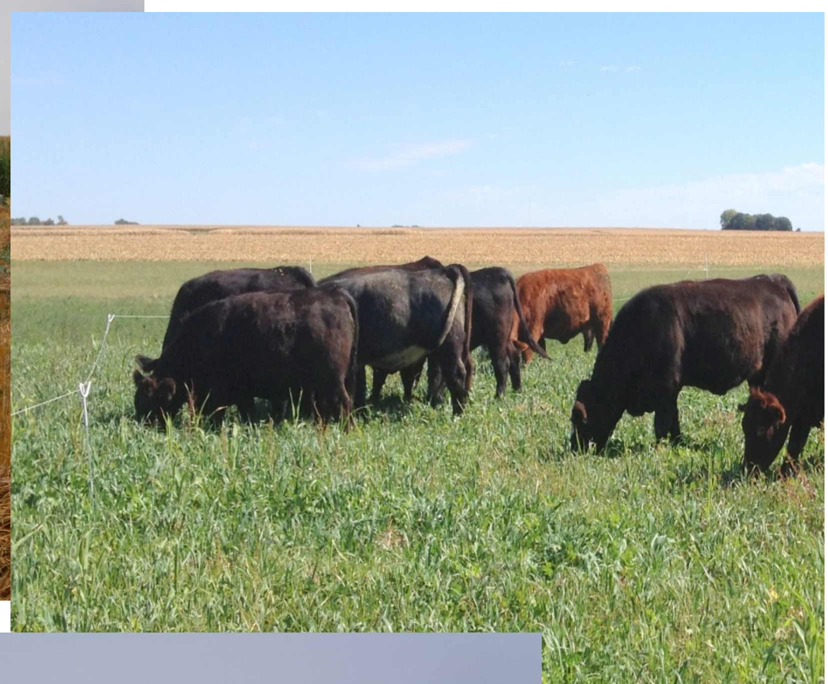
ANNUAL PROGRESS REPORT 2013

SOUTHEAST SOUTH DAKOTA EXPERIMENT FARM

SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION

SOUTH DAKOTA STATE UNIVERSITY



This is an annual report of the research program at the Southeast South Dakota Research Farm in cooperation with South Dakota Agricultural Experiment Station, SDSU Plant Science, and SDSU Animal Science and 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.

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The Southeast Farm is located at 29974 University Road, Beresford, SD 57004. Telephone 605-563-2989; Fax 605-563-2941; Farm Supervisor, Peter Sexton email (peter.sexton@sdstate.edu).

Internet web page: http://www.sdstate.edu/ps/research/farms/southeast/index.cfm

RESEARCH FARM EMPLOYEES

Peter Sexton, Farm Supervisor
Colton Buus, Research Assistant
Doug Johnson, Ag Technician
Molly Hansen, Ag Technician (Summer)
Brad Rops, Operations Manager
Ruth Stevens, Statistical Assistant
Garold Williamson, Ag Technician

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South Dakota State University, South Dakota Counties and U.S. Department of Agriculture Cooperating.

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ACKNOWLEDGEMENTS

Research done at the farm this year included trials on a host of subjects - soil fertility, weed control, variety evaluations, pest management, cover crops, row settings and populations for soybeans and corn, planting dates, and more – including work with livestock and grazing. In all these projects, the effort and good will of the permanent employees of the Southeast Research Farm (Garold Williamson, Ruth Stevens, Brad Rops, Doug Johnson, and Colton Buus) and seasonal employee (Molly Hansen) needs to be acknowledged.

The Board Members of the Southeast Experiment Farm non-profit corporation have played a key role this past year, as always, in helping to guide the use of resources on the farm. Their advice and direction have been very valuable. They have been willing to take risks on new projects, while also being prudent with use of resources. Their role in the work at the farm is critical and their public-spirited approach is appreciated by all the staff at the farm.

Support of the Ag Experiment Station at SDSU lead by Dr. Daniel Scholl, along with Tom Cheesbrough Associate Director of the SDSU Agricultural Experiment Station, and David Wright, Dept. Head Plant Science, Don Marshall, Interim Dept. Head Animal Science, have also been important for the farm's operation. We look forward to continuing and expanding our interaction with SDSU faculty and college administrators in the coming year.

We are thankful to God for yet another year that we can move forward with work, and we all hope it will be a productive one.

This publication was edited and compiled by Ruth Stevens and Peter Sexton.

Aerial Photo of "SDSU" planting with Southeast Farm's Multi-Hybrid Variable Rate Planter

INTRODUCTION ………………………………………………………………………………………….Pete Sexton
Farm Supervisor

The 2013 season brought some welcome relief from the drought of the previous year. Our yields were much improved, averaging 175 bushel per acre for corn and 50 bu/ac for soybeans . Several new developments were undertaken at the farm in the 2013 season. We established an area for research where grazing is integrated with crop production – so we now have some scope to conduct research looking at the effects of how grazing crop residues, cover crops and annual forages impacts crop productivity and soil health. Working with Chris Hay from the Ag. and Biological Systems Engineering Dept. at SDSU, a series of 0.75 acre plots with controlled tile drainage were set up on the farm – this gives the Southeast Farm a platform on which to study the effects of tile drainage on crop yield, and to look at ways to maintain water quality under tile drainage. The board approved putting most of the farm into a no-till production system in 2013. This is important looking towards the future where the climatologists tell us we can expect to see more extreme weather – severe storms and drought are both more likely to be part of the landscape and no-till is probably about the best way to try and cope with that. Finally, working with Raven Industries and Pioneer Hi-bred, the Southeast Farm participated in the development of a proto-type planter with the ability to switch between lines on-the-go in a production environment. This is a one of a kind unit which we think has already helped pave the way for some major changes in planter technology and for precision farming in the future.

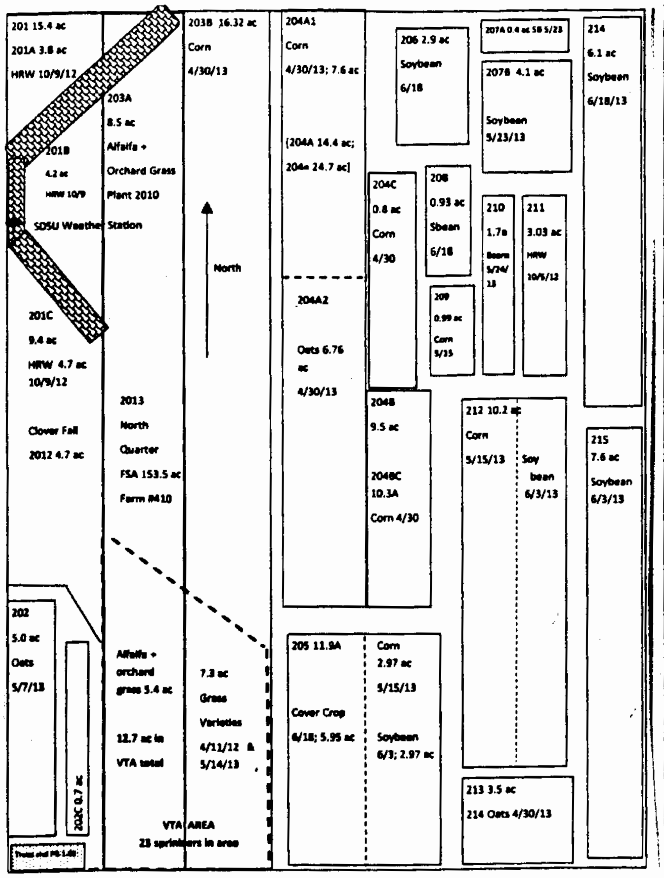
This annual report contains information ranging from soybean and corn variety evaluations and research on grazing, to research on winter rye cover crops and P fertilizer for soybeans. In all these projects, the work would not have gone forward without the goodwill and efforts of the farm staff: Garold Williamson, Ruth Stevens, Brad Rops, Doug Johnson, and Colton Buus. Molly Hansen helped over the summer. Their good work has kept the research farm going forward. This year we had a lot of help from Raven Industry technicians Brian Grode and Ray Munk in our field operations with the new multi-hybrid planter in the spring, and also the crew from the Sustainable Cropping Systems program in Brookings – Jesse Hall, Cory Smith, David Karki, and Ben Arlt - were called on at times to lend their efforts to farm operations, so we would like to recognize these folks for their help as well.

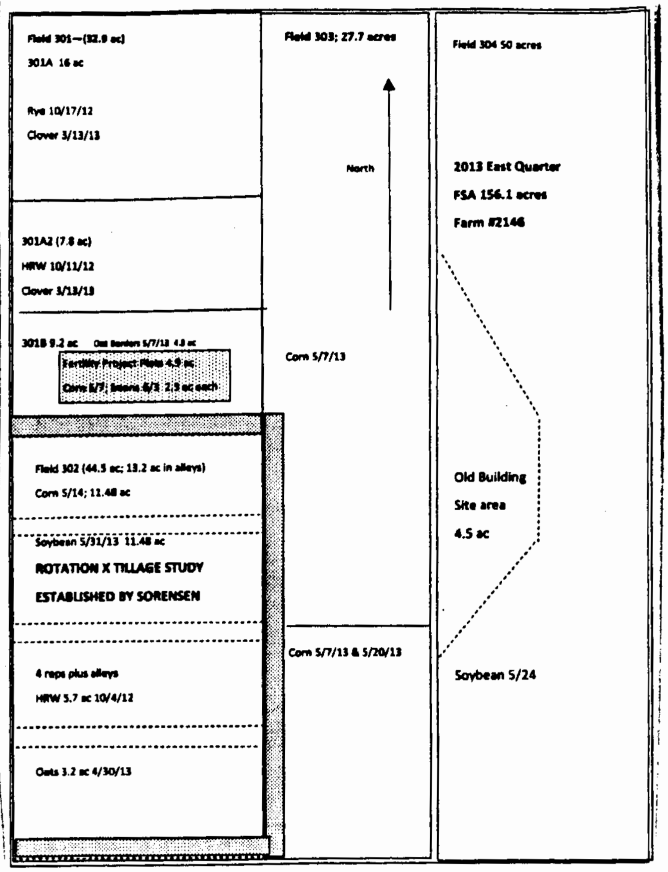
In the coming year, we hope to capitalize on the new initiatives started in 2013, and perhaps venture into a new area of vegetable or fruit production in high-tunnels as a way to support younger families who may want to get a start in agriculture but don't have much of a land base to work with. One day at a time. We try to lay our plans, but what the future holds is, of course, uncertain.

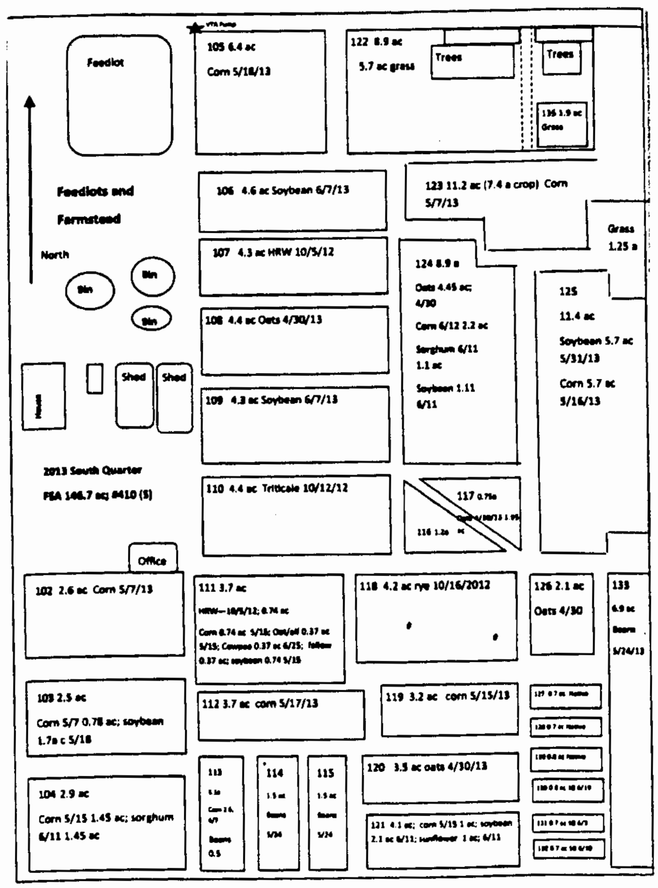
I hope this annual report is of value for your operation. We are always open to new ideas – so please feel free to share suggestions and comments about our research - we are all ears and would be glad to hear what you have to say. We plan to have our summer field day on July 9, and a fall one on Sept. 9, God willing. We hope that you can make it to Beresford for both events. As for the future, all I can think of is what my Mom says, "pray, hope, don't worry", and then think about how to diversify.

2013 Southeast Farm land Use Map

(maps not drawn to scale)







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WEATHER AND CLIMATE SUMMARY

R. Stevens*, P. Sexton, B. Rops, D. Johnson, G. Williamson, and C. Buus

After the record breaking drought and higher than average temperatures of 2012; 2013 brought a change with soaking rains in May (7.3 inches) that helped to replenish the subsoil to carry crops thru a dry July (-2.29 inches) and end the year with slightly above normal precipitation totals. Temperatures in 2013 were cooler with many below normal averages. These growing season conditions provided good crop growth and yields.

Climate for 2013 is summarized in tables and graphs on pages 2 to 7.

Maximum temperatures in 2013 were below normal for nine months of the year, only January, September and November had above normal average maximum temperatures (Table 1). Minimum temperatures were below normal six months out of the year; with March, April, June, October, November, and December having below normal minimum temperatures. The coldest temperature of the year was recorded on December 7 (-21°F) and the hottest temperature (97°F) recorded was on May 14 giving a 118-degree temperature range. Southeast Farm's frost-free season was 154 days for both the 32°F and 28°F-basis; with last spring frost/freeze on May 12 and fall frost/freeze on October 13. The average annual high temperature was 56°F and our average annual low temperature was 34°F; which were both below average (-2.2 and -0.8 degrees, respectively).

Both annual precipitation and growing season precipitation was above normal in 2013. We received 26.6 inches of annual precipitation, which is 106% of normal (Table 2). Growing season precipitation measured from April through September was 20.3 inches (108% of normal, +1.5 inches). The Southeast Farm received below average precipitation during seven months of 2013 (-0.1 to -2.9 inches). Precipitation in January, April, May, and September and October was above normal (+0.1 to +3.81). Our annual snowfall was 31 inches, with 24 inches received the first half of the year and 7 inches during the last half.

The 2013 growing season (Apr – Oct) accumulation of heat units was 3069 units, which is just 25 units above normal.

During the 2013 growing season 39.7 inches of water evaporated; while the Southeast Farm received 13.9 inches of rainfall during the same period of time.

* *Corresponding author: ruth.stevens@sdstate.edu*

Table 1. Temperatures[a] at the Southeast Research Farm - 2013

	2013 Average Air Temps. (°F)		61-year Average Air Temps. (F)		Departure from 60-year Average	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
January	28.0	10.1	26.5	5.6	+1.5	+4.5
February	31.8	13.9	32.3	11.2	-0.5	+2.7
March	38.3	20.6	44	22.9	-5.7	-2.3
April	51.8	29.4	60.1	35.2	-8.3	-5.8
May	69.6	47.5	72.0	47.3	-2.4	+0.2
June	79.0	58.5	81.4	57.7	-2.4	+0.8
July	84.8	59.8	86.2	62.1	-1.4	-2.3
August	82.9	61.6	84.2	59.5	-1.3	+2.1
September	80.0	54.3	75.6	49.0	4.4	+5.3
October	59.4	35.5	63.5	37.6	-4.1	-2.1
November	46.1	19.5	45.3	23.8	+0.8	-4.3
December	24.0	3.0	30.6	11.3	-6.6	-8.3

[a]Computed from daily observations-

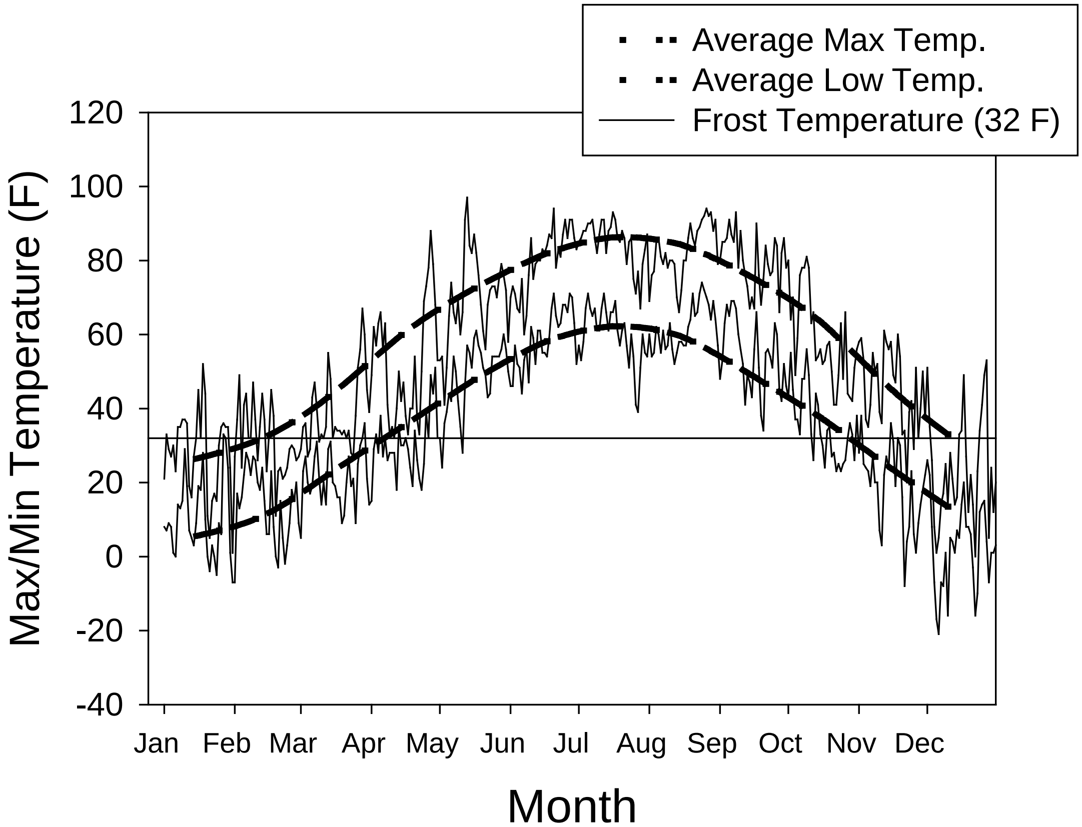
Table 2. Precipitation at the Southeast Research Farm - 2013

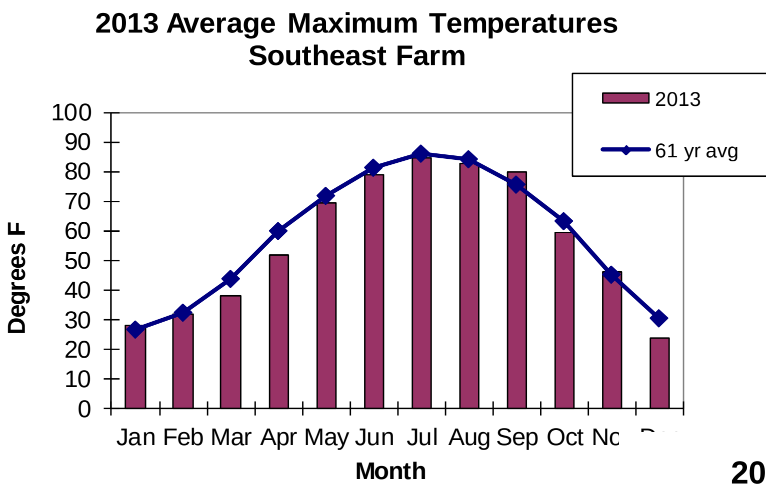
Month	Precipitation 2013 (inches)	61-year Average (inches)	Departure from Avg. (inches)
January	0.57	0.47	+0.10
February	0.77	0.82	-0.05
March	0.99	1.45	-0.46
April	3.33	2.57	+0.76
May	7.27	3.46	+3.81
June	3.84	4.09	-0.25
July	0.82	3.11	-2.29
August	4.0	2.92	+1.08
September	1.07	2.69	-1.62
October	3.39	1.87	+1.52
November	0.31	1.15	-0.84
December	0.28	0.63	-0.35
Totals	26.6	25.2	+1.4

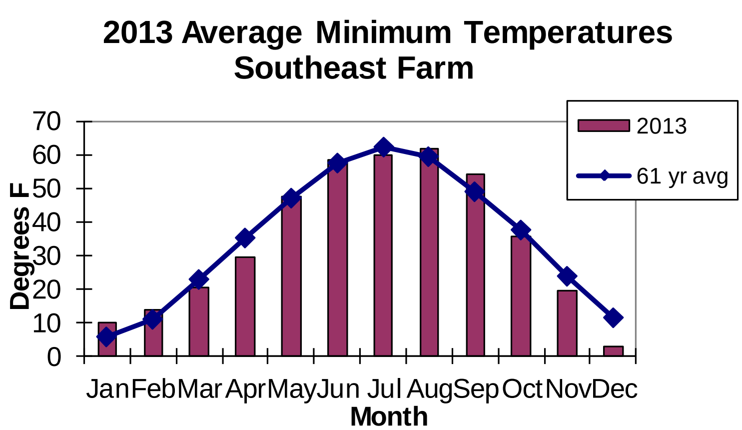
2013 CLIMATE SUMMARY
SOUTHEAST RESEARCH FARM

Annual Precipitation (inch)	26.6	106%*
Growing Season Precip (Apr-Sep, inch)	20.33	108%
Jan-Mar	2.33	85%
Apr-Jun	14.4	143%
Jul-Sep	5.89	68%
Oct-Dec	3.98	109%
Annual Snow (inch); (Jan-Jun/Jul-Dec)	24 / 7.3	31.3 total
Growing Degree Units (GDU)	3069	100%
Minimum / Maximum Air Temp, ºF	-21° F Dec 7	97° F May 14
Last Spring Frost; 32º / 28º basis	May12 - 28° F	May 12 - 28°F
First Fall Frost; 32º / 28º basis	Oct 13 - 26°F	Oct 13 - 26°F
Frost Free Period (days); 32º / 28º basis	154	154
Average Annual High / Low	56 / 34	-2.2 / -0.8

% of Normal

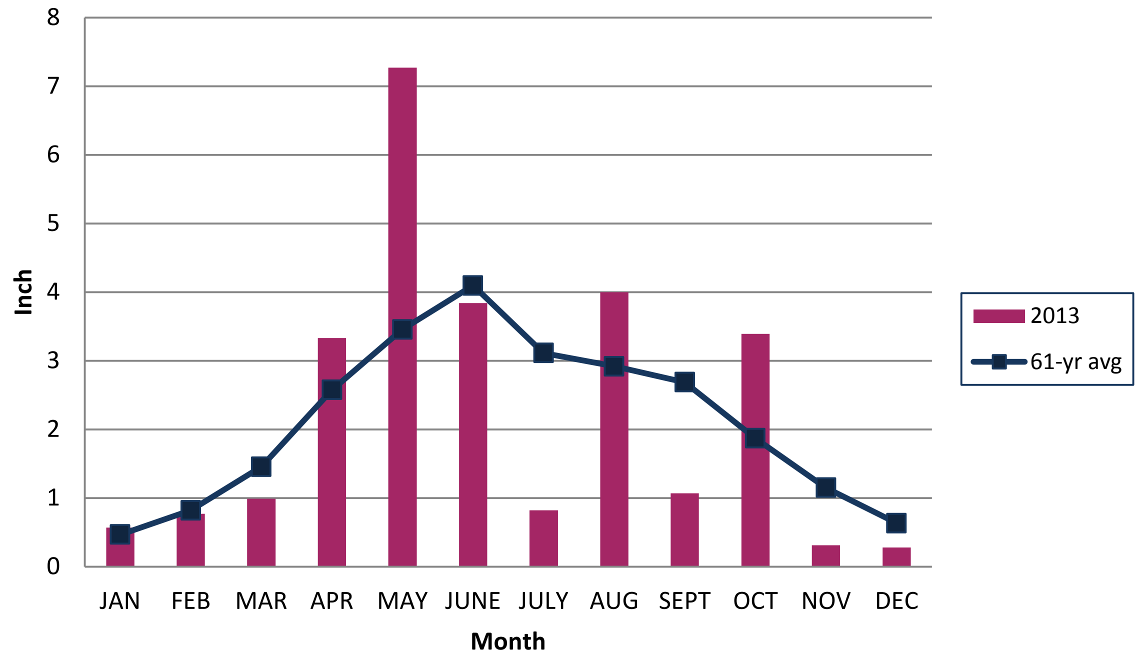

Average Max Temp.
Average Low Temp.
Frost Temperature (32 F)
Max/Min Temperature (F)
120
100
80
60
40
20
0
-20
-40
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Month


2013 Average Maximum Temperatures
Southeast Farm
2013
61 yr avg
Degrees F
100
90
80
70
60
50
40
30
20
10
0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct
Month


2013 Average Minimum Temperatures
Southeast Farm
2013
61 yr avg
Degrees F
70
60
50
40
30
20
10
0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Month

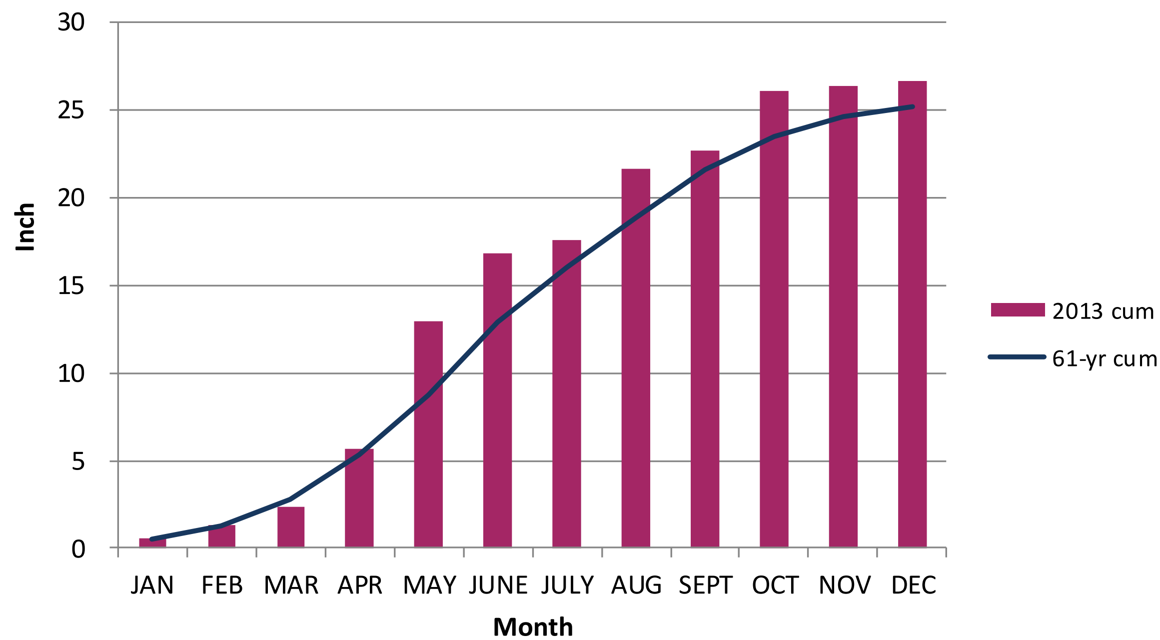
2013 Monthly Precipitation

Southeast Farm



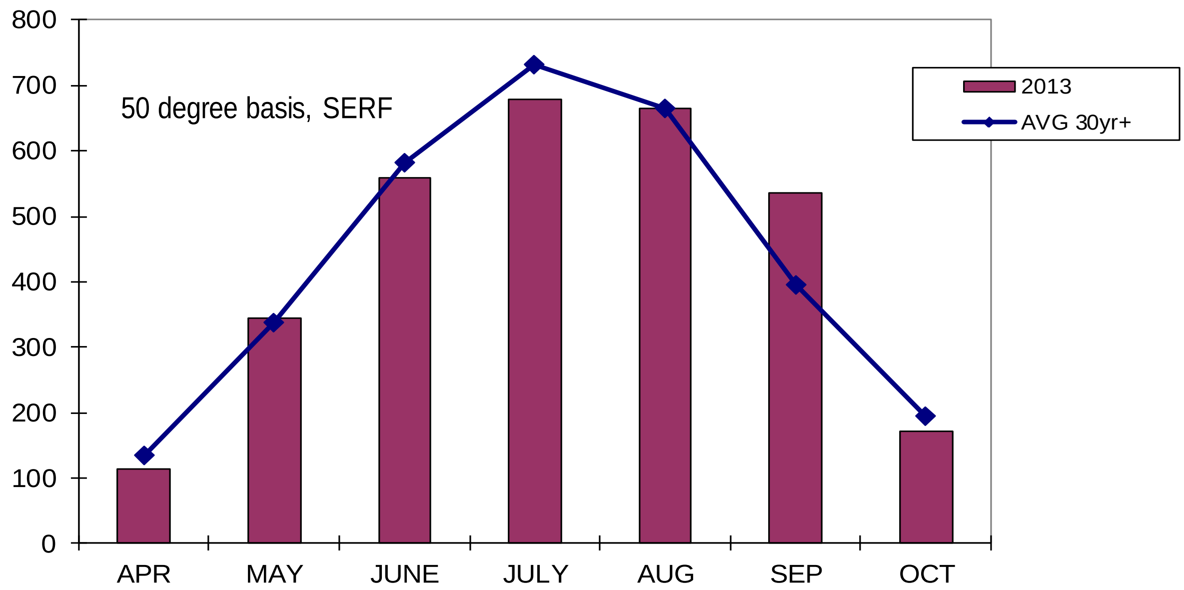
2013 Cumulative Precipitation

Southeast Farm



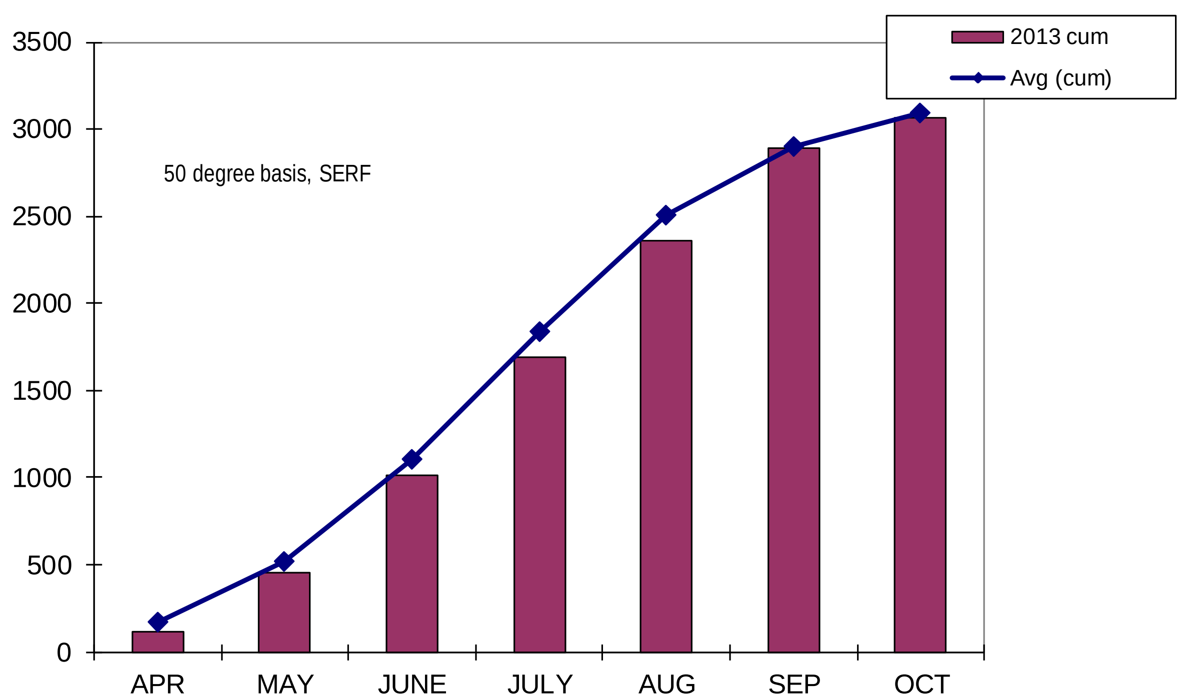
2013 Growing Degree Units (GDU)

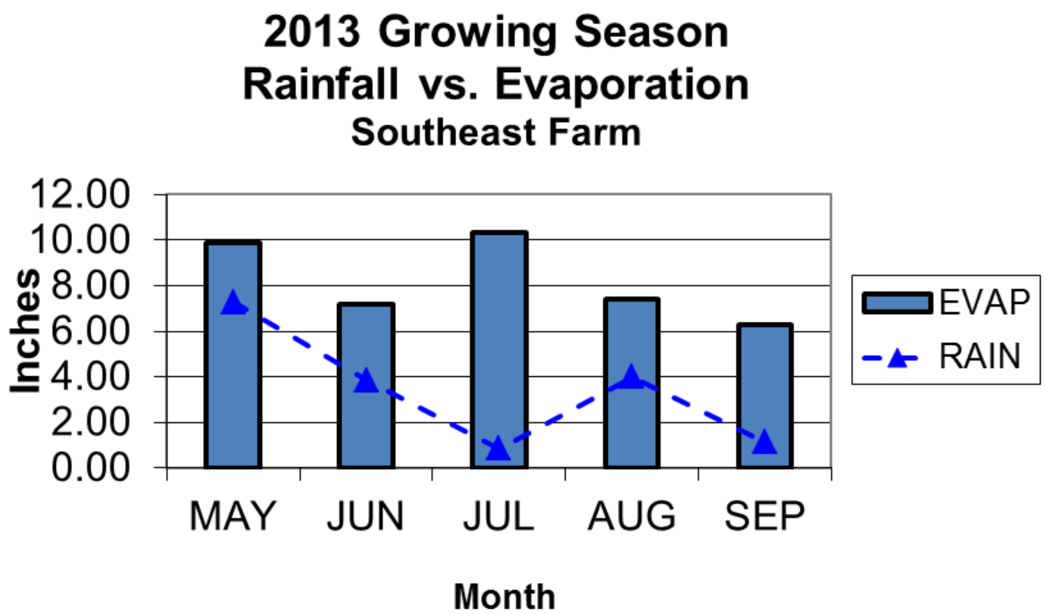
Southeast Farm

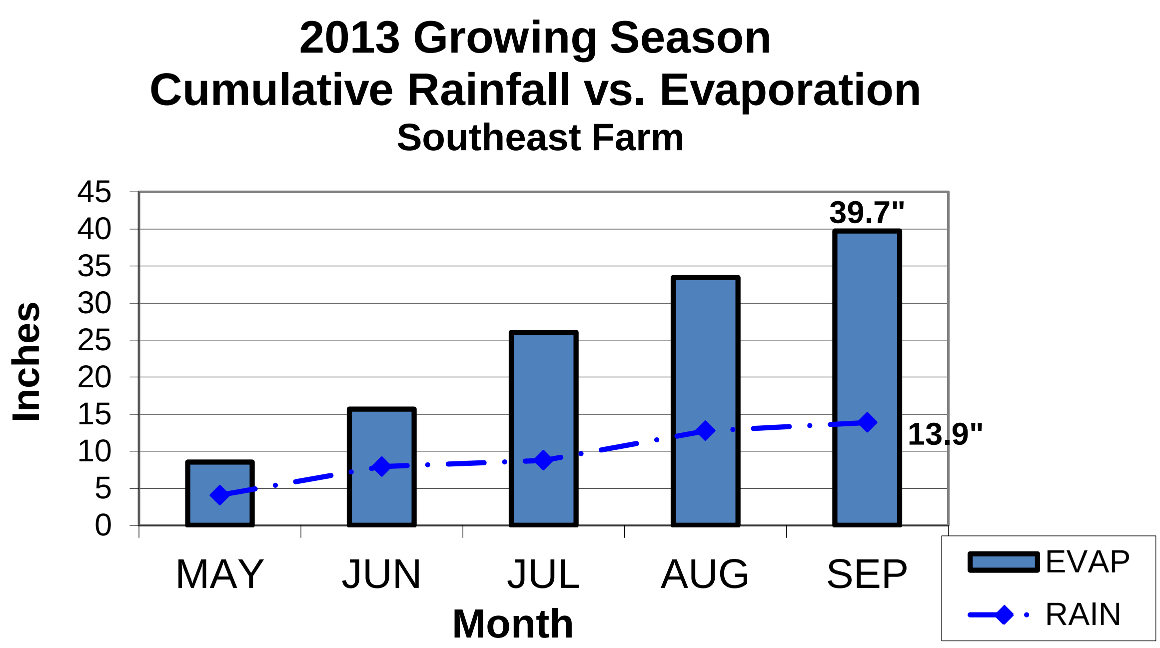


2013 Cumulative Growing Degree Units (GDU)

Southeast Farm




2013 Growing Season
Rainfall vs. Evaporation
Southeast Farm
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Inches
MAY
JUN
JUL
AUG
SEP
Month
EVAP
RAIN


2013 Growing Season
Cumulative Rainfall vs. Evaporation
Southeast Farm
45
40
35
30
25
20
15
10
5
0
Inches
39.7"
13.9"
MAY
JUN
JUL
AUG
SEP
Month
EVAP
RAIN

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Initial Evaluation of Multi-Hybrid Seeding for Corn in Southeastern South Dakota

Peter Sexton[1], Douglas S. Prairie[2], and Barry Anderson[3]

INTRODUCTION

The precipitation pattern in southeastern South Dakota is such that peak rainfall occurs on average in May and June and then starts to taper off. On the other hand, peak evaporative demand for corn production is from mid-July through August. Coupled with variation in soil type across the field, this creates a situation where the primary stress for corn grown in lower landscape positions may be too much moisture and intense disease pressure in late May and early June; whereas the primary yield limitation for corn grown in the same field in upper landscape positions is more likely to be drought conditions occurring in late July and August. Given these circumstances, it seems logical that gains in productivity within a field might be achieved by selecting for hybrids with a more horizontal root profile and tolerance to wet conditions for lowland portions of the landscape, and selecting for hybrids with a more vertical root profile and resistance to drought conditions for the upland parts of the landscape. Until recently this was a more hypothetical problem because it was impractical on a production level to repeatedly switch between lines on-the-go in order to match varietal selection to different landscape positions within a field. However, this has changed with the development of a multi-hybrid planter by Raven Industries working with the SDSU Southeast Research Farm. With this planter, it is now a practical question of evaluating what yield advantages may be gained by matching different hybrids to different landscape positions in the field.

The primary objective of this trial was to make an initial evaluation of improvements in grain yield for corn grown with a variable-hybrid planting system versus planting a single hybrid across the landscape.

METHODS

This project was a joint effort of the SDSU Southeast Research Farm, Raven Industries, and Pioneer Hi-Bred. A stock Monosem twin-row planter (model NG-66-33-0, Monosem Inc., Edwardsville, KS and Largeasse, France) was modified by engineers at Raven Industries and electronic controls were developed so that one row could be shut off and the other turned on as the planter crossed the field in order to switch between lines on the go. Controls were set up to shift the planter laterally when hybrids changed so that the rows stayed straight. Personnel from SDSU developed field maps for each site based on direct observation (walking each field) coupled with use of satellite imagery to delineate upper and lower landscape positions. Agronomists from Pioneer Hi-Bred selected the lines to be used in the upper and lower landscape

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SDSU Southeast Research Farm, Beresford, SD
[2] *Raven Industries, Sioux Falls, SD*
[3] *Pioneer Hi-Bred, Mankato, MN*

positions. The study involved use of four hybrids - two selected for adaptation to lower landscape positions (Pioneer 'P0987AM1', and 'P1151AM') and two selected for adaptation to for upper landscape positions (Pioneer 'P0533AM1', and 'P0876AM'). The primary criteria for the upper landscape position was good yield potential coupled with drought tolerance, while the criteria for the lower landscape position was good yield potential coupled with tolerance of excessive soil moisture. Replicated trials were established at Beresford, Parkston, Tripp, and Lennox, South Dakota on April 30, May 10, May 13, and May 15, respectively, by personnel from the SDSU Southeast Research Farm. The plots at Parkston, Tripp, and Lennox were with farmer-cooperators, and the plots at Beresford were at the SDSU Southeast Research Farm. The on-farm plots were 30' wide (12 rows with 30" row spacing) and were 510 feet to 1430 feet in length, with total length depending on the dimensions of the field and where replications were split. The plots at the SDSU Southeast Research Farm were 15' wide and 1630 to 1720 feet in length. Plots were laid out such that each plot within a block crossed both upper and lower landscape positions. There were four replications at Beresford and Lennox, and two replications each at the Parkston and Tripp sites. Treatments were as follows:

1. Pioneer P0533AM1 - across the field
2. Pioneer P0876AM - across the field
3. Pioneer P0987AM1 - across the field
4. Pioneer P1151AM - across the field
5. Pioneer P0533AM1 / P0987AM1 (upland / lowland position)
6. Pioneer P0533AM1 / P1151AM (upland / lowland position)
7. Pioneer P0876AM / P0987AM1 (upland / lowland position)
8. Pioneer P0876AM / P1151AM (upland / lowland position)

Because spring soil moisture levels were low, a seed rate of 28,000 seeds per acre was used for all treatments. Heavy rain in late May partially drowned out one replication at the Beresford site, so that single replication was dropped from the trial. At Beresford and Tripp, whole-plot yields were determined at harvest using weigh wagons to directly measure grain yield from each plot. Samples were taken for measurement of grain moisture and yields were corrected to 15.5 % moisture. Data from Parkston and Lennox were obtained from combine yield monitors. At Parkston, the yield monitor data was not recoverable at the north end of the trial, so this site was dropped from the data set. Data were subjected to analysis of variance using SAS statistical software using Proc GLM with all factors considered as fixed effects and replications nested within sites. The Beresford and Tripp data sets did not show any site by treatment interaction ($P > 0.10$), so data from these two sites was pooled. The Lennox site, however, did show site by treatment interaction ($P < 0.06$) when pooled with the other data, therefore yield data from Lennox was analyzed separately. Treatments were compared from the pooled data set using a series of orthogonal contrasts.

RESULTS AND DISCUSSION

On average at Tripp and Beresford, the variable-hybrid plots yielded 5.1 more bushels per acre than did the same hybrids planted as single lines across the landscape; this yield difference was statistically significant ($P < 0.05$) (Table 1). As a group, there was no significant difference between "upland" and "lowland" lines when sole seeded across the field. Within the "upland" lines, the hybrid 'P0876AM' tended to perform better than did 'P0533AM1'. The two "lowland" lines were statistically similar to each other in yield both when variable seeded, and when planted as single lines across the field.

Table 2 shows yield data from each site. Comparing variable seeding to the higher yielding of the paired hybrids at Beresford, the P08 / P11 combination showed yields that were 8 bu/ac more than the higher yielding of the same lines when seeded individually across the landscape, and about 11 bushels per acre better than the average of the two lines in that combination. The P08 / P09 and P05 / P09 combinations also showed numerically greater yields (on the order of 7 to 8 bu/ac) relative to the better of the individual lines in those combinations. On the other hand the P05 / P11 combination at Beresford did not show any yield advantage over either of the lines seeded individually. When the data from Tripp was analyzed on its own, the treatment effects were non-significant. Looking at the data numerically, 'P0876AM' appeared to be a well adapted line at this site and did not show any benefits from combinations with other lines in that environment; whereas the upland line 'P0533AM1' tended to show some benefit from being in combinations with lowland lines at Tripp. So while there was a statistically significant average yield benefit of 5.1 bu/ac for variable hybrid seeding in data pooled across these two sites (Beresford and Tripp), some combinations appeared to be more beneficial than others, with the better combinations showing an 8 bu/ac yield benefit over the better of the individual lines, while other combinations showed essentially no benefit. Proper selection of hybrids for a given field environment will be critical for multi-hybrid planting to be successful.

The data from Lennox failed to show any significant treatment effects. One of the factors that may have contributed to this was that this field had a portion of the lowland area that drowned out due to heavy rains in late May. The drowned out areas were avoided in the yield analysis. However, in places where the corn completely drowned out, the "lowland" lines would not have had an opportunity to show a yield advantage. A second point where Lennox differed from the other sites was that the yield data from Lennox was taken from the combine's yield monitor; whereas, at Tripp and Beresford the yield analysis was based on weigh wagon data, which would be more precise and accurate.

SUMMARY and CONCLUSION

Yield data was analyzed from trials conducted using large strip plots at Tripp, Lennox, and Beresford South Dakota to evaluate the advantage of variable hybrid planting according to landscape position versus planting each line by itself across the field. Four hybrids were included in the trial – two considered as "upland" lines and two considered as "lowland" lines. Data from Tripp and Beresford were pooled and analyzed together as they did not show any site by treatment interaction; whereas data from Lennox was analyzed seperately as it did show site by treatment interaction ($P < 0.10$). The Tripp and Beresford data showed an average yield benefit of 5.1 bu/ac for variable hybrid planting with the four lines tested. The better combinations of lines in these trials showed about an 8 bu/ac yield increase over the better of the individual lines, and about an 11 bushel per acre yield increase over the average of the two lines. The Lennox data did not show any significant yield effects, which may be at least partially due to some of the lowland areas being drowned out at that site. We expect that over time the yield benefit from variable hybrid planting will increase as lines are better characterized for their areas of adaptation, and as new lines are developed for specific portions of the landscape. Proper hybrid selection will be critical for variable hybrid seeding to be successful.

ACKNOWLEDGEMENTS

The authors would like to recognize Mr. Rich Luebke, Mr. Les Melhaff, Mr. Matt Loewe and Mr. Randall Questad for being willing to put trials on their operations and for their work in implementing these trials. The efforts of the crew at the SDSU Southeast Research Farm, and the Sustainable Cropping Systems program, particularly Mr. Garold Williamson and Mr. Doug Johnson, along with Mr. Brian Grode and Mr. Ray Munk of Raven Industries, were critical for the successful completion of this project.

Table 1. Comparison of variable vs single hybrid seeding for trials conducted at Beresford and Tripp, South Dakota in 2013. Four hybrids (two upland 'P0533AM1', and 'P0876AM'; and two lowland 'P0987AM1', and 'P1151AM') were seeded as single hybrids across the landscape, and also variable seeded in all combinations of upland and lowland lines according to landscape position. The trials were laid out in large strip plots with four replications at Tripp and three at Beresford.

CONTRASTS

Variable Hybrid vs. Single Hybrid Seeding

	Average Yield
Variable Hybrid Seeding	177.9
Single Hybrid Seeding	172.8
Significance	*

Within Variable Seeding Treatments

P0533AM1 vs P0876AM as the upland line

	Average Yield
Variable seeding - P08_ based	180.8
Variable seeding - P05_ based	175.0
Significance	+

note: further contrasts comparing P1151AM and P0987AM1 mixes beyond this point showed no significant differences between mixes for the two lowland lines.

Within Single Hybrid Seedings

Upland vs. Lowland Hybrids when seeded as single hybrids

	Average Yield
Upland Lines	174.6
Lowland Lines	170.9
Significance	NS

Comparison of Upland Hybrids when seeded as single hybrids

	Average Yield
P0876AM	179
P0533AM1	170
Significance	*

Comparison of Lowland Hybrids when seeded as single hybrids

	Average Yield
P1151AM	172
P0987AM1	169
Significance	NS

+, *, and **, denote statistical significance at the 0.10, 0.05, and 0.01 levels, respectively.

Table 2**.** Corn yields presented by site (Beresford, Tripp, and Lennox SD) for trials comparing variable versus single hybrid seeding in the 2013 season. Four hybrids (two upland 'P0533AM1', and 'P0876AM'; and two lowland 'P0987AM1', and 'P1151AM') were seeded as single hybrids across the landscape, and also variable seeded in all combinations of upland and lowland lines according to landscape position. The trials were laid out in large strip plots with four replications at Tripp and three at Beresford. Hybrid names are abbreviated in the table.

Site	Hybrid	Yield	standard error
BERESFORD:		(bu/ac)	
	P08 / P11	198	3.5
	P08 / P09	197	2.5
	P08	190	3.9
	P05 / P09	189	5.8
	P11	183	1.6
	P05	181	2.3
	P09	181	4.1
	P05 / P11	181	5.4
	Mean	*187.6*	
	CV (%)	*2.8*	
	LSD (0.10)	*7.5*	
TRIPP:			
	P08	168	6.2
	P08 / P11	167	6.2
	P05 / P11	166	4.6
	P05 / P09	165	8.7
	P11	161	4.5
	P08 / P09	161	4.4
	P05	159	7.6
	P09	157	2.8
	Mean	*163.2*	
	CV (%)	*5.5*	
	LSD (0.10)	*NS*	
LENNOX:			
	P05 / P11	189	3.7
	P09	188	2.0
	P05 / P09	185	3.7
	P11	185	3.9
	P08	183	2.0
	P08 / P11	182	2.9
	P08 / P09	182	4.0
	P05	181	2.9
	Mean	*184.2*	
	CV (%)	*2.7*	
	LSD (0.10)	*NS*	

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Initial Evaluation of Variable Variety Seeding for Soybeans in Southeastern South Dakota

Peter Sexton[1], Douglas S. Prairie[2], and Barry Anderson[3]

INTRODUCTION

In the rolling prairie soils of southeastern South Dakota, differences in landscape position and soil type across a field can create very different moisture regimes, and consequently different intensities of disease pressure, across the field. Overlapping this variation in soil type, the precipitation pattern is such that more rain is received on average in May and June than in July and August. Soybeans grown in lower landscape positions are more likely to suffer from yield limitations due to excess moisture in May and early June and corresponding disease pressure from phytophthora root rot, whereas soybeans grown in upper landscape positions are more likely to suffer yield limitations due to drought conditions in July and August.

On the other hand, there is genetic variability among soybean varieties in their ability to resist root rots, and in their ability to tolerate drought conditions. It seems logical therefore, that there may be some yield advantage and efficiencies of production to be gained by matching productive soybean lines with different resistance traits to meet variation in production constraints across a given field. Until recently it was impractical on a production level to repeatedly switch between lines on-the-go in order to match varietal selection to different landscape positions within a field. However, this has changed with the development of a multi-hybrid planter by Raven Industries working with the SDSU Southeast Research Farm. With this planter, it is now a practical question of what yield advantages may be gained by variable variety planting.

The primary objective of this trial was to measure grain yield for two soybean lines selected for growth in lower and upper landscape positions when the lines were seeded by themselves across the field, and when the two genotypes were precision seeded according to landscape position. A secondary objective was to measure yield of each line when it was seeded in a twin-row versus a single row configuration.

METHODS

This project was a joint effort of the SDSU Southeast Research Farm, Raven Industries, and Pioneer Hi-Bred. A stock Monosem twin-row planter (model NG-66-33-0, Monosem Inc., Edwardsville, KS and Largeasse, France) was modified by engineers at Raven Industries and electronic controls were developed so that one row could be shut off and the other turned on as the planter crossed the field in order to switch between lines on the go. Controls were set up shift the planter laterally when varieties changed

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so that the rows stayed relatively straight. Personnel from SDSU developed field maps for each site based on direct observation (walking each field) coupled with use of satellite imagery to delineate upper and lower landscape positions. Agronomists from Pioneer Hi-Bred selected the lines to be used in the upper and lower landscape positions. The lines selected were Pioneer '92Y51' for upper landscape positions and Pioneer '92Y70' for lower landscape positions. The primary criteria for the upper landscape position was good yield potential coupled with drought tolerance, while the criteria for the lower landscape position was good yield potential coupled with phytophthora resistance. Replicated trials were established at Tripp, Lennox, and Beresford, South Dakota on May 14, May 21, and May 24, respectively, by personnel from the SDSU Southeast Research Farm. The plots at Tripp and Lennox were with farmer-cooperators, and the plots at Beresford were at the SDSU Southeast Research Farm. Plots were 30' wide (12 rows with 30" row spacing) and were 485 to 740' in length, with total length depending on the dimensions of the field and where replications were split. Plots were laid out such that each plot within a block crossed both upper and lower landscape positions. There were four replications at Beresford and two replications each at the Lennox and Tripp sites. Treatments were as follows:

1. 92Y51 planted in single rows across landscape positions
2. 92Y70 planted in single rows across landscape positions
3. 92Y51 planted in upland positions switching to 92Y70 in lowland positions (single rows)
4. 92Y51 planted in twin rows across landscape positions
5. 92Y70 planted in twin rows across landscape positions
6. Twin rows with 92Y51 in one row and 92Y70 in the other across landscape positions

A seed rate of 150,000 seeds per acre was used for all treatments. Large portions of the field at the Lennox site were inundated due to heavy rainfall (> 9") occurring on May 26 and 27, 2013. This site was then dropped from the experiment because the lowland parts of the field were mostly drowned out and subsequently reseeded to another variety after the water receded.

Whole-plot yields were determined at harvest using weigh wagons to directly measure grain yield from each plot. Samples were taken for measurement of grain moisture and 100-seed weight. Stand counts were taken after harvest on three 6' sections of row in each plot. Data were subjected to analysis of variance using SAS statistical software using Proc GLM with all factors considered as fixed effects and replications nested within sites. There was no significant site by treatment interaction for yield, therefore data were pooled across sites. Treatments were compared from the pooled data set using a series of orthogonal contrasts.

RESULTS AND DISCUSSION

Yields in the trial area at Beresford averaged 52.1 bu/ac, while at Tripp the average yield was 48.9 bu/ac. The two varieties tested did not significantly differ from each other in yield at either site when planted in a single row configuration (Tables 1 and 2). However, the variable line treatment yielded 3.4 bu/ac more than the average of the two single variety treatments, and 2.7 bu/ac more than the higher of the two single variety treatments within the single row plots (Table 1). In this trial then, there was a clear yield advantage gained by switching between the two lines according to landscape position so each was in an area where it was relatively better adapted.

Of the two soybean lines, '92Y51' tended to have slightly higher yield, and it seemed to benefit more from a twin-row configuration than did '92Y70', showing a yield advantage over '92Y70' when planted in twin-rows (Table 1). On average, twin rows tended to yield slightly more than did single rows (51.5 versus 50.5 bushels per acre, respectively).

Planting one row of each variety across the landscape in a twin row configuration (which effectively mixed the population across the landscape), did not have show a yield benefit (Table 1). However, as outlined above, planting the lines according to landscape position according to their area of adaptation ('92Y51' in upland areas and '92Y70' in lowland areas), showed a statistically significant yield benefit (Table 1).

There appears to be real potential to increase yields with variable-line seeding of soybeans. More work needs to be done in this area, particularly with field mapping, and in characterizing varieties, so farmers know where individual lines are most likely to show a yield advantage in the field.

SUMMARY

Trials were conducted using large strip plots at two sites in southeastern South Dakota to evaluate the yield advantage of planting two soybean varieties according to landscape position ('92Y51' in upland areas and '92Y70' in lowland areas) versus planting each line by itself across the field. Treatments of twin-row planting for the two lines, and twin-rows where each of the paired rows was a different line, were also included in the trial. There tended to be a yield advantage with planting twin-rows over single rows; however, planting one row of each line in a twin row system did not show a yield advantage over sole-planting the better of the two lines. On the other hand, with single rows, matching variety to landscape position showed about a 3 bu/ac yield benefit over planting either line by itself across the landscape. This data is from only one season with limited replications at one of the sites; therefore it should be interpreted with caution – nevertheless, these initial results suggest there is a yield benefit to be gained by appropriately matching soybean lines with good yield potential to landscape positions where they have a relative advantage. More work needs to be done to verify these results, and to further develop mapping and variety selection tools in order to optimize variety placement in the field so that further increases in productivity may be gained.

ACKNOWLEDGEMENTS

The authors would like to recognize Mr. Les Melhaff and Mr. Matt Loewe for being willing to put trials on their operations and for their work in implementing these trials. The efforts of the crew at the SDSU Southeast Research Farm and the Sustainable Cropping Systems program, particularly Mr. Garold Williamson and Mr. Doug Johnson, along with Mr. Brian Grode and Mr. Ray Munk of Raven Industries, were critical for the successful completion of this project.

Table 1. Average soybean yields across sites for trials where two lines were seeded as sole lines versus variable seeding (92Y51 on upland, and 92Y70 on lowland areas) conducted at Tripp and Beresford, South Dakota in 2013. The trial was laid out in large strip plots with four replications at Beresford, and two at Tripp. The first part of the table shows individual treatment means, and the second part shows statistical contrasts between treatments.

Lines	**Row**	**Yield**	**100 Seed Wt.**	**Population**
		(bu/ac)	(g)	(plants/ac)
Variable	single	52.8	16.1	108940
92Y51	single	50.1	15.8	103791
92Y70	single	48.7	14.8	93944
92Y51	twin	52.4	15.6	104625
One of Each	twin	52.4	15.0	99986
92Y70	twin	49.8	14.3	99153
	Mean	*51.0*	*15.3*	*101963*
	CV (%)	*4.3*	*2.2*	*10.1*

CONTRASTS

within single rows:		**Average Yield**	**100-seed wt**	**Population**
		(bu/ac)	(g)	(plants/ac)
Variable vs. Single Lines				
	Variable Lines	52.8	16.1	108940
	Single Lines	49.4	15.3	99315
	significance	**	**	NS
'92Y51' vs. '92Y70'				
	'92Y51'	50.1	15.8	103791
	'92Y70'	48.7	14.8	93944
	significance	NS	**	NS
within twin rows:				
Mix vs. Single Lines				
	One Line Each	52.4	15.0	99986
	Single Lines	51.1	15.0	101888
	significance	NS	NS	NS
'92Y51' vs. '92Y70'				
	'92Y51'	52.4	15.6	104624
	'92Y70'	49.8	14.3	99152
	significance	*	**	NS
Single vs. Twin Rows				
	Twin Rows	51.5	15.0	101254
	Single Rows	50.5	15.6	102712
	significance	NS	**	NS

*, and **, denote statistical significance at the 0.05, and 0.01 levels, respectively.

Table 2. Soybean yields presented by site (Beresford and Tripp, SD) for trials comparing two lines seeded as sole lines versus variable seeding (92Y51 on upland, and 92Y70 on lowland areas) in 2013. The trial was laid out in large strip plots with four replications at Beresford, and two at Tripp. Note the trial at Tripp had limited replications, therefore that data should be interpreted with more caution.

Site	Line	Rows	Yield	100 Seed Wt.	Population
			(bu/ac)	(g)	(plants/ac)
Beresford	Variable	Single	53.5	16.3	118217
Beresford	92Y70	Single	50.4	14.8	95106
Beresford	92Y51	Single	50.4	16.0	108315
Beresford	92Y51	Twin	53.4	15.7	111199
Beresford	One Row Each	Twin	52.8	15.0	106964
Beresford	92Y70	Twin	51.8	14.2	103899
	Mean		52.1	15.3	107283
	CV (%)		2.9	1.8	9.5
	LSD (0.05)		2.2	0.4	NS

Site	Line	Rows	Yield	100 Seed Wt.	Population
Tripp	Variable	Single	51.3	15.7	90387
Tripp	92Y51	Single	49.5	15.4	94743
Tripp	92Y70	Single	45.4	15.0	89298
Tripp	One Row Each	Twin	51.4	15.1	86031
Tripp	92Y51	Twin	50.4	15.3	91476
Tripp	92Y70	Twin	45.7	14.5	89661
	Mean		48.9	15.2	90354
	CV		7.4	3.3	11.7
	LSD (0.05)		NS	NS	NS

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A New Grain Price Plateau and Other Thoughts

Douglas Johnson*, Southeast Farm

As I sit here on a very cold January day, I'm thinking of the wild ride the grain markets have sent us on the last few years. The ethanol boom started in about 2005. The summer drought of 2012 sent the markets into new higher territory, and China kept right on buying.

Now things seem to be changing again, and not for the good, unless you're buying feed. The local bids at Beresford are $4.00 or less for corn and around $12.50 for soybeans. The ethanol mandate is in danger. The drought is over for now, and China has started rejecting ship loads of corn for GMO's. The USDA is expected to find a record 2013 corn crop, and the third largest soybean crop. And it's raining enough to start talk of a record soybean yield this year in South America.

The charts (Fig 1 and Fig 2) that follow this article show how high the last two year's prices are above the eight year average. At present beans are still above the average, but corn has dropped below the average. Grain prices have a hard time staying well above average for long. The average also appears to be close to the present crop production costs. Sooner or later, high prices stop high prices. If 2014 has trend-line yields, crops prices could fall much further. If crop yields suffer somewhere else, there is some hope of higher prices here.

The cost of corn production is $4.35 to $4.85 per bushel, and soybeans are about $10.75 per bushel for 2013 and 2014. In 2004, corn cost was $1.67/bushel, and soybeans were $4.97. Crop production costs have more than doubled since 2004. Right now, corn is at or below the cost of production, and beans are just above.

It may well be the only way to make any money on grains is to cut costs, or find some livestock to feed. Both ways are going to be tough. Feeder cattle are sky high and going higher. A hog barn costs a half million dollars. Then you need a contract and the desire to feed pigs for the next ten or more years. Soybeans are hard to feed to livestock without processing.

The next thing everybody thinks of is getting the rent lowered. The landlords aren't likely to agree at all. Especially if they have noticed a lot of new stuff on the renter's place. Normally, it takes a couple of years before rents start dropping, and this is if prices or yields stay poor. Landlords aren't going to share the pain until they are sure there is a need to share the pain. This is also true about land values, especially when interest is near zero.

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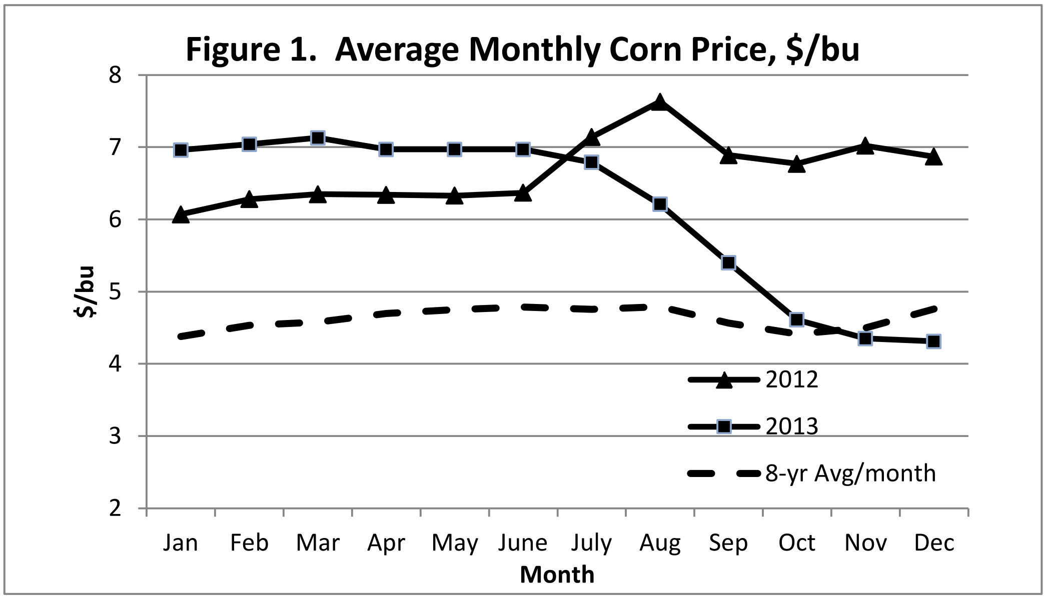
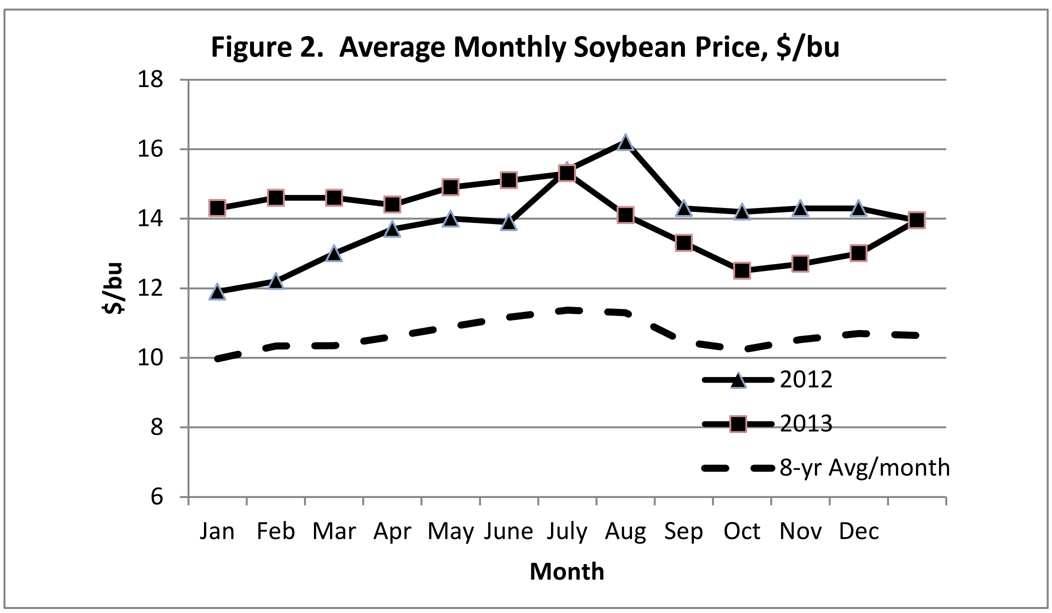
Web Site References:
http://www.farmdoc.illinois.edu/
http://www.farms.com/

The next thing is to lower crop inputs. You can use less fertilizer, cheaper seeds, and fewer chemicals. Been there. Done that. Didn't work. I lost more in yields than I saved in costs. You have to really know what your costs are, and where you can save money without giving up yield. The suppliers of inputs want at least the prices they are getting, and will resist lowering them.

What all this means is that it's time to be very careful in the next couple of years. The really good times of the recent past are probably gone. If there is a new plateau of grain prices, it is likely near present crop bids or below. It's not likely to match the prices of the last two years. Corn prices are being forecast at $2.75 to $5.50 per bushel with an average around $4.00. Soybeans for fall 2014 are right at the breakeven price. Profits are possible, but you will have to be constantly watching the markets, getting advice from "experts", and making careful judgments. The main thing to remember is it's hard to go broke when you make even a little profit, and when you go for a home run, sometimes you strike out and the game isn't nearly as much fun.





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Beef Cattle Grazing:

Cover Crop and Residue

G. Colton Buus*, Peter Sexton, and Brad Rops

The integration of crop and animal agriculture has historically played a significant role for diverse farming operations. However, over the past few decades many producers in southeastern South Dakota and across the country have shifted from an integrated farming system to one that is more heavily focused on crop production. As a result, more effort, resources, and most visibly land is being devoted to capitalize on intriguing grain prices and rising yields. Currently, grazing availability for livestock is becoming more difficult to find in a landscape that once was balanced with tilled soil and pastures or other forages. Many livestock producers are left to utilize small grazing areas next to creeks and riverbanks, or on ground too steep or rocky to farm. With few places to graze, many livestock producers end up feeding stored feed stuffs for a majority if not the entire year, which is both costly and an inefficient form of feed. As the prices for land maintain strong levels, both livestock and crop producers need to maximize their land earning potential, while still being mindful of long term soil health and productivity. With all this in mind, can a mutualistic relationship between livestock grazing and crop production still exist and be both economically and ecologically beneficial?

The idea behind this study is to integrate grazing into a cropping rotation, and observe and measure both the positive and negative effects including:

- Soil Fertility/ health
- Organic matter of the soil
- Impact on grain yield over time
- Cost comparison to stored feed/pasture grazing
- Crop variety within a rotation

FENCING

A grazing study began this past summer at the Southeast Research Farm following construction of a four (4) wire high tensile fence for an exterior boundary. We chose to use Gallagher™ high tensile wire, insulators, and strainers. Railroad ties and round wooden posts were used for the corner and brace posts. For line posts we used a PasturePro™ self-insulating post which is comprised of a wood-plastic composite. Line posts were spaced approximately 60 feet apart. We found the posts were easy to pound in, and the wire was simply attached by drilling a hole and using a cotter pin to connect the wire to the post. Two smaller posts made of the same materials called “stays” were placed evenly between the line posts. The stays are not pushed into the ground, but rest or float on the top and are used to keep separation of the wires and allow flexibility to the fence.

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Interior paddocks or grazing areas were fenced off using pig-tail step-in posts and a braided electric wire. The temporary fences allowed for easy set-up and tear-down as cattle moved to different grazing areas. Temporary wire also allowed for limiting daily grazing area and/or feed intake. A price summary is shown in Table 1 including approximate costs per foot of total fence and most individual item costs. Price per foot reflects a half mile length as price will increase with shorter lengths. Prices exclude labor and energizer.

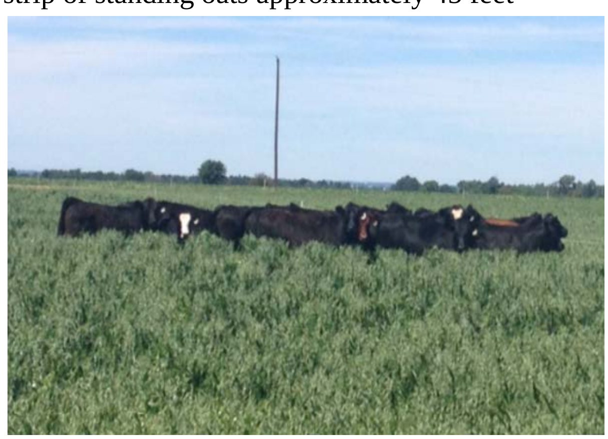
Table 1

Fence materials	**Price**
PasturePro™ 1 ½" x 66" insulated post	$8.75 each
PasturePro™ 1" x 48" Stay	$3.75 each
½ Mile Gallagher High Tensile Wire	$95/roll
High Tensile Dead Strainer	$3.00 each
Tension Spring	$6.50 each
Corner Insulator	$1.25 each
Cotter pins	$8.00/ 100pk
Railroad Tie	$15.00 each
Round 4"x 10' round wood post	$12.00 each
Push in Insulated Pig-tail post	$2.45 each
½ mile Turbo braided insulated wire	$110/ roll
Fence Cost Per Foot	
High Tensile 4 wire permanent electric fence	*$.46/ft*
Braided rope and push post temporary	*$.10/ft*

Water was supplied using a large round water tank which could hold up to a 2 day supply and was easily drained and moved to each grazing area.

GRAZING

On June 26, twenty head of yearling cattle comprising of 19 heifers and 1 bull were placed in a field (202) planted to an oat and field pea mix. The field was split in to three (3) paddocks, with 30 foot strips dividing the paddocks which were used as a control and cut and baled as oat hay. The oats were just reaching the "dough" stage when the study began. Upon arrival, cattle were placed in the field and had free range of the entire first paddock. We found that the cattle quickly trampled most of the oats down within the first few days. In the ensuing days, the cattle did eat a majority of the trampled crop. However, before moving them to the next paddock we decided to make a change in our management strategy. Instead of getting free range of the entire 2nd paddock, cattle started in a strip of standing oats approximately 45 feet wide. Each day, the temporary fence was moved ten feet to allow for new standing forage to be grazed. This lessened the amount of trampled



Cattle in free range oat paddock

crop and increased grazing head days per acre for the paddock to 170.3 compared to just 95.3 spent on the first paddock. This advantage from controlling the grazing area set a standard protocol for most of the remaining grazing season. Each time the cattle were moved into the next block, a sorghum/Sudan grass was drilled in the oat stubble, with the intention of moving the cattle back over the same area once the crop had grown. The controlled or non-grazed strips were cut, raked, and baled totaling 4,065 lb/acre. Other oats grown and harvested at the research farm for 2013 had an average yield of 120 bu/acre.

After completion of the entire oat block on July 31, cattle were moved into a field comprised of freshly combined wheat stubble surrounded by water ways of an alfalfa/clover mix. This area served as an interim grazing area while the sorghum/Sudan was growing. Following the grazing period, the field was planted to a grazing cover crop blend consisting of oats, peas, and radish.

The cattle were moved back into the first grazing paddock in field 202 again on August 28th. As earlier stated, the field had been planted to sorghum/Sudan following the first oat grazing. We unfortunately had a poor stand due to problems with the drill, so the grazing duration of the sorghum was much shorter than we had hoped.

Controlled grazing on cover crop blend of oats, peas, sorghum, and radish

Following the grazing of the last section of sorghum, the cattle were moved into a field of second cutting alfalfa that was over 25% bloom. The grazing was again controlled by moving the temporary fence daily. Grazing the alfalfa allowed the cover crop mix in field 201 to grow, to which the cattle were exposed September 17. We found that although the radishes grew very well, the cattle didn't like them and would graze around them only eating the oats, peas, and alfalfa.

After the completion of corn harvest, the cattle were moved to a field for the grazing of corn stover. This field had been planted to winter rye directly after the corn was taken out. However, due to little growth before grazing exposure, the rye did not provide any visible grazing for the cattle. For future study purposes, four 100 x 100 foot blocks were fenced off within the corn field to represent non-grazed areas. The cattle grazed the corn stover until November 1st when they were moved into another field consisting of a harvested oat field that had been planted to a cover crop blend and winter rye following harvest. We again fenced off four 100 x 100 foot non-grazed blocks for future research purposes. The cattle did very well on the winter rye and cover crops. They remained in this area until they left the farm on November 15, ending the 2013 grazing season. Table 2 is a summary of the grazing period including the amount of head days/acre for each crop grazed.

Table 2

Field ID	Grazing Days	Crop Grazed	Head days/acre
202 S	7	Oat & Field pea mix (free choice)	95.3
202 M	20	Oat & Field pea mix (controlled)	170.3
202 N	14	Oat & Field pea mix (controlled)	208.9
201	22	Alfalfa, Wheat Stubble, Sweet clover	28.3
202 S	7	Sorghum/Sudan	112
202 M	3	Sorghum/Sudan	25.7
202 N	2	Sorghum/Sudan	31.3
203 W	8	Alfalfa 2nd Cutting	11.4
201	30	Alfalfa/Oat/Radish/pea	40.6
203 E	15	Corn Stover w/ under seeded winter rye	20.3
204	14	Winter Rye, radish, corn stover	19.6
Total	**142**	**Grazed on 65 total acres**	**44.3**

SUMMARY

In summary, the grazing project for the first year went very well due to timely rains and high yielding crops. The cattle maintained excellent condition and gained approximately 1.5 pounds per day over the grazing period. In total the cattle grazed approximately 65 acres over the course of the period. Some of these acres were multi-cropped and/or grazed over more than once. Overall we found it is important to have a good strategy in place prior to the grazing season including crop types and planting dates. It is also important to have a grazing area or stored feed available to fill periods between crops or if there is a lack of precipitation. As this project is continued in future years, more data will become available pertaining to impacts on grain yield, soil fertility, and the economic value of acres grazed

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Effect of Feeding Order on Feedlot Performance

Brad Rops, Operations Mgr., SE Farm and
Colton Buus, Research Asst., SE Farm

Does feeding order have an effect on feedlot performance? Do cattle fed earlier in the day perform differently than those fed later? Does performance vary for cattle fed from the first, middle, or last part of a mixed batch of feed? To help answer some of these questions, heifer calves weighing 658 pounds were blocked by weight, and assigned to pens with 11 head per pen. They were fed a growing ration for 97 days. Pen weights were taken on day 0, 48, and 97. Feed was delivered once a day in the morning, typically between 8:30am and 10:30am. The rations fed are shown in Table 1.

Table 1. Rations Fed

	Ration, Day 0 - 48	Ration, Day 49 - 97
Liquid supplement	3.30%	3.75%
Rolled corn	25.40%	32.51%
Modified Distillers Grains	33.00%	34.00%
Corn silage	18.00%	15.00%
Straw	10.15%	7.37%
Corn stover	10.15%	7.37%

Four identical rations were mixed each day. Five pens were fed out of each batch. Bunks were managed to try to maximize feed intake, but also limit the sorting of feed stuffs. Table 2 shows the average performance for each group of five pens fed from the first, second, third, or fourth batch of feed. There were no statistical differences resulting from the time of feeding for average daily gain (ADG), dry matter intake (DMI), or feed conversion (F/G).

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Table 2. Feedlot Performance by Order of Batch Fed

	Ration 1, Day 0 – 48			**Ration 2, Day 49 – 97**			**Cumulative, Day 0 – 97**		
Batch Order	ADG	DMI	F/G	ADG	DMI	F/G	ADG	DMI	F/G
1	2.77 a	17.51 a	6.39 a	3.00 a	22.04 a	7.41 a	2.92 a	19.81 a	6.81 a
2	2.89 a	17.54 a	6.09 a	2.93 a	22.32 a	7.62 a	2.90 a	19.95 a	6.91 a
3	2.80 a	17.37 a	6.24 a	2.95 a	22.41 a	7.63 a	2.88 a	20.00 a	6.94 a
4	2.84 a	17.78 a	6.27 a	3.14 a	22.47 a	7.17 a	2.99 a	20.10 a	6.74 a

Performance data was also analyzed by the order pens were fed out of a particular batch. In other words, all pens fed first, second, third, fourth, or fifth out of their particular batch. The results in Table 3 indicate some differences here. In the first 48 day period, the first pens fed had significantly better ADG than the last pens fed. The pens fed out of the middle of the batch were not significantly different statistically to either the first or last pen. There were no significant differences in DMI or F/G in the first feeding period, nor did the statistics show any real differences in data in the second half of the feeding period.

The cumulative totals show no statistical difference in ADG or DMI, although numerically, the first pens fed had the best rate of gain on average and the last pens fed had the worst. In regard to F/G, the first pens fed were the most efficient, though not significantly different from the third and fourth pens fed. The last pens fed had the poorest feed efficiency, though not significantly different from the second and third pens fed.

The rations were delivered using a reel-type feed wagon. The mixing order was liquid supplement, corn, straw, stover, MDGS, and silage. The ration fed was very bulky. Not only did it contain straw and corn stover, but the silage fed was from drought-stressed corn, most of which had yield potential of less than 25 bu/ac. The resulting silage was quite light and fluffy. These ingredients, while helping to reduce the cost of the ration, made it difficult to mix well with the corn and modified distillers grains (MDGS).

Based on the data collected, some assumptions can be made. One assumption is that the first pens fed received a higher percent of concentrates in their delivered ration. It seems plausible that the more dense concentrates (corn and MDGS) stayed in the lower auger by the feed delivery table while the less dense roughages were kept floating above by the feed wagon’s reel. When the first pens were fed, the energy level of the feed delivered was not proportionate with the rest of the load. That would explain the numerically higher ADG and improved F/G in each feeding phase. In the second feeding period, eight percent of the roughage was replaced with concentrate in the ration and the advantage for the first pens in ADG and F/G, while still apparent, is not as pronounced.

As the first pens showed an indication of improved performance, the last pens fed were inclined to be slower gaining and less efficient; and as the first pens’ performance can be attributed to more concentrates being delivered. We can assume the last pens fed received a higher proportion of roughages.

SUMMARY

Lessons to be learned from this study are that the order batches are delivered to pens does not impact performance as long as pens are fed at a consistent time each day. When feed wagons are filled or overfilled, the ration is not likely to mix well. Although it takes extra time to mix additional batches, it may be worth the investment to decrease batch sizes by increasing the number of batches mixed. Smaller batch sizes should improve the uniformity of the ration delivered and avoid suppressing the performance in your last-fed pens.

Table 3. Feedlot Performance by Order Fed Within Batch

	Ration 1, Day 0 - 48			**Ration 2, Day 49 - 97**			**Cumulative, Day 0 - 97**		
Order Fed	ADG	DMI	F/G	ADG	DMI	F/G	ADG	DMI	F/G
1	3.10_{a}	17.53_{a}	5.67_{a}	3.16_{a}	22.33_{a}	7.08_{a}	3.13_{a}	19.93_{a}	6.39_{c}
2	2.78_{ab}	17.95_{a}	6.49_{a}	3.01_{a}	22.88_{a}	7.65_{a}	2.90_{a}	20.48_{a}	7.06_{ab}
3	2.77_{ab}	18.00_{a}	6.51_{a}	3.21_{a}	22.90_{a}	7.15_{a}	2.97_{a}	20.33_{a}	6.85_{abc}
4	2.88_{ab}	17.33_{a}	6.03_{a}	2.91_{a}	21.43_{a}	7.37_{a}	2.93_{a}	19.28_{a}	6.59_{bc}
5	2.57_{b}	17.25_{a}	6.72_{a}	2.75_{a}	22.03_{a}	8.03_{a}	2.69_{a}	19.80_{a}	7.37_{a}

SOUTHEAST RESEARCH FARM ANNUAL REPORT
South Dakota State University
2013 Progress Report
Agricultural Experiment Station
Plant Science Department
South Dakota State University, Brookings, SD 57007
Southeast Research Farm, Beresford SD 57004

Dealing with Drought in the Feedlot

Brad Rops*, Colton Buus, and Peter Sexton

The year 2012 will not soon be forgotten due to the severe drought experienced by much of the Midwest. It became apparent in July that there would not be much corn to harvest at the Southeast Research Farm that fall. Pre-harvest yield estimates ranged from 100 to less than 5 bushels per acre. The estimated forage yield for corn chopped for silage was 8 to 10 tons per acre. With a conservative value of $400 to $500 per acre gross return for silage, and the possible returns per acre considering various yield and price levels (Table 1), the decision was made to harvest all corn fields with projected yields of 25 bu/ac or less for silage. The exception was a few research plots where we still hoped to collect yield data.

Table 1. Gross Return per Acre at Various Yield and Price Levels

	$6.00/bu	**$7.00/bu**	**$8.00/bu**	**$9.00/bu**
25 bu/ac	$150.00	$175.00	$200.00	$225.00
50 bu/ac	$300.00	$350.00	$400.00	$450.00
75 bu/ac	$450.00	$525.00	$600.00	$675.00
100 bu/ac	$600.00	$700.00	$800.00	$900.00

Approximately one half of the corn acres were harvested for silage. The forage yield was 9.5 tons per acre. Nitrate levels on six different samples showed a range of 74 to 638 ppm Nitrate-N, all well below the 1000 ppm level considered safe. It was marketed through the feedlot at $58 per ton which resulted in a return per acre of $551. Storage costs were higher than in an average year, as we were able to put only 65% of the tonnage into the storage bags. This was due to the lack of grain weight. The remaining corn harvested for grain averaged 38 bushels per acre. The average price received over the feeding period (billed monthly) was $7.27 per bushel for a gross return of $276 per acre.

Southeast Research Farm cooperated with SDSU's Opportunities Farm by backgrounding light weight calves in preparation for finishing in their feedlot. The first group of 180 drought-stressed calves was 80% heifers. They were fed from September 4 to January 14. The second group was all heifers, and was fed from January 24 to May 15. The following tables show the rations and performance data for each group of calves. Rations were designed to utilize the

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available feedstuffs at Southeast Research Farm – silage, straw, stover, and limited corn and hay. Modified Distillers Grains and liquid supplement were purchased.

Silage made up a considerable part of the ration (55%) for the first group of calves. Despite very little grain in the silage, the calves performed extremely well, averaging 3.20 pounds daily gain over a 121 day feeding period. Feed conversion was also excellent at just under 5 pounds of feed per pound of gain. The silage was valued according to the grain price at the time it was harvested. Utilizing $58/ton corn silage ($181.25 per ton of dry matter) for a majority of the ration, the cost of feed per cwt of gain was $67.58.

Table 2. Backgrounding Rations for Group 1.

	Ration, Day 0 - 6	Ration, Day 7 - 30	Ration, Day 31 - 121
Liquid supplement	8.5%	5.28%	5.27%
Rolled corn	24.0%	8.46%	8.39%
Modified Distillers Grains	25.0%	25.00%	25.00%
Corn silage	--	55.00%	55.00%
Alfalfa/Grass mix	42.5%	6.26%	3.17%
Straw/Corn Stover	--	--	3.17%

Table 3. Feedlot Performance, Group 1.

Avg Starting weight, lbs	415
Avg Ending weight, lbs	802
Days on feed	121
Total gain, lbs	387
% Death loss	1.11
Average daily feed intake, lbs	14.22
Average daily gain, lbs	3.20
Feed:Gain, lbs	4.96
Feed cost/cwt gain	$67.58

The ration for the second group of calves utilized more straw and corn stover to cheapen the ration. The inclusion of silage was reduced in order to stretch out our remaining supply over a three month feeding period. The heifers gained 2.93 pounds per day. Feed conversion was 7.24 pounds of feed per pound of gain with a feed cost of $97.23 per cwt of gain.

Table 4. Backgrounding Rations for Group 2.

	Ration, Day 0 - 48	Ration, Day 49 - 97
Liquid supplement	3.30%	3.75%
Rolled corn	25.40%	32.51%
Modified Distillers Grains	33.00%	34.00%
Corn silage	18.00%	15.00%
Straw	10.15%	7.37%
Corn stover	10.15%	7.37%

Table 5. Feedlot Performance, Group 2.

Starting weight, lbs	658
Ending weight, lbs	943
Days on feed	97
Total gain, lbs	284
% Death loss	--
Average daily feed intake, lbs	20.89
Average daily gain, lbs	2.93
Feed:Gain, lbs	7.24
Feed cost/cwt gain	$97.23

SUMMARY

In summary, despite the lack of actual grain in drought-stressed corn silage, it did not inhibit the performance of calves backgrounded at the Southeast Research Farm. Marketing poorly pollinated corn acres as silage through the feedlot in 2012, provided at least an additional $275 per acre gross income compared to harvesting it as grain.

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Progress Report on Selecting Winter Wheat Lines for Their Ability to Compete with Weeds in an Organic System

David Karki*, Jesse Hall, and Peter Sexton

INTRODUCTION

Weed management for organic growers is more of a limitation than for their conventional counterparts because application of synthetic herbicides is not permitted under organic production standards. The levels of weed pressure within a cropping system largely depend on rotation, preceding crop, and overall weed control history. One tool for weed management under organic production systems is to utilize the inherent ability of the crop to compete against weeds. Growing competitive variety can be a cultural measure for helping to suppress weeds throughout the growing season. This consequently lessens accumulation of weed seed in the soil for subsequent growing seasons. One advantage of adding winter wheat to corn- and soybean-based rotations is that it would provide a way to increase crop diversity by including a winter annual in the production system. Including crops with diverse growing habits (cool and warm season) within rotations will further help to suppress weed population on a long-term basis. Our objective was to identify winter wheat lines with good yield potential that are competitive with weeds for uses in organic systems in our region.

METHODS

A total of 30 winter wheat genotypes provided by the Organic Small Grains Breeding Program at the University of Nebraska, and the Winter Wheat Breeding Program at South Dakota State University (SDSU), were grown at the SDSU Southeast Research Farm located at Beresford, SD in 2011 and 2012 growing seasons in an area certified for organic crop production. The genotypes consisted twelve released cultivars and eighteen advanced breeding lines. A winter rye (*Secale cereale* L.) cultivar 'Dacold', and two triticale (x *Triticsecale* Whittmack) lines, NE42G2T and NT01451, were included in each experimental set. Rye is known for its vigorous growth and ability to suppress weeds and was included as a check. In 2011, the trial was planted on 6 October. Seed rate was 43 seeds per square foot. The plots were laid out in a Randomized Complete Block (RCB) design with eight field replications. The plot size was 5 by 17 feet. In 2012, the experimental plots were planted on 11 October with a total of 6 replications. The plot size in 2012 was 5 by 20 feet and the seed rate was 45 seeds per square foot. Four replications in 2011 and three replications in 2012 were overseeded (seed rate: 5lbs/ac) with 'Dwarf Essex' winter rapeseed

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(*Brassica napus* L. var. napus) in early spring (March). The purpose of the 'Dwarf Essex' was to serve as a model weed in order to maintain uniform weed pressure across the trial area. In 2011, the same replications were underseeded with flax (*Linum usitatissimum* L.) and annual ryegrass (*Lolium multiflorum* Lam.) during planting; however, their emergence was negligible due to drought conditions and this practice was discontinued in the second year of the study. We did not apply any weed management method during either growing season, i.e. plots were allowed to grow in their natural state throughout the season. Field pennycress was the major weed species in the first growing season whereas pigweed and lambsquarters were more predominant in the second season. The area used for this study was previously planted to soybeans in both years. In order to evaluate above ground crop and weed biomass, in 2012 we made crop cuts of three square feet at a one-inch cutting height in each of the four replicates that had been overseeded to 'Dwarf Essex'. In 2013, more resources were available and all plots were sampled (i.e. six replicates) in like manner for crop and weed biomass. In each sample, weed and crop biomass were separated by hand, dried at 140 F, and dry weight was determined. The crop cuts were taken at milk stage. Plant height for winter wheat genotypes were measured from soil surface to tip of the awn.

In both years, plots were end-trimmed at the time of harvest to avoid border effects. Grain harvest was done on 29 June and 2 July in 2012, by using a small plot combine (Hege model 125B, Wintersteiger AG, Reid, Austria). In 2013, plots were harvested on 31 July and 1 August using a small plot combine (Wintersteiger model Elite, Wintersteiger AG, Reid, Austria). The harvested grain samples were evaluated for yield (corrected to 13% moisture), protein (13% moisture), test weight, and 100 seed weight.

Thirty winter wheat genotypes were evaluated for two years for ability to compete against weeds and for grain yield production. The genotypes were provided by University of Nebraska Organic Wheat Breeding program. The trials were conducted in Southeast Research Farm, Beresford South Dakota. Genotypes evaluated showed significant differences in suppression of weed production, and in grain yield performance; however, genotype-by-season interaction was significant suggesting that different weather conditions between the two seasons influenced genotype rankings. Weed biomass showed a significant negative relationship with crop shoot biomass in both years of the study. Certain released cultivars (Jerry and Scout66 winter wheat) and advanced breeding lines (NE03490 winter wheat, and NE42G2T and NT01451 winter triticale) showed promising results in terms of weed suppression and acceptable grain yield. Identifying winter wheat genotypes with good yield capability and weed competitiveness appears to have potential as a weed management tool for organic farmers interested in growing wheat.

Data Analysis

All data measured in each growing season were subject to analysis of variance (ANOVA) using PROC GLM in SAS statistical software (SAS Institute, Cary, NC). Tests of significance for each measured trait were obtained by mean squares. Genotype means were compared by Least Significant Difference (LSD) values at 0.05 probability level. There were significant interaction effects observed between growing season and genotype for weed biomass, crop biomass, and yield; therefore, data were not pooled across seasons and each season was analyzed separately. In 2013 growing season, there were no interactions between genotype and presence of 'Dwarf Essex' for yield, crop or weed biomass, so this data was pooled across all replications

Growing Conditions

Weather data was obtained from a weather station maintained at the research farm (South Dakota Climate and Weather: http://climate.sdstate.edu). The weather conditions in our growing region during 2011-12 differed markedly from those in the 2012-13 winter wheat growing season (Table 1). The spring of 2012 was unusually warm, especially March, whereas the spring of 2013 was much cooler with greater precipitation in May and June. This weather pattern had a noticeable effect on our experimental observations. The two seasons differed in both crop and weed biomass, and there was a significant genotype-by-season interaction effect for crop biomass. The average crop and weed biomass in the first growing season were 5700 lb/ac and 550 lb/ac respectively, whereas the values were 8360 lb/ac and 1040 lb/ac for the same in the following growing season. The increase in both crop and weed biomass in the second growing season was likely due to cooler spring weather and resulting longer growing period, along with better soil moisture conditions. The weather also impacted the harvesting dates with 2012 harvest being done a month earlier than 2013 (end of June vs. end of July). The average yields for the trial were similar in the two seasons (37.2 bu/ac in 2012 vs. 37.6 bu/ac in 2013).

RESULTS

Genotypes tested in this study showed significant differences in the amount of weed biomass produced under the crop (Table 2). There was a negative association between crop biomass and weed biomass in both growing seasons with R^2 values of 0.30 and 0.73 for first and second growing seasons respectively (Fig. 1). In both seasons, the rye check plots had the least amount of weed biomass. There were genotypes which were statistically similar to rye check plots in each growing season. Despite the interactions observed between genotype and growing seasons, the winter wheat genotypes Jerry, NE03490, and Scout66 were statistically similar ($LSD_{0.05}$) to rye in both years (Table 2). Similarly, the triticale lines, NE42G2T and NT01451 were also statistically equivalent to rye in terms of weed suppression for both growing seasons (Table 2). This suggests that these genotypes may possess essential traits for suppressing weed growth.

Weed biomass showed a significant negative relationship with crop plant height but the association tended to be weaker than that observed with crop biomass (data not shown). . We postulate from this that weed suppression is a complex trait and that there are other factors at work in addition to plant height in suppressing weed biomass production. Our study measured total weed biomass and did not separate individual weed species. The average plant height in the first season of our study ranged from 29.3 inch (NI08708) to 42.3 inch (Rye) whereas in the second season, the range was from 34.0 inch (NE03490) to 50.2 inch (Rye). There was significant effect of growing season on plant height (<0.0001), but there was no interaction observed between genotype and growing season. The plant height of each genotype averaged over two years is presented in Table 2 (note: genotype-by-season interaction was non-significant for plant height in this study).

Yield showed a positive relationship with crop biomass in both growing seasons with R^2 values of 0.29 and 0.59 respectively (Fig. 2). There was a trend for grain yield to be negatively associated with weed biomass in each growing season (Fig. 3). Among the lines tested, genotypes Ideal, NE42G2T, and NT01451 were not statistically different from the highest yielding winter wheat genotype in both years of the trial (Table 3). Among these, the triticale lines NE42G2T and NT01451 also did not differ from rye in ability to suppress weed growth (Table 2), showing the potential of winter triticale as an option for organic farmers interested in diversifying their rotation by including a winter annual grain crop that has the ability to suppress weed growth. Also worthy of mention are the winter wheat lines 'NE03490', 'Jerry', and 'Scout66' which also showed ability to suppress weed growth in both years, and showed good yield in at least one of the two growing seasons evaluated in this study. The average yield, when compared among only winter wheat genotypes (i.e. excluding rye and triticale), ranged from 44.8 bu/ac (NE03490) to 29.7 bu/ac (NE0545), and 46.3 bu/ac (Expedition) to 24.6 bu/ac (NE05425) in the first and second growing seasons respectively (Table 3). Data on grain protein content, test weight, and 100-seed weight for each are shown in Table 3.

Grain yield was not always related to ability to suppress weed growth. For instance, Ideal winter wheat was one of the highest yielding genotypes in both years, but did not show strong performance in terms of suppressing weed growth. On the other hand, the winter wheat genotypes 'Jerry' and 'NE03490', for example, performed statistically similar to rye in suppressing weed growth in both years, but were not consistent in terms of showing high grain yield. This infers that merely selecting genotypes for yield potential in weed-free environments will not necessarily lead to development of genotypes with improved competitiveness against weeds. Genotypes that have high yielding capability but poor competitiveness with weeds may not be preferred by organic growers due to the risk of increasing the weed seed bank in the soil. Finding a meeting point between good weed suppressing ability, and good yield potential would be useful to organic farmers, as well as to conventional farmers concerned about development of herbicide resistant weeds.

CONCLUSIONS

Thirty winter wheat genotypes along with two winter triticale lines and a rye check treatment were evaluated for grain yield, and for ability to suppress weeds, as measured by weed biomass produced under the crop in the 2011-12 and 2012-13 growing seasons. There were significant genotype-by-season interactions for weed and crop biomass, and for grain yield. Among the materials evaluated, rye showed the best weed suppressing ability in both years. The winter wheat genotypes Jerry, NE03490, and Scout66 along with the triticale lines NE42G2T, and NT01451, showed superior weed suppressing ability in both years, statistically similar to rye. The triticale lines NE42G2T and NT01451 also showed good yield potential in both seasons of the study. There was a negative association between weed biomass and crop shoot biomass in both growing seasons. There were examples of lines with good yield potential but apparent poor ability to compete against weeds, and also lines that performed similarly to rye in terms of weed suppression, but did not consistently show good yield potential. Therefore, there appears to be good potential to select for winter wheat lines with improved ability to suppress weed growth. Further work is needed to develop efficient screening methods to identify genotypes that optimize the combination of good yield potential with ability to suppress weed growth.

Table 1. Average monthly high and low temperatures, and cumulative precipitation during the winter wheat growing period at Beresford, SD for 2011-12 and 2012-13 growing seasons.

	2011-12			2012-13		
Month	High (F)	Low (F)	Ppt† (in)	High (F)	Low (F)	Ppt (in)
Oct	66.9	39.0	0.6	59.42	33.19	0.51
Nov	49.4	21.7	0.1	48.5	23.5	0.2
Dec	38.4	14.4	0.5	32.9	13.1	0.7
Jan	36.1	20.3	0.3	28.6	9.0	0.5
Feb	37.2	16.9	1.8	32.4	13.2	0.4
Mar	65.5	37.2	0.6	38.9	19.8	0.9
Apr	65.6	39.3	2.1	52.1	29.2	1.7
May	76.1	50.3	3.0	69.7	47.7	6.5
Jun	86.1	59.8	0.3	78.1	57.5	3.6
Jul	94.9	66.1	0.3	84.7	59.8	0.6

†=total monthly precipitation

Table 2. Average plant height, crop biomass, and weed biomass of 30 winter wheat genotypes, two winter triticale lines, and a rye check treatment grown at Beresford, SD in the 2011-2012 and 2012-2013 growing seasons. Lines that were not significantly different from rye, in terms of weed biomass produced in both seasons, are shown in bold font and are underlined.

		2011-12			2012-13		
			Biomass			Biomass	
Genotype	Source	Ht	Crop	Weed	Ht	Crop	Weed
		(in)	----(lb/ac)----		(in)	----(lb/ac)----	
ALLIANCE	NE	32.5	5935	677	40.3	9837	771
CAMELOT	NE	32.0	5544	619	37.8	8361	1333
EXPEDITION	SD	31.0	4357	612	38.8	8957	616
GOODSTREAK	NE	29.5	5891	457	43.7	6345	2280
IDEAL	SD	31.3	5830	548	35.8	8224	981
JERRY	ND	37.0	5878	481	42.0	8586	643
KARL92	KS	30.5	5146	522	34.7	8584	1076
LYMAN	SD	32.3	6069	630	38.7	7912	1059
McGILL	NE	33.8	5958	530	38.7	6675	1241
MILLENIUM	NE	33.8	5801	513	39.8	7776	1432
NE02558	NE	33.0	5745	545	37.7	6845	1342
NE03490	NE	31.5	6279	516	34.0	8380	729
NE05425	NE	31.0	5248	541	35.2	5822	2018
NE05496	NE	31.3	4805	656	37.3	8032	1223
NE05548	NE	34.3	6996	477	42.3	8336	850
NE06469	NE	33.0	4530	654	39.0	8006	1013
NE06545	NE	29.8	5070	824	36.2	8099	1146
NE06607	NE	31.8	5341	712	36.0	9027	892
NE07444	NE	33.0	6639	494	36.3	8286	967
NE08457	NE	33.0	4742	826	34.7	7052	1533
NE42G2T‡	NE	39.8	5623	398	49.5	9352	528
NIO8708	NE	29.3	5290	613	34.2	8386	892
NT01451‡	NE	38.8	5787	369	45.5	10422	266
NW03666(W)	NE	30.5	5170	660	36.7	7725	937
NW03681(W)	NE	32.0	6441	433	36.7	8255	1149
NW07505(W)	NE	32.5	6173	515	38.2	7323	1793
OVERLAND	NE	33.5	5584	480	37.2	6791	1253
RYE	ND	42.3	5504	301	50.2	12106	20
SCOUT66	NE	38.3	6216	461	43.0	10556	500
SD05085-1	SD	32.0	5204	686	35.7	10661	793
SD07165	SD	32.0	6193	443	36.7	8255	909
SD08080	SD	33.3	6060	672	35.2	7984	1168
WAHOO	NE	33.0	6967	412	40.8	9038	998
GRAND MEAN		33.3	5697	554	38.7	8364	1041
CV (%)		12.5	17.0	35.0	4.9	21.6	65.2
LSD (0.05)		4.1	2012	288	2.2	2058	774

‡ = winter triticale lines.

Table 3. Average grain yield, test weight (TW), 100 seed weight (SW) and grain protein content (Pro) of 30 winter wheat genotypes, two winter triticale lines, and a rye check treatment, grown at Beresford, SD in the 2011-2012 and 2012-2013 growing seasons.

	2011-12				2012-13			
GENOTYPE	Yield (lb/ac)	TW (bu/ac)	SW (g)	Pro (%)	Yield (lb/ac)	TW (bu/ac)	SW (g)	Pro (%)
ALLIANCE	37.6	61.8	3.5	12.1	36.5	63.4	2.5	12.4
CAMELOT	38.2	62.4	3.8	12.0	35.5	61.2	2.8	12.8
EXPEDITION	33.6	62.4	3.4	12.2	46.3	63.2	2.7	12.9
GOODSTREAK	34.0	61.7	3.2	11.6	33.0	58.5	2.9	13.1
IDEAL	42.6	62.5	3.4	11.4	44.7	65.1	2.7	13.2
JERRY	38.7	61.3	3.7	12.1	39.8	63.2	2.6	13.5
KARL92	29.9	61.4	3.4	13.8	40.6	63.1	2.6	13.3
LYMAN	37.6	61.8	3.8	12.9	39.6	66.7	3.0	13.3
McGILL	39.4	61.5	3.4	11.4	35.9	61.2	2.6	12.8
MILLENIUM	34.6	61.4	3.5	13.1	38.8	65.0	2.8	12.8
NE02558	35.5	62.0	3.5	11.8	25.5	60.4	2.3	12.8
NE03490	44.8	62.0	3.6	11.1	34.7	58.8	2.6	13.1
NE05425	29.7	61.7	3.4	11.9	24.6	59.5	2.5	12.9
NE05496	36.6	62.1	3.6	11.9	30.3	59.5	2.5	13.2
NE05548	42.1	61.3	3.6	12.7	34.8	61.5	2.6	13.4
NE06469	34.8	61.5	3.5	12.2	33.8	61.4	2.6	12.8
NE06545	37.1	61.5	3.5	11.8	33.1	60.0	2.6	12.9
NE06607	36.8	61.3	3.6	12.3	42.5	62.5	2.7	12.7
NE07444	36.1	61.5	3.3	12.4	39.6	63.5	2.7	12.3
NE08457	33.1	61.9	3.0	12.5	29.6	63.3	2.6	13.0
NE42G2T‡	40.9	54.6	4.0	11.7	44.2	55.6	3.0	13.2
NIO8708	34.6	61.7	3.5	11.8	35.6	56.9	2.5	13.1
NT01451‡	42.4	54.9	3.7	11.8	51.9	52.4	2.6	13.2
NW03666(W)	36.0	62.4	3.8	12.0	39.8	63.3	2.9	12.8
NW03681(W)	36.3	62.3	3.7	12.4	37.1	63.3	2.6	13.4
NW07505(W)	37.7	62.3	3.4	11.8	34.8	61.5	2.5	12.9
OVERLAND	40.9	61.5	3.6	11.9	34.9	65.6	2.7	12.7
RYE	33.7	53.8	2.3	10.6	54.5	60.5	2.6	11.1
SCOUT66	34.8	62.8	3.7	12.1	42.7	66.5	2.9	13.1
SD05085-1	36.3	62.7	3.6	12.5	41.5	65.3	2.6	12.5
SD07165	42.9	62.0	3.4	11.6	30.3	60.0	2.2	13.0
SD08080	35.1	61.2	3.6	13.1	36.8	63.3	2.5	13.7
WAHOO	43.3	61.7	3.5	11.6	36.4	62.5	2.6	13.1
GRAND MEAN	37.2	61.2	3.5	12.1	37.6	61.7	2.6	12.9
CV (%)	13.5	1.0	5.8	4.9	18.9	5.4	7.3	2.6
$LSD_{0.05}$	5.0	0.5	0.3	0.8	8.1	3.8	0.2	0.4

‡ = winter triticale lines.

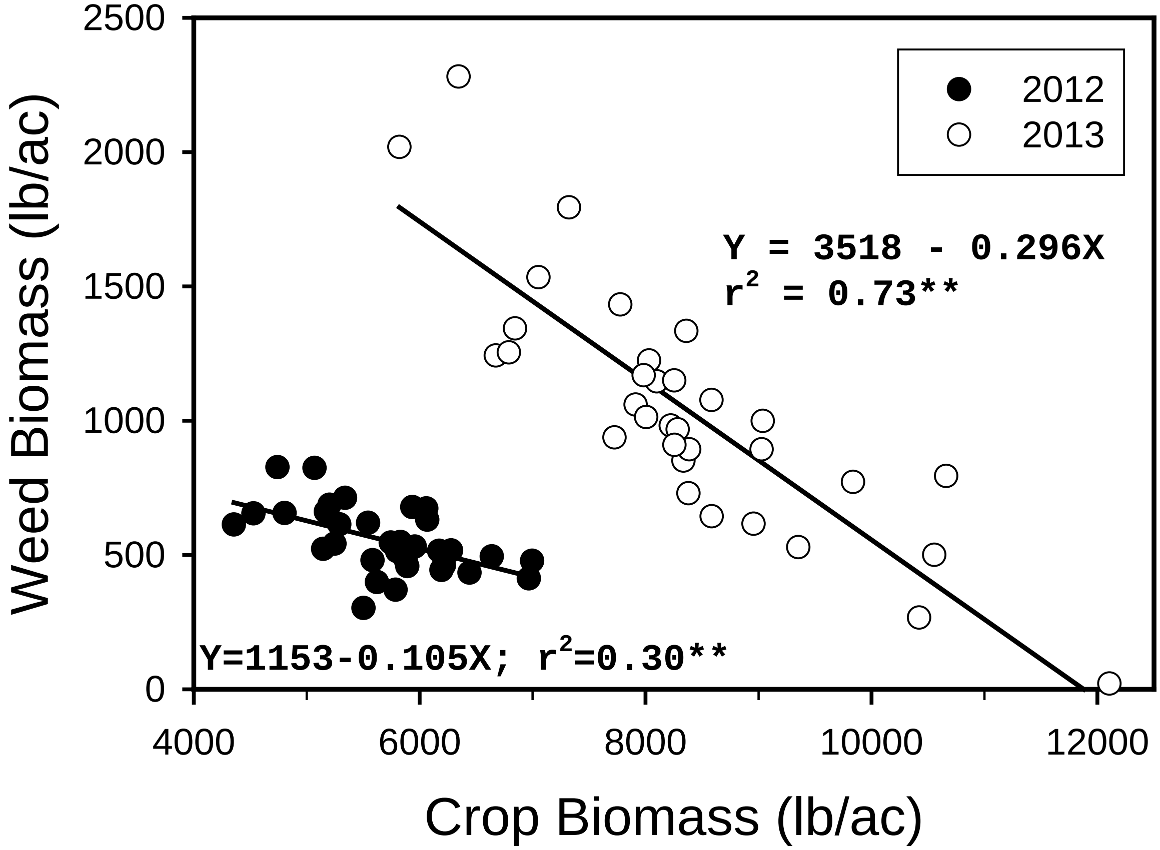

Figure 1. Weed biomass plotted against crop biomass for 30 winter wheat genotypes, two winter triticale lines, and a rye check treatment, grown in Beresford, SD in the 2011-12 and 2012-13 growing seasons. No weed control measures were taken in these studies. Biomass samples were taken when wheat was in milk stage. The symbol ** indicates statistical significance at the $p < 0.01$ level.

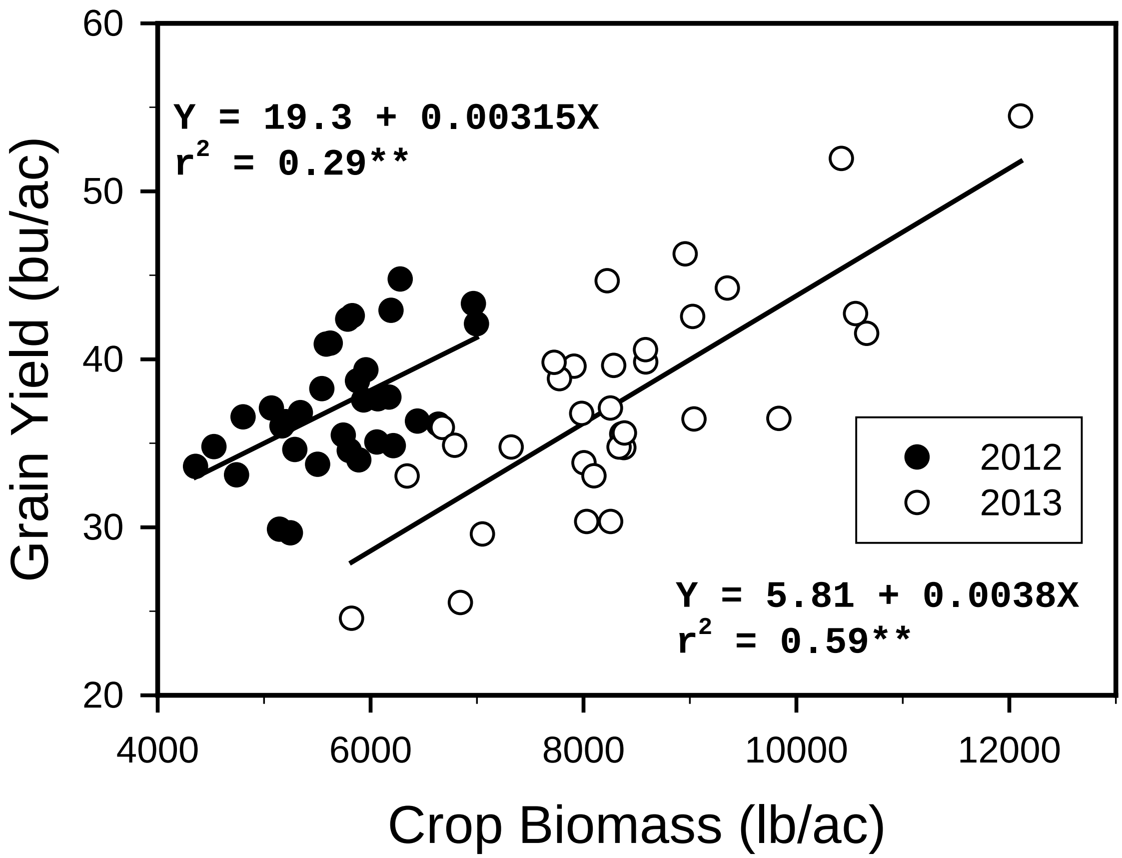

Figure 2. Grain yield plotted against crop biomass for 30 winter wheat genotypes, two winter triticale lines, and a rye check treatment, grown in Beresford, SD in the 2011-12 and 2012-13 growing seasons. No weed control measures were taken in these studies. The symbol ** indicates statistical significance at the $p < 0.01$ level.

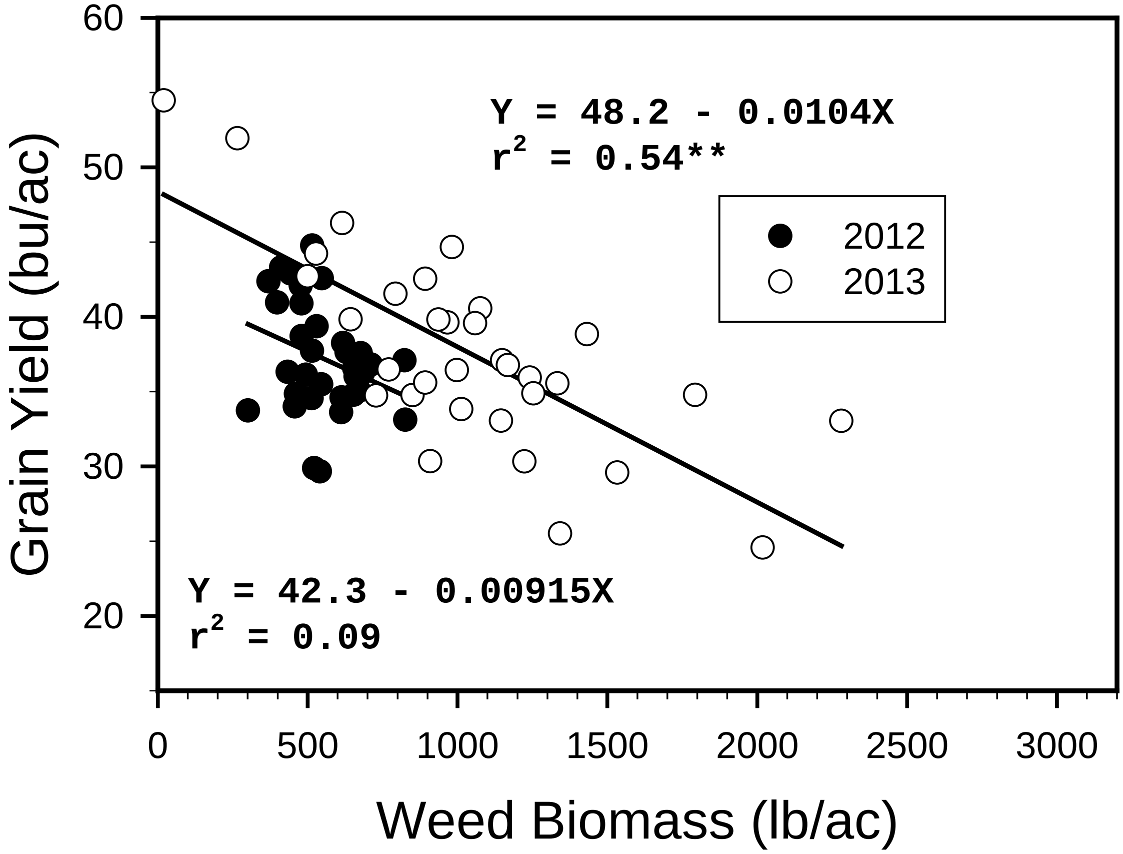

Figure 3. Grain yield plotted against weed biomass for 30 winter wheat genotypes, two winter triticale lines, and a rye check treatment, grown in Beresford, SD in the 2011-12 and 2012-13 growing seasons. No weed control measures were taken in these studies. The symbol ** indicates statistical significance at the $p < 0.01$ level.

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Observations with Winter Rye Cover/Forage Crop Grown after Corn and ahead of Soybean

David Karki*, Peter Sexton, Jesse Hall, and Al Miron

INTRODUCTION

There is interest among growers to produce winter rye as a cover or forage crop between corn and soybeans with winter rye being planted immediately after corn harvest and cut or sprayed out ahead of soybean planting in the spring. Further, introducing a small grain component into a corn-soybean rotation would diversify the cropping system. On a long-term basis, this approach would also help improve soil health and reduce pest pressure within a cropping system. Winter rye is known for its winter hardiness and vigorous growth among the small grain crops which allows it to tolerate late planting and put on rapid growth the following spring. Rye can be used as hay, as a cellulose bioenergy crop, or simply as a cover crop. Depending on the farm soil moisture, rye could either be allowed to grow until late spring to fulfill the forage needs or sprayed out earlier to conserve the moisture while providing extra soil cover and maintaining energy for the soil ecosystem. In any case, the field would be open for planting soybeans by early June, if not sooner.

Growing habits of all three crops were considered when determining the order of winter rye within the cropping sequence. Planting rye after corn and ahead of soybeans seems to be a better fit than to grow rye ahead of corn because corn residue provides protection to rye seedlings. On the other hand, soybeans can tolerate later planting better than corn which allows rye to put on more growth in the spring, hence more biomass. In addition, soybeans show good tolerance to a preceding rye cover crop, whereas corn yield tends to suffer following a rye cover crop.

There were three simultaneous studies conducted at two locations, Southeast Research Farm at Beresford, and an on-farm trial at Crooks. The first trial, which was grown at both sites, primarily focused on observing soybean yield from plots that were previously planted to a rye cover crop. The second trial, conducted in Beresford, focused on soybean yield from plots that were previously covered with winter rye, mustard (spring), and oats (spring). In the third trial, which was also conducted at Beresford, we observed soybean yields on plots that were previously seeded with rye, either broadcast during corn seed-filling or drilled after corn harvest within plots of

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different relative maturity corn (75, 85, 96, and 105 days relative maturity). All trials contained control plots with no rye planted. The objective of the first two trials was to observe the effect of the preceding cover crop(s) on soybean yield, whereas the objective of the third trial was to see if growing earlier maturing corn and planting winter rye immediately after corn harvest in the fall would be economically feasible within a cropping system.

METHODS

The winter rye was direct-seeded after corn harvest at all sites. For the study where corn relative maturity and rye planting method were focused, hand broadcasting was done when corn was in mid to late seed-filling stage. At Crooks, the rye plots were 68.5 ft x 1330 ft whereas in Beresford, the plots were 30 ft x 2468 ft for the same study. In the study which had different cover crops before soybeans, the plots were 10 ft x 300 ft and for the corn maturity-rye planting method study, the plots size was 10 ft x 200 ft. All treatments were planted in four replicates. At Crooks, the soybeans were planted on rye on May 15 and rye was sprayed out on May 17 using glyphosate. At the Beresford site, the rye was allowed to grow longer and was sprayed on June 5 using Sharpen, Metribuzen, Dual and glyphosate, after the plots were planted to soybeans on June 3. For the study with multiple cover crops, the soybeans were planted on rye strips on June 7 before being sprayed with roundup the next day. Other cover crops were spring seeded mustard and oats which were planted on May 7. For the corn maturity and rye planting method study, the rye was allowed to grow until heading, cut for hay, and baled on June 20 and the plots were planted with soybeans the same day. At Beresford, the rye was allowed to grow for three extra weeks and was able to put on markedly more biomass than at Crooks.

RESULTS AND DISCUSSION

In the first study, the effects of rye cover crop on soybean yields were not found to be statistically significant at either location (Table 1). At Crooks, the rye cover crop was sprayed out earlier in the season and left on the field for extra residue to cover the ground. In this way, the moisture used by the rye crop was balanced by the improved soil health by providing extra ground cover. This is part of on-going long-term research and we hope to reach more conclusive statement on improved soil health by cover crops in coming years.

At Beresford, the rye cover crop was allowed to grow until the first week of June which produced a significant amount of biomass, but it resulted in a 2.5 bu/ac drop in soybean yield relative to the no cover crop control (Table 1). The yield drop at the Beresford location was balanced by the biomass produced by the rye cover crop which could be used as a potential hay or biomass crop. In this study, we sprayed rye and left the residue on the field. Also, more residue on the ground may help improve the soil quality of the field.

Rye was planted as one of the cover crop treatments in another study with multiple cover crops followed by soybeans. This study was conducted at Beresford. Neither soybean yield nor the stand at harvest was statistically impacted by the preceding cover crops; however, there were some numerical differences among the obtained data (Table 2).

In the third study, observations were made on soybean yield followed by drilled or broadcasted rye planted on corn plots with varied relative maturity. There were control plots which did not have any rye crop before soybeans. The rye was cut and baled for hay before planting soybeans. The total biomass and soybean yields were not statistically impacted by either relative maturity or the rye planting methods (Table 3). If we consider the numerical values, rye biomass shows an apparent negative trend with corn relative maturity. The highest total biomass was observed for rye drilled into 75 day corn. This was expected because rye received almost a month of extra growth when planted after 75 day corn. The lack of strong differences in rye biomass following corn of different maturities suggests the established fact of rye's ability to tolerate harsh winters and put on rapid growth later in the spring. Soybean yields for all treatments were similar with a very narrow range (44.6 to 47.4 bu/ac). The 2012 corn yield showed the least and the highest yield for 75 and 96 day corn, respectively. Since 2012 was severely hit by drought, the numbers did not reflect yields as a normal year; thus data was presented in this report. This is ongoing research and data from subsequent trials may further highlight the possibility of growing earlier maturity corn in order to plant rye as biomass/forage crop.

CONCLUSIONS

Results from the above studies show that there appears to be potential for growing winter rye as a cover or biomass/forage crop after corn and ahead of soybeans within corn-soybean rotation systems. However, growing cover crops largely depends on the available moisture. Under low moisture conditions, there will be a negative influence on soybean yield unless the rye is sprayed out early.

Table 1. Soybean yields following rye cover crop at Crooks and Beresford, SD. Yields were not statistically different within location. Rye biomass data was available for only Beresford location.

Treatment	Rye Biomass	Soybeans Yield
	(lb/ac)	(bu/ac)
Crooks, SD		
Rye Cover crop	-	64.9
Control- no rye	-	66.2
Grand Mean		65.6
CV (%)		1.6
LSD (0.05)		NS
Beresford, SD		
Rye Cover crop	3076	47.5
Control- no rye	-	50
Grand Mean		48.96
CV (%)		0.21
LSD (0.05)		1.22

Table 2. Soybean yields and populations following winter rye, spring mustard and spring oat cover crops at Beresford, SD. Yield and population were not significantly different for the tested treatments. Biomass data was only measured for winter rye.

Treatment	Rye Biomass	Soybeans Yield	Soybeans Population
	(lb/ac)	(bu/ac)	(plants/ac)
Rye (winter)	2236	42.6	117128
Mustard (spring)	-	42.7	150040
Oat (spring)	-	46.9	119064
Control (no cover crop)	-	46.6	122936
Grand Mean		45.4	130680
CV (%)		9.4	17.2
LSD (0.05)		NS	NS

Table 3. Soybean yield following winter rye planted with two methods (i.e. Broadcast and Drilled) within different relative maturity corn (i.e. 75, 85, 96, and 105 day) at Beresford, SD.

Corn Relative Maturity (2012)	Rye Planting Method	Rye Biomass (2013)	Soybeans Yield (2013)
		(lb/ac)	(bu/ac)
105	Broadcast	2892	47.4
105	Drilled	3267	46.3
75	Broadcast	3823	45.8
75	Drilled	4100	45.7
85	Broadcast	3017	46.1
85	Drilled	2850	45.4
96	Broadcast	3141	44.6
96	Drilled	3091	44.9
105	Control	-	46.6
75	Control	-	45.9
85	Control	-	46.0
96	Control	-	46.3
Grand Mean		3273	45.7
CV		25.04	2.99
LSD(0.05)		NS	NS

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High-Input Corn Trial

Peter Sexton*, Garold Williamson,
Doug Johnson, and Brad Rops

INTRODUCTION

Although it appears to be short-lived, the past few years have seen high corn prices which in turn have lead to a strong interest among farmers to look at means of maximizing corn yields as a way to improve profits. There is interest in evaluating use of fertilizer, fungicide and insecticide treatments applied in-furrow, as well as foliar application of Zn and extra N and P at side-dressing. Narrower row spacing and increased plant population are also points of interest for evaluation. Accordingly, a trial was set up at the Southeast Farm to look at these treatments of interest, both applied individually and when applied all together, for their effect on corn yield. Narrower row spacing was evaluated by comparing twin rows (22.5" inter-row space) to single rows on 30" centers.

METHODS

The trial was planted on May 18, 2013 using the farm's new Monosem planter. The planting date was later than desired because the planter was engaged in off-station research work in early May (we received rain in early May and a decision was taken to move the planter to Parkston and Tripp to plant variable-line trials there). When the planter came back to Beresford, the trial was planted in 15 foot strips (6 row) 115 feet in length. Plots were laid out in a randomized complete block design with four replications. The previous crop was oats underseeded with a sweet clover/red clover mix.

Treatments were as follows:

1. Control (34,000 seeds per acre)
2. 10-34-0 (7.5 gal/ac)
3. 10-34-0 + Headline + Capture (7 oz/ac each)
4. 10-34-0 + Headline + Capture + Ascend (5 oz/ac)
5. 40,000 seeds per acre
6. Twin Row
7. Twin Row + 40,000 seeds per acre
8. *Additional N&P at side-dress (35 and 20 lb/ac N & P2O5)*
9. Foliar Zn (applied at V8 stage, 0.25 lb/ac Zn)
10. Foliar Fungicide (Quilt applied at V8 stage, 12 oz/ac)
11. ***Everything twin row***
12. ***Everything single row***

Unless otherwise stated, all plots were planted at a seed rate of 34,000 seeds per acre. The Headline, Capture, and Ascend treatments were applied at 7, 7, and 5 oz/ac, respectively.

Whole plot yields were end-trimmed (15' off each end) and the four middle rows were harvested for yield determination using a

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Kincaid Model 2065 plot combine. A grain sample was taken for measurement of moisture, test weight, and 100-seed weight. Plant stands were determined after harvest from 6' counts taken at three points in each plot.

RESULTS AND DISCUSSION

There were no significant treatment effects on corn yield in this study. There were a few trends of interest however. First, treatments with high population (40,000 seeds per acre) tended to show up at the bottom of the yield table (Table 1), as did those receiving foliar Zn. Other work done on the research farm in 2013 looking at corn seeding rates indicated that peak yield this season occurred around 29,000 to 30,000 seeds per acre. The 40,000 seeds per acre planting rate showed up in four out of the five lowest yielding treatments in this study. It is interesting to note that at the high seed rate, final plant stands were significantly greater in twin rows than in single rows across equivalent treatments (e.g. "everything twin row" had a plant stand of 38,720 plants vs. 35,816 plants per acre for "everything single row"). This suggests that seedling survival under high populations is greater with twin rows than with single rows.

Average yields in the twin row plots at 34,000 seeds per acre were numerically 3 bushels per acre more than the control plots – this difference, though not statistically significant, was similar to the numeric yield difference of 3 bushels per acre observed in another trial on the farm in 2013 comparing twin (average of 156 bu/ac) versus single rows (average of 153 bu/ac) across a range of seed rates.

A second trend of interest in this study is that all three of the numerically top yielding treatments received an application 10-34-0 in furrow. The "everything twin row" and "everything single row" also received 10-34-0 in furrow; however, these latter two treatments had a high seed rate (40,000 seeds per acre) which tended to be associated with the lower yielding plots in the trial.

Given the lack of statistically significant differences in this trial, it is somewhat speculative to try and draw conclusions out of the data. Nevertheless, it looks like plant population and use of 10-34-0 in furrow may be points that merit further work. Also, next season, if possible, it would be good to include an irrigation treatment, or conduct the trial at an irrigated site, so that treatment effects can be measured in a high yield potential environment.

Table 1. Corn yield, test weight, 100-seed weight, and population in response to a number of crop inputs in the 2013 season at the Southeast Research Farm.

Treatment	**Yield**	**Test Wt.**	**100-Seed Wt.**	**Population**
	(bu/ac)	(lb/bu)	(g)	(plants/ac)
10-34-0 + Headline + Capture + Ascend	173	57.9	31.5	32670
10-34-0 (7.5 gal/ac)	171	58.3	32.4	30492
10-34-0 + Headline + Capture	170	58.3	32.8	32670
Twin row	169	58.4	32.3	30734
Control (34,000 seeds per acre)	166	58.1	32.9	32428
Foliar Fungicide (Quilt)	166	58.4	31.4	33396
Additional N&P at side-dress	166	58.2	31.6	34122
Everything single row	165	58.2	31.2	35816
40,000 seeds per acre	163	56.3	31.4	34848
Everything twin row	162	58.2	30.5	38720
Foliar Zn	161	58.3	31.3	31460
Twin Row + 40,000 seeds per acre	157	58.2	30.2	37994
Mean	*165.6*	*58.1*	*31.6*	*33779*
CV (%)	*6.2*	*2.1*	*5.4*	*5.8*
LSD (0.05)	*NS*	*NS*	*NS*	*2826*

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Short-term Comparison of Strip-Till, No-Till and Conventional Till Corn

Peter Sexton* and Brad Rops

INTRODUCTION

No-till crop production has the advantage of leaving residue on the surface which protects it from erosion and helps to conserve moisture in the heat of the summer. On the other hand, no-till soils tend to be cooler in the spring which slows down early-season growth of corn. Strip tillage is an attempt to compromise between no-till and conventional tillage, with most of the soil covered by residue but the area over the seed bed worked up so the soil warms up quicker in the spring than a no-till system would. In the fall of 2012 the Southeast Farm was given a Brillion Zone Commander strip tillage unit, so it was decided to initiate a small experiment looking at strip tillage to see how it would do and to gain experience with the unit.

METHODS

Plots were laid out in a randomized complete block design with three replications. Plots were 30 feet (12 rows) wide and 330 feet in length. The previous crop was oats harvested for seed. Tillage treatments were imposed as follows: conventional tillage (fall chisel plow followed by field cultivating in the spring); strip-till (Brillion Zone Commander) done in the fall; no-till. Corn was seeded in the spring on May 7, 2013. Plot yields were determined in the fall with the use of a weigh wagon to measure yield from the middle six rows of each plot. A sample of the grain was taken for determination of percent moisture, test weight, and 100-seed weight.

RESULTS

The strip till and no-till plots did not differ in yield from each other, but the yield in the conventional till plots was 8 to 9 bu/ac lower than the strip till and no-till treatments in this trial ($P<0.10$) (Table 1). This is the first season these treatments were imposed, so results should be interpreted with caution. The most likely cause of this would be cooler soil temperatures and more soil moisture availability during seed-filling, but that is speculative at this point.

Table 1. Test weight, 100-seed weight, yield, and population for corn grown under conventional tillage, strip till, and no-till in the 2013 season. This is the first season these treatments were imposed in this field, so results should be interpreted with some caution.

Treatment	**Test Wt.** (lb/bu)	**100-Seed Wt.** (g)	**Yield** (bu/ac)	**Population** (plants/ac)
Strip-Till	57.8	35.9	201	28717
No-Till	57.3	36.6	200	27104
Conventional Till	57.2	35.9	192	24845
Mean	*57.4*	*36.1*	*197.6*	*26889*
CV (%)	*0.3*	*2.6*	*1.6*	*9.8*
LSD (0.10)	*0.3*	*NS*	*5.5*	*NS*

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Comparison of Corn Yield in Twin Row versus Single Rows across a Range of Populations

Peter Sexton* and Garold Williamson

INTRODUCTION

There is interest among farmers in evaluating potential yield benefits from planting corn in twin versus single rows. The Southeast Farm acquired a Monosem twin row planter for the purpose of working with Raven Industries to develop and test a multi-hybrid row crop planter. One of the benefits of this is that we can use also the same planter to look at planting corn in twin versus single rows. Plant population is an important variable to consider in evaluating the yield response of twin versus single rows for corn. Therefore, a large plot trial was established at the Southeast Farm to compare corn yield with twin versus single rows across a range of plant populations.

METHODS

Corn was planted in twin rows and in single rows at seed rates of 16,000; 22,000; 28,000, 34,000; and 40,000 seeds per acre. The row width was 30". The twin row units were 7.5" apart; therefore in the twin-row configuration the inter-row space was 22.5". It should be noted that in converting this planter into a multi-hybrid planter capable of switching between lines on the go, each row unit was set up with its own hydraulic drive and so we lost the ability to stagger the seed drop between the two rows.

Plots were 25 feet (10 rows) wide and 400' in length, laid out in a split plot design with three replications. Row configuration was the main plot, and seed rates were the sub-plots. With the Raven Omni-Star planting system, plot width did not have to match planter width. The first replication was planted on the May 7 - during planting it started to rain and planting was stopped after the first replication was completed. Because the planter had to be used in off-station research, we did not get back to finish the last two replications in this field until May 20. No statistical interaction was found between treatments and replications, so the data of all three replications was analyzed together. At harvest the inner six rows were harvested (leaving two-rows of border on each side of the plot), weighed in a weigh wagon, and a grain sample was taken for determination of percent moisture, test weight, and 100-seed weight. Stand counts were taken after harvest from 6 feet of row at three different places in each plot.

RESULTS AND DISCUSSION

The planter performed well and final stand counts reflected intended seed rates quite well (Fig. 1). Yield response to seed rate for single and twin rows is shown in Figure 2. The

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response to seed rate was remarkably similar for the two different planting configurations. The peak yield was predicted to occur at 29,450 seeds per acre with single rows, and at 29,520 seeds per acre with twin rows. Assuming a value of $4.00 per bushel for corn and a cost of $300 a bag for seed, the economic optimum seed rate in this study would have been 26,180 seeds per acre for single rows, and 26,060 seeds per acre with twin rows.

The average yield across seed rates was 153 bushels per acre for single rows, and 156 bushels per acre for twin rows; however, the difference in yield between the row configurations was not statistically significant (P=0.18). One might expect that seasons with a late planting date or with warmer weather in June and July might affect yield response to row configuration. For this reason, this trial should be repeated to see how results vary over time. Also, to be

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thorough, it would be good to evaluate planting in 22" rows as well as twin rows, as this would be a cheaper alternative and might provide the same outcome as using twin rows.

SUMMARY

Twin and single row configurations were evaluated across a range of populations in a large plot study at the SDSU Southeast Research Farm in 2013. Corn yield response to seed rate was similar across the different row configurations showing a peak yield at a seed rate of approximately 29,500 seeds per acre. There was a trend for twin rows to yield about 3 bushels more per acre over single rows in this study. This trial should be repeated in future seasons in order to see how results vary in different environments.

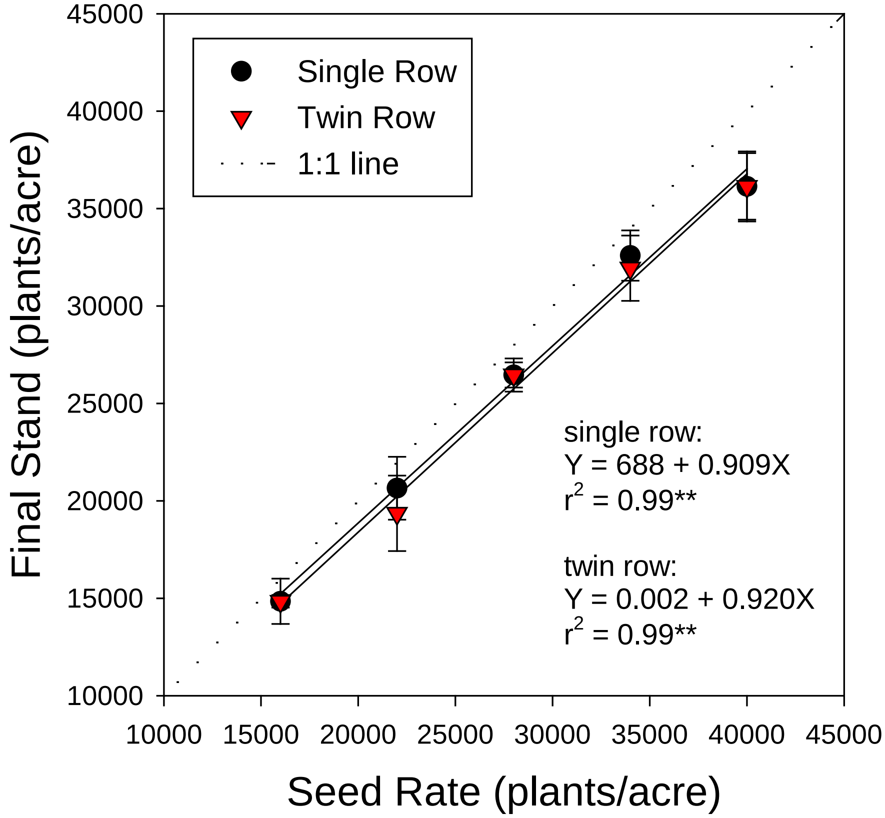

Fig. 1. Plant stand at harvest plotted against seed rate for a large plot study comparing single and twin row configurations for corn production at the SDSU Southeast Research Farm in 2013.

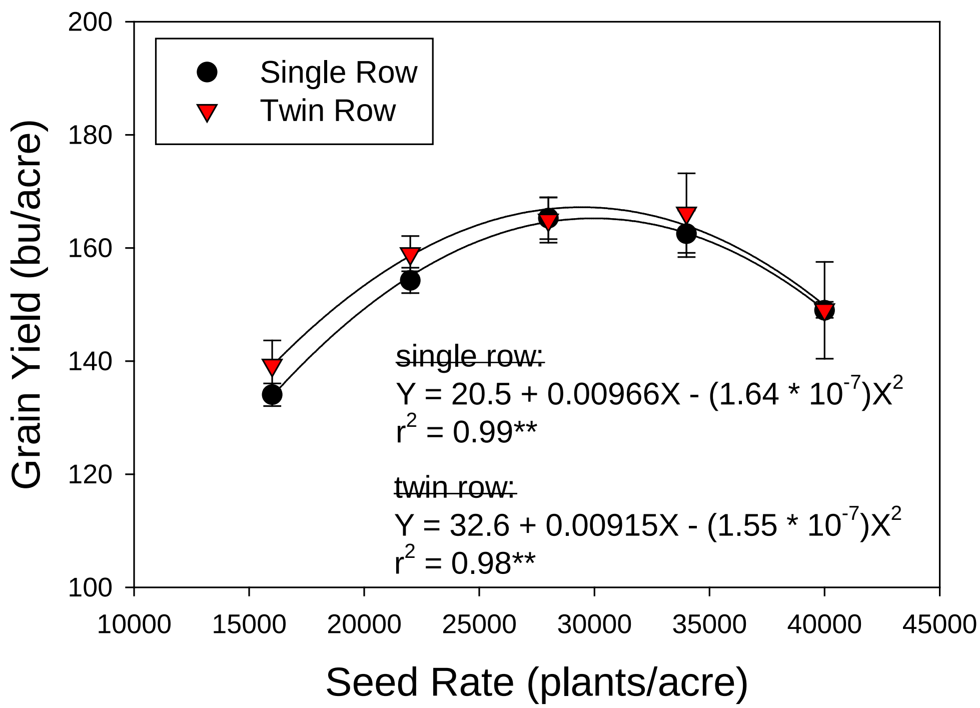

Fig. 2. Grain yield response to seed rate for 'P0533AM1' grown in single and twin row configurations at the SDSU Southeast Research Farm in 2013. The estimated peak yield occurred at 29,450 seeds per acre in single rows and at 29,520 seeds per acre in twin rows. The estimated economic optimum was closer to 26,180 seeds per acre for single rows, and 26,100 seeds per acre for twin rows.

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Observation on Corn Maturity and Yield in the 2013 Season

Peter Sexton[1] and Cory Smith

INTRODUCTION

As part of a project looking at winter rye productivity when grown after corn, four corn hybrids of differing maturities were planted in a trial at the Southeast Farm so that we could compare different planting dates for the following rye biomass/forage crop. The goal of this effort is to gather data on relative loss in corn yield versus the gain in rye biomass production, in planting an earlier maturing corn line.

METHODS

The corn hybrids were planted on May 16, 2013 in strips 45 feet wide (18 rows) by 150 feet in length in a randomized complete block design with four replications. The lines were 74, 86, 96, and 105 days relative maturity. At the end of two of the blocks was a plot of 111 days relative maturity corn – this data is presented in some of the analysis as a further point of reference. Whole plot yields were determined from yield monitor data and grain samples were taken for determination of grain moisture, test weight, and 100-seed weight. Harvest dates for the 74, 86, 96, and 105 day lines were Sept 17, Sept 25, Sept 27, and Oct. 7, respectively. All yield data was adjust to 15.5 % moisture.

RESULTS AND DISCUSSION

Among the hybrids tested, there was a trend for yield to increase by about 2 bushels per acre with each day increase in relative maturity going from 75 to 95 days relative maturity (Table 1). Plotting yield versus relative maturity, the yield curve of the trend line peaked at a relative maturity rating of 109 days; although numerically the 105 day lines showed the peak yield (Fig. 1). This is similar to results from the 2012 season, where the trend line peaked at 105 day relative maturity. The observations from both the 2012 and 2013 seasons suggest that yields drop fairly steeply at relative maturities less than 100 days in our environment.

Each of these plots was split into thirds, with one being broadcast seeded to rye near dent stage, one-third direct seeded to rye after corn harvest, and the remaining third left with no rye. Data will be taken on rye biomass production from each plot, and the field will be planted to soybeans in the spring of 2014.

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Table 1. Final stand count, yield, test weight and 100-seed weight for four corn hybrids differing in relative maturity planted in a trial at the SDSU Southeast Research Farm in 2013.

Hybrid	Corn Relative Maturity	Population	Yield	Test Wt.	100 Seed Wt.
	(d)	(plants/ac)	(bu/ac)	(lb/bu)	(g)
P7443R	74	25410	129	57.1	29.8
DK636	86	28798	148	57.1	30.4
DK646	96	25894	172	56.7	36.1
P0533XR	105	26781	179	57.8	34.0
Mean		26716	155.6	57.1	32.5
CV (%)		4.3	3.6	0.8	4.3
LSD (0.05)		2500	10.5	NS	2.7

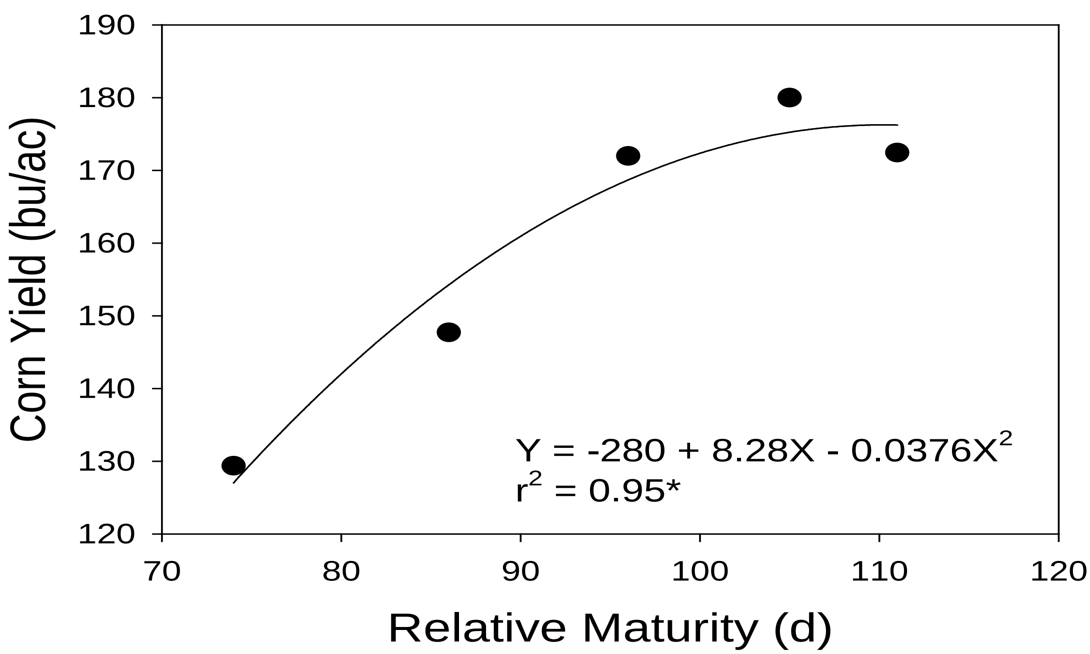

Fig. 1. Yield of five corn hybrids plotted against their relative maturity rating. This data is from a study conducted at the SDSU Southeast Research Farm in 2013. Each point is the average yield from a given hybrid. There were only two plots of the 111 day hybrid. The peak of the trend line for this particular set of hybrids occurs at 109 days relative maturity, though numerically the highest yielding maturity was the 105 day line.

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South Dakota State University, Brookings, SD 57007
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Soybean Seeding Rate and Seed Treatment Trial – 2013 Season

Peter Sexton[*] and Doug Johnson

INTRODUCTION

Soybeans possess a strong ability to branch and fill in weak spots in the stand. Given good weed control, there may be scope to lower seed rates and maintain yield potential. On the other hand, the question is also raised as to whether soybean yields might be improved by pushing up population. In order to evaluate these questions a seeding rate by seed treatment study was conducted at the Southeast Research Farm with seed rates ranging from 40,000 to 200,000 seeds per acre.

METHODS

The soybean line NK S30-E9 was seeded in 30" rows on May 30 at seeding rates of 40,000; 80,000; 120,000; 160,000; and 200,000 seeds per acre in a randomized complete block design with four replications. Plot size was four rows by 25' in length. Each seeding rate was tested with and without a seed treatment (CMX+Vibrance), to make a total of 10 treatments tested (5 seeding rates, +/- seed treatment). At maturity plots were end-trimmed 2.5 feet off each end and combined with a Hege small-plot combine.

RESULTS AND DISCUSSION

Plant stands at the end of the season reflected intended seeding rates (Fig. 1). Seed treatment showed a significant benefit on plant stand, increasing stand on average by about 8,000 plants per acre at harvest. Seed treatment did not show a statistically signficant effect on grain yield in this study; although, it did show a trend to be beneficial at low plant stands (Fig. 2). Looking at yield response to seed rate, in this study there was no benefit to increasing seed rate beyond 120,000 seeds per acre – which produced a final stand of about 100,000 plants per acre. These results suggest that a seed rate of 120,000 seeds per acre would not limit yield in our environment.

One additional factor to consider with this question is weed pressure. In this trial we had good weed control and the soybeans didn't have to compete with any unwanted neighbors. Where escaped weeds or herbicide resistant weeds are a potential concern, going with a low seed rate may exacerbate weed control problems.

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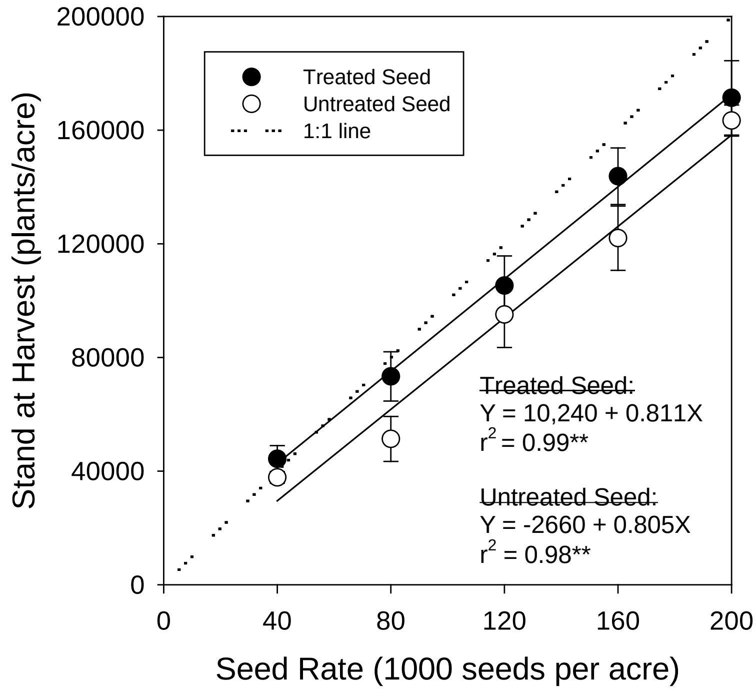

Fig. 1. Plant stand at maturity versus seeding rate from a trial conducted at the SDSU Southeast Research Farm in 2012. Vertical bars represent the standard error of the mean for each point. The dashed line is a 1:1 line showing what the stand would be if every seed made a plant. Seed treatment showed a significant positive effect on stand with an average stand of 104,238 plants per acre with the use of treated seed versus 96,138 plants per acre with the use of untreated seed.

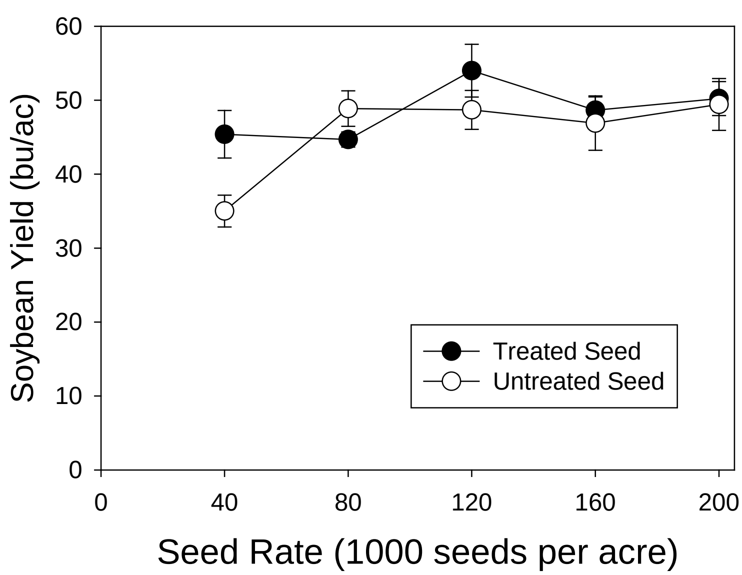

Fig. 2. Soybean yield versus seeding rate in the 2013 season from a trial conducted at the SDSU Southeast Research Farm. Vertical bars represent the standard error of the mean for each point. There were no significant effects of seed treatment in this study. The average yield across seeding rates for the treated seed was 48.5 bu/ac, and for untreated seed it was 45.6 bu/ac.

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Long-Term Rotation Study: Observations on Corn and Soybean Yields

Peter Sexton*, Brad Rops, Ruth Stevens, Doug Johnson, Garold Williamson, and Colton Buus.

INTRODUCTION

In 1991 Dale Sorensen initiated a long-term rotation study at the Southeast Farm including comparison of no-till and conventional till under two year (corn-soybean), three year (corn-soybean-small grain) and four year rotations (currently corn-oat-winter wheat-soybean – this rotation has not been constant over the years). The advantages of no-till are many: residue on the surface protects the soil from erosion; it helps to maintain soil organic matter which is important for good tilth; conserves moisture and limits run-off; and requires fewer trips across the field. The disadvantages are the loss of tillage as a tool for weed control and slower warming of the soil in the spring. This report provides a brief overview of how the corn and soybean crops yielded under tilled, and no-till, management this past season in the Southeast Farm's long-term rotation study.

METHODS

As mentioned earlier, this set of plots was first established in 1991. The corn-soybean and corn-soybean-small grain rotation have been consistently followed. The four year rotation initially included alfalfa, then after some years was changed to include peas, and lastly was changed again to include two soybean crops (corn-soybean-winter wheat-soybean), which was the case this last season (2012). Therefore when the data presented here refers to a four-year rotation, it doesn't mean that a fixed set of crops has been grown in a four-year sequence; it means that corn has been grown once every four years and the other crops in the rotation have varied over the years based on the researcher's interest and judgment at the time. At this point, the four-year rotation is in a corn-oat-winter wheat-soybean sequence.

This trial is laid out in a randomized complete block design with four replications. Plot size is 60 by 300 feet. Corn 'DKC58-83' was planted on May 14, 2013 in 30" rows at a population of 28,900 seeds per acre. Soybeans 'AG2031' were planted on May 31, 2013 in 30" rows at a population of 152,480 seeds per acre. Fertilizer MAP+Zinc (9-43-0 lb/ac NPK + 10.2 lb/ac Zn) was applied on March 19, 2013 to all corn and soybean treatments. Urea (92 lb/ac N) was applied April 16, 2013 to corn treatments and corn was sidedressed with 28% (14 gpa, or 42 lb/ac N) on June 28, 2013,

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Yield was measured from the center 30' of corn plots and from the center 20' of soybean plots, running the whole length of the plot; this was combined and the weight determined with a weigh wagon. A sample was kept for determination of moisture and test weight. Stand counts were taken after harvest in each plot from 6 feet of row at three places within each plot. Data was analyzed for main effects of rotation and tillage on yield using Proc GLM in SAS statistical software (note the strip till treatment was not included in analysis of main effects as it would make the data unbalanced). With the exception of soybean test weight (lb/bushel), there were no significant rotation by tillage interactions in the 2013 data from this study. For ease of presentation, the data was also analyzed as a simple randomized complete block design with each combination treated as an individual treatment and an LSD value obtained for comparing individual means that may be of interest to the reader.

RESULTS AND DISCUSSION

The overall average yield for the corn plots in the rotation trial was 202 bushels per acre (Table 1). There were no significant effects of rotation or tillage on seed yield for either crop within this study for the 2013 season. The average yield across rotations for the no-till and conventional tilled plots was remarkably similar (201 and 202 bushels/ac, respectively). There was a trend for yields to respond and increase with rotation length in the no-till plots, but there was no apparent response to rotation in the tilled plots.

Soybean yields averaged 57 bushels per acre in this study and did not show much variation between treatments (Table 2). Unlike corn, there was not even a trend for increased yield with increased rotation length in this year's data.

In 2012 when there was a severe drought, there were strong treatment effects on yield, with greater yields observed under no-till management and with longer rotations. In 2013, conditions seem to have been good enough that all treatments performed well.

Table 1. Corn yield data from the 2013 season in a long term tillage by rotation study conducted at the SDSU Southeast Research Farm. Tillage treatments are abbreviated as follows: "CT" = conventional tillage; "NT" = no-till; "ST" = strip till. The conventional and no-till treatments were initiated in 1991. The strip till treatment was initiated in the fall of 2012. There were no significant tillage by rotation interactions in this data set.

Tillage Regime	Rotation	Yield	Moisture	Test Wt.	100-Seed Wt.	Population
		(bu/ac)	(%)	(lb/bu)	(g)	(plants/ac)
Individual Treatments:						
CT	corn-soy	204	18.9	57.5	33.3	26136
CT	corn-soy-wheat	196	18.5	57.3	31.6	26862
CT	4-year	205	19.2	57.0	32.8	26862
NT	corn-soy	190	19.0	56.4	31.7	25168
NT	corn-soy-wheat	199	19.8	56.2	31.6	28072
NT	4-year	213	21.2	55.6	32.4	28072
ST	corn-soy	211	19.7	57.2	32.4	26378
Mean		*202.5*	*19.5*	*56.7*	*32.2*	*26793*
CV (%)		*6.8*	*4.0*	*0.7*	*4.5*	*6.9*
LSD (0.05)		*NS*	*1.2*	*0.6*	*NS*	*NS*
Tillage Main Effect:						
CT	all	202.0	18.8	57.3	32.5	26620
NT	all	201.0	20.0	56.0	31.9	27104
P-value		*NS*	*	*	*NS*	*NS*
Rotation Main Effect:						
CT & NT	corn-soy	197	18.9	57	32.5	25650
CT & NT	corn-soy-wheat	197	19.1	56.7	31.6	27470
CT & NT	4-year	209	20.2	56.3	32.6	27470
LSD (0.05)		*NS*	*0.8*	*0.5*	*NS*	*NS*

Table 2. Soybean yield data from the 2013 season in a long term tillage by rotation study conducted at the SDSU Southeast Research Farm. Tillage treatments are abbreviated as follows: "CT" = conventional tillage; "NT" = no-till; "ST" = strip till. The conventional and no-till treatments were initiated in 1991. The strip till treatment was initiated in the fall of 2012. The only significant tillage by rotation interaction in this data set was for soybean test weight.

Tillage Regime	Rotation	Yield	Moisture	Test Wt.	100-Seed Wt.	Population
		(bu/ac)	(%)	(lb/bu)	(g)	(plants/ac)
Individual Treatments:						
CT	corn-soy	58.4	11.6	56.6	18.8	67034
CT	corn-soy-wheat	57.1	11.5	57.3	17.9	68002
CT	4-year	55.3	11.5	56.5	18.6	80102
NT	corn-soy	57.8	11.7	57.1	17.6	85184
NT	corn-soy-wheat	59.1	11.5	56.7	18.0	74052
NT	4-year	56.8	11.8	56.6	17.9	72842
ST	corn-soy	56.7	11.4	57.0	16.3	85910
Mean		*57.3*	*11.6*	*56.8*	*17.9*	*76160*
CV (%)		*8.0*	*4.8*	*0.6*	*4.8*	*18.0*
LSD (0.05)		*NS*	*NS*	*0.5*	*1.3*	*NS*
Tillage Main Effect:						
CT	all	56.9	11.5	56.8	18.4	71710
NT	all	57.9	11.6	56.8	17.8	77360
P-value		*NS*	*NS*	*NS* 1/	*NS*	*NS*
Rotation Main Effect:						
CT & NT	corn-soy	58.1	11.7	56.9	18.2	76110
CT & NT	corn-soy-wheat	58.1	11.5	57.0	18.0	71030
CT & NT	4-year	56.0	11.6	56.5	18.3	76470
LSD (0.05)		*NS*	*NS*	*NS* 1/	*NS*	*NS*

1/ note: there was significant rotation by tillage interaction observed for soybean test weight, so this data should be interpreted accordingly.

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On-Farm Soybean P Studies

Nathan Mueller*, Ron Gelderman,
and Peter Sexton

INTRODUCTION

As part of a larger study conducted across eastern South Dakota, three on-farm trials were conducted to look at soybean yield response to P. Many farmers follow the practice of applying extra P to their corn crop as MAP and then not applying P to the following soybean crop. This trial was undertaken to see if there might be a benefit to applying some P directly to the soybean crop.

METHODS

Small plot trials were established in farmer's fields at Wagner, Tripp, and Freeman, South Dakota. Initial Olsen P levels in the soil were 21, 8, and 15.5 ppm , respectively, at the three sites. Plots were 10 by 30 feet in size and were laid out in a randomized complete block design with four replications at each site. Yields were determined at maturity with a Hege small plot combine.

RESULTS

There was no response to applied P in these on-farm studies (Fig. 1). Two of the sites had high initial soil P levels (> 12 ppm Olsen P), while the third one had medium levels of Olsen P (8 to 11 ppm), so these results were not totally unexpected. Measured yields in these plots were lower than expected. This is only the first year of a multi-year study to look at soybean response to P, and includes tracking leaf P levels in order to develop a data base for calibrating soil and plant tissue testing analysis to help guide P fertilization practices in the future.

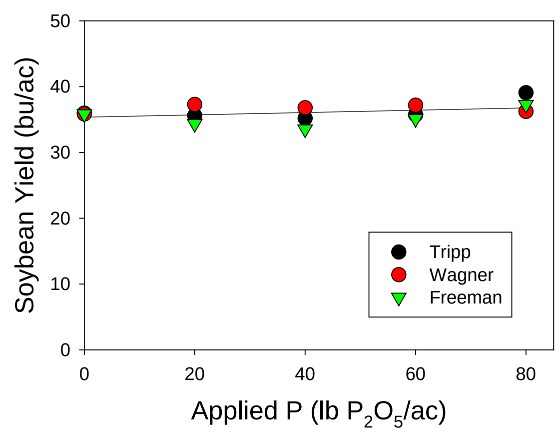

Fig. 1. Soybean yield response to applied P from three on-farm studies conducted in Southeastern South Dakota in 2013.

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Soybean High-Input Study

Peter Sexton* and Brad Rops

INTRODUCTION

There is strong interest among farmers on how to improve soybean yields, particularly when commodity prices are high. In this vein, it was decided to try a number of products of interest to see what impact they might have on soybean yield.

METHODS

The trial was planted on May 31, 2013 using Pioneer ‘92Y70’ soybeans planted to a depth of 1.5” at the Southeast Research Farm using a Monosem twin-row planter. The previous crop was corn. The treatments evaluated are listed in Table 1. Plots were 15 feet (6 rows) wide by 95 feet in length and were laid out in a randomized complete block design with four replications. Plots were end trimmed 10’ at harvest, and the middle four rows of each plot were combined for whole plot yield. A grain sample was taken for measurement grain moisture, test weight, and 100-seed weight. Plant height data was taken from the plot borders rows after harvest. Plant stands were measured after harvest with counts taken over 6 feet of row at three places in each plot. Data were analyzed with standard ANOVA using the Proc GLM routine in SAS statistical software.

In a related study at the Southeast Farm, soybeans were seeded in alternating 30’ wide strips either in 30” rows or drilled in 7.5” rows in a no-till environment. The 30” rows were seeded at a rate of 152,000 seeds per acre, and the drilled beans were seeded at a rate of 195,000 seeds per acre, following common production practices. This was replicated 7 times, and plots were 300 feet long. A 10 foot wide strip was harvested from each plot for a measurement of seed yield. Counts of plant stands (6 feet of row counted at three different places in the plot) were taken after harvest.

RESULTS

At the end of the study, there were no significant differences in yield between the treatments tested. All the treatments evaluated were within 2.5 bushels of the control (150,000 seeds per acre, single rows, no extra inputs). There was a trend for treatments that received foliar fungicide to show slightly greater yield than the control - all three of the treatments that were numerically greater than the control had received a foliar fungicide application; however, the difference was not statistically significant and even the numeric difference was less than 3 bushels per acre. Weed control was excellent in this field, so weed interference was not a factor in the trial. As for the seed rate, a nearby trial looking at seed rates this season failed to show any benefit to increasing seed rate beyond 120,000 seeds per acre. So the seed rate of 180,000 seeds per acre was greater than what was needed. The other materials tested must not have addressed limiting factors in this particular

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season at the Southeast Farm. Next season, if possible, it would be good to include an irrigation treatment, or include an irrigated site in the trial, so that treatment effects can be measured in an environment where moisture stress is not a factor.

In the study looking at 30” versus drilled rows, as would be expected from their higher seed rate, plant population at harvest was much higher in the drilled plots than in the plots with 30” rows (178,670 plants per acre in the drilled plots, and 98460 in 30” rows). However, grain yield was similar at 56.7 bu/ac in the drilled plots and 53.9 bu/ac in the 30” rows. There was a trend for higher yields with drilled beans, but it was not statistically significant (P > 0.10).

Table 1. Treatments imposed for the high-input soybean study conducted at the Southeast Farm in 2013. The 10-34-0 applied in-furrow was mixed 50:50 with water before application (total volume of 5 gal/ac).

Treatment Name	**Seed Rate**	**Rows**	**10-34-0 in-furrow (gal/ac)**	**Headline + Capture in-furrow**	**Quilt Fungicide at R3 Stage**	**Foliar Zn at R1 (lb/ac)**
Control - 150,000 sd/ac	150000	single	----	----	----	----
180,000 seed/ac	180000	single	----	----	----	----
180,000 plus 10-34-0	180000	single	2.5	----	----	----
180,000 plus Headline+Capture w/10-34-0	180000	single	2.5	7 oz/ac each	----	----
180,000+in-furrow+foliar fungicide	180000	single	2.5	7 oz/ac each	20 oz/ac	----
180,000+in-furrow+foliar Zn	180000	single	2.5	7 oz/ac each	----	0.25
180,000 plus everything	180000	single	2.5	7 oz/ac each	20 oz/ac	0.25
Twin row - 180,000	180000	twin	----	----	----	----
Twin row 180,000 plus Headline+Capture w/10-34-0	180000	twin	2.5	7 oz/ac each	----	----
Twin row - 180,000+in-furrow+foliar fungicide	180000	twin	2.5	7 oz/ac each	20 oz/ac	----
Twin row - 180,000 plus everything	180000	twin	2.5	7 oz/ac each	20 oz/ac	0.25

Table 2. Plant height, population at harvest, test weight, 100-seed weight, and yield for soybeans grown with a number of inputs to try and improve yields at the Southeast Farm in 2013.

Treatment	**Height**	**Population**	**Test Wt.**	**100-Seed Wt.**	**Yield**
	(in)	(plants/ac)	(lb/bu)	(g)	(bu/ac)
180,000+in-furrow+foliar fungicide	38.8	104181	57.8	15.5	54.5
Twin row - 180,000+in-furrow+foliar fungicide	39.8	99099	57.4	15.7	54.2
180,000 plus everything	39.0	95832	57.5	16.2	53.9
Control - 150,000 sd/ac	38.0	91113	57.4	15.4	52.3
Twin row 180,000; Headline+Capture w/10-34-0	38.8	104544	57.9	15.0	51.8
180,000 plus Headline+Capture w/10-34-0	40.0	98736	58.1	15.2	51.8
180,000+in-furrow+foliar Zn	38.8	98010	57.4	14.6	51.7
180,000 seed/ac	38.8	92928	57.3	15.3	51.4
Twin row - 180,000 plus everything	39.0	99462	56.9	15.3	51.4
180,000 plus 10-34-0	38.8	96558	58.2	15.2	51.4
Twin row - 180,000	38.5	107448	56.9	14.7	50.3
Mean	*38.9*	*98901*	*57.5*	*15.3*	*52.2*
CV (%)	*2.7*	*11.2*	*1.4*	*3.4*	*5.9*
LSD (0.05)	*NS*	*NS*	*NS*	*0.7*	*NS*

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Winter Wheat Seed Treated Field Trial

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Agronomy Field Specialist

A winter wheat seed treatment field trial was established at the Southeast Farm in the fall of 2012 to look at biological agents on seed. Due to dry conditions in the fall of 2012 most of the seed did not emerge before freezing temperatures. In the spring of 2013, a very poor stand developed, and was a couple weeks behind other winter wheat in the area. This was true for all plots that were planted with the variety Art. With the cool conditions in May and June the wheat tillered extremely well to the point the stand was close to normal, but delayed. The stand was not even creating large variability in yield from plot to plot and ended up showing no significant differences between treatments. In farm conditions, the poor early stand would have most likely been rotated to another crop. The trial averaged 51 bu/ac/

Winter Wheat Biological Treatments for Scab Control

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A field trial was established to look at control of scab in winter wheat. The treatments were applied in three stages of development. The trial did not have a large scab problem even though conditions were favorable for scab development. Head emergence was variable due to the extended tillering period. All treatments with a chemical fungicide treatment out yielded other treatments significantly. The LSD at .05 was 5.22 bushel, which is more than enough to pay for the chemical treatment. The biological treatments were not significantly better than the check when used alone. However, when used in combination with a chemical treatment they were better than the check and produced the highest yield over all at 67.5 bu/ac; compared to the check at 50.8 bu/ac. The chemical treatment alone produced a yield of 66 bu/ac. More research is needed to determine if the biological treatments can significantly improve yields over the check, or if they need to be used in combination with other chemicals.

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Soybean Seeding Rate Study: Seeding Rate Recommendations for 8" and 30" Row Spacing in South Dakota

Nathan Mueller[*], Kevin Kirby, and Shawn Hawks*

INTRODUCTION

The recommended seeding rate for drilled soybeans is generally higher than when soybeans are seeded with a planter. Additionally, we wanted to know if variety selection based on maturity had any interaction with the recommended seeding rate within each seeding option, 8-inch drilled versus 30-inch planted soybean. As a result, a study was initiated in 2009 by Robert Hall, former Extension Agronomist at three locations in South Dakota including Brown County, Brookings County, and Clay County. The results in this report will be for the location in Clay County at the Southeast Research Farm during the 2013 growing season.

METHODS

The study was arranged as two-factor factorial arrangement in a randomized complete block design with four replications. The first factor was six seeding rates (75, 100, 125, 150, 175, and 200K in the 8-inch row drilled study and 50, 75, 100, 125, 150, and 175K in the 30-inch planted study) and the other was two soybean maturity groups (Group I and Group II). Asgrow 1431 and Asgrow 2031 were selected for use in this study for the 2013 cropping season. The study was no-till planted on June 14 into cornstalks. Plot size for the 8-inch drilled study was six rows centered on 5 ft increments and 18 ft long whereas the 30-inch planted study consisted for 4 rows or 10 ft wide and 18 ft long. The entire 5 ft width was harvested in the drilled study and the middle two rows or 5ft was harvested in the 30-inch planted study. The seeding rate of each variety was adjusted for germination and purity so pure live seeds planted were equal at each of the seeding rates for each variety. Plant population was determined for the middle four rows for the 8-inch drilled study and the middle two rows for the 30-inch planted study. Both row spacing studies were located in the same field side-by-side, but are considered separate experiments so no statistical comparison can be made since the

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estimation of the location effect cannot be determined.

Data was analyzed with the MIXED procedure in SAS for the main effects (seeding rate and maturity) and their interaction within each row spacing (8-inch drilled and 30-inch planted). Block was treated as a random factor in the model. Statistical significance was set at $\alpha = 0.05$. Yield, plant population, and revenue less seed cost was analyzed for this report.

RESULTS AND DISCUSSION

There was no significant difference between how the two soybean varieties behaved as seeding rate increased in the 8-inch drilled or the 30-inch planted study (Table 1 and 2). Yield and plant population between the two varieties was not different in either row spacing study that suggests the percent of live soybean seeds that emerged was similar between the two varieties tested and maturity was not a critical factor in yield determination in 2013 at this location.

Yields at this location in 2013 ranged from 49.9 to 59.2 bushels per acre (Table 3 and 4). In in the 8-inch drilled study, the highest yield occurred at the 200,000 and 175,000 pure live seeding rate (Table 3). However, the revenue generated less seed cost (assuming a cash soybean price of $10.50 and seed unit, 140,000 seeds, cost of $55) was similar from 150,000 to 200,000 pure live seeding rate. Assuming an average germination percentage of 90%, 166,600 to 222,200 seeds per acre maximized profitability.

However, in the 30-inch planted study, a pure live seeding rate 100,000 to 175,000 produced top yields and profitability or roughly 111,100 to 194,400 seeds planted per acre (Table 4). In 2013 at this location, a lower seeding rate was required to maximize yield and profitability when soybeans were planted in 30-inch rows versus drilled in 8-inch row spacing. Averaged across seeding rates, the 30-inch planted study averaged 86% germination whereas the drilled soybeans were 82%. This trend of higher emergence with planted soybeans was consistent across all three locations in 2013. The results of this trial are consistent with current recommendations that higher seeding rates are usually necessary when using a drill versus a planter.

Table 1. Result by variety averaged across seeding rates in the 8-inch drilled study.

Maturity (Variety)	Yield (bu/ac)	Population (plants/acre)
1.4 (Asgrow 1431)	55.1	110,300
2.0 (Asgrow 2031)	55.2	112,100
LSD†	1.6	5,700

† Value needed between the values measured to say there is a significant difference between the treatments.

Table 2. Result by variety averaged across seeding rates in the 30-inch planted study.

Maturity (Variety)	Yield (bu/ac)	Population (plants/acre)
1.4 (Asgrow 1431)	56.2	91,800
2.0 (Asgrow 2031)	56.4	95,700
LSD†	1.3	6,100

† Value needed between the values measured to say there is a significant difference between the treatments.

Table 3. 8-inch drilled study results averaged across both varieties.			
Pure Live Seeding Rate	Yield (bu/ac)	Population (plants/acre)	Revenue Less Seed Cost ($)*
75,000	49.9	67,600	495
100,000	53.5	82,400	523
125,000	54.0	111,400	518
150,000	56.0	115,900	530
175,000	58.1	124,400	542
200,000	59.2	165,600	543
LSD†	2.7	9,900	20

† Value needed between the values measured to say there is a significant difference between the treatments.
*Assumed an cash price of $10.50 and $55/unit seed cost

Table 4. 30-inch planted study results averaged across both varieties.			
Pure Live Seeding Rate	Yield (bu/ac)	Population (plants/acre)	Revenue Less Seed Cost ($)*
50,000	51.4	45,700	520
75,000	54.5	68,900	543
100,000	57.1	89,400	561
125,000	56.8	100,700	548
150,000	59.3	131,500	563
175,000	58.7	126,400	547
LSD†	2.3	10,600	17

† Value needed between the values measured to say there is a significant difference between the treatments.
*Assumed an cash price of $10.50 and $55/unit seed cost

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2013 Crop Performance Testing Results for SERF: Corn, soybean, winter wheat, and oats.

Nathan Mueller*, Kevin Kirby,
and Shawn Hawks

INTRODUCTION

Crop performance testing results are released annually through the activities of SDSU Extension and the South Dakota Experiment Station. Corn, soybean, winter wheat and oat variety trials are conducted annually at the Southeast Research Farm. The Winter Wheat Breeding Project manages the winter wheat variety trial at this location whereas the other three crop trials are conducted by the Crop Performance Testing (CPT) Program. For more information about the CPT program and their staff, visit their Facebook page and click on "About':

https://www.facebook.com/SDSUExtCropTesting

METHODS

Corn and soybean trials were planted with a SRES precision four row planter with 30-inch row spacing. Plot size was 10 ft wide and 20 ft long and the middle two rows are harvested. The oat and winter wheat variety trials are drilled at 8-inch row spacing and plots are 5 ft wide and 13 ft long at harvest.

Additional information on management can be found with the trial results.

RESULTS AND DISCUSSION

Results for corn, soybean, and winter wheat and oats trials can be found at:

http://igrow.org/agronomy/profit-tips/variety-trial-results/

Table 1. 2013 average yields for each trial across variety or hybrid.

Trial (maturity)	Yield (bu/ac)
Corn (110 day or less)	217.3
Corn (111 day or more)	212.2
Soybean (Group I)	70.3
Soybean (Group II)	64.9
Winter Wheat	52
Oats	106

The five year average corn yields for this location are 177 and 175 bu/ac for the early and late maturing corn hybrid trials, respectively. Therefore, the 2013 growing season resulted in above average corn yield (Table 1). The same was true for soybean yields. Winter wheat and oat yields were similar to the 3-yr average.

2014 recommended oat varieties for this area (southeast South Dakota) based on 3-yr trial results are Goliath, Horsepower, or Souris. Recommended winter wheat varieties for this area based on 3-yr trial results are Art, Expedition, Ideal, Lyman, Overland, and SY Wolf.

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Grain Sorghum Seeding Rate Study

Nathan Mueller*, Peter Sexton,
and Jesse Hall

INTRODUCTION

The recommended seeding rate for grain sorghum in South Dakota has not been determined with currently available sorghum hybrids. We wanted to evaluate the response of grain sorghum to higher seeding rates under high yield conditions where water stress is not severe or less frequent compared to the dominant sorghum growing region in south central South Dakota centered around Lyman County. As a result, we conducted a seeding rate study at the Southeast Research Farm in 2013 (Figure 1). A study in Colorado (Larson and Thompson, 2010) showed that days to maturity were hastened as plant population increased. This was attributed to production of fewer tillers and heads on tillers that are later maturing than main heads. Higher than desired moisture of grain at harvest is frequently a problem in grain sorghum production in South Dakota. Hybrid selection for high yield, early maturity, and lodging resistance in combination with higher seeding rates are possible management options to minimize revenue lost from higher drying charges in shorter growing seasons.

METHODS

The study was arranged as a randomized complete block design with five replications. The four seeding rates (25, 50, 75, and 100K) were planted with the new Monosem planter on 30-inch row spacing. An early maturing grain sorghum hybrid, Mycogen 1G557, was selected for use in this study. The study was planted in early June. Fertilizer application included 20 gallons/acre of 28% UAN. Weed control consisted of a preemergence herbicide program and followed later in the season with row cultivation. Plot size for the study was 50 ft long and 12 rows wide with the middle 8 rows harvested on November 4 with a Kincaid combine. Plant population was determined during the growing season. Measurements at harvest included yield adjusted to 13.5%, grain moisture, test weight, and 100-seed weight. Data was analyzed with the GLM procedure in SAS. Statistical significance was set at $\alpha = 0.05$.

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Figure 1. Picture of sorghum in the seeding rate study at the Southeast Research Farm on August 28, 2013.

RESULTS AND DISCUSSION

There was significant difference between sorghum seeding rates for yield, grain moisture, and plant population in the study (Table 1). As seeding rate increased, plant population and yield increased and moisture decreased. The target plant populations were not achieved with planter settings, but plant population did increase with increasing seeding rates. However, test weight and 100 seed weight (grams) were not significantly different with changes in seeding rates (Table 2). Therefore, seed size at harvest was not decreased with increasing plant population. A good relationship was found between the mean or average plant population and mean yield by treatment, seeding rate (Figure 2). Mean plant population by seeding rate explained 95% of the variation in mean grain yield by seeding rate.

Additional locations and years will be needed to generate recommended grain sorghum seeding rates for South Dakota sorghum growers. However, increasing sorghum plant population not only increased yield in this high yield environment, but decreased grain moisture.

REFERENCES

Larson, K., and D. Thompson. 2010. Dryland grain sorghum seeding rate and seed maturation. TR11-02 Colorado State University Agricultural Experiment Station, Plainsman Research Center 2010 Research Reports. http://webdoc.agsci.colostate.edu/aes/prc/pubs/tr11-02.pdf

ACKNOWLEDGMENTS

This study was supported by staff at the Southeast Research Farm.

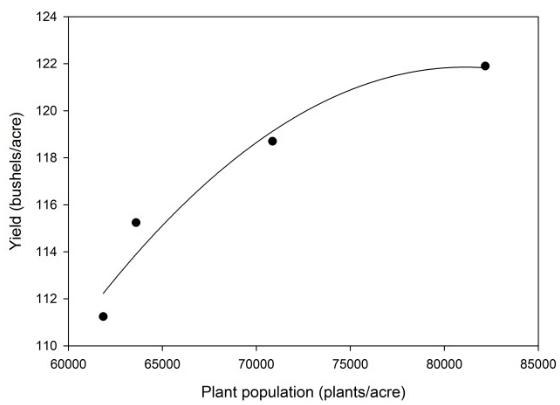

Figure 2. Mean sorghum grain yield and plant population response curve.

Table 1. Sorghum grain yield (13.5% moisture), grain moisture, and plant population by seeding rate.			
Seeding Rate/Acre	Yield (bu/ac)	Grain Moisture (%)	Plant Population (plants/ac)
25,000	111.2c	16.9c	61,855b
50,000	115.2bc	16.7bc	63,598b
75,000	118.7ab	16.5ab	70,858b
100,000	121.9a	16.3a	82,183a
LSD†	4.5	0.3	11,152

† Value needed between the values measured to say there is a significant difference between the treatments.

Table 2. Sorghum test weight and 100 seed weight by seeding rate.		
Seeding Rate/Acre	Test Weight	100 Seed Weight (grams)
25,000	55.6	2.5
50,000	55.9	2.5
75,000	55.4	2.6
100,000	56.2	2.5
LSD†	N.S.‡	N.S.

† Value needed between the values measured to say there is a significant difference between the treatments.
‡ N.S. No significant difference measured

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Phosphorus Rate and Method of Application Influence Soybean Leaf Size, Leaf P Content and Soybean and Corn Grain Yields.

R. Gelderman*, S. Berg, C. Smith and B. Rops

INTRODUCTION

When managing soil phosphorus, producer questions often arise concerning using phosphorus every year for a corn/soybean rotation vs. fertilizing only before corn is grown. The advantage to every other year fertilization is only one application charge. To address this question, a long term study was established at the SERF near Beresford, SD on a low P testing soil with a corn/soybean rotation.

OBJECTIVES

1. Determine if timing of P fertilization influences corn and soybean grain yield.

2. Determine if every year starter P applications can produce similar corn and soybean yields as higher rate broadcast P applications.

MATERIALS AND METHODS

The study has both corn and soybean grown each year on adjacent sites.

51513 Site - Soybean

Item	**Description**
Location	SE Research Farm near Beresford – field 121
Olsen P soil test, ppm	5 (low)
Crop rotation	soybean/corn
Soybean Hybrid	AG 2433
Planting date / rate	May 16, 2013 at 152,000 seeds/a
Soil series	Egan silty clay loam
P treatments	See Table 1
Tillage	Fall-Chisel, Spring field cult/harrow
Previous crop	soybean

51413 Site - Corn

Item	**Description**
Location	SE Research Farm near Beresford – field 121
Olsen P soil test, ppm	5 (low)
Crop rotation	corn / soybean
Corn Hybrid	DKC50-77
Planting date / rate	May 16, 2013 at 28,900 seeds/a
Soil series	Egan silty clay loam
P treatments	See Table 1
Tillage	Fall-Chisel, Spring field cult/harrow
Nitrogen applied	40 gpa of 28% side dressed on June 21.
Previous crop	soybean

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Results and Discussion

Since this is the first year, objective one cannot be addressed until next year. Early soybean leaf and petiole weight (at R1) were significantly increased by added P, especially if applied in furrow (Table 1). However, P content of soybean leaf and petiole was not increased over the check with the seed P treatment; whereas higher rates of broadcast P did increase P content of leaf and petiole at beginning bloom (Table 1). Treatment had no significant influence on leaf SPAD meter readings or leaf weight at R2 or plant weight (R7-R8) near maturity (data not shown). However, added phosphate significantly increased soybean grain yield (Table 1) with higher rates producing a linear response (Figure1). The 120 lb P_2O_5 broadcast rate produced about 8 bu/a more soybean yield than the check. Phosphorus uptake levels have not yet been calculated.

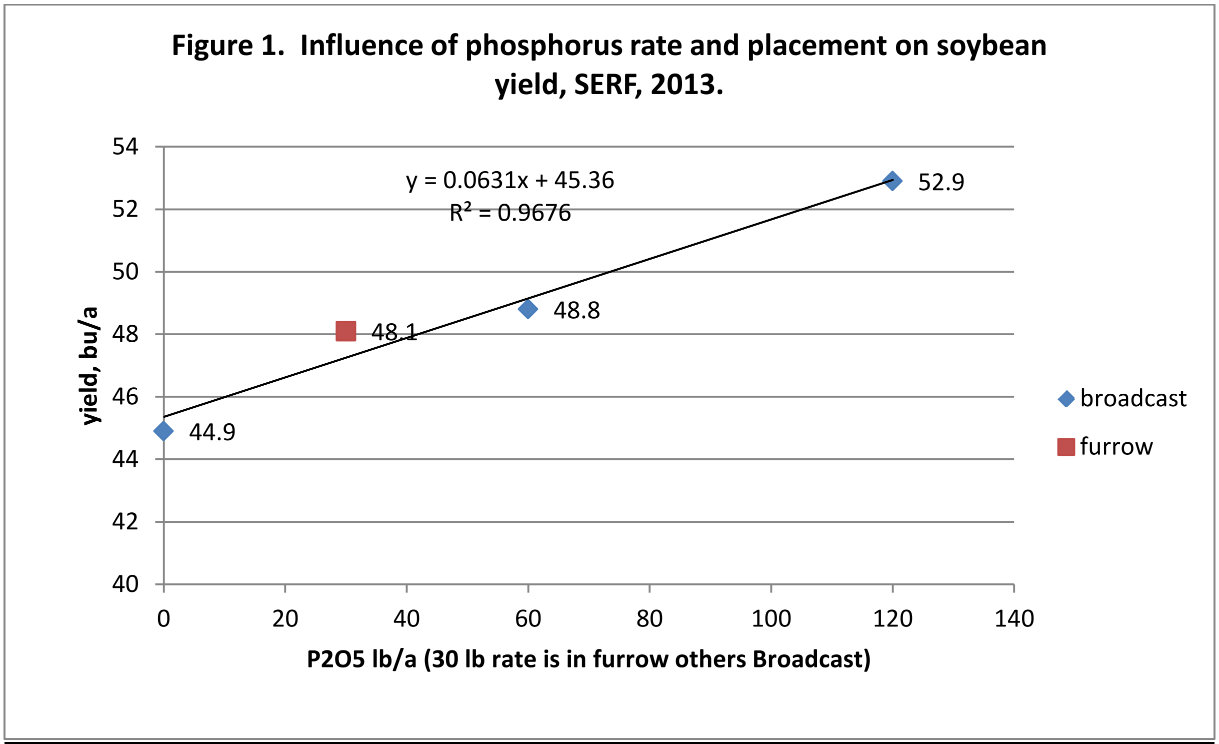
Table 1. Influence of phosphorus rate and application method on soybean (R1 stage) leaf and petiole weights and P content and grain yields, SERF, 2013.

Rate of P_2O_5	Application method	Wet leaf + petiole wt.	Dry leaf wt.	Dry petiole wt.	Petiole + leaf dry wt.	Leaf P	Petiole P	Yield
lb/a		------------ grams /15 leaves------------------				------------- %-- ---- ---		bu/a
0	---	51.5 b[3]	8.3 c	2.6 b	10.9 c	0.222 ab	0.1555 ab	44.9 b
30	with seed[1]	61 a	10.1 a	3.4 a	13.5 a	0.195 b	0.128 b	48.1 b
60	broadcast[2]	57 ab	9.1 bc	3 ab	12.1 bc	0.240 a	0.182 a	48.8ab
120	broadcast[2]	59 a	9.2 b	3.1	12.3 ab	0.253 a	0.166 a	52.9 a
Pr>F		0.11	0.02	0.06	0.03	0.07	0.05	0.07
$LSD_{0.10}$		6.5	0.85	0.45	1.27	0.0359	0.0304	4.7

[1] 10-34-0

[2] 11-55-0 broadcast before planting and tilled in.

[3] Numbers in the same column followed by the same letter are not significantly different at 0.10 level.



Added phosphate significantly increased corn yield over 25 bu/a with the 120 lb rate (Table 1). Rate of phosphorus produced a curvilinear response for corn on this low P testing soil. The added N from the P sources (9 lb N for the furrow placed 10-34-0 and 13 and 25 lb of N for the 60 and 120 lb P2O5 rates, respectively, using 11-52-0) were not balanced for either the soybean or corn treatments. Past studies have shown little response to added N from soybean. An assumed non-limiting N rate of 120 lb N/a (28%) was side dressed for the corn site on June 20th. An adjacent N rate study on corn following soybean maximized yield at 150 bu/a with an N application of about 115 lb N/a. Therefore the responses shown are assumed to be due to applied phosphorus rather than the additional nitrogen from the P products.

Table 2. Influence of phosphorus rate and application method on corn grain yield, SERF, 2013.

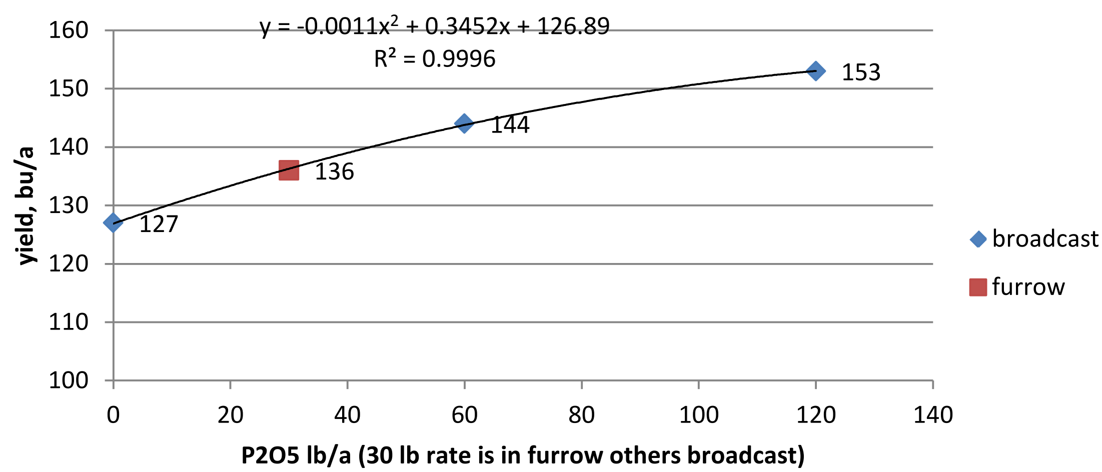
Rate of P_2O_5	Application method	Grain yield
lb/a		bu/a
0	---	126.7 c[3]
30	with seed[1]	135.8 bc
60	broadcast[2]	143.7 ab
120	broadcast[2]	152.6 a
Pr>F		0.018
LSD $_{0.10}$		12.0

[1] 10-34-0

[2] 11-55-0 broadcast before planting and tilled in.

[3] Numbers in the same column followed by the same letter are not significantly different at 0.10 level.

Figure 2. Influence of phosphorus rate and placement on corn yield, SERF, 2013.



Conclusions

Furrow applied phosphorus at 30 lb/a was not sufficient to produce grain yields comparable to the 60 and 120 lb/a broadcast rates on this low P testing soil. The response curves indicated that even the 120 lb rate was not a sufficient rate for either soybean or corn in 2013 at his site.

Acknowledgements

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Soil Test Potassium, Sulfur, Zinc, Phosphorus, Boron and Lime Effects on Soybean (1213 and 6013)

R. Gelderman*, S. Berg, and B. Rops

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, SDSU 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 on the SE 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 except for 2007 when no treatments were applied. A corn-soybean rotation was followed at both locations. No tillage was initiated at Beresford in 2011 and in 2012 at Brookings. Soybean was the 2013 crop at both sites. The soil at the SE 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. These treatments are: 50 lbs K_2O, 25 lbs sulfur (as gypsum), 5 lbs zinc (as zinc sulfate) and lime at both locations (Table 1). In addition, the Brookings site had a 40 lbs P_2O_5 treatment and the Beresford site a boron treatment (2 lbs/ac). The fertilizer treatments were applied each spring (except 2007) since the establishment year (1988 at Beresford and 1990 at Brookings) on the same plots. An exception is the boron treatment at Beresford that was initiated in 1997. Lime was applied only twice (1988 & 2003) at the SE Farm location and three times (1990, 1992, and 2011) at Brookings. All fertilizer treatments were surface broadcast followed by planting. 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 plot combine at both locations.

RESULTS AND DISCUSSION

Soil Tests

Soil test results from soil samples taken before 2013 fertilizer applications are presented in Table 2. The Beresford site has increased in soil

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test K levels even though K additions are similar to estimated K removal with the grain. Adding 50 lbs/a of K_2O per year since 1988 at Beresford and 1990 at Brookings raised the K soil test by 226 and 36 ppm respectively. The sulfur soil test increased by 49 and 45 lb/a for Beresford and Brookings, respectively. Sulfur is a mobile nutrient and can change quickly from one season to the next. The zinc soil test of the check was very high at both Beresford and Brookings. Applying 5 lbs/a zinc each year raised the soil test to 17.5 and 14.2 ppm at Beresford and Brookings, respectively. The lime treatments made during this study had a residual effect on soil pH. The check pH at Beresford was 5.7 and where lime was applied it was 6.4. At Brookings the check pH was 6.4 and limed treatments 7.0. The phosphorus soil test level at the Brookings site was 7 ppm without the phosphorus applications. The 40 lbs/ac annual phosphorus application raised the Olson soil test level to 31 ppm even though estimated grain removal was similar to P additions. Plant uptake of phosphorus from deeper in the soil profile could be the reason. There was no phosphorus treatment at Beresford and all plots receive phosphorus as needed. The boron check soil test at Beresford was 0.85 ppm, while the treated plot area was 3.42 ppm boron.

Soybean yields were fair to good at both sites although treatment had no significant influence on yield (Table 3).

ACKNOWLEDGMENTS

Support for these studies came from various sources including the Ag Experiment Station, Plant Science Dept., Extension Service and the SDSU Soil Testing Research Laboratory

Table 1. Fertilizer Treatments applied from 1988 at Beresford and 1991 at Brookings, Fertilizer and Lime Study, 2013.

Treatment	Beresford[1]	Brookings[2]
	------ lb/ac ------	
Check	0	0
Phosphorus (P_20_5)	----[3]	40
Potassium (K_20)	50	50
Sulfur	25	25
Zinc	5	5
Boron	2	----[3]
Lime	----[4]	----[5]

[1]Applied each spring, 1988 – 2006, and 2008 – 2013 except boron applied only since 1997.
[2]Applied each spring, 1990 – 2006, and 2008 – 2013
[3]Not a treatment at this location
[4]4000 lb and 3800 lb $CaC0_3$ equivalent applied spring 1988 and 2003 respectively.
[5]2500 lb, 2400 lb, and 3200 lb $CaC0_3$ equivalent applied spring 1990, 1992, and 2011 respectively

Table 2. Soil Test Levels, Fertilizer and Lime Study, Beresford and Brookings, 2013.

	Beresford[1, 3, 4]		Brookings[2, 5]	
Soil Test	Check	Treatment	Check	Treatment
Potassium ppm	160	367	129	172
Sulfur, lb/A, in 2 ft.	74	102	10	56
Zinc, ppm	0.94	17.0	3.6	24.2
pH	5.7	6.3	6.5	6.8
Olson Phosphorus, ppm	14	-----	6	27
Boron, ppm	0.83	3.45	-----	-----
NO_3-N, lb/A 2 ft	176	-----	40	-----
Organic Matter, %	4.2	-----	4.2	-----
Salts, mmho/cm	0.5	-----	0.3	-----

[1]Sampled 10/31/12
[2]Sampled 10/11/12
[3]160 lb P_2O_5 applied 11/19/01 and 4/01/03
[4]No till since spring of 2011
[5]No till since spring of 2012

Table 3. Treatment and Soil Test Effects on Soybean Yield, Brookings, 2013.

Fertilizer Treatment	Beresford Site[1]	Brookings Site[2]
	------- Yield, bu/ac -----------	
Check	54	49
Phosphorus	---	49
Potassium	54	48
Sulfur	52	47
Zinc	54	49
Boron	54	---
Lime	55	47
Prob of > F	0.66 (NS)	0.98 (NS)
C.V. %	4.3	10.7
LSD	2.8	6.4

[1] AG2433 soybean were no-till planted on 18 May 2013 at 152,000 seeds in 30” rows.
[2] AG1431 soybean were no-till planted on 24 May 2013 at 160,000 seeds in 30” rows.

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Crop Nutrient Management using Manure (33013 and 33113)

R. Gelderman*, S. Berg, C. Smith,
and B. Rops

INTRODUCTION

Manure has been shown to be an excellent source of plant nutrients. However, over application of manure near some concentrated animal feeding operations (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. In December, 2002 the EPA 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.

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 (beginning in 2003) is located on an Egan soil, just south of the office building at the SE Farm near Beresford, on which beef feedlot manure was applied. The other site (beginning in 2008) is located 3 miles north of Brookings on a Brookings soil, on which daily-scrape solid dairy cow manure with straw bedding was applied, except in 2012 and 2013 when stockpiled dairy manure was used. Treatments applied are explained in Table 3. Beginning soil tests for 2011 are 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 that fertilizer treatment.

The manure was applied on 2 Nov. 2012 and incorporated with a disc a few days later at the Beresford site and applied on 4 Nov. 2012 and disc incorporated within two weeks at

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Brookings. The analysis of the beef feedlot manure and the dairy 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 fertilizer treatments for 160 bu yield goal were applied on 4 April 2013 and incorporated just prior to planting to DKC50-17 corn on 7 May, 2013 at 28,900 seeds/a. Harvest was completed with a plot combine on 4 October, 2013. At Brookings, fertilizer treatments were spread on 3 June and worked in just before planting AG1421 soybean at 150,000 seeds/a on 3 June in 30 inch rows. Harvest was completed with a plot combine on October 9.

RESULTS

Previous manure for the P, N, and 2N, treatments have increased most soil tests over the other treatments at both sites (Table 1). Corn yields at Beresford followed the trend of CK<Fert<P<HiFert<2N<N (Table 3). This is similar to the long term trend at this site (Table 4). At the Brookings site the check and the 2N treatment had lowest yields (Table 3). There was obvious herbicide injury to the growing soybean early in the season. The suspected source was carryover from the bedding in the dairy manure pile. Observations indicated more injury with higher manure rate treatments. It is suspected that the lower yields from the 2N treatment may have been due to the herbicide injury.

Long Term Trends:

Nutrients from either manure or fertilizer increased long term yields over the check at Beresford and Brookings (Table 4 and 5). In general, higher manure rates produced higher yields. As expected, when phosphorus is added in excess of removal (grain P) soil test levels increase for both manure and fertilizer nutrient sources (Table 7). Higher manure rates are having a liming effect at both sites (increase in pH) and have increased organic matter levels (Table 7). The increase in pH may be due to neutralization of H^+ ions by organic anions such as carboxyl groups.

ACKNOWLEDGEMENTS

These studies were funded in part by the South Dakota Ag. Expt. Station, SE SD Research Farm, and the SDSU Soil F.E.R.T. project.

Table 1. Soil tests[1] after ten and five years of treatments at Beresford and Brookings, respectively, 2013.

Treatment	O.M.	NO_3-N	SO_4-S	Olsen P	K	Zinc	pH	salts
	%	--- lbs/a (0-2ft) --		---------- ppm ----------				mmho/cm
				Beresford site				
Check	4.0	66	54	5	217	0.77	6.8	0.5
Fert.	4.4	86	50	18	218	0.82	6.3	0.4
P	4.7	125	92	35	385	3.55	6.8	0.5
N	5.1	231	128	156	759	5.25	7.0	0.8
2N	6.1	513	198	175	1310	9.05	7.0	1.2
High Fert.	4.5	201	86	36	260	6.30	6.4	0.5
				Brookings site				
Check	4.7	18	78	7	129	1.47	7.1	0.3
Fert.	4.6	31	70	20	117	1.71	6.9	0.4
P	4.7	41	68	17	138	1.96	7.1	0.4
N	4.9	34	68	23	184	2.37	7.2	0.4
2N	5.7	76	102	59	286	6.95	7.4	0.5
High Fert.	5.0	92	126	18	130	8.80	7.1	0.5

[1] Samples taken fall 2012.

Table 2. Manure nutrient analysis for manure studies for 2013.

Analysis	units	---------------------- Manure[1] ----------------------	
		Beef (from apron)	Dairy Manure[2]
Total N	lb/ton	25.4	15.9
Organic-N	lb/ton	23.1	14.7
Ammonium-N	lb/ton	2.26	1.2
Total Available-N	lb/ton	13.6	7.4
P_2O_5	lb/ton	20.4	7.8
K_2O	lb/ton	31.9	10.5
Moisture	%	35.5	48.0

[1] Manure collected and analyzed in November 2012, as received basis.
[2] Dairy manure collected from a stockpile in fall of 2012.

Table 3. Treatments, nutrients applied and influence on grain yields, 2013.

Treatment	Manure applied[1]	Manure N-P_2O_5-K_2O applied	Fertilizer N-P_2O_5-K_2O applied	Grain Yield
	ton/a	---------------- lb/a	---------------	bu/a*
	------------------------------ Beresford site (corn)	---------------------------		
Check	0	0	0	125 d
Fertilizer (Rec)[2]	0	0	72-0-0-5Zn	135 cd
Manure – P[3]	3.9	42-56-125	27	139 bc
Manure – N[4]	0	0-0-0	0	152a
Manure - 2N	0	0-0-0	0	146ab
Fertilizer (High)[5]	0	0	0-50-60-5Zn-25S	142 bc
LSD				9.9
Pr>F				0.0008
C.V.%				4.7
	------------------------ Brookings site (soybean)	------------------------------		
Check	0	0	0	50.8 b
Fertilizer (Rec)[2]	0	0	0	55.4ab
Manure – P[3]	4.6	34-36-48	0	58.4a
Manure – N[4]	13.6	101-106-143	0	54.8ab
Manure – 2N	27.2	202-212-286	0	50.7 b
Fertilizer (High)[5]	0	0	0-50-60-25S	56.1ab
LSD $_{(0.05)}$				5.5
Pr>F				0.058
C.V.%				6.7

[1] Applied fall 2012. Little was applied at Beresford site because of high N carryover from 2011 drought.
[2] Recommended fertilizer rate determined from soil test and yield goal and applied in spring.
[3] P manure rate based on P recommendation from soil test or on P removal from crop, whichever is greater.
[4] 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.
[5] High fertilizer rate to determine maximum yield from fertilizer nutrients.
* Yields followed by different letters are significantly different at the 0.05 level.

Table 4. Long term yields from manure study, Beresford, 2003-2013.

Treatment	2008 soy	2009 corn	2010 soy	2011 corn	2012 soy	2013 corn	11 year total
	----------	----------	----------	bu/a	----------	----------	----------
Check	44.2	117 c	57.9 b	92	7.9 b	125d	835
Fert.	47.1	183 b	62.6 a	115	9.7 a	135cd	971
Man. P	44.5	205 a	62.3 a	137	4.9 a	139 bc	993
Man. N	45.8	214 a	63.5 a	133	5.9 a	152a	1058
Man. 2N	46.5	203 a	64.0 a	102	4.8 a	146ab	958
High Fert.	47.2	209 a	63.2 a	109	8.3 a	142bc	653[2]
Pr>F	0.37	0.01	0.01	---	0.0003	0.0008	---
L.S.D.	NS	20.1	2	---	1.6	9.9	---

[1] Soybean

[2]six year total

Table 5. Long term yields from manure study, Brookings, 2008-2013.

Treatment	2008 corn	2009 Soybean	2010 corn	2011 soybean	2012 corn	2013 soybean	6 year Total
	----------	----------	----------	bu/a	----------	----------	----------
Check	154 c	44.1 c	98 c	38.7 a	140 b	50.8 b	526
Fert.	185 a	47.1 c	135 b	40.5 ab	174a	55.4ab	636
Man. P	171 b	52.4 b	147 b	44.3 cd	166 a	58.4a	639
Man. N	181 ab	56.0 a	155 b	45.4 cd	170 a	54.8ab	662
Man. 2N	185 a	55.9 a	178 a	45.9 d	174	50.7 b	681
High Fert.	181 ab	50.8 b	191 a	42.7 bc	173.6 a	56.1ab	695
Pr>F	0.006	0.01	0.01	0.0003	0.0067		
L.S.D.	13.1	3.3	20.0	2.8	13.8		

Table 6. Manure and nutrients applied Beresford (2003 – 2013) and Brookings (2008-2012).

Treatment	----- Beresford -----				----- Brookings -----			
	manure	N[1]	P_2O_5	K_2O	manure	N[1]	P_2O_5	K_2O
	ton/a	----- lb/a ----			- ton/a -	----- lb/a ----		
Fert.	0	606	272	0	0	327	146	180
Man P	44	580 +195[2]	698	922	58	385 +110[2]	289	538
Man N	110	1303	1832	1993	123	815	590	1145
Man 2 N	220	2606	3664	3980	216	1502	1076	2034

[1] Available N

[2] Fertilizer N added to supplement manure

Table 7. Soil tests[1] after eleven and six years of treatments at Beresford and Brookings, respectively, 2013.

Treatment	O.M.	NO_3-N	SO_4-S	Olsen P	K	Zinc	pH	salts
	%	--- lbs/a (0-2ft) --		---------- ppm ----------				mmho/cm
				Beresford site				
Check	4.3	18	80	3	207	0.85	6.8	0.4
Fert.	4.7	50	66	15	205	1.06	6.5	0.3
P	5.1	68	96	51	506	3.10	7.1	0.4
N	5.4	100	114	140	681	4.82	7.4	0.4
2N	5.9	246	190	258	1165	7.32	7.4	0.5
High Fert.	4.8	86	122	37	292	6.55	6.0	0.3
				Brookings site				
Check	4.8	23	68	5.5	123	0.75	7.1	0.3
Fert.	4.8	24	70	11	122	1.98	6.9	0.3
P	4.9	28	77	17	156	1.84	7.3	0.4
N	5.4	36	103	35	245	3.46	7.3	0.4
2N	6.0	50	114	61	424	4.64	7.4	0.6
High Fert.	5.0	30	108	24	152	12.20	6.8	0.4

[1] Samples taken fall 2013.

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Corn Response to Nitrogen-loss Additives

R. Gelderman*, S. Berg, C. Smith, and B. Rops

INTRODUCTION AND OBJECTIVES

Nitrogen additives to control N losses thru volatilization, denitrification, and leaching are widely used in the Corn Belt particularly with surface applications of urea and in wet springs. Volatilization losses (ammonia loss from surface applied urea) can be slowed by use of urease inhibitor products such as NBPT (Agrotain[1]). Nitrification (Ammonium to nitrate) can be limited by using nitrification inhibitors such as DCD or Nitrapyrin. Slowing conversion of fertilizer products to nitrate may lessen leaching and/or denitrification losses if precipitation and/or soil water content is high. The long term yield and economic response to these additives is highly dependent on the amount and timing of precipitation events. Therefore, these studies will be conducted for at least five years to obtain a longer term evaluation for using these products.

The objective of this research is to compare long term agronomic and economic response from using nitrogen loss additives for corn.

Materials and Methods

Table 1. Selected parameters from nitrogen additive studies, 2013

Parameter Site	Beresford	Aurora
Soil series	Egan-Trent Silty Clay Loam (clay loam at 4 ft)	Brandt Silty Clay Loam (gravel at 4 ft)
Previous crop/tillage	Soybean/no-till	Soybean/chisel & field cult.
Begin nitrate-N soil test	54 lb/a in 2ft	32@2';44@3'; 56@4'lb/a
Plot size	15 x 60 ft	15 x 50 ft
Variety	Pioneer 9917 AM1	DKC 4551
Population	28,900 seeds/acre	32,000 seeds/acre
Planting date	5/13/13	5/13/13
Starter fertilizer	5 gpa 10-34-0	none
Other fertilizer applied	200 lb 11-52-0	45 lb P_2O_5, 60 lb K_2O
Treatments	See Table 2	See Table 2
Nitrogen application date	4/04/13	5/13/13 post-plant
Harvest Date	10/3/13	10/25/13
Experimental design	RCB[1]	RCB

[1] Randomized complete block with four replications

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The nitrogen additives used were; none (urea alone), NBPT, and NBPT with DCD (Super U[1]). All were applied with urea products.

RESULTS AND DISCUSSION

The Beresford site had greater late season moisture stress than did the Aurora site, resulting in somewhat lower yield than at Aurora (Table 1, Figures 1 and 2). Both sites responded to nitrogen rates even though Beresford had an additional 36 lb N/ac added to all plots from MAP and starter applications. Therefore an estimated 122 (86 + 36) lb of N were needed to achieve agronomic optimum yield. At Aurora, response was curvilinear and yields were not optimized even at the160 lb N/a rate.

Use of nitrogen additives did not significantly influence grain yield at either site in 2013 (Table 5). The Beresford site had 1.36 inches of rain within 5 days of the surface N application, indicating little ammonia volatilization occurred. In addition, a total of 11.08 inches of rainfall fell from N application until the June 6 sampling. Soil nitrate levels at 3 feet were higher at the June sampling than for earlier in the spring indicating downward movement. However, the soil nitrate and the soil ammonium levels were almost identical for the urea and the super U treatments at the 80 lb N rate for the June sampling (data not shown).

The Aurora site rainfall data was unavailable at this time.

Table 5. Nitrogen additive and nitrogen rate influence on grain yields, 2013.

Treatment no.	Treatment	N Rate	Beresford[1]	Aurora
			----------- grain yield -------	
		lb/a	-------------- bu/a ---------------	
1	Check	0	134	91
2	Urea	40	143	---
3	Urea+Agrotain	40	143	---
4	Super U	40	141	130
5	Urea	80	147	139
6	Urea+Agrotain	80	150	144
7	Super U	80	152	147
6	Super U	120	149	167
7	Super U	160	146	174
8	Super U	200	151	---

[1] Beresford site had an additional 36 lbs of N from starter and MAP applications for all plots.

Statistics: Beresford – additives (trts 2 - 7) C.V. % =5.0, Pr>F; rt=0.066, trt=0.93(NS), rt x trt=0.62 (NS)

Beresford – rate (0, 40, 80,120,160,200). C.V. %=4.3, Pr>F; rt=0.008.

Aurora – additives (trts 5 - 7). C.V. %=5.0, Pr>F; trt=0.34 (NS).

Aurora – rate (0, 40, 80,120,160). C.V.%=8.3, Pr>F; rt=0.0001.

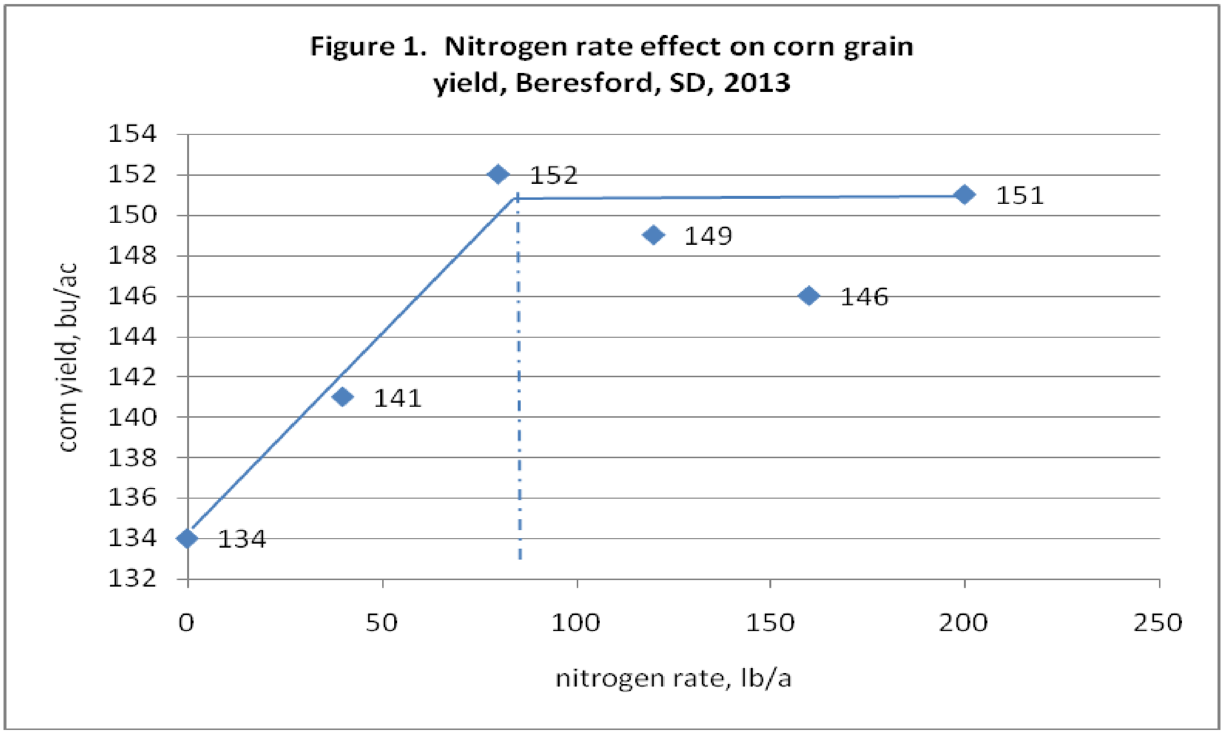
Figure 1. Nitrogen rate effect on corn grain yield, Beresford, SD, 2013
154
152
150
148
146
144
142
140
138
136
134
132
corn yield, bu/ac
152
151
149
146
141
134
0
50
100
150
200
250
nitrogen rate, lb/a

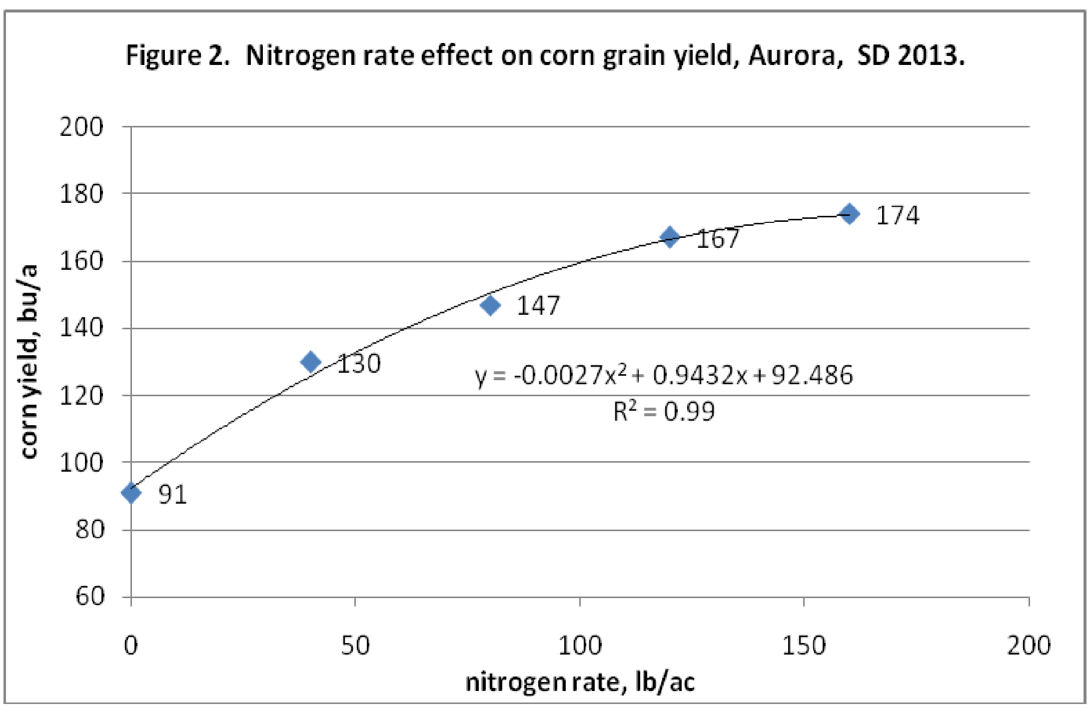
Figure 2. Nitrogen rate effect on corn grain yield, Aurora, SD 2013.
200
180
160
140
120
100
80
60
corn yield, bu/a
174
167
147
130
91
y = -0.0027x² + 0.9432x + 92.486
R² = 0.99
0
50
100
150
200
nitrogen rate, lb/ac

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Carryover Soil N after a Drought and Movement with Spring Rainfall (1312)

R. Gelderman[*], S. Berg, C. Smith
and B. Rops

INTRODUCTION

After the record drought with no grain yield in many SE SD fields, higher than normal soil nitrate-N remained in the surface soil after corn. Spring rains began in April of 2013 and continued into June. These events provided an opportunity to monitor the soil nitrate-N from this long term N study on a corn-soybean rotation.

MATERIALS AND METHODS

1313 site

Item:	Description
Location	SE Research Farm near Beresford
Average previous fall soil nitrate-N	See table 1.
Crop rotation	corn / soybean
Soybean hybrid	AG 2433
Planting date / rate	May 18, 2013 at 152,000 seeds
Soil series	Egan silty clay loam
Soil N rates applied	0, 50, 100, 150, 200, 400 lbs/a applied on corn in 2012
Tillage	No till since 2011
Soil samples	Table 1

OBJECTIVES

1. Determine amount and position of carryover soil nitrate-N from drought affected corn.
2. Determine any influence of carryover N rates on soybean yield.

RESULTS AND DISCUSSION

The carryover soil nitrate-N levels are given by date and depth of sampling in Table 1. Not all treatments were sampled at each date, nor were the same depths sampled for each date of sampling. As would be expected there was an accumulation of nitrate-N from the August sampling (after corn cut for silage) thru the April sampling of ~40 lb/a in the top two feet for both the check and the 100 lb rate. This increase is assumed to be due to residue and organic matter mineralization. Precipitation over this time was 9.38 inches (Table 1). Little plant moisture use or runoff loss would have occurred because of the very dry soil to this point, and most likely minimal evaporation.

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RESULTS AND DISCUSSION (cont.)

Since our clay loam soils can store 2-2.5 inches per foot, the four foot profile was most likely almost full of moisture and there should have been little nitrate-N loss from the root zone (4 foot) by the end of April. However, there appears to have been some downward movement of the N as lower depths have higher concentrations of nitrate (as compared to previous samplings).

There was an additional 7.78 inches of rainfall from the April 28 sampling date thru the June 6 sampling date – bringing the total precipitation from August to June to 17.16 inches. The June sampling revealed a lower level of nitrate-N (30 lb/a less) in the top 2 foot, as compared with the previous sampling, for the 100 lb/a treatment. It appears this nitrate moved into the 2-3 foot level. However, because deeper samples were not taken, we don't know if additional N moved even deeper in the profile. At this time the soybean plants had only 2 leaves and N removal by the plants would have been minimal.

It is possible that some leaching loss occurred even in this heavier textured soil with this level of spring rainfall. Past years data indicate that the April thru June period is when leaching events usually occur, and typically when soil moisture profiles are high going into early spring. This year was unusual in that soil moisture was very low going into the spring.

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The variable carryover soil nitrate-N levels due to past N treatments did not influence soybean yields (Table 2). This is consistent with most results from prior years

CONCLUSIONS

With the precipitation received from August to June, some of the carryover nitrogen (accumulated from last year's drought) did move to the three foot level at least. These soils are silty clay loams. For more coarse textured soils it would be realistic to have expected some carryover nitrate-N loss from the four foot root zone in the spring of 2013. We would not expect this type of movement with late fall or spring applied N fertilizers, however. The conversion of urea type fertilizers to nitrate takes time and much of the nitrogen would have likely been in ammonium form when most of the rainfall occurred.

ACKNOWLEDGEMENTS

These studies primarily supported by the Southeast Research Farm, South Dakota Ag Experiment Station, and South Dakota Coop Extension Service.

Table 1. Soil nitrate-N levels after corn silage harvest (Aug 2012) to soybean V2 stage (June, 6 2013).

Sampling date	Soil sampling depth	N Rate (applied spring 2012), lb/a: 0	50	100	150	200	400	Cumulative rainfall from Aug. sampling
	inches	lb carryover nitrate-N, lb/a						inches
8-19-12	0-6	16	20	28	40	92	250	0
	6-12	6	8	20	24	50	92	
	12-24	8	16	16	20	36	72	
	24-36	20			24		116	
	36-48	12			28		72	
	Total 2'	30	44	64	84	178	414	
	Total 3'	50			108		530	
	Total 4'	62			136		602	
11-12-12		lb carryover nitrate-N, lb/a						2.42
	0-6	39	38	46	96	86	248	
	6-24	18	24	30	77	96	240	
	Total 2'	57	62	76	173	182	488	
4-28-13		lb carryover nitrate-N, lb/a						7.78
	0-6	6		9				
	6-12	12		14				
	12-18	28		52				
	18-24	22		28				
	Total 2'	68		103				
6-6-13		lb carryover nitrate-N, lb/a						17.16
	0-6			22				
	6-12			12				
	12-18			14				
	18-24			28				
	24-30			38				
	30-36			32				
	Total 2'			76				
	total 3'			146				

Table 2. Prior year N treatment influence on soybean yields, Beresford, 2013

N Treatment, lb/a	Soybean yield, bu/a
0	52
50	52
100	54
150	53
200	55
400	54
C.V. %	4.9
Pr>F	0.54 (NS)
L.S.D.	3.2

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Cover Crop Impacts on Soil Bulk Density

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Aggregate, cores, and auger samples were taken from plot located at Southeast Research Farm, Beresford, South Dakota. Three replicas were taken from each plot for the core sample and two replicas were taken from the each field for both the aggregate and auger sample. Core and aggregate samples were taken for the first two depths 0-10 and the 10-20 and Augur sample was taken for the four depths; 0-10, 10-20, 20-30 and 30-40 respectively. Using the core sample, the moisture content and the bulk density of the soil was calculated, and the same core was used for retention study.

The retention study was done by using both the sand box equipment (for lower suction) and the pressure plate (for higher suction). The augur samples were air dried and sieved through the 2 mm sieve and archived for the further analysis. The aggregate samples are stored in cold storage, and will be used later for determination of aggregate stability.

Samples were collected from two locations at Southeast Research Farm. East quarter field (Fig 1) 304 (43°03'11.35"N and 96°53'10.54"W) and North quarter field (Fig. 2) 206 (43°03'14.20"N and 96°53'41.59"W).

Field 206 located at Southeast Research Farm consists of Egan-Trent silty clay loams (Fine-silty, mixed, mesic Udic Haplustolls) and field 304 consists of Egan-Clarno-Trent complex (Fine-silty, mixed, superactive, mesic Udic Haplustolls). In field 206, samples were taken from the three pair plots and in field 304 samples were taken from two pair plots. Plots on both locations are managed under two year corn-soybean rotation. Cover crop (rye) is grown during soybean year in treated plots and control plots are maintained without cover crop.

DETERMINATION OF BULK DENSITY

Bulk density (BD) of a soil is the ratio of the mass of oven-dried soil to its bulk. Volume and moisture content is the ratio of the soil water to the weight of oven dry soil. Moist sub sample from the core was taken to determine the moisture content. Moisture content was determined by oven drying moist soil for 48 hours at 105°C temperature. Undisturbed core samples of 5 cm diameter and 5 cm height were weighed. Moisture content of the whole core was determined based on the moisture content of subsample. Dry bulk density was calculated by calculating the oven dry weight of soil per unit volume of core.

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No Rye	***Rye***	***No Rye***	***Rye***	***No Rye***	Road

Fig.1 Field 304 plots **Note:** Area of field 2.09 acre; Bold+italic plots were sampled.

Rep	Plot#	Treatment
300	1	Oats(spring)
	2	Control
	3	Winter Rye(fall)
	4	Tile Recently Installed
301	5	Mustard (spring)
	6	***Control***
	7	Oats(spring)
	8	***Winter Rye(fall)***
303	***9***	***Winter Rye(fall)***
	10	Oats(spring)
	11	Mustard (spring)
	12	***Control***
304	13	Oats(spring)
	14	***Control***
	15	***Winter Rye(fall)***
	16	Mustard (spring)

Fig.2 Field 206 plots; **Note**: Area of field 2.92 acre; Bold+italic plots were sampled.

Table 1. Bulk density of soil for the plots located in field 206

Crop Management	Depth	Bulk Density
Winter Rye	0-10	1.39
Winter Rye	10-20	1.43
Control*	0-10	1.30
Control	10-20	1.32

*Cover crop (rye) is grown during soybean year in treated plot and control plots are maintained without cover crop.

Table 2. Bulk density of soil for the plots located in field 304

Crop Management	Depth	Bulk density
Rye	0-10	1.12
Rye	10-20	1.63
Control	0-10	1.28
Control	10-20	1.44

RESULTS

Bulk densities of different treatment along with the treatment are presented in above table.

The water retention and the carbon-nitrogen analysis study are under progress. The result will be presented in next report.

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2013 SOYBEAN FOLIAR FUNGICIDE TRIALS

Kay R. Ruden*, Greg S. Redenius, and Emmanuel Byamukama

INTRODUCTION

Soybeans can be infected by several pathogens throughout the growing season. Although South Dakota has, to date, been free of the major yield robbing foliar diseases, yield losses from foliar diseases may still occur, but are largely undocumented.

Brown spot (*Septoria glycines*) is the most commonly observed fungal foliar disease of soybean and, therefore, presumably the most important. Wet, humid conditions and heavy crop canopies tend to favor foliar disease development. Brown spot occurs in South Dakota every year in every field at varying severities. The brown spot pathogen survives in crop residues. The pathogen can be dispersed from the infected residues to soybean plants by splashing rain. The brown spot pathogen normally infects older leaves, but soybeans weakened by other diseases or environmental conditions become susceptible to this disease. Normally, no significant yield losses results from brown spot unless premature defoliation occurs in the mid and upper canopy. Fungicide application, if environmental conditions favor development of the disease, may be an effective management strategy. However, fungicides vary in their activity against this pathogen.

The objective of this study was to evaluate the efficacy of new and upcoming fungicides in controlling brown spot in soybeans.

MATERIALS AND METHODS

Pioneer 91Y40 was planted at 150,000 seeds/acre at the Southeast Research Farm (SERF) near Beresford, SD and at the SDSU Experiment Farm at Volga.

The experiment was planted in randomized complete blocks (RCBD) with four replications of each treatment. The plots were planted, rated and harvested on the dates listed in Table 1. Plants were rated for fungal foliar diseases and yield. Treatments in this study were compared to an untreated check.

RESULTS AND DISCUSSION

No ratings were taken for disease at the Volga Farm and the SE Farm since most of the leaves had fallen off due to dry weather conditions. One treatment was significant for yield at the Volga location. The treatment that was significant was Priaxor (4 fl oz/A) + Fastac (3.8 fl oz/A) + Induce NIS (0.25% V/V). There were no significant differences among treatments for yield at the SE Farm.

Foliar diseases were generally of minor importance in 2013. No significant brown spot developed to cause yield loss in 2013.

ACKNOWLEDGEMENT

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Table 1. Dates of planting, plot evaluations, and harvest at study locations.

Activity	Date of activity by location	
	SE Research Farm	Volga Research Farm
Planting	May 23, 2013	June 3, 2013
Harvest	October 1, 2013	October 9, 2013

Table 2. Products, rates and growth stages of fungicides applied as foliar treatments in 2013.

Product	Rate		Growth Stage
Untreated			
Fortix	5	fl oz/a	R1
Fortix	5	fl oz/a	R3
Quadris Top	10	fl oz/a	R3
Headline SC	6	fl oz/a	R3
Induce NIS	0.25	% v/v	R3
Priaxor	4	fl oz/a	R3
Induce NIS	0.25	% v/v	R3
Quilt Xcel	10.5	fl oz/a	R3
Induce NIS	0.25	% v/v	R3
Stratego YLD	4	fl oz/a	R3
Induce NIS	0.25	% v/v	R3
Experimental A	6	fl oz/a	R3
Induce NIS	0.25	% v/v	R3
Experimental A	5.6	fl oz/a	R3
Alto	5.6	fl oz/a	R3
Induce NIS	0.25	% v/v	R3
Evito 480 SC	2	fl oz/a	R3
Induce NIS	0.25	% v/v	R3
Evito 480 SC	2.1	fl oz/a	R3
Topguard	10.2	fl oz/a	R3
Induce NIS	0.25	% v/v	R3
Priaxor	4	fl oz/a	R3
Fastac	3.8	fl oz/a	R3
Induce NIS	0.25	% v/v	R3
Quilt Xcel	10.5	fl oz/a	R3
Warrior T	2.56	fl oz/a	R3
Induce NIS	0.25	% v/v	R3
Stratego YLD	4	fl oz/a	R3
Mustang Maxx	3.8	fl oz/a	R3
Induce NIS	0.25	% v/v	R3

Table 2 con't. Products, rates and growth stages of fungicides applied as foliar treatments in 2013.

Product	Rate		Growth Stage
Aproach	6	fl oz/a	R3
Induce NIS	0.25	% v/v	R3
Experimental B	5	fl oz/a	R3
Induce NIS	0.25	% v/v	R3
Experimental B	6.8	fl oz/a	R3
Induce NIS	0.25	% v/v	R3
Experimental B	6.8	fl oz/a	R3
Induce NIS	0.25	% v/v	R3
Experimental B	6.8	fl oz/a	10-14 days after R3
Induce NIS	0.25	% v/v	10-14 days after R3
Aproach	6	fl oz/a	R3
Induce NIS	0.25	% v/v	R3
Experimental C	14	fl oz/a	R3
Experimental B	6.8	fl oz/a	R3
Induce NIS	0.25	% v/v	R3
Experimental C	14	fl oz/a	R3
Quilt Xcel	14	fl oz/a	R3
Induce NIS	0.25	% v/v	R3
Quilt Xcel	10.5	fl oz/a	R3
Endigo ZC	3.5	fl oz/a	R3
Priaxor	4	fl oz/a	R3
Priaxor	4	fl oz/a	R3
Experimental D	1	qt/a	R3
Experimental E	3.2	fl oz/a	R3
Priaxor	4	fl oz/a	R3
Experimental E	6.4	fl oz/a	R3
Priaxor	4	fl oz/a	R3
Experimental E	6.4	fl oz/a	R3
Experimental D	1	qt/a	R3
Experimental F	3.2	fl oz/a	R3
Priaxor	4	fl oz/a	R3
Superb HC	0.5	pt/a	R3
InterLock	2	fl oz/a	R3
Quilt Xcel	10.5	fl oz/a	R3
Quilt Xcel	10.5	fl oz/a	R3
Experimental E	6.4	fl oz/a	R3
Quilt Xcel	10.5	fl oz/a	R3
Superb HC	0.5	pt/a	R3
Interlock	2	fl oz/a	R3

Table 3. Soybean Foliar Fungicide Study: Disease rating and yield associated with various foliar treatments at Beresford and Volga, SD.

Product	Yield bu/A		Test Weight lb/bu	
	Volga	SE Farm	Volga	SE Farm
Untreated	48.71	61.45	56.17	55.46
Fortix (5 fl oz/A- R1 application)	45.13	62.18	55.88	54.17
Fortix (5 fl oz/A- R3 application)	46.20	55.11	56.12	55.29
Quadris Top	43.87	60.96	55.38	54.62
Headline SC	51.89	56.49	55.16	54.98
Induce NIS				
Priaxor	47.18	60.61	55.55	55.11
Induce NIS				
Quilt Xcel	45.89	57.94	55.55	55.49
Induce NIS				
Stratego YLD	43.87	61.37	55.80	55.67
Induce NIS				
Experimental A	45.01	62.02	55.97	55.89
Induce NIS				
Experimental A	44.78	63.96	55.57	55.47
Alto				
Induce NIS				
Evito 480 SC	46.35	58.06	55.69	54.61
Induce NIS				
Evito 480 SC	44.01	62.99	55.55	55.86
Topguard				
Induce NIS				
Priaxor	**58.88**	60.96	55.23	54.76
Fastac				
Induce NIS				
Quilt Xcel	51.88	64.05	55.05	55.02
Warrior T				
Induce NIS				
Stratego YLD	57.62	55.28	55.32	55.15
Mustang Maxx				
Induce NIS				
Aproach	44.65	61.55	56.09	55.30
Induce NIS				
F-LSD (P=0.05)	7.63	NS	NS	NS
CV	11.70	9.73	1.04	1.73

Table 3 con't. Soybean Foliar Fungicide Study: Disease rating and yield associated with various foliar treatments at Beresford and Volga, SD.

Product	Yield bu/A		Test Weight lb/bu	
	Volga	SE Farm	Volga	SE Farm
Experimental B Induce NIS	45.72	56.44	55.23	55.00
Experimental B Induce NIS	44.56	58.30	55.69	55.20
Experimental B Induce NIS Experimental B Induce NIS	48.22	60.52	55.79	56.02
Aproach Induce NIS Experimental C	46.05	58.55	55.55	56.14
Experimental B Induce NIS Experimental C	46.54	58.62	56.05	55.79
Quilt Xcel Induce NIS	33.66	56.14	55.30	54.87
Quilt Xcel Endigo ZC	54.83	58.89	56.27	54.76
Priaxor	44.07	53.15	55.67	55.69
Priaxor Experimental D Experimental E	38.96	55.49	56.04	55.51
Priaxor Experimental E	46.72	53.76	55.51	55.18
Priaxor Experimental E Experimental D Experimental F	45.16	59.82	56.01	55.36
Priaxor Superb HC InterLock	43.51	56.14	56.19	54.80
Quilt Xcel	40.77	60.47	56.18	55.33
Quilt Xcel Experimental E	44.36	58.46	56.17	55.43
Quilt Xcel Superb HC Interlock	41.35	57.80	55.80	54.56
F-LSD (P=0.05)	7.63	NS	NS	NS
CV	11.70	9.73	1.04	1.73

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2013 CORN FOLIAR FUNGICIDE TRIALS

Kay R. Ruden*, Greg S. Redenius, and Emmanuel Byamukama

INTRODUCTION

Corn can be infected by several foliar diseases throughout the growing season that can and do periodically cause significant yield losses throughout the corn production areas. Fungicide applications for the control of these diseases can be effective. Corn does have effective genetic resistance to many of the diseases, but challenges still remain in the management of those diseases due to new races that develop. Corn foliar diseases are somewhat sporadic in South Dakota than in neighboring states. The occurrence of those diseases depends on the environmental conditions, cultural practices and the corn hybrid.

Gray leaf spot (*Cercospora zeae maydis*) can occur on susceptible hybrids, but it has not been a major problem for most years in South Dakota. Other foliar diseases such as the corn leaf blights: Northern corn leaf blight (*Exserohilum turcicum*), eyespot (*Aureobasidium zeae*), and common corn rust (*Puccinia sorghi*) occurs sporadically in South Dakota. Information on the effectiveness of fungicides and their timing in the management of these diseases is needed. The objectives of this study were to test the efficacy of several fungicide products at different timings in the control of fungal pathogens and the resulting yield increase.

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MATERIALS AND METHODS

Pioneer PO392AMX was planted at 35,000 plants/acre at the Southeast Research Farm (SERF) near Beresford, SD, and at the SDSU Experiment Farm at Volga, for both the early and late trials. Treatments included various fungicide products applied at V4-V7, V5-V6, V6, VT or VT-R2 as shown in Table 2.

The experiments were planted in randomized complete blocks (RCBD) with four replications of each treatment. The plots were planted, rated and harvested on the dates listed in Table 1. Plants were rated for fungal foliar diseases and yield. Treatments in this study were compared to an untreated check.

RESULTS AND DISCUSSION

Early growth stage fungicide applications:

No significant differences were observed among treatments for common rust and the percent of green left at both the Volga and the SE Farm location for the early growth stage applications. No significant differences were observed among treatments for yield at the SE Farm, but there were two significant treatments for yield at the Volga location. The two treatments that were significant were the Aproach treatments at the 3 and 6 fl oz/A.

Late growth stage fungicide applications:

No significant differences were observed among the late growth stage application treatments for common rust, percent of green left, and yield at both the Volga location and the SE Farm location for the VT and the R1 application timings.

These results indicate that increased yield due to fungicide may be site specific, depending on the level of disease development driven by the environment.

Table 1. Dates of planting, plot evaluations, and harvest at study locations.

Activity	**Date of activity by location**	
	SE Research Farm	Volga Research Farm
Planting	May 15, 2013	May 16, 2013
Disease Rating	September 12, 2013	September 13, 2013
Harvest	October 7, 2013	October 28, 2013

Table 2. Products, rates and growth stages of fungicides applied as early foliar treatments in 2013.

Product	Rate		Growth Stage
Untreated			
Priaxor	2	fl oz/a	V5-V6
Priaxor	4	fl oz/a	V5-V6
Stratego YLD	2	fl oz/a	V5-V6
Stratego YLD	4	fl oz/a	V5-V6
Quilt Xcel	5.25	fl oz/a	V5-V6
Quilt Xcel	10.5	fl oz/a	V5-V6
Aproach	3	fl oz/a	V5-V6
Aproach	6	fl oz/a	V5-V6
Evito 480 SC	1.4	fl oz/a	V5-V6
TopGuard	6.8	fl oz/a	V5-V6
Fortix	5	fl oz/a	V6
Glyfos X-tra	32	fl oz/a	V6
Induce NIS	0.25	% v/v	V6
Headline AMP	10	fl oz/a	V6
Glyfos X-tra	32	fl oz/a	V6
Induce NIS	0.25	% v/v	V6
Glyfos X-tra	32	fl oz/a	V6
Induce NIS	0.25	% v/v	V6
Stratego YLD	2	fl oz/a	V4-V7
Induce NIS	0.125	% v/v	V4-V7

Table 3. Products, rates and growth stages of fungicides applied as late foliar treatments in 2013.

Product	Rate		Growth Stage
Untreated			
Fortix	4	fl oz/a	VT
Induce NIS	0.25	% v/v	VT
Fortix	5	fl oz/a	VT
Induce NIS	0.25	% v/v	VT
Headline AMP	10	fl oz/a	VT
Induce NIS	0.25	% v/v	VT
Stratego YLD	4	fl oz/a	VT-R2
Induce NIS	0.125	% v/v	VT-R2
Headline SC	6	fl oz/a	VT-R2
Induce NIS	0.125	% v/v	VT-R2
Headline AMP	10	fl oz/a	VT-R2
Induce NIS	0.125	% v/v	VT-R2
Quilt	10.5	fl oz/a	VT-R2
Induce NIS	0.125	% v/v	VT-R2
Quilt Xcel	10.5	fl oz/a	VT-R2
Induce NIS	0.125	% v/v	VT-R2
Evito 480 SC	2	fl oz/a	VT-R2
Induce NIS	0.125	% v/v	VT-R2
Evito T	4	fl oz/a	VT-R2
Induce NIS	0.125	% v/v	VT-R2
Aproach	6	fl oz/a	VT-R2
Induce NIS	0.125	% v/v	VT-R2

Table 4. Products, rates and growth stages of fungicides applied as late foliar treatments in 2013.

Product	Rate		Growth Stage
Untreated			
Headline AMP	10	fl oz/a	R1
Induce NIS	0.25	% v/v	R1
Priaxor	4	fl oz/a	R1
Induce NIS	0.25	% v/v	R1
Quilt Xcel	10.5	fl oz/a	R1
Induce NIS	0.25	% v/v	R1
Stratego YLD	4	fl oz/a	R1
Induce NIS	0.25	% v/v	R1
Aproach	6	fl oz/a	R1
Induce NIS	0.25	% v/v	R1
Aproach	5.6	fl oz/a	R1
Alto	5.6	fl oz/a	R1
Induce NIS	0.25	% v/v	R1
Evito 480 SC	2.1	fl oz/a	R1
TopGuard	10.2	fl oz/a	R1
Induce NIS	0.25	% v/v	R1
Evito 480 SC	2	fl oz/a	R1
Induce NIS	0.25	% v/v	R1

Table 5. Corn- Early Foliar Fungicide Study: Disease rating and yield associated with various foliar treatments at Beresford and Volga, SD.

Product	% Green Left %		Common rust %		Stalk Rot %	Yield bu/A	
	Volga	SE Farm	Volga	SE Farm	Volga	Volga	SE Farm
Untreated	52.50	84.70	0.20	0.95	34.62	234.12	145.34
Priaxor (2 fl oz/A)	83.25	78.60	0.20	0.85	19.23	236.52	146.27
Priaxor (4 fl oz/A)	59.25	89.60	0.18	0.90	15.38	222.40	147.66
Stratego YLD (2 fl oz/A)	89.25	89.80	0.23	0.65	17.31	253.52	134.05
Stratego YLD (4 fl oz/A)	79.25	84.80	0.35	0.58	17.31	237.61	147.26
Quilt Xcel (5.25 fl oz/A)	75.25	89.25	0.10	1.00	23.08	257.82	145.09
Quilt Xcel (10.5 fl oz/A)	67.00	88.60	1.18	0.98	23.08	256.63	145.58
Aproach (3 fl oz/A)	69.50	80.35	0.20	1.15	22.12	**263.62**	139.36
Aproach (6 fl oz/A)	99.75	72.45	0.20	1.23	0.96	**280.35**	138.36
Evito 480 SC	69.50	90.45	0.55	1.35	28.85	255.71	150.33
TopGuard							
Fortix	52.50	87.10	0.30	0.90	33.65	233.33	148.28
Glyfos X-tra							
Induce NIS							
Headline AMP	79.50	82.90	0.28	0.95	21.15	252.49	146.46
Glyfos X-tra							
Induce NIS							
Glyfos X-tra	83.00	95.35	0.28	0.75	19.23	220.56	151.84
Induce NIS							
Stratego YLD	59.00	80.65	0.43	0.68	36.54	221.93	142.53
Induce NIS							
F-LSD (P=0.05)	NS	NS	NS	NS	NS	29.24	NS
CV	41.65	14.53	165.62	49.11	96.35	8.36	6.92

Table 6. Corn- Late Foliar Fungicide Study: Disease rating and yield associated with various foliar treatments at Beresford and Volga, SD.

Product	% Green Left %		Common rust %		Stalk Rot %	Yield bu/A	
	Volga	SE Farm	Volga	SE Farm	Volga	Volga	SE Farm
Untreated	52.50	84.70	0.20	0.95	34.62	234.12	145.34
Fortix (4 fl oz/A) Induce NIS	81.00	92.53	0.25	0.60	21.15	234.94	155.05
Fortix (5 fl oz/A) Induce NIS	75.75	88.55	0.20	0.65	16.35	234.23	145.32
Headline AMP Induce NIS	60.75	81.65	0.15	0.68	24.04	235.60	145.81
Stratego YLD Induce NIS	86.25	93.70	0.20	0.75	15.38	249.88	147.82
Headline SC Induce NIS	94.25	79.25	0.45	0.75	11.54	247.75	149.96
Headline AMP Induce NIS	46.25	91.90	0.18	0.83	37.50	217.11	150.14
Quilt Induce NIS	73.50	88.00	0.08	0.80	0.96	241.83	156.50
Quilt Xcel Induce NIS	76.00	96.50	0.00	0.68	24.04	242.90	131.17
Evito 480 SC Induce NIS	66.50	89.35	0.13	0.43	41.35	230.64	148.45
Evito T Induce NIS	73.75	80.80	0.23	0.68	21.15	235.17	142.78
Aproach Induce NIS	79.50	81.75	0.30	0.73	35.58	250.59	136.67
F-LSD (P=0.05)	NS	NS	NS	NS	NS	NS	NS
CV	31.90	17.96	93.41	42.45	82.58	11.66	7.83

Table 7. Corn- Late Foliar Fungicide Study: Disease rating and yield associated with various foliar treatments at Beresford and Volga, SD.

Product	% Green Left %		Common rust %		Stalk Rot %	Yield bu/A	
	Volga	SE Farm	Volga	SE Farm	Volga	Volga	SE Farm
Untreated	98.60	96.78	0.65	1.00	0.00	262.28	144.35
Headline AMP	98.75	96.40	0.38	0.58	0.00	269.69	138.39
Induce NIS							
Priaxor	99.55	92.05	0.13	0.50	0.96	280.16	149.15
Induce NIS							
Quilt Xcel	98.70	97.28	0.28	0.30	7.69	262.15	142.00
Induce NIS							
Stratego YLD	95.35	92.15	0.18	0.40	0.96	258.49	139.14
Induce NIS							
Aproach	99.10	98.15	0.90	0.48	1.92	267.93	145.08
Induce NIS							
Aproach	98.05	95.90	0.43	0.40	5.77	261.61	138.74
Alto							
Induce NIS							
Evito 480 SC	90.00	97.90	0.10	0.13	10.58	282.03	136.15
TopGuard							
Induce NIS							
Evito 480 SC	93.30	96.90	0.13	0.38	9.62	265.94	139.25
Induce NIS							
F-LSD (P=0.05)	NS	NS	NS	NS	NS	NS	NS
CV	6.57	5.44	113.53	72.44	175.69	9.14	6.86

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Drainage Management Strategies for Managing Water and Nutrients in South Dakota

Christopher Hay*, Jeppe Kjaersgaard, Michael Miller, Peter Sexton, Todd Trooien, Erin Cortus, Ronald Gelderman, and Dennis Todey

INTRODUCTION

Subsurface drainage has increased dramatically in eastern South Dakota in the last several years driven by increases in precipitation, commodity, and land prices. This research will evaluate the economic, water quality, and hydrologic impacts of drainage in South Dakota. We have separated the research into four components—a core component and three associated components. The core component is a monitoring network to study strategies to best manage water and nutrients on tiled and non-tiled fields at plot and field scales. This basic instrumentation setup will feed into the other three research components addressing drainage design criteria and economics, water quality and nutrient management, and hydrologic impacts of drainage (Fig. 1). This report provides a brief discussion of drainage research conducted at the SDSU Southeast Research Farm.

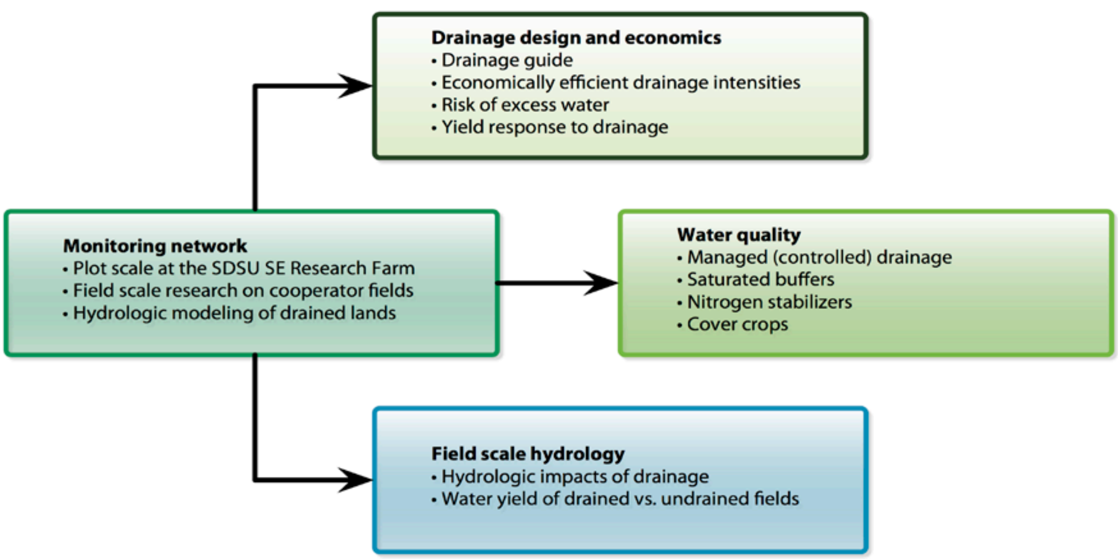

Figure 1. Diagram of research project components

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METHODS

Drainage plots at the SDSU Southeast Research Farm were installed during the week of May 6–10, 2013. The drain lines were installed in six plots of approximately 1-acre size across two fields that have been in a long-term corn-soybean rotation (Fig. 2). The drain lines were installed at a 4-ft. depth with 80-ft. spacing. For the soils in the plots, this results in an estimated drainage coefficient (design capacity of the drainage system) of ½ inches per day or ⅜ inches per day when operated at a 3-ft. outlet depth. Three of the plots are operated as drained to a 3-ft. depth, and the other three plots have the outlets closed and are operated as undrained.

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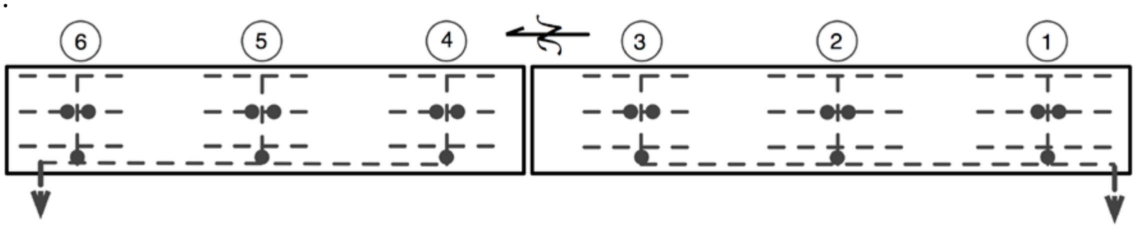

Fig. 2. Subsurface drainage plots at the Southeast Research Farm. Dashed lines are the tile lines, and dots are the control structures. Plots 2, 3, and 6 are drained to a 3-ft. depth, and plots 1, 4, and 5 have the outlets closed and are managed as undrained. Within each of these plots, half of the plot will receive conventional urea nitrogen applications, and the other half will receive applications of nitrogen with a nitrogen stabilizer (nitropyrin).

The study is set up in a split-plot design with drainage as the whole-plot treatment and nitrogen as the split-plot treatment. The tile plot area was seeded to soybeans in the spring of 2013 after disking operations to smooth out the fields following the drainage installation. The drained plots were planted on June 3rd. Because of wet conditions, planting was delayed on the undrained plots until June 18th and 20th. With the beginning of a new study, however, there was some initial confusion over study goals that resulted in one of the drained plots being planted later than it could have been.

Soil moisture, water level, and precipitation monitoring instrumentation we installed in the summer. Stevens Hydra Probe II sensors for continuous measurement of soil water content, soil temperature, and electrical conductivity were installed on the control (conventional nitrogen) side of each whole-plot at depths of 6″, 18″, 30″, and 42″. Decagon CTD sensors were installed in each of the control structures for continuous measurement of water level (for calculating drain discharge), water temperature, and electrical conductivity. Monitoring wells were installed in each whole-plot, midway between two tile lines, for monitoring shallow groundwater levels. Additionally, two tipping bucket gages were installed for measuring precipitation. Other climatological measurements will come from the existing weather station at the research farm. Data was analyzed for the main effects of drainage on yield using PROC GLM in SAS. The late-planted drained plot was dropped from the analysis.

RESULTS AND DISCUSSION

Following the drought in 2012, we were not optimistic that we would see much in the way of drainage in the spring of 2013. However, snowmelt and spring rains were enough to result in some initial drainage from the plots at the time of installation. Due to heavy rains around Memorial Day, the plots managed as undrained developed a high water table that was within a few inches of the soil surface and persisted for more than a week. It was the wet conditions as a result of the high water table conditions that delayed planting in the undrained plots. Because planting needed to wait until after tile installation, planting was already later than desired planting dates for both drained and undrained plots.

Yield from the drained plots was 6.6 bu/ac greater than yield from the undrained plots (P = 0.138) (Table 1). Numerically, this represents a 15% increase in yield from drainage relative to the undrained condition. Since this was the first year of the study, it will be interesting to see how results from subsequent years compare and to see results for corn. Additionally, we will be able to begin collecting water quality next year and will have the benefit of soil moisture, soil temperature, and water level data over the entire season.

Table 1. Mean soybean yield, moisture at harvest, and test weight and standard errors (SE) under drained and undrained treatments at the SDSU Southeast Research Farm in 2013.

Treatment	Yield (bu/ac)	(SE)	Moisture (%)	(SE)	Test Weight (lb/bu)	(SE)
Undrained	45.5	(1.5)	12.5	(0.7)	54.7	(0.5)
Drained	52.1	(0.5)	10.7	(0.1)	55.7	(0.3)
Overall Mean	48.2		11.8		55.1	
CV	2.5		9.0		1.1	
P-value	0.138		0.371		0.322	

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Funding for this research comes from a grant from the South Dakota Corn Utilization Council. Additional in-kind support was provided by Advanced Drainage Systems, Inc. and Agri Drain Corporation.

Photos of drainage installation and plot control structure and monitoring instrumentation.

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A High-input Trial to Evaluate Several Products on Soybean Yields

Graig Reicks*, David Clay, Sharon Clay, Gregg Carlson, and Dan Clay

INTRODUCTION

There are many products on the market that may increase soybean yields. A trial was initiated in 2013 near the eastern South Dakota locations of Beresford, Aurora, and South Shore, where six of these products were used in various combinations to investigate the individual contribution of each to yield.

METHODS

The previous crop was corn. The trial was a split-plot on a randomized complete block design with four replications. Planting date was the main plot effect, while product combination was the subplot (Table 1). Plot sizes were 10 ft wide by 30 ft long. An adapted soybean variety with a 2.1 maturity rating near Beresford and a 1.6 at the northern sites was planted in 30 in. wide rows on May 17 and June 2 near Beresford and May 10 and June 7 near South Shore. The Aurora location only had a May 18 planting date, but was replicated with and without irrigation. All plots were planted to approximately 160,000 seeds ac^{-1}. With the exception of treatment #8, seed was treated with the following fungicides: pyraclostrobin, fluxapyroxad, and metalaxyl. It also contained the insecticide, clothianadin, as well as *Bacillus firmus* I-1582 to protect against nematodes. Here's a summary of the remaining inputs:

1. Cobra®, a diphenyl-ether herbicide, was applied at V4 to burn the foliage and promote additional branching
2. Half of the urea in the mixture was coated with Agrotain®Ultra at 3 qt/ton^{-1} for faster N availability and the other half with ESN for slower release
3. Task Force®2, foliar fertilizer had a grade of 11-8-5 and also contained small amounts of boron, cobalt, copper, iron, manganese, molybdenum, and zinc
4. Bio-Forge™, was an antioxidant to suppress excessive ethylene produced under stressful conditions
5. QuiltXcel®,was a fungicide with 2 modes of action; a DMI and a strobilurin, the latter of which can also promote plant health

Spraying was performed with a 4-nozzle CO_2 backpack sprayer at approximately 15 gal. per acre. A plot combine was used to harvest the middle two rows of each plot.

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Table 1. Treatments in the high-input soybean trial near Beresford, SD in 2013

Input	Rate Acre^{-1}	Growth Stage	Treatment							
			#1	#2	#3	#4	#5	#6	#7	#8
Seed Treatment			x	x	x	x	x	x	x	
Cobra	12 oz	V4	x	x	x	x		x		
Urea	150 lbs N	V4	x	x	x		x	x		
TaskForce 2	64 oz	R1	x	x		x	x	x		
Bio-Forge	16 oz	R3	x		x	x	x	x		
Quilt XL	21 oz	R3		x	x	x	x	x		

RESULTS

Yield information is not being released at this time. Trials will be performed again in 2014 to provide better information on where and when these products may increase yields. Contact the corresponding author for more info.

AKNOWLEDGEMENTS

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Interactions Between Soybean Maturity Group, Planting Date, and Seed Treatments and Their Influence on Yields

Graig Reicks*, David Clay, Sharon Clay, Gregg Carlson, and Dan Clay

INTRODUCTION

From 2010 through 2012, the influence of maturity group on various planting dates has been evaluated. The primary objective was to observe if earlier soybean planting resulted in higher yields than more traditional planting dates, usually after corn planting is finished around May 10. On only one occasion in 3 years did we find that very early planted soybeans resulted in a significant yield increase. In 2013, planting was not started as early as in previous growing seasons. Planting operations were done within a more-normal timeframe for this part of the state. Since we had established that soybean yield losses usually start occurring between May 20 and 25 at the SE Research Farm, our first planting date was May 17.

METHODS

The previous crop was corn. The trial was laid out in a split-plot on a randomized complete block design with four replications. Planting date was the main plot with maturity group and seed treatment combination being the subplot. Plot sizes were 10 ft wide by 30 ft long. Soybeans were planted in 30 in. wide rows on the following dates at approximately 160,000 seeds per acre: May 17, June 2, and June 13. Most of the seed was untreated, except for the variety from maturity group 2. Treated vs. untreated seed was planted for this maturity group. The seed treatment contained the following fungicides: pyraclostrobin, fluxapyroxad, and metalaxyl. It also contained the insecticide, clothianadin, as well as *Bacillus firmus* I-1582 to protect against nematodes. A plot combine was used to harvest the middle two rows of each plot.

RESULTS AND DISCUSSION

The main effects of planting date (Pr>F 0.0268) maturity group (Pr>F 0.0001) were both significant, as well as the interaction between planting date and maturity group (Pr>F 0.001). Therefore, yields of the different maturity groups were analyzed within each planting date. At the earliest planting date of May 17, varieties from groups 3, mid-1, and 1 were the highest yielding (Table 1). Interestingly, the group 2 variety yielded below the group 3 variety when planted on this date. All varieties planted on June 2, except for group 0, yielded the same. On the latest planting date of June 13, maturity groups 1 and mid-1 fell out of the top yielding group. This growing season had a very dry July, with only 0.6 in of rain recorded for the month. The first 24 days of August had highly-favorable moisture conditions, with 3.66 in. of rain spread evenly throughout this timeframe. Treatments that were filling pods during this time were likely among the highest yielding in the study. A second hot and dry spell occurred from August 25 through the end of the growing season, which possibly affected the later-planted group 3 treatments that were filling pods at this time. A 9.5 bu ac^{-1} response to seed treatment was recorded for the May 17 planting date. An extensive wet period followed this planting date, which can have led to seed rot and/or seedling diseases. However, this was not evident in the stand counts at harvest.

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CONCLUSIONS

Like most growing seasons, 2013 had a few lengthy dry periods that likely impacted soybeans yields. The first of these was the entire month of July. Here, group 0's planted on May 17 and group 1's and mid-1's planted on June 13 were likely affected (Table2). The second dry spell stretched from the last week of August through the end of the growing season. This period likely affected the June-planted group 3 soybeans. These results once again show the importance of diversifying soybean maturity groups under dryland growing conditions. Also, a large yield response to seed treatment at the earliest planting date was recorded.

ACKNOWLEDGEMENTS

This study was funded by the South Dakota Soybean Research and Promotion Council.

Table 1. Soybean maturity group effect on yields at three different planting dates near Beresford, SD in 2013.

Planting Date	Maturity Group	Soybean Yield
		---bu ac^{-1}---
May 17	3	55.6 a†
	2	49.2 b
	mid-1	53.5 ab
	1	52.6 ab
	0	35.8 c
June 2	3	47.7 a
	2	51.6 a
	mid-1	50.5 a
	1	50.7 a
	0	41.2 b
June 13	3	47.5 ab
	2	46.6 ab
	mid-1	37.8 c
	1	42.4 bc
	0	44.0 ab

† Values followed by the same letter within the same planting date are significant at the 0.05 probability level.

Table 2. Soybean planting date effect on yields of varieties from five different maturity groups near Beresford, SD in 2013.

Maturity Group	Planting Date	Soybean Yield
3	May 17	55.6 a†
	June 2	47.7 b
	June 13	47.5 b
2	May 17	49.2 a
	June 2	51.6 a
	June 13	46.6 a
mid-1	May 17	53.5 a
	June 2	50.5 a
	June 13	37.8 b
1	May 17	52.6 a
	June 2	50.7 a
	June 13	42.4 b
0	May 17	35.8 b
	June 2	41.2 a
	June 13	44.0 a

† Values followed by the same letter within the same planting date are significant at the 0.05 probability level.

Table 3. Soybean maturity group effect on yields at three different planting dates near Beresford, SD in 2013.

Planting Date	Seed Treatment	Soybean Yield
		---bu ac^{-1}---
May 17	Treated	58.7 a†
	Untreated	49.2 b
June 2	Treated	51.1 a
	Untreated	51.6 a
June 13	Treated	50.6 a
	Untreated	46.6 a

† Values followed by the same letter within the same planting date are significant at the 0.05 probability level.

SOUTHEAST RESEARCH FARM ANNUAL REPORT
South Dakota State University
2013 Progress Report
Agricultural Experiment Station
Plant Science Department
South Dakota State University, Brookings, SD 57007
Southeast Research Farm, Beresford SD 57004

WEED CONTROL DEMONSTRATIONS and EVALUATION TESTS for 2013

Southeast South Dakota Research Center
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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 Center. 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.

2013 TESTS

Several studies were established to evaluate new weed control technologies. The demonstration plots centered around programs that would answer questions on the glyphosate resistance issue around the state, especially as it relates to soybean and corn waterhemp management.
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. Trade names 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 regional extension offices or iGrow.org 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. Weed Control Programs with Instigate
3. Anthem in Corn
4. Pre Followed by Postemergence Tank-Mix Combinations
5. Tank-Mixes with Glyphosate in Corn
6. Postemergence Broadleaf Control in Corn
7. Two Pass Corn Programs with Dicamba
8. Liberty Tank-Mixes with Dicamba
9. Roundup Ready Soybean Demonstration
10. Liberty Link Soybean Demonstration
11. Foundation Pre Followed by Postemergence Soy Demo
12. Soybean Pre & Post Weed Control
13. Conventional Till Soybean Programs

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14. Dimetric Combinations in Soybeans
15. Weed Control with Metribuzin & Zidua
16. No-Till Soybean Programs
17. Burndown & Residual Weed Control in Soybean
18. Flexstar GT with Adjuvants
19. Glyphosate and Avalanche Ultra with Oil Adjuvants
20. Glyphosate + AMS Adjuvants in Soybeans
21. Huskie in Sorghum

ACKNOWLEDGEMENTS:

We greatly appreciate the cooperation and assistance provided by the station personnel.

Due to the distance from the SDSU campus, assistance with field preparation and daily oversight of the fields is critical to the success of the weed control research. Field equipment and management of the plot areas are important contributions to the project. Regional Extension field specialists and program technicians provide assistance with tours and utilize the data in direct producer programs, publications and news releases. In addition to the Southeast Farm Report, research results will be published in the annual Weed Control Field Test Data Book (EMC 678), SDSU Pest Management Guides and Weed Control Fact Sheets updated annually for major South Dakota commodities, and on the internet at http://www.sdstate.edu/ps/extension/weed-mgmt/index.cfm and http://igrow.org/.

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

Crop Protection Industries

2013 Study Results

2013
CORN HERBICIDE DEMONSTRATION
Southeast Research Farm

Treatment	Rate/A	VCRR 6/17/13	Vele 6/17/13	Cowh 6/17/13	Vele 7/26/13	Cowh 7/26/13	Vele 9/11/13	Cowh 9/11/13	Yield bu/A 10/25/13
Check	---	0 a	0 h	0 e	0 e	0 c	0 g	0 c	113 b
Pre & Post									
Keystone LA + Hornet & Status + NIS	1.8 qt + 3 oz & 5 oz + 0.25%	0 a	80 b	99 a	95 cd	99 a	90 cd	99 a	182 a
Corvus + Atrazine & Laudis + Atrazine + COC + AMS	3 oz + 1 pt & 3 oz + 1 pt + 1% + 1.5 lb	0 a	97 a	99 a	99 a	99 a	98 a	99 a	178 a
Surestart & Durango DMA + N Pak AMS	2 pt & 1.5 pt + 2.5%	0 a	85 ab	99 a	98 abc	99 a	96 ab	99 a	182 a
Lumax EZ & Halex GT	1.5 qt & 3.6 pt	0 a	97 a	99 a	99 a	99 a	99 a	99 a	187 a
Bicep Lite II Mag & Halex GT	1 qt & 3.6 pt	0 a	40 f	99 a	99 ab	99 a	98 a	99 a	176 a
Dual II Mag & Halex GT	1 pt & 3.6 pt	0 a	25 g	99 a	98 abc	99 a	97 a	99 a	179 a
Harness Xtra 6L & Impact + RU Powermax + Atrazine + MSO + N Pak AMS	3 pt & 0.75 oz + 1 qt + 1 pt + 0.5% + 2.5%	0 a	63 cd	99 a	98 abc	99 a	97 a	99 a	187 a
Harness & RU Powermax + Atrazine + AMS	1.5 pt & 22 oz + 1 pt + 2.5 lb	0 a	49 e	99 a	98 abc	99 a	95 ab	99 a	174 a
Cinch ATZ Lite & Realm Q + Abundit Extra + AMS	3 pt & 4 oz + 1 qt + 2.5 lb	0 a	55 de	99 a	99 a	99 a	99 a	99 a	181 a
Zidua & RU Powermax + Status + NIS + AMS	3 oz & 22 oz + 5 oz + 0.25% + 2.5 lb	0 a	70 c	99 a	98 abc	99 a	98 a	99 a	172 a
Verdict & Status + RU Powermax + NIS + AMS	15 oz & 5 oz + 22 oz + 0.25% + 2.5 lb	0 a	94 a	99 a	95 bcd	99 a	91 bc	99 a	178 a
Balance Flexx & Liberty + Atrazine + AMS	3 oz & 22 oz + 1 pt + 2.5 lb	0 a	90 ab	94 b	98 abc	99 a	96 ab	99 a	180 a
Epost									
Surestart + Durango DMA + N Pak AMS	2 pt + 1.5 pt + 2.5%	0 a	97 a	99 a	96 a-d	97 a	93 abc	97 a	173 a
Warrant + Impact + RU Powermax + Atrazine + MSO + N Pak AMS	3 pt + 0.75 oz + 1 qt + 1 pt + 0.5% + 2.5 %	0 a	97 a	99 a	94 d	99 a	86 de	99 a	174 a
Anthem + RU Powermax + AMS	8 oz + 22 oz + 2.5 lb	0 a	97 a	99 a	95 a-d	98 a	89 cde	97 a	184 a
Liberty + Capreno + Atrazine + AMS	22 oz + 2 oz 1 pt + 2.5 lb	0 a	98 a	99 a	93 d	96 a	89 cde	96 a	177 a
RU Powermax + AMS	22 oz + 2.5 lb	0 a	92 ab	84 d	98 abc	20 b	65 f	63 b	169 a
Epost & Post									
RU Powermax + AMS & RU Powermax + AMS	22 oz + 2.5 lb & 22 oz + 2.5 lb	0 a	87 ab	85 c	95 bcd	97 a	85 e	97 a	177 a

2013
CORN HERBICIDE DEMONSTRATION
Southeast Research Farm

RCB: 4 reps
Variety: DKC 45-51 RIB
Planting Date: 5/13/13
Pre: 5/13/13
Epost: 6/5/13 Corn V2, 3-4 lf; Vele 1-3 lf, 1-3 in; Cowh cot.-1 in.
Post: 6/17/13 Corn V4 12-16 in; Vele 1-6 in; Cowh 1-4 in.

Soil: Silty Clay; 3.5% OM; 6.6 pH

Precipitation:
Pre: 1st week 0.62 inches
2nd week 1.16 inches
Epost: 1st week 1.78 inches
2nd week 0.52 inches
Post: 1st week 0.51 inches
2nd week 0.42 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)
Vele=Velvetleaf
Cowh=Common waterhemp

P=0.10

Comments: The objective of this study was to demonstrate and compare the efficacy of different herbicide programs in corn. Programs included conventional, Liberty Link, and Roundup Ready treatments with total POST or PRE followed by POST herbicides. Most of the PRE treatments provided nearly complete control of waterhemp. The preemergence (grass) herbicides resulted in poor velvetleaf control one month after application. The EPOST treatments provided good early season control, but had some velvetleaf escapes at the end of the season. Glyphosate applied alone EPOST resulted in poor late season weed control and the lowest yield. The PRE followed by POST program treatments gave nearly complete control mid-season with some late velvetleaf escapes. Yields were similar for most treatments. Weed densities were moderate as yield loss was near 40% in the untreated check.

2013
WEED CONTROL PROGRAMS with INSTIGATE
Southeast Research Farm

Treatment	Rate/A	Cowh 6/13/13	Vele 6/13/13	Vele 7/18/13	Cowh 7/18/13	Colq 7/18/13	Vele 8/16/13	Cowh 8/16/13	Yield bu/A 10/25/13
Pre & Post									
Instigate & Realm Q + Abundit Extra + AMS	6 oz & 4 oz + 32 oz + 2 lb	99 a	97 a	99 a	99 a	99 a	99 a	99 a	199 a
Instigate + Breakfree ATZ Lite & Abundit Extra + AMS	6 oz + 3 pt & 32 oz + 2 lb	99 a	98 a	97 ab	99 a	99 a	96 ab	99 a	194 a
Instigate + Breakfree & Abundit Extra + AMS	6 oz + 1.25 pt & 32 oz + 2 lb	99 a	98 a	96 ab	99 a	99 a	94 ab	99 a	202 a
Instigate + Breakfree & Abundit Extra + AMS	6 oz + 2.25 pt & 32 oz + 2 lb	99 a	97 a	95 b	99 a	99 a	96 ab	99 a	211 a
Instigate + Cinch ATZ Lite & Abundit Extra + AMS	6 oz + 3 pt & 32 oz + 2 lb	99 a	97 a	96 ab	99 a	99 a	96 ab	99 a	207 a
Instigate + Cinch & Abundit Extra + AMS	6 oz + 1 pt & 32 oz + 2 lb	99 a	98 a	95 b	99 a	99 a	94 ab	99 a	197 a
Lumax EZ & Abundit Extra + AMS	2.5 qt & 32 oz + 2 lb	99 a	97 a	95 b	99 a	99 a	92 b	99 a	200 a
Post									
Realm Q + Abundit Extra + AMS	4 oz + 32 oz + 2 lb	--	--	98 ab	99 a	99 a	98 a	98 a	200 a
Post & Post2									
Abundit Extra + AMS & Abundit Extra + AMS	32 oz + 2 lb & 32 oz + 2 lb	--	--	97 ab	99 a	99 a	98 a	98 a	200 a
Check	---	0 b	0 b	0 c	0 b	0 b	0 c	0 b	138 b

RCB: 3 reps
Variety: DKC 50-77 RIB
Planting Date: 5/13/13
Pre: 5/13/13
Post: 6/13/13
Post2: 6/25/13

Precipitation:
Pre: 1st week 0.62 inches; 2nd week 1.16 inches
Post: 1st week 0.14 inches; 2nd week 0.78 inches
Post2: 1st week 0.16 inches; 2nd week 0.06 inches

Soil: Clay Loam; 3.3% OM; 7.2 pH

Cowh=Common waterhemp
Vele=Velvetleaf
Colq=Common lambsquarters
P=0.10

Comments: Instigate and Realm Q are premixes of rimsulfuron (e.g. Resolve) and mesotrione (e.g. Callisto). Instigate is primarily for preemergence application. Almost all treatments provided excellent weed control and similar yield.

2013
ANTHEM in CORN
Southeast Research Farm

Treatment	Rate/A	VCRR 6/13/13	VCRR Leaf speckle 6/17/13	Vele 6/17/13	Cowh 6/17/13	VCRR 7/1/13	Vele 7/3/13	Cowh 7/3/13	Cowh 8/16/13	Vele 8/16/13	Yield bu/A 10/25/13
Pre & Post											
Anthem & RU Powermax + AMS	10 oz & 22 oz +1.7 lb	0 a	0 d	84 d	97 ab	0 a	88 c	98 a	98 a	95 ab	208 a
Anthem ATZ & RU Powermax + AMS	40 oz & 22 oz +1.7 lb	0 a	0 d	91 bc	98 a	0 a	95 ab	98 a	99 a	99 a	208 a
Harness & RU Powermax + AMS	2 pt & 22 oz +1.7 lb	0 a	0 d	47 e	96 b	0 a	79 d	98 a	98 a	91 b	202 a
Surestart & RU Powermax + AMS	2 pt & 22 oz +1.7 lb	0 a	0 d	84 d	98 ab	0 a	88 c	98 a	99 a	94 ab	213 a
Epost											
Anthem + RU Powermax + AMS	8 oz + 22 oz +1.7 lb	0 a	4 b	95 ab	99 a	0 a	86 c	94 b	98 a	90 b	206 a
Anthem ATZ + RU Powermax + AMS	32 oz + 22 oz +1.7 lb	0 a	4 b	97 a	99 a	0 a	92 b	98 a	98 a	94 ab	207 a
RU Powermax + AMS	22 oz +1.7 lb	0 a	0 d	90 c	91 c	0 a	80 d	67 c	70 b	81 c	200 a
Check	---	0 a	0 d	0 f	0 d	0 a	0 e	0 d	0 c	0 d	154 b

RCB: 3 reps
Variety: DKC 50-77 RIB
Planting Date: 5/13/13
Pre: 5/13/13
Epost: 6/5/13 Corn V2 3-4 lf; Vele 1-3 in, 1-3lf; Cowh cot-1 in.
Post: 6/25/13 Corn V8

Soil: Clay Loam; 3.3% OM; 7.2 pH

Precipitation:
Pre: 1st week 0.62 inches; 2nd week 1.16 inches
Epost: 1st week 1.78 inches; 2nd week 0.52 inches
Post2: 1st week 0.16 inches; 2nd week 0.06 inches

VCRR=Visual Crop Response Rating (0=no injury; 100=complete kill)
Vele=Velvetleaf
Cowh=Common waterhemp

P=0.10

Comments: Anthem contains pyroxasulfone (e.g. Zidua) and fluthiacet-methyl (e.g. Cadet). All treatments except the single application of glyphosate gave good control of common waterhemp. Including atrazine PRE or EPOST improved velvetleaf control.

2013
PRE FOLLOWED by POSTEMERGENCE TANK-MIX COMBINATIONS
Southeast Research Farm

Treatment	Rate/A	Vele 6/17/13	Cowh 6/17/13	Vele 7/18/13	Cowh 7/18/13	Vele 9/11/13	Cowh 9/11/13
Pre & Post							
Harness & RU Powermax + AMS	0.75 qt & 32 oz + 2%	35 b	99 a	90 c	99 a	94 c	99 a
Harness & RU Powermax + AMS + Atrazine	0.75 qt & 32 oz + 2% + 1 pt	--	--	94 b	99 a	95 bc	99 a
Harness & RU Powermax + Impact + AMS	0.75 qt & 32 oz + 0.74 oz + 2%	--	--	96 ab	99 a	97 abc	98 a
Harness & RU Powermax + Impact + Atrazine + AMS	0.75 qt & 32 oz + 0.74 oz + 1 pt + 2%	--	--	97 a	99 a	98 ab	99 a
Harness & RU Powermax + Status + AMS	0.75 qt & 32 oz + 7 oz + 2%	45 b	99 a	97 ab	99 a	96 bc	99 a
Harness Xtra 5.6L & RU Powermax + Atrazine + AMS	1.6 qt & 32 oz + 1 pt + 2%	53 b	99 a	94 b	99 a	97 abc	99 a
Harness Xtra 5.6L & RU Powermax + Status + Atrazine + AMS	1.6 qt & 32 oz + 7 oz + 1 pt + 2%	--	--	99 a	99 a	98 ab	99 a
Tripleflex & RU Powermax + AMS	1 qt & 32 oz + 2%	89 a	99 a	98 a	99 a	98 ab	98 a
Tripleflex & RU Powermax + Impact + Atrazine + AMS	1 qt & 32 oz + 0.74 oz + 1 pt + 2%	--	--	99 a	99 a	99 a	99 a
Check	---	0 c	0 b	0 d	0 b	0 d	0 b

RCB: 2 reps
Variety: DKC 50-77 RIB
Planting Date: 5/13/13
Pre: 5/13/13
Post: 6/17/13 Corn V4 12-16 in; Vele 1-6 in; Cowh 1-4 in.

Soil: Silty Clay; 3.5% OM; 6.6 pH

Precipitation:
Pre: 1st week 0.62 inches
2nd week 0.16 inches
Post: 1st week 0.51 inches
2nd week 0.42 inches

Vele=Velvetleaf
Cowh=Common waterhemp

P=0.10

Comments: The objective of the study was to demonstrate control of difficult weeds with PRE and POST programs. Most treatments provided excellent control of common waterhemp and velvetleaf.

2013
TANK-MIXES with GLYPHOSATE in CORN
Southeast Research Farm

Treatment	Rate/A	VCRR 6/17/13	VCRR 7/1/13	Vele 7/3/13	Cowh 7/3/13	Cowh 8/16/13	Vele 8/16/13	Yield bu/A 10/25/13
Post								
RU Powermax + AMS	22 oz + 1.7 lb	0 a	0 a	87 c	77 d	80 c	84 b	186 a
Liberty + AMS	22 oz + 1.7 lb	0 a	0 a	58 d	67 f	57 e	50 c	163 a
Cadet + RU Powermax + AMS	0.75 oz + 22 oz + 1.7 lb	0 a	0 a	92 b	73 e	76 d	87 b	174 a
Callisto + RU Powermax + AMS	3 oz + 22 oz + 1.7 lb	0 a	0 a	98 a	95 a	96 a	99 a	176 a
Status + RU Powermax + AMS	2.5 oz + 22 oz + 1.7 lb	0 a	0 a	92 b	83 c	83 c	91 ab	181 a
Check	---	0 a	0 a	0 e	0 g	0 f	0 d	126 b

RCB: 3 reps
Variety: DKC 45-51 RIB
Planting Date: 5/13/13
Post: 6/13/13 Corn V3-4 10-12 in; Vele 1-5 in; Cowh 0.5-3 in.

Precipitation:
Post: 1st week 0.41 inches
2nd week 0.78 inches

Soil: Clay Loam; 3.3% OM; 7.2 pH

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)
Vele=Velvetleaf
Cowh=Common waterhemp

P=0.10

Comments: Treatments were applied 4 weeks after planting. Only Callisto plus glyphosate gave late season waterhemp and velvetleaf control.

2013
POSTEMERGENCE BROADLEAF CONTROL in CORN
Southeast Research Farm

Treatment	Rate/A	VCRR Leaf Speckle 6/17/13	VCRR 7/1/13	Vele 7/3/13	Cowh 7/3/13	Cowh 8/16/13	Vele 8/16/13	Yield bu/A 10/25/13
Post								
RU Powermax + AMS	22 oz + 1.7 lb	0 f	0 a	80 c	74 e	74 d	82 d	190 ab
Callisto + COC + AMS	3 oz + 1% + 1.7 lb	0 f	0 a	97 a	93 abc	96 ab	98 a	193 ab
Status + NIS + AMS	5 oz + 0.25% + 1.7 lb	0 f	0 a	85 b	83 d	85 c	86 c	201 ab
Anthem + Callisto + COC + AMS	7 oz + 3 oz + 1% + 1.7 lb	7 c	0 a	99 a	98 a	97 ab	99 a	206 ab
Anthem ATZ + Callisto + COC + AMS	24 oz + 3 oz + 0.25% + 1.7 lb	4 e	0 a	99 a	99 a	99 a	99 a	210 a
Callisto + Aatrex + COC + AMS	3 oz + 1 pt + 0.25% + 1.7 lb	0 f	0 a	99 a	98 a	98 a	99 a	206 ab
Check	---	0 f	0 a	0 d	0 f	0 e	0 e	138 c

RCB: 3 reps
Variety: DKC 45-51 RIB
Planting Date: 5/13/13
Post: 6/13/13 Corn V3-4 10-12 in; Vele 1-5 in; Cowh 0.5-3 in

Soil: Clay Loam; 3.3% OM; 7.2 pH

Precipitation:
Post: 1st week 0.41 inches
2nd week 0.78 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)
Vele=Velvetleaf
Cowh=Common waterhemp

P=0.10

Comments: The objective of this study was to compare weed control of postemergence corn herbicides. A single application of glyphosate did not adequately control velvetleaf and common waterhemp. Treatments containing Callisto provided excellent weed control.

2013
TWO PASS CORN PROGRAMS with DICAMBA
Southeast Research Farm

Treatment	Rate/A	VCRR 7/1/13	VCRR 7/3/13	Vele 7/3/13	Cowh 7/3/13	VCRR Brace root 7/18/13	Vele 7/18/13	Cowh 7/18/13	VCRR Brace root 8/16/13	Vele 8/16/13	Cowh 8/16/13	Yield bu/A 10/25/13
Check	---	0 a	0 a	0 c	0 c	0 c	0 d	0 c	0 c	0 c	0 c	133 b
Pre												
Corvus + Atrazine	5.6 oz + 1 qt	0 a	0 a	98 b	94 b	0 c	98 c	95 b	0 c	98 b	97 b	197 a
Pre & Lpost												
Corvus + Atrazine & RU Powermax + AMS	3.3 oz + 1 qt & 32 oz + 3.4 lb	0 a	0 a	99 a	99 a	0 c	99 b	99 a	0 c	99 a	99 a	201 a
Corvus + Atrazine & RU Powermax + Clarity + COC + AMS	3.3 oz + 1 qt & 32 oz + 8 oz + 1% + 3.4 lb	0 a	0 a	99 a	99 a	5 b	99 a	99 a	5 b	99 a	99 a	202 a
Corvus + Atrazine & RU Powermax + Clarity + COC + AMS	3.3 oz + 1 qt & 32 oz + 16 oz + 1% + 3.4 lb	0 a	0 a	99 a	99 a	8 a	99 a	99 a	8 a	99 a	99 a	197 a
Corvus + Atrazine & RU Powermax + Status + COC + AMS	3.3 oz + 1 qt & 32 oz + 5 oz + 1% + 3.4 lb	0 a	0 a	99 a	99 a	1 c	99 a	99 a	0 c	99 a	99 a	203 a
Corvus + Atrazine & RU Powermax + Status + COC + AMS	3.3 oz + 1 qt & 32 oz + 10 oz + 1% + 3.4 lb	0 a	0 a	99 a	99 a	0 c	99 a	99 a	0 c	99 a	99 a	198 a

RCB: 4 reps
Variety: DKC 50-77 RIB
Planting Date: 5/13/13
Pre: 5/13/13
Lpost: 6/25/13 Corn V8; Vele 3-8 in; Cowh 2-5 in.

Soil: Silty Clay; 3.5% OM; 6.6 pH

Precipitation:
Pre: 1st week 0.62 inches
2nd week 1.16 inches
Lpost: 1st week 0.16 inches
2nd week 0.06 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)
Vele=Velvetleaf
Cowh=Common waterhemp
P=0.10

Comments: The objective of the study was to evaluate dicamba plus glyphosate tank-mixtures applied to large (V8) corn. Corvus plus atrazine was applied PRE to all treatments except the check, and provided excellent weed control. The high rate of Clarity with COC caused some brace root damage.

2013
LIBERTY TANK-MIXES with DICAMBA
Southeast Research Farm

Treatment	Rate/A	VCCR 7/1/13	Vele 7/3/13	Cowh 7/3/13	VCRR Brace root 8/16/13	Vele 8/16/13	Cowh 8/16/13	Yield bu/A 10/25/13
Check	---	0 a	0 f	0 b	0 f	0 d	0 b	120 c
Post* (Ultra Coarse Nozzles)								
Liberty + Clarity + AMS	22 oz + 8 oz + 1.5 lb	0 a	85 bc	99 a	11 cd	89 a	99 a	169 ab
Liberty + Clarity + AMS	22 oz + 16 oz + 1.5 lb	0 a	90 ab	99 a	19 b	92 a	99 a	175 a
Liberty + Clarity + AMS	29 oz + 8 oz + 1.5 lb	0 a	92 a	99 a	13 c	94 a	99 a	186 a
Liberty + Clarity + AMS	29 oz + 16 oz + 1.5 lb	0 a	91 ab	99 a	23 a	93 a	99 a	170 ab
Clarity	8 oz	0 a	23 e	99 a	6 e	45 c	99 a	144 b
Clarity	16 oz	0 a	63 d	99 a	9 d	75 b	99 a	158 ab
Post* (Medium Nozzles)								
Liberty + AMS	22 oz + 1.5 lb	0 a	79 c	98 a	0 f	76 b	99 a	167 ab
Liberty + AMS	29 oz + 1.5 lb	0 a	82 c	99 a	0 f	74 b	99 a	173 a

*All treatments except check received Dual II Mag @ 1 pt/A Pre

RCB: 4 reps
Variety: DKC 45-51 RIB
Planting Date: 5/13/13
Pre: 5/13/13
Post: 6/17/13 Corn V4 12-16 in; Vele 1-6 in; Cowh 1-4 in.

Soil: Silty Clay; 3.5% OM; 6.6 pH

Precipitation:
Pre: 1st week 0.62 inches
2nd week 1.16 inches
Post: 1st week 0.51 inches
2nd week 0.42 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)
Vele=Velvetleaf
Cowh=Common waterhemp

P=0.10

Comments: The purpose of this study was to evaluate dicamba and Liberty tank-mixes for weed control and crop response. Treatments containing dicamba were applied with very coarse nozzles (Teejet TT11003) to minimize spray particle drift. Nozzles (Teejet XR8003) with medium sized spray drops were used for the Liberty alone treatments to maximize weed control. The tank-mixtures resulted in greater weed control than either dicamba or Liberty applied alone.

2013
ROUNDUP READY SOYBEAN DEMONSTRATION
Southeast Research Farm

Treatment	Rate/A	VCRR Necrosis 7/1/13	Cowh 7/1/13	Cocb 7/1/13	Cowh 7/26/13	Cocb 7/26/13	Cowh 9/25/13	Vele 9/25/13	Colq 9/25/13	Yield bu/A 10/8/13
Check	---	0 b	0 d	0 g	0 c	0 b	0 c	0 d	0 c	17 b
Pre & Post										
Fierce & Firstrate + Harmony 50SG + Select Max + NIS	3 oz & 0.3 oz + 0.125 oz + 12 oz + 0.25%	0 b	98 a	39 de	95 b	99 a	90 b	94 c	99 a	48 a
Sonic & Flexstar + Select Max + COC	7 oz & 0.75 pt + 12 oz + 0.25%	0 b	99 a	99 a	99 a	99 a	99 a	99 a	99 a	50 a
Sequence & Flexstar GT + N Pak AMS	2.5 pt & 2.7 pt + 2 qt	0 b	70 c	28 f	98 a	99 a	99 a	99 a	99 a	55 a
Prefix & Touchdown Total + N Pak AMS	2 pt & 32 oz + 2 qt	0 b	98 a	33 ef	99 a	99 a	99 a	99 a	99 a	51 a
Boundary & Flexstar GT + N Pak AMS	1.5 pt & 3.5 pt + 2 qt	0 b	92 a	35 def	99 a	99 a	99 a	99 a	99 a	47 a
Sonic & Durango DMA + N Pak AMS	3 oz & 24 oz +2.5%	0 b	84 b	93 a	99 a	99 a	99 a	99 a	99 a	53 a
Sonic & Durango DMA + N Pak AMS	4.5 oz & 24 oz + 2.5%	0 b	93 a	96 a	99 a	99 a	99 a	99 a	99 a	55 a
Authority MTZ & RU Weathermax + N Pak AMS	11 oz & 22 oz + 2 qt	0 b	78 b	83 b	99 a	99 a	99 a	99 a	99 a	53 a
Valor & RU Weathermax + N Pak AMS	2 oz & 22 oz + 2 qt	0 b	80 b	43 cd	99 a	99 a	98 a	99 a	99 a	52 a
Gangster V + Gangster FR & RU Weathermax + N Pak AMS	2 oz + 0.4 oz & 22 oz + 2 qt	0 b	92 a	94 a	99 a	99 a	99 a	99 a	99 a	51 a
Valor + Dimetric & RU Weathermax + N Pak AMS	2 oz + 5.33 oz & 22 oz + 2 qt	0 b	92 a	48 c	99 a	99 a	98 a	99 a	99 a	52 a
Enlite & RU Weathermax + N Pak AMS	2.8 oz & 22 oz + 2 qt	0 b	92 a	88 ab	99 a	99 a	99 a	99 a	99 a	55 a
Fierce & RU Weathermax + N Pak AMS	3 oz & 22 oz + 2 qt	0 b	98 a	50 c	99 a	99 a	99 a	99 a	99 a	54 a
Zidua + Verdict & RU Weathermax + N Pak AMS	2.5 oz + 5 oz & 22 oz + 2 qt	0 b	97 a	82 b	99 a	99 a	99 a	99 a	99 a	51 a
Epost										
Anthem + RU Weathermax + N Pak AMS	7 oz + 22 oz + 2 qt	14 a	99 a	99 a	95 b	99 a	98 a	96 bc	91 b	49 a
Warrant + RU Weathermax + N Pak AMS	2.5 pt + 22 oz + 2 qt	0 b	98 a	98 a	97 a	99 a	97 a	98 ab	94 ab	48 a
RU Weathermax + N Pak AMS	22 oz + 2 qt	0 b	98 a	98 a	96 b	99 a	95 a	97 ab	95 ab	49 a
Epost & Post										
RU Weathermax + N Pak AMS &	22 oz + 2 qt &	0 b	98 a	98 a	99 a	99 a	99 a	99 a	99 a	54 a

RU Weathermax + N Pak AMS	22 oz + 2 qt

2013
ROUNDUP READY SOYBEAN DEMONSTRATION
Southeast Research Farm

RCB: 4 reps
Variety: AG 2433
Planting Date: 5/24/13
Pre: 5/25/13
Epost: 6/25/13 Soy 3 tri, 6-8 in; Cowh 2-6 in; Vele 1-4 in; Colq 1-4 in.
Post: 7/1/13 Soy 4-5 tri, 10-12 in; Cowh 4-12 in; Cocb 10-12 in.

Soil: Clay; 3.8% OM; 7.4 pH

Precipitation:

Pre:	1st week	3.63 inches
	2nd week	0.36 inches
Epost:	1st week	0.16 inches
	2nd week	0.06 inches
Post:	1st week	0.05 inches
	2nd week	0.50 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)
Cowh=Common waterhemp
Cocb=Common cocklebur
Vele=Velvetleaf
Colq=Common lambsquarters

P=0.10

Comments: The objective of this study was to demonstrate and compare glyphosate or conventional herbicide programs in Roundup Ready 2 soybeans. Treatments included PRE followed by POST programs and one pass EPOST applications with a tank-mix residual herbicide. Preemergence treatments with cloransulam (Sonic and Gangster FR) had good cocklebur control at the first evaluation on July 1. The follow up POST application provided excellent control of waterhemp, lambsquarters, velvetleaf, and cocklebur. Weed pressure was heavy with a 70% yield reduction in the untreated check. One application of glyphosate provided adequate weed control at this location.

2013
LIBERTY LINK SOYBEAN DEMONSTRATION
Southeast Research Farm

Treatment	Rate/A	VCRR Necrosis 7/1/13	VCRR Chlorosis 7/1/13	Cowh 7/1/13	Cocb 7/1/13	Cowh 7/26/13	Cocb 7/26/13	Cowh 9/25/13	Vele 9/25/13	Yield bu/A 10/8/13
Check	---	0 b	0 b	0 b	0 d	0 b	0 c	0 b	0 b	20 b
Pre & Post										
Valor & Liberty + AMS	2 oz & 29 oz + 1.7 lb	0 b	0 b	99 a	53 b	99 a	99 a	99 a	99 a	55 a
Authority First & Liberty + AMS	4.5 oz & 29 oz + 1.7 lb	0 b	0 b	99 a	98 a	99 a	99 a	99 a	99 a	56 a
Fierce & Liberty + AMS	3 oz & 29 oz + 1.7 lb	0 b	0 b	99 a	40 c	99 a	98 b	99 a	99 a	56 a
Epost & Post										
Zidua + Liberty + AMS & Liberty + AMS	2 oz + 29 oz + 1.7 lb & 29 oz + 1.7 lb	0 b	8 a	99 a	99 a	99 a	99 a	99 a	99 a	55 a
Marvel + Liberty + AMS & Liberty + AMS	5 oz + 29 oz + 1.7 lb & 29 oz + 1.7 lb	20 a	0 b	99 a	99 a	99 a	99 a	99 a	99 a	50 a
Liberty + AMS & Liberty + AMS	29 oz + 1.7 lb & 29 oz + 1.7 lb	0 b	0 b	99 a	99 a	99 a	99 a	99 a	99 a	56 a

RCB: 4 reps
Variety: LS 2512
Planting Date: 5/24/13
Pre: 5/25/13
Epost: 6/25/13 Soy 3 tri, 6-8 in; Cowh 2-6 in; Vele 1-4 in
Post: 7/1/13 Soy 4-5 tri, 10-12 in; Cowh 4-12 in; Cocb 10-12 in; Vele 2-6 in.

Soil: Clay; 3.8% OM; 7.4 pH

Precipitation:
Pre: 1st week 3.63 inches
2nd week 0.36 inches
Epost: 1st week 0.16 inches
2nd week 0.06 inches
Post: 1st week 0.05 inches
2nd week 0.50 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)
Cowh=Common waterhemp
Cocb=Common cocklebur
Vele=Velvetleaf

P=0.10

Comments: The objective of this study was to demonstrate and evaluate weed control with Liberty programs. Treatments included a PRE followed by POST Liberty and two sequential applications of Liberty. Marvel contains fluthiacet (e.g. Cadet) and fomesafen (e.g. Flexstar). Valor and Fierce had low cocklebur control on July 1. All treatments resulted in good weed control at the mid-season July 26 evaluation. Common waterhemp density was moderately heavy with a 65% yield loss in the check.

2013
LIBERTY and RESIDUAL HERBICIDES
Northeast Research Farm

Treatment	Rate/A	VCRR Stunt 7/2/13	VCRR Necrosis 7/2/13	VCRR 7/22/13	Yeft 7/2/13	Yeft 7/22/13	Wimu 7/22/13	Yeft 10/2/13	Pesw 10/2/13	Rrpw 10/2/13	Yield bu/A 10/9/13
Check	---	0 e	0 c	0 b	0 d	0 e	0 b	0 b	0 b	0 b	5 c
Pre & Post & Lpost											
Authority First & Liberty + AMS & Liberty + AMS	6.5 oz & 29 oz + 1.7 lb & 29 oz + 1.7 lb	0 e	0 c	0 b	18 c	92 b	99 a	99 a	99 a	99 a	57 ab
Valor XLT & Liberty + AMS & Liberty + AMS	3.5 oz & 29 oz + 1.7 lb & 29 oz + 1.7 lb	0 e	0 c	0 b	38 b	91 b	99 a	99 a	99 a	99 a	56 ab
Optill + Outlook & Liberty + AMS & Liberty + AMS	2 oz + 10 oz & 29 oz + 1.7 lb & 29 oz + 1.7 lb	0 e	0 c	0 b	93 a	97 a	99 a	99 a	99 a	99 a	60 a
Pre & Epost & Lpost											
Valor & Liberty + Zidua + AMS & Liberty + AMS	2 oz & 29 oz + 2 oz + 1.7 lb & 29 oz + 1.7 lb	10 b	4 b	0 b	96 a	83 d	99 a	99 a	99 a	99 a	55 ab
Envive & Liberty + Outlook + AMS & Liberty + AMS	4 oz & 29 oz + 14 oz + 1.7 lb & 29 oz + 1.7 lb	8 c	1 c	0 b	97 a	86 c	99 a	99 a	99 a	99 a	56 ab
Epost & Post											
Liberty + Prefix + AMS & Liberty + Zidua + AMS	29 oz + 2 pt + 1.7 lb & 29 oz + 2 oz + 1.7 lb	21 a	10 a	6 a	96 a	97 a	99 a	99 a	99 a	99 a	55 b
Liberty + Warrant + AMS & Liberty + Outlook + AMS	29 oz + 3 pt + 1.7 lb & 29 oz + 14 oz + 1.7 lb	5 d	0 c	0 b	96 a	98 a	99 a	99 a	99 a	99 a	56 ab

2013
LIBERTY and RESIDUAL HERBICIDES
Northeast Research Farm

RCB: 4 reps
Variety: LC 1142
Planting Date: 6/6/13
Pre: 6/6/13
Epost: 6/25/13 Soy uni-1 tri, 3-4 in; Yeft 3-4 in, 4 lf; Wimu 2 in.
Post: 7/2/13 Soy 2 tri, 6-8 in; Yeft 8-10 in; Wimu 2-4 in.
Lpost: 7/24/13 Soy ebloom, 18 in; Yeft 3-8 in.

Soil: Clay Loam; 4.1% OM; 5.8 pH

Precipitation:

Pre:	1st week	1.52 inches
	2nd week	0.09 inches
Epost:	1st week	0.56 inches
	2nd week	0.00 inches
Post:	1st week	0.00 inches
	2nd week	4.31 inches
Lpost:	1st week	0.15 inches
	2nd week	0.20 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)
Yeft=Yellow foxtail
Wimu=Wild mustard
Pesw=Pennsylvania smartweed
Rrpw=Redroot pigweed

P=0.10

Comments: The objective of the study was to evaluate Liberty in programs with PRE and POST treatments and Liberty tank-mixes with residual herbicides. Some initial crop response was noted for tank-mix treatments. Soybeans recovered quickly and yield was not affected. Severe yellow foxtail pressure reduced yield in the untreated check to 5 bu/acre.

2013
FOUNDATION PRE FOLLOWED by POSTEMERGENCE SOY DEMO
Southeast Research Farm

Treatment	Rate/A	Cowh 7/1/13	Cocb 7/1/13	VCRR Bronzing 7/18/13	Cowh 7/18/13	Cocb 7/18/13	Pesw 7/18/13	Cowh 9/25/13	Vele 9/25/13	Yield bu/A 10/8/13
Pre & Post										
Authority MTZ & RU Powermax + AMS	16 oz & 32 oz + 2%	97 b	69 b	0 b	99 a	99 a	99 a	99 a	99 a	55 a
Authority Assist & RU Powermax + AMS	0.31 qt & 32 oz + 2%	99 a	91 a	0 b	99 a	99 a	99 a	99 a	99 a	52 a
Authority First & RU Powermax + AMS	6.4 oz & 32 oz + 2%	98 a	94 a	0 b	99 a	99 a	99 a	99 a	99 a	57 a
Valor + Warrant & RU Powermax + AMS	3 oz + 2 qt & 32 oz + 2%			0 b	99 a	99 a	99 a	99 a	99 a	58 a
Gangster V + Gangster FR + Warrant & RU Powermax + AMS	3 oz + 0.6 oz + 2 qt & 32 oz + 2%	99 a	93 a	0 b	99 a	99 a	99 a	99 a	99 a	56 a
Valor & RU Powermax + AMS	3 oz & 32 oz + 2%	98 ab	40 d	0 b	99 a	99 a	99 a	99 a	99 a	53 a
Fierce & RU Powermax + Warrant + AMS	3 oz & 32 oz + 2 qt + 2%	98 ab	50 cd	0 b	99 a	99 a	99 a	99 a	99 a	52 a
Valor + Warrant & RU Powermax + Warrant + AMS	3 oz + 2 qt & 32 oz + 2 qt + 2%			0 b	99 a	99 a	99 a	99 a	99 a	53 a
Warrant + Sencor DF & Warrant + RU Powermax + AMS	2 qt + 7 oz & 2 qt + 32 oz + 2%	98 ab	55 c	0 b	99 a	99 a	99 a	99 a	99 a	54 a
Pre & Post & Post2										
Valor & RU Powermax + AMS + Warrant & Cobra + NIS	3 oz & 32 oz + 2% + 2 qt & 12.8 oz + 0.25%			13 a	99 a	99 a	99 a	99 a	99 a	50 a
Check	---	0 c	0 e	0 b	0 b	0 b	0 b	0 b	0 b	22 b

2013
FOUNDATION PRE FOLLOWED by POSTEMERGENCE SOY DEMO
Southeast Research Farm

RCB: 2 reps
Variety: AG 2433
Planting Date: 5/24/13
Pre: 5/25/13
Post: 7/1/13 Soy 10-12 in, 4-5 tri; Cowh 4-12 in; Cocb 10-12 in.
Post2: 7/9/13 Soy 7 tri, 14 in.

Soil: Clay; 3.8% OM; 7.4 pH

Precipitation:

Pre:	1st week	3.63 inches
	2nd week	0.36 inches
Post:	1st week	0.05 inches
	2nd week	0.50 inches
Post2:	1st week	0.49 inches
	2nd week	0.05 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)
Cowh=Common waterhemp
Cocb=Common cocklebur
Pesw=Pennsylvania smartweed
Vele=Velvetleaf

P=0.10

Comments: The objective of the study was to demonstrate and compare PRE followed by POST programs for control of difficult weeds. All treatments gave good control of waterhemp. Preemergence treatments containing cloransulam(e.g. Firstrate) and Authority Assist had good cocklebur control. After the POST glyphosate application, all treatments had excellent weed control. Yields were similar with a 30 bu/acre yield loss for the untreated check.

2013
SOYBEAN PRE & POST WEED CONTROL
Southeast Research Farm

Treatment	Rate/A	VCRR 6/17/13	VCRR Necrosis 7/1/13	Cowh 7/1/13	Vele 7/1/13	Cowh 7/26/13	Vele 7/26/13	Cowh 8/16/13	Vele 8/16/13	Vele 9/25/13	Cowh 9/25/13	Yield bu/A 10/8/13
Pre & Post												
Authority First & Select	6.4 oz & 8 oz	0 a	0 d	99 a	98 a	96 a	98 a	94 ab	95 ab	96 ab	94 ab	49 a
Authority Assist & Select	9 oz & 8 oz	0 a	0 d	99 a	98 a	97 a	99 a	91 bc	94 ab	93 ab	91 bc	52 a
Authority Elite & Select	32 oz & 8 oz	0 a	0 d	98 a	85 c	97 a	82 c	96 ab	73 d	66 e	97 a	41 b
Anthem & Select	10 oz & 8 oz	0 a	0 d	98 a	85 c	96 a	89 b	90 bc	78 c	71 d	90 c	43 ab
Fierce & Select	3 oz & 8 oz	0 a	0 d	99 a	98 a	99 a	94 a	97 ab	88 b	84 c	98 a	52 a
Authority Elite + Firstrate & Select	32 oz + 0.6 oz & 8 oz	0 a	0 d	98 a	96 ab	98 a	96 a	96 ab	94 ab	94 ab	97 a	47 a
Authority First & Marvel + RU Powermax + NIS + AMS	5 oz & 7 oz + 22 oz + 0.25% + 1.7 lb	0 a	0 d	97 a	96 ab	99 a	99 a	99 a	98 a	99 a	99 a	51 a
Pre & Epost												
Authority First & Anthem + RU Powermax + AMS	5 oz & 7 oz + 22 oz + 1.7 lb	0 a	4 c	99 a	99 a	99 a	98 a	98 ab	94 ab	95 ab	98 a	52 a
Epost & Post												
Marvel + RU Powermax + AMS & Marvel + RU Powermax + AMS	5 oz + 22 oz + 1.7 lb & 5 oz + 22 oz + 1.7 lb	0 a	5 b	99 a	99 a	99 a	99 a	99 a	99 a	99 a	99 a	52 a
Epost												
Marvel + RU Powermax + NIS + AMS	7 oz + 22 oz + 0.25% + 1.7 lb	0 a	11 a	99 a	99 a	92 b	97 a	86 c	90 b	88 bc	85 d	49 a
Marvel + Liberty + AMS	5 oz + 22 oz + 1.7 lb	0 a	0 d	99 a	98 a	85 c	86 b	--	--	--	--	--
Flexstar GT	3.5 pt	0 a	0 d	98 a	96 ab	97 a	97 a	94 ab	91 ab	91 ab	97 a	50 a
RU Powermax + AMS	22 oz + 1.7 lb	0 a	0 d	98 a	93 b	96 a	98 a	93 ab	95 ab	95 ab	96 ab	52 a
Check	---	0 a	0 d	0 b	0 d	0 d	0 d	0 d	0 e	0 f	0 e	10 c

2013
SOYBEAN PRE & POST WEED CONTROL
Southeast Research Farm

RCB: 4 reps
Variety: AG 2433
Planting Date: 6/3/13
Pre: 6/5/13
Epost: 6/25/13 Soy 2 tri, 5-7 in; Vele 1-3 in; Cowh 1-8 in.
Post: 7/1/13

Soil: Silty Clay; 3.5% OM; 6.6 pH

Precipitation:

Pre:	1st week	1.78 inches
	2nd week	0.52 inches
Epost:	1st week	0.16 inches
	2nd week	0.06 inches
Post2:	1st week	0.05 inches
	2nd week	0.50 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)
Vele=Velvetleaf
Cowh=Common waterhemp

P=0.10

Comments: The objective of the study was to evaluate sulfentrazone (e.g. Authority) combinations PRE and Marvel programs EPOST. Marvel contains fluthiacet (e.g. Cadet) and fomesafen (e.g. Flexstar). The PRE treatments followed by Select show broadleaf control without a follow up glyphosate application. Most treatments provided good common waterhemp control. A few of the PRE treatments had lower velvetleaf control which shows the different weed spectrums of the herbicides. Weed pressure was dense with a 40 bu/acre loss in the check.

2013
CONVENTIONAL TILL SOYBEAN PROGRAMS
Southeast Research Farm

Treatment	Rate/A	VCRR 6/17/13	Colq 7/3/13	Cowh 7/3/13	Vele 7/3/13	Vele 8/2/13	Cowh 8/2/13	Colq 8/2/13	Vele 9/25/13	Cowh 9/25/13	Colq 9/25/13	Yield bu/A 10/8/13
Pre & Post												
Zidua + Sharpen & RU Powermax + AMS	2 oz + 1 oz & 22 oz + 1.7 lb	0 a	95 b	97 abc	95 abc	94 a	99 a	99 a	97 a	99 ab	98 ab	39 a
Optill Pro(Optill + Outlook) & RU Powermax + AMS	2 oz + 10 oz & 22 oz + 1.7 lb	0 a	99 a	99 ab	99 a	99 a	99 a	99 a	99 a	99 a	99 a	35 a
Verdict + Outlook & RU Powermax + AMS	5 oz + 12 oz & 22 oz + 1.7 lb	0 a	86 d	95 c	89 c	93 a	98 a	99 a	95 a	97 b	98 ab	36 a
Valor & RU Powermax + AMS	2 oz & 22 oz + 1.7 lb	0 a	91 c	92 d	92 bc	95 a	99 a	99 a	97 a	98 ab	98 b	39 a
Zidua + Valor & RU Powermax + AMS	1.5 oz + 2 oz & 22 oz + 1.7 lb	0 a	99 a	99 a	99 a	99 a	99 a	99 a	99 a	99 a	99 a	37 a
Anthem & RU Powermax + AMS	8 oz & 22 oz + 1.7 lb	0 a	90 c	97 abc	92 bc	91 a	99 a	99 a	95 a	99 ab	99 a	37 a
Prefix & RU Powermax + AMS	2 pt & 22 oz + 1.7 lb	0 a	86 d	98 abc	74 d	84 b	99 a	99 a	88 b	99 a	99 ab	34 a
Authority MTZ & RU Powermax + AMS	14 oz & 22 oz + 1.7 lb	0 a	98 a	96 bc	98 ab	97 a	99 a	99 a	98 a	99 ab	99 a	37 a
Check	---	0 a	0 e	0 e	0 e	0 c	0 b	0 b	0 c	0 c	0 c	13 b

RCB: 4 reps
Variety: AG 2433
Planting Date: 6/3/13
Pre: 6/5/13
Post: 7/9/10 Soy 6-7 tri, 10-12 in; Colq 6-12 in; Cowh 6-12 in; Vele 6-10 in.

Soil: Clay; 3.8% OM; 7.4 pH

Precipitation:
Pre: 1st week 1.78 inches
2nd week 0.52 inches
Post: 1st week 0.49 inches
2nd week 0.05 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)
Colq=Common lambsquarters
Cowh=Common waterhemp
Vele=Velvetleaf
P=0.10

Comments: The objective of the study was to compare weed control with PRE treatments followed by glyphosate. Optill contains saflufenacil (e.g. Sharpen) and imazethapyr (e.g. Pursuit). Some differences in the PRE treatments weed spectrums are evident in the July 3 evaluation. The POST glyphosate application resulted in excellent weed control for most treatments.

2013
DIMETRIC COMBINATIONS in SOYBEANS
Southeast Research Farm

Treatment	Rate/A	VCRR 6/17/13	Cowh 7/9/13	Cowh 8/16/13	Cocb 8/16/13	Pesw 8/16/13
Pre						
Valor	2 oz	0 a	78 b	64 b	58 b	43 c
Valor + Dimetric	2 oz + 5.33 oz	0 a	89 a	79 a	53 b	79 b
Sonic	3.2 oz	0 a	90 a	84 a	91 a	94 a
Sonic + Dimetric	3.2 oz + 5.33 oz	0 a	91 a	86 a	90 a	95 a
Verdict	5 oz	0 a	55 d	45 c	55 b	38 c
Verdict + Dimetric	5 oz + 5.33 oz	0 a	68 c	58 b	53 b	73 b
Check	---	0 a	0 e	0 d	0 c	0 d

RCB: 4 reps
Variety: AG 2433
Planting Date: 5/24/13
Pre: 5/25/13

Soil: Clay; 3.8% OM; 7.4 pH

Precipitation:
Pre: 1st week 3.63 inches
2nd week 0.36 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)
Cowh=Common waterhemp
Cocb=Common cocklebur
Pesw=Pennsylvania smartweed

P=0.10

Comments: The objective of the study was to compare PRE herbicides with and without Dimetric (metribuzin). Dimetric increased common waterhemp and Pennsylvania smartweed control with Valor and Verdict.

2013
WEED CONTROL with METRIBUZIN & ZIDUA
Southeast Research Farm

Treatment	Rate/A	VCRR 6/17/13	Cowh 7/3/13	Cowh 9/25/13	Vele 9/25/13	Yield bu/A 10/8/13
Pre & Post						
Zidua + Sharpen & RU Weathermax	2.5 oz + 1 oz & 22 oz	0 a	98 ab	99 a	95 a	55 a
Zidua + Verdict & RU Weathermax	2.5 oz + 5 oz & 22 oz	0 a	97 ab	99 a	96 a	51 ab
Zidua + Verdict + Metribuzin 75DF & RU Weathermax	2.5 oz + 5 oz + 0.66 lb & 22 oz	0 a	97 ab	99 a	96 a	56 a
Zidua + Sharpen + Metribuzin 75DF & RU Weathermax	2.5 oz + 1 oz + 0.66 lb & 22 oz	0 a	98 ab	99 a	98 a	55 a
Verdict & RU Weathermax	5 oz & 22 oz	0 a	50 e	96 a	89 b	50 ab
Verdict + Metribuzin 75DF & RU Weathermax	5 oz + 0.66 lb & 22 oz	0 a	85 d	97 a	95 a	53 a
Anthem & RU Weathermax	9 oz & 22 oz	0 a	98 ab	99 a	95 a	56 a
Fierce & RU Weathermax	4.5 oz & 22 oz	0 a	99 a	99 a	98 a	56 a
Sonic & RU Weathermax	8 oz & 22 oz	0 a	99 a	99 a	99 a	54 a
Authority MTZ & RU Weathermax	16 oz & 22 oz	0 a	94 bc	99 a	97 a	57 a
Optill Pro (Optill + Outlook) & RU Weathermax	2 oz + 10 oz & 22 oz	0 a	93 c	99 a	99 a	54 a
Post						
RU Weathermax	22 oz	--	--	77 b	87 b	46 b
Check	---	0 a	0 f	0 c	0 c	--

RCB: 4 reps
Variety: AG 2433
Planting Date: 5/24/13
Pre: 5/25/13
Post: 7/9/13

Soil: Clay; 3.8% OM; 7.4 pH

Precipitation:
Pre: 1st week 3.63 inches
2nd week 0.36 inches
Post: 1st week 0.49 inches
2nd week 0.05 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)
Cowh=Common waterhemp
Vele=Velvetleaf

P=0.10

Comments: The objective of the study was to evaluate combination PRE treatments followed by glyphosate. Common waterhemp density was moderate and velvetleaf pressure was lite. Most PRE treatments had good waterhemp control before the POST glyphosate application. The glyphosate alone treatment had lower weed control and reduced yield.

2013
NO-TILL SOYBEAN PROGRAMS
Southeast Research Farm

Treatment	Rate/A	Cowh 7/1/13	Kocz 7/1/13	Pesw 7/1/13	Cowh 7/18/13	Colq 7/18/13	Pesw 7/18/13	Kocz 7/18/13	Yield bu/A 10/8/13
EPP & Post									
Zidua + Sharpen + RU Powermax + MSO + AMS & RU Powermax + AMS	2.5 oz + 1 oz + 22 oz + 1% + 1.7 lb & 22 oz + 1.7 lb	98 a	99 a	98 a	98 a	99 a	99 a	99 a	52 a
Optill + RU Powermax + MSO + AMS & RU Powermax + AMS	2 oz + 22 oz + 1% + 1.7 lb & 22 oz + 1.7 lb	78 b	98 a	98 a	98 a	99 a	99 a	99 a	53 a
Optill Pro (Outlook + Optill) + RU Powermax + MSO + AMS & RU Powermax + AMS	(10 oz + 2 oz) + 22 oz + 1% + 1.7 lb & 22 oz + 1.7 lb	95 a	99 a	99 a	99 a	99 a	99 a	99 a	51 a
Verdict + Prowl H2O + RU Powermax + MSO + AMS & RU Powermax + AMS	5 oz + 2 pt + 22 oz + 1% + 1.7 lb & 22 oz + 1.7 lb	98 a	99 a	98 a	99 a	99 a	99 a	99 a	52 a
2,4-D ester + Valor + RU Powermax + AMS & RU Powermax + AMS	16 oz + 2 oz + 22 oz + 1.7 lb & 22 oz + 1.7 lb	98 a	99 a	99 a	99 a	99 a	99 a	99 a	55 a
2,4-D ester + RU Powermax + AMS & RU Powermax + AMS	16 oz + 22 oz + 1.7 lb & 22 oz + 1.7 lb	68 c	76 b	94 b	96 b	99 a	99 a	99 a	54 a
2,4-D ester + Prefix + RU Powermax + AMS & RU Powermax + AMS	16 oz + 2 pt + 22 oz + 1.7 lb & 22 oz + 1.7 lb	99 a	99 a	99 a	99 a	99 a	99 a	99 a	52 a
Check	---	0 d	0 c	0 c	0 c	0 b	0 b	0 b	9 b

RCB: 4 reps
Variety: AG 2433
Planting Date: 6/11/13
EPP: 5/25/13 Cowh 0.5-1 in; Kocz 1 in; Pesw 2-4 in; Colq 1 in;
Post: 7/1/13

Soil: Silty Clay Loam; 3.0% OM; 6.8 pH

Precipitation:
EPP: 1st week 3.63 inches; 2nd week 0.36 inches
Post: 1st week 0.05 inches; 2nd week 0.50 inches

Cowh=Common waterhemp
Kocz=Kochia
Pesw=Pennsylvania smartweed
Colq=Common lambsquarters
P=0.10

Comments: The objective of the study was to evaluate early preplant burndown and residual herbicide programs in no-till soybeans. Burndown treatments were applied approximately two weeks before planting. The 2,4-D treatment without a residual partner had poor waterhemp and kochia control at the July 1 evaluation. With a follow up POST glyphosate application, all treatments provided excellent weed control and similar yield.

2013
BURNDOWN & RESIDUAL WEED CONTROL in SOYBEAN
Southeast Research Farm

Treatment	Rate/A	Dali 6/5/13	Cowh 7/1/13	Dali 7/1/13	Mata 7/1/13	Cowh 8/16/13	Dali 8/16/13	Mata 8/16/13	Mata 9/25/13
EPP & Post									
Affinity BroadSpec + Abundit Extra + AMS & Abundit Extra + AMS	0.5 oz + 32 oz + 2 lb & 32 oz + 2 lb	57 c	27 d	92 a	83 ab	91 a	92 a	84 abc	81 a
Affinity BroadSpec + Abundit Extra + AMS & Cinch + Abundit Extra + AMS	0.5 oz + 32 oz + 2 lb & 1 pt + 32 oz + 2 lb	59 bc	23 d	96 a	95 a	92 a	93 a	92 ab	86 a
Affinity BroadSpec + Valor + Abundit Extra + AMS & Abundit Extra + AMS	0.5 oz + 2 oz + 32 oz + 2 lb & 32 oz + 2 lb	75 a	60 c	93 a	93 a	93 a	88 a	88 ab	91 a
Affinity BroadSpec +Valor + Abundit Extra + AMS & Abundit Extra + AMS	0.5 oz + 3 oz + 32 oz + 2 lb & 32 oz + 2 lb	80 a	83 ab	89 a	89 a	96 a	93 a	86 ab	85 a
Affinity BroadSpec + Valor + Abundit Extra + AMS & Cinch + Abundit Extra + AMS	0.5 oz + 2 oz + 32 oz + 2 lb & 1 pt + 32 oz + 2 lb	77 a	70 bc	93 a	78 ab	97 a	93 a	81 bc	80 a
Valor + Abundit Extra + AMS & Abundit Extra + AMS	2 oz + 32 oz + 2 lb & 32 oz + 2 lb	75 a	71 bc	43 c	47 c	97 a	95 a	79 bc	82 a
Valor + Abundit Extra + AMS & Abundit Extra + AMS	3 oz + 32 oz + 2 lb & 32 oz + 2 lb	80 a	85 ab	67 b	80 ab	97 a	95 a	79 bc	87 a
Affinity BroadSpec + Sharpen + Abundit Extra + MSO & Abundit Extra + AMS	0.5 oz + 1 oz + 32 oz + 1% & 32 oz + 2 lb	80 a	20 d	72 b	93 a	98 a	92 a	94 a	94 a
Affinity BroadSpec + Spartan + Abundit Extra + AMS & Abundit Extra + AMS	0.5 oz + 4.5 oz + 32 oz + 2 lb & 32 oz + 2 lb	65 b	89 a	69 b	72 b	96 a	77 b	73 cd	80 a
Panoflex + Abundit Extra + AMS & Abundit Extra + AMS	0.3 oz + 32 oz + 2 lb & 32 oz + 2 lb	60 bc	20 d	92 a	91 a	97 a	94 a	91 ab	92 a
RU Powermax & Abundit Extra + AMS	22 oz & 32 oz + 2 lb	65 b	23 d	43 c	47 c	97 a	91 a	83 abc	91 a
EPP									
Enlite + COC	2.8 oz + 1%	82 a	84 ab	53 c	93 a	43 c	37 c	67 d	79 a
Enlite + Express 50SG + COC	2.8 oz + 0.25 oz + 1%	80 a	78 ab	93 a	93 a	63 b	93 a	86 ab	83 a
Check	---	0 d	0 e	0 d	0 d	0 d	0 d	0 e	0 b

2013
BURNDOWN & RESIDUAL WEED CONTROL in SOYBEAN
Southeast Research Farm

RCB: 4 reps
Variety: AG 2031
Planting Date: 6/3/13
EPP: 5/25/13 Dali 2-6 in; Cowh 0.5 in; Mata 4-6 in.
Post: 7/1/13

Soil: Silty Clay Loam; 3.2% OM; 6.3 pH

Precipitation:

EPP:	1st week	3.63 inches
	2nd week	0.36 inches
Post:	1st week	0.05 inches
	2nd week	0.50 inches

Dali=Dandelion
Cowh=Common waterhemp
Mata=Marestail

P=0.10

Comments: The objective of the study was to evaluate Affinity Broadspec combinations for burndown and residual weed control in no-till. Affinity Broadspec contains thifensulfuron (e.g. Harmony) and tribenuron (e.g. Express). Early preplant treatments were applied 9 days before planting. Spartan and Valor provided some residual waterhemp control and increasing the Valor rate increased control. At the July 1 evaluation date, treatments with Affinity Broadspec resulted in good dandelion control. The glyphosate alone treatment had poor control of all three weed species at the July 1 weed rating.

2013
FLEXSTAR GT with ADJUVANTS
Southeast Research Farm

Treatment	Rate/A	VCRR Bronzing 7/3/13	VCRR Bronzing 7/9/13	Cowh 7/9/13	Vele 7/9/13	Cowh 7/18/13	Colq 7/18/13	Vele 7/18/13	Cowh 8/17/13	Colq 8/17/13	Vele 8/17/13
Post											
Flexstar GT	1.75 pt	0 c	0 c	85 b	87 c	85 b	89 c	86 ab	84 ab	92 a	78 b
Flexstar GT + N-Tense	1.75 pt + 0.4 qt	4 c	0 c	89 a	91 ab	89 ab	93 ab	87 ab	87 ab	90 a	78 b
Flexstar GT + Prefer 90 + AMS	1.75 pt + 0.2 qt + 1.7 lb	0 c	0 c	90 a	92 ab	87 ab	92 ab	92 a	87 ab	94 a	90 a
Flexstar GT + Savvy + N-Tense	1.75 pt + 0.4 qt + 0.4 qt	11 a	4 b	89 a	92 ab	88 ab	93 ab	90 ab	81 b	91 a	89 ab
Flexstar GT + Stake + N-Tense	1.75 pt +0.4 qt + 0.4 qt	8 b	5 a	90 a	93 a	90 ab	92 ab	91 ab	85 ab	87 a	89 a
Check	---	0 c	0 c	0 c	0 d	0 c	0 d	0 c	0 c	0 b	0 c

RCB: 4 reps
Variety: AG 2433
Planting Date: 6/3/13
Post: 7/1/13 Soy 2-3 tri, 5-7 in;
Colq 1-5 in; Vele 3-6 in; Cowh 4-8 in.

Soil: Clay; 3.8% OM; 7.4 pH

Precipitation:
Post: 1st week 0.05 inches
2nd week 0.50 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)
Colq=Common lambsquarters
Vele=Velvetleaf
Cowh=Common waterhemp
Bdlf=General broadleaf (Colq/Cowh)

P=0.10

Comments: A lower rate of Flexstar GT was used to help detect adjuvant differences. Adjuvants increased weed control compared to Flexstar GT alone at the early and mid-season evaluations.

2013
GLYPHOSATE and AVALANCE ULTRA with OIL ADJUVANTS
Southeast Research Farm

Treatment	Rate/A	VCRR-Necrosis 7/3/13	VCRR-Necrosis 7/9/13	Cowh 7/18/13	Vele 7/18/13	Bdlf 8/17/13	Colq 8/17/13
Check	---	0 f	0 g	0 c	0 h	0 c	0 c
Post							
Touchdown Hi-Tech + Avalance Ultra	11 oz + 1 pt	0 f	0 g	82 b	78 g	68 ab	82 ab
Touchdown Hi-Tech + Avalance Ultra + N Pak AMS	11 oz + 1 pt + 2.5%	1 f	4 fg	81 b	84 ef	66 ab	85 ab
Touchdown Hi-Tech + Avalance Ultra + Class Act NG	11 oz + 1 pt + 2.5%	13 c	8 def	88 ab	88 b-e	73 ab	85 ab
Touchdown Hi-Tech + Flexstar + Class Act NG	11 oz + 0.75 pt + 2.5 %	4 e	1 g	84 ab	90 bcd	69 ab	91 a
Touchdown Hi-Tech + Avalance Ultra + Prime Oil + N Pak AMS	11 oz + 1 pt + 1% + 2.5%	15 bc	9 cde	86 ab	89 bcd	68 ab	76 ab
Touchdown Hi-Tech + Avalance Ultra + Superb HC + Class Act NG	11 oz + 1 pt + 1 pt + 2.5%	13 c	8 def	88 ab	88 b-e	75 a	88 ab
Touchdown Hi-Tech + Flexstar + Superb HC + Class Act NG	11 oz + 0.75 pt + 1 pt + 2.5%	5 e	0 g	82 b	93 ab	70 ab	91 a
Touchdown Hi-Tech + Avalance Ultra + MSO + N Pak AMS	11 oz + 1 pt + 1% + 2.5%	14 bc	10 bcd	88 ab	92 ab	61 b	79 ab
Touchdown Hi-Tech + Avalance Ultra + Destiny HC + Class Act NG	11 oz + 1 pt + 1 pt + 2.5%	18 ab	13 abc	93 a	95 a	70 ab	78 ab
Touchdown Hi-Tech + Flexstar + Destiny HC + Class Act NG	11 oz + 0.75 pt + 1 pt + 2.5%	8 d	5 ef	88 ab	90 bcd	68 ab	84 ab

RCB: 4 reps
Variety: AG 2433
Planting Date: 6/3/13
Post: 7/1/13 Soy 2-3 tri, 5-7 in;
Colq 1-5 in; Vele 3-6 in; Cowh 4-8 in.

Soil: Clay Loam; 3.3% OM; 7.2 pH

Precipitation:
Post: 1st week 0.05 inches
2nd week 0.50 inches

VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)
Colq=Common lambsquarters
Vele=Velvetleaf
Cowh=Common waterhemp
Bdlf=General broadleaf (Colq/Cowh)

P=0.10

Comments: The objective of this study was to compare tank-mixes of Touchdown with Avalanche Ultra or Flexstar plus adjuvants. Avalanche Ultra contains acifluorfin (e.g.Blazer). Adjuvants increased velvetleaf and common waterhemp control.

2013
GLYPHOSATE + AMS ADJUVANTS in SOYBEANS
Southeast Research Farm

Treatment	Rate/A	Colq 7/9/13	Vele 7/9/13	Cowh 7/9/13	Bdlf 8/16/13
Check	---	0 e	0 d	0 d	0 e
Post					
Touchdown Hi-Tech	11 oz	40 d	68 bc	68 c	13 d
Touchdown Hi-Tech + N Pak AMS	11 oz + 2.5%	40 d	80 ab	77 b	23 d
Touchdown Hi-Tech + Class Act NG	11 oz + 2.5%	88 b	92 a	92 a	65 ab
Touchdown Hi-Tech + Class Act NG	11 oz + 1.25%	87 bc	85 ab	82 ab	50 bc

RCB: 3 reps
Variety: AG 2433
Planting Date: 6/3/13
Post: 6/25/13

Soil: Clay Loam; 3.3% OM; 7.2 pH

Precipitation:
Post: 1st week 0.16 inches
2nd week 0.06 inches

Colq=Common Lambsquarters
Vele=Velvetleaf
Cowh=Common waterhemp
Bdlf=General broadleaf (Colq/Cowh)

P=0.10

Comments: A lower rate of Touchdown HiTech was used to help detect weed control differences. Adding AMS increased velvetleaf and waterhemp control. The combination product Class Act NG (surfactant & AMS) greatly increased control of all three weed species and showed a rate response.

2013
HUSKIE in SORGHUM
Southeast Research Farm

Treatment	Rate/A	VCRR Necrosis 7/16/13	Cowh 7/26/13	VCRR 8/16/13	Cowh 9/11/13	VCRR 9/11/13	Yield bu/A 10/28/13
Check	---	0 c	0 c	0 a	0 c	0 a	68 b
Post							
Huskie + Atrazine + AMS + Iron Chelate 4.5%	13 oz + 1 pt + 1 lb + 13 oz	4 b	98 ab	0 a	96 a	0 a	115 a
Huskie + Atrazine + AMS + Iron Chelate 4.5%	16 oz + 1 pt + 1 lb + 16 oz	5 b	97 b	0 a	96 a	0 a	112 a
Huskie + Atrazine + NIS + AMS + Iron Chelate 4.5%	16 oz + 1 pt + 0.25% + 1 lb + 16 oz	6 b	99 a	0 a	98 a	0 a	119 a
Huskie + Atrazine + 2,4-D ester + AMS + Iron Chelate 4.5%	13 oz + 1 pt + 4 oz + 1 lb + 13 oz	0 c	99 a	0 a	98 a	0 a	120 a
Huskie + Atrazine + Banvel + AMS + Iron Chelate 4.5%	13 oz + 1 pt + 4 oz + 1 lb + 13 oz	0 c	99 a	0 a	98 a	0 a	117 a
Huskie + Atrazine + Starane Ultra + AMS + Iron Chelate 4.5 %	13 oz + 1 pt + 3 oz + 1 lb + 13 oz	5 b	98 ab	0 a	96 a	0 a	125 a
Huskie + Atrazine + Aim EC + AMS + Iron Chelate 4.5%	13 oz + 1 pt + 0.5 oz + 1 lb + 13 oz	18 a	98 ab	0 a	95 a	0 a	121 a
Atrazine + Buctril	1 pt + 1 pt	0 c	97 b	0 a	87 b	0 a	112 a

RCB: 4 reps
Variety: Mycogen 1G557
Planting Date: 6/11/13
Post: 7/8/13 Sorghum V4-5 10-14 in; Cowh 4-12 in.

Soil: Silty Clay Loam; 3.0% OM; 6.8 pH

Precipitation:
Post: 1st week 0.50 inches
2nd week 0.05 inches

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

P=0.10

Comments: The objective of this study was to evaluate Huskie tank-mixes with iron chelate and other broadleaf herbicides for weed control and crop response. Huskie contains bromoxynil (e.g. Buctril) and pyrasulfotole an HPPD inhibitor. All treatments with Huskie provided good common waterhemp control. Only the tank-mix treatment with Aim had a significant crop response. Symptoms dissipated quickly and yield was not affected.

SOUTHEAST RESEARCH FARM ANNUAL REPORT
South Dakota State University
2012 Progress Report (**NOT PREVISOULY PUBLISHED**)
Agricultural Experiment Station
Plant Science Department
South Dakota State University, Brookings, SD 57007
Southeast Research Farm, Beresford SD 57004

Seed Treatment Effects on Soybean Cyst Nematode Population

Buyung Hadi*
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NOTE: 2012 REPORT NOT PUBLISHED IN 2012 PROGRESS REPORT

BACKGROUND & GOAL

The 2012 study on seed treatment effects on Soybean cyst nematode (SCN) population conducted at South Eastern Research Farm was the last part of a three year multi-site study sponsored by North Central Soybean Research Program. The goal of the study was to investigate the effect of several seed treatment options on field SCN population dynamic and soybean yield across the north central region.

METHODOLOGY

The study was implemented as a randomized complete block design with 6 treatments and 6 replications. The treatments used in 2012 were:

1. Non-treated control
2. ApronMax + 0.16 oz Apron XL (Syngenta Crop Protection)
3. Avicta Complete (Syngenta Crop Protection)
4. Evergold Energy + 0.32 oz Allegiance (Bayer Crop Science)
5. Evergold Energy + 0.32 oz Allegiance with Poncho Votivo (Bayer Crop Science)
6. Cruiser Maxx Plus + Harpin (Plant Health Products) this will be applied with the Curiser Maxx Plus treated seed from Syngenta.

Soybeans were planted on 30 inch row width with a population of 140,000 seed per acre. SCN were sampled in the spring (the beginning of the soybean season) and fall (after harvest). Plots of up to 30 ft. in length were sampled by collecting 10 cores per plot. SCN eggs were extracted and counted from the soil samples at SDSU Plant Diagnostic Clinic. The changes in SCN population between the two sampling time was calculated as the reproductive factor, that is a ratio between the number of eggs found in the fall samples and the number of eggs found in the spring samples. The soybean yield data was collected.

RESULTS

The 2012 study data showed that while there is a numerical difference in the change of SCN population throughout the year and the associated yield between various seed treatments and the untreated control, no statistically significant difference was detected (ANOVA, p=.05, Table 1). This result is consistent with the 2011 study conducted at South Eastern Research Farm. Deployment of resistant soybean varieties remains the most dependable tool to manage SCN.

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Table 1 Average yield and SCN reproductive factors associated with several seed treatments on soybean

Treatment	Yield (Means ± Std dev, in bu/Ac)	Reproductive factor (Means ± Std dev)
Untreated	5.78 ± 3.53	1.06 ± 0.71
Apron Maxx + Apron XL'	6.41 ± 2.91	5.89 ± 7.75
Avicta Complete	6.35 ± 0.60	1.04 ± 0.67
Evergold Energy + Allegiance	7.59 ± 4.69	1.18 ± 0.68
Evergold Energy + Allegiance + Poncho Votivo	9.35 ± 3.36	2.19 ± 1.52
Cruiser Maxx Plus + Harpin	8.37 ± 1.49	2.41 ± 1.80

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Corn Planting Date, Population, Relative Maturity Rating and Seed Treatment Effects on Grain Yields in Southeast South Dakota

G. W. Reicks*, D. E. Clay, and C. G. Carlson

NOTE: 2012 REPORT NOT PUBLISHED IN 2012 PROGRESS REPORT

INTRODUCTION

New precision farming implements, such as light bars, self-guided tractors, yield monitors, global positioning systems (GPS), computers and smart phones, and planters and fertilizer applicators with variable rate capacity are helping producers integrate new innovative technologies into their operation. The efficient use of these new tools requires accurate algorithms. Interactions between plant populations, N fertilizer, and genetics with improved stress tolerance may influence the accuracy of the precision algorithms. Precision corn planting starts with understanding the relationship between population, maturity rating, and seeding date. The objective for this study was to determine the impact of corn planting date, seed treatment, maturity rating, and plant population on corn yields.

METHODS

A similar study was also conducted at the NE Experimental Farm in 2012. Corn was planted into a field previously seeded to soybeans. Field cultivation was performed just prior to the first planting date and corn was planted on April 17, May 1, and May 17. All plots were 4 rows wide with 30 inch-row spacings. Final population goals were 25,000, 30,000, or 35,000 plants ac^{-1}. Pioneer P9630, the 96 day hybrid, had a standard seed treatment. This seed treatment contained the following fungicides: thibendazole, fludioxonil, mefenoxam, and azoxystrobin plus 0.25 mg clothianidin insecticide per kernel. Pioneer P0448, the 104 day hybrid had the either the standard seed treatment or a premium seed treatment. The premium seed treatment contained the same fungicides at their respective rates; however the insecticide dosage was 5 times higher. The premium seed treatment also contained VOTiVO®, a bacteria strain that lives and grows on young roots to create a barrier against nematodes. The plots were arranged on a randomized complete block design. Four replications were performed.

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RESULTS

Planting date, relative maturity rating, and population didn't affect grain yield (Table 1). The planting date x seed treatment interaction was significant (Table 5). When planted on May 1, the standard seed treatment yielded significantly higher than the premium seed treatment (Table 6).

CONCLUSIONS

When planting dates are spread over one month, populations differ by 10,000 plants per acre, and relative maturity ratings are 8 days apart, some yield differences would be expected. This however was not the case at the Southeast Research Farm in 2012. At the May 1 planting date, the standard seed treatment yielded significantly higher than the premium seed treatment. These were all unique findings and can likely be attributed to the extremely hot and dry growing conditions in 2012.

ACKNOWLEDGEMENTS

This study was funded by the South Dakota Soybean Research and Promotion Council.

Table 1. Significance of treatments and interactions on corn grain yields near Beresford, SD in 2012.

Factor	Pr>F
Planting Date (PD)	0.8867
Relative Maturity (RM)	0.5738
Population (POP)	0.1914
PD x RM	0.1468
PD x POP	0.6180
RM x POP	0.7035
PD x RM x POP	0.8330

Table 2. Effect of planting date on corn grain yields near Beresford, SD in 2012.

Planting Date	Grain Yield
	--bu ac^{-1}--
Apr 17	9.5
May 17	11.0
May 1	10.7

Table 3. Effect of hybrid relative maturity rating on corn grain yields near Beresford, SD in 2012.

Relative Maturity	Grain Yield
--days--	--bu ac^{-1}-
104	11.2
96	9.7

Table 4. Effect of plant population on corn grain yields near Beresford, SD in 2012.

Target Population	Grain Yield
--plants ac^{-1}--	--bu ac^{-1}--
25,000	13.8
30,000	9.3
35,000	8.2

Table 5. Significance of treatments and interactions on corn grain yields near Beresford, SD in 2012.

Factor	Pr>F
Planting Date (PD)	0.9104
Seed Treatment (ST)	0.0751
Population (POP)	0.2151
PD x ST	**0.0087**
PD x POP	0.8229
ST x POP	0.8035
PD x ST x POP	0.5753

Table 6. Interaction between seed treatment and planting date on corn grain yields near Beresford, SD in 2012.

Planting Date	Seed Treatment	Grain Yield
		--bu ac^{-1}--
Apr 17	Premium	12.8 a†
	Standard	6.9 a
May 1	Standard	14.4 a
	Premium	3.3 b
May 17	Standard	12.3 a
	Premium	5.2 a

†Values followed by the same letter are not significantly different at the 0.05 probability level.

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Effects of Planting Date, Maturity Group, Population, and Seed Treatment on Soybean Yields near Beresford SD in 2012

G. Reicks*, C. G. Carlson, D. E. Clay, and R. K. Berg

NOTE: 2012 REPORT NOT PUBLISHED IN 2012 PROGRESS REPORT

INTRODUCTION

Soybeans, as with most crops grown in the region, typically yield higher when planted earlier. Planting too early can lead to problems with frost, poor emergence, and possibly early bean leaf beetle damage. In recent years, other Midwest states have demonstrated that soybean yields can begin to decline in around May 10. Many farmers end corn planting around this date and switch to soybeans. These individuals could be losing yield potential on their soybeans. This was the third growing season of an ongoing study at the Southeast Experiment Farm to investigate the interaction between soybean maturity groups and their planting dates on yields in the SE part of the state. This study also has been replicated near Brookings and Watertown. Seed treatment and planting population effects have also been added to the study.

METHODS

Second-year soybeans were planted into soil that had been field cultivated just before the first planting date. Soybeans were planted on April 25, May 1, May 11, May 17, and June 7. Asgrow varieties ranging from maturity group 0.2 to 3.1 were grown in this trial (Table 3). Most plots were planted with untreated seed, were 4 rows wide, had 30 inch-row spacings, and were planted at 160,000 seeds ac^{-1}. Within the 1.6 maturity group, half of the plots were 8 rows wide with 15 in. row spacings and planted at 200,000 seeds ac^{-1}. Half of the plots within the 1.6 maturity group were also planted treated seed that contained an insecticide, four fungicide modes-of action, and a biological mode-of-action to protect against nematodes. Planting date was the main plot. The maturity group/seed treatment/planted population combination was the subplot. Four replications were planted.

RESULTS

As shown in Table 1, planting date was the only variable that significantly affected soybean yields in 2012. The two latest planting dates of and May 17 and June 7 were both the highest yielding at 15 bu ac^{-1} (Table 2). The other dates yielded about 11 bu ac^{-1}. These results are the complete opposite of previous growing seasons. Yield reductions of an adapted variety (2.1 maturity group) occurred after May 17 in 2010 and after June 6 in 2011.

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There were no yield differences between maturity groups in 2012 (Table 1). In previous growing seasons, the 1.1, 1.6, and 2.1 maturity groups have almost always yielded the same. In 2 years, we haven't recorded a yield response to seed treatment at the SE Farm. This was the first growing season where 2 different populations were grown and no yield difference was observed.

CONCLUSIONS

The severe drought and extreme heat in 2012 led to findings that were not consistent with previous growing seasons. For example, there were no yield differences between maturity groups and yields were actually higher as planting dates became later. We haven't recorded a yield response to seed treatment in 2 years at the SE farm. There were no yield differences between planting populations.

ACKNOWLEDGEMENTS

This study was funded by the South Dakota Soybean Research and Promotion Council.

Table 1. Significance of treatments and interactions on soybean yields near Beresford in 2012.

Factor	Pr>F
Planting Date (PD)	0.0001
Maturity Group (MG)	0.1128
PD x MG	0.4687

Table 2. Planting date effect on soybean yields near Beresford, SD in 2012.

Planting Date	Grain Yield
	---bu ac^{-1}---
June 7	15.4 a†
May 17	15.0 a
May 11	11.5 b
May 1	11.5 b
April 25	11.3 b

†Values followed by the same letter are not significantly different at the 0.05 probability level.

Table 3. Maturity group effect on soybean yields near Beresford, SD in 2012.

Maturity Group	Variety	Grain Yield
		---bu ac^{-1}---
3.1	AG3131	14.4
1.1	AG1131	13.1
2.1	AG2131	12.8
0.2	AG0202	12.8
1.6	AG1631	11.5

Table 4. Significance of treatments and interactions on soybean yields near Beresford in 2012.

Factor	Pr>F
Planting Date (PD)	0.0021
Seed Treatment (ST)	0.3945
Population (POP)	0.2328
PD x ST	0.9773
PD x POP	0.3313
ST x POP	0.7720
PD x ST x POP	0.5071

Table 5. Population effect on soybean yields near Beresford, SD in 2012.

Population	Grain Yield
--plants ac^{-1}--	---bu ac^{-1}--
160,000	11.9
200,000	11.1

Table 6. Seed treatment effect on soybean yields near Beresford, SD in 2012.

Seed Treatment	Grain Yield
	---bu ac^{-1}---
Treated	11.8
Untreated	11.2