TILLAGE & CROP ROTATIONS
FOR SOUTHEAST SOUTH DAKOTA

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INTRODUCTION

This research project has evaluated the feasibility of seven cropping systems in southeastern South Dakota since 1991. Our primary goal is to compare the production and economics of no-till and conventional tillage systems using multiple crop rotations. Ridge-till, in a two-crop rotation, is also evaluated. This information can help producers select or modify cropping strategies based on long term systems-based research.

During the project's first phase (1991-1995) tillage systems were established and at least one cycle completed for each crop rotation. Alfalfa was initially managed as an annual and later as a biennial crop. Reduced inputs in a conventionally tilled four-crop rotation were also evaluated by restricting the use of fertilizers and herbicides. Extremely wet weather made it impossible to plant or collect any crop data in 1993 and greatly delayed planting of alfalfa, corn, and wheat in 1995. Results from 1991 to 1996 are summarized in our 31st to 36th Annual Research Progress Reports (except 1993).

Table 1. Tillage and crop rotation systems. Southeast Research Farm; Beresford, SD; 1997.

System	Tillage	Crop Rotation
1	No-Till (NT)	Corn-Soybean (C-S)
7	Ridge-Till (RT)	Corn Soybean (C-S)
2	Conventional (CT)	Corn-Soybean (C-S)
3	No-Till (NT)	Corn-Soybean-Wheat (C-S-W)
4	Conventional (CT)	Corn-Soybean-Wheat (C-S-W)
5	No-Till (NT)	Corn-Soybean-Wheat-Alf (C-S-W+A)
6	Conventional (CT)	Corn-Soybean-Wheat-Alf (C-S-W+A)

Our research strategy was slightly modified at the beginning of the second phase in 1996. Fertilizers and herbicides are now used in System 6 so it can be managed as a more traditional conventional tillage system and we intend to keep alfalfa stands established longer. These modifications should allow a more thorough investigation of the interaction between the factors of tillage methods and crop rotations. We can also evaluate the recovery of the former low input system. Doug Franklin, an SDSU Agricultural Economist, is also using data collected from this project to summarize the long-term economic trends of these systems more extensively.

METHODS

Table 1 outlines the seven cropping systems used in this study. No-till (NT) systems are raised without tillage or cultivation. Primary tillage for the conventional (CT) system consists of chiseling corn stalks and small grain stubble after harvest and either field cultivating or disking soybean and/or wheat residue in the spring as needed to incorporate fertilizer and herbicide during seedbed preparation. Row crops are planted on ridges in the ridge-till (RT) system using row cleaners when possible to displace corn residue, herbicide is banded over the row at planting, and weeds between rows are controlled by cultivation. The two-crop systems (C-S) are a corn-soybean rotation. Three-crop systems (C-S-W) have corn then soybean followed by spring wheat. Four-crop systems (C-S-W+A) consist of the three-crop rotation plus alfalfa managed as a long-term forage crop.

Field operations were performed using commercial-sized farm equipment as outlined in Table 2. Spring wheat and most soybean were drilled in 7.5-inch row widths with corn and RT soybean established in 30-inch row widths. 'Sharp' spring wheat was drilled at approximately 90 lb/ac. DeKalb 512 corn was planted at 27,900 seeds/ac. 'Parker' soybean was drilled at 260,000 seeds/ac in NT and CT systems with RT planted at 167,000 seeds/ac. DeKalb 127 alfalfa was drilled with oat as a nurse crop in 1996.

Table 3 summarizes planting dates as well as fertilizer and herbicide applications for 1997. Liquid fertilizer was broadcast before planting as 10-34-0 and/or 28-0-0 for yield goals of 180 bu/ac corn, 50 bu/ac soybean and wheat, and 5 ton/ac alfalfa based on fall soil samples collected from every plot in 1996 (SDSU Soil Testing Laboratory; Brookings, SD). Corn was also sidedressed by injecting 25 gal/ac of 28-0-0 between alternate rows. Soybean was broadcast sprayed for grasshoppers with Sevin XLR at 1.5 qt/ac and border areas and alleyways associated with this study were treated several times with baited wheat bran.

Table 2. Field operations[1] for tillage and crop rotation systems. Southeast Research Farm; Beresford, SD; 1997.

Tillage System	1997 Crop Rotation	Growing Season[2] Before	During	After
NT	Corn	spray		
	Soybean	spray	spray, walk	
RT	Corn	spray	cultivate (2x)	
	Soybean	spray	spray, cultivate (3x), bean buggy, walk	
CT	Corn	disk, spray	cultivate	fall chisel
	Soybean	disk, spray, field cultivate	spray, walk	
NT	Corn	spray		
	Soybean	spray	spray, walk	
	Wheat		spray	bale straw, spray
CT	Corn	disk, spray	cultivate	fall chisel
	Soybean	disk, spray, field cultivate	spray, walk	
	Wheat	disk, field cultivate	spray	bale straw, spray, fall chisel
NT	Corn	spray		
	Soybean	spray	spray, walk	
	Wheat		spray	bale straw, spray
	Alfalfa		harvest (3x)	
CT	Corn	disk, spray	cultivate	fall chisel
	Soybean	disk, spray, field cultivate	spray, walk	
	Wheat	disk, field cultivate	spray	bale straw, spray, fall chisel
	Alfalfa		harvest (3x)	

[1]All plots were also fertilized (spring), planted (except alfalfa), and harvested. Corn was sidedressed June 17, 1997.
[2]Before = from Jan 1 to planting/emergence; During = from planting or alfalfa emergence to harvest or fall dormancy [includes banding at planting and popup]; After = from harvest or fall dormancy to Dec 31.

Table 3. Herbicide and fertilizer rates for tillage & rotation system study. Southeast Research Farm; Beresford, SD; 1997.

ROTATION	TILLAGE	CROP	PLANTING DATE	FERTILIZER	HERBICIDE[2]
				$N-P_2O_5-K_2O$[1]	
C-S	NT	C	May 15	170-65-0	Dual II + Bladex, PP
		S	May 15	4-10-0	Prowl + Pursuit, PP; Basagran + Pinnacle, Post
	RT	C	May 15	185-75-0	Dual II, PRE (band)
		S	May 16	6-20-0	Dual II, PRE (band)
	CT	C	May 15	135-65-0	Dual II + Atrazine, PRE
		S	May 15	8-25-0	Sonalan + Pursuit, PPI; Basagran + Pinnacle, Post
C-S-W	NT	C	May 15	195-50-0	Dual + Bladex, PP
		S	May 15	5-15-0	Prowl + Pursuit, PP; Basagran + Pinnacle, Post
		W	May 14	105-30-0	Bronate, Post; Roundup, AH
	CT	C	May 15	170-50-0	Dual II + Atrazine, PPE
		S	May 15	8-25-0	Sonalan + Pursuit, PPI; Basagran + Pinnacle, Post
		W	May 14	65-30-0	Bronate, Post; Roundup, AH
C-S-W+A	NT	C	May 15	195-50-0	Dual II + Bladex, PP
		S	May 15	5-15-0	Prowl + Pursuit, PP; Basagran + Pinnacle, Post
		W	May 14	105-30-0	Bronate, Post; Roundup, AH
		A	April 19, 1996	15-55-0	None
	CT	C	May 15	170-50-0	Dual II + Atrazine, PRE
		S	May 15	10-40-0	Sonalan + Pursuit, PPI; Basagran + Pinnacle, Post
		W	May 14	65-30-0	Bronate, Post; Roundup, AH
		A	April 19, 1996	15-55-0	None

[1]Liquid fertilizer applied as 10-34-0 and 28-0-0.
[2]PP = Preplant, PPI = Preplant incorporated, PRE = Pre-emergence, Post = Post emergence, AH = After Harvest

Stand counts were measured for each crop on July 21 and 22, 1997. Plant height for wheat and soybean were recorded at harvest. Crop production was measured at harvest by weighing the entire crop for each plot (except for wheat grain, 20% of each plot). Grain was weighed in a weigh wagon with manual moisture content and test weight recorded in the field. Wheat and soybean grain samples were analyzed for protein and oil content. Corn and soybean grain yield and moisture were also determined simultaneously using an IH AFS combine yield monitor with a differential global positioning system (DGPS). Alfalfa was commercially harvested as a three-cut system with production measured at each cutting but only collected for individual plots from the second and third cuttings. Spring wheat straw and alfalfa hay were baled and weighed as small square and large round bales, respectively.

Crop rotations and tillage systems are grown in the same plot locations every year with crops rotated within each system as needed. The proper combination of tillage and crop rotation systems requires twenty treatments. Each treatment is replicated four times and the size of each plot is 0.4 ac (60 ft x 300 ft). Statistical comparisons among systems for measured agronomic responses are based on treatment averages obtained from Analysis of Variance as a randomized block design using Least Significant Differences (LSD) at the 90% probability level. Coefficient of Variation (CV) is a measure of the variability associated with a particular response and should generally be less than 15% to be considered reliable.

Economic analyses are based on 1997 costs and receipts using the actual rates of inputs, local commodity prices at harvest, and crop yields associated with each system. Market prices were $2.40/bu for corn, $5.77/bu for soybean, $3.61/bu for wheat grain, $50/ton for wheat straw, ($71.44/ton for total harvested production; THP), and $95/ton for alfalfa hay. Variable and fixed costs are compared for each system by crop on a per acre, per bushel (or ton), and on a whole farm basis using Maximum Economic Yield Analysis Software (Potash and Phosphate Institute; Atlanta, GA; Version 3.0). Income and production costs for grain and straw are both included for spring wheat. This was accomplished in the spreadsheet by adding the value of grain and straw on a per ton basis. Fixed costs include cash rent for land (at $70/ac), interest on machinery debt, and depreciation. Equipment inventory and costs commonly used for each type of tillage system suitable for a 640-ac cash grain farm are shown in Table 4.

Table 4. Tillage and crop rotation system, equipment inventories. Southeast Research Farm; Beresford, SD; 1997.

	Tillage System		
Equipment	No-Till	Ridge-Till	Conventional
120-HP Tractor	45,000	45,000	45,000
70-HP Tractor	17,000	17,000	17,000
No-Till Drill 15 ft	20,000		
30" Planter 6-Row	10,000		10,000
Sprayer 45 ft	2,500	2,500	2,500
Fertilizer Applicator 6-row	2,500		
Ridge-Till Planter 6-row		14,000	
Ridge-Till Cultivator 6-row		12,000	
Chisel 13 ft			2,000
Tandem Disk 18 ft			9,000
Field Cultivator 19 ft			8,500
Drill 15 ft			6,000
Cultivator 6-row			4,500
Total Equipment Cost	$97,000	$90,500	$104,500

RESULTS & DISCUSSION

Crop Production

Soil test results from samples collected in each plot during the fall of 1996 indicate that this site had an average topsoil (0-6") pH of 6.1, organic matter content of 3.7%, Olsen phosphorus levels were moderate (10 ppm), available potassium was very high (357 ppm), and soluble salt levels were low (0.6 mmho/cm) when averaged across the entire area. Residual N levels (0-24") were 20 to 45 lb $N0_3$-N/ac where corn or soybean were raised in 1996, 60 to 70 lb NO_3-N/ac following wheat, and about 12 lb NO_3-N/ac in the alfalfa.

Early spring fertilizing, herbicide, tillage, and planting operations were difficult because soils were wet in many areas of the field, following heavy snows during the winter. We were not able to begin field work at this site until the end of April and it was the middle of May before conditions were suitable to plant. Cool temperatures delayed emergence and growth of all crops except alfalfa during the spring and early summer. A moderate to severe shortage of growing season precipitation, along with relatively heavy corn borer and grasshopper pressure later in the summer, contributed to average or below production for the annual crops. Corn borer pressure in this field was well below economic threshold levels when scouted for the first generation. The percentage of the yield goal that each crop actually achieved was approximately 70% for corn, 75% for soybean, 50% for spring wheat, and 112% for alfalfa. Only the second-year stands of alfalfa met or exceeded its expected yield goal in 1997.

Corn Corn yield was relatively low this year ranging from 113 to 130 bu/ac (Table 5). Within the two-crop rotation, conventional tillage outyielded no-till and ridge-till systems by about 15 bu/ac. Grain moisture for no-till corn was 2% wetter than when conventionally tilled which amounted to nearly $5/ac more in drying costs based on $0.025/pt per bushel. Test weight was generally light ranging from 51.5 to 55 lb/bu and was usually 1.5 lb/bu heavier when conventionally tilled. Plant populations were relatively consistent among cropping systems at 26,000 to 27,000 plants/ac. Normally this is considered an ideal population, but may have been a little high for the low precipitation we received in July and August this year.

Table 5. Effects of tillage and crop rotation systems on corn production. Southeast Research Farm; Beresford, SD; 1997.

Rotation[1]	Tillage	Stand Count	Grain Yield[2]	Moisture Content	Test Weight
		plts/ac	bu/ac	%	lb/bu
C-S	NT	26,800	117	20.5	53.1
	RT	25,900	113	18.7	53.8
	CT	26,600	130	18.4	54.9
C-S-W	NT	26,100	121	21.6	51.8
	CT	26,800	126	19.8	53.1
C-S-W+A	NT	25,800	123	22.3	51.4
	CT	27,100	124	19.5	52.9
Avg		26,400	122	20.1	53.0
$LSD_{0.10}$		NS[3]	13	1.3	0.5
CV (%)		7.00	8.35	5.31	0.75

[1] 1996 Crop: C-S = soybean, C-S-W and C-S-W+A = wheat
[2] Grain yield at 15% moisture and 56 lb/bu test weight, harvested Oct 9, 1997
[3] NS = not significant

Soybean Soybean produced average to moderate amounts of grain ranging from 34 to 45 bu/ac with a test weight of 57 lb/bu and 8.5% moisture at harvest (Table 6). Grain production was highest in the four-crop NT system (45 bu/ac) and lowest in the two-crop RT and four crop CT rotations (35 bu/ac). Soybean plants were relatively short and averaged 3 inches less for CT in the four-crop system. This indicates a lower level of productivity associated with soybean grown in the system where inputs were intentionally reduced prior to 1996. Even though plant height was relatively tall in the RT system its production was reduced by 15% and reflects the lower plant population when planted in 30-inch rows rather than drilled. Grain at 13% moisture contained about 34% protein and 18% oil. This translates into 700 to 900 lb protein/ac and 400 to 500 lb oil/ac. No-till produced 200 lb/ac more protein and 100 lb/ac more oil than CT in the four-crop rotation. Likewise, RT produced 200 lb/ac less protein and 75 lb/ac less oil than either NT or CT in the two-crop rotation.

Table 6. Effect of tillage and crop rotation systems on soybean production. Southeast Research Farm; Beresford, SD; 1997.

Rotation[1]	Tillage	Plant Height	Stand Count	Grain Yield[2]	Moisture Content	Test Weight	- - - -Grain - - - - Protein[2]	Oil[2]
		inch	plts/ac	bu/ac	%	lb/ bu	%	%
C-S	NT	26	171,000	40	8.5	57.0	33.5	18.6
	RT	29	139,000	34	8.5	56.9	33.8	18.5
	CT	27	180,000	40	8.4	56.9	33.2	18.7
C-S-W	NT	27	177,000	37	8.6	56.9	33.6	18.4
	CT	26	194,000	37	8.4	56.9	34.0	18.3
C-S-W+A	NT	28	179,000	45	8.5	57.1	33.8	18.3
	CT	25	166,000	35	8.3	56.9	34.2	18.2
Avg		27	172,000	38	8.5	56.9	33.8	18.4
$LSD_{0.10}$		2	25,000	4	NS[3]	NS	0.4	0.4
CV (%)		7.15	11.98	9.46	2.96	0.64	1.02	1.63

[1] 1996 Crop = Corn
[2] Grain yield, protein, and oil at 13% moisture and 60 lb/bu test weight, harvested Oct 1 & 2, 1997
[3] NS = not significant

Wheat Spring wheat grain production was less than 30 bu/ac and had low test weight, however, 1.5 to 2 ton/ac of straw was baled in 1997 (Table 7). Below average grain yield and test weight for wheat occurred mainly because it was impossible to plant small grain on this site before the middle of May. Low to moderate grasshopper populations may have also had some impact on yield. The CT system was 5 inches shorter and yielded 5 bu/ac less grain and 0.67 ton/ac less straw than NT in the four-crop rotation. Spring wheat grain contained 15% protein which resulted in a $0.06/bu premium and an average protein yield of 200 to 260 lb protein/ac.

Table 7. Effects of tillage and crop rotation systems on wheat production. Southeast Research Farm; Beresford, SD; 1997.

Rotation[1]	Tillage	Plant Height	Stand Count	Grain Yield[2]	Moisture Content	Test Weight	Straw Yield	Grain Protein
		inch	tillers/ft^2	bu/ac	%	lb/bu	ton/ac	%
C-S-W	NT	33	27	28	13.4	51.0	1.83	15.4
	CT	32	28	28	15.3	51.8	1.66	15.1
C-S-W+A	NT	37	30	27	14.5	52.3	2.20	15.5
	CT	32	33	22	15.0	51.3	1.53	15.0
Avg		34	29	26	14.6	51.6	1.80	15.2
$LSD_{0.10}$		4	4	5	1.5	NS[3]	0.43	NS
CV (%)		8.02	11.13	15.84	8.13	2.05	18.42	3.3

[1] 1996 Crop = Soybean
[2] Grain yield at 13% moisture and 60 lb/bu test weight, harvested Aug 13, 1997; straw baled Aug 21
[3] NS = not significant

Alfalfa Alfalfa production was quite successful this season (Table 8). Treatment differences between these two systems were nearly negligible. The first cutting produced an average of 2.4 ton/ac, the second produced 1.8 ton/ac, and the third produced 1.5 ton/ac for a total of 5.6 ton/ac during the season.

Total Harvested Crop Production On a whole farm basis, the total production harvested from all crops ranged from 1,300 to 2,200 tons on 640 acres in these systems (2.1 to 3.4 tons/ac, Table 13). Four-crop rotations produced about 2,000 tons of total harvested crop which was at least 500 tons more than the other rotations. Most of this was from alfalfa (45%), with corn contributing about 25%, small grain 20% (grain 5%, straw 15%), and soybean 10%. Two- and three-crop rotations produced about 1,500 tons or less. The three-crop rotations were almost half corn, a third small grain (10% grain, 25% straw), and 15% soybean. Corn accounted for 75% and soybean 25% of the total production in the two-crop rotations.

Alfalfa produced the greatest yields at about 5.5 ton/ac, followed by corn at just more than 3 ton/ac. Spring wheat yields were 2.5 to 3 ton/ac (0.8 ton/ac grain, 2 ton/ac straw) and soybean yielded a little more than 1 ton/ac. Conventional tillage produced about 100 ton more total crop than NT in the two-crop rotation, the same as NT in the three-crop rotation, and 200 tons less than NT in the four-crop rotation. The RT system produced 100 to 200 tons less than the other two- and three-crop systems and 600 to 800 tons less than the four-crop systems. Grain accounted for all of the total production in the two-crop rotations, 75% in the three-crop rotations, and 42% in the four-crop rotations. Straw made up 25% of the production in three-crop rotations and 15% in the four-crop systems. The tonnage of hay and grain were comparable in the four-crop rotation at 800 to 900 tons each.

Table 8. Effects of tillage and crop rotation systems on second-year alfalfa hay production. Southeast Research Farm; Beresford, SD 1997.

Rotation[1]	Tillage	1st Cut	2nd Cut	3rd Cut	2nd + 3rd	Total[2]
		- - - - - - - - - - - - - - ton/ac	- - - - - - - - - - - -			
C-S-W+A	NT	----	1.82	1.53	3.35	---
	CT	----	1.76	1.39	3.15	---
Avg		2.35	1.79	1.47	3.25	5.60
Pr > F[3]		---	>0.50	0.26	0.33	---
CV %		---	14.47	9.94	7.63	---

[1] 1996 Crop = Oat + Alfalfa
[2] Harvested: June 19, July 15, and September 4, 1997
[3] Pr > F = Probability of tillage treatments not being significantly different.

Economics

Income Total revenue for a 640-ac farm ranged from $148,000 to 210,000 among the seven systems tested in 1997 (Table 12). Alfalfa generated the most income per acre ($500/ac, Table 11), followed by corn ($300/ac, Table 9), soybean ($200-250/ac, Table 10), and then spring wheat ($150-200/ac, Table 11).

Expenses Total expenses ranged from $145,000 to 162,000. They were approximately $300/ac for corn and $200/ac for the other three crops. Variable costs accounted for two thirds of the total expenses for corn ($186-211/ac) and a little more than half for other crops ($100-144/ac). Fixed cash costs for land and interest on machinery were $77/ac, one fourth of the total expenses for corn and one third for other crops. Fixed non cash expense (depreciation) was $13 to 15/ac (4 to 8% of total expenses).

Net Income Not all cropping systems generated profit during 1997 and their profitability varied depending on the crop, rotation, and/or type of tillage system (Table 14). Whole farm net income ranged from -$6,000 to $62,000 among these systems. Alfalfa was very profitable in both four-crop rotations. It generated nearly $50,000 in net income which was at least four or five times more profitable than any other single crop in any system. Net income from corn ranged from - $6,000 to $10,000/system and it was only profitable when raised with conventional tillage. Conversely no-till and ridge-till soybean were profitable with net income of $2,000 to $8,000/system but conventional tillage was not (- $600 to - $2,000/system), except in the two-crop rotation. Raising spring wheat was not economically viable (- $4,000 to - $7,000/system) in three of the four systems and just barely paid for its costs of production in the four crop no-till system.

Four-crop rotations were by far the most profitable on a whole farm basis with the excellent yields and strong prices for alfalfa. They generated roughly $40,000 to 60,000 in net income. Two-crop rotations were the next profitable with net incomes of $2,000 to 15,000 ($100 for RT). Adding spring wheat to the rotation was not profitable in 1997 given the conditions of this study where both three-crop rotation systems lost $2,000 to 6,000.

Break-even Price Break-even prices for corn ranged from $2.14 to 2.55/bu, were $4.64 to 6.17/bu for soybean, $70 to $91/ton for spring wheat (grain + straw), and about $37/ton for second-year alfalfa. On a whole farm basis the average break-even price per crop in 1997 was approximately $100 to 115/ton for the two- and three-crop rotations and $70 to 75/ton for the four-crop rotation systems.

SUMMARY

Alfalfa production was by far the most profitable crop produced in this study followed by soybean, then corn, and spring wheat during 1997. Good alfalfa yields accompanied by a strong market price made both four-crop rotation systems highly profitable. These four-crop rotations generated the greatest amount of revenue and had the lowest total expenses. As a group, no-till and conventional till systems were profitable in two- and four-crop rotations and the ridge till two-crop system barely broke even. Selection of the best tillage method varied by crop. Alfalfa was very profitable regardless of is previous tillage history. Corn production tended to be more profitable with conventional tillage, however, soybean profits were generally better with no-till production, and growing wheat was not generally cost effective using either method of tillage in 1997.

Table 9. Economic Analysis, Corn Rotations ($2.40/bu). Southeast Research Farm; Beresford, SD; 1997.

GENERAL FIELD INFO.	NT C-S	RT C-S	CT C-S	NT C-S-W	CT C-S-W	NT C-S-W+A	CT C-S-W+A
System	1	7	2	3	4	5	6
Acres	320	320	320	213.3	213.3	160	160
PER ACRE AMOUNTS							
Yield (bu/ac)	117	113	130	121	126	123	124
Receipts	281	271	312	290	302	295	298
EXPENSES							
Field Operations	23	25	27	23	27	23	27
Seed	33	33	33	33	33	33	33
Fertilizer	74	82	63	76	68	76	68
Herbicide	33	9	22	33	22	28	22
Insecticide	0	0	0	0	0	0	0
Other Expenses by Acre	9	9	9	9	9	9	9
Other Expenses by Yield	26	20	22	30	25	32	24
Other Expenses by Field	<1	<1	<1	<1	<1	<1	<1
Operating Interest	11	10	9	11	10	10	10
Total Variable Costs	208	188	186	214	194	211	193
Land Costs	70	70	70	70	70	70	70
Other Fixed Cash Expenses	7	7	8	7	7	7	8
Total Fixed Cash Expenses	77	77	78	77	77	77	78
Net Cash Income	(4)	7	48	(1)	31	7	27
Fixed Non-Cash Expenses	14	13	15	14	15	14	15
Net Income	(18)	(6)	33	(15)	16	(7)	12
AVG/BUSHEL COSTS							
Variable expenses	1.78	1.67	1.43	1.77	1.54	1.72	1.56
Fixed Cash Expenses	0.66	0.68	0.60	0.64	0.62	0.63	0.63
Fixed Non-Cash Expenses	0.12	0.11	0.11	0.11	0.12	0.11	0.12
Total Costs	2.55	2.46	2.14	2.52	2.27	2.46	2.30
OPERATOR SUMMARY							
Total Receipts	89,856	86,784	99,840	61,942	64,502	47,232	47,616
Total Variable Expenses	66,585	60,222	59,650	45,748	41,364	33,817	30,939
Total Fixed Cash Expenses	24,631	24,482	24,804	16,418	16,533	12,316	12,402
Total Cash Income	(1,360)	2,081	15,386	(224)	6,605	1,099	4,275
Fixed Non-Cash Expenses	4,365	4,073	4,703	2,910	3,135	2,183	2,351
Net Income @ Yield	(5,725)	(1,992)	10,684	(3,133)	3,471	(1,083)	1,924
Seasonal Labor Hours	128.0	160.0	198.4	85.3	132.2	64.0	99.2
Labor hours/ac	0.40	0.50	0.62	0.40	0.62	0.40	0.62

Table 10. Economic Analysis, Soybean Rotations ($5.77/bu). Southeast Research Farm; Beresford, SD; 1997.

GENERAL FIELD INFO.	NT C-S	RT C-S	CT C-S	NT C-S-	CT C-S-W	NT C-S-	CT C-S-W+A
System	1	7	2	3	4	5	6
Acres	320	320	320	213.3	213.3	160	160
PER ACRE AMOUNTS							
Yield (bu/ac)	40	34	40	37	37	45	35
Receipts	231	196	231	213	213	260	202
EXPENSES							
Field Operations	22	26	25	22	25	22	25
Seed	19	12	19	19	19	19	19
Fertilizer	5	9	12	7	12	7	12
Herbicides	43	28	42	43	42	43	42
Insecticide	9	9	9	9	9	9	9
Other Expenses by Acre	8	8	8	8	8	8	8
Other Expenses by Yield	3	3	3	3	3	4	3
Other Expenses by Field	<1	<1	<1	<1	<1	<1	<1
Operating Interest	7	6	8	7	7	7	7
Total Variable Costs	116	100	124	117	124	118	124
Land Costs	70	70	70	70	70	70	70
Other Fixed Cash	7	7	7	7	7	7	7
Total Fixed Cash	77	77	77	77	78	77	78
Net Cash Income	38	19	9	19	12	65	1
Fixed Non-Cash Expenses	14	13	15	14	15	14	15
Net Income	24	7	14	5	(3)	51	(14)
AVG/BUSHEL COSTS							
Variable Expenses	2.89	2.95	3.12	3.17	3.35	2.62	3.54
Fixed Cash Expenses	1.92	2.25	1.94	2.08	2.09	1.71	2.21
Fixed Non-Cash Expenses	0.34	0.37	0.37	0.37	0.40	0.30	0.42
Total Costs	5.16	5.58	5.42	5.62	5.84	4.64	6.17
OPERATOR SUMMARY							
Total Receipts	73,856	62,778	73,856	45,537	45,537	41,544	32,321
Total Variable Expenses	37,043	32,134	39,918	25,044	26,445	18,893	19,816
Total Fixed Cash Expenses	24,631	24,482	24,804	16,418	16,533	12,316	12,402
Total Cash Income	12,182	6,162	9,135	4,076	2,560	10,335	94
Fixed Non-Cash Expenses	4,365	4,073	4,703	2,910	3,135	2,183	2,351
Net Income @ Yield	7,817	2,090	4,432	1,166	(575)	8,153	(2,257)
Seasonal Labor Hours	1075.2	1228.8	1177.6	716.7	742.3	537.6	556.8
Labor (hours/ac)	3.36	3.84	3.68	3.36	3.48	3.36	3.48

Table 11. Economic Analysis, Spring Wheat (Grain + Straw = $71.44/ton) and Alfalfa ($95/ton) Rotations. Southeast Research Farm; Beresford, SD; 1997.

GENERAL FIELD INFO.	NT C-S-W	CT C-S-W	NT C-S-W+A	CT C-S-W+A	NT C-S-W+A	CT C-S-W+A
System	3	4	5	6	5	6
Crop	Wheat	Wheat	Wheat	Wheat	Alfalfa	Alfalfa
Acres	213.4	213.4	160	160	160	160
PER ACRE AMOUNTS						
Total Yield ton/ac	2.67	2.49	3.01	2.18	5.71	5.50
Receipts	191	178	215	155	542	523
EXPENSES						
Field Operations	18	23	18	23	1	1
Seed	10	10	10	10	0	0
Fertilizer	43	31	43	31	25	25
Herbicides	11	11	11	11	0	0
Insecticide	0	0	0	0	0	0
Other Expenses by Acre	7	7	7	7	28	28
Other Expenses by Yield	0	0	0	0	57	55
Other Expenses by Field	23	21	23	16	<1	<1
Operating Interest	7	6	7	6	3	3
Total Variable Costs	119	110	120	105	114	112
Land Costs	70	70	70	70	70	70
Other Fixed Cash Expenses	7	7	7	7	7	8
Total Fixed Cash Expenses	77	77	77	77	77	78
Net Cash Income	(5)	(9)	18	(27)	351	333
Fixed Non-Cash Expenses	14	15	14	15	14	15
Net Income	(19)	(24)	4	(42)	337	318
AVG / TON COSTS						
Variable Expenses	45	44	40	48	20	20
Fixed Cash Expenses	29	31	26	36	14	14
Fixed Non-Cash Expenses	5	6	4	7	2	3
Total Costs	79	81	70	91	36	37
OPERATOR SUMMARY						
Total Receipts	40,705	38,022	34,417	24,873	86,716	83,630
Total Variable Expenses	25,504	23,376	19,245	16,819	18,284	17,960
Total Fixed Cash Expenses	16,426	16,541	12,316	12,402	12,316	12,402
Total Cash Income	(1,225)	(1,895)	2,856	(4,349)	56,116	53,269
Fixed Non-Cash Expenses	2,911	3,136	2,183	2,351	2,183	2,351
Net Income @ Yield	(4,136)	(5,031)	674	(6,700)	53,934	50,918
Seasonal Labor Hours	66.2	108.8	49.6	81.6	8.0	8.0
Labor (hour/ac)	0.31	0.61	0.31	0.51	0.05	0.05

Table 12. Economic summary of all rotation systems (640 ac). Southeast Research Farm; Beresford, SD; 1997.

GENERAL FIELD INFO.	NT	RT	CT	NT	CT	NT	CT
Crop Rotation	C-S	C-S	C-S	C-S-W	C-S-W	C-S-W+A	C-S-W+A
System	1	7	2	3	4	5	6
PER ACRE AMOUNTS							
Avg. Receipts	256	234	271	232	231	328	294
AVG. EXPENSES							
Field Operations	23	25	26	21	25	16	19
Seed	26	22	26	21	21	16	16
Fertilizer	39	46	38	42	37	38	34
Herbicide	38	19	32	29	25	20	19
Insecticide	5	5	5	3	3	2	2
Other Expenses by Acre	8	8	8	8	8	13	13
Other expenses by Yield	14	11	13	11	9	23	20
Other Expenses by Field	<1	<1	<1	8	7	6	4
Operating Interest	9	8	8	8	8	7	7
Total Variable Costs	162	144	155	150	142	141	134
Land Costs	70	70	70	70	70	70	70
Other Fixed Cash Expenses	7	7	7	7	8	7	8
Total Fixed Cash Expenses	77	77	77	77	78	77	78
Net Cash Income	17	13	39	4	11	110	83
Fixed Non-Cash Expenses	14	13	15	14	15	14	15
Net Income	3	0	24	(10)	(3)	96	69
AVG/TON COSTS							
Variable Expenses	72	69	64	63	60	42	44
Fixed Cash Expenses	34	37	32	32	33	23	25
Fixed Non-Cash Expenses	6	6	6	6	6	4	5
Total Costs	113	112	102	101	99	69	74
OPERATOR SUMMARY							
Total Receipts	163,	149,56	173,696	148,185	148,061	209,909	188,431
Total Variable Expenses	103,	92,356	99,568	96,296	91,185	90,240	85,534
Total Fixed Cash Expenses	49,2	48,963	49,607	49,262	49,607	49,262	49,607
Total Cash Income	10,8	8,243	24,521	2,627	7,269	70,407	53,290
Fixed Non-Cash Expenses	8,73	8,145	9,405	8,730	9,405	8,730	9,405
Net Income @ Yield	2,09	98	15,116	(6,103)	(2,136)	61,677	43,885
Seasonal labor Hours	120	1388.8	1376.0	868.2	983.4	659.2	745.6
Labor (hours/ac)	1.88	2.17	2.15	1.36	1.54	1.03	1.17

Table 13. Crop production summary for tillage and rotation study. Whole Farm Basis. Southeast Research Farm. Beresford, SD. 1997.

	System	1	7	2	3	4	5	6
	Rotation	CS	CS	CS	CSW	CSW	CSW+A	CSW+A
	Tillage	NT	RT	CT	NT	CT	NT	CT
Crop	units							
Corn	bu	37440	36160	41600	25809	26876	19680	19840
	ton	1048	1012	1165	723	753	551	556
	% THP *	73	76	75	47	49	25	28
Soybean	bu	12800	10880	12800	7892	7892	7200	5600
	ton	384	326	384	237	237	216	168
	%THP	27	24	25	16	16	10	9
Wheat	ton	-	-	-	570	534	482	351
	% THP	-	-	-	37	35	23	18
grain	bu	-	-	-	5975	5975	4320	3520
	ton	-	-	-	179	179	130	106
straw	ton	-	-	-	391	354	352	245
Alfalfa	ton	-	-	-	-	-	913	880
	% THP	-	-	-	-	-	42	45
	1st cut	-	-	-	-	-	376 **	376 **
	2nd cut	-	-	-	-	-	291	282
	3rd cut	-	-	-	-	-	245	222
Total THP	ton	1432	1338	1549	1530	1524	2162	1955
	ton/ac	2.2	2.1	2.4	2.4	2.4	3.4	3.1
grain	bu	50240	47040	54400	39676	40743	31500	28960
	ton	1432	1338	1549	1139	1169	897	830
	%THP	100	100	100	74	77	42	42
straw	ton	0	0	0	394	354	352	245
	% THP	0	0	0	26	23	16	13
hay	ton	0	0	0	0	0	913	880
	% THP	0	0	0	0	0	42	45

* THP = Total Harvested Production

** = average of 1st cutting

Table 14. Income and expense comparison for tillage and crop rotations Southeast Research Farm. Beresford, SD. 1997.

	System	1	7	2	3	4	5	6
	Rotation	CS	CS	CS	CSW	CSW	CSW+A	CSW+A
	Tillage	NT	RT	CT	NT	CT	NT	CT
Crop		- - - - - - - - - -	- - - - - - - - - -	- - - - - - - - - -	$	- - - - - - - - - -	- - - - - - - - - -	- - - - - - - - - -
Corn	Income	89,856	86,784	99,840	61,942	64,502	47,232	47,616
	Expenses	95,581	88,776	89,156	65,075	61,031	48,315	45,692
	Net	(5,725)	(1,992)	10,684	(3,133)	3,471	(1,083)	1,924
Soybean	Income	73,856	62,778	73,856	45,537	45,537	41,544	32,321
	Expenses	66,039	60,688	69,424	44,371	46,112	33,391	34,578
	Net	7,817	2,090	4,432	1,166	(575)	8,153	(2,257)
Wheat	Income	0	0	0	40,705	38,022	34,417	24,873
	Expenses	0	0	0	44,841	43,053	33,743	31,573
	Net	0	0	0	(4,136)	(5,031)	674	(6,700)
Alfalfa	Income	0	0	0	0	0	86,716	83,630
	Expenses	0	0	0	0	0	32,782	32,712
	Net	0	0	0	0	0	53,934	50,918
Whole Farm	Income	163,712	149,562	173,696	148,185	148,061	209,909	188,431
	Expenses	161,620	149,464	158,580	154,288	150,197	148,232	144,546
	Net	2,092	98	15,116	(6,103)	(2,136)	61,677	43,885

HIGH OIL CORN PRODUCTION FOR SOUTHEAST SOUTH DAKOTA

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Southeast Farm 9702

INTRODUCTION

There is always interest in evaluating commodities with unique characteristics and specialty crops are no exception. We initiated a research study this year to evaluate the use of high oil corn as a specialty crop for the western Cornbelt. Part of our objectives are to examine the performance of high oil corn in terms of its agronomic characteristics in the field and its suitability as a component of livestock rations. High oil seed corn is available as single cross hybrids and as top cross blends. Preliminary 1997 field results using a single cross corn hybrid are summarized in this report.

METHODS

Two dryland ridge till fields that totaled nearly 50 acres, were planted as six-row strip plots in rows 30 inches wide for each of two Pioneer Hi-bred International corn hybrids that are adapted for production in southeast South Dakota. One hybrid was being evaluated for possible use in the high oil corn market. The other is a popular non high oil hybrid used as a control to make comparisons. We selected 34M55 because: a) it already contained the high oil trait as a single cross hybrid without requiring isolation in the field, b) its maturity is suited for production in this area, and c) it is relatively similar genetically to the control hybrid 3489.

Table 1. Management information common to both high oil corn field studies. Southeast Research Farm. Beresford, SD. 1997.

Tillage System	Ridge-Till
Previous Crop	Soybean
Hybrids	Pioneer 34M55, 110-d RM, high oil (HOC) Pioneer 3489, 108-d RM, check (CK)
Herbicide	Clarity + Atrazine, PRE
Cultivated	Jun 18
Harvest Dates	Oct 29 to Nov 3

Field 1 had a relatively uniform seeding rate of both hybrids established in alternating strips. A range of six seeding rates were randomly established to obtain a broad range of populations for each hybrid in Field 2. Both fields were scouted for first-generation European corn borer (ECB) in early July. Net economic return for these studies reflects marketing dried grain at harvest after subtracting input, field operation, and drying costs. The local corn price at harvest was $2.31/bu and drying cost was figured at $0.025/bu for every percentage point above 15%.

Table 2. Agronomic management information by field. Southeast Research Farm. Beresford, SD. 1997.

	HYBRID COMPARISON (Field 1)	**HYBRID & POPULATION STUDY (Field 2)**
Seeding rates: (PLS[1] /ac)	High oil: 27,000 Check: 27,500	High oil: 17,100; 20,800; 25,600; 29,300; 32,700; 37,900 Check: 16,100; 21,200; 26,000; 30,000; 33,000; 38,600
Treatments	2 hybrids	12 (6 populations & 2 hybrids)
Observations/trt	14	4
Planting Dates	Apr 29	May 9 (HOC) & May 10 (CK)
Fertilizer	160 lb N/ac sidedressed as 28-0-0	140 lb N/ac sidedressed as 28-0-0
Scouted ECB[2]	Index = 0.25 & 0.28	Index = 0.17 & 0.37
Stand Count (plants/ac)	High oil = 22,700 Check = 19,000	See Table 4
SDSU laboratory	Sep 12 (silage)	Oct 9 (high moisture grain)
Soil test: 0-6 in. 6-24 in.	OM = 4.2%; NO_3-N = 9.2 ppm; Olsen P = 23 ppm (VH); K = 419 ppm (VH); pH = 5.8; salts (1:1) = 0.4 mmho/cm NO_3-N = 4.8 ppm	OM = 3.8%; NO_3-N = 8.2 ppm; Olsen P = 8 ppm (M); K = 282 ppm (VH); pH = 5.8; salts (1:1) = 1.0 mmho/cm NO_3-N = 5.8 ppm

[1] PLS = Pure Live Seed
[2] ECB = European corn borer (index according to SDCES Extension Extra Bulletin 8125; June, 1996).

Research data from these fields is also part of a regional project that uses Global Positioning System (GPS) technology to evaluate site specific farming practices. Both fields were harvested using an IH 2144 combine with an AFS yield monitor. Yield was simultaneously measured using standard weigh wagons with manual grain moisture and test weight data recorded in the field for each strip plot. The standard data is summarized in this preliminary report.

Dry shelled corn was harvested and stored in separate large plastic agbags as either rolled or whole corn for each hybrid to use in cattle feedlot trials this winter. Each field was harvested systematically to help minimize any effects that spatial variability within these fields might have on grain stored in the agbags. A few representative corn silage and high moisture grain samples were collected from each hybrid for laboratory analyses at SDSU. Grain samples collected at harvest from these strip plots are being analyzed for oil content and feed value. Results from some laboratory samples are currently still pending. Additional management information is summarized in Tables 1 and 2.

RESULTS & DISCUSSION

Hybrid Comparison

The control performed better than the high oil hybrid in Field 1 where they were compared at a uniform seeding rate planted in late April (Table 3). The check hybrid outyielded the high oil hybrid by 27 bu/ac (20%) even though stand count estimates taken when the silage samples were collected indicate the population may have been greater for the high oil hybrid by about 4,000 plants/ac (Table 2). A yield gradient was observed in this field with the east part being more productive than the west (data not shown). Test weight was good for both hybrids, however, grain from the high oil hybrid was 1.5 lb/bu lighter. The high oil hybrid was also slower to dry down which translated into an extra drying cost of $4/ac. Producing high oil corn in this field resulted in $64/ac less economic return using the conditions outlined in this study. In general, cash grain producers would need a premium for the high oil hybrid of nearly $0.65/bu to compensate for the difference in net income between these hybrids.

Table 3. High oil corn hybrid comparison. Southeast Research Farm (Field 1); Beresford, SD. 1997.

Hybrid	Grain Yield[1]	Moisture	Test Weight	Drying cost	Net Return[2]
	bu/ac	%	lb/bu	$/ac	$/ac
Pioneer 34M55	109	18.7	56.4	10.0	104
Pioneer 3489	136	16.7	57.9	5.9	172
Avg	122	17.7	57.1	7.9	138
Pr > F[3]	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
CV%	4.14	2.32	1.05	15.41	8.69

[1] Standardized at 15% moisture and 56 lb/bu.
[2] Corn at $2.31/bu less input, field operation, and drying ($0.025/pt/bu) costs.
[3] Pr > F = The probability that hybrid means are not significantly different.

Population and Hybrid Comparison

Similar results were observed in Field 2 except that production was lower (Table 4). This trial was designed to evaluate populations more closely and was planted in early May. The control hybrid here had actual stands ranging from 16,000 to 40,800 plants/ac which equaled or slightly exceeded our intended population range (-5 to +10%). Actual stands measured for Pioneer 34M55 were 16,000 to 32,600 plants/ac and were close to or slightly less than intended (-5 to -15%).

The grain yield of both hybrids was relatively low in this field averaging from 76 to 118 bu/ac. The control consistently outyielded the high oil hybrid by about 25 bu/ac (22-30 bu/ac) at comparable plant populations. Grain yield and net return was maximized at 22,000 plants/ac for the control and 19,000 plants/ac for the high oil hybrid and declined significantly when populations exceeded 26,000 plants/ac. A yield gradient was also observed in this field with the north part being more productive than the south (data not shown). Grain moisture content at harvest was 2 to 3% wetter, test weight was from 1 to 3 lb/bu lighter, and drying costs were two times greater for the high oil hybrid.

Table 4. Effect of hybrid and population on high oil corn production (Field 2); Southeast Research Farm. Beresford, SD. 1997.

Hybrid	Population Goal	Stand Count	Grain Yield[1]	Moisture	Test Weight	Drying Cost	Net Return[2]
	plants/ac	plants/ac	bu/ac	%	lb/bu	$/ac	$/ac
Pioneer 34M55	17,000	16,200	90	20.2	54.9	11.8	91
	21,000	19,200	95	19.3	56.8	10.1	97
	25,000	23,300	93	19.4	54.6	10.1	85
	29,000	25,600	82	18.9	54.4	7.9	53
	33,000	28,100	77	19.4	55.0	8.5	37
	37,000	32,600	76	18.7	54.8	6.9	33
Pioneer 3489	17,000	16,000	112	16.8	57.8	5.1	144
	21,000	21,800	118	16.8	57.6	5.4	150
	25,000	25,800	112	16.5	57.8	4.2	128
	29,000	30,800	101	16.7	56.5	4.6	98
	33,000	34,600	97	16.6	57.3	3.9	85
	37,000	40,800	90	16.2	55.8	2.8	62
Avg	27,000	26,200	95	18.0	56.1	6.8	89
LSD[3] $_{0.10}$		1,800	9	0.9	1.3	2.3	21
CV %		5.60	7.63	4.35	1.87	28.76	19.88

[1] Standardized at 15% moisture and 56 lb/bu.
[2] Corn at $2.31/bu less input, field operation, and drying costs ($0.025/pt/bu).
[3] LSD = Least Significant Difference

Preliminary laboratory results for dry shelled corn revealed that oil concentrations were 5.7% (5.2 - 6.0%) for the single cross high oil hybrid versus 4.7% (4.2 - 5.5%) for the control hybrid (Table 5). Protein (10-11%) and starch (68-71%) levels of these hybrids were also similar. The oil levels observed for 34M55 in these fields are below the 6% minimum required for quality premiums associated with most current high oil corn contracts.

CONCLUSIONS

This research agrees with results observed by others in the industry. Pioneer Hi-bred International currently recommends that hybrid 34M55 seed not be sold nor its grain marketed for high oil corn purposes. Our studies indicate that raising Pioneer 34M55 during stressful environmental conditions like we experienced this year may be challenging. This high oil corn hybrid (34M55) had substantially lower yield (25 bu/ac), took longer to dry down in the fall, had 1 to 3 lb/bu lighter test weight, and only had 1% more oil than the non high oil control hybrid (3489). It also provided $50 to 70/ac less economic return if both hybrids were marketed at the same price. The optimum populations for these hybrids were approximately 19,000 (HOC) and 22,000 plants/ac (CK).

Table 5. Laboratory analyses[1] for high oil corn comparison. Southeast Research Farm, Beresford, SD. 1997.

Hybrid		Field 1 n[2]	Field 1 Oil	Field 2 n	Field 2 Oil
			%		%
Pioneer 34M55	Avg	14	5.84	19	5.64
	Std dev		0.14		0.16
	Maximum		6.00		5.98
	Minimum		5.53		5.29
Pioneer 3489	Avg	12	4.72	24	4.60
	Std dev		0.17		0.25
	Maximum		4.94		5.53
	Minimum		4.35		4.24

[1] Pioneer Hi-bred International [2] n = number of samples

The growing season this year in our immediate area was drier and cooler than normal. We also had relatively heavy insect pressure from second-generation European corn borer and grasshoppers. Weed control was very good in the majority of both fields. As a result of relatively stressful conditions, both our yield potential and optimum plant population were lower than in the past few years. It appears that 1997 may be among the first, out of at least the last five years, that the plant population for optimum corn production was less than 25,000 plants/ac. Seedling quality or standability may have also influenced the performance of these hybrids. Corn borer pressure from late-season generations seemed to affect both hybrids. General observations at harvest noted that lodging and ear drop seemed to be at least a little more prevalent in the high oil hybrid.

It is important to remember that these studies are very preliminary. The other phases of this project have not been conducted yet. This phase reflects only one high oil hybrid examined during a single growing season. By itself it does not indicate that this or other specialty crops may not have important roles in the western Cornbelt. Other germplasm reportedly has the potential to produce high levels of oil. Isolation requirements for the top cross systems were not as conducive to our research objectives for the area we had available to conduct these studies. These results suggest that grain growers will likely require a market premium in order for this type of high oil corn to profitably compete with at least some of the non specialty corn hybrids as a cash grain crop. Premium incentives would need to be about $0.65/bu ($0.50-0.90/bu) for circumstances similar to these studies. This contrasts sharply with some of the premium levels reportedly being offered, some of which are $0.30/bu or less. The oil levels observed in our control hybrid (3489) were also higher than expected in this study.

ACKNOWLEDGMENTS

This project is sponsored in part by the South Dakota Corn Utilization Council. It reflects a cooperative effort within the South Dakota Agricultural Experiment Station between several projects within the Plant Science and the Animal and Range Science departments. Pioneer Hi-Bred International, Inc. provided weigh wagons to assist with data collection at harvest and analyzed the grain samples collected from these strip plots for oil content and feed value.

The Southeast Research Farm staff also played a major role in conducting this project. Bruce Jurgensen planted, cultivated, and harvested these fields. Dale DuBois and Garold Williamson applied herbicide and fertilizer, helped collect field data during the growing season, assisted with harvest, and worked with Brad Rops to store harvested grain in agbags. Ruth Stevens recorded inputs and field operations; entered data into the computer; ran spreadsheet calculations and preliminary statistical analyses; prepared graphics, GPS grain yield maps, and helped type manuscripts.

DATE OF PLANTING CORN

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SUMMARY

Two hybrids were each planted on five dates to monitor long-term effects of planting early and late maturing corn hybrids in southeast South Dakota. Planting dates this year began on April 25 and ended on May 23. The late maturing hybrid produced more grain and had heavier test weight, but was wetter at harvest than the early maturing hybrid. Net economic return was similar for both hybrids at the earlier planting dates but the 102-day hybrid was approximately \$25 to \$30/ac more profitable when planted after the middle of May. Penalties for planting corn in late May instead of late April or early May were \$25/ac for the short season hybrid and nearly \$50/ac for the long season hybrid this year.

METHODS

The goal of this research is to begin planting in mid April and continue at approximately 10-day intervals through late May. Dates actually planted this year were April 25, May 05, May 12, May 19, and May 23. Stand counts were taken during the season to monitor corn populations. Grain yield, moisture, test weight, and ear loss were measured at harvest. The economic return is based on corn marketed directly from the field at harvest at \$2.40/bu after subtracting inputs costs for seed, fertilizer, herbicide and moisture dockage (\$0.05/bu for every point above 15% on a fresh weight basis). Table 1 outlines additional management factors related to this study for 1997.

Table 1. Management practices for date of planting corn study. Southeast Research Farm; Beresford, SD; 1997.

Previous Crop	Soybean
Tillage	No-Till
Planting rate	27,000 seed/acre
Hybrids	Pioneer 3615 (102 day RM)
	Pioneer 3357 (112 day RM)
Fertilizer	58 lb P_2O_5/ac + 140 lb N/ac as 10-34-0 & 28-0-0
Herbicide	Dual II + Atrazine, EPP
Harvest	October 9

RESULTS & DISCUSSION

The early planting dates began a little more than a week later than usual this year primarily because of wet soil conditions following heavy snows last winter. As a result the length of our planting season was 28 days and the planting intervals after early May are less than 10 days. Yield averaged 145 bu/ac across all treatments for this study and was a little above average for our location in 1997. This is 81% of the 180 bu/ac yield goal we typically manage for. Table 2 outlines the crop production obtained with these hybrids for 1997.

Table 2. Effect of planting date and relative maturity on corn production; Southeast Research Farm; Beresford, SD; 1997.

Hybrid (RM)[1]	Planting Date	Stand Count	Grain Yield[2]	Moisture Content	Test Weight	Economic Return[3]
		plant/ac	bu/ac	%	lb/bu	$/ac
P-3615	Apr 25	25,900	141	16.4	56.4	215
(102)	May 05	25,300	140	17.2	55.5	207
	May 12	27,900	136	18.0	55.5	190
	May 19	26,400	138	18.7	55.5	190
	May 23	25,900	140	19.5	55.6	190
P-3357	Apr 25	23,600	150	20.1	57.3	205
(112)	May 05	26,000	153	20.9	57.3	205
	May 12	27,400	155	23.2	56.8	190
	May 16	26,100	147	24.0	55.8	165
	May 23	26,900	148	25.3	56.0	157
Avg		26,100	145	20.3	56.2	191
LSD 0.10		1,500	7	0.8	0.7	16
CV %		4.75	3.67	3.32	0.98	6.61

[1] RM = Relative maturity in days

[2] Grain yield at 15% moisture content and 56 lb/bu test weight.

[3] Based on $2.40 bu less moisture dock ($0.05/point), seed, fertilizer & herbicide costs.

The full season hybrid consistently outyielded the short season hybrid by nearly 10 to 15 bu/ac at each planting date. Neither hybrid exhibited dramatic differences in the amount of grain produced as a function of planting date this year. Reduced yield seemed a little more prominent for the 112 day hybrid planted after the middle of May (7-8 bu/ac) and the 102 day hybrid yielded approximately 140 bu/ac regardless of the date it was planted.

The short season hybrid dried down well as expected and was 4 to 6% drier than the long season hybrid for a given planting date. Differences in grain moisture when planted in late April compared to late May were 3% for the 102 day hybrid (16.4 vs. 19.5%) and 5% for the 112-day hybrid (20.1 vs. 25.3%). Test weight was good for both hybrids and was 1 to 2 lb/bu heavier for the full season hybrid until planted after the middle of May. Plant populations averaged about 26,000 plants/ac this year and were generally within 500 to 1,000 plants/ac of each other at a given planting date. Pioneer 3357 may be a little more sensitive to cool soils when planted in late April as noted by a lower population of 23,600 plants/ac but this did not seem to reduce its yield or economic return.

The profitability of both hybrids was very similar when planted through the middle of May. After that the 102 day hybrid provided an economic benefit that was nearly $30/ac more than the 112 day hybrid. Planting in late April instead of late May this year generated $25/ac more money with Pioneer 3615 and $48/ac more with Pioneer 3357. About 30% of the plants had shot wholes but no live larvae were observed when scouted for first-generation European corn borer. This study was not treated with insecticide and ear loss was monitored before harvest (data not shown). Ear drop averaged 90 to 270 ears/ac which is less than 1.0% of the plant population.

The eleven year averages associated with this project are reported in Table 3. Incorporating the amount of grain produced in 1997 increased the long term average yields by 1 to 2 bu/ac for both hybrids at each planting date (4 bu/ac when planted in late May for the full season hybrid).

Table 3. Eleven year average (1986-1997)[1] grain yields for date of planting corn study. Southeast Research Farm; Beresford, SD; 1997.

Hybrid	- - - - - - - - - - - Avg. Planting Date - - - - - - - - - -				
Maturity	Apr 17	Apr 27	May 7	May 17	May 27
RM	- - - - - - - - - - - - - - bu/ac @ 15% -				
103 day	130	132	130	129	115
112-118 day	142	143	140	131	107

[1] No data for 1995.

Typically short and full season hybrids have similar yields when planted the middle of May in this study. Full season hybrids usually yield better when planted earlier than this and short season hybrids do better after this even though yields for both decline when planted beyond this date. These results are not always consistent each year and other factors also influence profitability. The economic benefits associated with planting during mid to late April when conditions are suitable have consistently paid good dividends in this study and should be practiced to utilize as much of the growing season as possible as an important management tool in this area.

DATE OF PLANTING SOYBEAN

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Southeast Farm 9704

SUMMARY:

This study evaluates the performance of early and mid season soybean varieties as influenced by a range of planting dates from early May through mid June. Our goal is to intentionally begin planting soybean earlier than normal each year then continue with optimum and later than usual seedings at approximately 10-day intervals. Soybean yields this season ranged from 42 to 49 bu/ac. Grain production was 7% less when 'Parker' (Group I) was planted late and up to 15% less when 'Sturdy" (Group II) was planted early. Economic return ranged from $200 to $230/ac and was optimized when 'Parker' was planted in mid May and when 'Sturdy' was established in late May through early June. Approximately 900 lb protein/ac and 500 lb oil/ac were produced this season.

METHODS:

'Parker' and 'Sturdy' varieties were planted in 30-inch rows. This year's planting dates were May 05, May 15, May 22, June 04, and June 13 and nearly all were either exactly on or within a day of our target dates (except May 22 was three days early). Stand count, plant height, grain yield, moisture content, test weight, and laboratory analyses for grain protein and oil contents were measured for each plot. Economic return was calculated using a market price of $5.77/bu at harvest then deducting variable costs for seed, herbicide, and fertilizer. Table 1 reports additional management information related to this study.

Table 1. Management practices for date of planting soybean study.
Southeast Research Farm, Beresford, SD; 1997.

Previous Crop	Corn
Tillage	No-till
Varieties	'Parker' (Group I), 'Sturdy' (Group II)
Seeding rate	167,000 seed/ac
Weed Control	Dual II + Sencor, EPP
	Assure, Post
Harvest Dates	October 2

RESULTS AND DISCUSSION:

Soybean plants averaged 33 inches tall with a population of 140,000 plants/ac this year (Table 2). The 'Sturdy' population averaged 10,000 plants/ac more than for 'Parker', but this had little or no impact on the amount of grain produced. Yield of 'Parker' (Group I) decreased by 3 to 4 bu/ac when planted in late June. On the other hand 'Sturdy' (Group II) yielded from 3 to 7 bu/ac less when planted in early May. Grain moisture content was 8% when harvested except for the late June planting date for the Group II variety (9%). Test weight was generally 58 lb/bu and decreased nearly 0.5 lb/bu by the last planting date.

Protein concentration was about 33% and oil level was 18 to 19% for grain adjusted to 13% moisture content. This translates into 800 to 1,000 lb/ac of protein and 500 lb/ac of oil. 'Sturdy' produced 0.5 to 1.0% more protein than 'Parker' with this difference increasing as they were planted later in the season. Soybean oil content decreased from 19% when planted in early May to 18% or less with the mid June plantings. 'Parker' usually had a little higher oil concentration than 'Sturdy'. The rate that oil levels declined as planting date was delayed dropped more rapidly for 'Study'. Economic return ranged from $195 to 230/ac. This was optimized when the Group I variety was planted in mid May but in late May and early June for the Group II variety. There was a $30/ac penalty for planting 'Parker' in late June and 'Sturdy' in early May.

Long-term grain yield tends to decline during the planting season by 7 to 8 bu/ac when planted in early May versus mid June and the early group tends to produce a little more grain than the mid group at a given planting date (Table 3). The yield advantage for raising early maturity (Group I & II) versus mid Group II at each planting date is 1 to 3 bu/ac based on the 12-year average.

Table 2. Effect of planting date on soybean production. Southeast Research Farm; Beresford, SD; 1997.

Variety	Planting Date	Stand Count	Plant Height	Grain Yield[1]	Moisture Content	Test Weight	Economic Return[2]	- - - Grain - - - Protein[1]	Oil[1]
		plants/ac	inch	bu/ac	%	lb/bu	$/ac	%	%
'Parker'	May 05	130,700	32	47	8.1	57.9	226	33.5	18.7
	May 15	144,700	32	48	8.2	58.1	231	33.2	18.8
	May 22	128,900	35	46	8.1	57.9	214	33.4	18.6
	Jun 04	136,800	35	48	7.9	57.9	225	33.1	18.7
	Jun 13	131,900	32	43	8.2	57.6	196	33.6	18.3
'Sturdy'	May 05	146,500	32	42	8.0	58.3	194	33.3	19.0
	May 15	151,400	32	45	8.0	58.1	212	33.8	18.4
	May 22	142,900	33	49	7.9	57.5	227	33.9	18.5
	Jun 04	144,700	29	49	8.2	57.5	228	34.5	18.0
	Jun 13	139,200	35	46	9.3	57.4	212	34.5	17.8
	Avg	139,800	33	46	8.3	57.8	216	33.7	18.5
	$LSD_{0.10}$	13,500	NS[3]	6	0	0.5	36	0.8	0.4
	CV (%)	7.78	15.65	1.82	2.28	0.76	13.38	1.92	1.71

[1] Grain yield, protein, and oil at 13% moisture content and 60 lb/bu test weight.
[2] Based on $5.77/bu less seed, herbicide and fertilizer costs.
[3] NS = Not significant

Table 3. Twelve year average yields (1986-1997) for date of planting soybean study. Southeast Research Farm; Beresford, SD; 1997.

Variety	- - - - - - - - - - Average Planting Date - - - - - - - - - - May 5	May 15	May 25	June 4	June 14
	-----------------Bu/ac @ 13%----------------				
Early (Group I & II)	44	43	43	41	37
Mid (Group II)	43	41	41	38	35

CULTIVATION EFFECTS ON NO-TILL CORN AND SOYBEAN

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Southeast Farm 9705

SUMMARY:

This study examines whether cultivating row crops influences crop performance in a no-till corn and soybean rotation. Our goal is to measure how the frequency of cultivating between rows during the growing season after emergence affects crop production and economics when weed control is not the primary objective. In previous years we have seen positive, negative, and no cultivation effects on row crops. In 1997 cultivating had no effect on no-till soybean production but reduced the economic return by $10 to 20/ac. Soybean grain contained 33.5% protein (1,060 lb/ac) and 17.5% oil (560 lb/ac) at 13% moisture. Cultivating no-till corn one or two times slightly increased grain production (5 bu/ac or less) but generally not by enough to pay for cost of cultivating. Adding a third cultivation lowered grain production slightly and reduced the economic return nearly $25/ac.

METHODS:

Zero, one, two, and three cultivations during the growing season have been applied to exactly the same replicated strip plots managed as a no-till corn and soybean rotation since 1992. Economic return reflects the income for grain marketed at harvest after subtracting variable costs associated with field operations, seed, herbicide, fertilizer, and drying costs for corn ($0.025/bu for each point above 15% moisture). Laboratory analyses for soybean protein and oil reported are adjusted to 13% grain moisture content. Additional management practices for this study are summarized in Table 1.

Table 1. Management practices for no-till cultivation study. Southeast Research Farm; Beresford, SD; 1997.

	Corn	Soybean
Tillage	Modified No-till	Modified No-till
Past Crop	Soybean	Corn
Hybrid/Variety	Pioneer 3559	Dekalb CX228
Planting Date	May 16	May 21
Seeding Rate	27,900 seed/ac	185,600 seeds/ac
Herbicide	Dual II + Atrazine, PRE	Prowl + Pursuit, EPP
Fertilizer	140 lb N/ac as 28-0-0	None
Harvest Date	October 7	October 2

RESULTS AND DISCUSSION:

The soybean population in this field averaged approximately 150,000 plants/ac, was about 32 inches tall, produced 53 bu/ac of grain, had 8% moisture and 56.5 lb/bu test weight at harvest, and provided an economic return of nearly $200/ac (Table 2). Soybean yields were greater than 50 bu/ac in spite of moderate grasshopper pressure later in the growing season during pod fill. The no-till soybean production responses measured in 1997 were not affected by cultivating but income was reduced by about $10 to 20/ac. Protein and oil levels of soybean grain were 33.5% and 17.5%, respectively and were not influenced by cultivating. This translates into average yields of about 1,060 lb protein/ac and 560 lb oil/ac when grain yield and quality responses are adjusted to 13% moisture.

Table 2. Effect of cultivation on no-till soybean production. Southeast Research Farm; Beresford, SD; 1997.

Cultivations	Stand Count	Plant Height	Grain Yield[1]	Moisture Content	Test Weight	Economic Return[2]
	plant/ac	inch	bu/ac	%	lb/bu	$/ac
0	150,800	34	54	8.2	56.3	215
1	151,400	32	53	8.2	56.5	206
2	147,100	31	52	8.1	56.3	196
3	152,600	31	54	8.1	56.4	200
Avg	150,500	32	53	8.2	56.3	204
$LSD_{0.10}$	NS[3]	NS	NS	NS	NS	11
CV %	4.70	5.0	2.7	1.2	0.6	4.1

[1] Grain yield at 13% moisture and 60 lb/bu test weight
[2] Based on $5.77/bu less variable costs for field operations, seed, and herbicide.
[3] NS = not significant

No-till corn had an average population of 26,000 plants/ac. Grain yielded about 130 bu/ac and had 18% moisture and 56.5 lb/bu test weight at harvest that provided an economic return of nearly $160/ac (Table 3). Plant population as well as drydown (measured as grain moisture at harvest) were not influenced by cultivating but subtle trends were indicated for grain yield and economic return. Cultivating corn one or two times increased and three cultivations reduced the amount of grain produced slightly compared to the non cultivated control. The small yield increase associated with cultivating one or two times did not offset the cost of performing these field operations. However, the slightly lower yields obtained by cultivating three times reduced income by $25/ac.

Table 3. Effect of cultivation on no-till corn production. Southeast Research Farm; Beresford, SD; 1997.

Cultivations	Stand Count	Grain Yield[1]	Moisture Content	Economic Return[2]
	plant/ac	bu/ac	%	$/ac
0	26,100	130	17.9	162
1	25,600	135	17.9	167
2	25,500	133	17.5	160
3	26,900	126	17.9	137
Avg	26,000	131	17.8	157
$LSD_{0.10}$	NS[3]	3	NS	8
CV %	6.18	2.05	1.33	3.88

[1] Grain yield at 15% moisture and 56 lb/bu test weight.
[2] Based on $2.40/bu less variable costs for field operations, seed, fertilizer, herbicide, and drying costs.
[3] NS = not significant

15 INCH VS. 30 INCH ROW SPACING EFFECT ON HYBRID CORN YIELD

Zeno Wicks III and Craig Converse

Plant Science 9706

Introduction

There has been increasing interest in narrow row spacing (less than 30 inches over the last few years. The purpose of this experiment is to evaluate 15-inch narrow rows compared to conventional 30-inch rows in Eastern South Dakota. Very little research has been done in South Dakota to determine the effectiveness of planting corn in narrower rows. Research done in the surrounding states has shown that the more consistent yield responses have seemed to occur in the northern cornbelt when planting corn in narrow rows. The yield advantages have been in places where sunlight, heat and rainfall are more limiting. The 1996 results at Southeast Research Farm showed a reduction in yield by planting corn in 15-inch rows when compared to 30-inch rows. Changes that were made for this year included an increase in the number of hybrids to include more maturities at a higher population.

Methods

Nine Pioneer hybrids, two Dekalb hybrids and one early maturing hybrid from Cornell University which contains genes for leafiness and dwarfism were chosen to represent different genetic backgrounds and maturities. The study was set up in a spit-plot randomized design, replicated three times. Six 15 and 30-inch rows were planted in 27.5 foot rows and were thinned to a population of 27,878 plants/acre. A six-row John Deere flex planter was used to plant the 15-inch rows due to the ability of the planter units to be narrowed to 15 inches. The 30-inch rows were planted with a two-row John Deere Max Emerge planter. The plot was planted May 18, thinned to the correct population on June 26 and harvested on October 18, 1997.

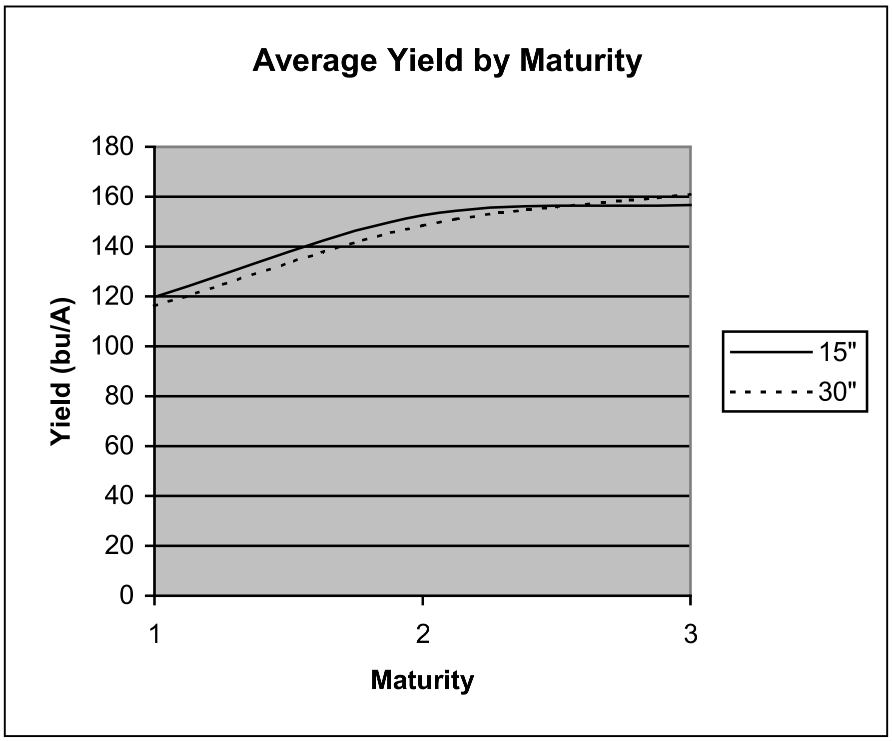
The center four rows were harvested in the 15 inch plots and the center two rows were harvested in the 30 inch plots to allow for a buffer between spacings and to represent the same amount of area and the same number of harvested plants. The 30 inch rows were mechanically harvested with a Gleaner K combine that is equipped with an electronic weigh bucket and moisture tester. The 15 inch rows were hand harvested and ears were shelled and weighed using the Gleaner combine.

Results and Discussion

Table 1 shows the harvest results of this experiment, which includes the %moisture at harvest time, the %broken stalks (stalks broken below the ear) and yield in bushels per acre adjusted to 15.5% moisture and a population of 27,878 plants per acre. Maturity is present as overall relative maturity provided by the seed companies. The numbers were calculated as the average of the three replications. Table 2 compares the average harvested %moisture, %broken stalks and the yield between the 15 inch and 30 inch row spacings. The 15-inch row spacing resulted in a 2.6% increase in stalk breakage and a .4% increase in grain moisture. There was no significant difference in yield between the two row spacings.

Figure 1 shows the average yield by maturity. The earlier hybrids are showing a slight increase in yield with the 15-inch row spacing, while the late hybrids are showing a reduction in yield with the 15-inch row spacing. Table 3 shows the average yield, and %stalk lodging between maturities. There is no significant difference between yield and stalk lodging within each maturity. The late maturity hybrids are performing best at this location in each of the row spacings. The mid maturity is showing the greatest yield gain with 15 inch row spacing at 4.2 bu/acre increase over 30 inch rows. Late maturity hybrids are performing best in the 30 inch row spacing, with a 4.4 bu/acre yield increase over 15 inch row spacing.

Figure 1



1997 results show no significant yield advantage by planting corn in narrow rows. There is an increase in lodging of 2.6 % in the 15-inch row spacing that could possibly increase harvest losses. Results indicate a possible yield advantage in areas where early maturity hybrids are planted. Specific hybrids such as Pioneer 3970 and Pioneer 3914 are performing better in the 15-inch row spacing, while Pioneer 3751 is performing better in the 30-inch row spacing. Testing of more genetic sources may help identify hybrids that perform better in one row spacing over the other.

Table 1. 1997 Southeast Farm Harvest Data.

Hybrid	***Maturity (days)***	***Row Spacing***	***%Moisture***	***%Broken Stalks***	***Yield (Bu/Ac)***
CM174lfy	70	15	15.9	3.4	85.9
CM174lfy	70	30	15.8	3.3	82.6
P3941	82	15	16.5	9.4	127.4
P3941	82	30	16.6	5.4	129.1
P3970	77	15	16.4	28.3	135.1
P3970	77	30	16.1	23.8	121.4
DK345	84	15	16.1	4.2	130.3
DK345	84	30	15.4	1.9	132.0
DK417	91	15	16.4	12.1	152.5
DK417	91	30	16.3	5.1	152.3
P3861	93	15	16.6	12.9	148.5
P3861	93	30	16.3	14.4	149.3
P3893	90	15	16.7	7.6	150.7
P3893	90	30	16.4	4.6	145.5
P3914	86	15	16.8	7.1	158.9
P3914	86	30	16.7	6.3	146.7
P3559	104	15	19.4	9.1	155.2
P3559	104	30	18.9	8.2	157.6
P3563	103	15	20.6	7.6	172.2
P3563	103	30	19.9	9.4	178.8
P3730	99	15	18.3	7.6	167.3
P3730	99	30	17.9	5.5	161.3
P3751	97	15	16.6	16.4	132.2
P3751	97	30	16.6	7.6	146.6
Mean			**17.1**	**9.2**	**142.5**
C.V. %			**1.6**	**39.3**	**8.2**
LSD(.05)			**0.32**	**4.3**	**13.9**

Table 2. Average Values for 15” vs. 30” Row Spacing.

	%Moisture	*%Broken Stalks*	*Yield*
15 inch rows	17.2	10.9	140.3
30 inch rows	16.9	8.3	139.1
Difference	**+0.3**	**+2.6**	**+1.2**
C.V.%	**1.6**	**39.3**	**8.2**
LSD(.05)	**.13**	**1.8**	**ns**

Table 3. Difference in Spacing between Maturities.

	%Stalk Lodging	*Yield*
15” Early	11.3	119.7
30” Early	8.6	116.3
C.V.%	**45.3**	**11.8**
LSD(.05)	**ns**	**ns**
15” Mid	9.9	152.7
30” Mid	7.6	148.5
C.V.%	**36.0**	**5.8**
LSD(.05)	**ns**	**ns**
15” Late	10.2	156.7
30” Late	7.7	161.1
C.V.%	**28.0**	**7.3**
LSD(.05)	**ns**	**ns**

PERFORMANCE OF WHITE FOOD CORN HYBRIDS IN SOUTHEASTERN AND SOUTHCENTRAL SOUTH DAKOTA

Patrick B. Beauzay and Dr. Zeno W. Wicks, III

Plant Science 9707

Introduction

In 1997, the corn breeding project at South Dakota State University participated in the regional Early White Food Corn Performance Test coordinated by Dr. Larry L. Darrah of the USDA Agricultural Research Service, University of Missouri, Columbia, MO. This test evaluated yield and other agronomic traits of commercially available and experimental white food corn hybrids at several locations in the Midwest. The purposes of conducting a trial in South Dakota were to 1) evaluate the performance of early white food corn hybrids in primary corn producing areas of the state and 2) establish baseline data for comparison with future performance trials. This data will be used to assess the potential of white corn production in South Dakota.

Materials and Methods

The trial was conducted at the Southeast Research Farm near Beresford, SD, with separate, smaller trials at Armour, SD, and Dakota Lakes Research Farm near Pierre, SD. The Dakota Lakes site was irrigated.

Hybrids were planted in 2-row plots with 30” row spacing. The 2-row plots were 26’ long with 4’ breaks across the width of the field. Each plot was thinned to a population of 24,500 plants/acre. Management inputs are listed in Table 1.

Results and Discussion

Yield results of the regional trial conducted at Beresford are presented in Table 2. Yield results for the smaller trials conducted at Armour and Pierre are listed in Tables 3 and 4. Entries in bold print are in the top yielding group for the location given.

Test weight is a good indicator of kernel hardness and density. Hybrid test weights (not listed) ranged from 54-61 lb/bu at all three locations. 54 lb/bu is considered the minimum acceptable test weight for dry milling.

NIR (near-infrared spectroscopy) analysis of crude protein, oil and starch composition was performed on whole kernel samples taken during harvest from the Southeast Research Farm and the Dakota Lakes Research farm (Tables 5 and 6). These values are comparable to industry standards for milling.

We are looking forward to participating in the regional performance test again next year.

Acknowledgements

The authors greatly appreciate the efforts of the following people and organizations: the members of the South Dakota Corn Utilization Council; Larry Darrah of the USDA Agricultural Research Service, Columbia, MO; Bob Berg and the staff at the Southeast Research Farm; Dwayne Beck and the staff at the Dakota Lakes Research Farm; Kevin Kirby, Dave Delay and Robert Hall of SDSU Crop Performance Testing; Robert Clark (Armour cooperator); Craig Converse (Plant Science graduate student); Jeremy Brady and Shawn May
(Corn Project technicians).

Table 1. Some management inputs at study sites.

	Beresford	**Armour**	**Pierre**
Previous Crop	Soybean	Wheat	Wheat
Tillage	Conventional	No-till	No-till
N-P_2O_5-K_20 (lb/ac)	28-0-0 45gal/ac	37-18-0 100lb	N/A
Herbicide	Dual/Bladex	Dual	N/A
Insecticide	None	Force t-band	N/A
Irrigation	No	No	Yes

Table 2. Adjusted mean yields for SE Research Farm.

Hybrid	**Mean Yield (bu/ac)**	**Maturity (DRM)**
LG Seeds LG2596W	**146.7**	**112**
LG Seeds NB742W	**139.0**	**112**
Dekalb EXP764WB	**133.7**	**114**
Asgrow XP7767	**131.1**	**113**
Diener DB 114W	**129.5**	**114**
Pioneer X1156MW	**129.5**	**113**
Wilson 1780W	**125.2**	**114**
Wilson 1790W	**120.3**	**113**
Pioneer 3394 (ylw)	117.8	110
Garst 8320W	115.0	114
NC+ 5633W	113.9	113
LG Seeds X58-605W	113.8	111
Garst 8527W	112.8	108
Garst N4309W	112.4	113
Sturdy Grow SG765W	112.4	112

Table 2. (continued)

Hybrid	Mean Yield (bu/ac)	Maturity (DRM)
Vineyard V453W	111.7	117
Hoegemeyer 1142W	111.3	118
Sturdy Grow SG797W	109.9	115
Vineyard V449W	109.9	116
IFSI 90-1	109.7	114
Whisnand 51AW	109.3	112
Whisnand 50AW	107.6	111
Wilson E1744	106.4	112
Vineyard V438W	105.6	114
Pioneer 32H39	105.5	115
Wilson 1732W	105.5	113
Sturdy Grow SG781W	105.0	114
Sturdy Grow SG777W	104.7	113
IFSI 93-4	103.9	113
IFSI 9252187 x FR819	103.2	108
LG Seeds NB749W	102.6	114
Glenn Seeds White 1	101.9	105
Vineyard V424W	101.0	115
Vineyard V414W	100.8	110
Trisler T-4211W	100.7	111
IFSI 95-2	99.3	112
Zimmerman Z73W	99.1	112
Pioneer 3463W	97.2	109
Vineyard V448W	96.9	116
Sturdy Grow SG735W	96.8	110
Vineyard Vx4296	96.2	110
Garst 8490W	92.5	114
IFSI 9353190 x FR819	91.4	111
IFSI 97-2	90.0	108
Dekalb EXP766W	89.7	116
Pioneer 3443W	89.3	109
IFSI 9353225 x FR819	88.3	111
Dekalb EXP764W	85.9	114
Sturdy Grow SG730W	85.8	110
B73 x Mo17 (ylw)	83.5	115
Vineyard V413W	81.7	109
IFSI 9252169 x FR819	67.6	109
IFSI 9353228 x FR819	66.5	111
Average	107.9	
LSD (.05)	27.6	
CV (%)	15.7	

Table 3. Adjusted yields for Armour, SD.

Hybrid	Mean Yield (bu/ac)	Maturity (DRM)
IFSI 9353190 x FR819	**176.2**	**111**
IFSI 9252187 x FR819	**175.4**	**108**
Sturdy Grow SG730W	**165.4**	**110**
Wilson 1780W	**164.4**	**114**
Sturdy Grow SG735W	**163.4**	**110**
IFSI 9252195 x FR819	**163.2**	**106**
Wilson 1790W	**161.7**	**113**
Vineyard V413W	**159.3**	**109**
Vineyard VX4296W	**157.1**	**110**
IFSI 9353225 x FR819	156.1	111
IFSI 9252169 x FR819	154.6	109
Sturdy Grow SG765W	154.2	112
IFSI 9353228 x FR819	153.1	111
Vineyard V414W	146.7	110
Glenn Seeds White 1	130.3	105
Average	158.7	
LSD (.05)	19.8	
CV (%)	9.0	

Table 4. Adjusted yields for Dakota Lakes Research Farm.

Hybrid	Mean Yield (bu/ac)	Maturity (DRM)
Wilson 1790	**178.9**	**113**
IFSI 9252187 x FR819	**167.4**	**108**
Sturdy Grow SG735W	**162.2**	**110**
Pioneer 3357 (ylw)	**153.8**	**112**
Glenn Seeds White 1	**152.8**	**105**
IFSI 9252195 x FR819	**152.4**	**106**
IFSI 9353225 x FR819	**152.3**	**111**
Vineyard VX4296W	147.9	110
Wilson 1780W	143.4	114
Vineyard V413W	142.1	109
IFSI 9252169 x FR819	141.8	109
Dekalb 471 (ylw)	138.4	97
Sturdy Grow SG765W	136.6	112
Vineyard V414W	135.6	110
Sturdy Grow SG730W	135.4	110
IFSI 9353190 x FR819	134.8	111
IFSI 9353228 x FR819	134.3	111
Average	147.7	
LSD (.05)	29.9	
CV (%)	11.6	

Table 5. Summary statistics for NIR whole kernel composition of crude protein, oil and starch from the Southeast Research Farm trial.

	Crude Protein	Oil	Starch
	%	%	%
Minimum	8.56	3.90	70.34
Maximum	11.10	4.57	75.31
Average	9.67	4.21	72.40
Std. Dev.	0.52	0.14	0.95
CV (%)	5.40	3.30	1.30

Table 6. Summary statistics for NIR whole kernel composition of crude protein, oil and starch from the Dakota Lakes Research Farm Trial.

	Crude Protein	Oil	Starch
	%	%	%
Minimum	8.49	3.91	69.31
Maximum	11.12	4.39	73.52
Average	9.55	4.16	71.53
Std. Dev.	0.52	0.13	1.05
CV (%)	5.40	3.00	1.50

LONG TERM RESIDUAL PHOSPHOROUS STUDY

R. Gelderman and J. Gerwing

Plant Science 9708

Introduction

This study was reestablished in 1994 on the site of a P study that was begun in 1964. The low soil test P treatment of this experiment has not received fertilizer phosphorus for over 30 years.

The objectives of this study are:

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

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

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

Methods

Four soil test levels (Table 1) were established by broadcasting phosphorus fertilizer in the spring of 1993 and were chiseled for incorporation. Soybeans were planted in 1993 and the stubble moldboard plowed in the fall. Two medium (M) soil test levels were established to compare placement effects for annually applied phosphorus rates.

Annual broadcast rates (0, 20, 40, and 60 lb/ac P_20_5) were applied and chiseled in the spring of 1994. The site was planted to DeKalb 554 at 25,600 plants/ac on 10 May 1994. Identical annual P rates were applied at planting with a fertilizer opener that placed the fertilizer 2 inches below and 2 inches to the side of the seed band. The phosphorus fertilizer used for all treatments was 0-46-0. Five pounds of zinc/ac (as zinc sulfate) was applied with all annual treatments (including the zero rate). Ninety pounds of N/ac was applied over the site.

For 1995, soybeans ‘Marcus’ were planted no-till (30" rows) at about 180,000 plants per acre on 19 May 1995. Annual band phosphate for soybean was placed as for corn in 1994. Broadcast phosphate rates were hand applied on the soil surface after planting. All phosphorus fertilizer was 0-46-0. No zinc was applied in 1995.

For 1996, corn (DK 512) was planted at 26,600 plants/ac on 9 May 1996. Band and broadcast treatments were applied as in 1995. Plot size is 15' x 45'. Nitrogen was knifed on all plots as 28% material at 120 lb N/ac on 19 June 1996. Three of the center rows were harvested for grain with a plot combine on 24 October 1996.

For 1997, soybeans (DK 228) were planted with a 10’ JD 750 no-till drill at 280,000 plants per acre in 7.5” rows on 16 May 1997. Annual band phosphorus treatments were applied with the drill at planting and placed directly with the seed. Broadcast P rates were applied on the soil surface after planting. All P fertilizer was 0-46-0. Plot size was 10’ x 45’. The five foot area between plots was drilled into soybeans with a no-till plot drill. Weed control consisted of Prowl and Pursuit as a preplant application. The entire 10’ x 45’ plot was harvested on 30 September 1997. A grain sample was taken for P analysis.

Soil samples were taken on all zero annual rate treatments for all soil test levels (Table 1). In addition, soil samples were taken on all broadcast annual rate treatments (Table 2). Samples were taken in 3 inch increments to a 9 inch depth.

Results and Discussion

The Olsen soil P tests from the fall of 1994, 1995 and 1996 (Table 1) reflect the soil test levels that were established by application of phosphorus in 1993. The results indicate that soil tests have stayed almost constant since the fall of 1994 on these plot areas that received no added P. Crop removal of phosphorus increases with higher soil tests (Table 1). Soil tests also appear to be increasing with annual broadcast applications of P (Table 2). The increase is even occurring where P application is below the level of P being removed by grain. The reason for this is not clear although the plant may be translocating deeper soil P onto the soil surface.

Yields for the study are found in Table 3 and are presented in graphical form in Figures 1 and 2. Rate of banded phosphate influenced soybean yields differently depending on soil test level (Table 3 and Figure 1). At a very low soil test, soybean yield was raised 14 bu/ac by banding phosphorus - maximizing with the 40 lb/ac rate. At the intermediate test levels, yields increased about 8-10 bu/ac, with the 20 lb/ac rate. At the high soil test level, yields <u>were not</u> influenced by annual P rates. In addition, where no P has been applied annually, a high P test raised soybean yields about 10 bu/ac (Table 3).

Placement of fertilizer P did not significantly ($p \geq 0.81$) influence soybean yields to rates of phosphorus (Figure 2). These results are surprising in that the broadcast P was applied directly to the surface after planting. In addition, the season did produce some dry surface conditions in July and August. Apparently, roots were absorbing adequate P even with this placement. Crop production data from 1993 to 1996 are available in previous annual reports.

Table 1. Phosphorus soil tests[1] and phosphorus removed by grain for 1994, 1995 and 1996 of long-term P study, SE Farm.

Soil Test level	Olsen P 1994	Olsen P 1995	Olsen P 1996	P_2O_5 removal by grain 1994	P_2O_5 removal by grain 1995	P_2O_5 removal by grain 1996
	ppm			lb/ac		
L	3	3	3	31	20	27
M	5	4	4	46	27	42
H	8	7	8	50	31	46
VH	15	13	14	54	33	53

[1] Sampled in fall of 1994, 1995 and 1996 from check plots(0-6") of each soil test level.

Table 2. Phosphorus soil tests[1] and phosphorus removed by grain from broadcast rates of long-term P study, SE Farm.

P_2O_5 Rate	Olsen P 1994	Olsen P 1995	Olsen P 1996	P_2O_5 removal by grain 1994	P_2O_5 removal by grain 1995	P_2O_5 removal by grain 1996
lb/ac	ppm			lb/ac		
0	6	5	5	48	31	49
20	6	8	9	51	32	49
40	7	8	12	50	33	57
60	8	12	16	50	35	49

[1] Sampled in fall of 1994, 1995 and 1996 from broadcast treatments (0-6").

Table 3. Soybean yields as influenced by soil test level, annual P rates and placement, long-term P study, 1997.

Soil test category[1]	annual P_2O_5 rates - lb/ac 0	20	40	60	mean
	Yield, bu/ac				
VL (band)	46	55	60	60	55
L (band)	47	57	56	55	54
L (bct.)	51	59	48	53	53
M (band)	51	59	54	55	55
H (band)	56	59	56	54	56
mean	50	57	57	56	

[1]VL, L, M and H (Olsen P)= very low (3 ppm), low (4 ppm), medium (8 ppm), and high (13 ppm), respectively.
Pr >F: soil test level = 0.94(NS); annual rate = 0.041; soil test *rate = 0.0099. Placement = 0.81. C.V.= 6.9%

Figure 1. Influence of Soil P Test and fertilizer P on Soybean Yield, SE Farm, 1997.

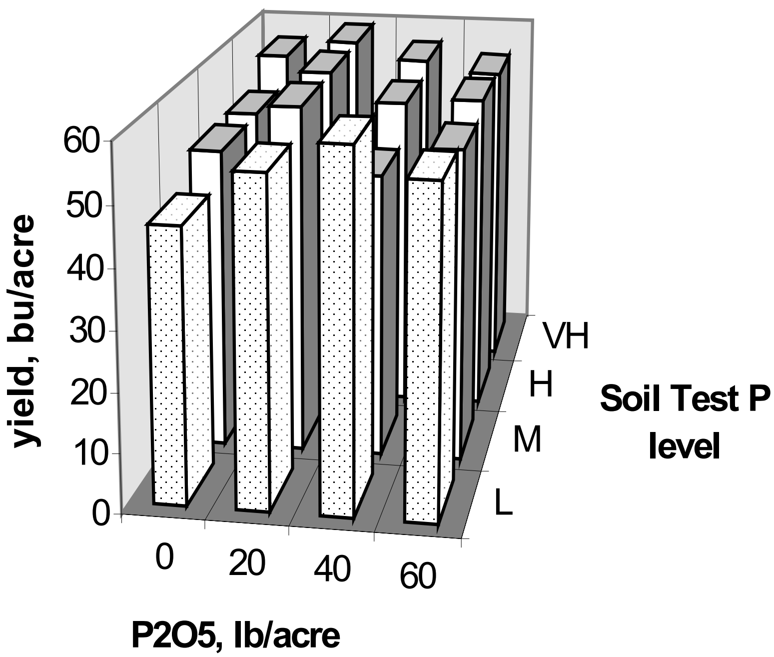


Figure 2. Influence of P placement and rate of P on soybean yield with a medium soil test level, SE Farm, 1997.

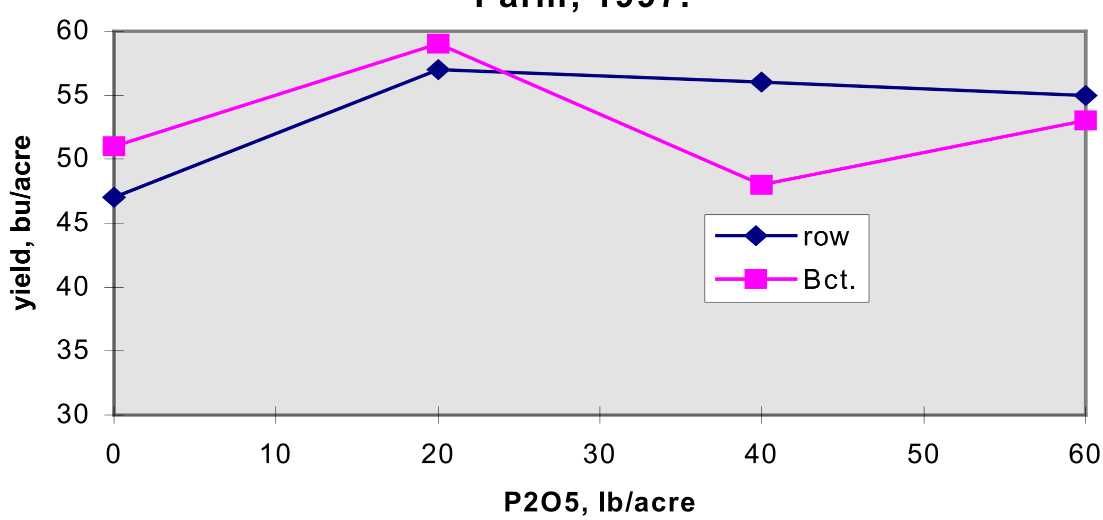
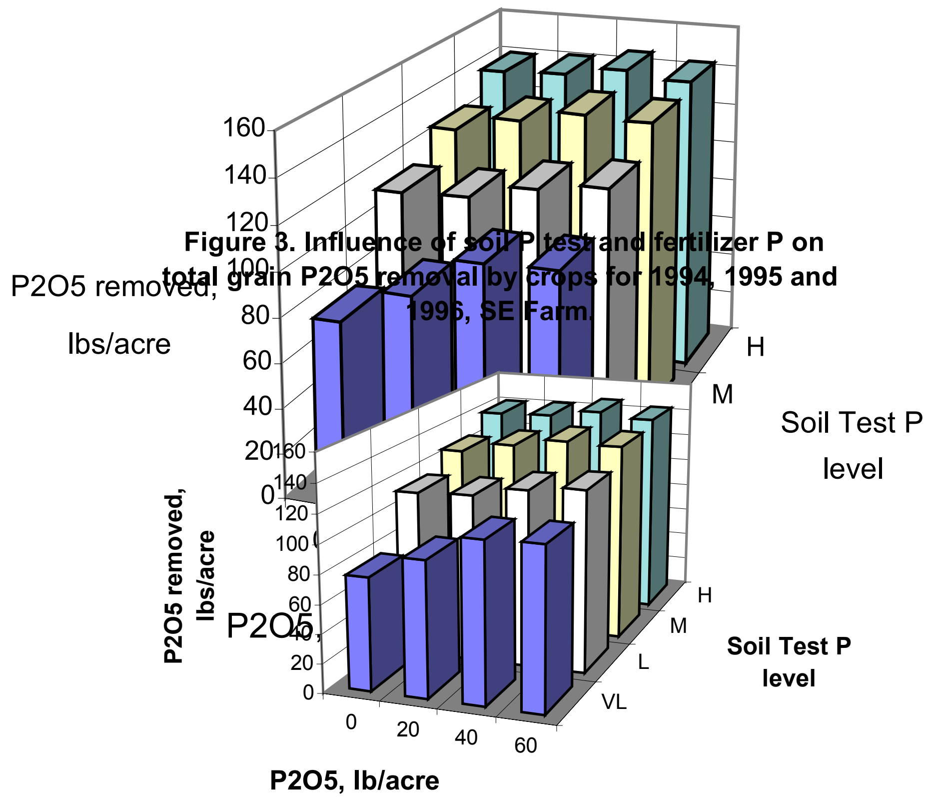


Figure 3. Influence of soil P test and fertilizer P on grain P2O5 removal by crops for 1994, 1995 and 1996, Farm.



NITROGEN FOR CRP ACRES

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

Plant Science 9709

Introduction

In the next four years (1997-2000) over 1.5 million acres of CRP could come back into crop production in South Dakota. Much of these acres are grass or grass/legume and typically are low in plant available nitrate-N. Tillage of these acres will result in the break down of organic residues into plant available nutrients.

The objectives of this study are to evaluate the influence of tillage and added N on yields and soil nitrate levels after a grass sod.

Methods

The experiment site had been big bluestem (a warm season grass) for over 20 years. In later years the stand contained some cool season bluegrass. The grass was chiseled in the fall of 1994, chiseled and disked in the spring of 1995 before planting.

1996:

The experiment was established with two tillage systems (tilled and no-till) and 6 rates of N (0, 30, 60, 90, 120, 150 lbs N/ac) in a split plot design. The tillage treatments were established in the fall of 1996. The treatments were replicated four times. Pioneer hybrid 3556 was planted at 27,000 seeds/ac on May 7, 1996. Nitrogen was hand broadcast as ammonium nitrate just after corn emergence. Weed control consisted of Dual band applied with the planter and Buctril and Accent applied as a post emergence application. Big bluestem plants emerged later in the season from the tilled sod; however, it was felt that yield reduction was minimal from this grass competition.

Two-foot soil samples were taken from the zero N plots at planting and 6-leaf growth stage. The zero and 150 lb N rate plots were sampled at silk stage and all plots were sampled after harvest. Yields were taken by harvesting three of the center rows of the six-row plots on Oct. 16, 1996. Plot size is 15' x 40'. Phosphorus and K soil tests were considered very high. Organic matter was 3.5 to 4.0% and pH was 5.9.

1997:

The tillage treatments were applied with a chisel and disk operation in the fall of 1996. A light disking was also done in the spring of 1997. Soybean variety DeKalb CX222RR (Roundup resistant) was planted with a 10' JD 750 no-till drill with 7.5" row spacing at 280,000 seeds/ac on May 14, 1997. Weed control consisted of Prowl and Pursuit as a preplant application and two post plant applications of Roundup to control the warm-season big bluestem grass. Grain yields were taken by harvesting 12 feet of the entire plot length with a plot combine.

Two-foot soil samples from the 0 and 150 residual N treatments were taken at initial bloom (June 30, 1997) and after harvest (October 30, 1997). Plant samples were not taken in 1997.

Results & Discussion

Soil nitrate-N levels after harvest of corn in 1996 were very low (Table 1). A slight increase in residual N levels are seen with increasing N rate. Most of the applied N was probably taken up by the corn or immobilized by soil microbes. At soybean bloom (1997), residual nitrate-N levels are still low (Table 1). There is some influence of the 1996 N rates on soil nitrate-N levels, particularly with the no-till treatment. There is less nitrate-N in the no-till treatments. A reduction in N mineralization could be occurring due to less soil aeration in the no-till treatments.

Soybean yields (Table 1) were variable and suffered from dry weather in July and August. Residual N from the previous year had no influence on soybean yield. The tilled treatment yielded significantly (Pr > F 0.06) higher than no-till (Table 1). Better plant stands observed within the tilled treatment may explain the yield increase. Seed placement was not as desirable under the no-till treatment because of rough soil surface conditions.

Conclusions

Soybean following corn after CRP were not influenced by the previous year's N rates. Corn will be planted in 1998 and N treatments re-applied.

Table 1. Soil nitrate-N and soybean yields as influenced by N rate and tillage, SE Farm, 1997 (project no. 25197).

Treatment	------------ Fertilizer N rate ------------						
	0	30	60	90	120	150	mean
	------------ nitrate-N, lb/ac -2' ------------						
Soil[1]	12	10	14	11	14	19	--
soil[2] - till	35	--	--	--	--	40	--
soil[2] - no-till	18	--	--	--	--	29	--
	------------ yield, bu/ac ------------						
yield - till	32	36	33	30	31	32	32
yield - no-till	31	30	29	26	34	28	29

[1] Soil sampled after harvest in 1996, before tillage treatments imposed.
[2] Soil sampled at R1 (bloom) stage in 1997
Yield statistics, Pr>F: Rate 0.33; tillage 0.059; rate x tillage 0.74. CV = 19.6 %.

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

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

Plant Science 9710

Introduction

Some farmers in South Dakota are using phosphorus, potassium, sulfur, zinc and lime on soils with very 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 very high. The SDSU Soil Testing Lab, therefore, does not recommend they be applied as fertilizer or lime unless soil test levels are lower. The studies reported on 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. A corn-soybean rotation was followed at both locations. Soybean was the 1997 crop.

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.

Fertilizer treatments were 50 lbs K_2O, 25 lbs sulfur (as elemental sulfur), 5 lbs zinc (as zinc sulfate) and lime at both locations (Table 1). In addition, the Brookings site had a 40 lb P_2O_5 treatment and the Beresford site a boron treatment (2 lb/ac) in 1997. The fertilizer treatments were applied each spring since the establishment year (1988 at Beresford and 1990 at Brookings) on the same plots. An exception is the boron treatment at Beresford which was initiated in 1997. Lime was applied only once (the establishment year) at the SE Farm location and twice (1990 & 1992) at Brookings. All fertilizer materials were broadcast and followed by either discing or field cultivation. Herbicides were applied as needed at both locations.

Adapted soybean varieties (Hefty HSC 203 at Beresford and Dekalb CX096 at Brookings) were planted in 30 inch wide rows at Beresford and 7 inch rows at Brookings. Harvest was done with a field combine at Beresford and a small plot combine at Brookings.

A randomized complete block design with four repletions was used at both sites. Plot size was 15 by 50 feet at Beresford and 20 by 40 feet at Brookings.

Results and Discussion

Soil test levels from soil samples taken in the fall of 1996 at both sites are presented in Table 2. Potassium soil tests were very high at both sites. Adding 50 lb K_2O per year for 10 years increased K soil test at Beresford 103 ppm. Potassium additions had little effect on K soil tests at Brookings.

The sulfur soil test in the check plots at Beresford and Brookings was low, possibly due to leaching from very heavy rainfall from 1994-1996. Sulfur would have been recommended on a trial basis by the SDSU soil testing lab for these soil types. The annual application of 25 lbs sulfur raised the soil test into the high range.

Zinc soil tests were very high at both locations and no fertilizer recommendations would have been made. Zinc applications raised the zinc test from 1.26 ppm in the check to 7.3 ppm at Beresford and from 1.18 to 7.50 ppm at Brookings. The lime treatment raised the pH at the Beresford site from 6.0 to 6.6 and at the Brookings site from 6.5 to 7.4. The SDSU Soil Testing Lab would not have recommended lime at either site. The phosphorus soil test level at the Brookings site was 19 ppm prior to the phosphorus application and no phosphorus would have been recommended. The 40 lb annual phosphorus applications at this site raised the Olson soil test level to 33 ppm. There was no phosphorus treatment at Beresford.

A boron treatment was added to the Beresford experiment in 1997 due to interest in this nutrient in SE South Dakota. The boron soil test was 0.86 ppm which is in the high range (> .50 ppm).

Soybean yields were 31 bushels per acre at Brookings and 37 bushels per acre at Beresford. Soybean yield was not significantly increased over the check by any of the applied nutrients or lime at either of the locations. The lack of response at both of these locations to the applied nutrients and lime is consistent with previous studies and current fertilizer recommendations made by SDSU.

Yield results and soil test levels from previous years for these two studies can be found in the SE Farm Progress Reports (1988-1996) and in the 1988-96 SDSU Plant Science Department Soil/Water Science Research annual report, Technical Bulletin Nos. 97 or 99.

Table 1. Fertilizer Treatments, Fertilizer and Lime Demonstration, Beresford and Brookings, 1997.

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

[1] Applied each spring, 1988-1997 except boron applied only in 1997.
[2] Applied each spring, 1990-1997.
[3] 4000 lb $CaCO_3$ equivalent applied spring 1988.
[4] 2500 and 2400 lb $CaCO_3$ equivalent applied spring 1990 and 1992 respectively.

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

	Soil Test Level			
	Beresford[1]		Brookings[2]	
Soil Test	Check	Treatment	Check	Treatment
Potassium ppm	299	402	173	177
Sulfur, lb/ac, 0 - 6 in	6	14	6	14
lb/ac, 6 - 24 in	12	18	12	24
Zinc, ppm	1.26	7.3	1.18	7.50
pH	6.0	6.6	6.5	7.40
Olson Phosphorus, ppm	9	-----	19	33
Boron	0.86	-----	-----	-----
NO_3-N, lb/ac 2 ft	26	-----	50	-----
Organic Matter, %	3.6	-----	3.3	-----
Salts, mmho/cm	0.20	-----	0.20	-----

[1] Sampled 11/13/96
[2] Sampled 11/12/96

Table 3. Fertilizer Effects on Soybean Yield, Beresford, 1997.

Fertilizer Treatment	Soybean Yield
	bu/ac
Check	37
Potassium	39
Sulfur	35
Zinc	38
Boron	37
Lime	37
Prob of > F	0.70
C.V. %	13
LSD .05	NS

Table 4. Fertilizer Effects on Soybean Yield, Brookings, 1997.

Fertilizer Treatment	Soybean Yield
	bu/ac
Check	31
Phosphorus	31
Potassium	29
Sulfur	30
Zinc	31
Lime	32
Prob of > F	0.14
C.V. %	5.4
LSD .05	NS

NITROGEN MANAGEMENT IN A CORN SOYBEAN ROTATION

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

Plant Science 9711

Introduction

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

This nitrogen management demonstration was established to show the effects of N rates in a corn-soybean rotation on nitrogen movement below the root zone. In most situations in South Dakota, if nitrogen moves below the root zone it stays there and only rarely moves back up. Therefore, once out of reach of crop roots, NO_3 - N has the potential to move down to the groundwater with percolating water during wet periods.

Materials and Methods

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

Corn was planted on the site in even numbered years from 1988-1996 and soybean was planted in the odd numbered years, 1989-1997. The rates and timing of nitrogen fertilizer applied to the corn in 1996 are listed in Table One. The treatments included a check (no N), the recommended rate applied in fall, spring or split between spring and just prior to the last cultivation and 200 and 400 lb rates spring applied regardless of the previous soil test. These treatments were applied to the same plots each year that corn was planted in the rotation. The recommended rate, however was adjusted according to the NO_3 - N soil test level and for credit given for the previous years' soybeans (1 lb N credit for 1 bushel beans). The recommended nitrogen rate was 123, 62, 90, 95 and 95 lb/ac respectively for 1988, 1990, 1992, 1994 and 1996. Nitrogen was broadcast as urea and immediately incorporated by tillage except for the fall application which was not incorporated.

Phosphorus, potassium and pH soil test levels at the site are 10 and 290 ppm and 5.8 respectively. A randomized complete block design was used on this experiment with four replications. Plot size was 15 feet by 50 feet.

Soybean was planted on May 5, 1997 in 30 inch rows. The site had been disced just prior to planting. Soil samples were taken to a depth of 6 feet in 1 foot increments on Oct. 30, 1997. Four cores were taken per plot and replicates combined for analysis. Only the 0, spring recommended (95 lbs), 200 and 400 lb/ac N treatments were soil sampled. Plots were harvested with a field sized combine.

Results and Discussion

Nitrate soil test results from samples taken in the fall of 1996 and 1997 are given in Table Two. In the 0 and recommended rate treatments, nitrate levels were similar for both years. This was expected since nitrate levels were low (less than 32 lb/ac 3 feet) in both treatments in the fall of 1996 allowing almost no opportunity for soybeans leaching or denitrification to reduce them further. However, the 200 and 400 lb/ac treatments in 1996 had resulted in elevated nitrate levels (65 and 200 lb/ac 3 feet respectively) in the fall of 1996 and the soybean crop in 1997 did reduce these levels by 33 and 164 lb/ac respectively. This was also expected since soybeans will use nitrate from soil when available before fixing atmospheric nitrogen.

It appears that some, but not a large amount of leaching occurred in 1997. The two-foot soil layer between four and six feet below the soil surface in the 400 lb treatment contained 145 lb/ac nitrate – N in the fall of 1996. After the 1997 season, this level was reduced to 86 lb/ac. Some N was clearly lost from this zone but the loss was not nearly as large as the previous wet years. The loss that did occur may have been due to leaching and/or dentrification. Leaching was likely minimal in 1997 due to slightly below normal precipitation (Table Three). The previous four years had above normal precipitation and nitrate soil tests from this experiment showed evidence of nitrate leaching below the root zone.

Soybean yields averaged 37 bu/ac and were not influenced by previous nitrogen fertilizer rates or soil test levels (Table Four) even though soil tests ranged from 24 lb/ac 2 feet where no nitrogen fertilizer had been applied for ten years to 156 lb/ac 2 feet where 400 lb N/ac was applied in 1996. The soybeans were able to fix all the N needed when soil test levels were low and high available N levels did not result in yield increases.

These plots will be rotated back to corn in 1998 and soil sampled in the fall to determine the amount and location of residual soil nitrate. Corn and soybean yields and soil tests from previous years of this study can be found in the SE Farm Progress Reports and in the Plant Science Department Soil/Water Science Research Annual Reports, 1988-1996.

Table 1. Nitrogen Fertilizer Treatments, Nitrogen Fertilizer Management Study, Beresford, SD, 1996.

	Time of Application		
Treatment	Spring[1]	Split[2]	Fall[3]
No.	------------------------------ lb N/ac ------------------------------		
1	0	-----	-----
2	95	-----	-----
3	30	65	-----
4	-----	-----	95
5	200	-----	-----
6	400	-----	-----

[1] May 1, 1996
[2] June 19, 1996
[3] November 8, 1995

Table 2. Fall Nitrate Soil Test Levels, Nitrogen Management Study, Beresford, SD.

	Fertilizer N Applied, 1988, 1990, 1992, 1994, 1996, lb/ac							
	- - - - 0 - - - -		Recommended[1]		- - - 200 - - -		- - - 400 - - -	
Depth	1996	1997	1996	1997	1996	1997	1996	1997
feet	- Soil NO_3 - N, lb/ac[2] - - - - - - - - - - - - - - - - - - -							
0 - 1	14	26	15	9	21	16	69	16
1 - 2	7	14	10	13	22	10	87	10
2 - 3	11	7	6	7	23	6	44	10
3 - 4	11	6	7	6	15	8	32	26
4 - 5	13	5	13	7	26	12	67	38
4 - 6	8	6	12	7	37	17	78	48

[1] Rates applied were 123, 62, 90, 95 and 95 lb N/acre in spring of 1988, 1990, 1992, 1994, and 1996 respectively.
[2] Soil sampling dates: Nov. 12, 1996, Oct. 30, 1997

Table 3. Rainfall at the SE Experiment Farm, Beresford, Nov. 1, 1996 to Oct. 31, 1997.

Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct
- - - - - - - - -	- - - - - - - - -	- - - - - - - - -	- - - - - - - - -	- - - - - - - - -	- - - - - - - - - inches	- - - - - - - - -	- - - - - - - - -	- - - - - - - - -	- - - - - - - - -	- - - - - - - - -	- - - - - - - - -
3.9	0.7	0.5	0.4	0.4	2.2	3.5	3.6	1.3	2.1	3.5	2.2

Table 4. Influence of Previous Year's Nitrogen Rates Applied to Corn on Soybean Yield, Beresford, 1997.

1996 Nitrogen		NO_3 - N Soil Test	Soybean Yield	
Rate	Timing	Nov, 1996	1997	
lb/ac		lb/ac 3 ft.	bu/ac	
0	Spring	32	37	A
95	Spring	31	37	A
200	Spring	66	38	A
400	Spring	200	37	A
95	Fall	-----	35	A
95	Split	-----	38	A
Pr > F			0.7	
CV			10	
LSD (.05)			5.0	

PHOSPHORUS RATE AND PLACEMENT EFFECTS ON TILLED CORN AND SOYBEAN ROTATION

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

Plant Science 9712

Introduction

Questions concerning phosphorus (P) fertilizer placement are being asked. Is row placement of P more effective than broadcast for corn and soybean under a tilled environment? Will fertilizing only the corn in the rotation influence soil tests and influence yields? Due to these questions a long-term experiment was established south of the office building at the Southeast Experiment Farm. Objectives are to determine the long-term effect of P management practices on yield and soil test level in a tilled corn-soybean rotation.

Methods

Egan silty clay loam is the predominant soil of the study location . The study is separated into two parts by another experiment (210' apart). The west side will have soybean in odd years and the east side will have corn in odd years. Each side will be a corn-soybean rotation. The west side is smaller in area and only four treatments could be established compared to six on the east side. The treatment numbers 1, 2, 4 and 5 on the east side are identical to treatment numbers 7, 8, 9 and 10 on the west side. Treatments and locations are given in Table 1.

The row placement treatments are 10-34-0 placed directly with the seed. The 30 lb/ac P_2O_5 rate of this material will supply 9 lb of N/ac. Broadcast placements receive 0-46-0 as a P source. Ammonium nitrate (34-0-0) is used to balance N for each broadcast and check treatment. Broadcast treatments were applied and disk incorporated prior to planting.

The east side was planted to DK 512 corn on May 15, 1997. Ninety pounds of N/ac as 28-0-0 was knifed on all plots. Weed control consisted of Atrazine and Dual II applied pre-plant and Accent and Buctril applied post-plant. Plot size is 15' x 50'. Corn grain yield was estimated by harvesting three of the center rows with a plot combine on October 7, 1997.

Hefty HSC203 soybeans were planted on the west side. Since treatments are not applied to the west side during the soybean year, no yield data was taken.

Results and Discussion

Soil analysis from both sides of the experiment are very similar (Table 2). Olsen P levels are considered low. Yields ranged from 86 to 98 bu/ac and were not significantly different (Table 1). Yields from row applied P treatments (2, 3 and 6) are significantly higher (Pr>F = 0.06) than yields from broadcast P treatments (4 and 5). Row treatments averaged 97 bu/ac compared to broadcast yield of 86 bu/ac. Broadcast P_2O_5 at 60 lb/ac did not produce yields comparable to 30 lbs/ac of row applied P.

These yields agree with observations at pre-tassel plant growth. Plants from broadcast treatment plots appeared slightly larger than plants from check plots. Plants from row applied treatment plots appeared to be 8 to 12 inches taller at the V8 leaf stage.

These results are consistent with other tilled P placement studies. Banded P is usually better when compared to broadcast P. There were no significant differences in grain moisture and test weight due to treatment (data not shown).

Conclusion

For tilled conditions in 1997, banded P produced more corn than broadcast P.

Table 1. Treatments and corn yield of the P placement and rate study, SE Farm, 1997. (project no. 26897)

treatment number	side of experiment	P_2O_5 rate	P placement	crop P is applied to[1]	yield
		lb/a			bu/ac
1	east	0	--	--	86
2	east	30	row	c	98
3	east	30	row	c+s	95
4	east	30	bct[2]	c	86
5	east	60	bct	c	88
6	east	30 30	bct row	c+s	98
7	west	0	--	--	--
8	west	30	row	c	--
9	west	30	bct	c	--
10	west	60	bct	c	--

[1] c = corn, s = soybean.
[2] bct = broadcast.
Yield statistics; Pr > F: all treatments = 0.28, row vs. broadcast treatments = 0.06.
CV = 10.2%.

Table 2. Soil analysis for P placement and rate study, SE Farm, 1997.
(project no. 26897)

side of study	soil test				
	Olsen P	NO_3-N	K	O.M.	pH
	ppm			%	
east[1]	4	--	291	3.8	6.1
west[2]	7	34	279	3.6	6.0

1 1996 spring 0-6” sample.
2 0-6” sample taken 6 June 1996.

INFLUENCE OF P SOIL TEST LEVEL, ROW SPACING, AND TILLAGE METHOD ON GROWTH AND GRAIN YIELD OF SOYBEAN VARIETIES

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Plant Science 9713

Introduction

Management of soybean production includes many different types of tillage systems, row spacing and variety/maturity group selections. Using different management practices might influence early soybean growth and grain yield. The objective of this experiment is to measure early plant growth and grain yield response of nine soybean varieties as influenced by P soil test level, row spacing, and tillage.

Materials and Methods

This field experiment has been conducted on the northeast quarter section of the Southeast Research Farm for three years. The soil type is predominately Egan silty clay loam. In 1995 the tillage treatments (tilled and no-till), crop rotation (corn/soybean), and soil test P levels were established.

In previous years, phytophthora root infection occurred and was especially severe during the 1996 growing season. It was very evident what varieties were susceptible to infection. The 0 maturity group was especially hard hit with less infection in group I and still less in group II. The intent was to use all the varieties throughout the length of the experiment, but decided we must select new varieties to replace those that showed susceptibility to phytophthora infection. Reduced plant population of susceptible soybean varieties greatly reduced yield.

P applications to this site have totaled 175 lbs P_2O_5/ac. The first application (75 lbs P_2O_5/ac) was made in 1995 prior to planting the first year plots as broadcast 10-34-0 and incorporated with a field cultivator on treatment plots. There were no tillage system comparisons made in 1995. The second application (100 lbs P_2O_5/ac) was applied perpendicular to plot rows with a knife applicator set on 12 inch spacing prior to planting corn in 1996. No application of P was made in 1997.

This year, tillage treatments were tilled with a disk and field cultivated prior to planting. There are some wet areas at this site and the effectiveness of the tillage implements was somewhat limited. Work on this experiment was delayed by these wet areas.

On June 9 and 10, three soybean varieties from each of three maturity groups were planted at a rate of 200,000 pure live seeds/ac into tilled and un-tilled corn stalks with the same grain seeding drill. The varieties and maturity group can be found in Table 3. Tillage treatments (no-till and disc/field cultivator), P application (0 and cumulative 175 lbs P_2O_5/ac), and row spacing (7,14, and 28 inch) were randomized as a split block design within 4 replications. All variety plots measured 5' x 42.5'.

Weed control consisted of 2 pt/ac Prowl and 1.44 oz/ac Pursuit applied on May 13, and 0.25 oz/ac of each Pinnacle and Classic on July 15. The July 15 herbicide application was made to control tall waterhemp. Waterhemp weeds were also rouged out due to escape from herbicide application. Lorsban (1 pt/ac) was applied on July 23 for control of grasshoppers.

Soil sample cores (0-6 inch) were randomly selected and composited from each replication, P treatment, and conventional till main block prior to planting. No-till blocks were not sampled due to known P variably that can occur from not knowing the location of residual P bands.

Early bloom plant samples were taken from a 2 foot x 5 foot section of each treatment plot on July 21 and dried to determine dry matter weight. Number of plants were counted from each plant sample section for determination of stand and dry weight per plant. Grain from each plot was harvested with a small plot combine on Oct. 9, 10, and 17. Treatments were compared using analysis of variance (ANOVA) and least significant difference (LSD) statistics by using SAS, a statistical analysis software computer program.

Results and Discussion

Soil sample results indicate differences in Olsen P levels between the 0 and cumulative 175 lb/a P_2O_5 application blocks (Table 1). Organic matter, soil test K, and pH are very similar. Replication 1 has higher levels of organic matter, soil test K, pH and electrical conductivity (EC) which is an indication of the presence of salts when compared to other replications. Replication 1 is an area where wetness is a problem. During 1996, corn was planted in this area and in 1995 more soybean emergence problems and phytophthora infections were observed. Yields from this area of the project have been lower when compared to other areas (data not shown).

Presence of phytophthora infection was not visible in 1997. Plant populations are significantly different between varieties but more than adequate for optimal yield (data not shown). Differences in variety plant populations are more likely due to emergence, seedling vigor, and in calculating a seeding rate which could be influenced by errors in seed count, germination, and purity.

Two separate ANOVA were used to determine what sources of variation (SOV) had significant probabilities of a greater F value for early bloom (EB) dry weight and grain yield. The first ANOVA used variety as a SOV, in the second ANOVA maturity group was substituted for variety. All other SOV remained the same between the two separate ANOVA. ANOVA indicated that variety, row spacing, and maturity group had significant F values for EB dry weight samples and grain yield (Table 2). Other single factors and interaction SOV had non-significant F values. P and tillage treatment did not significantly effect EB dry matter or grain yield. One would expect that if variety was significant that maturity group would also be. Even though soil test P levels were measured by added P (Table 1) yields were not significantly influenced by this residual P.

Variety, row spacing and maturity group EB dry weight means are presented in Table 3. There does not seem to be any definitive trend in the variety and maturity group EB dry weight means. EB dry weight and grain yield was highest for 14 inch rows, decreased with 7 inch rows and lowest for 28 inch. The 28 inch row spacing could have added competition within the row reducing EB dry weight and grain yield. Grain yield means of varieties show significant differences paralleled with the maturity group that each variety represents (Table 3). Varieties of maturity group 0 have the lowest yields while group II has the highest.

Further work on measured variables are expected in the future, these include P uptake in the plant, grain protein, and oil.

Conclusions

- Residual P increased soil test levels but did not influence soybean yields. Increase soluble salt levels in replication one correspond to observed wet areas on this site.

- Variety, row spacing, and maturity group were significant sources of variation from ANOVA. No definite trends in EB dry matter means were obvious except differences between row spacing as paralleled by grain yield. Grain yield means increased as maturity group increased from 0 to II. Row spacing of 14 inches produced highest yields.

Table 1. Soil sample analysis from a soybean project at the Southeast Research Farm near Beresford SD during 1997. (project no. 17197)

		Soil Test Parameter				
Replication	P Rate[A]	Organic Matter	Olsen P	K	pH	salts[B]
	total lbs P_2O_5/a	%	ppm P	ppm K	-log[h^+]	mmho/cm
1	0	3.6	8	328	6.1	0.8
	175	3.8	13	326	6.1	0.9
2	0	3.1	7	273	5.8	0.4
	175	3.4	11	272	5.5	0.5
3	0	3.6	5	278	6.0	0.4
	175	3.1	13	259	5.7	0.4
4	0	3.3	5	215	5.8	0.4
	175	3.5	16	246	5.9	0.4

[A] 75 lbs P_2O_5/a applied in May 1995 (broadcast incorporated)
100 lbs P_2O_5/a applied in May 1996 (knifed applied as 12 inch spacing)

[B] Electrical Conductivity (EC) measurement.

-Soybeans grown in 1995 and corn in 1996.

-Sampled at planting, random composite cores (0-6 inch) from each replication P treatment and tilled block.

Table 2. Two ANOVA analysis with variety and maturity group substituted for each other as a source of variation (SOV) for early bloom (EB) dry matter and grain yield for a randomized factorial (2x2x3x2) soybean study at the Southeast Research Farm near Beresford SD during 1997. (project no. 17197)

SOV	Early Bloom dry matter ($g/10ft^2$)		Grain Yield (bu/a)	
	Pr > F			
ANOVA 1				
Variety (V)	0.0001	**	0.0001	**
Tillage (T)	0.5466		0.4875	
Row Spacing (S)	0.0009	**	0.0171	*
P treatment (P)	0.2228		0.6839	
V x T	0.7491		0.8213	
V X S	0.1378		0.2483	
V x P	0.1723		0.2555	
T x S	0.2733		0.3168	
T x P	0.1764		0.3010	
S x P	0.7447		0.6107	
V x T x S	0.1888		0.0969	
V x T x P	0.0846		0.6110	
T x S x P	0.6252		0.4197	
V x T x S x P	0.1597		0.9005	
ANOVA 2				
Maturity Group (M)	0.0019	**	0.0001	**
Tillage (T)	0.5466		0.4875	
Row Spacing (S)	0.0009	**	0.0171	*
P treatment (P)	0.2228		0.6839	
M x T	0.8397		0.6439	
M x S	0.3430		0.6724	
M x P	0.2730		0.2704	
T x S	0.2733		0.3168	
T x P	0.1764		0.3010	
S x P	0.7447		0.6107	
M x T x S	0.9717		0.1952	
M x T x P	0.1542		0.1493	
T x S x P	0.6252		0.4197	
M x T x S x P	0.4885		0.9382	

** highly significant (Pr > F is less than 0.01)
* significant (Pr> F is less than 0.05)

Table 3. Treatment means of significant sources of variation (SOV) for early bloom (EB) dry matter and grain yield for a soybean study at the Southeast Reasearch Farm near Beresford SD during 1997. (project no. 17197)

SOV		Dependant Variable	
		Early Bloom dry matter[A]	Grain Yield
Variety (Maturity group)		$g/10\ ft^2$	bu/a
Glacier	0	93.6 A	22.3 A
Dassel	0	117.9 CD	33.9 B
LOL L0727	0	116.7 C	36.8 C
BSR 101	I	95.2 A	40.3 D
Granite	I	97.2 A	40.6 D
Hardin 91	I	116.3 C	41.6 D
Kenwood 94	II	124.4 DE	46.1 E
Marcus 95	II	104.4 B	40.7 D
IA 2021R	II	125.6 D	45.4 E
$LSD_{(.05)}$		6.7	2.3
Row Spacing (inches)			
7		118.2 A	38.8 AB
14		122.1 A	40.5 A
28		90.1 B	36.6 B
$LSD_{(.05)}$		11.5	2.3
Maturity Group			
0		109.4 A	31.0 A
I		102.9 B	40.9 B
II		118.1 C	44.1 C
$LSD_{(.05)}$		5.7	1.6

[A] early bloom dry matter samples taken at beginning flowering stage from a 2' x 5' section of each plot.

- means within an SOV with similar upper-case letter are not significantly different.

SOYBEAN CYST NEMATODE STUDIES, 1997

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Plant Science 9714

Objectives

Continue to survey for soybean cyst nematode (SCN) in eastern South Dakota. Determine effect of various population levels of SCN on soybean yield under irrigated and dryland conditions.

Results

<u>Survey</u>: Approximately 300 soil samples were processed for SCN from the following counties: Aurora, Beadle, Brookings, Brown, Clay, Codington, Davison, Day, Grant, Hamlin, Hanson, Jerauld, Lake, Lincoln, Miner, Minnehaha, Moody, Sanborn, Turner, Union, and Yankton. The current distribution of SCN in eastern SD, and the year in which the nematode was first detected are shown in Figure 1. The nematode was detected in an additional seven counties in 1997: Clay, Lincoln, Moody, Brookings, Hamlin, Grant and Day. A portion of the 1997 survey was conducted in cooperation with the SDSU Soil Testing Service, which resulted in the detection of SCN in the five northernmost counties.

Figure 1.

Distribution of SCN
in Eastern South Dakota

Small Plot Tests: In cooperation with Roy Scott (SDSU soybean breeder) small plot tests were established in a cooperators field in Turner County. The test included public and private varieties, as well as experimental material from the SDSU breeding program. Plots were established in irrigated and dryland portions of the field. Initial populations of SCN in the irrigated area were moderately high, and yield of the resistant (R) entries was 17 to 45% greater than the average yield of the susceptible (S) entries (Table 1). In general, populations of SCN at harvest were significantly lower in plots planted to resistant entries. Several of the SDSU experimental entries were resistant to SCN, and also appear to yield well in the presence of the nematode.

Table 1. Soybean Yields and SCN Populations in Irrigated Small Plot Test, Turner County, 1997.

Entry	Response to SCN Yield	Bu/A	#SCN eggs+J-2 per 100 cm^3 soil at harvest[b]
Pioneer 9234	R	67.9[a]	117
SD94-495	R	65.9	1183
SD93-522L	R	60.4	600
DeKalb CX235C	R	58.8	583
SD93-522E	R	57.3	567
Bell	R	53.9	217
Sturdy	S	48.7	4188
Pioneer 9245	S	46.2	3833
Parker	S	45.1	7683
SD94-461	S	44.1	3683
		10.5	2570

[a/] Average of 3 replications.
[b/] Population of SCN at planting was 917 eggs+J-2/100cm^3 soil.

In the dryland portion of the field populations of SCN at planting were extremely high (Table 2). The plant stand was erratic and yield data was not obtained, but the stand was sufficient to allow a measure of SCN populations. Populations of SCN declined over the growing season in plots planted to resistant entries and generally increased on susceptible entries (Table 2).

Table 2. Soybean Cyst Nematode Populations in Dryland Small Plot Test, Turner County, 1997.

Entry	Response to SCN	# SCN eggs+J-2 at harvest
Pioneer 9234	R	817[a]
SD94-495	R	533
SD93-522L	R	650
DeKalb CX235C	R	533
SD93-522E	R	433
Bell	R	817
Pioneer 9245	S	4683
Sturdy	S	28,367
Parker	S	6400
SD94-461	S	16,317

[a/] Average of 3 replications. Initial SCN population was 4816 eggs+J-2/100 cm^3 soil.

<u>Strip Tests</u>: In cooperation with area producers field-scale tests were conducted in Turner and Union Counties. The initial population of SCN in the Union County test was in the moderate range. There were no readily visible differences in growth between the varieties, but the average yield of the resistant varieties was 29% higher than the susceptible (Table 3). Also, SCN populations increased to very high levels on the susceptible varieties over the growing season.

Table 3. Soybean yields and SCN Populations in Union County Strip Test, 1997.

Entry[a]	Response to SCN	Yield Bu/ac	#SCN eggs+J-2 per 100 cm^3 soil at harvest[b]
DeKalb 260C	R	31.2	550
Asgrow 2540	R	28.6	450
Pioneer 9234	R	28.1	75
Bell	R	24.2	450
Sturdy	S	24.9	2675
Latham 660	S	21.1	3050

[a/] Pioneer 9234, Sturdy, and Latham 660 were replicated twice and remaining entries were not replicated.
[b/] Initial SCN population was 300 eggs+J-2/100 cm^3 soil.

The tests in Turner County were conducted in a center pivot irrigated field with a variable cropping history. The test was established in the eastern portion of the field that included a non-irrigated corner. Soybeans had been planted in 1994, 1995, and 1996 in the non-irrigated corner, while in the irrigated portion soybeans were planted in 1994 and corn was planted in 1995 and 1996. This cropping history had a major effect on initial SCN populations (see bottom of Table 4). In the heavily infested non-irrigated area growth differences between resistant and susceptible varieties were dramatic. Yield of the resistant varieties was 2 to 4 times greater than that of the susceptible varieties (Table 4). Populations of SCN did not increase over the growing season on the resistant varieties. On the susceptible varieties populations of SCN increased to extremely high levels and, in this sandy soil, have reached a level that probably would prevent the growth of a susceptible soybean variety. In the lightly infested irrigated portion of the field there was no major difference in yield between the resistant and susceptible varieties (Table 4). Populations of SCN declined to a non-detectable level on some of the resistant varieties, and increased to the moderate range on the susceptible varieties.

Table 4. Soybean Yields and SCN Populations in Irrigated and Non-Irrigated Strip Tests inTurner County.

	Non-irrigated			Irrigated	
Entry[a]	Response to SCN	Yield Bu/ac	#SCN eggs+J-2 at harvest[b]	Yield Bu/A	#SCN eggs+J-2 at harvest
Pioneer 9234	R	22.6	417	46.4[a]	0
DeKalb CX260C	R	21.2	950	45.8	25
Latham 772SCN	R	20.6	175	44.7	0
Bell	R	23.2	50	45.0	0
Garst D267N	R	22.0	300	44.3	0
DeKalb CX235C	R	19.7	1100	48.8	250
Stauffer 4211SCN	S	17.6	50	44.0	0
Sturdy	S	10.8	17,900	50.0	200
Pioneer 9245	S	7.4	5450	46.1	650
Pioneer 9233	S	4.9	13,750	49.8	650

[a]/Pioneer 9234 was replicated 3 times in the test, DeKalb 260C and Latham 722SCN were replicated twice, and the remaining entries were not replicated.

[b]/Average initial SCN population in the non-irrigated area was 1250 eggs+J-2 (2nd stage juveniles) per 100 cm^3 soil, and average initial population in the irrigated area was 100 eggs+J-2.

<u>Rotation Effects</u>: A limited amount of rotation data was collected in 1997, and this data supports the more intensive 1996 studies. A single year of a non-host crop (corn, alfalfa, etc.) will reduce SCN populations only 10-20%. Reductions in SCN populations following a resistant soybean variety are generally much greater.

Conclusions

The detection of SCN in the northern area of the state emphasizes the importance of remaining vigilant for the presence of the nematode in all areas of South Dakota where soybeans have been extensively planted. Conversations with producers in the northern area indicate that a series of wet years has encouraged more continuous cropping of soybeans, which may account for the detection of SCN in these areas.

The 1997 yield tests have been helpful in estimating the impact that various population levels of SCN will have on soybean yields in dryland and irrigated environments. Under dryland conditions it appears that even moderately low (ca 300 eggs+J-2/100 cm^3 soil) populations will substantially reduce yield. High SCN populations (>1000) will dramatically reduce soybean yield under both irrigated and dryland conditions. Very low populations (<100) have little effect on yield of irrigated soybeans, but unless a resistant variety is planted SCN populations will increase to a level that could seriously damage future soybean crops.

PERFORMANCE OF BT-CORN HYBRIDS AGAINST THE EUROPEAN CORN BORER IN SOUTHEASTERN SOUTH DAKOTA

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Plant Science 9715

INTRODUCTION

Genetically-engineered Bt corn is fast becoming a favored pest management tactic for use against the European corn borer in South Dakota and the entire United States cornbelt. In 1996, only three seed corn companies offered Bt-corn seed (Mycogen, Maximizer, and Northrup King). This year (1997), six Bt-corn seed brands were commercially available (Ciba, Dekalb, Golden Harvest, Mycogen, Northrup King, and Pioneer). Almost every corn seed company will soon offer its own version of Bt corn. Because Bt corn is still a new pest management tactic, there are lingering doubts among corn producers as to whether Bt-corn hybrids can yield as well as, or better than their non-Bt isolines. This research seeks to answer this concern as we report the results of our 1997 studies.

Two generations of corn borer attack corn in southeastern South Dakota (Figures 1 and 2). Adult corn borers (that will then lay eggs and become the 1st generation larvae) begin to appear on the first week of June then continue emerging until the end of the month. By July, almost all of the corn borers are inside the corn stalks doing damage by disrupting plant nutrient transport. They then pupate in the stalks and emerge as adults that will give rise to the 2nd generation larvae during the entire month of August. These 2nd generation larvae also tunnel into the stalks, and in addition, damage the ear shanks and the corn ears. Second generation larvae overwinter in corn stubble and debris after harvest, ready to strike again the following spring. The European corn borer, if not managed properly, will consistently reduce corn yields in southeastern South Dakota each year.

MATERIALS AND METHODS

Seven corn hybrid groups (Dekalb 566, Dekalb 580, Golden Harvest 2390, Golden Harvest 2493, Ciba 4394, Northrup King 4640, and Pioneer 3489) were evaluated for their performance against the corn borer at the SDSU Southeast Farm in Beresford, SD during the 1997 season. The experimental design was a split-plot with the main plots arranged as randomized complete blocks. The main plot treatments were the seven corn hybrid groups mentioned above while the subplot treatments were the three methods of controlling corn borers: (1) hybrid with the Bt gene, (2) non-Bt isoline of the hybrid, and (3) non-Bt isoline treated with Pounce 1.5G granular insecticide at the rate of 8 lb formulated material/acre. Main plot treatments were replicated four times.

Each subplot was six rows wide and 90 feet long. Damage due to natural infestations of 1st and 2nd generation larvae were observed by splitting 2,520 corn stalks (120 stalks per treatment) then recording the proportion of stalks infested, and the number and length of tunnels in the stalks and ear shanks. Other indicators of damage and corn borer activity including moth flights were also recorded. Three rows out of six were left intact for yield data. Plots receiving the insecticide treatment were treated only for 1st generation larvae after scouting indicated an economic injury level. The insecticide granules were applied manually using a hand applicator to prevent contamination of untreated plots.

RESULTS AND DISCUSSION

In general, the seven corn hybrids evaluated this year reacted differently to the treatments. That is, significant treatment by hybrid interactions were observed in most of the indicators of corn borer damage recorded. This means that the subplot treatments (Bt corn, non-Bt corn, non-Bt corn plus Pounce 1.5G) need to be evaluated by hybrid (Tables 1-2).

Corn with the Bt gene significantly outperformed their non-Bt counterparts (in terms of yield) in the following hybrid groups: Dekalb 566, Dekalb 580, Ciba 4394, Northrup King 4640, and Pioneer 3489. Yield advantages ranged from 15 to 30 bu/ acre (Table 2). Bt corn did not show yield advantages in the two Golden Harvest hybrids tested despite providing excellent corn borer protection. Insecticide treatment with Pounce 1.5G (1st generation only) was comparable to Bt corn in Dekalb 566 and Dekalb 580, but less effective than Bt corn in Ciba 4394, Northrup King 4640, and Pioneer 3489. Insecticide treatment provided the best yield in Golden Harvest 2493.

Some of the Bt-corn hybrids sustained more injury than others indicating the different characteristics of the Bt gene introduced into the corn seed by their respective manufacturers. Dekalb 566Bt, Dekalb 589Bt, and Maximizer 21 allowed some degree of corn borer infestations. In contrast, Golden Harvest 2390Bt, Golden Harvest 2493Bt, Northrup King 4640Bt, and Pioneer 34R06 (Bt) provided virtually “clean” or injury-free stalks, ear shanks, and ears throughout the season. However, having “clean” or injury-free stalks, ear shanks, and ears, did not automatically translate to higher yields (Tables 1-2).

To summarize, this research indicates that European corn borer caused significant yield losses for corn in southeastern South Dakota during 1997. The Bt gene significantly improved yields in most of the corn hybrids by protecting the corn stalk, ear shank, and ear from damage due to corn borer larvae. Treating non-Bt corn with Pounce 1.5G at 8 lb of product/acre was as effective as the Bt trait in some hybrids but not in others. The recurring theme is that corn hybrid groups responded differently to the corn borer management tactics that we tested.

ACKNOWLEDGMENT

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Table 1. Performance of Bt-corn hybrids and their non-Bt isolines with and without conventional insecticide treatments (**PCT. INFESTED**, percent of stalks with tunnels; **NO. TUNNELS**, avg. no. of tunnels per infested stalk; **CM. TUNNELS**, cumulative length of tunnels in cm per infested stalk; **LIVE LARVAE**, avg. no. of live ecb larvae per infested stalk) (Beresford, SD 1997).

Treatment	**Damage to corn stalks** (mean ± SEM)							
	Due to first-generation corn borer				Due to first- and second-generation corn borers			
	PCT. INFESTED	**NO. TUNNELS**	**CM. TUNNELS**	**LIVE LARVAE**	**PCT. INFESTED**	**NO. TUNNELS**	**CM. TUNNELS**	**LIVE LARVAE**
Dekalb 566Bt	5 ± 3 a	0.8 ± 0.5 a	2.2 ± 1.8 a	0.0 ± 0.0 a	30 ± 7 a	1.2 ± 0.1 a	2.9 ± 0.6 a	1.0 ± 0.0 a
Dekalb 566	71 ± 4 b	1.9 ± 0.1 b	5.6 ± 0.5 b	0.0 ± 0.0 a	90 ± 4 b	2.4 ± 0.3 a	6.9 ± 1.6 b	1.1 ± 0.4 a
Dekalb 566+Pounce 1.5G	9 ± 4 a	0.8 ± 0.35 a	2.2 ± 1.2 a	0.0 ± 0.0 a	35 ± 10 a	1.7 ± 0.3 a	1.3 ± 0.3 a	0.8 ± 0.3 a
Dekalb 580Bt	14 ± 4 a	1.6 ± 0.2 a	7.2 ± 2.2 b	0.3 ± 0.3 a	48 ± 13 a	1.5 ± 0.3 a	3.2 ± 0.5 a	1.1 ± 0.1 a
Dekalb 580	76 ± 5 b	2.5 ± 0.2 b	7.4 ± 0.7 b	0.5 ± 0.5 a	98 ± 3 b	2.7 ± 0.3 b	7.7 ± 1.3 b	1.6 ± 0.2 a
Dekalb 580+Pounce 1.5G	20 ± 2 a	1.1 ± 0.1 a	2.5 ± 0.5 a	0.0 ± 0.0 a	65 ± 13 a	1.6 ± 0.1 a	3.0 ± 0.4 a	1.3 ± 0.1 a
Golden Harvest 2390Bt	1 ± 1 a	0.5 ± 0.5 a	0.2 ± 0.2 a	0.0 ± 0.0 a	0 ± 0 a	0.0 ± 0.0 a	0.0 ± 0.0 a	0.0 ± 0.0 a
Golden Harvest 2390	65 ± 6 c	1.6 ± 0.2 b	3.2 ± 0.1 b	0.0 ± 0.0 a	73 ± 11 b	2.7 ± 0.9 b	2.8 ± 0.5 b	0.6 ± 0.4 b
Golden Harvest 2390+Pounce 1.5G	16 ± 6 b	0.9 ± 0.3 a	1.1 ± 0.5 a	0.0 ± 0.0 a	15 ± 10 a	0.6 ± 0.4 a	1.5 ± 0.9 b	0.6 ± 0.3 b
Golden Harvest 2493Bt	3 ± 3 a	0.3 ± 0.3 a	0.1 ± 0.1 a	0.0 ± 0.0 a	5 ± 5 a	0.3 ± 0.3 a	0.3 ± 0.3 a	0.0 ± 0.0 a
Golden Harvest 2493	69 ± 4 c	2.1 ± 0.3 b	7.4 ± 1.3 c	0.3 ± 0.3 a	88 ± 5 c	2.5 ± 0.3 c	6.8 ± 0.8 c	1.2 ± 0.4 b
Golden Harvest 2493+Pounce 1.5G	19 ± 3 b	1.6 ± 0.2 b	3.6 ± 0.8 b	0.0 ± 0.0 a	45 ± 3 b	1.2 ± 0.1 b	4.1 ± 1.2 b	1.0 ± 0.0 b
Maximizer 21 (Bt)	0 ± 0 a	0.0 ± 0.0 a	0.0 ± 0.0 a	0.0 ± 0.0 a	40 ± 14 a	1.6 ± 0.3 a	3.4 ± 0.7 a	0.9 ± 0.3 a
Ciba 4394	69 ± 7 c	2.0 ± 0.2 c	4.9 ± 0.4 b	0.0 ± 0.0 a	80 ± 7 a	2.9 ± 0.5 b	8.8 ± 2.0 b	1.5 ± 0.1 a
Ciba 4394 + Pounce 1.5G	16 ± 7 b	1.1 ± 0.5 b	3.3 ± 1.1 b	0.0 ± 0.0 a	63 ± 8 a	1.5 ± 0.2 a	3.3 ± 0.3 a	1.2 ± 0.1 a
Northrup King 4640Bt	1 ± 1 a	0.3 ± 0.3 a	0.3 ± 0.3 a	0.0 ± 0.0 a	0 ± 0 a	0.0 ± 0.0 a	0.0 ± 0.0 a	0.0 ± 0.0 a
Northrup King 4640	78 ± 1 c	2.3 ± 0.2 c	5.6 ± 0.6 b	0.3 ± 0.3 a	88 ± 6 c	2.4 ± 0.3 c	4.4 ± 0.8 b	1.1 ± 0.1 b
Northrup King 4640+Pounce 1.5G	21 ± 5 b	1.1 ± 0.1 b	2.7 ± 0.6 b	0.0 ± 0.0 a	50 ± 11 b	1.3 ± 0.2 b	2.8 ± 0.3 b	1.3 ± 0.1 b
Pioneer 34R06 (Bt)	1 ± 1 a	1.0 ± 1.0 a	4.0 ± 4.0 b	0.0 ± 0.0 a	5 ± 5 a	0.3 ± 0.3 a	1.4 ± 1.4 a	0.0 ± 0.0 a
Pioneer 3489	68 ± 7 c	1.7 ± 0.1 b	5.0 ± 0.8 b	0.3 ± 0.3 a	83 ± 6 c	2.2 ± 0.1 b	5.7 ± 0.7 b	1.2 ± 0.2 b
Pioneer 3489 + Pounce 1.5G	6 ± 2 b	1.0 ± 0.4 a	0.8 ± 0.4 a	0.0 ± 0.0 a	33 ± 3 b	1.4 ± 0.3 b	3.7 ± 0.8 b	0.8 ± 0.3 b

Means (within a hybrid group) followed by the same letter are not significantly different (*P*>0.05, Fisher's protected LSD). Mike Catangui, SDSU

Table 2. Performance of Bt-corn hybrids and their non-Bt isolines with and without conventional insecticide treatments (**PCT. INFESTED**, percent of ear shanks with tunnels; **NO. TUNNELS**, avg. no. of tunnels per infested ear shank; **CM. TUNNELS**, cumulative length of tunnels in cm per infested ear shank; **LIVE LARVAE**, avg. no. of live ecb larvae per infested ear shank; **EPC. INFESTED,** percent of ears infested) (Beresford, SD 1997).

Treatment	**Damage to ear shank and ear** (mean ± SEM)					**Yield (bu/ac) @ 15%**
	PCT. INFESTED	**NO. TUNNELS**	**CM. TUNNELS**	**LIVE LARVAE**	**EPC. INFESTED**	
Dekalb 566Bt	5 ± 5 a	0.3 ± 0.3 a	0.2 ± 0.2 a	0.3 ± 0.3 a	48 ± 20 a	177 ± 4 b
Dekalb 566	28 ± 5 b	1.0 ± 0.0 b	1.6 ± 0.5 b	1.0 ± 0.0 b	68 ± 16 a	161 ± 8 a
Dekalb 566+Pounce 1.5G	18 ± 5 b	1.0 ± 0.0 b	1.8 ± 0.6 b	1.0 ± 0.0 b	68 ± 6 a	171 ± 6 b
Dekalb 580Bt	13 ± 5 a	0.8 ± 0.3 a	0.8 ± 0.3 a	0.8 ± 0.3 a	40 ± 23 a	188 ± 6 b
Dekalb 580	23 ± 10 a	0.9 ± 0.3 a	1.5 ± 0.5 a	0.9 ± 0.3 a	35 ± 17 a	173 ± 7 a
Dekalb 580+Pounce 1.5G	5 ± 5 a	0.4 ± 0.4 a	0.5 ± 0.5 a	0.5 ± 0.5 a	53 ± 9 a	185 ± 7 b
Golden Harvest 2390Bt	0 ± 0 a	0.0 ± 0.0 a	0.0 ± 0.0 a	0.0 ± 0.0 a	0 ± 0 a	165 ± 7 a
Golden Harvest 2390	23 ± 5 b	1.2 ± 0.2 b	2.1 ± 0.3 b	1.0 ± 0.0 b	35 ± 10 b	166 ± 10 a
Golden Harvest 2390+Pounce 1.5G	28 ± 6 b	1.2 ± 0.1 b	2.5±0.4 b	1.0 ± 0.0 b	30 ± 7 b	163 ± 9 a
Golden Harvest 2493Bt	3 ± 3 a	0.3 ± 0.3 a	0.1 ± 0.1 a	0.0 ± 0.0 a	0 ± 0 a	171 ± 11 a
Golden Harvest 2493	10 ± 4 a	0.8 ± 0.3 a	0.9 ± 0.5 a	0.5 ± 0.3 b	45 ± 3 b	173 ± 9 a
Golden Harvest 2493+Pounce 1.5G	5 ± 3 a	0.5 ± 0.3 a	1.2 ± 0.8 a	0.5 ± 0.3 b	50 ± 13 b	180 ± 9 b
Maximizer 21 (Bt)	35 ± 5 a	1.0 ± 0.0 a	2.0 ± 0.3 a	1.3 ± 0.2 a	80 ± 11 a	179 ± 6 b
Ciba 4394	25 ± 9 a	1.1 ± 0.1 a	2.7± 0.4 a	1.0 ± 0.0 a	38 ± 19 b	160 ± 7 a
Ciba 4394 + Pounce 1.5G	50 ± 16 a	1.0 ± 0.0 a	2.7 ± 0.3 a	0.8 ± 0.3 a	63 ± 15 a	165 ± 6 a
Northrup King 4640Bt	0 ± 0 a	0.0 ± 0.0 a	0.0 ± 0.0 a	0.0 ± 0.0 a	0 ± 0 a	172 ± 6 c
Northrup King 4640	25 ± 10 b	0.9 ± 0.3 b	1.3 ± 0.5 b	0.8 ± 0.3 b	55 ± 14 b	155 ± 5 a
Northrup King 4640+Pounce 1.5G	33 ± 6 b	1.0 ± 0.0 b	2.0 ± 0.4 b	1.0 ± 0.0 b	48 ± 15 b	164 ± 6 b
Pioneer 34R06 (Bt)	0 ± 0 a	0.0 ± 0.0 a	0.0 ± 0.0 a	0.0 ± 0.0 a	0 ± 0 a	199 ± 4 c
Pioneer 3489	20 ± 4 b	1.0 ± 0.0 b	2.3 ± 0.5 b	1.0 ± 0.0 b	45 ± 18 b	170 ± 5 a
Pioneer 3489 + Pounce 1.5G	23 ± 6 b	1.0 ± 0.0 b	3.1 ± 0.4 b	1.0 ± 0.0 b	78 ± 14 c	185 ± 7 b

Means (within a hybrid group) followed by the same letter are not significantly different (*P*>0.05, Fisher's protected LSD). Mike Catangui, SDSU

SOYBEAN BREEDING

Roy Scott

Plant Science 9716

We tested both group I and group II soybean breeding lines at the Southeast Research Farm in 1997. Group I tests were not harvested due to poor plot stands. A summary of group II breeding lines is presented in the Table to compare this site with other sites at which the lines were tested across the state.

There were several breeding lines that performed as good as the check to which they had similar maturity, but none were significantly better based on the overall mean. Location mean yields ranged from 36 to 62 bushels per acre, and were highest at the non-irrigated test at Dakota Lakes. Yield rankings were not consistent across locations. The highest ranking lines at each location, however, were high yielding in at least one other location.

Maturities indicated that the lines in this test included both group I and II maturities, which might explain the inconsistency in rankings. Some lines were better adapted at some locations than at others, and did better in those locations. Protein and oil concentration data were presented for two contrasting locations to show the relative differences which may be obtained at different locations. Differences were as large as 5% between the two locations for the same line. The test experienced severe water stress at the Brookings site in 1997 during flowering, pod set, and pod fill. This was the main reason for the significant drop in protein at this location. Oil concentration did not fluctuate as much as protein.

A few promising lines were identified for further testing in 1998 based on evaluation of the data presented here, and from previous testing in 1996. Comparisons were made between lines and checks of similar maturity. Several lines were tested with the same parentage, and only the best one, or two, that are good enough will be advanced from a particular cross. Of the lines presented here, only 1 to 3 will make it to the national uniform tests.

	YIELD		PROTEIN		OIL	OIL	YIELD AND RANKS AT INDIVIDUAL LOCATIONS								
NAME	MEAN	RANK	DI	BK	DI	BK	YBK	RNK	YBF	RNK	YDI	RNK	YDD	RNK	MAT
SD951043	55.17	1	40.4	39.3	21.1	21.0	39.9	5	56.1	3	54.3	19	69.5	3	134
IA2021	54.62	2	40.8	39.3	21.2	20.9	38.7	13	57.8	2	63.1	1	67.4	7	138
SD95610	53.56	3	40.6	38.3	20.6	20.8	35.8	25	58.5	1	58.5	7	66.4	10	136
SD951041	52.75	4	40.8	38.9	20.7	21.5	39.8	6	51.5	10	58.8	5	66.9	8	133
SD951499	52.69	5	42.8	40.5	20.4	20.2	42.4	2	51.9	9	49.7	36	63.8	13	134
SD951452	52.59	6	41.2	39.9	20.0	21.4	41.7	3	52.8	7	59.3	4	63.3	16	134
PARKER	52.15	7	41.3	41.8	20.7	19.7	34.2	31	50.2	14	58.5	6	72.0	2	135
SURGE	51.29	8	42.4	38.0	20.5	21.8	34.0	32	45.9	28	60.3	2	73.9	1	130
SD95118	51.26	9	40.3	38.1	20.9	21.3	36.2	23	49.4	15	49.2	38	68.2	5	134
SD95751	51.04	10	41.0	39.4	20.8	21.1	43.5	1	55.1	4	49.3	37	54.6	42	135
SD951478	50.53	11	42.4	39.2	20.0	21.6	39.1	12	52.5	8	54.2	20	60.0	31	136
SD951657	50.41	12	44.2	41.7	18.9	19.9	35.8	26	53.1	6	47.0	41	62.3	21	135
SD951575	50.16	13	42.1	40.8	20.5	20.4	39.5	9	45.6	31	57.0	10	65.4	12	135
SD95574	50.16	14	41.2	39.5	20.8	21.5	35.9	24	51.0	13	56.1	15	63.6	14	135
SD951050	50.03	15	41.1	39.7	20.7	20.7	39.5	10	47.7	19	59.8	3	62.8	19	134
SD951503	49.70	16	41.1	39.7	21.2	20.3	39.6	8	51.2	11	51.7	29	58.3	35	134
SD951031	49.38	17	40.5	38.9	20.7	21.4	34.5	29	45.8	30	56.9	11	67.8	6	135
STURDY	49.17	18	42.5	38.2	19.6	21.4	33.9	34	47.1	22	53.3	24	66.5	9	137
SD951063	49.01	19	40.5	39.4	21.2	20.4	39.2	11	46.5	24	54.9	17	61.3	24	133
SD95554	48.87	20	41.8	38.9	20.1	21.5	36.5	19	46.6	23	57.9	8	63.5	15	136
SD9565	48.83	21	42.2	40.9	19.6	20.4	33.7	35	54.1	5	54.1	22	58.7	34	139
SD951060	48.80	22	40.6	38.5	21.1	21.8	34.6	28	46.0	26	54.7	18	65.9	11	134
STRIDE	48.47	23	39.8	38.9	21.0	22.2	36.7	18	40.5	41	52.6	26	68.3	4	133
SD95179	48.36	24	41.9	39.1	20.5	20.9	33.4	37	51.1	12	52.5	27	60.6	28	135
SD951652	48.06	25	44.2	39.0	19.4	21.6	34.4	30	47.5	20	56.7	13	62.3	22	135
SD95222	48.01	26	41.8	38.8	20.3	21.6	39.7	7	43.4	34	48.4	40	61.0	25	136
SD951654	47.89	27	44.7	41.7	18.7	19.8	33.0	39	48.3	18	54.1	21	62.4	20	135
SD95550	47.56	28	41.9	39.5	20.3	20.8	38.3	14	41.4	39	51.4	32	62.9	18	136
SD951662	47.45	29	44.8	42.6	18.7	19.5	36.4	20	45.9	27	57.2	9	60.1	30	136
SD95520	47.19	30	41.5	37.5	20.0	21.3	32.7	41	45.9	29	56.5	14	63.0	17	135
SD951660	46.59	31	44.7	40.9	19.1	19.5	31.9	44	48.4	17	51.6	31	59.4	33	136
SD95517	46.46	32	43.2	40.3	19.8	20.7	33.2	38	45.6	32	43.3	44	60.6	29	135
SD951557	46.39	33	41.2	38.3	20.4	20.9	36.2	22	47.5	21	50.5	34	55.5	40	133
SD95134	46.34	34	40.1	38.3	20.9	21.2	32.5	42	48.9	16	49.1	39	57.6	38	133
SD9539	45.94	35	40.7	38.8	20.7	22.0	36.3	21	43.2	35	53.7	23	58.3	36	134
SD95580	45.69	36	42.8	40.9	20.0	20.6	33.6	36	46.4	25	56.8	12	57.0	39	136
SD951706	45.54	37	42.7	41.4	18.8	20.5	32.8	40	43.0	36	43.3	43	60.8	26	135
SD951066	45.11	38	43.4	39.0	19.2	20.9	34.9	27	38.8	42	53.0	25	61.6	23	134
SD951653	45.10	39	44.0	41.5	19.9	20.4	32.0	43	42.5	38	55.2	16	60.8	27	136

	YIELD		PROTEIN		OIL	OIL	YIELD AND RANKS AT INDIVIDUAL LOCATIONS								
NAME	MEAN	RANK	DI	BK	DI	BK	YBK	RNK	YBF	RNK	YDI	RNK	YDD	RNK	MAT
SD951502	44.86	40	41.7	41.0	20.4	20.1	38.2	15	41.0	40	51.7	30	55.4	41	134
SD95757	44.46	41	40.8	39.2	20.7	21.3	37.1	17	38.5	43	51.2	33	57.8	37	136
SD95596	43.21	42	40.7	38.2	20.8	21.6	37.5	16	44.1	33	49.9	35	48.0	45	133
SD951663	43.00	43	44.4	41.9	19.1	19.9	33.9	33	35.5	44	52.5	28	59.6	32	135
SD95133	41.84	44	40.9	38.8	20.0	21.4	29.7	45	42.9	37	43.8	42	52.9	43	135
SD95253	40.81	45	41.1	39.0	21.7	20.9	40.2	4	33.7	45	37.7	45	48.6	44	137
GRAND MEAN	48.37			37.6		21.8	36.3		47.1		53.1		61.7		
CV	13.02						9.5		13.6		13.1		9.0		
LSD	5.84						5.6		10.4		14.1		9.0		

DI and DD = Dakota Lakes irrigated and dry; BK = Brookings; BF = Beresford; MAT = Maturity in days.

OAT RESEARCH

Dale Reeves and Lon Hall

Plant Science 9717

Oat research at the Southeast Research Farm is used for variety release and oat foliar fungicide screening. The oat foliar fungicide research is a cooperative effort with Extension pathologist Marty Draper. There was no major problem here this year although the spring and early summer had little rain.

The most important characteristics for varietal release are yield, yield stability, and test weight; however, there may be several factors that will contribute to the increase of these characteristics. Genetics, lodging resistance, Barley Yellow Dwarf resistance, crown rust, and stem rust resistance all contribute to increased yield and test weight. Some other characteristics that are considered when releasing a variety are hull percent, high protein, high oil, low oil, plant height, maturity, hulled or hulless, and hull color.

The quality of the oat may determine the consumer. The millers want a high protein; whereas, the livestock producer wants a high oil, high protein, and tall variety. The race horse industry want a white hulled variety with very high test weight.

A total of 850 plots were grown on soybean ground at the southeast research farm, they included seven breeding nurseries and an oat foliar fungicide trial. The Uniform Early Nursery is made up of advanced early lines, usually 1 to 3 each from several states. These lines are also grown in these states, the data collected provides information needed for varietal release. The 28 entries averaged 121 bu/ac with an average test weight of 35.2 lbs/bu here this year. Our two entries yielded 132 and 134 bu/a and had a test weight of 38.3 lbs/bu. The Tri-State nursery is made up of 30 lines and 6 checks. The 30 lines consist of 10 advanced lines from Minnesota, North Dakota, and South Dakota. Our best line in this test this year yielded 125 bu/ac and had a test weight of 39.9 lbs/ac. The best lines will be entered in either the Uniform Early Nursery or the Uniform Midseason Nursery the following year.

Plant breeding is a long drawn out process. It takes, on average, approximately 10 years from the initial cross to varietal release if every thing goes well. There are approximately 40,000 non segregating lines evaluated for each variety released.

Our best test at this farm was our advanced test of early maturity selections. This test had 20 entries and had an average yield of 125 bu/ac. The best performing selection yielded 139 bu/ac with a test weight of 38 lbs/bu.

The best yielding entry of ours at this location this year produced 146 bu/ac and had a test weight of 36 lb/bu. This was the first year for yield testing this line, so we don’t know if this reflects the real yield potential or if 1997 was just a good year for it.

ALFALFA CULTIVAR YIELD TEST

K. D. Kephart, R. Bortnem, S. Selman
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PLANT SCIENCE 9718

The variety trial planted at the Southeast Research Farm in 1994 was lost because of winterkill and there are no 1997 yield data to report for that study. Remarkably, the mortality of every variety was essentially 100%. This stand was encrusted in ice for essentially the entire winter of 1996-97. Alfalfa stands throughout southeastern South Dakota suffered similar losses.

A new variety trial was established at the Southeast Research Farm in April 1997. This stand was successfully established and collection of yield data will commence in 1998. Below-normal rainfall not only resulted in reduced alfalfa seeding growth, but also promoted record infestations of potato leafhoppers. High population densities of potato leafhoppers provided a nice opportunity to evaluate varieties for hopper burn; results are presented in this report. A new variety with resistance to potato leafhopper (Pioneer Brand 5347LH) had the best rating of the 28 marketed varieties.

Table 1. Potato leafhopper ratings of 28 alfalfa cultivars planted April 25, 1997, at the Southeastern Experiment Station Beresford, SD. Plots were rated on July 17, 1997 using a scale of 1 to 5[a].

Entry	17 July PLH Rating
Pioneer Brand 5347LH	2.6
ICI Brand 620	2.9
Innovator +Z	2.9
DK 127	2.9
Complete	3.0
DK 142	3.2
WL 324	3.3
Asset	3.3
Ciba 2888	3.3
Vernal 2	3.4
Amerigraze 401 +Z	3.0
DK 140	3.0
Avalanche +Z	3.0
Spur	3.0
Excalibur II	3.1
Ciba 2444	3.1
Rainier	3.1

Table 1. Potato leafhopper ratings continued. . .

Entry	17 July PLH Rating
Depend +Ev	3.2
Pioneer Brand 5454	3.2
Spartan	3.4
Vernal 3	3.4
Pioneer Brand 5312	3.5
TMF Multiplier II	3.5
Vernal I	3.5
ICI 631	3.5
Rhino	3.7
Ace	4.0
WL 325 HQ	4.2
Average	3.3
CV %	16.7
LSD (P=0.05)	0.62

[a]Potato Leafhopper Resistance Ratings:

North American Alfalfa Improvement Conference

1 No apparent injury
2 Very minor stunting and yellowing
3 Moderate stunting, yellowing is evident on 20-40% of leaves
4 Significant injury, plant showing significant stunting with yellowing on 40-60% of leaves.
5 Severe injury plant with severe stunting, yellowing or reddening evident on 60-100% of leaves.

POTATO LEAFHOPPER RESISTANT TRIAL

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S. Selman and V. Owens

Plant Science 9719

Several seed companies are marketing alfalfa varieties with resistance to potato leafhoppers. This experiment was started to determine the field performance of these new varieties.

Potato leafhopper infestations were particularly high during 1997, providing excellent conditions for evaluating these new alfalfa varieties. The best rating occurred for an experimental variety developed at SDSU. Vernal was entered as a check had expressed the most damage from potato leafhopper feeding.

Potato leafhopper ratings of 8 alfalfa cultivators planted April 25, 1997, at the Southeast Experiment Station, Beresford, SD. Plots were rated on July 17, 1997 using a scale of 1 to 5[a.]

Entry	17 July 1997
	-PLH Rating-
SD 201	2.0
DK 121 HG	2.6
Arrest	2.8
Clean Sweep	3.1
5347LH	3.1
Interceptor	3.6
Runner II	3.9
Vernal	4.3
AVERAGE	3.2
CV (%)	15.4
LSD (0.05)	0.7

[a]Potato Leafhopper Resistance Ratings: North American Alfalfa Improvement Conference

1 No apparent injury
2 Very minor stunting and yellowing
3 Moderate stunting, yellowing is evident on 20-40% of leaves
4 Significant injury, plant showing significant stunting with yellowing on 40-60% of leaves.
5 Severe injury plant with severe stunting, yellowing or reddening evident on 60-100% of leaves.

COMPARISON OF GRANULAR AND LIQUID SOYBEAN INOCULANTS TO ZERO CHECK ON A VIRGIN SOYBEAN FIELD

R.G.Hall and K.K. Kirby

Plant Science 9720

Introduction

A common question often asked by soybean growers is whether they need to inoculate their soybeans at planting. The general recommendations are: (1) to always inoculate when seeding soybeans to soils having no prior history of soybean production and (2) that inoculating at seeding is cheap insurance that an adequate number of *rhizobia* are present to benefit the crop. In addition, growers often ask whether there are yield differences among some of various inoculant application methods which are available today.

The objective of this study was to evaluate whether inoculation was beneficial and whether soybean yields differed between granular soil and liquid seed treatment methods applied to a virgin soybean field.

Methods

This experiment was established on the Robert Clark Farm east of Armour, SD. The inoculant experiment was established in a virgin soybean field using a maturity group-I soybean variety no-till seeded at 160,000 viable seeds per acre. Prior cropping history included an extended period of alfalfa followed by no-till corn. The experimental design consisted of three treatments in a randomized complete block design. The treatments were as follows: (1) zero check, no inoculant applied, (2) granular inoculant, applied down the insecticide tube into the seed furrow before closure, and (3) liquid inoculant, applied to the seed minutes prior to seeding. The granular inoculant was Granular Soil Implant+ Nitragin Brand Inoculant for Soybeans, manufactured by Lipha Tech, 3101 West Custer Ave., Milwaukee, WI 53209. The granular was applied at a 6.5 lb/ac rate in 30" rows at 5 mph. The product cost per acre seeded was $1.38 per pound or $8.94 per acre ($1.38 x 6.5 lb). This product contains a minimum of 100 million viable cells of *Bradyrhzobium japonicum* per gram or roughly 2.96 x 10^{11} cells per acre. This product was stored in a cold room prior to planting. The liquid inoculant was Liqui-Prep XT, manufactured by Urban Laboratories, P.O. Box 1393, St. Joseph, MO 64502. The cost per acre seeded was $0.95 to $1.04 per bushel of seed or roughly $0.95 to $1.04 per acre. The liquid was applied to the seed at a rate of 2 fl oz per bushel of seed immediately prior to seeding. This production contains a minimum of 500 million viable cells of *Bradyrhozobium japonicum* per gram or roughly 2.96 x 10^{10} cells per acre. This product was refrigerated prior to use.

The concentration per acre for the granular product was ten time greater (10^{11} vs. 10^{10}) than for the liquid product. Plots were seeded in zero check, granular, liquid treatment sequence in order to prevent cross contamination of the seed cones on the planter. Plots consisted of four 30"-rows 20' long. The center two rows were harvested for yield. Weed control was excellent using recommended soybean herbicides.

Results and Discussion

The results are indicated in the table below:

A comparison of zero check vs. liquid and granular soybean inoculant applications in a virgin soybean field.

Treatment	Yield (bu/ac)
Zero check (no inoculant)	48
Liquid (seed treatment)	55
Granular (soil treatment)	60

Treatment Comparison	Yield Difference	Prob>F
Inoculants vs. Check (Liquid & Granular)	57.5-48 = 9.5	0.0152
Granular vs. Liquid	50-55 = 5	0.1120

The results indicate the liquid seed and granular soil treatments numerically out yielded the zero check by 7 and 12 bushels per acre, respectively. In turn the liquid out yielded the granular treatment by 5 bushels per acre. Additional statistical comparisons were done to determine (1) whether the inoculant treatments differed from the zero check and (2) whether the two inoculant treatments differed.

In the first comparison, the average yield difference of the inoculant treatments ((55 + 60)/2 = 57.5) minus the zero check equaled 9.5 bushel per acre (57.5-48 = 9.5). Associated with this 9.5 bushel yield difference was a probability of a greater F-value of 0.0152. This indicates that we would be wrong only 1.5% of the time when we make this statement. In otherwords, we have a high degree of confidence there is a real and beneficial inoculant effect on soybean yields compared to no inoculant.

In the second comparison, the difference between the granular and liquid treatments was 5 bushels per acre (60 - 5 = 5). Associated with this 5 bushel yield treatment difference was a probability of a greater F-value of 0.1120. This indicates that we would be wrong 11.2% of the time when making this statement. Therefore, we would be less confident there was a real treatment yield difference when comparing the two inoculants. Growers would likely opt to use the liquid compared to the granular based on economics alone. The granular is about nine times more expensive than the liquid. Depending on the seeding year and soybean cropping history some growers may or may not opt to use the granular and its more convenient but expensive method of application.

Summary

The use of a soybean inoculant on a virgin soybean field was highly beneficial. In contrast, the method of inoculant application was not as beneficial. Moreover it was the use of an inoculant not the method of inoculation that was of more benefit on virgin soils.

CROP PERFORMANCE TRIALS, CORN, SOYBEAN, AND OAT

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Plant Science 9721

Corn:

Early maturity trial results for 1997 and 1996-97 are shown in Table 1. In the early trial there are four hybrids in the top-yield group for 1997. The top-yield group and the minimum top-yield value for each one-, two-, and three-year average was determined by using the calculated Least Significant Difference (LSD) value associated with each test. Each top-yield group was identified by taking the highest numerical yield and subtracting the LSD value from it. In the early trial the test LSD value of 21 bushels per acre was subtracted from the highest yield of 209 bushels per acre for Pioneer 34R06 resulting in a value of 188 bushels per acre. All hybrids yielding 189 bushel per acre or higher are in the top-yield group because these hybrids yield within 21 bushels per acre or one LSD value of the highest numerical yield of 209 bushels per acre. Entries had to yield 189 bushels per acre or higher to be in the top-yield group for 1997. In addition, the yield difference between hybrids had to differ by 21 bushel per acre to be significantly different. Likewise, entries had to yield 181 bushels per acre or higher to be in the top-yield group for 1996-97 in the early maturity test. In addition, for the two year period hybrids had to differ by 20 bushels per acre to be significantly different in yield.

Late maturity trial results for 1997 and 1996-97 are shown in Table 2. In the late trial are 13 hybrids in the top-yield group for 1997. Entries had to yield 171 bushels per acre or higher to be in the top-yield group for 1997. In addition, hybrids had to differ by 17 bushels per acre for there to be a significant yield difference. In contrast, there was no significant yield difference among the hybrids tested for two-years.

During crop establishment both the seedbed and field emergence was good. After emergence both trials were thinned to a population of 26,136 plants per acre. The harvest population was consistent with no significant differences among trial entries. In 1997 some corn trials at other locations were somewhat affected by “greensnap”. This growth condition is influenced by environment and genetics and allows some hybrid stalks to be weak and break at nodes during rapid growth. Greensnap generally ceases shortly after tasseling. Producers are encouraged to discuss greensnap ratings with corn seed companies when making seed purchases. The coefficients of variation ranged from 6 to 8% indicating the variability associated with both trials was not significant during testing.

Soybean:

Group - I trial results for 1997, 1996-97 and 1995-97 are shown in Table 3. In this test nine varieties in sequence from Mustang/X-200 down to Prairie Brand/PB-197 were in the top-yield group for 1997 (see corn discussion for explanation of top-yield group). Entries yielding 65 bushels per acre or higher were in the top-yielding group for 1997. Also, the yield difference between any two varieties had to be 5 bushel per acre or higher for there to be a significant yield difference between varieties. Likewise, entries had to yield 68 and 60 bushels per acre or higher to be in the top-yielding group for 1996-97 and 1995-97, respectively. In addition, for the two-year and three-year periods varieties had to differ by 5 and 8 bushels per acre, respectively, to be significantly different in yield.

Group - II trial results for 1997, 1996-97 and 1995-97 are shown in Table 4. In this test the 50 entries in sequence from Terra/E267 down to Stine/2580 were in the in the top-yielding group for 1997. Entries had to yield 60 bushels per acre or higher to be in the top-yielding group for 1997. Also, the yield difference between any two varieties had to be 8 bushels per acre for there to be a significant yield difference between varieties. Likewise, entries yielding 66 and 60 bushels per acre or higher are in the top-yield group for 1996-97 and 1995-97, respectively. In addition, for the two-year and three-year periods varieties had to differ by 6 and 5 bushels per acre, respectfully, to be significantly different. The coefficients of variation ranged from 5 to 7% indicating the variability associated with both trials for 1997, 1996-97 and 1995-97 yields was not significant during crop testing.

Oat:

Test results for 1997 are indicated in Table 5. Yields averaged 115 bushels per acre which are 4 bushels per acre less than was reported last year. In 1997, Don, Jerry, Jim, Valley, and the experimental SD92057 were in the top-yield group (see corn discussion for explanation of top-yield group). In 1995-97 the varieties, Don, Jerry, Jim, Newdak, Settler, and Valley were in the top-yield group. Also, the yield difference between varieties had to be 9 and 15 bushels per acre in 1997 and 1995-97, respectively, to be significant. The variety Hytest was the best bushel weight variety followed by the variety Jerry. Generally, the South Dakota experimentals exhibited above average bushel weights. The coefficients of variation ranged from 5 to 6% indicating the variability associated with the 1997 and 1995-97 yields was not significant in evaluating test performance.

TABLE 1. 1997 CORN HYBRID PERFORMANCE TRIAL RESULTS - BERESFORD SE RESEARCH FARM, EARLY MATURITY - 110 DAYS OR LESS, PLOTS WERE THINNED TO A TARGET POPULATION OF 26,136 PLANTS/ACRE.

	YIELDS AT 15.5% MOIST.		1997			
BRAND & HYBRID	1997 (Bu/ac)	2-YR (Bu/ac)	GRAIN MOIST. (%)	BU. WT. (lb)	HARVEST STAND (No./ac)	STALKS LODGED (%)
PIONEER 34R06	209	.	19	58	26136	1
PIONEER 35N05	200	.	18	60	26136	1
KRUGER K9513	197	200	17	58	26136	3
HOEGEMEYER 2612	189	.	16	56	26136	7
ENTRIES ABOVE THIS LINE ARE IN THE TOP-YIELD* GROUP FOR 1997						
LG SEEDS LG2583	188	.	17	58	26136	3
ASGROW RX730	187	.	19	57	26136	3
SEED MART 1112	183	198	17	58	26136	4
PIONEER 35M02	181	.	19	60	26136	0
GARST N3526	180	191	17	57	26136	4
KRUGER K9812	179	.	19	59	26136	6
WILSON 1390	179	.	17	57	26136	8
KRUGER K9813	179	.	18	55	26136	4
PIONEER 34K77	178	.	18	60	26136	2
KAYSTAR KX-777	178	185	18	57	26136	2
DEKALB DK566	178	186	16	58	26136	4
PIONEER 35R57	177	.	16	59	26136	1
M-W GENETICS G 7610	177	183	17	57	26136	2
DEKALB DK586	177	194	17	57	26136	4
DEKALB DK595	177	.	17	57	26136	3
GARST N5579	177	.	16	56	26136	5
STAUFFER 2436	175	190	18	57	26136	4
ASGROW RX601	175	189	17	58	26136	3
NC+ 3877	175	.	17	58	26136	2
MYCOGEN 2674	175	180	16	60	26136	2
KRUGER K9709	174	.	17	56	26136	3
NC+ 4880	174	.	19	56	26136	2
PIONEER 3559	173	174	17	61	26136	2
KRUGER K9614A	172	190	19	57	26136	2
FONTANELLE 4567	172	.	17	59	26136	3
KRUGER K9906	172	.	17	57	26136	1
WILSON 1438	172	.	17	59	26136	1
GARST 8605	171	.	16	58	26136	3
PIONEER 3489	171	184	17	58	26136	3
SEED MART 2108	171	.	16	56	26136	3

TABLE 1 (CONTINUED). BERESFORD, EARLY MATURITY - 110 DAYS OR LESS.

BRAND & HYBRID	YIELDS AT 15.5% MOIST. 1997 (Bu/ac)	2-YR	1997 GRAIN MOIST. (%)	BU. WT. (lb)	HARVEST STAND (No./ac)	STALKS LODGED (%)
TERRA TR 1066	170	182	18	55	26136	3
MYCOGEN 2616IMI	170	178	16	58	26136	2
GOLDEN HARVEST H-2478	170	168	17	57	26136	6
KRUGER K9910	169	.	21	58	26136	1
KRUGER K9811+	169	.	18	56	26136	2
KRUGER K9410	169	.	17	57	26136	3
PIONEER 3568	168	182	16	60	26136	2
WILSON 1435	167	.	17	55	26136	2
TERRA TR 1087	167	187	18	58	26136	1
CURRY 2163	165	.	17	56	26136	4
KRUGER K9713	165	.	17	57	26136	5
LG SEEDS LG2539	165	.	17	55	26136	7
CURRY 2161	163	.	17	58	26136	4
EPLEY EX2422	163	177	17	56	26136	7
SANDS SOI 9087	163	.	17	59	26136	0
DEKALB DK580	162	183	18	58	26136	3
JACOBSEN JS4635	162	.	18	55	26136	2
DAIRYLAND ST-1406	161	179	16	56	26136	7
EPLEY EX1500	161	164	16	59	26136	2
PIONEER 34G81	161	.	17	59	26136	2
FONTANELLE 4997	161	.	18	62	26136	1
WILSON 1394	160	.	16	57	26136	5
CARGILL 5677	160	181	18	58	26136	3
HOEGEMEYER 2591	160	168	15	58	26136	0
HOEGEMEYER 2614	160	172	16	60	26136	1
SANDS SOI 9067	160	.	17	60	26136	3
GOLDEN HARVEST H-2468	159	169	17	60	26136	1
KRUGER K9806	158	.	16	57	26136	2
CARGILL 6303	158	178	17	58	26136	2
FONTANELLE 4966	156	.	16	55	26136	5
KRUGER K9712+	155	.	17	56	26136	3
HOEGEMEYER 2567	154	.	15	58	26136	3
TERRA TR 1106	154	174	21	55	26136	2
CURRY 2151	154	.	16	57	26136	1
DOMESTIC DX720	152	177	16	57	26136	3
ASGROW RX670	151	.	18	55	26136	1
KAYSTAR KX-790	150	.	17	56	26136	5
CURRY 2155	150	.	17	59	26136	2

TABLE 1 (CONTINUED). BERESFORD, EARLY MATURITY - 110 DAYS OR LESS.

BRAND & HYBRID	YIELDS AT 15.5% MOIST. 1997 (Bu/ac)	YIELDS AT 15.5% MOIST. 2-YR (Bu/ac)	1997 GRAIN MOIST. (%)	1997 BU. WT. (lb)	1997 HARVEST STAND (No./ac)	1997 STALKS LODGED (%)
FONTANELLE 4426	146	.	15	58	26136	3
DOMESTIC DX602	146	154	16	57	26136	2
MYCOGEN 2677	145	.	18	57	26136	2
SANDS SOI 9045	145	169	16	57	26136	2
ENESTVEDT'S E-580	140	.	16	58	26136	1
SANDS SOI 9074	139	.	17	57	26136	1
EPLEY EX2417	136	149	16	58	26136	3
AVERAGE:	167	179	17	58	26136	3
LSD (5%):	21	20	1	1	NS**	4
MIN. TOP YIELD VALUE*:	189	181				
COEF. OF VARIATION#:	8	7				

*TOP YIELD - YIELDS WITHIN ONE LSD VALUE OF HIGHEST NUMERICAL YIELD.
**DIFFERENCES WITHIN A COLUMN ARE NOT SIGNIFICANT (NS).
#A MEASURE OF VARIABILITY; A VALUE OF 15% OR LESS IS DESIRABLE.

TABLE 2. 1997 CORN HYBRID PERFORMANCE TRIAL RESULTS - BERESFORD SE RESEARCH FARM, LATE MATURITY - 111 DAYS OR MORE, PLOTS WERE THINNED TO A TARGET POPULATION OF 26,136 PLANTS/ACRE.

BRAND & HYBRID	YIELDS AT 15.5% MOIST. 1997 (Bu/ac)	2-YR (Bu/ac)	1997 GRAIN MOIST. (%)	BU. WT. (lb)	HARVEST STAND (No./ac)	STALKS LODGED (%)
KAYSTAR KX-808	187	.	18	55	26136	0
GARST N5440	184	.	19	58	26136	1
GARST 8464	180	.	20	56	26136	2
MYCOGEN 2725	179	188	19	58	26136	1
WILSON 1664	178	.	18	57	26136	0
MYCOGEN 7250	178	196	19	57	26136	1
TERRA TR 1136	176	179	20	55	26136	0
CARGILL 7770	176	185	22	57	26136	1
STAUFFER 2207	174	191	20	57	26136	1
M-W GENETICS G 7636	174	185	16	58	26136	0
M-W GENETICS G 7711	173	189	19	57	26136	0
CARGILL 6888	172	188	19	56	26136	2
EPLEY EX3608	172	192	17	58	26136	0
ENTRIES ABOVE THIS LINE ARE IN THE TOP-YIELD* GROUP FOR 1997						
SANDS SOI 9115	168	160	17	57	26136	1
MYCOGEN 7059	167	.	20	57	26136	0
SANDS SOI 9128	167	.	18	56	26136	1
EPLEY EX3242	163	187	18	55	26136	2
SANDS SOI 9137	161	.	17	57	26136	0
CARGILL 6997	160	171	19	57	26136	0
SANDS SOI 9126	159	186	20	57	26136	0
LG SEEDS LG2574	155	.	17	56	26136	2
GOLDEN HARVEST H-2547	154	181	20	57	26136	1
TERRA E1128	153	.	20	58	26136	2
AVERAGE:	170	184	19	57	26136	1
LSD (5%):	17	NS**	1	1	NS**	1
MIN. TOP YIELD VALUE*:	171					
COEF. OF VARIATION#:	6	6				

*TOP YIELD - YIELDS WITHIN ONE LSD VALUE OF HIGHEST NUMERICAL YIELD.
**DIFFERENCES WITHIN A COLUMN ARE NOT SIGNIFICANT (NS).
#A MEASURE OF VARIABILITY; A VALUE OF 15% OR LESS IS DESIRABLE.

TABLE 3. MATURITY GROUP-I TRIAL RESULTS - BERESFORD, SOUTH DAKOTA.
S.E. RESEARCH FARM, SEEDED MAY 10, 1997.

--- BRAND / ENTRY ---	--- YIELD --- '97	2YR	3YR	-- 1996 -- PROT.	OIL	--- 1997 --- HT.	$$ LDG.	## REL. MAT.
	--- bu/ac ---			-- % --		in.		
MUSTANG/X-200	69	.	.	.	.	30	1	1.7
LATHAM/392	69	72	.	37.0	18.0	31	1	1.7
KRUGER/K2021	69	.	.	.	.	28	1	1.7
STINE/1970	67	70	66	38.0	17.7	30	1	1.7
KAUP/KS1977	67	72	65	36.4	18.6	29	1	1.7
KRUGER/K2021+	67	.	.	.	.	31	1	1.8
GOLDEN HARVEST/H-1194	66	.	.	.	.	29	1	1.8
STINE/1690	65	72	67	36.4	19.2	28	1	1.6
PRAIRIE BRAND/PB-197	65	71	66	38.0	17.7	27	1	1.7
**** ENTRIES ABOVE THIS LINE ARE IN THE TOP-YIELD GROUP FOR 1997 ****								
DYNA-GRO/3195A	64	.	.	.	.	32	1	1.7
TERRA/TS194	62	69	63	39.4	17.9	28	1	1.5
MUSTANG/M-1192	61	68	62	35.9	19.0	27	1	1.7
PRAIRIE BRAND/PB-194	61	.	.	.	.	26	1	1.6
MUSTANG/M-195STS	61	.	.	.	.	30	1	1.7
ASGROW/A1900	60	.	.	.	.	28	1	1.6
DEKALB/CX205	60	.	.	.	.	34	1	1.7
M-W GENETICS/G1912	60	65	.	35.8	18.3	31	1	1.6
COYOTE/9519	60	66	.	37.8	18.3	30	1	1.6
LATHAM/250	59	66	.	38.9	17.9	27	1	1.6
LATHAM/410	58	63	.	36.7	18.4	25	1	1.7
M-W GENETICS/G1930	57	.	.	.	.	27	1	1.7
TERRA/TS174	57	64	59	37.8	18.6	26	1	1.6
AGRIPRO/AP1995	56	.	.	.	.	30	1	1.6
PUBLIC/STURDY,II-CK*	56	63	60	38.5	18.2	31	1	2.2
PUBLIC/IA1006	56	62	.	37.2	18.8	31	1	1.6
JACOBSEN/J659	56	.	.	.	.	26	1	1.4
PUBLIC/HARDIN	55	57	55	37.7	18.3	29	2	1.6
TOP FARM/TFE188	55	.	.	.	.	31	1	1.7
PRAIRIE BRAND/PB-192	54	63	.	35.5	18.5	27	1	1.6
PUBLIC/GRANITE	53	59	56	38.5	18.1	29	1	1.6
TOP FARM/TF6175	52	59	.	37.6	17.8	24	1	1.4
LATHAM/EX-330	52	.	.	.	.	30	1	1.8
PUBLIC/PARKER,I-CK*	51	58	57	36.2	19.3	29	1	1.5
PUBLIC/BELL,SCN	50	57	54	39.7	18.3	28	1	1.7

TABLE 3. MATURITY GROUP-I TRIAL RESULTS - BERESFORD - (CONTINUED).

--- BRAND / ENTRY ---	--- YIELD --- '97	2YR	3YR	-- 1996 -- PROT.	OIL	--- 1997 --- HT.	$$ LDG.	## REL. MAT.
	--- bu/ac ---			-- %	--	in.		
TERRA/E147	47	.	.	.	.	27	1	1.3
PUBLIC/FREEBORN,SCN	46	53	.	39.1	18.4	29	1	1.4
PUBLIC/FAIRBAULT,SCN	45	49	.	37.3	18.2	24	1	1.5
PUBLIC/MN 1301	44	52	.	38.4	18.4	27	1	1.3
PUBLIC/STRIDE	44	.	.	.	.	25	1	1.2
PUBLIC/DAWSON,0-CK*	34	42	44	36.7	18.7	24	1	0.5
TEST AVERAGE:	56	62	59	37.5	18.4	29	1	
LSD(5%) VALUES:	5	5	8					
MIN.TOP-YIELD VALUE ($):	65	68	60					
COEF. OF VARIATION (#):	5	5	6					

* CK = MATURITY CHECK. $ MINIMUM TOP-YIELD VALUE - BASED ON ONE LSD.
# CV - A MEASURE OF VARIABILITY, 15% OR LESS IS DESIRABLE.
$$ 1= EXCELLENT, 5= POOR.
A SCALE DIFFERENCE OF 0.1 IS EQUAL TO 1.2 DAYS IN MATURITY.

TABLE 4. MATURITY GROUP-II TRIAL RESULTS - BERESFORD, SOUTH DAKOTA.
S.E. RESEARCH FARM, SEEDED MAY 10, 1997.

	--- YIELD ---			-- 1996 --		--- 1997 ---		
--- BRAND / ENTRY ---	'97	2YR	3YR	PROT.	OIL	HT.	$$ LDG.	## REL. MAT.
	--- bu/ac ---			-- % --		in.		
STINE/2180	67	.	.	.	.	28	1	2.6
PROFISEED/PS2898	67	.	.	.	.	29	1	2.9
GOLDEN HARVEST/X282	66	.	.	.	.	28	1	2.9
JACOBSEN/J865	66	69	.	38.0	17.4	28	1	2.6
KRUGER/K2725	66	.	.	.	.	29	1	2.7
KRUGER/K2818	65	.	.	.	.	28	1	2.8
SANDS/EXP C301	65	.	.	.	.	30	1	2.7
PRAIRIE BRAND/PB-218	65	.	.	.	.	31	1	2.5
KRUGER/K2625+	65	.	.	.	.	28	1	2.7
MUSTANG/M-2200	65	70	64	37.3	18.0	31	1	2.6
HOEGEMEYER/202	65	71	.	38.0	17.7	30	1	2.6
LATHAM/680	65	68	.	37.2	18.1	29	1	2.8
LATHAM/480	65	70	63	36.8	18.8	27	1	2.4
PRAIRIE BRAND/PB-276	64	70	.	36.6	18.3	29	1	2.8
PRAIRIE BRAND/PB-246	64	66	.	37.0	18.4	26	1	2.7
KRUGER/K2727+	64	69	.	35.5	19.9	28	1	2.9
PRAIRIE BRAND/PB-202	63	68	.	36.8	18.2	30	1	2.7
ASGROW/A2553	63	.	.	.	.	30	1	2.7
GREAT LAKES/GL2818	63	.	.	.	.	26	1	2.9
PRAIRIE BRAND/PB-247	63	70	61	37.8	17.6	30	1	2.7
MUSTANG/M-2215	62	68	61	36.5	19.2	26	1	2.3
GOLDEN HARVEST/X214	62	.	.	.	.	28	1	2.5
M-W GENETICS/G2519	62	.	.	.	.	29	1	2.5
KRUGER/K2535	62	.	.	.	.	28	1	2.6
JACOBSEN/J971	62	.	.	.	.	33	1	2.9
SANDS/EXP 9631A	62	.	.	.	.	27	1	2.9
KRUGER/K2343+	61	64	.	37.4	17.7	28	1	2.6
PRAIRIE BRAND/PB-256	61	.	.	.	.	28	1	2.7
COYOTE/9425	61	63	.	37.2	18.3	27	1	2.6
RENZE/R2798	61	.	.	.	.	27	1	2.8
TERRA/E267	61	.	.	.	.	28	1	2.8
AGRIPRO/AP2595	61	.	.	.	.	31	1	2.8
KRUGER/K2625	61	67	62	37.7	17.9	26	1	2.7
KRUGER/K3040	61	.	.	.	.	30	1	2.9
DYNA-GRO/3256	61	.	.	.	.	26	1	2.6

TABLE 4. MATURITY GROUP-II TRIAL RESULTS - BERESFORD - (CONTINUED).

--- BRAND / ENTRY ---	--- YIELD --- '97	2YR	3YR	-- 1996 -- PROT.	OIL	--- 1997 --- HT.	$$ LDG.	## REL. MAT.
	--- bu/ac	---		- %	--	in.		
KRUGER/K2525	61	68	61	37.3	18.2	29	1	2.7
SANDS/SOI 264	61	67	60	37.6	17.8	31	1	2.7
MUSTANG/M-2220	61	68	.	36.2	18.8	25	1	2.7
PRAIRIE BRAND/PB-2120	60	66	59	38.3	17.8	27	1	2.7
KRUGER/K2162	60	69	63	35.4	19.6	26	1	2.3
PIONEER/92B61	60	.	.	.	.	28	1	2.7
RENZE/R2597	60	64	58	38.2	17.2	26	1	2.6
PRAIRIE BRAND/PB-235X	60	.	.	.	.	27	1	2.6
KAUP/KS2685	60	.	.	.	.	27	1	2.9
LATHAM/EX-640	60	.	.	.	.	27	1	2.7
JACOBSEN/J777	60	.	.	.	.	29	1	2.9
COYOTE/9527	60	.	.	.	.	30	1	2.9
PRAIRIE BRAND/PB-271X	60	.	.	.	.	34	1	2.8
AGRIPRO/AP2220	60	64	.	38.4	18.3	27	1	2.5
STINE/2580	60	.	.	.	.	28	1	2.7
**** ENTRIES ABOVE THIS LINE ARE IN THE TOP-YIELD GROUP FOR 1997 ****								
TERRA/E277	59	.	.	.	.	27	1	2.9
KRUGER/K2121+	59	66	.	35.6	18.3	29	1	2.4
KRUGER/K2552	59	.	.	.	.	29	1	2.7
PIONEER/9273	59	.	.	.	.	29	1	2.7
KAUP/KS2474	59	65	60	38.1	17.4	27	1	2.7
PIONEER/92B52	59	.	.	.	.	29	1	2.6
PROFISEED/PS2000	59	68	.	38.4	17.6	29	1	2.5
KRUGER/K2162+	59	68	62	36.0	19.4	27	1	2.6
STINE/2488	59	.	.	.	.	26	1	2.6
HOEGEMEYER/253	59	66	.	38.1	17.6	28	1	2.7
LATHAM/720	59	65	57	36.4	18.3	29	1	2.9
STINE/2480	59	.	.	.	.	27	1	2.7
MUSTANG/M-2262	59	65	59	35.7	18.6	29	1	2.7
PIONEER/9233	59	63	.	37.2	18.0	29	1	2.6
DYNA-GRO/3258	59	.	.	.	.	27	1	2.7
LATHAM/662	59	.	.	.	.	26	1	2.6
DEKALB/CX229	59	66	.	36.8	18.5	27	1	2.6
KRUGER/K2535+	58	.	.	.	.	29	1	2.6
HY-VIGOR/2375	58	.	.	.	.	29	1	2.7
MUSTANG/E-270	58	.	.	.	.	29	1	2.8

TABLE 4. MATURITY GROUP-II TRIAL RESULTS - BERESFORD - (CONTINUED).

	--- YIELD ---			-- 1996 --		--- 1997 ---		
--- BRAND / ENTRY ---	'97	2YR	3YR	PROT.	OIL	HT.	$$ LDG.	## REL. MAT.
	--- bu/ac ---			-- % --		in.		
PROFISEED/PS299	58	.	.	.	.	32	1	2.7
COYOTE/9525	58	67	.	34.8	19.2	34	1	2.8
M-W GENETICS/G2440	58	66	59	37.1	18.7	27	1	2.7
JACOBSEN/J774	58	.	.	.	.	29	1	2.6
LATHAM/660	58	64	60	36.6	18.8	25	1	2.7
HY-VIGOR/2400	58	65	56	36.1	19.2	35	1	2.9
COYOTE/9123	58	63	.	36.0	19.1	31	1	2.5
LATHAM/621	58	.	.	.	.	26	1	2.6
FONTANELLE/2232	58	65	.	35.4	19.5	32	1	2.6
TERRA/TS253	57	65	59	36.3	18.9	26	1	2.7
MYCOGEN/5205	57	64	.	38.2	18.6	28	1	2.3
PRAIRIE BRAND/PB-214	57	.	.	.	.	28	1	2.3
HOEGEMEYER/232	57	62	58	36.9	19.0	31	1	2.4
DEKALB/CX267	57	63	56	36.9	17.9	35	1	2.6
JACOBSEN/J876	57	.	.	.	.	27	1	2.8
PIONEER/9245	57	.	.	.	.	27	1	2.7
SANDS/SOI 217	57	.	.	.	.	35	1	2.7
MYCOGEN/5270	57	.	.	.	.	34	1	2.7
RENZE/R2297	57	65	.	38.3	17.6	28	1	2.6
KAUP/KS2275	57	65	.	37.0	18.3	28	1	2.4
MYCOGEN/251	57	65	60	38.0	18.2	27	1	2.7
TERRA/TS285	56	64	56	36.9	18.6	26	1	2.9
HOEGEMEYER/225	56	64	57	37.5	17.9	26	1	2.7
GREAT LAKES/GL2415	56	65	59	36.5	18.8	27	1	2.7
RENZE/R2698	56	.	.	.	.	27	1	2.9
ASGROW/A2247	56	.	.	.	.	28	1	2.4
SANDS/SOI 276	56	65	.	38.7	17.0	26	1	2.7
KRUGER/K2711	56	.	.	.	.	28	1	2.9
GOLDEN HARVEST/H-1269	56	63	58	36.3	18.4	30	1	2.8
TOP FARM/TF6227	55	.	.	.	.	27	1	2.6
TERRA/TS200	55	63	57	36.7	18.4	27	1	2.6
PRAIRIE BRAND/PB-2720	55	.	.	.	.	27	1	2.9
PUBLIC/IA2021	55	61	56	36.6	19.4	25	1	2.6
LATHAM/EX-420	55	.	.	.	.	31	1	2.3
ASGROW/A2833	54	.	.	.	.	27	1	2.7

TABLE 4. MATURITY GROUP-II TRIAL RESULTS - BERESFORD - (CONTINUED).

--- BRAND / ENTRY ---	--- YIELD --- '97	2YR	3YR	-- 1996 -- PROT.	OIL	--- 1997 --- HT.	$$ LDG.	## REL. MAT.
	--- bu/ac ---			-- %	--	in.		
PRAIRIE BRAND/PB-236	54	63	59	38.6	17.0	26	1	2.7
SANDS/SOI 268A	54	64	55	37.2	18.7	26	1	3.0
PUBLIC/PARKER,I-CK*	54	58	56	36.7	18.9	34	2	1.5
PUBLIC/JACK,III-CK*	54	.	.	.	.	38	2	2.9
KRUGER/K2202	53	.	.	.	.	25	1	2.3
PRAIRIE BRAND/PB-SP25X	53	.	.	.	.	31	1	2.7
MUSTANG/X-233	53	.	.	.	.	27	1	2.6
PROFISEED/PS4266	53	.	.	.	.	30	1	2.7
GREAT LAKES/GL2772	53	61	.	35.9	18.7	31	1	2.7
MUSTANG/M-2259	52	.	.	.	.	27	1	2.7
PUBLIC/KENWOOD 94	52	59	53	37.0	18.9	30	1	2.6
PUBLIC/IA2008R	52	60	.	36.3	18.5	32	1	2.6
KRUGER/K2616	52	.	.	.	.	26	1	2.8
PIONEER/9234	51	55	.	36.9	18.4	29	1	2.6
DEKALB/CX232	51	62	58	36.2	19.3	25	1	2.6
MYCOGEN/200	51	.	.	.	.	27	1	2.6
LATHAM/634STS	51	.	.	.	.	29	1	2.6
PRAIRIE BRAND/PB-SP23X	51	.	.	.	.	27	1	2.8
PUBLIC/STURDY,II-CK*	49	59	52	38.1	18.7	30	1	2.2
PUBLIC/CORSOY 79	48	57	52	38.7	17.8	37	1	2.5
TEST AVERAGE:	58	65	58	37.0	18.4	29	1	
LSD(5%) VALUES:	8	6	5					
MIN.TOP-YIELD VALUE ($):	60	66	60					
COEF. OF VARIATION (#):	7	7	7					

* CK = MATURITY CHECK. $ MINIMUM TOP-YIELD VALUE - BASED ON ONE LSD.
# CV - A MEASURE OF VARIABILITY, 15% OR LESS IS DESIRABLE.
$$ 1= EXCELLENT, 5= POOR.
A SCALE DIFFERENCE OF 0.1 IS EQUAL TO 1.5 DAYS IN MATURITY.

TABLE 5. OAT ONE AND THREE-YEAR AVERAGE YIELDS, BUSHEL WEIGHTS, AND GRAIN PROTEINS AT THE SE RESEARCH FARM, BERESFORD.

VARIETY	YIELD YIELD '97	3-YR	BUSHEL WEIGHT '97	3-YR	GRAIN PROTEIN '97	3-YR
	-- Bu/ac --		-- LB --		--- % ---	
DON	123+	109+	35	35	16.0*	.
GEM	112	.	37	.	19.5	.
HYTEST	90	85	40+	40+	18.0	.
JERRY	129+	113+	39	37	17.8	.
JIM	124+	105+	36	36	14.7	.
NEWDAK	119	109+	36	35	17.2	.
SETTLER	113	105+	36	35	16.0	.
TROY	108	97	35	33	17.6	.
VALLEY	125+	107+	36	35	17.7	.
SD92057	129+	.	39	.	17.8	.
SD92125	120	94	37	37	19.6	.
SD93055	107	.	39	.	20.3	.
SD93269	103	.	39	.	18.9	.
SD93311	111	.	38	.	19.5	.
ND880107	111	.	33	.	20.4	.
TEST AVG.:	115	103	37	36	18.1	.
LSD (5%)$:	9	15	1	2		
CV (%) #:	5	6	1	2		

+ A TOP-YIELD OR TOP-BUSHEL WEIGHT VARIETY - BASED ON ONE LSD.
* PERCENTAGE IS BASED ON ONE COMPOSITE SAMPLE.
$ LSD(5%) - MEAN SEPARATION BY LEAST SIGNIFICANT DIFFERENCE TEST.
# A MEASURE OF VARIABILITY; A VALUE OF 15% OR LESS IS DESIRABLE.

WEED CONTROL DEMONSTRATIONS AND EVALUATIONS TESTS FOR 1997

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INTRODUCTION

Weed evaluation and extension demonstration plots provide weed control data for counties served by the Southeast Experiment Farm. The station is the major site for many corn and soybean weed control studies. The tests provide information on special local weed problems and management systems typical for producers in the area.

The tests provide data and are a source of training material for extension programs. The information is utilized in county extension meetings and for statewide programs.

1997 Evaluation/Demonstration Tests

Field tests are designed to provide comparative performance data for labeled herbicides and products that may be registered in the near future. Some tests are designed to evaluate control of specific weeds, such as cocklebur, velvetleaf, common waterhemp, and foxtail; others are designed to evaluate crop tolerance.

Plots are visually evaluated for weed control and crop response. Weed control ratings less than 70% are considered unsatisfactory; 85% control would be commercially acceptable in many situations; however at least 90-95% control is desired if seed production is to be minimized. Visual crop response ratings (VCRR) of 20% or less usually represent an acceptable level of stunting, discoloration or other effect. Ratings over 30% are considered excessive; 100% represents complete kill. Yields are harvested and reported for studies designed with replication.

Early-season performance in 1997 was very good for most tests. Early precipitation was adequate for many preemergence treatments. Weed flush extended somewhat later in the season; primarily the result of the rainfall pattern in late June and early July. Studies that were delayed due to wet field conditions in the plot site were somewhat more variable with results form soil applied treatments less consistent than for normal conditions.

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. Velvetleaf Control in Corn
3. Velvetleaf Control with Basis Tank-Mixes
4. Cocklebur Control in Corn
5. Cocklebur Control with Basis Gold Tank-Mixes
6. Common Waterhemp Control in Corn
7. Sandbur Control in No-Till Corn
8. Preemerge Grass Control in Corn
9. Weed Control in Herbicide Resistant Corn
10. Herbicide Tolerant Corn
11. Weed Control in Liberty Corn
12. Weed Control with Lightning
13. Demonstration of Factors on Grass Herbicides
14. Foxtail Removal Timing in Corn
15. Effect of Herbicide Drift on Corn
16. 1X & 3X Corn Rate Pre
17. 1X & 3X Corn Rate Post
18. 1X & 3X Soybean PPI/Pre Carryover to Corn
19. 1X & 3X Soybean Postemergence Carryover to Corn
20. No-Till Corn Demonstration
21. Soybean Herbicide Demonstration
22. Velvetleaf Control in Soybeans
23. Cocklebur Soybean Demonstration
24. Common Waterhemp Control in Soybeans
25. Preemergence Weed Control in Soybeans
26. Herbicide Tolerant Soybeans
27. Tank-Mixes in Roundup Ready Soybeans
28. Foxtail Removal Timing in Soybeans
29. Weed Removal Timing in Roundup Ready Soybeans
30. 1X and 3X Soybean Rate PPI/Pre
31. 1X and 3X Soybean Rate Post
32. 1X and 3X Corn Carryover to Soybeans
33. No-Till Soybean Burndown with Select
34. No-Till Soybeans in Stubble Demonstration

Other Herbicide Tests

Precise, small plot tests are established to evaluate experimental herbicides or to define rate comparisons. Treatments showing promise in these tests are moved forward into standard demonstration plots if industry continues development. Tests in 1997 include:

CORN

1. Postemergence Cocklebur Control
2. Grass Control in Corn with CGA-77102 II Granular
3. Weed Control in Corn with CyPro
4. Weed Control in Corn
5. Grass Control in Corn
6. Weed Control in Roundup Corn
7. Velvetleaf Control with Basis Gold
8. Post Velvetleaf in Corn
9. Velvetleaf Control in Corn
10. DPX-79406 Tank-Mixes
11. 1X & 3X Corn Rate PPI/Pre
12. Comparing Prepack Products
13. Weed Control in SR Corn
14. Weed control with Balance
15. Corn Tolerance

SOYBEANS

1. Weed Control in Liberty Soybeans
2. Weed Control with Stellar
3. Weed Control with FirstRate
4. No-Till Soybeans in Stalks
5. Weed Control with Cobra/Basagran Premixes
6. Burndown with V-53482
7. Weed Control with Amitrole
8. Pre Velvetleaf Control in Soybeans
9. Waterhemp Control with Cobra
10. Weed Control in STS Soybeans
11. STS Soybean Tolerance
12. Postemerge Velvetleaf Control

The cooperation and direct assistance from station personnel is acknowledged. Field equipment and management of the plot areas are important contributions to the project. Extension agents provide assistance with tours and utilize the data in direct producer programs.

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. Users are responsible for applying herbicide according to label directions. Refer to the appropriate weed control fact sheet available from county extension offices for herbicide recommendations.

Table 1. Corn Herbicide Demonstration

Demonstration	Precipitation:			
Variety: Curry 2135		PPI/PRE:	1st week	0.00 inches
Planting Date: 5/15/97			2nd week	1.81 inches
PPI/PRE: 5/15/97		EPOST:	1st week	0.83 inches
EPOST: 6/6/97			2nd week	1.81 inches
POST: 6/10/97		POST:	1st week	0.83 inches
POST(1): 6/16/97			2nd week	2.05 inches
POST(2): 6/24/97		POST(1):	1st week	1.97 inches
Soil: Silty clay; 3.5% OM; 6.0 pH			2nd week	0.29 inches
Grft=Green foxtail		POST(2):	1st week	0.16 inches
Bdlf=Common waterhemp			2nd week	0.35 inches

COMMENTS: Uniform, heavy foxtail. Excellent early-season performance. Plots were not cultivated. Considerable late-season grass flush; late-season data presented as cultivation following early postemerge treatments was required for satisfactory program for conditions of this test.

Treatment	Rate/A	% Grft 7/5/97	% Grft 9/11/97	% Bdlf 9/11/97	2 Yr Avg % Grft	2 Yr Avg % Bdlf
Check	----	0	0	0	0	0
PREPLANT INCORPORATED						
Eradicane	4.75 pt	91	75	68	76	74
Eradicane+Extrazine II	3.6 pt+2.2 lb	93	85	98	86	96
Double Play	5 pt	98	81	97	83	94
SHALLOW PREPLANT INCORPORATED						
Dual II	2.5 pt	98	76	72	73	76
Lasso	3 qt	94	70	80	65	77
Frontier 6L	2 pt	95	75	84	65	80
Harness	2.3 pt	96	75	88	70	83
Surpass	2.5 pt	95	73	89	72	84
PREEMERGENCE						
Dual II Magnum	1.6 pt	96	78	80	86	82
Dual II	2.5 pt	94	82	81	88	72
Lasso	3 qt	95	76	84	84	82
Prowl	3.6 pt	81	66	75	62	82
Harness	2.3 pt	99	95	96	94	93
Surpass	2.5 pt	99	96	96	94	92
Frontier	2 pt	96	96	94	94	90
Axiom	21 oz	95	88	96	---	---
Balance	1.5 oz	94	77	97	---	---
Balance+Surpass	1.5 oz+1.25 pt	98	90	98	---	---
Broadstrike+Dual	2.25 pt	96	88	99	88	94

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

Treatment	Rate/A	% Grft 7/5/97	% Grft 9/11/97	% Bdlf 9/11/97	2 Yr Avg % Grft	2 Yr Avg % Bdlf
PREEMERGENCE (Continued) . . .						
Axiom+atrazine	19 oz+1.1 lb	94	81	98	---	---
Acetochlor 6.4L+atrazine	1.67 pt+1.1 lb	96	88	99	---	---
Lasso+atrazine	2 qt+1.1 lb	93	76	98	78	99
Lasso+Bladex	2 qt+2.2 lb	90	72	86	81	93
Bicep Lite	4.8 pt	94	85	98	88	99
Dual II+Sen/Lex	2 pt+3.2 oz	95	84	99	---	---
PREEMERGENCE & POSTEMERGENCE(2)						
Dual II&Marksman	2 pt&2.5 pt	96	87	99	91	99
PREEMERGENCE & POSTEMERGENCE(1)						
Dual II&atrazine+ Sen/Lex+X-77	2.5 pt&.56 lb+ 2 oz+.25%	97	94	99	---	---
PREEMERGENCE & POSTEMERGENCE(2)						
Dual II&Sen/Lex+Hornet	2.5 pt&2 oz+2.4 oz	98	93	99	---	---
PREEMERGENCE & POSTEMERGENCE						
Surpass&Accent+ COC+28% N	1.25 pt&.67 oz+ 1%+4 qt	98	97	99	---	---
Surpass&Hornet+ X-77+28% N	1.25 pt&2.4 oz+ .25%+2 qt	98	89	99	---	---
Prowl&Accent+Banvel+ X-77+28% N	3 pt&.67 oz+.5 pt+ .25%+4 qt	97	89	96	---	---
EARLY POSTEMERGENCE						
Prowl+Marksman	3.6 pt+2.5 pt	85	55	97	---	---
Prowl+Accent+Banvel+ X-77+28% N	3 pt+.33 oz+.5 pt+ .25%+4 qt	98	75	96	67	97
Basis+COC+28% N	.33 oz+1%+2 qt	96	62	98	56	97
Basis+Hornet+ COC+28% N	.33 oz+1.6 oz+ 1%+2 qt	96	71	97	---	---
POSTEMERGENCE						
Accent+COC+28% N	.67 oz+1%+2 qt	96	81	78	---	---
Accent+Buctril+atrazine+ X-77+28% N	.67 oz+1 pt+.56 lb+ .25%+2 qt	98	81	99	---	---
Accent+atrazine+ COC+28% N	.67 oz+.56 lb+ 1%+2 qt	96	84	98	---	---
Accent+Exceed+ COC+28% N	.67 oz+.25 oz+ 1%+2 qt	97	85	98	---	---
EARLY POSTEMERGENCE						
Extrazine II+Veg Oil	2.2 lb+1 qt	95	79	96	67	94
Marksman+X-77	2.9 pt+.5%	86	60	95	50	96

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

Treatment	Rate/A	% Grft 7/5/97	% Grft 9/11/97	% Bdlf 9/11/97	2 Yr Avg % Grft	2 Yr Avg % Bdlf
POSTEMERGENCE						
Frontier+Accent+Clarity+	1.25 pt+.3 oz+1 pt+					
X-77+28% N	.25%+4 qt	95	76	97	---	---
Accent+Beacon+Banvel+	.33 oz+.38 oz+2 oz+					
X-77+28% N	1 pt+4 qt	96	89	98	---	---
Tough	1.5 pt	40	43	97	---	---
Tough+Accent+Beacon+	1 pt+.33 oz+.38 oz+					
COC+28% N	1%+4 qt	96	84	97	---	---
PREEMERGENCE & POSTEMERGENCE						
Ramrod&Tough+	4 qt&1 pt+					
atrazine+COC	1 pt+1 qt	93	74	94	---	---
Ramrod&Clarity	4 qt&1.25 pt	86	61	97	---	---
PREEMERGENCE & POSTEMERGENCE(2)						
Ramrod&Banvel	4 qt&.5 pt	88	57	98	---	---
Ramrod&Laddok S-12+	4 qt+1.67 pt+					
COC+28% N	1 qt+1 qt	85	58	95	---	---
Ramrod&Buctril	4 qt&1.5 pt	82	52	98	---	---
Ramrod&Buctril+atrazine	4 qt&1 pt+.56 lb	84	63	99	---	---
PREEMERGENCE & POSTEMERGENCE(1)						
Ramrod&2,4-D amine	4 qt&1 pt	86	59	86	---	---
Ramrod&Sen/Lex+atrazine	4 qt&2 oz+.56 lb	84	54	99	---	---
Ramrod&Shotgun	4 qt&3 pt	85	62	98	---	---
Ramrod&Shotgun+Broclean	4 qt&1.5 pt+.75 pt	82	54	99	---	---
PREEMERGENCE & POSTEMERGENCE(2)						
Ramrod&Permit+X-77	4 qt&.67 oz+.5%	84	51	98	---	---
Ramrod&Exceed+	4 qt&.8 oz+					
COC+28% N	1 qt+4 qt	83	52	98	---	---
Ramrod&Exceed+Banvel+	4 qt&.8 oz+2 oz+					
COC+28% N	1 qt+4 qt	86	60	99	---	---
Ramrod&Beacon+	4 qt&.38 oz+					
COC+28% N	1 qt+4 qt	89	65	98	---	---
Ramrod&Scorpion III+	4 qt&4 oz+					
X-77+28% N	.25%+2.5%	80	57	99	---	---
Ramrod&Hornet+	4 qt&2.4 oz+					
X-77+28% N	.25%+2.5%	81	58	99	---	---
Ramrod&Resource+atrazine+	4 qt&4 oz+.56 lb+					
COC+28% N	1 pt+2 qt	88	71	98	---	---
LSD (.05)					17	12

Table 2. Velvetleaf Control in Corn

RCB; 2 reps	Precipitation:			
Variety: Garst 8810 IT	PPI/PRE:	1st week	0.00 inches	
Planting Date: 5/15/97		2nd week	1.81 inches	
PPI/PRE: 5/15/97	POST:	1st week	0.16 inches	
POST: 6/25/97		2nd week	0.35 inches	
POST(1): 7/2/97 POST(1):	1st week	0.35 inches		
Soil: Silty clay loam; 3.0% OM; 6.9 pH		2nd week	0.08 inches	
Vele = Velvetleaf				

COMMENTS: Heavy velvetleaf. Delayed weed emergence and slow early weed growth. Good weed pressure. Performance in 1997 was excellent; conditions were favorable. Fourteen treatments provided at least 95% control. The 3-year average gives a measure of consistency over varying conditions. "IMI" corn.

Treatment	Rate/A	% Vele 8/7/97	3-Yr Avg % Vele
Check	----	0	0
PREPLANT INCORPORATED			
Eradicane	7 pt	45	48
Eradicane+atrazine	5 pt+1.1 lb	83	77
Contour	1.33 pt	99	94
Atrazine	2.2 lb	84	82
SHALLOW PREPLANT INCORPORATED			
Broadstrike+Dual	2 pt	95	89
PREPLANT INCORPORATED & POSTEMERGENCE			
Eradicane&Atrazine+COC	5 pt&1.1 lb+1 qt	81	88
Eradicane&2,4-D amine	5 pt&1 pt	86	83
PREEMERGENCE			
Lasso+Bladex	2 qt+2.2 lb	78	77
Dual II+Atrazine	2 pt+1.1 lb	55	71
Dual II+Atrazine	2 pt+2.2 lb	76	85
Balance	1.5 oz	98	---
Axiom	21 oz	82	---
PREEMERGENCE & POSTEMERGENCE			
Balance&Buctril+atrazine	1.5 oz&1 pt+.56 lb	99	---
POSTEMERGENCE			
Prowl+atrazine	3.5 pt+1.1 lb	97	96
Accent+atrazine+Scoil+28% N	.67 oz+.56 lb+1%+4 qt	51	---
PREEMERGENCE & POSTEMERGENCE			
Ramrod&Resolve SG+X-77+28% N	5 qt&5.33 oz+.25%+1 qt	79	---
Ramrod&atrazine+COC	5 qt&1.1 lb+1 qt	72	---
Ramrod&Tough+atrazine+COC	4 qt&1 pt+1.1 lb+1 qt	68	---

Table 2. Velvetleaf Control in Corn (Continued) . . .

Treatment	Rate/A	**% Vele** 8/7/97	**3-Yr Avg** % Vele
PREEMERGENCE & POSTEMERGENCE (Continued) . . .			
Ramrod&atrazine+COC	5 qt&2.2 lb+1 qt	78	---
Ramrod&Clarity	5 qt&1 pt	81	84
Ramrod&Buctril+atrazine	5 qt&1 pt+.56 lb	75	---
Ramrod&Marksman	5 qt&3 pt	90	86
Ramrod&Laddok S-12+28% N	5 qt&1.66 pt+4 qt	98	93
Ramrod&Shotgun	5 qt&3 pt	99	---
Ramrod&2,4-D amine	5 qt&1 pt	96	83
Ramrod&Buctril	5 qt&1.5 pt	93	84
Ramrod&Beacon+X-77+28% N	5 qt&.76 oz+1%+4%	70	63
Ramrod&Exceed+X-77	5 qt&.8 oz+.5%	72	69
Ramrod&Sen/Lex+2,4-D amine	5 qt&2 oz+.5 pt	94	84
PREEMERGENCE & POSTEMERGENCE & POSTEMERGENCE(1)			
Ramrod&Buctril+atrazine&Buctril	5 qt&1 pt+1 pt&1 pt	98	---
PREEMERGENCE & POSTEMERGENCE			
Ramrod&Permit+X-77	5 qt&.67 oz+.25%	79	68
Ramrod&Scorpion III+X-77+28% N	5 qt&.25 lb+.25%+2.5%	95	86
Ramrod&Resource+COC	5 qt&4 oz+1 qt	73	84
Ramrod&Sen/Lex+Buctril	5 qt&2 oz+1 pt	95	89
Ramrod&Hornet+X-77+28% N	5 qt&2.4 oz+.25%+2.5%	97	---
Ramrod&Lightning+atrazine+ Sun-It II+28% N	5 qt&1.28 oz+.56 lb+ 1.5 pt+1 qt	84	---
Ramrod&Hornet+atrazine+ COC+28% N	5 qt&2.4 oz+.56 lb+ 1%+2.5%	82	---
Ramrod&Action+COC	5 qt&1.5 oz+1 qt	99	98
Ramrod&Resource+atrazine+ COC+28% N	5 qt&4 oz+.56 lb+ 1 qt+2 qt	94	85
Ramrod&Aim+atrazine+X-77	5 qt&.32 oz+.56 lb+.25%	75	---
PREEMERGENCE & POSTEMERGENCE(1)			
Ramrod&Banvel	5 qt&.5 pt	53	71
Ramrod&Resource+COC	5 qt&8 oz+1 qt	86	---
Ramrod&Action+COC	5 qt&1.5 oz+1 qt	96	---
LSD (.05)		15	11

Table 3. Velvetleaf Control with Basis Tank-Mixes

RCB; 4 reps
Variety: Curry 2135
Planting Date: 5/13/97
POST: 6/10/97
Soil: Silty clay loam; 2.7% OM; 7.1 pH

Precipitation: 1st week 0.83 inches
2nd week 2.05 inches

VCRR = Visual Crop Response Rating
(o=no injury; 100=complete kill)
Yeft = Yellow foxtail
Vele = Velvetleaf
Cowh = Common waterhemp

COMMENTS: Purpose to evaluate velvetleaf control with tank-mix combinations. Velvetleaf control was excellent with all treatments. All treatments produced higher yields than the check.

Treatment	Rate/A	% VCRR 7/16/97	% Yeft 7/16/97	% Vele 7/16/97	% Cowh 7/16/97	Yield bu/A
Check	----	0	0	0	0	82
POSTEMERGENCE						
Basis+COC+28% N	.33 oz+1%+2 qt	0	88	93	97	131
Basis+Tough+ COC+28% N	.33 oz+.25 pt+ 1%+2 qt	0	90	94	98	120
Basis+Tough+ COC+28% N	.33 oz+.5 pt+ 1%+2 qt	0	89	95	98	123
Basis+Tough+ COC+28% N	.33 oz+1 pt+ 1%+2 qt	0	90	93	99	116
Basis+Lexone+ COC+28% N	.33 oz+1 oz+ 1%+2 qt	0	87	95	98	110
Basis+Lexone+ COC+28% N	.33 oz+2 oz+ 1%+2 qt	0	88	96	99	122
Basis+Lexone+ COC+28% N	.33 oz+3 oz+ 1%+2 qt	4	89	96	98	120
Basis+Tough+atrazine+ COC+28% N	.33 oz+.5 pt+.33 lb+ 1%+2 qt	0	85	92	99	116
Basis+Hornet+atrazine+ COC+28% N	.33 oz+.8 oz+.33 lb+ 1%+2 qt	3	86	96	98	120
LSD (.05)		4	7	4	1	20

Table 4. Cocklebur Control in Corn

RCB; 2 reps
Variety: DK493SR
Planting Date: 5/21/97
POST: 6/16/97
Soil: Loam; 2.9% OM; 6.5 pH

Precipitation:		
	1st week	1.97 inches
	2nd week	0.29 inches

Cocb = Common cocklebur
Grft = Green foxtail
Cowh = Common waterhemp

COMMENTS: Very heavy cocklebur. Waterhemp light. Cocklebur control was excellent for several treatments; very limited late flush. SR corn for all plots. Poast Plus was applied to all treatments for foxtail control. Grass ratings represent late flush; value of residual herbicide such as atrazine apparent on grass evaluations and for common waterhemp.

Treatment	Rate/A	% Cocb 7/17/97	% Grft 9/11/97	% Cowh 9/11/97	% Cocb 9/11/97	Yield bu/A
Check	----	0	49	0	0	60
POSTEMERGENCE						
Buctril	1 pt	73	83	61	73	87
Buctril+atrazine	1 pt+1.1 lb	86	91	97	83	105
Banvel	.5 pt	83	96	47	91	95
Marksman	3.5 pt	96	88	99	99	105
Banvel+Buctril	4 oz+1 pt	84	76	86	97	116
Shotgun	3 pt	90	96	99	98	119
Exceed+COC+28% N	.8 oz+1 qt+4 qt	92	85	99	99	101
Permit+X-77	1 oz+.5%	94	91	89	99	110
Beacon+COC+28% N	.76 oz+1 qt+4 qt	87	88	91	95	109
Extrazine II+Prime Oil II	2.2 lb+1 qt	91	98	96	99	110
Scorpion III+X-77+28% N	4 oz+.25%+2.5%	85	85	99	99	110
Hornet+X-77+28% N	2.4 oz+.25%+2.5%	88	91	98	99	98
Hornet+X-77+28% N	4 oz+.25%+2.5%	97	85	99	99	106
2,4-D ester	.5 pt	77	82	94	79	96
2,4-D amine	1 pt	76	86	93	74	87
Laddok S-12+COC+28% N	2.33 pt+1 qt+1 qt	80	84	98	79	104
LSD (.05)		9	40	26	13	24

Table 5. Cocklebur Control with Basis Gold Tank-Mixes

RCB; 3 reps
Variety: Pioneer 493SR
Planting Date: 5/21/97
POST: 6/16/97
Soil: Clay; 3.1% OM; 7.1 pH

Precipitation: 1st week 1.97 inches
2nd week 0.24 inches

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

COMMENTS: Very heavy cocklebur. All treatments provided very good cocklebur control.

Treatment	Rate/A	% VCRR 6/28/97	% Grft 7/16/97	% Cocb 7/16/97	% Cowh 7/16/97
Check	----	0	0	0	0
POSTEMERGENCE					
Basis Gold+COC+28% N	14 oz+1%+2 qt	0	71	91	80
Basis Gold+Exceed+ COC+28% N	14 oz+.25 oz+ 1%+2 qt	3	91	93	85
Basis Gold+Hornet+ COC+28% N	14 oz+1.6 oz+ 1%+2 qt	0	89	96	91
Basis Gold+Tough+ COC+28% N	14 oz+.5 pt+ 1%+2 qt	3	90	98	95
Basis Gold+Clarity+ COC+28% N	14 oz+.25 pt+ 1%+2 qt	3	92	96	90
LSD (.05)		6	10	9	13

Table 6. Common Waterhemp Control in Corn

RCB; 4 reps
Variety: Pioneer 3730
Planting Date: 5/14/97
POST: 6/16/97
Soil: Clay loam; 3.3% OM; 7.2 pH

Precipitation: 1st week 1.97 inches
2nd week 0.24 inches

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

COMMENTS: Purpose to evaluate treatments for common waterhemp control. Resource with atrazine/dicamba combinations provided excellent control. All treatments produced higher yield than the check. Ramrod applied across all treatments.

Treatment	Rate/A	% VCRR 7/16/97	% Grft 7/16/97	% Cowh 7/16/97	Yield bu/A
Check	----	0	0	0	106
POSTEMERGENCE					
Atrazine+COC	1.5 pt+1 pt	0	5	79	119
Resource+atrazine+COC	4 oz+1.5 pt+1 qt	0	30	97	122
Clarity+X-77	.5 pt+.25%	3	3	69	125
Resource+Clarity+X-77	4 oz+.5 pt+.25%	5	5	88	114
Buctril	1 pt	0	3	69	113
Resource+Buctril	4 oz+1 pt	0	5	81	119
Exceed+COC	.88 oz+1 pt	3	43	83	121
Resource+Exceed+COC	4 oz+.88 oz+1 pt	0	35	95	114
Marksman	2 pt	4	8	97	113
Resource+Marksman	4 oz+2 pt	0	8	89	123
LSD(.05)		5	10	14	13

Table 7. Sandbur Control in No-Till Corn

RCB; 2 reps
Variety: DK993SR(SR), DK493GR(LL),
Garst 8810IT(IMI and Std)
Planting Date: 5/15/97
PRE: 5/15/97
EPOST: 6/17/97
POST: 7/2/97
Soil: Clay; 3.1% OM; 7.1 pH
Fisb=Field sandbur

Precipitation:		
PRE	1st week	0.00 inches
	2nd week	1.81 inches
EPOST	1st week	2.05 inches
	2nd week	0.16 inches
POST	1st week	0.35 inches
	2nd week	0.08 inches

COMMENTS: Purpose to evaluate sandbur control in no-till corn. Plot area was moderately heavily infested. Treatments with Accent or transgenic hybrids with Poast Plus, Lightning, or Liberty provided excellent results. Very limited emergence after post timing.

Treatment	Rate/A	% Fisb 8/7/97
Check - Standard Corn	-----	0
PREEMERGENCE		
Dual II	2.5 pt	61
Harness	2.3 pt	50
Frontier	2 pt	46
Axiom	22 oz	59
Balance	1.5 oz	62
Balance	2 oz	65
Balance+Surpass	1.5 oz+1.25 pt	81
PREEMERGENCE & POSTEMERGENCE		
Prowl&Accent+COC+28% N	3.6 pt&.67 oz+1%+4 qt	95
Extrazine II&Accent+COC+28% N	2.2 lb&.67 oz+1%+4 qt	93
Surpass&Accent+COC+28% N	1.25 pt&.67 oz+1%+4 qt	83
Surpass&Accent+COC+28% N	2.5 pt&.67 oz+1%+4 qt	92
EARLY POSTEMERGENCE		
Prowl+Accent+COC+28% N	3.6 pt+.67 oz+1%+4 qt	96
Accent+atrazine+COC+28% N	.67 oz+1.1 lb+1%+4 qt	85
Atrazine+COC	2.2 lb+1 qt	72
Prowl+atrazine+COC	3.5 pt+1.1 lb+1 qt	74
EARLY POSTEMERGENCE & POSTEMERGENCE		
Accent+COC+28%N& Accent+COC+28% N	.33 oz+1%+4 qt& .33 oz+1%+4 qt	96
POSTEMERGENCE		
Accent+Beacon+COC+28% N	.33 oz+.38 oz+1%+4 qt	84
Accent+COC+28% N	.67 oz+1%+4 qt	94

Table 7. Sandbur Control in No-Till Corn (Continued) . . .

Treatment	Rate/A	% Fisb 8/7/97
CHECK - SR Corn	----	0
PREEMERGENCE & POSTEMERGENCE		
Surpass&Poast Plus+COC+28% N	2.5 pt&1.5 pt+1 qt+2 qt	98
Extrazine II&Poast Plus+COC+28% N	2.2 lb&1.5 pt+1 qt+2 qt	96
EARLY POSTEMERGENCE		
Poast Plus+COC+28% N	1.5 pt+1 qt+2 qt	96
EARLY POSTEMERGENCE & POSTEMERGENCE		
Poast Plus+COC+28% N& Poast Plus+COC+28% N	.5 pt+1 qt+2 qt& 1 pt+1 qt+2 qt	99
POSTEMERGENCE		
Poast Plus+COC+28% N	1.5 pt+1 qt+2 qt	97
Check - Liberty Link Corn	----	0
PREEMERGENCE & POSTEMERGENCE		
Dual II&Liberty+AMS	2.5 pt&1.75 pt+3 lb	92
Extrazine II&Liberty+AMS	2.2 lb&1.75 pt+3 lb	81
EARLY POSTEMERGENCE		
Liberty+AMS	1.75 pt+3 lb	70
EARLY POSTEMERGENCE & POSTEMERGENCE		
Liberty+AMS&Liberty+AMS	1 pt+3 lb&1 pt+3 lb	89
POSTEMERGENCE		
Liberty+AMS	1.75 pt+3 lb	91
Check - IMI Corn	----	0
PREEMERGENCE & EARLY POSTEMERGENCE		
Surpass&Resolve SG+Sun-It II+28% N	1.5 pt&5.33 oz+1.5 pt+1 qt	88
Surpass&Lightning+Sun-It II+28% N	1.5 pt&1.28 oz+1.5 pt+1 qt	84
Prowl&Lightning+Banvel+ Sun-It II+28% N	3 pt&1.28 oz+6 oz+ 1.5 pt+1 qt	97
EARLY POSTEMERGENCE		
Lightning+Sun-It II+28% N	1.28 oz+1.5 pt+1 qt	97
POSTEMERGENCE		
Lightning+Sun-It II+28% N	1.28 oz+1.5 pt+1 qt	98
LSD (.05)		10

Table 8. Preemerge Grass Control in Corn

RCB; 4 reps
Variety: Pioneer 3730
Planting Date: 5/14/97
PRE: 5/14/97
Soil: Silty clay loam; 3.1% OM; 7.1 pH

Precipitation: 1st week 0.00 inches
2nd week 1.81 inches

Yeft=Yellow foxtail
Cowh=Common waterhemp

COMMENTS: Test comparison of Axiom with standard preemergence treatments. The high rate of Axiom provided greater common waterhemp control than lower rates. Heavy precipitation the second week after application.

Treatment	Rate/A	% Yeft 8/5/97	% Cowh 8/5/97
Check	----	0	0
PREEMERGENCE			
Axiom	19 oz	94	90
Axiom	21 oz	91	92
Axiom	23 oz	94	97
Dual II	2.5 pt	97	95
Frontier 6L	2 pt	96	96
Surpass	2.5 pt	95	99
LSD (.05)		5	5

Table 9. Weed Control in Herbicide Resistant Corn

Split Block; 4 reps
Varieties: Garst 8540LLIT, DK561SR
Planting Date: 5/13/97
PRE: 5/13/97
POST: 6/16/97
Soil: Silty clay loam; 3.4% OM; 6.3 pH
Vele = Velvetleaf
Grft = Green foxtail

Precipitation:

PRE:	1st week	0.00 inches
	2nd week	1.69 inches
POST:	1st week	1.97 inches
	2nd week	0.24 inches

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

COMMENTS: Velvetleaf emergence slow and uneven. Foxtail pressure light. Lightning combinations, Liberty combinations and Bicep+Exceed combination provided excellent grass and velvetleaf control. Garst 8540LLIT was used for IMI, Liberty Link and standard treatments.

Treatment	Rate/A	% VCRR 7/2/97	% Vele 7/2/97	% VCRR 7/10/97	% Grft 7/10/97	% Vele 7/10/97	Yield bu/A
POSTEMERGENCE							
Lightning+atrazine+ X-77+28% N	1.28 oz+1 pt+ .25%+2 qt	0	94	0	96	90	150
Lightning+Banvel+ X-77+28% N	1.28 oz+4 oz+ .25%+2 qt	8	99	8	97	99	142
PREEMERGENCE							
Bicep II ("IMI")	1.8 qt	3	41	0	92	34	135
POSTEMERGENCE							
Libery+atrazine+AMS	24 oz+1.5 qt+3 lb	8	92	0	97	86	145
Liberty+Prowl+ atrazine+AMS	24 oz+3 pt+ 1.5 qt+3 lb	9	95	6	97	92	146
PREEMERGENCE							
Bicep II (Liberty Link)	1.8 qt	3	40	0	95	31	140
POSTEMERGENCE							
Poast Plus+Banvel+COC	20 oz+8 oz+1 qt	10	57	4	99	50	122
Poast Plus+Prowl+ Banvel+COC	20 oz+3 pt+ 8 oz+1 qt	13	59	6	98	56	131
PREEMERGENCE							
Bicep II (SR)	1.8 qt	0	38	0	96	27	127
PREEMERGENCE & POSTEMERGENCE							
Bicep II&Exceed+ COC+28% N	2.4 qt&1 oz+ 1 qt+2 qt	3	99	0	97	97	144
POSTEMERGENCE							
Basis Gold+Banvel+COC	14 oz+6 oz+1 qt	8	66	8	92	59	137
PREEMERGENCE							
Bicep II (Std)	1.8 qt	0	42	0	94	30	135
LSD (.05)		6	7	8	4	8	14

Table 10. Herbicide Tolerant Corn

RCB; 3 reps
Variety: See comments
Planting Date: 5/15/97
PRE: 5/15/97
EPOST: 6/10/97
POST: 6/24/97
Soil: Silty clay; 3.5% OM; 6.0 pH
Grft = Green foxtail
Bdlf = Common waterhemp

Precipitation:

PRE:	1st week	0.00 inches
	2nd week	1.81 inches
EPOST:	1st week	0.83 inches
	2nd week	2.05 inches
POST:	1st week	0.16 inches
	2nd week	0.35 inches

COMMENTS: Varieties planted were: Curry 2182(IMI), Cargill 4400SR, and Pioneer 34A55(LL). Heavy foxtail pressure. Evaluations represent mid-season ratings and provide an indication of greater than usual late flush. Early-season grass control was satisfactory for all treatments; residual effects apparent in treatment differences. Considerable grass emerged after the early post timing. 3X rates included to evaluate crop tolerance. No response noted for any treatments.

Treatment	Rate/A	% Grft 7/5/97	% Bdlf 7/5/97	2 Yr Avg % Grft	2 Yr Avg % Bdlf
CHECK - Libery Link Corn	----	0	0	0	0
EARLY POSTEMERGENCE					
Liberty+AMS	1.75 pt+3 lb	64	98	60	74
Atrazine+Liberty+AMS	1.1 lb+1.75 pt+3 lb	72	99	75	90
Liberty+AMS (3X)	5.25 pt+3 lb	59	98	66	81
PREEMERGENCE & EARLY POSTEMERGENCE					
Atrazine&Liberty+AMS	1.1 lb&1.75 pt+3 lb	77	99	83	97
Surpass&Liberty+AMS	1.67&1.75 pt+3 lb	92	99	95	89
EARLY POSTEMERGENCE & POSTEMERGENCE					
Liberty+AMS& Liberty+AMS	1.25 pt+3 lb& 1.25 pt+3 lb	81	98	---	---
CHECK - IMI Corn	----	0	0	0	0
PREEMERGENCE & POSTEMERGENCE					
Prowl&Resolve SG+ X-77+28% N	3.6 pt&5.3 oz+ .25%+2 qt	97	99	---	---
PREPLANT INCORPORATED & EARLY POSTEMERGENCE					
Surpass&Resolve SG+ X-77+28% N	1.5 pt&5.3 oz+ .25%+2 qt	96	99	---	---
PREPLANT INCORPORATED					
Contour	1.33 pt	83	99	83	98
EARLY POSTEMERGENCE					
Lightning+atrazine+ Sun-It II+28% N	1.28 oz+.56 lb+ 1.5 pt+1 qt	92	89	---	---
Lightning+atrazine+ Sun-It II+28% N (3X)	3.84 oz+.56 lb+ 1.5 pt+1 qt	99	99	---	---

Table 10. Herbicide Tolerant Corn (Continued) . . .

Treatment	Rate/A	% Grft 7/5/97	% Bdlf 7/5/97	2 Yr Avg % Grft	2 Yr Avg % Bdlf
CHECK - SR Corn	-----	0	0	0	0
PREEMERGENCE & EARLY POSTEMERGENCE					
Surpass&Poast Plus+ Laddok S-12+COC+28% N	1.25 pt&1.5 pt+ 1.67 pt+1 qt+2 qt	87	96	91	98
Atrazine&Poast Plus+ 2,4-D ester+COC+28% N	1.1 lb&1.5 pt+ .5 pt 1 qt+2 qt	71	84	79	93
EARLY POSTEMERGENCE					
Poast Plus+Laddok S-12+ COC+28% N	1.75 pt+1.75 pt+ .5 pt+1 qt+2 qt	89	55	86	80
EARLY POSTEMERGENCE & POSTEMERGENCE					
Poast Plus+Clarity+COC& Poast Plus+Laddok S-12+ COC+28% N	.5 pt+.25 pt+1 pt& 1 pt+1.33 pt+ 1 qt+2 qt	85	68	89	89
POSTEMERGENCE					
Poast Plus+COC+28% N (3X)	4.5 pt+1 qt+2 qt	84	0	94	0
LSD (.05)				6	19

Table 11. Weed Control in Liberty Corn

RCB; 4 reps	Precipitation:			
Variety: DK493GR	PRE	1st week	0.00 inches	
Planting Date: 5/14/97		2nd week	1.81 inches	
PRE: 5/14/97	POST	1st week	0.83 inches	
POST: 6/10/97		2nd week	2.05 inches	
LPOST: 6/25/97 LPOST	1st week	0.16 inches		
Soil: Silty clay; 3.5% OM; 6.6 pH		2nd week	0.35 inches	
Yeft=Yellow foxtail				
Cowh=Common waterhemp				

COMMENTS: Purpose to evaluate weed control program with Liberty. Atrazine plus Liberty at both early or late application timing tended to be most consistent on yellow foxtail and waterhemp in this test.

Treatment	Rate/A	% Yeft 8/5/97	% Cowh 8/5/97
Check	----	0	0
POSTEMERGENCE			
Liberty+atrazine+AMS	1.75 pt+13.33 oz+3 lb	97	98
POSTEMERGENCE & LATE POSTEMERGENCE			
Liberty+AMS&Liberty+AMS	1.25 pt+3 lb&1.25 pt+3 lb	92	92
PREEMERGENCE & POSTEMERGENCE			
Atrazine&Liberty+AMS	13.33 oz&1.75 pt+3 lb	97	98
Dual II&Liberty+AMS	2.5 pt&1.75 pt+3 lb	86	80
POSTEMERGENCE			
Accent+Buctril/Atrazine+ X-77+28% N	.67 oz+2 pt+ .25%+2 qt	96	86
PREEMERGENCE			
Bicep II	1.8 qt	86	95
LSD (.05)		5	7

Table 12. Weed Control with Lightning

RCB; 4 reps
Variety: Garst 8810 IT
Planting Date: 5/14/97
PRE: 5/14/97
POST: 6/10/97
Soil: Silty clay loam; 3.1% OM; 7.1 pH
Grft=Green foxtail
Cowh=Common waterhemp

Precipitation:

PRE:	1st week	0.00 inches
	2nd week	1.81 inches
POST:	1st week	0.83 inches
	2nd week	2.05 inches

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

COMMENTS: Uniform site; moderate foxtail pressure. Excellent foxtail control for all treatments. Excellent waterhemp control was noted in all combinations containing atrazine. All treatments produced higher yield than the check.

Treatment	Rate/A	% VCRR 6/28/97	% VCRR 7/8/97	% Grft 7/8/97	% Cowh 7/8/97	% Grft 8/5/97	% Cowh 8/5/97	Yield bu/A
POSTEMERGENCE								
Lightning+	1.28 oz+							
Sun-It II+28% N	1.5 pt+1 qt	0	0	98	35	98	9	100
Lightning+Banvel+	1.28 oz+6 oz+							
Sun-It II+28% N	1.5 pt+1 qt	10	4	99	79	99	67	112
PREEMERGENCE								
Bicep	2.4 qt	0	0	92	94	94	96	104
PREEMERGENCE & POSTEMERGENCE								
Dual II&Marksman	2 pt&3 pt	0	0	92	98	96	99	103
Check	----	0	0	0	0	0	0	46
Surpass&Exceed+	2.5 pt&1 oz+							
Accent+X-77+	.33 oz+.25%+							
28% N	2 qt	5	0	99	99	99	98	101
Surpass&Marksman	1.5 pt&3 pt	0	0	89	99	94	99	112
POSTEMERGENCE								
Resolve SG+	5.33 oz+							
Sun-It II+28% N	1.5 pt+1 qt	10	3	92	74	97	42	103
LSD (.05)		6	4	6	7	3	9	15

Table 13. Demonstration of Factors on Grass Herbicides

Demonstration	Precipitation:	1st week	0.00 inches
Variety: Curry 2135		2nd week	0.83 inches
Planting Date: 5/15/97			
PRE: 5/15/97	Grft=Green foxtail		
Soil: Silty clay; 3.5% OM; 6.0 pH	Cowh=Common waterhemp		

COMMENTS: Purpose to demonstrate factors affecting herbicide performance. Pre herbicides are compared at two-thirds and full normal use rate. Reduced rate was not satisfactory for any treatment. The addition of fertilizer carrier tended to produce a grass growth response rather than improve control.

Treatment	Rate/A	% Grft 9/11/97	% Cowh 9/11/97
Check	----	0	0
PREEMERGENCE			
Dual II	1.25 pt	58	30
Dual II	2.5 pt	89	58
Lasso	1.5 qt	64	45
Lasso	3 qt	83	68
Frontier 6L	1 pt	77	40
Frontier 6L	2 pt	91	80
Surpass	1.25 pt	64	60
Surpass	2.5 pt	92	88
Harness	1.15 pt	69	65
Harness	2.3 pt	94	90
Lasso (10 gal)	3 qt	82	78
Lasso (20 gal)	3 qt	86	80
Lasso (60 gal)	3 qt	84	76
Lasso+28% N (20 gal)	3 qt	71	82
Lasso+Fertilizer	3 qt+200 lb	65	74

Table 14. Foxtail Removal Timing in Corn

RCB; 4 reps
Variety: DK493GR
Planting Date: 5/14/97
PRE: 5/14/97
2 WKS: 6/6/97
3 WKS: 6/16/97
4 WKS: 6/25/97
5 WKS: 7/2/97
Soil: Silty clay loam; 3.5% OM; 6.6 pH
Grft=Green foxtail
Cowh=Common waterhemp

Precipitation:

2 WKS	1st week	0.83 inches
	2nd week	1.81 inches
3 WKS	1st week	1.97 inches
	2nd week	0.24 inches
4 WKS	1st week	0.16 inches
	2nd week	0.35 inches
5 WKS	1st week	0.35 inches
	2nd week	0.08 inches

COMMENTS: Timing treatments based on weed emergence. Late foxtail emergence was apparent at the 2-week timing; common waterhemp tended to emerge even after the first three timings. Residual components reduced late flush.

Treatment		Rate/A	% Grft 8/7/97	% Cowh 8/7/97	Yield bu/A
Check		----	0	0	61
PREEMERGENCE					
Surpass		2.5 pt	96	99	111
Surpass&		2.5 pt&			
Liberty+AMS	3 weeks	28 oz+3 lb	99	99	99
Liberty+AMS	2 weeks	28 oz+3 lb	83	39	100
	3 weeks		94	38	100
	4 weeks		97	94	107
	5 weeks		89	80	87
Liberty+AMS&	2 weeks	28 oz+3 lb&			
Liberty+AMS	3 weeks	28 oz+3 lb	95	98	107
Liberty+AMS&	2 weeks	28 oz+3 lb&			
Liberty+AMS	4 weeks	28 oz+3 lb	98	90	104
Liberty+AMS&	2 weeks	28 oz+3 lb&			
Liberty+AMS	5 weeks	28 oz+3 lb	98	98	103
LSD (.05)			5	10	19

Table 15. Effect of Herbicide Drift on Corn

RCB; 4 reps
Variety: DK512
Planting Date: 5/13/97
POST: 6/24/97
Soil: Silty clay; 3.0% OM; 6.6 pH

Precipitation: 1st week 0.16 inches
2nd week 0.35 inches

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

COMMENTS: Purpose to evaluate crop response from exposure to very low herbicide rates. Applied at 12 inch corn stage. Visual symptoms and yield response provides data for producer decisions when problems with tank contamination or off target movement have occurred. The lowest three Liberty rates, two lower Poast Plus rates and lowest Gramoxone rate did not reduce yield.

Treatment	Rate/A	% VCRR 8/7/97	Yield buA
Check	----	0	136
POSTEMERGENCE			
Roundup Ultra+AMS	1.6 oz+.85 lb/100 gal	19	111
Roundup Ultra+AMS	3.2 oz+1.7 lb/100 gal	58	76
Roundup Ultra+AMS	6.4 oz+3.4 lb/100 gal	89	1
Roundup Ultra+AMS	12.8 oz+6.8 lb/100 gal	99	1
Liberty+AMS	1.4 oz+.15 lb	5	129
Liberty+AMS	2.8 oz+.3 lb	5	130
Liberty+AMS	5.6 oz+.6 lb	14	128
Liberty+AMS	11.8 oz+1.2 lb	58	70
Poast Plus+COC	.083 pt+.166 pt	0	125
Poast Plus+COC	.167 pt+.33 pt	5	126
Poast Plus+COC	.33 pt+.67 pt	5	105
Gramoxone Extra+X-77	3.2 oz+.0625%	9	128
Gramoxone Extra+X-77	6.4 oz+.125%	24	111
Gramoxone Extra+X-77	12.8 oz+.25%	24	100
LSD (.05)		19	14

Table 16. 1X and 3X Corn Rate Pre

RCB; 4 reps
Variety: DK512
Planting Date: 5/13/97
POST: 6/24/97
Soil: Silty clay; 3.0% OM; 6.6 pH

Precipitation: 1st week 0.16 inches
2nd week 0.35 inches

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

COMMENTS: Purpose to evaluate crop response from exposure to very low herbicide rates. Applied at 12 inch corn stage. Visual symptoms and yield response provides data for producer decisions when problems with tank contamination or off target movement have occurred. The lowest three Liberty rates, two lower Poast Plus rates and lowest Gramoxone rate did not reduce yield.

Treatment	Rate/A	% VCRR 8/7/97	Yield buA
Check	----	0	136
POSTEMERGENCE			
Roundup Ultra+AMS	1.6 oz+.85 lb/100 gal	19	111
Roundup Ultra+AMS	3.2 oz+1.7 lb/100 gal	58	76
Roundup Ultra+AMS	6.4 oz+3.4 lb/100 gal	89	1
Roundup Ultra+AMS	12.8 oz+6.8 lb/100 gal	99	1
Liberty+AMS	1.4 oz+.15 lb	5	129
Liberty+AMS	2.8 oz+.3 lb	5	130
Liberty+AMS	5.6 oz+.6 lb	14	128
Liberty+AMS	11.8 oz+1.2 lb	58	70
Poast Plus+COC	.083 pt+.166 pt	0	125
Poast Plus+COC	.167 pt+.33 pt	5	126
Poast Plus+COC	.33 pt+.67 pt	5	105
Gramoxone Extra+X-77	3.2 oz+.0625%	9	128
Gramoxone Extra+X-77	6.4 oz+.125%	24	111
Gramoxone Extra+X-77	12.8 oz+.25%	24	100
LSD (.05)		19	14

Table 17. 1X and 3X Corn Rate Post

RCB; 4 reps
Variety: DK512
Planting Date: 5/13/97
EPOST: 6/10/97
POST: 6/16/97
Soil: Silty clay; 3.0% OM; 6.6 pH

Precipitation:		
EPOST	1st week	0.83 inches
	2nd week	2.05 inches
POST	1st week	1.97 inches
	2nd week	0.24 inches

COMMENTS: Purpose to evaluate crop response to postemergence corn herbicides by comparing 1X and 3X the normal rate. No visual response could be noted at three evaluaton times during the season. No differential response was apparent with the 1X rates within the statistical limits of this test. Dual applied preemergence over plot area.

Treatment	Rate/A	Yield bu/A	2 Yr Avg Yield bu/A
Check	----	138	131
POSTEMERGENCE			
Accent+COC+28% N	.67 oz+1%+4 qt	128	131
Accent+COC+28% N	2 oz+1%+4 qt	131	128
Beacon+X-77	.76 oz+.25%	136	129
Beacon+X-77	2.3 oz+.25%	126	126
2,4-D amine	.5 qt	136	127
2,4-D amine	1.5 qt	130	124
Banvel	.5 qt	130	131
Banvel	1.5 qt	110	108
Buctril	1.5 pt	138	135
Buctril	4.5 pt	139	133
Permit+X-77	.67 oz+.25%	138	129
Permit+X-77	2 oz+.25%	133	135
Exceed+COC	.8 oz+1 qt	143	---
Exceed+COC	2.4 oz+1 qt	134	---
EARLY POSTEMERGENCE			
Basis+X-77+28% N	.33 oz+.25%+2 qt	129	130
Basis+X-77+28% N	1 oz+.25%+2 qt	148	138
Basis Gold+COC+28% N	14 oz+1%+2 qt	144	---
Basis Gold+COC+28% N	42 oz+1%+2 qt	127	---
POSTEMERGENCE			
Action+COC+28% N	1.5 oz+2 pt+4 qt	145	138
Action+COC+28% N	4.5 oz+2 pt+4 qt	144	136

Table 17. 1X and 3X Corn Rate Post (Continued) . . .

Treatment	Rate/A	Yield bu/A	2 Yr Avg Yield bu/A
POSTEMERGENCE (Continued) . . .			
Hornet+X-77+28% N	4 oz+.25%+2.5%	130	---
Hornet+X-77+28% N	12 oz+.25%+2.5%	135	---
Resource+COC	5 oz+1 pt	132	---
Resource+COC	15 oz+1 pt	134	---
LSD (.05)		16	11

Table 18. 1X and 3X Soybean PPI/Pre Carryover to Corn

RCB: 4 reps
Variety: Pioneer 3559
Planting Date: 5/16/97
Soil: Silty clay; 3.5% OM; 6.6 pH

COMMENTS: Purpose to evaluate corn response to 1X and 3X soybean herbicides applied in 1996. Data report 1996 soybean yield and 1997 corn yield. No-till planting. Dual applied preemergence in 1997. Plots cultivated at lay-by. Yield variation due to soil variability in test area.

Treatment	Rate/A	1996 Soybean Yield bu/A	% VCRR Corn	1997 Corn Yield bu/A
Check	----	31	0	122
PREPLANT INCORPORATED				
Treflan	1 qt	49	0	126
Treflan	3 qt	46	8	119
Sonalan	2.67 pt	47	7	116
Sonalan	8 pt	42	7	113
Prowl	3 pt	46	3	118
Prowl	9 pt	47	12	119
Command 4L	1 qt	45	0	120
Command	3 qt	51	17	114
Broadstrike+Treflan	2.25 pt	46	0	108
Broadstrike+Treflan	6.75 pt	46	23	119
PREEMERGENCE				
Lasso	3 qt	52	0	118
Lasso	9 qt	50	2	121
Dual II	2.5 pt	51	0	121
Dual II	7.5 pt	51	0	129
Frontier 6L	2 pt	51	0	118
Frontier	6 pt	44	0	116
Sen/Lex	.67 lb	52	12	112
Sen/Lex	2 lb	34	8	119
PREPLANT INCORPORATED				
Treflan+Scepter	1 pt+.67 pt	49	17	110
Treflan+Scepter	1 pt+2 pt	49	76	68
Treflan+Pursuit 2L	1 pt+4 oz	51	7	123
Treflan+Pursuit	1 pt+12 oz	54	62	94
PREPLANT INCORPORATED & PREEMERGENCE				
Treflan&Authority	1 pt& 8 oz	54	23	122
Treflan&Authority	1 pt&24 oz	51	42	118
LSD(.05)		8	14	18

Table 19. 1X and 3X Soybean Postemergence Carryover to Corn

RCB; 4 reps
Variety: Pioneer 3559
Planting Date: 5/16/97
Soil: Silty clay loam; 3.5% OM; 6.6 pH

COMMENTS: Purpose to evaluate corn response to 1X and 3X soybean herbicides applied in 1996. Data report 1996 soybean yield and 1997 corn yield. No-till planting. Dual applied preemergence in 1997. Plots cultivated at lay-by. Pioneer 3559 planted 5/16/97. Yield variation due to soil variability in test area.

Treatment	Rate/A	1996 Soybean Yield bu/A	% VCRR Corn	1997 Corn Yield bu/A
Check	----	41	0	103
POSTEMERGENCE				
Classic+X-77	.75 oz+.25%	47	13	112
Classic+X-77	2.25 oz+.25%	46	9	110
Pinnacle+X-77	.25 oz+.25%	47	0	112
Pinnacle+X-77	.75 oz+.25%	43	13	106
Cobra+COC	.8 pt+.5 qt	50	5	108
Cobra+COC	2.4 pt+.5 qt	48	8	103
Blazer+X-77	1.5 pt+.5%	51	0	107
Blazer+X-77	4.5 pt+.5%	51	0	103
Basagran+COC	1 qt+1 qt	46	0	107
Basagran+COC	3 qt+1 qt	48	0	111
Resource+COC	.5 pt+1 qt	52	0	123
Resource+COC	1.5 pt+1 qt	51	5	116
Action+X-77+28% N	1.5 oz+.25%+4 pt	47	3	109
Action+X-77+28% N	4.5 oz+.25%+4 pt	45	8	116
FirstRate+X-77+28% N	.3 oz+.125%+2.5%	50	4	107
FirstRate+X-77+28% N	.9 oz+.125%+2.5%	51	17	103
LSD (.05)		7	20	17

Table 20. Soybean Herbicide Demonstration

Demonstration
Variety: Hefty 203
Planting Date: 5/21/97
PPI, PRE: 5/21/97
EPOST: 6/16/97
POST: 6/24/97
POST(1): 6/29/97
Soil: Silty clay; 3.4% OM; 6.2 pH

Precipitation:

PPI, PRE:	1st week	1.81 inches
	2nd week	0.04 inches
EPOS:	1st week	1.97 inches
2nd week	0.24 inches	
POST:	1st week	0.16 inches
	2nd week	0.35 inches
POST(1):	1st week	0.00 inches
	2nd week	0.43 inches

Grft = Green foxtail

COMMENTS: Light grass pressure in 1997. Greater grass pressure in chiseled seedbed; however seedbed difference did not produce a consistent trend for all similar applications.

Treatment	Rate/A	% Grft Plowed 8/15/97	% Grft Chiseled 8/15/97	% Grft 3 Yr Avg	% Grft 2 Yr Avg
Check	----	0	0	0	0
PREPLANT INCORPORATED					
Prowl+Pursuit 2L	2.1 pt+4 oz	98	92	93	91
Pursuit 2L	4 oz	97	95	91	87
Treflan	1.5 pt	95	86	92	87
Sonalan	2.67 pt	96	87	92	90
Prowl	3 pt	90	88	90	83
Treflan+Sen/Lex	1.5 pt+.5 lb	92	80	91	90
Treflan+Command 4L	1.5 pt+1.5 pt	95	78	91	85
Command 4L+Sen/Lex	1.5 pt+.33 lb	93	80	---	---
Treflan+Pursuit 2L	1.5 pt+4 oz	96	96	94	96
Broadstrike+Treflan	2 pt	88	80	89	96
Prowl+Pursuit 2L	3 pt+2 oz	78	88	86	94
Steel	3 pt	85	85	---	---
Treflan+FirstRate	1.5 pt+.75 oz	90	85	---	---
SHALLOW PREPLANT INCORPORATED					
Broadstrike+Dual	2.25 pt	75	75	84	83
Lasso+Treflan	2 qt+.5 pt	86	78	85	88
SHALLOW PREPLANT INCORPORATED & POSTEMERGENCE(1)					
Command 4L&Pursuit 2L+ Sun-It II+28% N	1.5 pt&2 oz+ 1 qt+1 qt	88	92	91	95
PREEMERGENCE & POSTEMERGENCE(1)					
Comamnd 3ME&Pursuit 2L+ Sun-It II+28% N	2 pt&4 oz+ 1.5 pt+1 qt	97	98	---	---
Command 3ME&Galaxy+ X-77+28% N	2 pt&2 pt+ .5%+2.5%	86	86	---	---

Table 20. Soybean Herbicide Demonstration (Continued) . . .

Treatment	Rate/A	% Grft Plowed 8/15/97	% Grft Chiseled 8/15/97	% Grft 3 Yr Avg	% Grft 2 Yr Avg
PREPLANT INCORPORATED & PREEMERGENCE					
Treflan+Sen/Lex&Sen/Lex	1.5 pt+.33 lb&.5 lb	98	97	96	99
Treflan&Sen/Lex	1.5 pt&.67 lb	99	98	95	97
PREPLANT INCORPORATED & POSTEMERGENCE(1)					
Prowl&Pursuit 2L+	3 pt&4 oz+				
Sun-It II+28% N	1.5 pt+1 qt	99	99	---	---
PREEMERGENCE					
Dual II+Sen/Lex	2 pt+.67 lb	98	98	92	88
Lasso	3 qt	99	99	85	83
Dual II	2.5 pt	99	98	91	63
Frontier 6L	2 pt	99	99	90	59
Pursuit 2L	4 oz	98	98	91	70
Command 3ME	2.67 pt	98	98	---	---
Lasso+Sen/Lex	2 qt+.67 lb	99	99	89	91
Lasso+Lorox	2 qt+1 qt	99	97	88	90
Axiom	22 oz	97	97	---	---
Authority+Command 3ME	8 oz+2 pt	90	94	---	---
Check	----	0	0	---	---
PREEMERGENCE & POSTEMERGENCE(1)					
Lasso&Pursuit 2L+	2 qt&4 oz+				
Sun It II+28% N	1 qt+1 qt	99	99	94	93
Lasso&Scepter+X-77	2 qt&.33 pt+.5%	97	92	92	92
Lasso&Basagran+COC	2 qt&1 qt+1 qt	99	86	88	78
Lasso&Blazer+X-77	2 qt&1.5 pt+.5%	97	95	88	92
Lasso&Stellar+COC+28% N	2 qt&5 oz+.5%+2.5%	96	88	---	---
Lasso&Cobra+COC	2 qt&.8 pt+.5 qt	92	92	86	87
Lasso&Flexstar 1.88L+	2 qt&12.25 oz+				
Sun-It II+28% N	1%+2.5%	98	98	---	---
Lasso&Galaxy+X-77+28% N	2 qt&2 pt+.5%+2.5%	96	96	91	93
Lasso&Pinnacle+X-77	2 qt&.25 oz+.25%	95	90	88	88
Lasso&Classic+X-77	2 qt&.75 oz+.25%	90	86	87	88
Lasso&Concert+X-77+28% N	2 qt&.5 oz+.25%+1 qt	90	86	87	93
Lasso&Basagran+	2 qt&1 pt+				
Pursuit 2L+COC	2 oz+1 qt	96	92	93	94
Lasso&Pinnacle+	2 qt&.25 oz+				
Pursuit 2L+X-77	3 oz+.25%	97	95	92	94
Lasso&Pursuit 2L+Cobra+	2 qt&4 oz+6 oz+				
Sun-It II+28% N	1 pt+1 qt	97	97	---	---
Lasso&Expert+X-77+28% N	2 qt&1.5 oz+.5%+2 qt	96	88	---	---

Table 20. Soybean Herbicide Demonstration (Continued) . . .

Treatment	Rate/A	% Grft Plowed 8/15/97	% Grft Chiseled 8/15/97	% Grft 3 Yr Avg	% Grft 2 Yr Avg
POSTEMERGENCE					
Poast Plus+COC	1.5 pt+1 qt	97	97	98	0
Poast Plus	1.5 pt	99	99	94	0
Option II+COC	15 oz+1 qt	99	99	96	0
Select+COC	6 oz+1 qt	99	99	96	0
Fusilade DX+COC	12 oz+1 qt	97	89	95	0
Fusion+COC	8 oz+1 qt	99	97	96	0
Assure II+COC	7 oz+1 qt	99	99	96	0
EARLY POSTEMERGENCE					
Raptor+Sun-It II+28% N	5 oz+.75 qt+1 qt	99	98	---	---
Pursuit+Sun-It II+28% N	4 oz+1 qt+1 qt	97	95	---	---
Pursuit 2L	4 oz	90	86	---	---
POSTEMERGENCE					
Poast Plus+Galaxy+COC	2.25 pt+2 pt+1 qt	98	78	92	80
LSD (.05)		---	---	8	15

Table 21. Velvetleaf Control in Soybeans

Split Block; 2 reps
Variety: Kenwood, NKS14-M7 (RR)
Planting Date: 5/15/97
PPI/PRE: 5/15/97
POST: 6/24/97
POST(1): 7/14/97
Soil: Silty clay loam; 3.0% OM; 6.9 pH
Vele = Velvetleaf

Precipitation:		
PPI/PRE:	1st week	0.00 inches
	2nd week	1.81 inches
POST:	1st week	0.16 inches
	2nd week	0.35 inches
POST (1):	1st week	0.00 inches
	2nd week	0.59 inches

COMMENTS: Dense velvetleaf pressure; some variability. Ten treatments provided greater than 95% control in 1997. Excellent performance comparisons.

Treatment	Rate/A	% Vele 8/5/97	% Vele 3 Yr Avg
Check	----	0	0
PREPLANT INCORPORATED			
Treflan+Sen/Lex	1.5 pt+.5 lb	90	77
Command 4L+Treflan	1.5 pt+1.5 pt	91	---
Command+Treflan	2 pt+1.5 pt	96	---
Prowl+Pursuit 2L	2.12 pt+4 oz	99	88
Treflan+Pursuit+Sen/Lex	1.5 pt+2 oz+.33 lb	98	92
PREPLANT INCORPORATED & POSTEMERGENCE(1)			
Treflan+Command 4L&Pursuit+ Sun-It II+28% N	1.5 pt+1 pt&2 oz+ 1 qt+1 qt	98	95
PREPLANT INCORPORATED			
Broadstrike/Treflan	2 pt	62	83
Treflan+Command 4L+Sen/Lex+ Pursuit+Scepter	1.5 pt+.5 pt+.167 lb+ 1 oz+.17 pt	99	92
Steel	3 pt	94	---
PREPLANT INCORPORATED & PREEMERGENCE			
Treflan&Sen/Lex	1.5 pt&.67 lb	84	88
Treflan+Sen/Lex&Sen/Lex	1.5 pt+.33 lb&.5 lb	99	96
SHALLOW PREPLANT INCORPORATED			
FirstRate+Treflan	.6 oz+1.5 pt	76	---
PREEMERGENCE			
Dual II+Sen/Lex	2 pt+.67 lb	88	89
Lasso+Pursuit	2 qt+4 oz	92	90
Lasso+Lorox	2 qt+2 lb	58	50
PREPLANT INCORPORATED & PREEMERGENCE			
Treflan&Command 3ME	1.5 pt&2.67 pt	98	---

Table 21. Velvetleaf Control in Soybeans (Continued) . . .

Treatment	Rate/A	% Vele 8/5/97	% Vele 3 Yr Avg
PREPLANT INCORPORATED & POSTEMERGENCE			
Treflan&Blazer+28% N	1.5 pt&1.5 pt+4 qt	52	64
Treflan&Galaxy+28% N	1.5 pt&1 qt+4 qt	86	87
Treflan&Basagran+28% N	1.5 pt&1 qt+4 qt	**74**	**89**
PREPLANT INCORPORATED & POSTEMERGENCE(1)			
Treflan&Basagran+28% N	1.5 pt&1 qt+4 qt	62	73
PREPLANT INCORPORATED & POSTEMERGENCE & POSTEMERGENCE(1)			
Treflan&Basagran+28% N& Basagran+28% N	1.5 pt&1 pt+4 qt& 1 pt+4 qt	92	95
PREPLANT INCORPORATED & POSTEMERGENCE			
Treflan&Cobra+COC	1.5 pt&.8 pt+.5 qt	56	58
Treflan&Classic+28% N	1.5 pt&.75 oz+4 qt	33	54
Treflan&Concert+X-77+28% N	1.5 pt&.5 oz+.125%+1 qt	74	61
Treflan&Pursuit 2L+Sun-It II+28% N	1.5 lb&4 oz+1 qt+4 qt	81	90
Treflan&Pursuit+Sun-It II+28% N	1.5 lb&2 oz+1 qt+4 qt	44	---
Treflan&Basagran+Pursuit 2L+ COC+28% N	1.5 pt+1 pt+2 oz+ 1 qt+4 qt	75	87
Treflan&Pursuit 2L+Cobra+ Sun-It II+28% N	1.5 pt&4 oz+4 oz+ 1 qt+4 qt	82	86
Treflan&Action+COC	1.5 pt&1.5 oz+1 qt	99	99
Treflan&Resource+COC	1.5 pt&4 oz+1 qt	44	75
Treflan&Stellar+COC	1.5 pt&5 oz+.5 qt	74	71
Treflan&Expert+X-77+28% N	1.5 pt&1.5 oz+.25%+4 pt	67	---
Treflan&FirstRate+X-77+28% N	1.5 pt&.3 oz+.125%+2.5%	69	---
Treflan&Raptor+Sun-It II+28% N	1.5 pt&5 oz+1.5 pt+1 qt	89	---
PREPLANT INCORPORATED & POSTEMERGENCE(1)			
Treflan&Action+COC	1.5 pt&1.5 oz+1 qt	96	---
Treflan&Resource+COC	1.5 pt&4 oz+1 qt	76	---
Treflan&Resource+COC	1.5 pt&8 oz+1 qt	88	---
Check	----	0	---
PREPLANT INCORPORATED & POSTEMERGENCE			
Treflan&Roundup Ultra+AMS	1.5 pt&1 pt+8.5 lb/100 gal	69	---
Treflan&Roundup Ultra+AMS	1.5 pt&1 qt+8.5 lb/100 gal	79	---
PREPLANT INCORPORATED & POSTEMERGENCE(1)			
Treflan&Roundup Ultra+AMS	1.5 pt&1 pt+8.5 lb/100 gal	70	---
Treflan&Roundup Ultra+AMS	1.5 pt&1 qt+8.5 lb/100 gal	61	---
PREPLANT INCORPORATED & POSTEMERGENCE & POSTEMERGENCE(1)			
Treflan&Roundup Ultra+AMS& Roundup Ultra+AMS	1.5 pt&1.5 pt+8.5 lb/100 gal& 1 pt+8.5 lb/100 gal	99	---
LSD (.05)		18	14

Table 22. Cocklebur Soybean Demonstration

RCB; 2 reps
Variety: Hefty 203
PPI/PRE: 5/21/97
POST: 6/17/97
LPOST: 6/24/97
Soil: Loam; 2.4% OM; 7.0 pH
Cocb = Common cocklebur

Precipitation:

PPI/PRE:	1st week	1.81 inches
	2nd week	0.04 inches
POST:	1st week	2.05 inches
	2nd week	0.16 inches
LPOST:	1st week	0.16 inches
	2nd week	0.35 inches

COMMENTS: Extreme weed pressure. Excellent treatment response. Six treatments provided greater than 90% control for the 3-year average.

Treatment	Rate/A	% Cocb 7/17/97	% Cocb 10/6/97	% Cocb 3 Yr Avg
Check	----	0	0	0
PREPLANT INCORPORATED				
Steel	3 pt	80	73	--
Broadstrike+Treflan	2.25 pt	53	50	47
Pursuit 2L+Command 4L	4 oz+1.5 pt	30	30	--
PREPLANT INCORPORATED & PREEMERGENCE				
Sen/Lex&Sen/Lex	.5 lb&.33 lb	43	40	56
PREPLANT INCORPORATED				
Pursuit 2L+Command 4L	4 oz+1.5 pt	30	30	---
POSTEMERGENCE				
Basagran+COC	1 qt+1 qt	96	75	90
POSTEMERGENCE & LATE POSTEMERGENCE				
Basagran+COC&Basagran+COC	1 pt+1 qt&1 pt+1 qt	99	96	97
POSTEMERGENCE				
Cobra+COC+28% N	.8 pt+.5 qt+4 qt	93	62	85
Blazer+X-77	1.5 pt+.5%	86	65	67
Classic+X-77	.75 oz+.125%	99	98	98
Pursuit 2L+Sun-It II+28% N	4 oz+1 qt+1 qt	99	96	98
Concert+X-77	.5 oz+.125%	88	78	83
Scepter+X-77	.33 pt+.25%	98	98	94
Basagran+Pursuit+COC+28% N	1 pt+2 oz+1 qt+2 qt	96	86	92
Basagran+COC	1 pt+1 qt	62	46	67
Pursuit 2L+Sun-It II+28% N	2 oz+1 qt+1 qt	96	67	83
Raptor+Sun-It II+28% N	5 oz+1.5 pt+1 qt	95	80	---
FirstRate+X-77+28% N	.3 oz+.125%+2.5%	99	99	---
Expert+X-77+28% N	1.5 oz+.25%+4 pt	93	81	---
Stellar+COC	7 oz+1 pt	95	79	---
LSD (.05)		11	12	11

Table 23. Common Waterhemp Control in Soybeans

RCB: 4 reps
Variety: Hefty 203
Planting Date: 6/4/97
PPI/PRE: 6/4/97
POST: 7/14/97
Soil: Silty clay; 3.3% OM; 7.2 pH
Grft = Green foxtail
Cowh = Common waterhemp

Precipitation:

PPI/PRE:	1st week	0.28 inches
	2nd week	0.55 inches
POST:	1st week	0.00 inches
	2nd week	0.59 inches

COMMENTS: Some variability in waterhemp emergence. Grass pressure influenced waterhemp emergence. Reduced grass control with Treflan noted in test area. Postemerge Cobra, Galaxy, Blazer or Status provided over 95% common waterhemp control in selected treatments.

Treatment	Rate/A	% Grft 8/7/97	% Cowh 8/7/97
Check	----	0	0
PREPLANT INCORPORATED			
Treflan	1.5 pt	34	68
Treflan+Sen/Lex	1.5 pt+.5 lb	52	63
PREEMERGENCE			
Command+Authority	1.5 pt+.5 lb	87	97
PREPLANT INCORPORATED & POSTEMERGENCE			
Treflan&Galaxy+X-77	1.5 pt&2 pt+.5%	65	93
Treflan&Blazer+X-77	1.5 pt&12 oz+.5%	73	77
Treflan&Blazer+X-77	1.5 pt&1.5 pt+.5%	68	91
POSTEMERGENCE			
Blazer+X-77	1.5 pt+.5%	35	85
Pursuit+Sun-It II+28% N	4 oz+1 qt+1 qt	60	56
PREPLANT INCORPORATED & POSTEMERGENCE			
Treflan&Cobra+COC	1.5 pt&.8 pt+1 pt	70	90
POSTEMERGENCE			
Blazer+X-77	1.5 pt+.5%	23	98
Pursuit DG+Status+Sun-It II+28% N	1.44 oz+12 oz+1.5 pt+1 qt	41	86
PREPLANT INCORPORATED & POSTEMERGENCE			
Treflan&Action+X-77+28% N	1.5 pt&1.5 oz+.25%+2 qt	95	47
Treflan&Expert+COC	1.5 pt&1.5 oz+2 pt	82	74
Treflan&FirstRate+X-77+28% N	1.5 pt&.3 oz+.125%+2.5%	56	45
LSD (.05)		10	11

Table 24. Preemergence Weed Control in Soybeans

RCB; 4 reps
Variety: Hefty 203
Planting Date: 6/4/97
PRE: 6/4/97
Soil: Silty clay; 3.3% OM; 7.2 pH

Precipitation: 1st week 0.28 inches
2nd week 0.55 inches

Grft = Green foxtail
Cowh = Common waterhemp

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

COMMENTS: Heavy foxtail pressure. Grass control was somewhat variable but unsatisfactory for several treatments. Full preemergence grass herbicide rates were required for the most effective control. Common waterhemp control was very good. Excellent yield response even for marginal treatments.

Treatment	Rate/A	% Grft 8/5/97	% Cowh 8/5/97	% VCRR 10/7/97	% Grft 10/7/97	% Cowh 10/7/97	Yield bu/A
Check	-----	0	0	0	0	0	14
PREEMERGENCE							
Turbo	2.25 pt	80	98	0	83	96	40
Turbo+Dual II	1.67 pt+1 pt	88	99	0	82	97	42
Turbo+Dual II	1.4 pt+1 pt	77	98	0	76	90	38
Dual II Magnum+Cover	.5 pt+4.25 oz	46	99	0	65	94	35
Dual II Magnum+Cover	.5 pt+5.33 oz	35	99	0	57	98	34
Dual II Magnum+Cover	.5 pt+8 oz	58	99	0	66	96	41
Dual II Magnum+Cover	1 pt+4.25 oz	44	98	0	62	96	35
Dual II Magnum+Cover	1 pt+5.33 oz	51	99	0	72	98	38
Dual II Magnum+Cover	1 pt+8 oz	64	99	0	79	97	42
Cover	4.25 oz	14	99	0	44	88	30
Cover	5.33 oz	28	99	0	48	96	30
Cover	8 oz	63	99	0	66	98	36
Dual II Magnum	.5 pt	6	10	0	40	19	19
Dual II Magnum	1 pt	47	5	0	56	19	26
LSD (.05)		25	4	0	15	10	4

Table 25. Herbicide Tolerant Soybeans

Demonstration	Precipitation:			
Variety: See comments	PPI/PRE:	1st week	1.81 inches	
PPI/PRE: 5/21/97		2nd week	0.04 inches	
POST: 7/2/97	POST:	1st week	0.35 inches	
LPOST: 7/14/97	2nd week	0.08 inches		
Soil: Silty clay; 3.4% OM; 6.2 pH	LPOST:	1st week	0.00 inches	
		2nd week	0.59 inches	

Treatment	Rate/A	% Fxtl SE Farm 1997	% Bdlf SE Farm 1997
CHECK - STS SOYBEANS	----	0	0
POSTEMERGENCE			
Reliance STS+Assure II+	.5 oz+7 oz+		
COC+28% N	1%+2 qt	84	99
PREEMERGENCE & POSTEMERGENCE			
Dual II&Reliance STS+	2.5 pt&.5 oz+		
COC+28% N	1%+2 qt	88	98
PREPLANT INCORPORATED & POSTEMERGENCE			
Treflan&Reliance STS+	1.5 pt&.5 oz+		
COC+28% N	1%+2 qt	85	99
Treflan&Reliance STS+	1.5 pt&1 oz+		
COC+28% N	1%+2 qt	83	99
PREEMERGENCE & POSTEMERGENCE			
Cover&Reliance STS+Assure II+	4 oz&.5 oz+7 oz+		
COC+28% N	1%+2 qt	87	99
PREPLANT INCORPORATED & POSTEMERGENCE			
Cover+Treflan&Reliance STS+	4 oz+1.5 pt&.5 oz+		
COC+28% N	1%+2 qt	89	99

Table 26. Tank-Mixes in Roundup Ready Soybeans

RCB; 4 reps
Variety: NK S14-M7 (RR)
Planting Date: 6/4/97
PRE: 6/4/97
POST: 7/14/97
Soil: Silty clay; 3.3% OM; 7.2 pH
Grft=Green foxtail
Cowh=Common waterhemp

Precipitation:

PRE	1st week	0.28 inches
	2nd week	0.55 inches
POST	1st week	0.00 inches
	2nd week	0.59 inches

COMMENTS: Wet field site delayed planting. Roundup Ready soybeans for all treatments. Minimal precipitation first two weeks after planting. Roundup post and Dual preemergence treatments provided very good yellow foxtail control. Residual herbicide provided better waterhemp control than a single Roundup application in this test.

Treatment	Rate/A	% Grft 8/5/97	% Grft 10/7/97	% Cowh 10/7/97	Yield bu/A
Check	----	0	0	0	7
PREEMERGENCE & POSTEMERGENCE					
Broadstrike+Dual&Expert+ Action+COC+28% N	2.25 pt&1.5 oz+ 1.2 oz+1 pt+4 pt	85	79	98	23
Broadstrike+Dual&Expert+ Cobra+COC+28% N	2.25 pt&1.5 oz+ 6 oz+1 pt+1 pt	91	86	95	19
Broadstrike+Dual&Expert+ Blazer+COC+28% N	2.25 pt&1.5 oz+ .5 pt+1 pt+1 pt	90	86	98	26
Broadstrike+Dual&Expert+ Reflex+COC+28% N	2.25 pt&1.5 oz+ .5 pt+1 pt+1 pt	88	84	97	26
Prowl&Pursuit DG+ COC+28% N	2.4 pt&1.44 oz+ 2 pt+4 pt	50	58	33	14
Prowl&Pursuit DG+ Pinnacle+COC+28% N	2.4 pt&1.44 oz+ .2 oz+2 pt+4 pt	47	52	89	14
Prowl&Pursuit DG+ Cobra+COC+28% N	2.4 pt&1.44 oz+ 6 oz+1 pt+4 pt	44	32	92	11
POSTEMERGENCE					
Roundup Ultra	1.5 pt	99	98	80	25
Expert+Roundup Ultra+X-77	1.5 oz+.75 pt+.25%	97	98	71	23
Expert+Roundup Ultra+ X-77+AMS	1.5 oz+.75 pt+ .25%+2.5 lb	96	98	84	24
PREEMERGENCE & POSTEMERGENCE					
Prowl&Roundup Ultra	2.4 pt&1 pt	96	96	74	21
LSD (.05)		12	9	14	5

Table 27. Foxtail Removal Timing in Soybeans

RCB; 4 reps
Variety: Roundup Ready
Planting Date: 6/4/97
PPI/PRE: 6/4/97
2 WKS: 6/17/97
3 WKS: 6/25/97
4 WKS: 7/2/97
5 WKS: 7/14/97
6 WKS: 7/24/97
Soil: Silty clay loam; 2.9% OM; 6.2 pH

Precipitation:

PPI/PRE	1st week	0.28 inches
	2nd week	0.55 inches
2 WKS	1st week	2.05 inches
	2nd week	0.16 inches
3 WKS	1st week	0.16 inches
	2nd week	0.35 inches
4 WKS	1st week	0.35 inches
	2nd week	0.08 inches
5 WKS	1st week	0.55 inches
	2nd week	0.04 inches

Grft = Green foxtail
Cowh = Common waterhemp

COMMENTS: Purpose to evaluate timing of postemergence herbicide on weed control and yield. Timing based on planting date. Moderately heavy foxtail pressure. Post treatments applied 3 or 4 weeks after planting produced the highest yield. Foxtail control appeared to be a greaterfactor for yield than common waterhemp. Soil treatments were less effective than expected for most situations.

Treatment	Rate/A	% Grft 8/7/97	% Cowh 8/7/97	% Grft 10/7/97	% Cowh 10/7/97	Yield bu/A
Check	----	0	0	0	0	16
PREPLANT INCORPORATED						
Treflan	1.5 pt	56	71	58	73	28
PREEMERGENCE						
Dual II	2.5 pt	53	54	60	40	27
POSTEMERGENCE						
Roundup Ultra+AMS	1 qt+8.5 lb/100 gal					
2 weeks		28	59	33	44	25
3 weeks		82	59	80	59	38
4 weeks		98	94	97	91	40
5 weeks		99	99	99	98	29
6 weeks		99	98	98	98	25
LSD (.05)		17	9	9	17	6

Table 28. Weed Removal Timing in Roundup Ready Soybeans

RCB; 4 reps
Variety: Roundup Ready
Planting Date: 6/4/97
PPI: 6/4/97
EPOST: 6/17/97
POST(1): 6/25/97
POST(2): 7/14/97
POST(3): 7/24/97
Soil: Silty clay loam; 2.9% OM; 6.2 pH
Grft = Green foxtail
Cowh = Common waterhemp

Precipitation:		
PPI:	1st week	0.28 inches
	2nd week	0.55 inches
EPOST:	1st week	2.05 inches
	2nd week	0.16 inches
POST(1):	1st week	0.16 inches
	2nd week	0.35 inches
POST(2):	1st week	0.00 inches
	2nd week	0.59 inches
POST(3):	1st week	0.55 inches
	2nd week	0.04 inches

COMMENTS: All split timing and preplant treatments provided excellent weed control and produced the highest yield. No crop injury apparent based on yield. Yield for late timing was similar to check. Excellent comparisons to demonstrate effect of timing of weed removal and comparison of preplant and postemergence systems.

Treatment		Rate/A	% Grft 7/2/97	% Cowh 7/2/97	% Grft 7/24/97	% Cowh 7/24/97	% Grft 8/5/97	% Cowh 8/5/97	Yield bu/A
PREPLANT INCORPORATED									
Pursuit Plus		2.5 pt	98	98	97	97	96	96	41
PREPLANT INCORPORATED & POSTEMERGENCE									
Pursuit Plus&		2.5 pt&							
Roundup Ultra		1 qt							
EPOST	POST2								
POST1	POST3		99	99	99	99	99	99	40
Roundup Ultra		1 qt							
EPOST	POST2								
POST1	POST3		99	99	99	99	99	99	39
Roundup Ultra		1 qt							
POST1	POST3								
POST2			98	98	99	99	99	99	40
Roundup Ultra		1 qt							
POST1			97	97	73	71	69	68	36
Roundup Ultra		1qt							
POST3			---	---	---	--	99	99	23
Check		-----	0	0	0	0	0	0	19
Roundup Ultra		1 qt							
EPOST									
POST2			73	71	99	99	99	99	38
PREPLANT INCORPORATED & POSTEMERGENCE									
Pursuit Plus&		2.5 pt&							
Roundup Ultra	POST1	1 qt	98	99	96	98	93	98	37
LSD (.05)			4	3	4	3	7	6	4

Table 29. 1X and 3X Soybean Rate PPI/Pre

RCB; 4 reps
Variety: Hefty 203
Planting Date: 5/21/97
PPI/PRE: 5/21/97
Soil: Silty clay; 3.5% OM; 6.6 pH

Precipitation: 1st week 1.81 inches
2nd week 0.04 inches

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

COMMENTS: Purpose to evaluate crop response to X and 3X normal herbicide rates. Visual response (VCRR) primarily stunting; ratings greater than 25% usually would be apparent on a field basis. Some variability in yield; several 3X rates tended to yield less than labeled X rates for the 2-year average; however overall tolerance under 1997 conditions appeared very good.

				2-Yr Avg	
Treatment	Rate/A	% VCRR 7/16/97	Yield bu/A	% VCRR	Yield bu/A
Check	----	0	20	0	25
PREPLANT INCORPORATED					
Treflan	1 qt	9	34	4	42
Treflan	3 qt	13	33	17	40
Sonalan	2.67 pt	9	36	4	42
Sonalan	8 pt	16	33	19	38
Prowl	3 pt	0	31	0	38
Prowl	9 pt	5	37	7	41
Command 4L	1 qt	4	39	2	42
Command	3 qt	4	39	3	45
Broadstrike+Treflan	2.25 pt	14	43	8	45
Broadstrike+Treflan	6.75 pt	20	37	22	41
Treflan+Scepter	1 pt+.67 pt	10	39	6	44
Treflan+Scepter	1 pt+2 pt	19	36	19	42
PREPLANT INCORPORATED & PREEMERGENCE					
Treflan&Authority	1 pt&8 oz	0	41	2	48
Treflan&Authority	1 pt&24 oz	10	39	9	45
PREEMERGENCE					
Frontier 6L	2 pt	0	35	3	43
Frontier	6 pt	16	35	16	40
Sen/Lex	.67 lb	6	32	3	42
Sen/Lex	2 lb	24	35	33	37
LSD (.05)		10	7	7	5

Table 30. 1X and 3X Soybean Rate Post

RCB; 4 reps
Variety: Hefty 203
Planting Date: 5/21/97
POST: 6/24/97
Soil: Silty clay; 3.5% OM; 6.6 pH

Precipitation: 1st week 0.16 inches
2nd week 0.35 inches

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

COMMENTS: Dual was applied over entire area on 5/22/97. Purpose to evaluate crop tolerance to postemergence herbicides using X and 3X normal use rates. Visual response (VCRR) ratings were within acceptable limits for all treatments. Yields were not statistically different from the check. Treatments had excellent tolerance under 1997 conditions.

Treatment	Rate/A	% VCRR 7/16/97	Yield bu/A
Check	----	0	39
POSTEMERGENCE			
Classic+X-77	.75 oz+.25%	3	40
Classic+X-77	2.25 oz+.25%	1	40
Pinnacle+X-77	.25 oz+.25%	1	43
Pinnacle+X-77	.75 oz+.25%	8	40
Cobra+COC	.8 pt+.5 qt	9	41
Cobra+COC	2.4 pt+.5 qt	11	40
Blazer+X-77	1.5 pt+.5%	0	42
Blazer+X-77	4.5 pt+.5%	4	42
Basagran+COC	1 qt+1 qt	3	44
Basagran+COC	3 qt+1 qt	3	42
Resource+COC	.5 pt+1 qt	0	42
Resource+COC	1.5 pt+1 qt	5	42
Action+X-77+28% N	1.5 oz+.25%+4 pt	4	40
Action+X-77+28% N	4.5 oz+.25%+4 pt	3	46
FirstRate+X-77+28% N	.3 oz+.125%+2.5%	0	45
FirstRate+X-77+28% N	.9 oz+.125%+2.5%	3	44
Pursuit 2L+Sun-It II+28% N	4 oz+1.5 pt+1 qt	0	44
Pursuit+Sun-It II+28% N	12 oz+1.5 pt+1 qt	8	41
Raptor+Sun-It II+28% N	5 oz+1.5 pt+1 qt	8	41
Raptor+Sun-It II+28% N	15 oz+1.5 pt+1 qt	18	39
LSD (.05)		6	4

Table 31. 1X and 3X Corn Carryover to Soybeans

RCB; 4 reps
Variety: DK 228
Planting Date: 5/21/97
Soil: Silty clay; 3.7% OM; 6.4 pH

COMMENTS: Purpose to evaluate soybean response to 1X and 3X herbicides applied to corn the previous year. Data reported for 1996 corn yield and 1997 soybean yield. Weeds were not a factor in 1997; no significant yield differences measured in 1997.

Treatment	Rate/A	1996 Corn Yield bu/A	1997 Soybean Yield bu/A
Check	----	122	25
POSTEMERGENCE			
Accent+COC+28% N	.67 oz+1%+4 qt	135	32
Accent+COC+28% N	2 oz+1%+4 qt	126	34
Beacon+X-77	.76 oz+.25%	122	31
Beacon+X-77	2.3 oz+.25%	126	35
2,4-D amine	.5 qt	119	35
2,4-D amine	1.5 qt	119	34
Banvel	.5 qt	129	30
Banvel	1.5 qt	106	31
Buctril	1.5 pt	126	31
Buctril	4.5 pt	127	33
Permit+X-77	.67 oz+.25%	119	31
Permit+X-77	2 oz+.25%	136	32
Exceed+COC	1 oz+1 qt	118	32
Exceed+COC	3 oz+1 qt	122	35
Basis+X-77+28% N	.33 oz+.25%+2 qt	130	34
Basis+X-77+28% N	1 oz+.25%+2 qt	128	32
Action+COC+28% N	1.5 oz+2 pt+4 qt	132	31
Action+COC+28% N	4.5 oz+2 pt+4 qt	119	31
Scorpion III+X-77+28% N	4 oz+.25%+2.5%	128	31
Scorpion III+X-77+28% N	12 oz+.25%+2.5%	123	29
LSD (.05)		16	6

Table 32. No-Till Soybean Burndown with Select

RCB; 3 reps	Precipitation:	1st week	0.28 inches
EPP: 6/4/97		2nd week	0.55 inches
Soil: Silty clay; 3.5% OM; 6.6 pH			

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

COMMENTS: Purpose to evaluate burndown treatments for no-till soybeans. Data for burndown performance indicate excellent control for all treatments. Pursuit+Cobra broadcast postemergence over plot area after burndown evaluations.

Treatment	Rate/A	% Grft 6/16/97	% Colq 6/16/97	% Grft 8/7/97	% Cowh 8/7/97
Check	----	0	0	0	0
EARLY PREPLANT					
Select+2,4-D ester+COC+28% N	3 oz+1 pt+1 qt+1 qt	93	98	88	99
Select+2,4-D ester+COC+28% N	4 oz+1 pt+1 qt+1 qt	89	92	93	99
Select+2,4-D ester+COC+28% N	6 oz+1 pt+1 qt+1 qt	96	92	92	99
Select+Prowl+2,4-D ester+ COC+28% N	3 oz+2.5 pt+1 pt+ 1 qt+1 qt	93	94	99	99
Select+Prowl+2,4-D ester+ COC+28% N	4 oz+2.5 pt+1 pt+ 1 qt+1 qt	91	96	98	99
Select+Sen/Lex+COC+28% N	3 oz+3 oz+1 qt+1 qt	97	86	96	99
Select+Sen/Lex+COC+28% N	4 oz+3 oz+1 qt+1 qt	87	83	89	99
Roundup Ultra+2,4-D ester+AMS	1 pt+1 pt+17 lb/100 gal	96	99	95	99
LSD (.05)		10	8	7	.5

Table 33. No-Till Soybeans in Stubble Demonstration

RCB; 2 reps	Precipitation:			
Variety: Stine 186RR	PRE		1st week	0.04 inches
Planting Date: 5/22/97			2nd week	0.83 inches
FALL: 11/12/97	POST		1st week	1.97 inches
EPP: 4/25/97			2nd week	0.24 inches
PRE: 5/31/97				
POST: 6/16/97				
Soil: Silty clay loam; 3.2% OM; 6.6 pH				

Grft=Green foxtail
Cowh=Common waterhemp

COMMENTS: Wet conditions delayed planting. Roundup burndown applied to stubble in late fall.

Table 34. No-Till Corn Demonstration

RCB; 2 reps	Precipitation:			
Variety: Legend 7595IT	PRE		1st week	1.81 inches
Planting Date: 5/21/97			2nd week	0.04 inches
FALL: 11/12/96	EPOST		1st week	1.97 inches
EPP: 4/25/97			2nd week	0.24 inches
PRE: 5/22/97	POST		1st week	0.16 inches
EPOST: 6/16/97	2nd week	0.35 inches		
POST: 6/24/97				
Soil: Silty clay loam; 3.2% OM; 6.6 pH				

Fisb=Field sandbur
Grft=Green foxtail
Cowh=Common waterhemp

COMMENTS: Heavy extended season grass pressure. Sandbur variable. Few treatments provided satisfactory control of both foxtail and broadleaf weeds. Sandbur rated on plot margin where infestation was heavy. Evaluation represents weed control in late-season; flushes at mid-season were heavier than usual.

Table 33. No-Till Soybeans in Stubble Demonstration

FALL	EARLY PREPLANT	PREEEMERGENCE	POSTEMERGENCE	% Grft 9/11/97	% Cowh 9/11/97	2 Yr Avg % Grft	2 Yr Avg % Cowh
Pursuit DG(1.44 oz)+ Prowl(2.1 pt)				87	20	84	40
Pursuit DG(1.44 oz)				81	35	75	45
Preview(.56 lb)+ Dual II(2.75 pt)				69	91	65	94
	Pursuit DG(1.44 oz)+ Prowl(3.65 pt)			98	97	98	97
	Pursuit Plus(2.5 pt)+ Scepter(.33 pt)			95	83	96	91
	Broadstrike+Dual(2.5 pt)			81	98	90	98
	Pursuit DG(1.44 oz)			94	30	91	48
	Prowl(3.65 pt)		Pursuit DG(1.44 oz)+ Sun-It II(1 qt)+ 28% N(1 qt)	99	86	99	92
	Prowl(3.65 pt)		Pursuit DG(.72 oz)+ Sun-It II(1 qt)+ 28% N(1 qt)	99	95	99	92
		Roundup Ultra(.75 pt)+ AMS(8.5 lb/100 gal)+ 2,4-D ester(.5 pt)	Pursuit DG(1.44 oz)+ Sun-It II(1 qt)+ 28% N(1 qt)	90	78	---	---
			Pursuit DG(1.44 oz)+ Sun-It II(1 qt)+ 28% N(1 qt)	98	25	97	55
		Select(4 oz)+ 2,4-D ester(1 pt)	Poast Plus(2.25 pt)+ Galaxy(1 qt)+ COC(1 qt)	85	80	---	---
			Poast Plus(2.25 pt)+ Galaxy(1 qt)+ COC(1 qt)	72	60	---	---
	Prowl(3.65 pt)+		Reliance STS(.5 oz)+ COC(.5%)+ 28% N(2 qt)	98	99	---	---

Table 33. No-Till Soybeans in Stubble Demonstration (Continued) . . .

FALL	EARLY PREPLANT	PREEEMERGENCE	POSTEMERGENCE	% Grft 9/11/97	% Cowh 9/11/97	2 Yr Avg % Grft	2 Yr Avg % Cowh
		Cover(4 oz)+ Roundup Ultra(1 pt)+ AMS(8.5 lb/100 gal)	COC(.5%)+ 28% N(2 qt)	98	99	---	---
			Poast Plus(2.25 pt)+ Reliance STS(.5 oz)+ COC(.5%)+ 28% N(2 qt)	90	77	---	---
	Prowl(3.65 pt)			64	40	---	---
			Roundup Ultra(2 pt)+ AMS(8.5 lb/100 gal)	86	64	---	---
			Roundup Ultra(1.5 pt)+ AMS(8.5 lb/100 gal)	85	30	---	---
LSD (.05)						13	34

Table 34. No-Till Corn Demonstration

FALL	EARLY PREPLANT	PREEMERGENCE	EARLY POSTEMERGENCE	POSTEMERGENCE	% Fisb 9/11/97	% Grft 9/11/97	% Cowh 9/11/97	2 Yr Avg % Grft	2 Yr Avg % Cowh
Atrazine(1.1 lb)+ Dual II(2.75 pt)					35	80	82	77	88
Atrazine(1.1 lb)	Dual II(2.75 pt)				55	94	85	84	95
Dual II(2.75 pt)			Marksman(2.5 pt)		50	90	80	---	---
Micro-Tech(3.25 qt)		Marksman(2.5 pt)		40	94	82	---	---	
TopNotch(6 pt)			Marksman(2.5 pt)		44	96	88	---	---
	Atrazine(1.1 lb)+ Dual II(2.75 pt)				52	90	83	86	94
	Atrazine(1.1 lb)+ MicroTech(3.25 qt)				40	80	76	79	89
	Atrazine(1.1 lb)+ Frontier 6L(1 qt)				30	84	75	77	90
	Atrazine(1.1 lb)+ TopNotch(6 pt)				50	95	82	84	97
	Atrazine(1.1 lb)+ Harness(2.75 pt)				45	55	78	---	---
	Atrazine(1.1 lb)	Dual II(2.75 pt)			54	94	86	---	---
	Atrazine(1.1 lb)	Frontier(1 qt)			30	85	77	---	---
	Atrazine(1.1 lb)	Harness(2.75 pt)			48	87	79	---	---
	Atrazine(1.1 lb)		Resolve SG(5.3 oz)+ X-77(.25%)+ 28% N(2 qt)		60	94	85	91	96
			Lightning(1.28 oz)+ atrazine(.56 lb)+ Sun-It II(1.5 pt)+ 28% N(1 qt)		76	65	91	---	---
	Extrazine II(2.2 lb)		Extrazine II(2.2 lb)+ Veg Oil(1 qt)		75	95	91	94	97
		Roundup Ultra(1 pt)+ AMS(8.5 lb)+ Harness(2.25 pt)+ atrazine(1.1 lb)			30	98	80	---	---

Table 34. No-Till Corn Demonstration (Continued) . . .

FALL	EARLY PREPLANT	PREEMERGENCE	EARLY POSTEMERGENCE	POSTEMERGENCE	% Fisb 9/11/97	% Grft 9/11/97	% Cowh 9/11/97	2 Yr Avg % Grft	2 Yr Avg % Cowh
		Roundup Ultra(1 pt)+ AMS(8.5 lb)+ Balance(1.5 oz)+ TopNotch(2.5 pt)		Buctril(1 pt)+ atrazine(.55 lb)	85	91	93	---	---
		Gramoxone Extra(1.6 pt)+ X-77(.5%)	Prowl(2.75 pt)+ Accent(.33 oz)+ Beacon(.38 oz)+ X-77(.25%)+ 28% N(4 qt)		88	99	97	97	99
LSD (.05)								10	11

FEEDING FIELD PEAS TO CATTLE

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Field peas are commonly grown for human consumption. However, quality problems can make them available at times for feeding to livestock. As a result, feeding value puts a floor under the economic value of field peas. Feeding value is a function primarily of protein and energy content. Field peas contain a moderate amount of protein (20 - 29%). Additionally, they are high in starch (41 - 54%) and low in fiber (< 9%), suggesting a high energy content.

Little research has been conducted to evaluate peas as feed for cattle. North Dakota State University recently conducted two studies in which peas replaced barley and soybean meal in diets for 500-600 lb. calves (24 - 54% forage). In the first study, peas were included at 20% of the diet, whereas they were included at 9% in the second. While the results were mixed, the feeding value of peas appeared to be high; at least equal to the barley and soybean meal that was replaced. Similar conclusions have been drawn from Canadian studies conducted with 150-lb dairy calves as well as high producing dairy cows during lactation.

Because no information has been available regarding field peas in high concentrate, finishing diets for yearling cattle, a study was conducted at the Southeast South Dakota Research Farm to address this question.

Yearling steers were allotted to pens (11 head per pen, 6 pens per treatment) and assigned to 90% concentrate diets without or with 10% peas (Table 1). Peas were fed whole (no processing) and replaced soybean meal and corn such that the diets contained similar amounts of protein (12.6%). Peas were supplied by the Dakota Lakes Field Station and their composition is presented in Table 2.

The steers were fed for 97 days. Performance data are presented in Table 3. Average daily gain of the steers fed the pea diet did not differ from the controls. However, they tended to consume less feed dry matter and, as a result, were 6% more efficient in converting feed to body weight. Based on performance, field peas were a good alternative source of protein and appear to contain more energy than corn.

Feeds like field peas are often compared to competing feeds based on price per unit of protein supplied. For example, if soybean meal (44% protein "as is") cost $240 per ton, field peas at 22.5% protein would be worth $120 per ton (50% of soybean meal). If the protein content of the peas is only 18.8%, then it would be worth $101 per ton (42% of soybean meal). The cost per pound of protein would be $0.27 in each case.

However, the above approach gives no credit for the additional energy field peas have compared to soybean meal. While this omission has little impact on the competitive price of field peas for grass cattle, it can be important in higher energy growing and finishing diets. A series of diets were formulated with a computerized "least-cost" program so that protein and energy could be simultaneously considered.

Corn, alfalfa and soybean meal prices "in the bunk" were assumed to be $2.50/bushel, $80/ton and $240/ton, respectively. In this scenario, peas containing 18.8% protein ("as is") and energy equal to corn would be worth $130/ton in growing and finishing diets compared to $101/ton when priced only on protein content. Likewise, if they contained 22.5% protein and energy equal to corn, they would be worth $142/ton compared to $120/ton based on protein content alone. The assumption that energy content of peas is equal to corn is conservative and, as a result, so are the price comparisons.

Field peas can be used effectively as a source of protein and energy in high concentrate, finishing diets for yearlings. Depending on composition, field peas are worth at least 54% the price of soybean meal.

Table 1. Diets (DM Basis)

	Control	Peas
	- - - - - - - - - %	- - - - - - - - - -
Dry Corn	38.9	35.3
HM Corn	34.5	32.3
Silage	20.0	20.0
Soybean Meal	4.0	--
Peas	--	10.0
Supplement	2.6	2.4

Table 2. Pea Composition
(DM Basis)

Protein	24.7
Fat	1.4
Fiber	6.9
Ash	3.3
Ca	0.08
P	0.48

Table 3. Yellow Field Peas in Finishing Diets

Item	Control	Peas	Pr >F[1]
Initial Wt., lb	774	774	0.94
Final Wt., lb	1172	1182	0.29
DM Intake, lb	20.9	20.2	0.13
Daily Gain, lb	4.1	4.2	0.19
Feed:Gain	5.1	4.8	0.004

[1] The probability of treatments not being significantly different.

EARLY-WEANING OF SINGLE SOURCE AND COMMINGLED PIGS: EFFECT ON GROWTH PERFORMANCE AND DISEASE STATUS

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Summary

Two hundred pigs weaned at 14 days of age were used to determine the effects of commingling pigs on performance and disease exposure. One herd provided the single source pigs and four herds provided pigs for the commingled treatment. Single source pigs gained faster ($P < 0.05$) and tended to be more efficient ($P < 0.13$) than commingled pigs for the 32 day trial, with the greatest effect observed during the first 10 days. Titers for Mycoplasmal pneumoniae (MP) and Porcine Reproductive and Respiratory Syndrome (PRRS) were elevated for the commingled pigs but did not increase for the single source pigs. Based on this data, it appears that commingling early-weaned pigs is not advantageous to weaned pig performance or health status.

Introduction

Early-weaning of pigs (< 14 days of age) is becoming a widely used and effective practice in today's swine industry to improve health status and growth performance of pigs. To capture the benefits of this technology, smaller producers have formed production networks where several producers farrow on their own operations and then wean into a common nursery. These pigs will then leave the nursery and go into finishing units as potentially single-source pigs. However, no information is available on whether early-weaned commingled pigs achieve the same health status as single source early-weaned pigs. Therefore, it is critical for producers utilizing this type of system to know if it is effective, or if they would be better off putting up their own nursery.

The objective of this trial was to monitor the growth performance and disease titers of early-weaned pigs from either single or commingled sources raised in identical environments.

Materials and Methods

Two hundred 14 day old pigs were purchased and placed in an Iso-Wean nursery. The nursery was divided into two identical rooms with separate ventilation and waste handling systems, as well as separate access doors. One half of the pigs (100 pigs) were purchased from a single source (SS) and placed into one room while the other 100 pigs were purchased from four different sources (COM) and placed in the other room. One of the commingled sources was also the herd providing the single

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source pigs. All pigs were from a genetically similar line of PIC matings. There were 10 pigs per pen with 10 pens per room. Standard early-weaning management practices were followed including a commercial early-weaning feeding program with antimicrobials present in all diets.

Upon arrival to the unit, the single source pigs were weighed and two randomly chosen pigs from each pen bled for baseline titers of Mycoplasmal pneumoniae (MP) and Porcine Reproductive and Respiratory Syndrome (PRRS). Fresh clothing and boots were then put on and the pigs from the four other herds were commingled, weighed, and bled (20 pigs). Daily chores were done in the SS room first and then in the COM room.

There were three phases in the trial. Daily feed additions were recorded and pigs weights obtained at the end of each phase. Phase 1 was the first 10 days, Phase 2 was the next 14 days, and Phase 3 the last 8 days for the entire 32 day study. At the end of the trial, the same 40 pigs were re-bled to determine titers of MP and PRRS.

There were 10 pens per treatment (pig source) with pen being the experimental unit. The study was analyzed as a completely randomized design.

Results and Discussion

Performance data is presented in Table 1 and titer levels in Table 2. For Phase 1 single source pigs gained weight faster and were more efficient than commingled pigs ($P < 0.01$). However, in Phase 2, gains were similar but feed efficiency was still superior for SS pigs. In the last phase, SS pigs gained faster ($P < 0.01$) and more efficiently ($P < 0.05$) than COM pigs. For the overall 32 day trial, SS pigs exhibited faster gains ($P < 0.05$) and tended to be more efficient ($P < 0.13$). Part of the differences in performance may be attributed to the health status of the two different groups. PRRS titers decreased and MP titers stayed constant from day 0 to day 32 for the SS pigs but both PRRS and MP titers increased for the COM. Research at Iowa State University suggests that activation of the immune system requires a great deal of energy that normally would be used for growth. If the COM pigs' immune systems were more activated as indicated by the higher MP and PRRS titers, less energy and other nutrients would have been available for growth resulting in the decreased performance observed in this trial.

Data from this trial indicate that while commingling of early-weaned pigs will result in acceptable nursery performance, maintaining a single source status of early-weaned pigs will result in superior performance. Therefore, producers need to evaluate the cost of the loss in performance as compared to the cost of separate nursery facilities when deciding on the appropriated early-weaning system to use.

Table 1. Effect of source on growth performance.

	Single Source	Commingled	P <
Phase 1			
Daily gain, lb	0.44	0.34	0.004
Feed intake, lb	0.49	0.44	0.137
Feed/gain	1.11	1.34	0.001
Phase 2			
Daily gain, lb	0.84	0.78	0.355
Feed intake, lb	1.17	1.00	0.065
Feed/gain	1.39	1.29	0.016
Phase 3			
Daily gain, lb	1.29	1.01	0.002
Feed intake, lb	2.50	2.31	0.483
Feed/gain	1.93	2.26	0.035
Overall			
Daily gain, lb	0.82	0.69	0.018
Feed intake, lb	1.28	1.14	0.210
Feed/gain	1.54	1.63	0.130

Table 2. Number of pigs with positive titers for MP and PRRS*.

	- - - - - Single Source - - - - - -		- - - - - Commingled - - - - -	
	MP	PRRS	MP	PRRS
Day 0	2/20	14/20	2/20	9/20
Day 32	2/20	2/20	4/20	10/20

* Titers >0.50 S/P for MP and >0.40 S/P for PRRS assumed to be positives.

THERMAL ENVIRONMENTAL EFFECTS AND GROUP SIZES ON GROWING SWINE PERFORMANCE

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Introduction

Improper environmental management is one of the most costly problems of animal production. High Lean growth swine have the genetic potential to reach mature market weight in 150 days, yet the current U.S. average is approximately 200 days. This extra time represents a tremendous facilities and efficiency cost decreasing the profitability of U.S. swine producers. The current and future implications facing swine producers include the availability and cost of fossil fuels, and the additional costs of trying to maintain optimal environments for efficient pork production with changing genetics, population densities, disease control practices, high cost facilities, and profitability.

Swine in the growing and finishing stages of production can be subjected to a wide range of environmental factors. These factors depend on weather, the type and condition of the swine facility, and how well the environmental control system is designed and managed. Facility types may vary from a mechanically ventilated and well insulated structure where temperatures can be maintained to within a few degrees of a desired set-point to a non-insulated building and dirt lot with minimal environmental modification. In numerous cases, the high cost of new facilities, lack of financing, and the availability of older existing buildings have forced producers to use marginal facilities to grow and finish swine. Placing swine, especially high lean pigs, in adverse environments may be counter productive economically and result in poor pig performance.

The adequacy of a particular thermal environment for swine is dependent on more than air temperature alone. The environmental factors of air velocity, floor surface material, surrounding pen and wall surface temperatures, and relative humidity influence changes in conductive, convective, radiant, and evaporative animal heat losses. Body heat losses are also influenced by animal factors such as body weight, thickness of subcutaneous fat layer and group size. In addition, dietary factors such as level of feed intake as well as source and digestibility of nutrients will alter the amount of heat produced by swine.

Stressful conditions also have been shown to increase the likelihood and severity of infectious disease (Peterson et al., 1991). Further, stress has been shown to cause alterations in the immune response of both laboratory and domestic animals (Christopher-Hennings et al., 1993). For swine, very little is known about the effects of thermal and social stress on the capacity and function of the immune response and the resulting effect on the susceptibility to disease.

Numerous studies have been conducted to monitor swine performance and physiological responses. The physiologically based model NCPIG, (Usry et al., 1992) developed by the NC-204 project approaches pig growth and heat production by simulating the growth and metabolic processes. One major objective of the project was to develop a physiologically based model capable of predicting responses of growing swine for various feeding and environmental conditions. The model is capable of simulating transient, diurnal energy flows for growing pigs considering metabolic heat production, sensible and radiant heat gains and losses, latent heat losses and heat storage within the animal body. However, while this model does take into consideration the energetic response of the animal it does not involve the thermodynamic characteristics of the structure and the environment. Hahn et. al. (1987) concluded that daily cycles of + or - 5 to 8 degrees C about the mean temperature in the nominal loss zones will cause no adverse consequences in healthy animals fed a well-balanced diet. This, however, is in the absence of other negative environmental effects such as strong radiative or conductive heat gains or losses, which ultimately determine the "effective environmental temperature" for the animal. Additional studies are needed to compare latent, sensible, and total heat production of the NC-204 model to additional observed data (Usry et. al., 1992). Further development of a model is also needed which relates weather conditions to the pen micro-environment conditions.

Objectives

Further development of the physiologically based model NCPIG to predict growing and finishing pig performance which better represents animals in production facilities and to assist producers decision making will be generated with the following objectives:

1. Determining the effect of a maintained cold temperature and group size on pig performance.
2. Determining the effect of a maintained hot temperature and group size on pig performance.
3. Quantifying the pen micro-environment during cold and hot weather test periods.
4. Developing appropriate prediction equations for the NCPIG model from test results.

Procedures

The Southeast Experiment Station swine facility (Figure 1) is divided into two 8-pen rooms with an insulated wall and plywood divider in each manure gutter. Six of the pens in each room are 4' x 15' in size with 50 percent of the pen area covered by slats. Two pens in each room have a dimension of 8' x 15' to accommodate a larger pig group size. Pen dividers are constructed with PVC planking and are solid except the area over the slats has a 15-inch high by 7.5 foot long insert with vertical rods.

The ventilation system in each room consists of counter weighted bi-flo boxes (one for each pen and 2 units for the 8 foot wide pen), 3 variable speed fans [8-inch (480 cfm), 12-inch (1500 cfm), 20-inch (5000 cfm)], one 20-40,000 btu/hr supplemental heater, and a commercially available control system (RayDot Ventium). The control systems regulates fan ventilation rates according to set point temperature, humidity, and average pen air speed. Air flow measurements at ceiling and pen floor levels at recommended room static pressure (0.05 to 0.08 inches of water) were taken to determine air inlet performance prior to placement of pigs.

Tests were conducted during the usually hot and cold weather seasons of the year. Each room began with 65 feeder pigs (barrows or barrows and gilts depending on availability) weighing approximately 50 pounds (23 kg). These single source supplied pigs have high lean growth genetics and a standard vaccination regime. Pigs were randomly distributed in each pen by using weight blocks to reduce within pen variation. In each test room, two pens (8' x 15') were stocked with 18 pigs at 6.6 square feet per pig, two pens (4' x 15') were stocked with nine pigs at 6.6 square feet per pig, and the two pens along the dividing wall were stocked with one pig in each pen (60 square feet). The remaining two corner pens were stocked with 5 pigs which served as spares as needed. The corner pens were occupied so that environmental conditions of a fully stocked building were represented.

A two space feeder was located in each of the nine and single head pens. A four space feeder two-hole feeders) was placed in the 18 head pens. Feeders were placed at the gate along the center aisle. A diet (Nebraska and South Dakota swine nutrition guide) consisting of 1.0% total lysine for high lean gain and an average dietary density of 1.5 Mcal/lb was fed. One nipple waterer was used in the 9 and single head pens and two waterers were placed in the 16 head pen. Total water usage in each room was monitored. Manure pits were drained prior to each test and drained at the end of each 28 day test period.

Each group of pigs were on test for a 28 day period, and three groups of pigs per hot and cold season were monitored. The experiment started one week after pigs arrived allowing for an acclimation time.

Four environmental conditions (two during cold weather and two during hot weather) will be controlled and monitored. During the cold weather tests, presently being conducted, one room will be held at 50° F (10° C) and the other room will be operated at 70° F (21° C). The room held at 50° F will require additional ventilation to maintain temperature. During hot weather, one room had a set point temperature of 70° F (21° C) and followed increasing diurnal temperature variation with a corresponding increase in ventilation rate. The other room temperature was set at 90° F (32° C) with increases in ventilation rate occurring when the room temperature exceeds 91° F (33° C). The room held at 90° F was supplementally heated as needed to maintain stress temperature. The air speed at pig level was sustained at less than 50 feet per minute 7.5 feet from the outside walls in the hot room.

Pig weights were recorded on a weekly basis. Average daily gain, feed efficiency, and feed intake were measured. The pigs were scanned for back fat thickness at the end of each test with an ultra-sound machine.

Environmental conditions in each room and the micro-environment in each of the test pens were observed. One temperature and airspeed sensor was centered and placed as low as feasible 7.5 feet from the outside walls in test pens in each room. These sensors in conjunction with a humidity sensor in each room controlled the ventilation system. Temperature, humidity, and airspeed data from these sensors was recorded on a real time basis. Daily (weekdays) morning (9:00 a.m.) and afternoon (4:00 p.m.) surface temperatures were obtained from outside walls, slated floor and solid floor in all test pens with an infrared thermometer.

Ammonia and carbon dioxide gas levels (passive gas tubes) were recorded over the slatted portion in a pen located on the north side of each room on a weekly basis during the hot weather tests. Pen temperatures and room humidity were recorded on an hourly basis and compared to ventilation monitoring sensors. Outdoor weather conditions (air temperature, wind speed and direction, relative humidity, and solar radiation) were monitored and compared to indoor environmental conditions and to ventilation control system and pig responses. A comparative analysis of these responses will be made with the NCPIG growth model. General behavioral observations such as pigs huddling or spreading out, dunging patterns, and disease incidence were taken manually and recorded. Supplemental heater propane usage and heater and fan run times will also be monitored and recorded during cold weather operation.

Immunological Procedures

Two medium weight pigs from the nine and 18 head pens and the two single pen pigs for a total of 10 pigs from each treatment were monitored on days five or six during acclimation period, and days 14 or 15 and 27 or 28 days after acclimation period. Blood was drawn for mononuclear cell (10 ml) and antibody (3 ml) determination. The tests evaluate the following immune measures: T cell capacity (with Con A and PEA stimulation), general B cell capacity (by measurement of total serum Ig levels and specific B cell response to mycoplasma vaccine antigens). Detailed records were kept of disease incidence in the groups and isolation of causative agents were routinely carried out. In addition, fluorescent phagocytosis and bacterial killing assays and nature of illnesses were correlated with the treatment and immunological changes which occurred during the course of the study to determine the relationship between the stressor, immune alterations and incidence or severity of disease.

Statistical Procedures

A randomized complete block design with a 3 x 2 factorial arrangement comparing pig performance (average daily gain, feed efficiency, feed intake, backfat and immune status) will be used to compare the two experimental temperatures for cold weather conditions and group size. The same statistical design will be conducted for the two hot weather experimental environmental conditions and group size. Each treatment will be replicated three times. There will be two weight blocks and three weather variation blocks for a total of 6 blocks per treatment. Appropriate analysis of variance and regression procedures will be utilized to compare outdoor weather conditions to pen micro-environmental conditions and to develop prediction equations for the NCPIG model.

Preliminary Results

Data is being analyzed at this time. Preliminary results from the hot weather tests indicate that the pigs in the control room held at 70° F plus diurnal temperature variation had average daily gains of 1.73, 1.63 and 1.60 lb/day for the single pig , 9 pig, and 18 pig groups, respectively. The average daily gain performance in the 90° F room was 1.57, 1.4 and 1.38 lb/day for the single pig, 9 pig, and 18 pig group respectively.

The average starting weight for all groups was 60 pounds, ranging from 49 to 75 pounds.

Daily feed intake for the pigs in the 70° F control room was 3.53, 3.40 and 3.36 lb/day for the single, 9 pig, and 18 pig groups respectively. Daily feed intakes for pigs in the 90° F room were 3.12, 3.01 and 2.98 lb/day for the single pig, 9, and 18 pig groups respectively. NCPIG model results for barrows having medium to high lean genetics would have an average daily gain of 0.46 lb/day and a daily feed intake of 1.64 lb/day when air temperatures are held at 90 degrees indicating a wide variation in actual versus predicted results.

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