6 lf; Cowh 2-6"
Soil: Silty clay loam; 3.0% OM; 6.9 pH

Precipitation:

PRE:	1st week	0.04 inches
	2nd week	0.32 inches
POST:	1st week	0.08 inches
	2nd week	0.08 inches

Vele=Velvetleaf
Cowh=Common waterhemp

COMMENTS: Outlook broadcast preemergence over postemergence treatments. Moderate velvetleaf; somewhat variable. Thirteen treatments exceeded 90% control.

Treatment	***Rate/A***	***% Vele 8/5/04***	***% Cowh 8/5/04***
Check	----	0	0
PREEMERGENCE			
Dual II Magnum+atrazine	1.67 pt+2 qt	83	97
Dual II Magnum+atrazine	1.67 pt+1 qt	69	99
Lumax	3 qt	99	99
Balance Pro	2.25 oz	99	97
Balance Pro+atrazine	1.875 oz+1 qt	97	98
PREEMERGENCE & POSTEMERGENCE			
Balance Pro&Buctril/Atrazine	2.25 oz&1.5 pt	99	99
POSTEMERGENCE			
Atrazine+COC	1 qt+1 qt	79	99
Atrazine+COC	2 qt+1 qt	92	99
Distinct+NIS+28% N	4 oz+.25%+2 qt	92	99
Marksman+28% N	3 pt+2 qt	97	99
Buctril/Atrazine	2 pt	91	99
Resource+COC	6 oz+1 qt	97	99
Hornet WDG+NIS+28% N	3 oz+.25%+2 qt	91	97
Aim EW+NIS	.5 oz+.25%	89	97
Northstar+NIS+28% N	5 oz+.25%+2 qt	88	99
Callisto+COC+28% N	3 oz+1%+2 qt	98	99
Callisto+atrazine+COC+28% N	3 oz+1.5 pt+1%+2 qt	99	99
Liberty+atrazine+AMS	32 oz+1.5 pt+3 lb	94	99
LSD (.05)		*8*	*3*

Table 6. Field Sandbur Control in Corn

RCB; 3 reps
Planting Date: 5/6/04
Variety: DeKalb DKC 52-24
PRE: 5/6/04
EPOST: 6/14/04; Corn V3, 8"; Fisb 2-4 lf, 2-4"
POST: 6/21/04; Corn 18"; Fisb 3-5 lf, 5"
Soil: Clay; 3.0% OM; 7.8 pH

Precipitation:

PRE:	1st week	0.64 inches
	2nd week	0.32 inches
EPOST:	1st week	0.92 inches
	2nd week	0.08 inches
POST:	1st week	0.08 inches
	2nd week	0.08 inches

Fisb=Field sandbur

COMMENTS: No-till evaluation. Preemergence treatments provided partial control. Pre/post split or early post combinations (conventional programs) provided very good control. Roundup provided excellent sandbur control; consistent with previous year's data.

Treatment	***Rate/A***	***% Fisb 7/28/04***
Check	----	0
PREEMERGENCE		
Harness	3 pt	75
Lumax	3 qt	75
Balance Pro	2.5 oz	76
PREEMERGENCE & POSTEMERGENCE		
Surpass&Accent+COC+28% N	3.5 pt&.67 oz+1%+2 qt	96
Surpass&Accent+COC+28% N	1.5 pt&.67 oz+1%+2 qt	88
Surpass&Steadfast+COC+28% N	1.5 pt&.75 oz+1%+2 qt	95
Balance Pro&Option+MSO+28% N	1.87 oz&1.5 oz+1.5 pt+2 qt	94
EARLY POSTEMERGENCE		
Accent+Callisto+COC+28% N	.67 oz+3 oz+1%+2.5%	98
Steadfast+Callisto+COC+28% N	.75 oz+3 oz+1%+2 qt	96
Option+Callisto+MSO+28% N	1.5 oz+3 oz+1.5 pt+2 qt	97
Steadfast+Accent+Callisto+ COC+28% N	.75 oz+.25 oz+3 oz+ 1%+2 qt	98
Harness+Roundup UltraMax II+AMS	2.75 pt+22 oz+2.5 lb	99
EARLY POSTEMERGENCE & POSTEMERGENCE		
Accent+COC+28% N& Accent+COC+28% N	.5 oz+1%+2 qt& .67 oz+1%+2 qt	98
POSTEMERGENCE		
Roundup UltraMax II+AMS	22 oz+2.5 lb	99
EARLY POSTEMERGENCE & POSTEMERGENCE		
Roundup UltraMax II+AMS& Roundup UltraMax II+AMS	22 oz+2.5 lb& 22 oz+2.5 lb	99
PREEMERGENCE & POSTEMERGENCE		
Balance Pro&Roundup UltraMax II+AMS	2.25 oz&22 oz+2.5 lb	99
LSD (.05)		*7*

Table 7. Pre and Post Programs in Corn

RCB; 4 reps
Planting Date: 5/5/04
Variety: Pioneer 36N72
PRE: 5/6/04
EPOST: 6/2/04; Corn 3lf, 4"; Yeft 1-3 lf, 1.5"; Cowh .25-.5"; Pesw 1-2"; Vema 1-2 lf
POST: 6/14/04; Corn V4, 10"; Yeft 2-4"; Cowh 2-4"; Pesw 2-4"; Vema 2-4"
Soil: Silty clay loam; 3.7% OM; 3.8 pH

Precipitation:

PRE:	1st week	0.64 inches
	2nd week	0.32 inches
EPOST:	1st week	0.47 inches
	2nd week	1.12 inches
POST:	1st week	0.92 inches
	2nd week	0.08 inches

VCRR=Visual Crop Response Rating
(O=no injury; 100=complete kill)
Yeft=Yellow foxtail
Cowh=Common waterhemp
Pesw=Pennsylvania smartweed
Vema=Venice mallow

Treatment	***Rate/A***	***% VCRR 7/13/04***	***% Yeft 7/13/04***	***% Cowh 7/13/04***	***% Pesw 7/13/04***	***% Vema 7/13/04***	***% Yeft 9/2/04***
Check	----	0	0	0	0	0	0
PREEMERGENCE & POSTEMERGENCE							
Balance Pro&Liberty+	1.5 oz&32 oz+						
Atrazine+AMS	1 pt+3 lb	0	99	99	99	99	97
Balance Pro&Option+	1.5 oz&1.5 oz+						
MSO+28% N	1.5 pt+1.5 qt	0	98	99	99	98	96
PREEMERGENCE							
Balance Pro+Define SC	2.25 oz+12 oz	0	98	98	99	99	95
Epic Pro	14.5 oz	0	98	99	99	98	95
Balance Pro+atrazine	2.5 oz+1 qt	0	97	98	99	99	94
Balance Pro+	2.25 oz+						
Define SC+atrazine	12 oz+1 qt	0	97	99	99	99	96
PREEMERGENCE & POSTEMERGENCE							
Define SC&Liberty+	12 oz&32 oz+						
Atrazine+AMS	1 pt+3 lb	0	99	99	99	99	98
Define SC&Option+	12 oz&1.5 oz+						
Distinct+	4 oz+						
MSO+28% N	1.5 pt+1.5 qt	0	99	99	99	99	97
EARLY POSTEMERGENCE							
Liberty+atrazine+AMS	32 oz+1 pt+3 lb	0	92	95	99	99	90
PREEMERGENCE & POSTEMERGENCE							
Define SC&	21.7 oz&						
Buctril/atrazine	2 pt	0	99	99	98	99	96
Balance Pro&	2.25 oz&						
Buctril/atrazine	2 pt	0	97	98	99	99	93
POSTEMERGENCE							
Option+Distinct+	1.5 oz+4 oz+						
MSO+28% N	1.5 pt+1.5 qt	0	89	96	99	99	92

Table 7. Pre and Post Programs in Corn (Continued . . .)

Treatment	Rate/A	% VCRR 7/13/04	% Yeft 7/13/04	% Cowh 7/13/04	% Pesw 7/13/04	% Vema 7/13/04	% Yeft 9/2/04
EARLY POSTEMERGENCE & POSTEMERGENCE							
Liberty+atrazine+AMS&	32 oz+1 pt+3 lb&						
Liberty+AMS	28 oz+3 lb	0	98	99	99	99	96
PREEMERGENCE & POSTEMERGENCE							
Dual II Magnum&	2 pt&						
Callisto+	3 oz+						
COC+28% N	1%+2 qt	0	99	99	99	89	98
LSD (.05)		*0*	*2*	*3*	*1*	*2*	*3*

Table 8. Roundup/Priority Combinations in Corn

RCB; 4 reps
Planting Date: 5/5/04
Variety: DeKalb DKC 44-46
EPOST: 6/8/04; Corn V3, 6"; Vele 1-2 lf;
Colq 1-2"; Cocb 2-3"
POST: 6/14/04; Corn V4, 8"; Vele 1-3 lf;
Colq 2-5"; Cocb 3-5"
Soil: Silty clay loam; 3.0% OM; 6.9 pH

Precipitation:

EPOST:	1st week	0.48 inches
	2nd week	0.88 inches
POST:	1st week	0.92 inches
	2nd week	0.08 inches

Colq=Common lambsquarters
Vele=Velvetleaf
Cocb=Common cocklebur

COMMENTS: Uniform site; very low weed pressure in 2004. Heavy weed history in filler blocks. Treatments provided very good control of three broadleaf species. No crop response differences due to treatment.

Treatment	Rate/A	% Colq 7/14/04	% Vele 7/14/04	% Cocb 7/14/04	% Colq 9/27/04	% Vele 9/27/04
Check	----	0	0	0	0	0
EARLY POSTEMERGENCE						
Roundup UltraMax II+	22 oz+					
Priority+NIS+AMS	1 oz+.25%+2 lb	98	96	98	97	94
Roundup UltraMax II+	22 oz+					
Priority+COC+AMS	1 oz+1%+2 lb	98	97	98	94	95
POSTEMERGENCE						
Roundup UltraMax II+	22 oz+					
Priority+NIS+AMS	1 oz+.25%+2 lb	98	97	98	98	97
Roundup UltraMax II+	22 oz+					
Priority+COC+AMS	1 oz+1%+2 lb	98	97	98	96	93
LSD (.05)		*NS*	*2*	*1*	*3*	*3*

Table 9. Glyphosate Programs

RCB; 4 reps
Planting Date: 5/5/04
Variety: DeKalb DKC 44-46
PRE: 5/6/04
EPOST: 6/2/04; Corn V2-3, 4-5";
Grft 1-3 lf, 1.5"; Cowh .25-.5"; Colq .5-1"
POST: 6/14/04; Corn V3-4, 10";
Grft 2-4 lf, 2-4"; Cowh 2-5"; Colq 2-5"
Soil: Silty clay loam; 3.5% OM; 6.6 pH

Precipitation:

PRE:	1st week	0.64 inches
	2nd week	0.32 inches
EPOST:	1st week	0.47 inches
	2nd week	1.12 inches
POST:	1st week	0.92 inches
	2nd week	0.08 inches

Grft=Green foxtail
Cowh=Common waterhemp
Colq=Common lambsquarter

COMMENTS: Light weed pressure; delayed early season weed growth. All treatments provided acceptable weed control. Yield similar for treatments. Data represents competition factors under low weed pressure.

Treatment	***Rate/A***	***% Grft 7/16/04***	***% Cowh 7/16/04***	***% Colq 7/16/04***	***% Grft 9/2/04***	***% Cowh 9/2/04***	***% Colq 9/2/04***	***Yield bu/A***
Check	----	0	0	0	0	0	0	169
EARLY POSTEMERGENCE								
Roundup UltraMax II+AMS	22 oz+2.5 lb	86	89	93	77	82	81	183
POSTEMERGENCE								
Roundup UltraMax II+AMS	22 oz+2.5 lb	97	96	97	93	93	93	190
EARLY POSTEMERGENCE & POSTEMERGENCE								
Roundup UltraMax II+AMS& Roundup UltraMax II+AMS	22 oz+2.5 lb& 22 oz+2.5 lb	95	96	98	87	91	93	182
PREEMERGENCE & POSTEMERGENCE								
Harness Xtra& Roundup UltraMax II+AMS	3 pt& 22 oz+2.5 lb	98	99	99	94	96	97	186
LSD (.05)		*5*	*4*	*2*	*7*	*5*	*5*	*13*

Table 10. Define SC & Axiom Preemerge on Corn

RCB; 4 reps
Planting Date: 5/5/04
Variety: DeKalb DKC 44-46
PRE: 5/6/04
LPRE: 5/14/04
EPOST: 6/2/04; Corn V2, 3-4"; Grft 1-3 lf, 1.5"; Cowh .25-.5"; Colq .25-.5"; Pesw 1"
POST: 6/9/04; Corn V3-4, 8"; Grft 2-5 lf, 3"; Cowh 1-1.5"; Colq 1-2"; Pesw 2"
Soil: Silty clay loam; 3.7% OM; 6.8 pH

Precipitation:

PRE:	1st week	0.64 inches
	2nd week	0.32 inches
LPRE:	1st week	1.15 inches
	2nd week	1.51 inches
EPOST:	1st week	0.47 inches
	2nd week	1.12 inches
POST:	1st week	1.12 inches
	2nd week	0.32 inches

Grft=Green foxtail
Cowh=Common waterhemp
Colq=Common lambsquarters
Pesw=Pennsylvania smartweed

COMMENTS: Uniform test site. Excellent control with all treatments. Very good weed control maintained into late season. Programs benefit from residual component. Differences in weed evaluations were small; however all treatment yields were higher than the check. Post treatments with Atrazine tended to have highest yield; possibly associated with residual effect on late emerging weeds.

Treatment	***Rate/A***	***% Grft 7/12/04***	***% Cowh 7/12/04***	***% Colq 7/12/04***	***% Pesw 7/12/04***	***% Grft 9/2/04***
Check	----	0	0	0	0	0
PREEMERGENCE & POSTEMERGENCE						
Bicep Lite II Magnum&	2.1 qt&					
Buctril/Atrazine+Callisto	2 pt+.75 oz	98	99	99	99	95
Define SC+atrazine&	18 oz+1.6 qt&					
Buctril/Atrazine+Callisto	2 pt+.75 oz	97	99	99	99	95
Axiom+atrazine&	16 oz+1.6 qt&					
Buctril/Atrazine+Callisto	2 pt+.75 oz	97	99	99	99	93
PREEMERGENCE & EARLY POSTEMERGENCE						
Define SC+atrazine&	8 oz+.5 qt&					
Define SC+atrazine+COC	8 oz+1 qt+1 qt	97	99	99	99	93
Axiom+atrazine&	8 oz+.5 qt&					
Axiom+atrazine+COC	6.5 oz+1 qt+1 qt	97	99	99	99	95
LATE PREEMERGENCE						
Define SC+atrazine+COC	18 oz+1.5 qt+1 qt	94	97	99	99	92
Axiom+atrazine+COC	16 oz+1.5 qt+1 qt	96	99	99	99	95
LSD (.05)		*3*	*2*	*0*	*0*	*4*

Table 11. Weed Control with Balance Pro

RCB; 4 reps
Planting Date: 5/5/04
Variety: DeKalb DKC 44-46
PRE: 5/6/04
Soil: Silty clay, 3.5% OM; 6.6 pH

Precipitation:
PRE: 1st week 0.64 inches
2nd week 0.32 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)
Grft=Green foxtail
Cowh=Common waterhemp
Vema=Venice mallow

COMMENTS: Conventional tillage; tillage prior to planting. Heavy weed pressure history in plot area; delayed weed emergence in 2004. All treatments provided excellent control across the weed spectrum. No apparent rate response for Balance Pro or Camix in the programs. Treatment yields similar.

Treatment	***Rate/A***	***% VCRR 5/14/04***	***% Grft 6/8/04***	***% Cowh 6/8/04***	***% Vema 6/8/04***	***% Grft 9/2/04***	***% Cowh 9/2/04***	***Yield bu/A***
Check	----	0	0	0	0	0	0	174
PREEMERGENCE								
Balance Pro+atrazine	1.5 oz+1 qt	0	98	98	98	96	94	169
Balance Pro+atrazine	2.5 oz+1 qt	0	96	98	98	93	95	177
Balance Pro+Define SC	1.5 oz+12 oz	0	98	98	98	97	97	183
Camix	2.5 qt	0	97	98	97	95	96	184
Camix	3 qt	0	98	98	97	95	95	176
Epic	12 oz	0	98	98	98	97	97	178
Balance Pro+ Define SC+atrazine	1.5 oz+ 12 oz+1 qt	0	98	98	98	97	98	178
Balance Pro+ Define SC+atrazine	2.5 oz+ 12 oz+1 qt	0	98	98	98	96	97	175
Lumax	2.5 qt	0	98	98	98	96	95	183
Lumax	3 qt	0	97	98	98	96	96	185
LSD (.05)		*0*	*1*	*0*	*1*	*5*	*3*	*17*

Table 12. Glyphosate Tank-Mixes - Antagonism

RCB; 4 reps
Planting Date: 5/5/04
Variety: DeKalb DKC 44-46
POST: 6/9/04
POST1: 6/14/04; Corn V4, 10";
Grft 2-4"; Cowh 2-5"; Colq 2-4"; Vema 2-3"

Precipitation:

POST:	1st week	1.12 inches
	2nd week	0.32 inches
POST1:	1st week	0.92 inches
	2nd week	0.08 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)
Grft=Green foxtail
Cowh=Common waterhemp
Colq=Common lambsquarters
Vema=Venice mallow

COMMENTS: Conventional tillage. Purpose to evaluate antagonism with tank-mix partners for glyphosate. Excellent weed control. No treatment differences on grass or broadleaf weeds. No significant crop response treatment differences.

Treatment	***Rate/A***	***% VCRR 7/13/04***	***% Grft 7/13/04***	***% Cowh 7/13/04***	***% Colq 7/13/04***	***% Vema 7/13/04***	***% VCRR Root 9/27/04***
Check	----	0	0	0	0	0	0
POSTEMERGENCE							
Roundup UltraMax II+AMS	22 oz+2.5 lb	0	99	97	98	95	0
Roundup UltraMax II+ Atrazine+AMS	22 oz+ 3 pt+2.5 lb	0	99	99	99	99	0
Roundup UltraMax II+ Distinct+AMS	22 oz+ 6 oz+2.5 lb	0	99	99	99	97	1
Roundup UltraMax II+ Yukon+AMS	22 oz+ 4 oz+2.5 lb	0	98	99	99	98	1
Roundup UltraMax II+ 2,4-D ester+AMS	22 oz+ 1 pt+2.5 lb	0	99	99	99	96	8
Roundup UltraMax II+Permit+ Atrazine+AMS	22 oz+.67 oz+ 1.5 pt+2.5 lb	0	99	99	99	99	0
Roundup UltraMax II+ Northstar+AMS	22 oz+ 5 oz+2.5 lb	0	99	98	99	97	3
Roundup UltraMax II+ Callisto+AMS	22 oz+ 3 oz+2.5 lb	0	99	99	99	97	0
POSTEMERGENCE & POSTEMERGENCE1							
Roundup UltraMax II+AMS& Roundup UltraMax II+AMS	22 oz+2.5 lb& 22 oz+2.5 lb	0	99	99	98	96	0
LSD (.05)		*0*	*1*	*1*	*1*	*2*	*2*

Table 13. Glyphosate Tank-Mixes - Injury

RCB; 4 reps
Planting Date: 5/5/04
Variety: DeKalb DKC 44-46
4-6 INCH: 6/14/04; Corn 8"
12-16 INCH: 6/24/04; Corn 14-18"
Soil: Silty clay loam; 3.7% OM; 6.8 pH

Precipitation:

4-6 INCH:	1st week	0.92 inches
	2nd week	0.08 inches
12-16 INCH:	1st week	0.08 inches
	2nd week	0.08 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)

COMMENTS: Weed free plots. Evaluation of crop tolerance to plant growth regulator (PGR) herbicide rates and timing when used in glyphosate tank-mixes. There were no significant visual crop responses at early timing. Rates above recommended levels at late timing caused visual response. Clarity, Distinct, and Callisto at the low rate at early timing produced yields similar to check. All treatments at late timing reduced yield compared to the check.

Treatment	*Rate/A*	*% VCRR Stunt 7/16/04*	*% VCRR Root 9/27/04*	*Yield bu/A*
Check	----	0	0	186
4-6 INCH:				
Roundup UltraMax II+Clarity+AMS	22 oz+4 oz+2.5 lb	0	1	183
Roundup UltraMax II+Clarity+AMS	22 oz+8 oz+2.5 lb	4	6	174
Roundup UltraMax II+Clarity+AMS	22 oz+12 oz+2.5 lb	13	9	166
Roundup UltraMax II+Callisto+AMS	22 oz+3 oz+2.5 lb	1	0	186
Roundup UltraMax II+Distinct+AMS	22 oz+4 oz+2.5 lb	1	1	179
12-16 INCH:				
Roundup UltraMax II+Clarity+AMS	22 oz+4 oz+2.5 lb	0	4	174
Roundup UltraMax II+Clarity+AMS	22 oz+8 oz+2.5 lb	1	20	164
Roundup UltraMax II+Clarity+AMS	22 oz+12 oz+2.5 lb	4	31	161
Roundup UltraMax II+Callisto+AMS	22 oz+3 oz+2.5 lb	0	0	168
Roundup UltraMax II+Distinct+AMS	22 oz+4 oz+2.5 lb	0	9	174
LSD (.05)		*3*	*4*	*10*

Table 14. Glyphosate Residue in Corn

RCB; 4 reps
Planting Date: 5/5/04
Variety: Garst 468LL
2-3 LEAF: 6/8/04; Corn 6"
4-5 LEAF: 6/14/04; Corn V3, 8"
6-7 LEAF: 6/24/04; Corn 15"
Soil: Silty clay loam; 3.0% OM; pH 6.9

Precipitation:

2-3 LEAF:	1st week	0.48 inches
	2nd week	0.88 inches
4-5 LEAF:	1st week	0.92 inches
	2nd week	0.08 inches
6-7 LEAF:	1st week	0.08 inches
	2nd week	0.08 inches

VCRR=Visual Crop Response Rating
(O=no injury; 100=complete kill)

COMMENTS: Purpose to evaluate crop response to low levels of glyphosate, simulating application errors, applied at three rates and three timings. All rates in the test reduced yield. Yields reduced as rates increased at all timings.

Rate/A	***7/14/04***	***% VCRR 9/27/04***	***% VCRR bu/A***	***Yield***
Check	----	0	0	182
2-3 LEAF:				
Roundup UltraMax II+AMS	.6875 oz+2.5 lb	71	50	91
Roundup UltraMax II+AMS	1.375 oz+2.5 lb	83	66	55
Roundup UltraMax II+AMS	2.75 oz+2.5 lb	98	96	7
4-5 LEAF:				
Roundup UltraMax II+AMS	.6875 oz+2.5 lb	23	15	138
Roundup UltraMax II+AMS	1.375 oz+2.5 lb	76	44	84
Roundup UltraMax II+AMS	2.75 oz+2.5 lb	90	86	23
6-7 LEAF:				
Roundup UltraMax II+AMS	.6875 oz+2.5 lb	38	20	121
Roundup UltraMax II+AMS	1.375 oz+2.5 lb	81	64	35
Roundup UltraMax II+AMS	2.75 oz+2.5 lb	93	95	3
LSD (.05)		*8*	*9*	*24*

Table 15. 1X and 2X Corn Rates - Postemerge

RCB; 4 reps
Planting Date: 5/5/04
Variety: DeKalb DKC 58-24
EPOST: 6/2/04; Corn V2
POST: 6/9/04; Corn V3, 7"
Soil: Silty clay, 3.7% OM; 6.6 pH

Precipitation:

EPOST:	1st week	0.47 inches
	2nd week	1.12 inches
POST:	1st week	1.12 inches
	2nd week	0.32 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)

COMMENTS: Weed free conditions. Evaluation of crop tolerance to X and 2X rates of postemerge herbicides. No significant yield differences to herbicide when comparing X and 2X rates.

		1X Rate			2X Rate		
Treatment	***Rate/A***	*% VCRR Stunt 7/14/04*	*% VCRR Root 7/14/04*	*Yield bu/A*	*% VCRR Stunt 7/14/04*	*% VCRR Root 7/14/04*	*Yield bu/A*
Check	----	0	0	145	----	----	----
EARLY POSTEMERGENCE							
2,4-D amine	1 pt	0	0	139	5	3	145
Clarity	1 pt	0	0	149	16	3	146
Distinct+ NIS+28% N	6 oz+ .25%+1.25%	0	0	141	4	1	150
POSTEMERGENCE							
Buctril	1.5 pt	0	0	139	0	0	148
Callisto+COC+28% N	3 oz+1%+2 qt	0	0	143	1	0	148
Aim EW+NIS	.5 oz+.25%	0	0	150	0	0	154
Steadfast+COC+28% N	.75 oz+1%+2 qt	0	0	143	1	0	146
Option+ MSO+28% N	1.5 oz+ 1.5 pt+2 qt	0	0	150	0	0	146
LSD (.05)		*2*	*2*	*13*	*2*	*2*	*13*

Table 16. 2003 Soybean Herbicide Carryover to Corn 2004

RCB; 4 reps
Planting Date: 5/30/03
Variety: DeKalb DKC 58-24
PRE: 6/3/03
Soil: Silty clay; 2.7% OM; 6.6 pH

Precipitation:
PRE: (2003) 1st week 0.91 inches
2nd week 0.00 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)

COMMENTS: Corn response to soybean herbicides applied at X and 2X rates in 2003. Limited visual response; yield of 2X treatments similar to X rates.

		1X Rate		***2X Rate***	
Treatment	***Rate/A***	***% VCRR 7/12/04***	***Corn Yield bu/A***	***% VCRR 7/12/04***	***Corn Yield bu/A***
Check	----	0	172	—	—
PREEMERGENCE					
Command 3ME	2.6 pt	0	165	0	162
Authority	5.33 oz	0	166	8	163
Sencor	.67 lb	0	172	0	173
Valor	3 oz	0	165	0	168
Authority+FirstRate	5.3 oz+.6 oz	3	154	9	160
Valor+FirstRate	3 oz+.6 oz	0	168	0	160
LSD (.05)		*3*	*15*	*3*	*15*

Table 17. Soybean Herbicide Demonstration

Demonstration
Planting Date: 5/14/04
Variety: Prairie Brand BP 2141
PPI/PRE: 5/14/04
EPOST: 6/10/04; Soybean 1 tri;
Grft 1-3 lf, 1-3"; Cowh .5-1.5"; Colq 1-2"
POST: 6/21/04; Soybean 2-3 tri;
Grft 2-5 lf; Cowh 1-4"; Colq 2-5"
Soil: Silty clay; 3.4% OM; 6.6 pH

Precipitation:
PPI/PRE: 1st week 1.15 inches
2nd week 1.51 inches
EPOST: 1st week 1.20 inches
2nd week 0.40 inches
POST: 1st week 0.08 inches
2nd week 0.08 inches

Grft=Green foxtail
Cowh=Common waterhemp
Colq=Common lambsquarters

COMMENTS: Conventional tillage. Moderate to heavy weed pressure. Excellent foxtail control with post treatments. Ten treatments provided 90% or greater control of both waterhemp and lambsquarters. Note treatments that controlled waterhemp, but did not control lambsquarters. Possible explanation for species shift to lambsquarters.

Table 17. Soybean Herbicide Demonstration (Continued . . .)

Treatment	***Rate/A***	***% Grft 8/5/04***	***% Cowh 8/5/04***	***% Colq 8/5/04***
Check	----	0	0	0
PREPLANT INCORPORATED				
Treflan	2 pt	78	80	94
Sonalan	3 pt	83	75	91
Prowl H_2O	2.75 pt	88	67	92
Treflan+Authority	1.5 pt+5.3 oz	86	91	99
Treflan+Sencor	1.5 pt+5 oz	82	84	98
PREEMERGENCE				
Boundary	2.5 pt	97	98	99
Outlook+Valor+Python	16 oz+2 oz+1 oz	98	99	99
Lasso+Authority	1.5 qt+4 oz	97	99	99
PREPLANT INCORPORATED & POSTEMERGENCE				
Prowl H_2O&Pursuit DG+Flexstar+ MSO+28% N	2.25 pt&.72 oz+10 oz+ 1 qt+1 qt	97	95	96
PREPLANT INCORPORATED & EARLY POSTEMERGENCE				
Treflan&Aim EW+NIS	2 pt&.25 oz+.25%	82	90	95
PREEMERGENCE & POSTEMERGENCE				
Boundary&Poast Plus+COC	2.5 pt&1.5 pt+1 qt	99	98	99
Valor&Poast Plus+COC	2 oz&1.5 pt+1 qt	99	70	99
Valor&Poast Plus+COC	3 oz&1.5 pt+1 qt	99	78	99
Authority&Assure II+COC	3.5 oz&7 oz+1 qt	99	96	99
Authority&Assure II+COC	5.3 oz&7 oz+1 qt	99	97	99
Gauntlet&Select+COC	7.9 oz&7 oz+1 qt	99	99	99
PREEMERGENCE & POSTEMERGENCE				
Valor+Python&Select+COC	2 oz+1 oz&7 oz+1 qt	99	88	98
Valor+FirstRate&Select+COC	3 oz+.6 oz&7 oz+1 qt	99	78	88
EARLY POSTEMERGENCE & POSTEMERGENCE				
Poast Plus+COC&Ultra Blazer+NIS	1.5 pt+1 qt&1.5 pt+.25%	99	58	78
Poast Plus+COC&Phoenix+COC	1.5 pt+1 qt&.8 pt+1 pt	98	98	15
Poast Plus+COC& Flexstar+MSO+28% N	1.5 pt+1 qt& 16 oz+1 qt+1 qt	99	68	60
Poast Plus+COC& FirstRate+MSO+28% N	1.5 pt+1 qt& .3 oz+1 qt+1 qt	98	65	40
Poast Plus+COC& Harmony GT +NIS	1.5 pt+1 qt& .083 oz+.25%	99	40	94
EARLY POSTEMERGENCE				
FirstRate+Flexstar+Select+ MSO+28% N	.3 oz+10 oz+6 oz+ 1 qt+1 qt	99	98	89
Raptor+MSO+28% N	5 oz+1 qt+1 qt	95	20	88

Table 18. Herbicide Tolerant Soybean Demonstration

Demonstration
Planting Date: 5/14/04
Variety: Prairie Brand PB 2141
PPI/PRE: 5/14/04
EPOST: 6/21/04; Soybean 2-3 tri;
Grft 2-5 lf; 1-5"; Cowh 1-4"
POST: 6/24/04; Soybean 3 tri;
Grft 2-6"; Cowh 3-6"
POST1: 7/2/04
Soil: Silty clay; 3.4% OM; 6.6 pH

Precipitation:

PPI/PRE:	1st week	1.15 inches
	2nd week	1.51 inches
EPOST:	1st week	0.08 inches
	2nd week	0.08 inches
POST:	1st week	0.08 inches
	2nd week	0.08 inches
POST1:	1st week	0.08 inches
	2nd week	0.12 inches

Grft=Green foxtail
Cowh=Common waterhemp

COMMENTS: No-till Roundup Ready soybeans in no-till corn stubble. All glyphosate treatments provided excellent foxtail control. One pass non-residual treatments resulted in reduced waterhemp control. Indication of antagonism for waterhemp with some postemerge glyphosate treatments compared to glyphosate alone.

Treatment	***Rate/A***	***% Grft 8/5/04***	***% Cowh 8/5/04***
Check	—	0	0
EARLY POSTEMERGENCE			
Roundup UltraMax II+AMS	11 oz+2.5 lb	96	80
Roundup UltraMax II+AMS	22 oz+2.5 lb	99	88
POSTEMERGENCE1			
Roundup UltraMax II+AMS	22 oz+2.5 lb	99	70
EARLY POSTEMERGENCE & POSTEMERGENCE1			
Roundup UltraMax II+AMS& Roundup UltraMax II+AMS	22 oz+2.5 lb& 22 oz+2.5 lb	99	99
EARLY POSTEMERGENCE			
Treflan+Roundup UltraMax II+AMS	1.5 pt+11 oz+2.5 lb	98	45
Treflan+Roundup UltraMax II+AMS	1.5 pt+22 oz+2.5 lb	99	72
PREPLANT INCORPORATED & POSTEMERGENCE			
Prowl H_2O&Extreme+NIS+AMS	2.25 pt&1.5 qt+.25%+2.5 lb	99	99
PREEMERGENCE & POSTEMERGENCE			
Python&GF-1279+AMS	1 oz&24 oz+2.5 lb	98	97
Valor&Roundup UltraMax II+AMS	2 oz&22 oz+2.5 lb	99	99
Valor+Python& Roundup UltraMax II+AMS	1.5 oz+1 oz+ 22 oz+2.5 lb	99	99
Valor+FirstRate& Roundup UltraMax II+AMS	1.5 oz+.3 oz& 22 oz+2.5 lb	99	99

Table 18. Herbicide Tolerant Soybean Demonstration (Continued . . .)

Treatment	***Rate/A***	***% Grft 8/5/04***	***% Cowh 8/5/04***
PREEMERGENCE & POSTEMERGENCE			
Gauntlet&Roundup UltraMax II+AMS	7.9 oz&22 oz+2.5 lb	99	99
Authority&Roundup UltraMax II+AMS	2 oz&22 oz+2.5 lb	99	99
Authority&Roundup UltraMax II+AMS	4 oz&22 oz+2.5 lb	99	99
Axiom&Roundup UltraMax II+AMS	13 oz&22 oz+2.5 lb	99	99
Domain&Roundup UltraMax II+AMS	12 oz&22 oz+2.5 lb	99	99
Sencor&Roundup UltraMax II+AMS	.5 lb&22 oz+2.5 lb	99	99
Boundary&Touchdown Total+AMS	1.5 pt&23 oz+2.5 lb	99	99
EARLY POSTEMERGENCE			
Extreme+NIS+AMS	1.5 qt+.25%+2.5 lb	99	68
Dual II Magnum+ Roundup UltraMax II+AMS	1.5 pt+ 22 oz+2.5 lb	99	82
Lasso+Roundup UltraMax II+AMS	1.5 qt+22 oz+2.5 lb	99	75
G-1279+FirstRate+AMS	24 oz+.3 oz+2.5 lb	99	99
Roundup UltraMax II+Supporrt+AMS	11 oz+.5 oz+2.5 lb	99	78
Roundup UltraMax II+Aim EW+AMS	11 oz+.25 oz+2.5 lb	99	84
Roundup UltraMax II+Resource+AMS	11 oz+4 oz+2.5 lb	99	55
Roundup UltraMax II+Flexstar+AMS	11 oz+8 oz+2.5 lb	99	65
Roundup UltraMax II+ Harmony GT XP+AMS	11 oz+ .083 oz+2.5 lb	99	88
POSTEMERGENCE			
Roundup UltraMax II+Resource+AMS	11 oz+4 oz+2.5 lb	99	86
Roundup UltraMax II+Flexstar+AMS	11 oz+8 oz+2.5 lb	99	85
Roundup UltraMax II+ Harmony GT XP+AMS	22 oz+ .083 oz+2.5 lb	99	99
Roundup UltraMax II+AMS	44 oz+2.5 lb	99	99

Table 19. Weed Control in STS/RR Soybeans

RCB; 4 reps
Planting Date: 5/16/04
POST: 6/24/04; Soybean 2 tri;
Grft 2-4"; Cowh 4-7"; Colq 4-8"
Soil: Silty clay loam; 3.0% OM; 6.9 pH

Precipitation:

POST:	1st week	0.08 inches
	2nd week	0.08 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)
Grft=Green foxtail
Cowh=Common waterhemp
Colq=Common lambsquarters

COMMENTS: Stacked STS/Roundup Ready soybeans. Essentially complete early weed control. No early crop response differences due to treatments. Late season evaluation showed somewhat higher control; possibly from short residual effects.

Treatment	***Rate/A***	***% VCRR 7/14/04***	***% Grft 7/14/04***	***% Cowh 7/14/04***	***% Colq 7/14/04***	***% Cowh 9/27/04***
Check	----	0	0	0	0	0
POSTEMERGENCE						
Roundup UltraMax II +AMS*	22 oz	0	99	96	98	88
Harmony GT XP+	.083 oz+					
Roundup UltraMax II+AMS*	22 oz	0	99	97	99	85
Harmony GT XP+	.167 oz+					
Roundup UltraMax II+AMS*	22 oz	0	99	98	99	91
Harmony GT XP+	.33 oz+					
Roundup UltraMax II+AMS*	22 oz	0	99	97	99	91
Classic+	.5 oz+					
Roundup UltraMax II+AMS*	22 oz	0	99	98	99	85
Classic+	1 oz+					
Roundup UltraMax II+AMS*	22 oz	0	99	98	98	90
Harmony GT XP+Classic+	.33 oz+1 oz+					
Roundup UltraMax II+AMS*	22 oz	0	99	99	99	89
LSD (.05)		*0*	*0*	*2*	*1*	*4*

* AMS applied at 17 lb/100 gal.

Table 20. No-Till Soybean Demonstration

Demonstration
Planting Date: 5/12/04
Variety: Prairie Brand PB 2141
FALL: 11/19/03
EPP: 5/6/04
PRE: 5/12/04
EPOST: 6/22/04
POST: 6/24/04; Soybean 2-3 tri; Grft 1-3"; Cowh 1-4"
Soil: Silty clay loam; 3.2% OM; 6.6 pH

Grft=Green foxtail
Cowh=Common waterhemp

Precipitation:

FALL:	1st week	0.08 inches
	2nd week	0.00 inches
EPP:	1st week	0.64 inches
	2nd week	0.32 inches
PRE:	1st week	0.56 inches
	2nd week	2.34 inches
EPOST:	1st week	0.08 inches
	2nd week	0.08 inches
POST:	1st week	0.08 inches
	2nd week	0.08 inches

COMMENTS: No-till into no-till corn stubble. Excellent grass control. Late emerging waterhemp reduced control for some fall or EPP residual treatments. Pre/post split programs were consistent.

Treatment	***Rate/A***	***% Grft 8/5/04***	***% Cowh 8/5/04***
Check	----	0	0
FALL & POSTEMERGENCE			
Valor&Select+COC	3 oz&7 oz+1%	99	75
Valor+FirstRate&Select+COC	3 oz+.6 oz&7 oz+1%	99	68
Gauntlet&Select+COC	7.9 oz&7 oz+1%	99	80
Authority&Assure II+COC	5.33 oz&10 oz+1%	99	65
Authority&Roundup UltraMax II+AMS	5.33 oz&22 oz+2.5 lb	99	99
Python&Roundup UltraMax II+AMS	1.25 oz&22 oz+2.5 lb	99	99
EARLY PREPLANT & POSTEMERGENCE			
Valor&Select+COC	3 oz&7 oz+1%	99	60
Valor&Roundup UltraMax II+AMS	3 oz&22 oz+2.5 lb	99	99
Authority&Select+COC	5.33 oz&7 oz+1%	99	78
Authority&Roundup UltraMax II+AMS	5.33 oz&22 oz+2.5 lb	99	99
Valor+FirstRate& Roundup UltraMax II+AMS	3 oz+.6 oz& 22 oz+2.5 lb	99	99
Gauntlet&Roundup UltraMax II+AMS	7.9 oz&22 oz+2.5 lb	99	99
Boundary&Touchdown Total+AMS	2.5 pt&1.5 pt+2.5 lb	99	99
PREEMERGENCE & POSTEMERGENCE			
Valor+COC&Select+COC	3 oz+1%&7 oz+1%	99	65
Valor+COC&Roundup UltraMax II+AMS	3 oz+1%&22 oz+2.5 lb	99	97
Valor+COC&Roundup UltraMax II+AMS	2 oz+1%&22 oz+2.5 lb	99	98
Authority+COC&Assure II+COC	5.33 oz+1%&10 oz+1%	99	92
Check	----	0	0

Table 20. No-Till Soybean Demonstration (Continued . . .)

Treatment	***Rate/A***	***% Grft 8/5/04***	***% Cowh 8/5/04***
PREEMERGENCE & POSTEMERGENCE			
Authority+COC&	5.33 oz+1%&		
Roundup UltraMax II+AMS	22 oz+2.5 lb	99	99
Python&Glyphomax Plus+AMS	1.25 oz&32 oz+2.5 lb	99	99
Outlook&Roundup UltraMax II+AMS	21 oz&22 oz+2.5 lb	99	94
PREEMERGENCE			
Prowl H_2O+Authority+	2.17 pt+4 oz+		
Roundup UltraMax II+AMS	22 oz+2.5 lb	45	75
PREEMERGENCE & POSTEMERGENCE			
Domain&Roundup UltraMax II+AMS	10 oz&22 oz+2.5 lb	99	99
Boundary+COC&	2.5 pt+1%&		
Roundup UltraMax II+AMS	22 oz+2.5 lb	99	88
Gauntlet+COC&	7.9 oz+1%&		
Roundup UltraMax II+AMS	22 oz+2.5 lb	99	99
Lasso&Roundup UltraMax II+AMS	2 qt&22 oz+2.5 lb	99	99
Boundary&Flexstar+Fusion+	1.5 pt&1 pt+8 oz+		
MSO+AMS	1%+2.5 lb	99	97
Authority&Select+Flexstar+	4 oz&7 oz+12 oz+		
MSO+28% N	1%+2 qt	99	99
POSTEMERGENCE			
Select+Flexstar+MSO+28% N	7 oz+16 oz+1%+2 qt	92	97
Select+FirstRate+Flexstar+	7 oz+.3 oz+12 oz+		
MSO+28% N	1%+2 qt	97	99
EARLY POSTEMERGENCE			
Roundup UltraMax II+AMS	22 oz+2.5 lb	98	96
EARLY POSTEMERGENCE & POSTEMERGENCE			
Roundup UltraMax II+AMS&	11 oz+2.5 lb&		
Roundup UltraMax II+AMS	11 oz+2.5 lb	99	99
Roundup UltraMax II+AMS&	22 oz+2.5 lb&		
Roundup UltraMax II+AMS	22 oz+2.5 lb	99	99
EARLY POSTEMERGENCE			
Roundup UltraMax II+Resource+AMS	22 oz+6 oz+2.5 lb	99	97
Roundup UltraMax II+FirstRate+	25.6 oz+.3 oz+		
Flexstar+AMS	12 oz+2.5 lb	99	99
Check	----	0	0

Table 21. Soybean Demonstration - Late Timing

Demonstration
Planting Date: 5/14/04
Variety: Prairie Brand PB 2141
LPOST: 7/29/04; Soybean 2-3'; Cowh 2-4'; Grft 2-4'
Soil: Silty clay, 3.4% OM; 6.6 pH

Precipitation:

LPOST:	1st week	1.46 inches
	2nd week	0.04 inches

Cowh=Common waterhemp

COMMENTS: Demonstration of performance of late season salvage treatments for 2 to 4 foot waterhemp. PPO tank-mixes appeared to increase weed response; however control was incomplete.

Treatment	***Rate/A***	***% Cowh 8/5/04***
LATE POSTEMERGENCE		
Roundup UltraMax II+AMS	32 oz+2.5 lb	65
Roundup UltraMax II+Harmony GT XP+AMS	16 oz+.083 oz+2.5 lb	68
Roundup UltraMax II+Phoenix+AMS	16 oz+10 oz+2.5 lb	85
Roundup UltraMax II+Flexstar+AMS	16 oz+12 oz+2.5 lb	80
Roundup UltraMax II+Aim EW+AMS	16 oz+.5 oz+2.5 lb	75
Roundup UltraMax II+Resource+AMS	16 oz+4 oz+2.5 lb	83

Table 22. Cocklebur Control in Soybeans

RCB; 2 reps
Planting Date: 5/14/04
Variety: Prairie Brand PB 2141
PRE: 5/14/04
POST: 6/9/04; Soybeans 1-2 tri, 2-3"; Cocb 2-4"
Soil: Loam; 2.9% OM; 6.8 pH

Precipitation:

PRE:	1st week	1.15 inches
	2nd week	1.51 inches
POST:	1st week	1.12 inches
	2nd week	0.32 inches

Cocb=Common cocklebur

COMMENTS: Very heavy cocklebur pressure. Outlook broadcast over plot area. All plot treatments are in top yield group. Post treatments were most effective.

Treatment	***Rate/A***	***% Cocb 7/14/04***	***Yield bu/A***
Check	----	0	3
PREEMERGENCE			
Valor+Python	2 oz+1 oz	55	30
Valor+FirstRate	3 oz+.6 oz	68	35
Gauntlet	7.9 oz	78	44
POSTEMERGENCE			
Phoenix+COC+28% N	.8 pt+.5 qt+4 qt	89	42
Flexstar+MSO+28% N	16 oz+1%+2 qt	94	50
Classic+NIS	.33 oz+.125%	78	43
FirstRate+NIS+28% N	.3 oz+.125%+2 qt	94	48
Raptor+MSO+28% N	5 oz+1.5 pt+1 qt	88	43
Pursuit DG+MSO+28% N	1.44 oz+1 qt+1 qt	92	48
Extreme+AMS	3 pt+2.5 lb	92	47
Roundup UltraMax II+AMS	22 oz+2.5 lb	85	44
Roundup UltraMax II+Supporrt+AMS	22 oz+.5 oz+2.5 lb	88	43
LSD (.05)		*18*	*9*

Table 23. Velvetleaf Control in Soybeans

RCB; 2 reps
Planting Date: 5/14/04
Variety: Prairie Brand PB 2141
PRE: 5/14/04
POST: 6/24/04; Soybean 3 tri;
Vele 1-4 lf; Cowh 2-5"
Soil: Silty clay loam; 3.0% OM; 6.9 pH

Precipitation:

PRE:	1st week	1.15 inches
	2nd week	1.51 inches
POST:	1st week	0.08 inches
	2nd week	0.08 inches

Vele=Velvetleaf
Cowh=Common waterhemp

COMMENTS: Tilled seedbed. Slow early season crop growth. Velvetleaf moderate, uniform waterhemp density. Very good waterhemp control for several treatments; wide treatment response for velvetleaf control. Possible interaction between broadleaf species; control of one may have increased the growth of the other.

Treatment	***Rate/A***	***% Vele 8/5/04***	***% Cowh 8/5/04***
Check	—	0	0
PREEMERGENCE			
Command 3ME	2.67 pt	98	97
Gauntlet	7.9 oz	97	99
Authority	5.33 oz	88	99
Valor	3 oz	30	99
Valor+FirstRate	1.5 oz+.3 oz	78	90
PREEMERGENCE & POSTEMERGENCE			
Valor&Roundup UltraMax II+AMS	2 oz&22 oz+2.5 lb	79	98
Boundary&Touchdown Total+AMS	2.5 pt&23 oz+2.5 lb	84	99
POSTEMERGENCE			
Basagran+COC	1 qt+1 qt	88	50
Phoenix+COC	.8 pt+1 pt	15	98
Flexstar+MSO+28% N	16 oz+1%+2 qt	64	92
Resource+COC	6 oz+1 qt	78	92
FirstRate+NIS+28% N	.3 oz+.125%+2 qt	13	80
Extreme+NIS+AMS	1.5 qt+.25%+2.5 lb	86	96
Roundup UltraMax II+AMS	11 oz+2.5 lb	83	97
Roundup UltraMax II+AMS	22 oz+2.5 lb	85	90
Roundup UltraMax II+AMS	16 oz+2.5 lb	83	98
Roundup UltraMax II+Resource+AMS	11 oz+4 oz+2.5 lb	86	99
Roundup UltraMax II+Phoenix+AMS	11 oz+10 oz+2.5 lb	86	99
Roundup UltraMax II+Flexstar+AMS	11 oz+12 oz+2.5 lb	87	99
Roundup UltraMax II+Aim EW+AMS	11 oz+.25 oz+2.5 lb	89	97
Glyphomax Plus+FirstRate+AMS	1 pt+.3 oz+2.5 lb	91	96
LSD (.05)		*13*	*7*

Table 24. Common Waterhemp Control in Soybeans

RCB; 4 reps
Planting Date: 5/14/04
Variety: Prairie Brand BP 2141
PRE: 5/14/04
EPOST: 6/9/04; Soybean 1-2 tri, 3-4";
Cowh 3-4 lf, 1-2"
POST: 6/24/04; Soybean 3-4 tri; Cowh 1-2"
Soil: Silty clay; 3.9% OM; 7.0 pH

Precipitation:

PRE:	1st week	1.15 inches
	2nd week	1.51 inches
EPOST:	1st week	1.12 inches
	2nd week	0.32 inches
POST:	1st week	0.08 inches
	2nd week	0.08 inches

Cowh=Common waterhemp

COMMENTS: Very heavy waterhemp competition; severe effect on yield. Sixteen treatments provided at least 90% control.

Treatment	***Rate/A***	***% Cowh 7/14/04***	***Yield bu/A***
Check	----	0	3
PREPLANT INCORPORATED			
Treflan	2 pt	70	46
Treflan+Python	1.5 pt+1 oz	77	49
Treflan+Authority	1.5 pt+5.3 oz	96	54
PREPLANT INCORPORATED & PREEMERGENCE			
Treflan&Authority	1.5 pt&5.3 oz	97	47
PREPLANT INCORPORATED & POSTEMERGENCE			
Treflan&Roundup UltraMax II+AMS	1.5 pt&11 oz+2.5 lb	98	53
PREEMERGENCE & POSTEMERGENCE			
Authority&Poast Plus+COC	5.33 oz&1.5 pt+1 qt	98	53
Authority&Roundup UltraMax II+AMS	4 oz&22 oz+2.5 lb	98	49
Valor&Poast Plus+COC	3 oz&1.5 pt+1 qt	82	39
Valor+Python&Poast Plus+COC	2 oz+1 oz&1.5 pt+1 qt	88	47
Valor&Roundup UltraMax II+AMS	2 oz&22 oz+2.5 lb	98	55
Gauntlet&Roundup UltraMax II+AMS	7.9 oz&22 oz+2.5 lb	98	47
Boundary&Roundup UltraMax II+AMS	1.5 pt&22 oz+2.5 lb	98	53
EARLY POSTEMERGENCE			
Pursuit DG+MSO+28% N	1.44 oz+1 qt+1 qt	23	5
PREPLANT INCORPORATED& POSTEMERGENCE			
Treflan&Phoenix+COC	1.5 pt&.8 pt+1 pt	97	47
Treflan&FirstRate+NIS+28% N	1.5 pt&.3 oz+.125%+2 qt	82	36
Treflan&Flexstar+COC+28% N	1.5 pt&12 oz+1%+2 qt	96	53
EARLY POSTEMERGENCE			
Roundup UltraMax II+AMS	22 oz+2.5 lb	74	42

Table 24. Common Waterhemp Control in Soybeans (Continued . . .)

Treatment	*Rate/A*	*% Cowh 7/14/04*	*Yield bu/A*
POSTEMERGENCE			
Roundup UltraMax II+AMS	22 oz+2.5 lb	96	50
EARLY POSTEMERGENCE & POSTEMERGENCE			
Roundup UltraMax II+AMS& Roundup UltraMax II+AMS	11 oz+2.5 lb& 11 oz+2.5 lb	98	50
Roundup UltraMax II+AMS& Roundup UltraMax iI+AMS	22 oz+2.5 lb& 22 oz+2.5 lb	98	52
LSD (.05)		*5*	*7*

Table 25. Late Waterhemp Control in Soybeans

Demonstration
Planting Date: 6/10/04
Variety: Asgrow AG2403
LPOST: 7/29/04; Soybeans 2-3'; Cowh 2-4'
Soil: Silty clay; 4.0% OM; 7.8 pH

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)

Precipitation:

LPOST:	1st week	1.46 inches
	2nd week	0.04 inches

Cowh=Common waterhemp
Vele=Velvetleaf

COMMENTS: Heavy weed pressure. Demonstration comparison of additives and tankmixes with Roundup and comparison of glyphosate products for rescue application in large (2-4 ft) waterhemp. Increased crop response with high rate of Harmony GT; waterhemp control similar for treatments. High level of control suggests favorable conditions; greater than experienced in some other situations.

Treatment	***Rate/A***	***% VCRR Delay 9/8/04***	***% Cowh 9/27/04***	***% Vele 9/2704***
Check	----	0	0	0
LATE POSTEMERGENCE				
Roundup UltraMax II+AMS	16 oz+2.5 lb	0	99	99
Roundup UltraMax II+AMS	16 oz+10 lb	5	99	90
Roundup UltraMax II+Preference+AMS	16 oz+4.8 pt+2.5 lb	10	90	90
Roundup UltraMax II+AMS	32 oz+2.5 lb	5	99	99
Roundup UltraMax II+ Harmony GT XP+AMS	16 oz+ .083 oz+2.5 lb	10	99	95
Roundup UltraMax II+ Harmony GT XP+AMS	16 oz+ 1.67 oz+2.5 lb	25	99	98
Roundup UltraMax II+Phoenix+AMS	16 oz+10 oz+2.5 lb	0	90	98
Roundup UltraMax II+Flexstar+AMS	16 oz+12 oz+2.5 lb	0	95	98
Roundup UltraMax II+Aim EW+AMS	16 oz+.5 oz+2.5 lb	0	95	98
Roundup UltraMax II+Resource+AMS	16 oz+4 oz+2.5 lb	0	95	98
Roundup UltraMax II	16 oz	0	97	98
Roundup Original Max	16 oz	0	97	97
Touchdown Total	17 oz	0	97	95
GF-1279	18 oz	0	97	95
ClearOut 41 Plus	24 oz	0	98	98
Buccaneer Plus	24 oz	0	98	98
Glyphomax Plus	24 oz	0	98	97
Gly Star Plus	24 oz	0	98	98
Glyfos X-tra	24 oz	0	98	98

Table 26. Weed Control Programs - Pre/Post

RCB; 4 reps
Planting Date: 5/14/04
Variety: Prairie Brand PB 2141
PRE: 5/14/04
EPOST: 6/9/04; Soybean 1-2 tri, 3-4";
Cowh 1-3 lf, 1-2"
POST: 6/21/04; Soybean 2-3 tri; Cowh 1-4"
Soil: Silty clay, 3.4% OM, 6.6 pH

Precipitation:

PRE:	1st week	1.15 inches
	2nd week	1.51 inches
EPOST:	1st week	1.12 inches
	2nd week	0.32 inches
POST:	1st week	0.08 inches
	2nd week	0.08 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)
Cowh=Common waterhemp

COMMENTS: Moderate weed pressure. Conventional tillage. Evaluation of weed control programs. Single pass post, split-post, and pre/post programs provided the most effective control and similar yield; yields exceeded check.

Treatment	***Rate/A***	***% VCRR Stunt 7/16/04***	***% Cowh 7/16/04***	***Yield bu/A***
Check	----	0	0	26
EARLY POSTEMERGENCE				
Roundup UltraMax II+AMS	22 oz+2.5 lb	0	86	41
POSTEMERGENCE				
Roundup UltraMax II+AMS	22 oz+2.5 lb	0	96	45
EARLY POSTEMERGENCE & POSTEMERGENCE				
Roundup UltraMax II+AMS& Roundup UltraMax II+AMS	22 oz+2.5 lb& 22 oz+2.5 lb	0	99	43
PREEMERGENCE & POSTEMERGENCE				
Authority&Roundup UltraMax II+AMS	5.33 oz&22 oz+2.5 lb	0	99	45
Authority+Outlook& Roundup UltraMax II+AMS	5.33 oz+19 oz& 22 oz+2.5 lb	15	99	38
LSD (.05)		*4*	*2*	*5*

Table 27. Soybean Yield Response - Late Rescue

RCB; 4 reps
Planting Date: 5/14/04
Variety: Prairie Brand PB 2141
EPOST: 6/24/04
POST: 7/12/04; Soybeans Early bloom, 14"
Soil: Silty clay loam; 3.0% OM; 6.9 pH

Precipitation:

EPOST:	1st week	0.08 inches
	2nd week	0.08 inches
POST:	1st week	0.12 inches
	2nd week	0.43 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)

COMMENTS: Conventional tillage, Roundup Ready soybeans. Outlook applied preemerge. Objective to evaluate crop response to glyphosate tank-mixes applied at critical early bloom stage. Limited visual crop responses. Yield for treatments similar to check.

Treatment	***Rate/A***	***% VCRR 7/14/04***	***Yield bu/A***
Check	----	0	39
EARLY POSTEMERGENCE			
Roundup UltraMax II+AMS	44 oz+2.5 lb	0	34
Roundup UltraMax II+ Harmony GT XP+AMS	22 oz+ .3 oz+2.5 lb	0	36
Roundup UltraMax II+ Resource+AMS	22 oz+ 4 oz+2.5 lb	0	33
Roundup UltraMax II+ Flexstar+AMS	22 oz+ 12 oz+2.5 lb	0	40
Roundup UltraMax II+ Pursuit DG+AMS	22 oz+ 1.44 oz+2.5 lb	0	32
Roundup UltraMax II+ FirstRate+AMS	22 oz+ .3 oz+2.5 lb	0	36
POSTEMERGENCE			
Roundup UltraMax II+AMS	44 oz+2.5 lb	0	39
Roundup UltraMax II+ Harmony GT XP+AMS	22 oz+ .3 oz+2.5 lb	13	33
Roundup UltraMax II+ Resource+AMS	22 oz+ 4 oz+2.5 lb	10	38
Roundup UltraMax II+ Flexstar+AMS	22 oz+ 12 oz+2.5 lb	5	39
Roundup UltraMax II+ Pursuit DG+AMS	22 oz+ 1.44 oz+2.5 lb	8	32
Roundup UltraMax II+ FirstRate+AMS	22 oz+ .3 oz+2.5 lb	5	37
LSD (.05)		*2*	*9*

Table 28. Blanket Followed by Buccaneer on RR Soybeans

RCB; 4 reps
Planting Date: 5/14/04
Variety: Prairie Brand PB 2141
PRE: 5/14/04
POST: 6/24/04; Soybean 2-3 tri; Cowh 4-7"; Colq 4-8"; Yeft 1-2"
Soil: Silty clay loam; 3.4% OM; 6.8 pH

Precipitation:

PRE:	1st week	1.15 inches
	2nd week	1.51 inches
POST:	1st week	0.08 inches
	2nd week	0.08 inches

VCRR=Visual Crop Response Rating
(O=no injury; 100=complete kill)
Colq=Common lambsquarter
Cowh=Common waterhemp
Yeft=Yellow foxtail

COMMENTS: Evaluation of sulfentrazone and glyphosate products. Moderate weed pressure in plot area. Pre/post split programs provided excellent early foxtail, lambsquarters, and waterhemp control. Late season control was very good; slight increased residual response for higher rates; possible impact on soil seed bank.

Treatment	***Rate/A***	***% VCRR 6/24/04***	***% Colq 6/24/04***	***% Cowh 6/24/04***	***% Yeft 6/24/04***	***% Colq 7/14/04***	***% Cowh 7/14/04***
Check	----	0	0	0	0	0	0
PREEMERGENCE & POSTEMERGENCE							
Blanket&Buccaneer+ NIS+AMS	4 oz&32 oz+ 1%+2.5 lb	0	97	97	96	99	99
Blanket&Buccaneer+ NIS+AMS	5 oz&32 oz+ 1%+2.5 lb	0	99	98	98	99	99
Blanket&Buccaneer+ NIS+AMS	6 oz&32 oz+ 1%+2.5 lb	0	98	99	98	99	99
Blanket&Buccaneer+ NIS+AMS	7 oz&32 oz+ 1%+2.5 lb	0	99	99	98	99	99
Blanket&Buccaneer+ NIS+AMS	8 oz&32 oz+ 1%+2.5 lb	10	99	99	99	99	99
LSD (.05)		*3*	*1*	*1*	*2*	*0*	*0*

Table 29. Volunteer RR Corn Control in Soybeans

RCB; 3 reps
Planting Date: 5/21/04
Variety: Asgrow AG1401
6-8": 6/23/04; Soybean 2-3 tri, 3-5";
Voco 8-10"
16-20": 7/9/04; Soybean 4-5 tri, 10-12";
Voco 18-24"

Precipitation:

6-8":	1st week	0.25 inches
	2nd week	3.50 inches
16-20":	1st week	0.65 inches
	2nd week	0.11 inches

Voco=Volunteer corn

COMMENTS: High volunteer corn density. Evaluation of post grass herbicides applied alone with crop oil and in tank-mixes with glyphosate without crop oil at 2 timings. Essentially complete volunteer corn control for all treatments alone with crop oil. Assure II and Exp. provided equivalent control at both timings when applied with glyphosate or alone with crop oil.

Treatment	***Rate/A***	***% Voco 7/28/04***	***% Voco 9/7/04***
Check	----	0	0
6-8"			
Poast+COC+AMS	1 pt+1%+2.5 lb	98	96
Assure II+COC+AMS	5 oz+1%+2.5 lb	98	98
Fusilade DX+COC+AMS	6 oz+1%+2.5 lb	99	99
Select+COC+AMS	4 oz+1%+2.5 lb	99	99
Exp.+COC+AMS	8 oz+1%+2.5 lb	99	99
Poast+Roundup UltraMax II+AMS	1 pt+22 oz+2.5 lb	79	83
Assure II+Roundup UltraMax II+AMS	5 oz+22 oz+2.5 lb	94	95
Fusilade DX+Roundup UltraMax II+AMS	6 oz+22 oz+2.5 lb	96	95
Select+Roundup UltraMax II+AMS	4 oz+22 oz+2.5 lb	86	86
Exp.+Roundup UltraMax II+AMS	8 oz+22 oz+2.5 lb	98	99
16-20"			
Poast+COC+AMS	1 pt+1%+2.5 lb	89	89
Assure II+COC+AMS	5 oz+1%+2.5 lb	97	99
Fusilade DX+COC+AMS	6 oz+1%+2.5 lb	97	99
Select+COC+AMS	4 oz+1%+2.5 lb	95	92
Exp.+COC+AMS	8 oz+1%+2.5 lb	97	94
Poast+Roundup UltraMax II+AMS	1 pt+22 oz+2.5 lb	70	63
Assure II+Roundup UltraMax II+AMS	5 oz+22 oz+2.5 lb	98	99
Fusilade DX+Roundup UltraMax II+AMS	6 oz+22 oz+2.5 lb	93	97
Select+Roundup UltraMax II+AMS	4 oz+22 oz+2.5 lb	87	80
Exp.+Roundup UltraMax II+AMS	8 oz+22 oz+2.5 lb	95	89
LSD (.05)		*3*	*6*

Table 30. Volunteer RR Corn Control in Soybeans - Time and Yield

RCB; 4 reps
Planting Date: 5/1/404
Variety: Prairie Brand PB 2141
4-5 INCH: 6/9/04; Soybeans 1-2 tri, 3-4";
Voco 3-4 lf, 4-5"
12-16 INCH: 6/21/04; Soybeans 2 tri; Voco 12-18"
24-36 INCH: 7/2/04
Soil: Silty clay loam; 3.1% OM; 7.1 pH

Precipitation:

4-5 INCH:	1st week	1.12 inches
	2nd week	0.32 inches
12-16 INCH:	1st week	0.08 inches
	2nd week	0.08 inches
24-36 INCH:	1st week	0.08 inches
	2nd week	0.12 inches

Voco=Volunteer corn

COMMENTS: Yield response for time of removal of volunteer corn at three densities. Time of removal had little effect on yield at any density. Volunteer corn reduced yield 22, 33, and 38 bu/A for low, medium, and high density respectively; density should be reduced to reflect more common field levels.

Treatment	***Rate/A***	***Timing***	***% Voco 7/27/04***	***% Voco 7/27/04***	***Yield bu/A***
Check (weed free)	----	----	0	99	48
		(Low Density)			
Check	----	----	10	0	26
Assure II+COC	7 oz+1%	4-5"	0	99	49
		12-16"	0	99	50
		24-36"	0	99	45
		(Medium Density)			
Check	----	----	19	0	15
Assure II+COC	7 oz+1%	4-5"	3	99	49
		12-16"	3	99	44
		24-36"	15	99	42
		(High Density)			
Check	----	----	38	0	10
Assure II+COC	7 oz+1%	4-5"	3	99	44
		12-16"	5	99	47
		24-36"	20	99	41
LSD (.05)			*5*	*0*	*7*

Table 31. Volunteer RR Corn Control in Soybeans - Clump vs. Plant

RCB; 4 reps
Planting Date: 5/14/04
Variety: Prairie Brand PB 2141
6-8 INCH: 6/4/04; Soybean 1-2 tri, 3-4";
Voco 3-4 lf; 4-6"
16-20 INCH: 6/21/04; Soybean 2 tri; Voco 12-18"'
Soil: Silty clay loam; 3.1% OM; 7.1 pH

Precipitation:

6-8 INCH:	1st week	0.91 inches
	2nd week	0.84 inches
16-20 INCH:	1st week	0.08 inches
	2nd week	0.08 inches

Voco=Volunteer corn

COMMENTS: Conventional tillage. Volunteer corn ear pieces from 2003 crop; volunteer corn incorporated with field cultivator. First two reps have clumps (buried ear pieces) and individual volunteer plants of Roundup Ready corn. Clump control at early timings was nearly ineffective. Fusilade, Select, and V-10137 were the most effective treatments on late timing for clumps. Treatment similar on volunteer corn plants at either timing.

Treatment	***Rate/A***	***% Voco Clump 7/27/04***	***% Voco Plant 7/27/04***
Check	----	0	0
6-8 INCH:			
Poast+COC+AMS	1 pt+1%+2.5 lb	30	90
Assure II+COC+AMS	5 oz+1%+2.5 lb	30	97
Fusilade DX+COC+AMS	6 oz+1%+2.5 lb	38	98
Select+COC+AMS	4 oz+1%+2.5 lb	35	97
V-10137+COC+AMS	8 oz+1%+2.5 lb	35	98
16-20 INCH:			
Poast+COC+AMS	1 pt+1%+2.5 lb	63	89
Assure II+COC+AMS	5 oz+1%+2.5 lb	77	97
Fusilade DX+COC+AMS	6 oz+1%+2.5 lb	87	97
Select+COC+AMS	4 oz+1%+2.5 lb	85	97
V-10137+COC+AMS	8 oz+1%+2.5 lb	85	99
LSD (.05)		*8*	*3*

Table 32. 1X and 2X Soybean Rates - Preemerge

RCB; 4 reps
Planting Date: 5/14/04
Variety: Prairie Brand PB 2141
PRE: 5/17/04
Soil: Silty clay; 3.7% OM; 6.6 pH

Precipitation:
PRE: 1st week 2.34 inches
2nd week 0.87 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)

COMMENTS: Crop response to "X" and "2X" herbicides to simulate application errors. All treatments provided adequate crop tolerance at normal use rates. Early season stunting apparent for some "2X" rates. Yield to be reported.

		1X Rates			2X Rates		
Treatment	**Rate/A**	**% VCRR 7/12/04**	**% VCRR 7/12/04**	**Soybean Yield bu/A**	**% VCRR 7/12/04**	**% VCRR 7/12/04**	**Soybean Yield bu/A**
Check	----	0	0	38	—	—	—
PREEMERGENCE							
Command 3ME	2.6 pt	0	0	38	1	0	37
Authority	5.33 oz	3	0	38	9	5	32
Sencor	.67 lb	3	0	39	16	1	32
Valor	3 oz	1	0	37	16	0	35
Authority+FirstRate	3 oz+.6 oz	1	0	41	13	0	31
Valor+FirstRate	3 oz+.6 oz	15	0	33	25	4	29
LSD (.05)		*4*	*2*	*6*	*4*	*2*	*6*

Table 33. 2003 Corn Herbicide Carryover to Soybean 2004

RCB; 4 reps
Planting Date: 5/28/03
Variety: Prairie Brand PB 2141
PRE: 5/28/03
EPOST: 6/16/03
POST: 6/27/03
Soil: Silty clay; 3.7% OM; 6.7 pH

Precipitation:

PRE: (2003)	1st week	0.20 inches
	2nd week	0.87 inches
EPOST: (2003)	1st week	0.12 inches
	2nd week	3.08 inches
POST: (2003)	1st week	0.91 inches
	2nd week	3.30 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)

COMMENTS: Soybean response to herbicides applied to corn at X and 2X rates in 2003; yields similar; no carryover response at X and 2X rates.

		1X Rate		2X Rate	
Treatment	**Rate/A**	**% VCRR 7/12/04**	**Soybean Yield bu/A**	**% VCRR 7/12/04**	**Soybean Yield bu/A**
Check	----	0	43	—	—
PREEMERGENCE					
Atrazine	2 qt	0	43	0	42
Axiom	23 oz	0	47	0	46
Balance Pro	2.25 oz	0	45	0	43
Callisto	6 oz	0	47	0	45
LSD (.05)		*NS*	*4*	*NS*	*4*
EARLY POSTEMERGENCE					
2,4-D amine	1 pt	0	44	0	45
Clarity	1 pt	0	46	0	47
Distinct+NIS+28% N	6 oz+.25%+1.25%	0	45	0	47
POSTEMERGENCE					
Buctril	1.5 pt	0	45	0	47
Hornet WDG+NIS+28% N	5 oz+.25%+2.5%	0	45	0	48
Callisto+COC+28% N	3 oz+1%+2 qt	0	46	0	47
Aim EW +NIS	.5 oz+.25%	0	44	0	44
Steadfast+COC+28% N	.75 oz+1%+2 qt	0	47	0	46
Option+MSO+28% N	1.5 oz+1.5 pt+2 qt	0	43	0	47
LSD (.05)		*NS*	*4*	*NS*	*4*

EFFECTIVENESS OF DRIED DISTILLER'S GRAINS + SOLUBLES AS A REPLACEMENT FOR OILSEED MEAL IN SUPPLEMENTS FOR CATTLE CONSUMING POOR-QUALITY FORAGE – A PROGRESS REPORT

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Animal Science 0430

INTRODUCTION

As a result of the rapid expansion of the ethanol industry in South Dakota, distiller's co-products have become increasingly more available as a feed ingredient for beef cattle. Research to date has focused heavily upon the use of distiller's grains in feedlot and dairy diets. Unfortunately, research evaluating the effectiveness of distiller's grains as supplement for cattle consuming poor quality forages, such as winter range or crop residue, is scarce.

To support effective microbial fermentation and digestion of feeds, ruminants have a requirement for rumen degradable protein. When a ruminant is fed a protein source, a portion of that protein is broken down in the rumen (degradable intake protein; DIP) and can be utilized by the microbial population to support fermentation. The majority of protein that is not degraded in the rumen (undegradable intake protein; UIP) subsequently gets digested by the animal in the small intestine, much like a non ruminant. As a result, to allow for maximum utilization of fiberous feeds it is critical to meet the protein, or nitrogen, needs of the microbes. Since distillers grains contain a significantly higher percentage of UIP than oilseed meals, it would be necessary to supplement in excess of 6 lb of distillers grains daily to meet the reported requirement for DIP in cattle consuming poor quality forages,. However, ruminants have the capability to "recycle" nitrogen. In other words, they can add nitrogen to the rumen via the saliva or directly across the rumen wall. Unfortunately, we do not have a clear understanding of the extent to which this process occurs. The more nitrogen that is "recycled" into the rumen, the less distillers grains would be necessary to meet the DIP requirement.

Therefore, the objective of this experiment is to determine the effectiveness of dried distiller's grains + solubles (DDGS) as a protein source in supplements for beef cattle consuming poor quality forages.

MATERIALS AND METHODS

In the first of this two-year experiment, 90 cows, obtained as part of a research collaboration agreement with a beef producer in South Dakota, were stratified by weight and randomly assigned to 15 pens. The pens were then randomly assigned to one of three dietary treatments. Dietary treatments included a basal diet of ground corn stalks and one of three supplements: 1) sunflower meal and soybean oil (SFM), 2) dried distillers grains plus solubles (DDG), and 3) sunflower meal, soybean oil, and dried distillers grains plus solubles (COMB). The supplements were formulated to provide equal amounts of energy and crude protein, but vary in the amount of rumen degradable protein.

The cows were maintained on their treatment diets for 70 days. However, two cows were removed from the project for health reasons. One cow died for reasons unrelated to the project and the second cow was removed because of her reluctance to consume the treatment diets and exceptionally poor performance.

At the initiation of the experiment, the cows were weighed on two consecutive days and blood samples were collected. Initial body condition scores were recorded as the average of the estimates from three trained individuals. Fat depth was also measured at the 12th rib and on the rump via ultrasound. On day 35, the cows were weighed, and blood and fecal samples were collected. At the conclusion of the experiment, the cows were again weighed on two consecutive days, and blood and fecal samples were collected. Final body condition scores and ultrasound measurements were also recorded. Feed samples from each supplement and the basal diet were collected weekly throughout the experiment. Blood samples will be subsequently used for analysis of plasma urea nitrogen and the feed and fecal samples will be used to determine fiber and total diet digestibility.

RESULTS AND DISCUSSION

At this time the lab work to determine plasma urea nitrogen and fiber and total diet digestibility is in process. As a result, only the weight, body condition, and ultrasound data will be reported.

Dietary treatment had no effect ($P > 0.05$) on forage intake, cow weight and body condition scores (Table 1), or rib or rump fat depth measurements (Table 2). This similarity supports our hypothesis that distillers grains can replace oilseed meal in protein supplements on an equal crude protein basis. If the diets would have been deficient in DIP, we would have likely observed a decrease in forage intake, reduced performance, and reduced forage and diet digestibility in cattle consuming distillers grains.

The observed response may be due to “recycled” nitrogen compensating for a calculated deficiency in DIP or it may suggest that the rumen degradable fraction of the crude protein in the distillers grains supplements used in this experiment is sufficient to meet the needs of the rumen microbial population. Further experimentation will be required to elucidate these answers.

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Table 1. Cow weights and body condition scores and changes.[a]

	DDG	SFM	COMB	SEM
	----------	---------- lb ----------	----------	
Initial weight	1293.3	1286.1	1285.5	9.6
Final weight	1341.2	1355.6	1332.4	9.4
Weight change	47.9	69.5	46.9	7.6
	----------	---------- BCS ----------	----------	
Initial BCS	4.75	4.70	4.72	0.04
Final BCS	4.90	4.91	4.92	0.10
BCS change	0.15	0.21	0.20	0.09

[a]Measurements were taken on d 0 and 70.

Table 2. Ultrasound rib and rump fat depths and change.[a]

	DDG	SFM	COMB	SEM
	----------	---------- in ----------	----------	
Initial rib fat	0.10	0.11	0.11	0.01
Final rib fat	0.10	0.11	0.11	0.01
Rib fat change	0.00	0.00	0.00	0.01
	----------	---------- in ----------	----------	
Initial rump fat	0.16	0.18	0.15	0.01
Final rump fat	0.15	0.17	0.13	0.01
Rump fat change	0.01	0.01	0.02	0.01

[a]Measurements were taken on d 0 and 70.