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

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

South Dakota Agricultural Experiment Station
Brookings, SD 57007

Dr. David Bryant, Dean **Dr. Fred Cholick, Director**

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INTRODUCTION..Robert K. Berg

On behalf of the Southeast South Dakota Experiment Farm Directors, our staff, and South Dakota Agricultural Experiment Station I am pleased to present our 35th Annual Progress Report. This report highlights our agricultural research and demonstration endeavors for 1995. In addition, I would like to express our appreciation to Bryan Stevens and John Jacobson who both provided valuable part-time assistance for us this past year. We also welcome Dr. Dale Gallenberg as the new department head of the Plant Science Department in the College of Agriculture and Biological Sciences in Brookings, SD.

As always weather played a major role in what we all accomplished again this year. Our maximum air temperatures were 5 to 10 degrees below normal during the spring and fall and we had a relatively mild summer. We received 31 inches of precipitation for the year (5 inches above normal). Two thirds of this (21 inches) occurred during the growing season from April through September which was only 1.4 inches more than we usually get. We acquired 2795 growing degree units (87% of normal) between April and October. The coldest day of the year was - 15^{o} F on March 8 and the hottest temperature recorded was 103 ^{o} F on July 14. The last freeze this spring was on April 27 (29 ^{o} F) and the first freeze in the fall occurred September 22 (24° F) providing 146 frost-free days (32 ^{o} F basis). We recorded a total of 16.3 inches of snow this year with 10.3 inches from January through June and 6.0 inches since July.

Excessive precipitation early in the spring made calving, lambing, and chores of any sort extremely difficult at times. Establishing alfalfa, small grain, and even row crops was almost impossible during much of the prime planting time. For a while, spring field work lagged behind the record-breaking conditions experienced in 1993 when regional flooding plagued so many areas. By the time conditions were fit to plant there weren't many practical options left and cropland had to be left unplanted in some areas. Unlike 1993, when it was impossible to plant a few of our fields, we were eventually able to plant all of our cropland this year, although some trials were abandoned. There was moderate to heavy grasshopper and corn borer activity in the area during the summer. Weather conditions were favorable for harvest and field work this fall.

Some, but not all of this year's trials, were established at normal planting dates. Keep in mind, in those cases where research was influenced by things like delayed planting, that this type of information may be a little atypical or of limited feasibility for some commercial farming enterprises. It may also affect results associated with long-term studies. Sometimes we planted crop late to have residue or to maintain a particular rotation needed for next year's research. On the other hand, it also gives us a window of opportunity to obtain research-based results pertaining to extreme weather conditions that are often overlooked when the going gets tough. We feel this is also part of our mission to provide information to our clientele in good times as well as bad and may help you make better decisions in the future. Furthermore, crop prices are as high as they have been for many years.

In addition to our weed control, soil fertility, plant breeding, disease, and livestock research there are a few areas I would like to highlight. Our livestock trials deal with innovative ways to utilize unique crop products or enhance the value of low quality crops. There is currently a lot of interest in precision farming or site-specific crop management and you can see preliminary results from some of this type of research we initiated this year. Our tillage and crop rotation trial has evaluated production and economics among major cropping systems for this region since 1991. A three-year water quality research project that concluded in 1994 is also summarized in this year's report.

In terms of building projects, our office received a face lift when we had it re-sided this summer. We also completed a feed room addition as well as a fair amount of external repairs to our hog house. It has been an extremely challenging year, yet rewarding in many respects. We all have a lot to be thankful for and can look forward to new opportunities in the coming year. Please feel free to stop by and visit whenever you can. If we can be of assistance in any way, don't hesitate to let us know.

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Table 1. Temperatures at the Southeast Research Farm - 1995

	1995 Average Air Temps.(°F)[a]		30-year Average Air Temps. (°F)		Departure from 30-year Average	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
January	23.6	8.7	26.0	3.8	-2.4	+4.9
February	34.7	14.5	32.3	10.4	+2.4	+4.1
March	42.1	22.9	45.5	23.5	-3.4	-0.6
April	51.1	31.6	61.5	35.7	-10.4	-4.1
May	64.1	44.4	74.2	48.4	-10.0	-4.0
June	79.5	58.7	84.0	58.5	-4.5	+0.2
July	85.3	60.5	88.3	62.9	-3.0	-2.4
August	84.8	63.9	86.2	60.0	-1.4	+3.9
September	72.0	45.8	77.0	49.1	-5.0	-3.3
October	59.1	37.1	64.3	36.6	-5.2	+0.5
November	37.3	18.9	44.7	23.4	-7.4	-4.5
December	32.0	15.7	30.3	11.0	+1.7	+4.7

[a]Computed from daily observations

Table 2. Precipitation at the Southeast Research Farm - 1995

Month	Precipitation 1995 (inches)	30-year Average (inches)	Departure from Avg. (inches)
January	0.22	0.47	-0.25
February	0.09	0.70	-0.61
March	4.19	1.57	+2.62
April	4.45	2.44	+2.01
May	5.23	3.47	+1.76
June	1.77	4.12	-2.35
July	3.80	3.69	+0.11
August	3.22	3.03	-0.19
September	2.32	2.62	-0.30
October	4.35	1.98	+2.37
November	0.92	1.13	-0.21
December	0.12	0.65	-0.53
Totals	30.68	25.87	+4.81

ROTATION STUDY

R. K. Berg

Southeast Farm 9501

Introduction: This year marks the fifth season for research designed to evaluate tillage and crop rotation systems in southeastern South Dakota. Production and economics of conventional tillage is compared to no-till using two-, three-, and four-crop rotations. Ridge till in a two-crop system and reducing inputs (herbicide and fertilizer) in a four-crop rotation are also considered. This information is useful in helping farmers select or modify cropping strategies with systems-based research. Soybean yielded well but performance of the other crops was poor due to weather related planting delays in the early spring. This is the first year that all crops in each system have completed at least one rotation cycle.

Table 1. Tillage and crop rotation systems. Southeast Research Farm; Beresford, SD; 1995.

Tillage System	Crop Rotation
No-Till (NT)	Corn-Soybean (C-S)
Ridge-Till (RT)	Corn Soybean (C-S)
Conventional (CT)	Corn-Soybean (C-S)
No-Till (NT)	Corn-Soybean-Wheat (C-S-W)
Conventional (CT)	Corn-Soybean-Wheat (C-S-W)
No-Till (NT)	Corn-Soybean-Oat/Alf-Alfalfa (C-S-OA-A)
Conventional Reduced Input (CTRI)	Corn-Soybean-Oat/Alf-Alfalfa (C-S-OA-A)

Methods: Twenty combinations of tillage and crop rotations form seven systems representing the main practices used in this area (Table 1). The crop rotations used were corn-soybean (C-S), corn-soybean-spring wheat (C-S-W), and corn-soybean-oat/alfalfa-alfalfa (C-S-OA-A). The two-crop systems are a corn-soybean rotation. Three-crop systems have corn then soybean followed by small grain. In the four-crop systems, corn is produced after alfalfa and followed by soybean. Alfalfa is usually planted with oat as a nurse crop and hayed for one year after establishment.

No till (NT), ridge till (RT), conventional till (CT), and CT with reduced inputs (CTRI) are the tillage systems evaluated. No-till systems are raised without tillage or cultivation. Primary tillage for the conventional systems consists of fall chisel for corn stalks and small-grain stubble, field cultivating or disking soybean residue in the spring, and plowing second-year alfalfa in the fall (CTRI). In the ridge-till system row crops are planted on ridges using row cleaners to remove corn residue and herbicide banded over the row at planting plus cultivation to control most weeds.

Soil test results collected during the fall of 1994 are summarized in Table 2 . Plot size is 60 ft x 300 ft (0.4 ac) and field operations are performed using commercial sized farm equipment. Plots are managed as a group within their respective tillage and rotation systems each year using four replications for each treatment. Tables 3 through 5 highlight specific management and cultural practices for 1995 and were basically similar to previous years. Row crops grown in 30-inch rows were planted using an Acculplant hydraulic control system mounted onto our planter (Rawson Control systems, Inc.; Oelwein, IA). Wheat and oat were hayed as small square bales and two cuttings of alfalfa were put up as large round bales.

Table 2. Soil test results[1] (0-6"). Southeast Research Farm; Beresford, SD; Fall 1994.

Tillage	Rotation	pH	OM	P	K
			%	lb/ac	lb/ac
NT	C-S	6.02	3.6	28	928
RT	C-S	6.00	3.7	20	736
CT	C-S	6.03	3.7	28	866
NT	C-S-W	6.00	3.5	26	740
CT	C-S-W	5.85	3.6	32	800
NT	C-S-OA-A	6.09	3.7	24	868
CTRI	C-S-OA-A	6.15	3.5	14	686
	AVG.	6.03	3.6	24	794

[1] Egan and Trent soil series.

Equipment inventory and (1991) costs shown are designed for a 640-acre farm (Table 6). Depreciation along with variable and fixed costs are included in computer spreadsheets used for the economic analyses of these systems (Maximum Economic Yield; Potash & Phosphate Institute, Atlanta, GA). Crop revenue is based on market prices at harvest. Responses measured in 1995 included crop residue cover that overwintered before and after planting, stand count, grain or forage yield, moisture content, test weight, and crop quality (soybean and alfalfa). Differences among treatments are compared using least significance differences (LSD) at the 90% probability level. Coefficients of variation (CV) indicate the variability associated with a particular response and should be less than 15% for a response to be considered reliable. Results from subsequent years were previously reported for 1991, 1992, and 1994 in our 31st, 32nd, and 34th Annual Progress Reports.

Table 3. Field operations for tillage and crop rotation systems. Southeast Research Farm; Beresford, SD; 1995.

Tillage System	1995 Crop Rotation	Before Planting	After Planting	After Harvest[1]
NT	Corn	Spray	Spray Sidedress N	Chop stalks
	Soybean	Spray		
RT	Corn	Spray	Cultivate, spray Sidedress N	Chop stalks
	Soybean	Spray	Cultivate	
CT	Corn	Spray Field Cultivate 2X	Sidedress N Spray	Chop stalks Fall chisel
	Soybean	Fall chisel corn stalks Spray, field cultivate 2X		
NT	Corn	Spray	Sidedress N Spray	Chop stalks
	Wheat	Spray		Spray
	Soybean	Spray		
CT	Corn	Fall chisel wheat stubble Spray, field cultivate	Spray, sidedress N Cultivate	Chop stalks Fall chisel
	Wheat	Field cultivate		Spray
	Soybean	Fall chisel corn stalks Spray, field cultivate		
NT	Corn	Spray	Sidedress N, spray	Chop stalks
	Soybean	Spray		
	Oat+Alfalfa	Spray	Spokewheel P fertilize	Spray
	Alfalfa		Spokewheel P fertilize Harvest 2X	Spray
CTRI	Corn	Fall plow alfalfa Field cultivate	Cultivate 2X	Chop stalks Fall chisel
	Soybean	Fall chisel corn stalks Field cultivate	Cultivate 2X	Fall chisel
	Oat+Alfalfa	Field cultivate		Fall chisel
	Alfalfa		Harvest 2X	Fall chisel

[1]All plots were soil sampled after harvest 1995.

Table 4. Herbicide and fertilizer rates for tillage & rotation system study. Southeast Research Farm; Beresford, SD; 1995.

Tillage & Rotation	Crop	Planting Date	$N-P_2O_5-K_2O$[1] (lb/ac)	Herbicide (material/ac)
NT C-S	C	June 14	70-30-0	1 pt Dual + 1.6 lb Bladex + 0.5 lb Atrazine + 3 pt Roundup EPP 5/24; 1.5 lb Bladex Post 6/22
	S	June 14		4 oz Pursuit + 2 pt Prowl + 2 pt Roundup EPP 5/24;
RT C-S	C	June 14	70-30-0	2 pt Roundup + 1 pt 2,4-D EPP 5/24; 2.5 pt Dual band 6/14; 0.67 oz Accent post 7/11
	S	May 25		2 pt Roundup EPP 5/24; 2.5 pt Dual banded 5/15
CT C-S	C	June 14	70-30-0	5 pt Eradicane + 0.9 lb Atrazine PPI 5/24
	S	June 14		1.5 pt Treflan + 4 oz Pursuit PPI 5/24
NT C-S-W	C	June 14	115-30-0	1 pt Dual + 1.6 lb Bladex + 0.5 lb Atrazine + 3 pt Roundup EPP 5/24; 1.5 lb Bladex Post 6/22
	S	June 14		1 pt Roundup + 3 pt Dual + 0.5 lb Sencor EPP 5/24
	W	May 25		2 pt Roundup EPP 5/24; 2 pt Roundup + 1 pt 2,4-D burndown applied to stubble 8/1
CT C-S-W	C	June 14	115-30-0	5 pt Eradicane + 0.9 lb Atrazine PPI 5/24
	S	June 14		3 pt Sonolan + 0.5 lb Sencor PPI 5/24
	W	May 25		2 pt Roundup + 1 pt 2,4-D burndown applied to stubble 8/1
NT C-S-OA-A	C	June 14	70-30-0	1 pt Dual + 1.6 lb Bladex + 0.5 lb Atrazine + 3 pt Roundup EPP 5/24; 1.5 lb Bladex Post 6/22
	S	June 14		1 pt Roundup + 3 pt Dual + 0.5 lb Sencor EPP 5/24
	OA	May 25	0-60-0	2 pt Roundup EPP 5/24; 2 pt Roundup + 1 pt 2,4-D burndown applied to stubble 7/28
	A		0-60-0	2 pt Round-up + 1 pt 2,4-D applied to stubble 7/28
CTRI C-S-OA-A	C	June 14		
	S	May 25		
	OA	May 25		
	A			

[1] Fertilizer for corn consisted of 9-30-0 applied with seed as 10-34-0 plus 70 or 115 lb N/ac sidedressed as 28% UAN; No-till alfalfa received 60 lb P_20_5/ac as 10-34-0 injected with a spokewheel.

Table 5. Management for tillage and crop rotation systems. Southeast Research Farm; Beresford, SD; 1995.

Tillage	Rotation	Seeding Rates[1]				
		'DK 401' Corn	Kenwood' Soybean	'Sharp' Spring Wheat	'Troy' Oat	SD Common Alfalfa
		seeds/ac	seeds/ac	seeds/ac	lb/ac	lb/ac
NT	C-S	27,000	208,000 (75) drill	NA[2]	NA	NA
RT	C-S	27,000	166,000 (60) 30"	NA	NA	NA
CT	C-S	27,000	208,000 (75) drill	NA	NA	NA
NT	C-S-W	27,000	208,000 (75) drill	1,200,000 (90)	NA	NA
CT	C-S-W	27,000	208,000 (75) drill	1,200,000 (90)	NA	NA
NT	C-S-OA-A	27,000	208,000 (75) drill	NA	NA (48)	NA (13)
CTRI	C-S-OA-A	27,000	166,000 (60) 30"	NA	NA (48)	NA (13)

[1] All corn planted in 30-inch rows; soybean planted in 30-inch or drilled in 7.5-inch rows; all small grain and small seeded legume drilled in 7.5-inch rows.

[2] NA = Not applicable (values in parenthesis are lb/ac).

Table 6. Tillage and crop rotation system, equipment inventories. Southeast Research Farm; Beresford, SD; 1995.

	Tillage System			
Equipment	No-Till	Ridge-Till	Conventional	Conventional (RI)[1]
120-HP Tractor	45,000	45,000	45,000	45,000
70-HP Tractor	17,000	17,000	17,000	17,000
No-Till Drill 15 ft	20,000			
30" Planter 6-Row	10,000		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	2,000
Tandem Disk 18 ft			9,000	9,000
Field Cultivator 19 ft			8,500	8,500
Drill 15 ft			6,000	6,000
Cultivator 6-row			4,500	4,500
Plow 5 bottom				2,500
Rotary Hoe 6-row				2,700
Total Equipment Cost	$97,000	$90,500	$104,500	$107,200

[1] RI = Reduced Input

<u>Results and Discussion:</u> Extremely wet spring weather greatly delayed early-season spraying and planting this year. All crops were eventually planted but seeding was later than would be considered feasible for commercial operations especially for corn, alfalfa, and small grain. Market prices at harvest were higher than normal for corn ($2.80/bu) and soybean ($5.88/bu) and moderate for small grain ($50/ton) and alfalfa ($65/ton) hay.

Crop residue cover was at least 80% (usually more than 90%) for no-till systems before planting and still had 50 to 80% remaining after planting. Conventionally tilled systems had 50 to 90% residue cover before planting but dropped to 30% or less during spring tillage and planting. Ridge-tilled residue dropped from 78% that overwintered to 40 to

50% cover after planting. Second-year alfalfa never had less than 90% residue cover. The CTRI clover residue from 1994 was essentially bare after moldboard plowing last fall. Only no-till and ridge-till systems were able to maintain adequate residue cover for complying with conservation plan requirements.

Corn performance suffered this season with very low yield and test weight in all systems (Table 7). No-till two- and three-crop systems had the best stands, produced more grain with heavier test weights (except in the three-crop rotation), and had consistently drier grain than conventional tillage by 3 to 8% at harvest. Corn in the three-crop rotation received an extra 45 lb N/ac because it lacked legume credit from last year's soybean crop. Without herbicide or fertilizer application the CTRI corn yielded just under 50 bu/ac, or 63% less than NT. Conventional and ridge tilled treatments in the two-crop rotation did just about as poorly.

Table 7. Effects of tillage and crop rotation systems on corn production. Southeast Research Farm; Beresford, SD; 1995.

Tillage	Rotation	Past Crop	Stand Count	Grain Yield[1]	Moisture Content	Test Weight	Residue 4-3-95	Residue 6-28-95
			plts/ac	bu/ac	%	lb/bu	%	%
NT	C-S	Soybean	26,100	66	23.6	49.5	94	69
RT	C-S	Soybean	23,900	53	26.4	48.4	78	42
CT	C-S	Soybean	22,800	52	29.4	47.5	89	17
NT	C-S-W	Wheat	25,600	72	24.4	48.9	97	82
CT	C-S-W	Wheat	21,900	68	27.4	48.6	60	17
NT	C-S-OA-A	Clover	26,400	78	22.7	49.4	93	48
CTRI	C-S-OA-A	Clover	27,400	49	30.7	46.6	5	2
Avg.			24,900	63	26.4	48.4	74	39
$LSD_{0.10}$			2,500	10	3.7	1.1	7	9
CV (%)			8.4	13	11.4	1.8	8	18

[1] Grain yield at 15% moisture and 56 lb/bu test weight. Harvest date = October 04, 1995.

The best crop performance was clearly associated with soybean which typically does better planted later in the spring than other crops. Both soybean treatments in 30-inch rows were planted just before prolonged rains in late May. No further planting was possible for three weeks until mid June. This gave the RT and CTRI soybean a longer growing season than those that were drilled.

Good stands of soybean were established in each system (Table 8). Approximately 75% or more of the seed planted survived. Populations with the planter reflect the lower seeding rate used for rowed soybean (RT and CTRI). Soybean yield ranged from 32 to 44 bu/ac. No-till outyielded conventional and ridge-tilled soybean in the two-crop rotations, but CT yielded as well as NT in the three- and four-crop rotations. Moisture and test weight of soybean were not significantly affected by either tillage or crop rotation. Protein and oil information will be available when these results come back from the laboratory.

Table 8. Effect of tillage and crop rotation systems on soybean production. Southeast Research Farm; Beresford, SD; 1995.

Tillage	Rotation	Past Crop	Stand Count	Grain Yield[1]	Moisture Content	Test Weight	Residue 4-3-95	Residue 6-28-95
			plts/ac	bu/ac	%	lb/bu	%	%
NT	C-S	Corn	157,300	40	8.9	56.4	86	60
RT	C-S	Corn	125,300	34	8.7	56.4	78	54
CT	C-S	Corn	175,500	32	8.7	56.8	56	30
NT	C-S-W	Corn	154,900	42	8.8	56.0	79	63
CT	C-S-W	Corn	150,000	44	8.8	56.3	45	30
NT	C-S-OA-A	Corn	152,500	43	8.8	56.4	90	62
CTRI	C-S-OA-A	Corn	128,900	40	8.8	56.0	50	34
Avg			149,200	39	8.8	56.3	69	47
$LSD_{0.10}$			23,200	6	NS	NS	11	10
CV (%)			12.7	12	2	1.9	13	18

[1] Grain yield at 13% moisture and 60 lb/bu test weight. Harvest date = October 18, 1995

Small grain crops were baled for hay because of the late planting date. Wheat produced 30 tillers/ft^2 and 0.8 ton of hay regardless of the tillage system (Table 9). The no-till oat nurse crop did nearly twice as well due to better stands and nutrient levels in this system (Table 10). No-till oat stands averaged 26 tillers/ft^2 and produced 0.9 ton/ac. Second-year alfalfa averaged 13 stems/ft^2 regardless of the tillage system (Table 11). CTRI produced twice as much alfalfa forage as no-till (1.5 vs. 0.6 ton/ac) at the first cutting in June. Yields were similar at 0.5 ton/ac when cut in mid-July. The July cutting had 6% more protein than in June. Better yields associated with CTRI reflect better establishment than NT when planted in 1994. Our attempt to establish alfalfa with an oat nurse crop was not successful in late May and it was too dry to replant during late summer. An alternating legume crop will need to be substituted in this rotation like we did when alfalfa stands drowned in 1993.

Table 9. Effects of tillage and crop rotation systems on wheat hay production. Southeast Research Farm; Beresford, SD; 1995.

Tillage	Rotation	Past Crop	Stand Count	Hay Yield[1]	Residue 4-3-95	Residue 6-21-95
			tillers/ft^2	ton/ac	%	%
NT	C-S-W	Soybean	34	0.782	92	62
CT	C-S-W	Soybean	27	0.849	87	22
Avg			30	0.816	90	42
Pr > F[2]			NS	NS	NS	<0.01
CV (%)			32	24.05	6	12

[1] Harvest Date = July 28, 1995
[2] Pr > F = probability of treatment averages not being significantly different.
(NS = not significant; P > 0.50.)

Table 10. Effects of tillage and crop rotation systems on oat hay production (nurse crop). Southeast Research Farm; Beresford, SD; 1995.

Tillage	Rotation	Past Crop	Stand Count	Hay Yield[1]	Residue 4-3-95	Residue 6-21-95
			tillers/ft^2	ton/ac	%	%
NT	C-S-OA-A	Soybean	26	0.908	92	58
CTRI	C-S-OA-A	Soybean	15	0.375	85	24
Avg			21	0.642	88	41
Pr > F[2]			0.09	0.02	0.04	<0.01
CV (%)			28	28	4	5

[1] Harvest date = July 28, 1995
[2] Pr > F = Probability of treatment averages not being significantly different.

Table 11. Effects of tillage and crop rotation systems on alfalfa hay production. Southeast Research Farm; Beresford, SD; 1995.

Tillage	Rotation	Past Crop	Stand count	----Hay Yield[1]---- 1st Cut	2nd Cut	Total	----Residue---- 4-3-95	6-21-95	Crude --Protein-- 1st Cut	2nd Cut
			tillers/ft^2	------------ton/ac-------------			------------------%---------------------			
NT	C-S-OA-A	Oat + Alfalfa	12	0.634	0.492	1.126	99	94	12.8	19.0
CTRI	C-S-OA-A	Oat + Alfalfa	15	1.491	0.639	2.130	95	90	12.6	18.9
Avg			13	1.062	0.565	1.626	97	92	12.7	19.0
Pr >F[2]			NS	0.10	NS	0.13	0.02	NS	ND	ND
CV (%)			41	47.61	46.23	42.10	1	4	ND	ND

[1] Dry matter adjusted to 12% moisture; Harvest dates: June 12 and July 14, 1995
[2] Pr > F = Probability of treatment averages not being significantly different. (NS = not significant; ND = not determined).

The profitability of each crop is based on the actual yields measured for each system. Marketing corn at harvest was not profitable in any system this year (Table 12), and net income losses ranged from $36 to $98/ac. Four-crop systems suffered the least amount of loss. Many systems barely generated enough revenue to recover variable expenses. Market prices needed to recover expenses for corn produced in these systems ranged from $3.26 to 4.58/bu.

Soybean was profitable in all cropping systems and produced from $16 to 89/ac of net income (Table 13). Conventional three- and four-crop systems (including CTRI) were among the most profitable, whereas the two-crop conventional and ridge-till systems netted less than $40/ac. Breakeven soybean prices were from $3.65/bu for CTRI to $5.39/bu for the CT two-crop rotation.

Small grain and alfalfa forages lost $33 to 146/ac. Most losses exceeded $100/ac and market prices of $80 to 200/ton were needed to break even (Tables 14 and 15). Revenue was barely enough to cover variable costs this year. The oat hay nurse crop lost $128 to 146/ac and receipts only paid for half of the variable costs, requiring extravagant prices of $200 to 400/ton to breakeven. Second-year alfalfa lost $33 to 103/ac this year (Table 15) with CTRI losing less money than no-till. Breakeven prices for alfalfa were $81 (CTRI) and $156/ton (NT).

The economic summary of all rotations on a whole-farm cash grain basis (Table 16) indicates that the no-till two-crop was the only one of the seven systems tested that broke even. The other systems lost as much as $55/ac. No system was able to generate a profit on a whole-farm basis with the weather and management conditions in 1995.

Summary and Conclusions: Climate this spring was devastating to many producers throughout South Dakota. It also provided an opportunity to evaluate the performance of late-planted crops in terms of tillage and crop rotations using this long-term systems based research project. It would not be as possible or feasible to obtain this type of information using short-term studies. Corn and small grain yields and alfalfa was not successfully established. Most row crops did mature in spite of an early killing freeze on September 22 and 23.

Soybean was the only profitable crop grown when weather seriously delayed planting. It did not generate enough net income to make any of the seven cropping systems tested economically viable when crops were marketed at harvest. This was in spite of strong commodity prices observed during harvest. The capability to store and market crops throughout the year could boost the profitability for some of these systems considerably. This is especially true this year with the potential for close to historically high market prices for several crops.

Table 12. Economic Analysis, Corn Rotations. Southeast Farm; Beresford, SD; 1995.

GENERAL FIELD INFO.	NT C-S	RT C-S	CT C-S	NT C-S-W	CT C-S-W	NT C-S-0A-A	CTRI C-S-OA-A
Crop	Corn	Corn	Corn	Corn	Corn	Corn	Corn
Acres	320	320	320	213	213	160	160
Yield (bu/ac)	66	55	52	72	68	78	49
Cash Price Received	2.80	2.80	2.80	2.80	2.80	2.80	2.80
PER ACRE AMOUNTS							
Receipts	185	154	146	202	190	218	137
Variable Expenses							
Field Operations	32	33	35	33	36	33	33
Seed	29	29	29	29	29	29	29
Fertilizer	26	26	26	39	39	26	0
Herbicides	41	38	14	41	14	41	0
Drying Expenses	16	18	21	19	23	17	22
Operating Interest	8	8	6	9	7	8	4
Total Variable Costs	152	151	132	170	148	154	88
Fixed Cash Expenses							
Land Costs	70	70	70	70	70	70	70
Other fixed cash expenses	18	18	21	17	20	17	21
Total Fixed Cash Expenses	88	88	91	87	90	87	91
Cash Income	(55)	(85)	(78)	(55)	(48)	(23)	(41)
Fixed Non-Cash Expenses	14	13	15	14	15	14	15
Net Income	(68)	(98)	(92)	(69)	(63)	(36)	(57)
Avg/bushel costs							
Variable expenses	2.30	2.75	2.54	2.36	2.18	1.97	1.79
Fixed Cash Expenses	1.33	1.60	1.76	1.22	1.33	1.12	1.85
Fixed Non-cash Expenses	0.21	0.23	0.28	0.19	0.22	0.17	0.31
Total Costs	3.83	4.58	4.58	3.76	3.73	3.26	3.95
OPERATOR SUMMARY							
Total Receipts	59,136	49,280	46,592	42,941	40,555	34,944	21,952
Total Variable Expenses	48,535	48,407	42,200	36,139	31,604	24,621	14,052
Total Fixed Cash Expenses	28,094	28,134	29,235	18,642	19,289	13,935	14,536
Total Cash Income	(17,492)	(27,261)	(24,843)	(11,841)	(10,338)	(3,612)	(6,636)
Fixed Non-Cash Expenses	4,365	4,073	4,703	2910	3,135	2,183	2,412
Net Income @ Yield	(21,857)	(31,333)	(29,545)	(14,751)	(13,473)	(5,795)	(9,048)
Seasonal Labor Hours	186	221	304	124	183	93	126
Labor (hours/ac)	0.58	0.69	0.95	0.58	0.86	0.58	0.79

Table 13. Economic Analysis, Soybean Rotations. Southeast Farm; Beresford, SD; 1995.

GENERAL FIELD INFO.	NT C-S	RT C-S	CT C-S	NT C-S-W	CT C-S-W	NT C-S-OA-A	CTRI C-S-0A-A
Crop	soybean	soybean	soybean	soybean	soybean	soybean	soybean
Acres	320	320	320	213	213	160	160
Yield (bu/ac)	40	34	32	42	44	43	40
Cash Price Received	5.88	5.88	5.88	5.88	5.88	5.88	5.88
PER ACRE AMOUNTS							
Receipts	235	200	188	247	259	253	235
Variable Expenses							
Field Operations	27	28	28	27	28	27	29
Seed	11	9	11	11	11	11	9
Fertilizer	0	0	0	0	0	0	0
Herbicides	25	20	24	40	23	40	0
Drying Expenses	0	0	0	0	0	0	0
Operating Interest	4	4	4	5	4	5	2
Total Variable Costs	66	61	67	83	66	82	40
Fixed Cash Expenses							
Land Costs	70	70	70	70	70	70	70
Other fixed cash expenses	18	18	21	17	21	17	21
Total Fixed Cash Expenses	88	88	91	87	91	87	91
Cash Income	81	51	30	77	102	83	104
Fixed Non-Cash Expenses	14	13	15	14	15	14	15
Net Income	67	38	16	63	87	70	89
Avg/bushel costs							
Variable expenses	1.66	1.79	2.08	1.96	1.51	1.91	1.00
Fixed Cash Expenses	2.19	2.59	2.85	2.08	2.06	2.03	2.27
Fixed non-cash Expenses	0.34	0.37	0.46	0.33	0.33	0.32	0.38
Total Costs	4.20	4.75	5.39	4.37	3.90	4.26	3.65
OPERATOR SUMMARY							
Total Receipts	75,264	63,974	60,211	52,602	55,107	40,454	37,632
Total Variable Expenses	21,238	19,493	21,292	17,574	14,120	13,174	6,384
Total Fixed Cash Expenses	28,094	28,134	29,235	18,642	19,289	13,935	14,536
Total Cash Income	25,933	16,348	9,684	16,387	21,699	13,346	16,712
Fixed Non-Cash Expenses	4,365	4,073	4,703	2,910	3,135	2,183	2,412
Net Income @ Yield	21,568	12,275	4,981	13,477	18,564	11,163	14,300
Seasonal Labor Hours	90	166	147	60	98	45	86
Labor (hours/ac)	0.28	0.52	0.46	0.28	0.46	0.28	0.54

Table 14. Economic Analysis, Spring Wheat Hay Rotations.
Southeast Farm; Beresford, SD; 1995.

GENERAL FIELD INFO.	NT C-S-W	CT C-S-W
Crop	Sp. Wheat	Sp. Wheat
Acres	213	213
Yield (ton/ac)	0.78	0.84
Cash Price Received	50.00	50.00
PER ACRE AMOUNTS		
Receipts	39	42
Variable Expenses		
Field Operations	11	13
Seed	11	11
Fertilizer	0	0
Herbicides	23	12
Drying Expenses	0	0
Operating Interest	3	2
Total Variable Costs	48	38
Fixed Cash Expenses		
Land Costs	70	70
Other fixed cash expenses	17	20
Total Fixed Cash Expenses	87	90
Cash Income	(97)	(86)
Fixed Non-Cash Expenses	14	15
Net Income	(110)	(101)
Avg/ton costs		
Variable expenses	62	45
Fixed Cash Expenses	112	107
Fixed Non-cash Expenses	17	17
Total Costs	191	169
OPERATOR SUMMARY		
Total Receipts	8,328	9,042
Total Variable Expenses	10,308	8,106
Total Fixed Cash Expenses	18,642	19,289
Total Cash Income	(20,622)	(18,353)
Fixed Non-Cash Expenses	2,910	3,135
Net Income @ Yield	(23,532)	(21,488)
Seasonal Labor Hours	62	98
Labor (hour/ac)	0.29	0.46

Table 15. Economic Analysis, Oat and Alfalfa Hay Rotations. Southeast Farm; Beresford, SD; 1995.

GENERAL FIELD INFO.	NT C-S-OA-A	CT C-S-OA-A	NT C-S-OA-A	CT C-S-OA-A
Crop	Oat	Oat	Alfalfa	Alfalfa
Acres	160	160	160	160
Yield (ton/ac)	1.0	0.4	1.1	2.1
Cash Price Received	50.00	50.00	65.00	65.00
PER ACRE AMOUNTS				
Receipts	50	19	73	138
Variable Expenses				
Field Operations	27	17	40	62
Seed	21	21	0	0
Fertilizer	19	0	19	0
Herbicides	23	0	12	0
Drying Expenses	0	0	0	0
Operating Interest	5	2	4	4
Total Variable Costs	95	40	75	66
Fixed Cash Expenses				
Land Costs	70	70	70	70
Other fixed cash expenses	17	21	17	20
Total Fixed Cash Expenses	87	91	87	90
Cash Income	(132)	(113)	(89)	(18)
Fixed Non-Cash Expenses	14	15	14	15
Net Income	(146)	(128)	(103)	(33)
Avg/ton costs				
Variable expenses	95	108	67	31
Fixed Cash Expenses	87	242	77	43
Fixed Non-cash Expenses	14	40	12	7
Total Costs	196	390	156	81
OPERATOR SUMMARY				
Total Receipts	8,000	3,000	11,710	22,152
Total Variable Expenses	15,211	6,474	12,007	10,528
Total Fixed Cash Expenses	13,935	14,536	13,935	14,536
Total Cash Income	(21,146)	(18,010)	(14,231)	(2,911)
Fixed Non-Cash Expenses	2,183	2,412	2,183	2,412
Net Income @ Yield	(23,328)	(20,422)	(16,414)	(5,323)
Seasonal Labor Hours	74	75	179	154
Labors (hours/ac)	0.46	0.47	1.12	0.96

Table 16. Economic summary of all rotation systems. Southeast Research Farm; Beresford, SD; 1995.

GENERAL FIELD INFO.	NT	RT	CT	NT	CT	NT	CTRI
Crop Rotation	C-S	C-S	C-S	C-S-W	C-S-W	C-S-OA-A	C-S-OA-A
Acres	640	640	640	639	639	640	640
PER ACRE AMOUNTS							
Receipts	210	177	167	162	164	149	132
Variable Expenses							
Field Operations	29	30	31	24	26	32	35
Seed	20	19	20	17	17	15	15
Fertilizer	13	13	13	13	13	16	0
Herbicides	33	29	19	35	16	29	0
Drying Expenses	8	9	10	6	8	4	5
Operating Interest	6	6	5	5	4	6	2
Total Variable Costs	109	106	99	100	84	102	58
Fixed Cash Expenses							
Land Costs	70	70	70	70	70	70	70
Other fixed cash expenses	18	18	21	17	21	17	21
Total Fixed Cash Expenses	88	88	91	87	91	87	91
Cash Income	13	(17)	(24)	(25)	(11)	(40)	(17)
Fixed Non-Cash Expenses	14	13	15	14	15	14	15
Net Income	(0)	(30)	(38)	(39)	(26)	(55)	(32)
OPERATOR SUMMARY							
Total Receipts	134400	113254	106803	103872	104704	95109	84736
Total Variable Expenses	69773	67900	63492	64020	53830	65012	37439
Total Fixed Cash Expenses	56187	56268	58470	55927	57867	55741	58142
Total Cash Income	8440	(10913)	(15159)	(16076)	(6993)	(25644)	(10845)
Fixed Non-Cash Expenses	8730	8145	9405	8730	9405	8730	9648
Net Income @ Yield	(290)	(19058)	(24564)	(24806)	(16398)	(34863)	(20493)
Seasonal Labor Hours	275	387	451	245	379	390	442
Labor (hours/ac)	0.43	0.61	0.70	0.38	0.59	0.61	0.69
Labor ($/ac)	4.00	5.05	6.50	3.59	5.56	3.03	5.60

PRECISION FARMING CORN HYBRID EVALUATION

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Southeast Farm 9502

Introduction: A study was initiated to evaluate corn hybrids as part of our efforts to begin precision farming research. Our goal here was to characterize the spatial variability within and among strip plots using hybrids that differ in relative maturity. Two hybrids were monitored for their performance in terms of grain yield and profitability as well as nitrogen efficiency. The mid-season hybrid (108 day) out-performed the early-season hybrid (102 day) even though both were planted in mid May and we had a killing freeze early in fall. The short-season hybrid dried down better and had lower drying costs.

Methods: A 24-acre field, managed as a corn-soybean rotation, was planted using two corn hybrids, Pioneer 3615 (102 day) and 3489 (108 day) at two levels of nitrogen. Each hybrid was planted in 16 alternating six-row strip plots (0.73 ac/strip) with eight strips for each of two N levels. Herbicide was banded over the row and popup fertilizer applied with the seed at planting. The sidedress application of 28-0-0 was injected between every other row. Potential yield goals were 165 bu/ac (west half) and 185 bu/ac (east half) based on residual soil $N0_3$-N levels last fall, a legume credit for the previous year's soybean crop (49 bu/ac) and fertilizer applied in 1995 based on 1.2 lb N needed per bushel of corn. Final plant population was 26,700 plants/ac on July 20 for both hybrids.

The field was harvested by Ag Specs Inc., dba Rasmussen Swine Farms, Hurley, SD, using a rotary combine with an Ag Leader yield monitor (Ames, IA). Grain yield and moisture data were collected for each strip plot at one second cycles with a corrected FM radio signal using a Global Positioning System (GPS) receiver. Crop responses measured were grain yield, moisture content, and net economic return using the average data for each strip plot directly from the yield monitor with little or no screening to remove outliers. Economic return is based on a market price of $2.80/bu less variable expenses for drying ($0.02/point), seed, and fertilizer. A nitrogen use efficiency index was considered that reflects the amount of N that was available to produce each bushel of grain harvested (residual soil NO_3, legume credit, and fertilizer). Other management information is presented in Table 1.

Table 1. Management practices and climatic summary for GPS corn hybrid performance test . Southeast Research Farm; Beresford, SD; 1995.

Previous Crop	Soybean
Tillage	Ridge-Till
Hybrids	Pioneer 3489 and 3615
Seeding Rate	26,100 seeds/ac
Planting Date	May 16
Fertilizer	9 lb N/ac + 30 lb P_2O_5/ac as 10-34-0 with seed + 86 or 108 lb N/ac as 28-0-0 sidedressed.
Weed Control	Dual banded PRE Banvel + Atrazine PRE Cultivate
Harvest Dates	Oct 11 and Oct 12
Soil Test (Fall 1994)	0-6": pH = 5.8, OM = 3.7%, P = 52 ppm (VH) K = 451 ppm (VH), salts = 0.60 mmho/cm, texture = fine, NO_3-N = 23 lb N/ac; 6-24": NO_3-N = 32 lb N/ac.

Growing Degree Units (GDU)	
-Annual	2795 (407 below normal, Apr - Oct)
-Planting to Harvest	2549 (May 16 - Oct 11)
-Planting to 1st Freeze	2382 (May 16 - Sep 22, 24°F)

Results and Discussion: Corn production was very good considering the type of season we had this year, averaging 148 bu/ac across the entire field with a range among individual strip plots of 128 to 168 bu/ac (Table 2). The best performance was obtained with the mid-season hybrid Pioneer 3489. It outyielded the shorter-season hybrid (Pioneer 3615) by an average of 8 bu/ac and produced $9/ac more profit after subtracting costs for seed, fertilizer, and drying. Pioneer 3615 was 2% drier at harvest which reduced drying costs by $6/ac ($8 vs. $14/ac).

There was also evidence that the mid-season hybrid was more efficient in terms of its use of available N. Pioneer 3489 produced a bushel of grain for each 1.4 lb/ac of N available compared to 1.5 lb N/ac for Pioneer 3615. The higher rate of fertilizer resulted in an extra 12 bu/ac of grain which netted an additional $25 to 30/ac.

Actual yields were about 85% of the yield potential predicted at the beginning of the season. The hybrids used nearly 0.25 lb N/bu more than the 1.2 lb N/bu that was used to estimate the yield potential. We also received 12% fewer growing degree units than normal. European corn borer activity was observed in this field but did not cause major problems in terms of ear loss this fall. Many other factors, like not being able to plant any earlier because of wet spring weather, also played an important role. These results are consistent with previous research we have conducted on planting dates for corn which show that full-season out performs shorter-season corn hybrids when planted in the middle of May.

Preliminary yield maps indicated good productivity in this field with high yielding areas in the north end and southeast corner. We suspected a history of livestock manure application somewhere in this field based on high soil P levels detected in last fall's soil test results. The yield maps highlight possible distribution patterns used to spread livestock manure at least six years ago on the north end and 30 years ago or more for the southeast corner.

The initial results of this study using traditional methods of analysis have provided a brief, yet detailed, idea of corn performance in general. Additional research analyses are pending that examine the spatial variability within each strip plot and incorporates this with soil test results from grid samples collected in April.

Table 2. Mid- vs. short-season corn hybrid performance for precision farming. Southeast Research Farm; Beresford, SD; 1995.

Hybrid	RM[1]	Available Nitrogen	n[2]	Grain Yield[3]	Moisture Content	Net Return
	days	lb/ac		bu/ac	%	$/ac
PIO 3489	108	200	8	146	19.8	333
		220	8	158	19.6	358
		Avg	16	152	19.7	346
PIO 3615	102	200	8	137	18.1	322
		220	8	150	17.7	352
		Avg	16	144	17.9	337
Avg			32	148	18.8	341
LSD 0.10 n=8				3	0.5	10
CV %				2.66	2.92	3.17

[1] RM = Relative Maturity
[2] n = Number of observations used to compute each average.
[3] Grain yield at 15% moisture and 56 lb/bu test weight.

CORN SEEDING RATES FOR PRECISION FARMING

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Introduction: Several agronomists have promoted that populations used be increased from the 20,000 plants/ac or less commonly used for dryland corn production in some areas to 25,000 plants/ac or more. Farmers in much of the western cornbelt are reluctant to routinely plant higher populations because of greater seed cost and concerns about lower crop yield especially during drier years. This study evaluates a broad range of seeding rates for corn using large strip plots in southeastern South Dakota. Our primary objective is to determine which plant population will ensure annually sustainable corn production in this area. Scientific research results based on entire fields should help all producers make precise management decisions concerning seeding rates regardless of whether they directly use GPS technology or not. This is one of two corn seeding rate trials we conducted this year. The other trial evaluates the row spacings and populations using small research test plots (page 32).

Methods: Five seeding rates were established in 0.4 ac strip plots across a 24-acre corn field that is managed as a corn-soybean rotation. Rates tested were 16,100, 19,900, 23,700, 27,400, and 31,200 pure live seed/ac, planted with an Accuplant variable rate seeding system (Rawson Control Systems, Inc.; Oelwein, IA). This system was adjustable in 2% increments and required both 12T and 16T sprockets to obtain these rates. The 12T sprocket planted the 16,000, 20,000 and half of the 24,000 seeds/ac rates and the remaining rates were established with the 16T sprocket. These treatments represent the widest range of corn populations we could reliably test.

The 24,000 seeds/ac rate was used as the control to compare against the other treatments. This rate was planted in alternating six-row strip plots across the entire field (26 out of 54 strip plots) four times as often as the other rates. There were 13 strips of 24,000 seeds/ac rate planted using each sprocket. The other four rates were replicated in seven strip plots interspersed across the field.

Herbicide was banded over every row and popup fertilizer applied with the seed during planting. The sidedress application of 28-0-0 was injected post emerge between every other row before the rows were cultivated. A potential yield goal of approximately 150 bu/ac was estimated based on 184 lb N/ac available from a combination of residual soil $N0_3$-N, legume credit for last year's soybean crop, and fertilizer applied during 1995 assuming 1.2 lb of available N would be needed for each bushel of grain harvested.

The field was harvested by Ag Specs Inc; dba Rasmussen Swine Farms; Hurley, SD, using a rotary combine with a GPS yield monitoring system (Ag Leader; Ames, IA). Grain yield and moisture data were collected at one second cycles using each strip plot as a single load. A FM radio signal was used with the GPS receiver for correction. Stand count, net economic return, and relative grain yield were other crop responses determined for each strip plot. Net economic return is based on the market price at harvest of $2.80/bu less variable costs for seed and grain drying ($0.02/point). Relative yield was calculated as the amount of grain produced adjusted for variations in the plant populations (grain yield divided by stand count in thousands). Additional climate and management information are summarized in Table 1.

Table 1. Management practices and climatic summary for GPS corn seeding rate evaluation. Southeast Research Farm; Beresford, SD; 1995 .

Previous Crop	Soybean
Tillage	Ridge-Till
Hybrid	DeKalb 512
Planting Dates	May 23
Fertilizer	9 lb N/ac + 30 lb P_20_5 as 10-34-0 (with seed) + 86 lb N/ac sidedressed as 28-0-0
Weed Control	Dual banded PRE Clarity + Atrazine PRE Cultivate
Stand Count	July 19
Harvest Dates	Oct 11 and 12 Ag Leader GPS
Soil Test (Fall 1994)	0-6": pH= 6.6, OM = 3.7%, P=16 ppm (M), K = 397 (VH), salts = 0.90 mmho/cm; texture=fine; $N0_3$-N = 19 lb N/ac; 6-24": $N0_3$-N = 21 lb N/ac
Growing Degree Units	
-Annual	2795 (407 below normal Apr - Oct)
-Planting-Harvest	2472 (May 23 - Oct 11)
-Planting-1st freeze	2305 (May 23 - Sep 22, 24°F)

Results and Discussion: The growing season was especially challenging this year. Soil moisture was a major limiting factor. The main problem being excessive precipitation during late winter and early spring that greatly delayed or prevented planting in many fields. Air temperatures were 5 to 10 degrees below normal from March through May and continued somewhat cool for much of the season. As a result we received 12% fewer growing degree units than normal (2800 vs. 3200) from April through October. The season was shortened even further by killing frosts on September 22 and 23.

Corn production averaged 132 bu/ac across the entire field with a range among individual strip plots of 107 to 153 bu/ac. The best performance was observed with corn populations of 25,000 and 28,000 plants/ac with the management and climatic conditions affecting this field (Table 2). These optimum populations achieved 96% of their predicted yield potential of 150 bu/ac. Populations of less than 25,000 plants/ac only reached 75 to 88% of their yield and economic potentials. These losses ranged from more than 10 to 30 bu/ac in yield for an economic loss of $25 to 75/ac after subtracting seed and drying costs if the corn was dried and marketed at harvest.

The Accuplant variable seeding rate system was very accurate on a pure live seed basis. The seeding rate efficiency (stand count/seeding rate) averaged 92% accuracy across all plant populations. Average corn populations for each seeding rate were within 11% of the amount seeded. The main inconvenience in this study was having to change sprockets to obtain the desired range in seeding rates required for this trial. This would not normally be a major concern for most commercial applications unless frequent changes were needed to plant numerous dryland and irrigated fields or dramatic changes were required for variable seeding rate GPS applications. Tests also showed very good agreement between different sprockets used to plant the same corn seeding rate.

The higher plant populations tended to dry down better (16.2% vs. 17.5%). This seemed to be a function of relative yield where the lower the populations produced nearly 7 bu of grain/1000 plants (0.38 lb/ear) compared to 5 bu/1000 plants (0.29 lb/ear) for the higher populations (assuming single ears per plant). Even though the lower populations were more efficient in the amount of grain each plant produced, the populations of 25,000 to 28,000 plants/ac utilized sunlight and other nutrients more effectively on each acre of land available. Lower populations were also less efficient in the use of available N. Higher populations produced a bushel of grain for every 1.28 lb of available N whereas, the lower populations needed 1.64 lb N/bu.

The range of seeding rates used this year did not extend far enough to reach the point where overcrowding inhibited corn performance with the hybrid tested. This was also confirmed with geostatistical analysis (data not shown). That approach, however, used individual data points collected by the GPS receiver after cleaning up the data by deleting a few outliers (extraneous clutter) and making decisions (inferences) based on nearest neighbor comparisons among the data points.

Preliminary results using geostatistics suggest we still gained nearly $2 to 3/ac return by increasing the plant populations from 25,000 to 28,000 plants/ac. This is not significantly different than results with the traditional strategy where $1.00/ac was lost going to the higher rate. The data in Table 2 are averages of the GPS data points for each strip plot, analyzed without regard to nearest neighbor comparisons, directly as it was stored in the yield monitor without deleting many outliers. Some producers may not have the time or resources to clean up this information very easily before making yield maps or obtaining load averages.

Table 2. Seeding rate effects on corn production for precision farming. Southeast Research Farm; Beresford, SD; 1995.

Seeding Rate	Sprocket Size	n[1]	Stand Count	Grain Yield[2]	Moisture Content	Net Return[3]	Relative Yield
seeds/ac			plants/ac	bu/ac	%	$/ac	bu/1000 plants
16,100	12T	7	16,400	112	17.5	290	6.87
19,900	12T	7	18,800	127	17.0	327	6.78
23,700	12 & 16T	26	21,800	132	16.8	339	6.11
27,400	16T	7	24,700	144	16.5	365	5.85
31,200	16T	7	27,900	144	16.2	364	5.18
Avg		54	21,900	132	16.8	339	6.14
LSD 0.10 n=7			1,200	4	0.4	12	0.39
CV (%)			5.96	3.49	2.73	3.84	6.67

[1] n = number of observations used to compute the average.
[2] Grain at 15% moisture and 56 lb/but test weight.
[3] Based on $2.80/bu less drying and seed costs.

The yield average for the entire field was lower for this seeding rate study than that measured for the GPS corn hybrid evaluation (133 vs. 148 bu/ac). They are both upland fields positioned adjacent to each other on the landscape and are managed in a similar manner. The seeding rate field is a little lower in elevation on a gradual hillslope position and is planted in an east-west row direction. The hybrid study lies just above it on the topslope or shoulder position and is planted in north-south rows. The hybrid study was planted nearly one full week earlier. Half of the hybrid field planted using a mid-season hybrid that outyielded a shorter-season hybrid that had a relative maturity comparable to the hybrid used in this seeding rate study. Another 50% of the field received enough additional N fertilizer when sidedressed to bring the yield potential to as much as 30 bu/ac more (185 vs. 150 bu/ac). The hybrid field also had 10 to 15 bu/ac greater potential due to residual soil N levels.

When crop performance is measured at comparable levels of management we get very similar results. Both fields yielded about 140 bu/ac and had $325/ac for net economic return after deducting seed, fertilizer, and drying costs at the same population level. There was more ear loss from European corn borer at harvest in the seeding rate field but not enough to be considered as serious damage. The field used for hybrid evaluation, however, was less efficient in achieving its yield potential (83% of 165 bu/ac vs. 96% of 150 bu/ac) and in its N use efficiency (1.5 vs. 1.3 lb N/bu).

In a field with such a large range in seeding rates it could be difficult to accurately detect historic patterns of livestock manure distribution (more than six years ago). The yield maps indicate that the northern portions of this field were more productive and agrees well with the way the landowner said manure had been applied years ago.

In summary our preliminary findings show that the optimum populations for corn production were 25,000 to 28,000 plants/ac. These populations were more sustainable in terms of yield, profit, and N use than all corn populations less than 25,000 plants/ac given the levels of managements and climate that controlled crop production on this field. It may be that dryland corn populations of 30,000 plants/ac or more will perform the better with ideal conditions like we experienced in 1994. Conversely, lower populations will likely be more sustainable in our drier years. It appears that higher seeding rates may be justified for this area especially during years when soil moisture is not short in the spring.

DATE OF PLANTING SOYBEAN

R. K. Berg

Southeast Farm 9504

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 36 to 49 bu/ac. Best yields occurred when these varieties were planted in mid May through very early June. Yield decreased 5 to 8 bu/ac (15%) when planted after June 1. Extremely wet spring weather made establishing the companion planting date study with corn impossible this year during April through mid May.

Methods: 'Granite' (Group I) and 'Sturdy' (Group II) varieties were evaluated for 1995. This year's planting dates were May 15, May 25, June 01, June 08, and June 15. Weed pressure required the use of a burndown herbicide in the spring and post emergence treatments for volunteer corn and perennial broadleaf control. Stand count, plant height, grain yield, moisture content, test weight and net return were measured for each plot. Laboratory analyses are pending for grain protein and oil contents. Economic return was calculated using a market price of $5.88/bu at harvest then deducting cost for seed and herbicide. The first three planting dates were harvested on September 26 and the last two dates on October 17. Table 1 reports additional management information.

Table 1. Management practices for date of planting soybean study. Southeast Research Farm, Beresford, SD; 1995.

Previous Crop	Corn 1994
Tillage	Ridge-Till
Seeding Rate	170,000 seeds/ac
Harvest Dates	Sep 26 and Oct 17
Weed Control	Dual+Pursuit+Gramoxone (EPP)
	Poast & Basagran (Post)
	Cultivation
Soil Test	0-6": pH=6.0, OM=3.5%, P=19 ppm (M), K=312 ppm (VH) salts=0.30 mmho/cm, texture=medium, $N0_3$-N=22 lb/ac;
	6-24": $N0_3$-N=23 lb/ac

Results and Discussion: Wet spring weather made it impossible to establish our first planting date on May 5 so dates were adjusted to 7-day intervals after May 25. Good stands were established for both varieties (approximately 151,000 plants/ac) and plant height was more than 30 inches (Table 2). 'Granite' tended to have better stands than 'Sturdy'.

Table 2. Effect of planting date on soybean performance. Southeast Research Farm; Beresford, SD; 1995.

Variety	Planting Date	Stand Count	Plant Height	Grain Yield[1]	Moisture Content	Test Weight	Net Return[2]
		plts/ac	inch	bu/ac	%	lb/bu	$/ac
'Granite'	May 15	164,900	29.4	48	9.9	57.1	177
	May 25	166,100	34.1	49	10.4	56.4	182
	Jun 01	153,300	33.8	45	11.3	55.5	161
	Jun 08	141,800	33.3	37	8.2	56.6	113
	Jun 15	152,700	30.6	36	8.1	56.5	110
'Sturdy'	May 15	158,800	31.9	46	10.5	56.1	171
	May 25	149,100	31.0	49	11.7	55.0	187
	Jun 01	138,100	34.2	44	10.6	55.6	157
	Jun 08	138,700	32.9	38	8.2	57.5	125
	Jun 15	143,600	33.9	39	8.3	57.6	130
	Avg	150,700	32.5	43	9.7	56.4	151
$LSD_{0.10}$		13,000	3.2	5	1.4	1.4	27
CV (%)		7.11	8.2	9	11.6	2.1	15

[1] Grain yield at 13% moisture content and 60 lb/bu test weight.
[2] Based on $5.88/bu less seed and herbicide expenses.

Planting date strongly influenced each response measured (except plant height). Plant populations, grain yield, moisture content, and profitability were higher with the earlier planting dates through the end of May. Yield and profitability peaked at the May 25 planting date then declined 0.5 to 1 bu/ac at a cost of about $3 to 6/day between May 25 and June 8. Moisture content was 2 to 3% greater for grain harvested on September 26. The variation in crop maturity is usually too great for the entire trial to be combined at the same time. Problems from shatter or lodging have not been observed in this study. There was no evidence of any variety by planting date interactions that might indicate these varieties responded differently to the planting dates tested this year.

Table 3. Ten year average yields (1986-1995) for date of planting soybean study. Southeast Research Farm; Beresford, SD; 1995.

	Average Planting Date				
Variety	1st	2nd	3rd	4th	5th
	-----------------Bu/ac @ 13%----------------				
Early (Group I & II)	43	42	42	40	35
Mid (Group II)	41	39	38	36	33

In terms of long-term yield averages (Table 3) the earlier maturing varieties tested during the past 10 years seem to provide about 2 to 4 bu/ac (5-10%) greater yield than the mid-Group II varieties. These results, however, can vary depending on the conditions associated with each year's growing season.

CULTIVATION EFFECTS ON NO-TILL CORN AND SOYBEAN

R. K. Berg

Southeast Farm 9505

Summary: This is the fourth year of a study designed to examine the effects cultivation has on crop performance in a no-till corn and soybean rotation where both crops are monitored each year. No-till cultivations increased soybean yields by 3 bu/ac (8%), but had little or no measurable effect on corn production.

Methods: This trial was designed with replicated strip plots in 1992 to compare no-till corn and soybean with zero, one, two, and three cultivations during the growing season. Crops are rotated but otherwise cultivation schemes are maintained in exactly the same field and plot positions each year. Herbicides were used on all plots but the main intent is to examine effects of cultivation rather than strictly for weed control. Responses measured this year included stand count, grain yield, moisture content, test weight, and economic return for both crops. Economic return reflects gross income with corn at $2.80 and soybean at $5.88 per bushel with discounts for moisture and low test weight as well as the tillage costs at $5.00/ac for each cultivation. Other management factors regarding this study are presented in Table 1.

Table 1.Management practices: No-till cultivation. Southeast Research Farm; Beresford, SD; 1995.

	Corn	Soybean
Tillage	No-till planted	No-till planted
Past Crop	Soybean	Corn
Hybrid/Variety	DeKalb 401	'Conrad'
Planting Date	Jun 15	Jun 15
Seeding Rate	27,000 seeds/ac	170,000 seeds/ac
Herbicide	Dual banded at planting; Roundup+Bladex+2,4-D (PRE) Bladex+Atrazine (early Post)	Roundup (PRE) Pursuit (Early Post)
Fertilizer	9 lb N + 30 lb P_20_5/ac 10-34-0 popup; 65 lb N/ac 28-0-0 sidedressed	None
Cultivation Dates	Jul 10, 14, 18	Jul 10, 18, 26
Stand Count	Jul 19	Jul 19
Harvest Date	Oct 16	Oct 19

Results and Discussion: Cultivation significantly increased soybean grain yield again this year by 3 bu/ac (8%); (Table 2). Soybean yielded 35 bu/ac without cultivation. Wet soil at planting resulted in less than optimum stands and soybean was not fully mature when the hard freeze occurred on September 23 and 24.

Table 2.Effect of cultivation on no-till soybean performance. Southeast Research Farm; Beresford, SD; 1995.

Cultivations	Stand Count	Grain Yield[1]	Moisture Content	Test Weight	Economic Return
	plts/ac	bu/ac	%	lb/bu	$/ac
0	102,200	35	9.3	56.1	208
1	95,500	38	9.3	56.1	217
2	93,100	38	9.2	56.3	211
3	104,600	38	9.2	56.4	209
Avg	98,900	37	9.2	56.2	211
$LSD_{0.10}$	NS	2	NS	NS	
CV %	11	4	2.0	0.4	

[1] Grain yield at 13% moisture and 60 lb/bu test weight.

Corn yield averaged only 70 bu/ac (Table 3), dried to 17% moisture at harvest, and had light test weight (52 lb/bu). The final plant population was almost 22,100 plants/ac. Cultivation during the growing season did not affect no-till corn production in 1995, except that corn plant populations increased with more frequent cultivations.

Field operations this season were greatly delayed due to wet spring weather. Both crops were established under less than ideal planting date and soil conditions for commercial farming operations. Tillage may have enhanced soil aeration, mineralized more organic matter, stimulated microbial activity and soil enzymes that resulted in better no-till soybean yield again this season and enhanced corn plant populations but there was no apparent economic benefit from cultivation for either crop. Gross revenue after cultivation costs and dockage was approximately $200/ac for both crops.

Table 3.Effect of cultivation on no-till corn performance. Southeast Research Farm; Beresford, SD; 1995.

Cultivations	Stand Count	Grain Yield[1]	Moisture Content	Test Weight	Economic Return
	plts/ac	bu/ac	%	lb/bu	$/ac
0	20,800	70	16.9	51.4	196
1	21,300	73	16.7	51.9	198
2	22,400	71	17.1	51.8	189
3	24,000	72	17.2	52.3	185
Avg	22,100	71	17.0	51.8	192
$LSD_{0.10}$	1,800	0.2	NS	NS	
CV %	6.31	2.07	1.8	1.0	

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

CORN ROW SPACING AND POPULATION STUDY

R. K. Berg

Southeast Farm 9506

<u>Introduction:</u> There is considerable interest about raising corn in very narrow (22-inch) rows using higher seeding rates for modern hybrids. Corn performance at various combinations of row spacings and seeding rates is needed to help producers make decisions about seed and equipment purchases and whether changing either of these factors will be profitable or not. This study evaluates the interaction between these factors across a broad range of row spacing and seeding rate options with climatic conditions common to the western Cornbelt. This is one of two corn seeding rate trials that we conducted in 1995. The other trial characterized a 24-acre field using in large strip plots harvested with a yield monitor and global positioning system (page 21).

<u>Methods:</u> Corn was planted in 20-, 30-, and 36-inch rows at rates of 20,000, 25,000, and 30,000 seed/ac within each row spacing. A unit planter was used so the individual seed boxes could be easily moved to change the distances between rows. The nine combinations used were the same as those tested in 1992 to 1994 in a conventionally tilled corn-soybean rotation. Stand count, grain yield, moisture content, and test weight were measured directly. Relative yield was calculated as the ratio between the amount of grain harvested and the stand count. The economics of these factors was also computed with corn valued at $2.80/bu after subtracting seed and drying costs ($0.02/point above 15% moisture). Climate and other management factors are outlined in Table 1.

<u>Results and Discussion:</u> An extremely wet and cool spring provided abundant to excessive soil moisture levels that made this growing season challenging to manage. In general, when averaged across all plots, a population of 21,300 plants/ac was established that yielded 122 bu/ac at 20% moisture and 55.6 lb/bu test weight (Table 2). Net returns after paying for seed and drying costs were around $300/ac and nearly 6 bu of grain was harvested for every 1000 plants. This amounts to approximately 0.33 lb of shelled corn per ear assuming one ear per plant.

Table 1. Management practices and climatic summary for row spacing and population study. Southeast Research Farm; Beresford, SD; 1995.

Previous Crop	Soybean
Tillage	Spring field cultivate
Hybrid	Pioneer 3556
Fertilizer	130 lb N/ac + 35 lb P_2O_5 as 28-0-0 and 10-34-0 incorporated at planting.
Seeding Rate	20,000, 25,000, and 30,000 seed/acre
Row Spacing	20, 30, and 36 inches
Planting Date	May 16
Stand Count	Jul 14
Harvest Date	Oct 3
Herbicide	Lasso + Bladex + Atrazine; PPI
Precipitation	
-Annual	30.7 inches (4.8 inches above normal, Jan - Dec)
-Growing Season	20.8 inches (1.4 inches above normal, Apr - Sep)
Growing Degree Units	
-Annual	2795 (407 below normal, Apr - Oct)
-Planting-Harvest	2502 (May 16 - Oct 3)
-Planting-1st Freeze	2382 (May 16 - Sep 22 & 23 24°F)
Soil Series	Egan silty clay loam (0-1% slope)
Soil Taxonomy	Fine-silty, mixed, mesic Udic Haplustoll
Soil Test (fall 1994)	0-6": pH=6.4, OM=4.3%, P=11 ppm(L), K=572(VH), salts=1.20 mmho/cm, texture=fine, NO_3-N= 21 lb N/ac; 6-24": NO_3-N= 30 lb N/ac.

Plant populations ranged from 16,000 to 29,000 plants/ac, however, the population distribution is not consistent among the row spacings. The intended populations were achieved for the 20-inch row spacing and are 15 to 25% lower for the others. As in previous years the 30-inch rows had the best production and profit. Most populations in the 36-inch row spacing were less productive and profitable than the 30-inch rows, but still performed better than the 20-inch rows.

Because the populations are not consistent among treatments, it is important to examine relative yield which attempts to adjust yield as a function of population. The lower populations were more efficient in the amount of grain they were able to produce per plant because there is less competition for sunlight, soil moisture, and other nutrients. It is interesting to note that the 30- and 36-inch rows had similar efficiencies for relative yield and both were more efficient than the 20-inch rows. The least efficient combination was 29,000 plants/ac in 20-inch rows, (0.23 lb of shelled corn/ear) and the most efficient group was 17,000 plants/ac in 30-inch rows (0.42 lb shelled corn/ear). The amount of grain per plant is important, but the distribution of plants per unit area must also be considered. The best yield in the trial was a population of 23,000 plants/ac in 36-inch rows (131 bu/ac), however, it was not any more profitable than those in 30-inch rows.

Both row spacing and plant population had a large impact on corn production and net earnings. The best row spacing was 30-inch rows. Even though better stands were established in the 20-inch rows overcrowding greatly inhibited crop performance. The economic impact of differences among these factors amounted to $40/ac ($322 vs. 280/ac).

Table 2. Row spacing and seeding rate effects on corn production. Southeast Research Farm; Beresford, SD; 1995.

Row Spacing	Seeding Rate	Stand Count	Grain Yield[1]	Grain Moisture	Test Weight	Net Return[2]	Relative Yield
inches	seeds/ac	plants/ac	bu/ac	%	lb/bu	$/ac	bu/1000 plants
20	20,000	21,500	113	19.9	55.5	284	5.28
	25,000	24,900	116	19.9	56.0	286	4.67
	30,000	28,500	116	19.8	55.9	281	4.07
30	20,000	17,000	127	19.7	55.8	322	7.54
	25,000	20,400	128	19.8	55.5	319	6.32
	30,000	22,000	128	20.1	55.6	313	5.84
36	20,000	15,900	116	20.1	54.8	291	7.32
	25,000	19,000	124	19.7	55.1	309	6.55
	30,000	23,000	131	19.9	56.0	322	5.71
Avg		21,300	122	19.9	55.6	303	5.92
LSD $_{0.10\ n=4}$		1,600	7	NS[3]	1.2	19	0.50
CV (%)		6.26	4.65	1.7	0.7	5.50	7.05

[1] Grain yield at 15% moisture and 56 lb/bu test weight.
[2] Based on $2.80/bu less drying and seed costs.
[3] NS = not significant

LATE PLANTED SHORT-SEASON CORN HYBRID PERFORMANCE

R. K. Berg

Southeast Farm 9507

Introduction: A research study, sponsored in part by DeKalb Plant Genetics (Brandon, SD), evaluated the performance of short-season corn hybrids when planted after May in southeast South Dakota. While it is well documented that corn performs poorly when planted late in the planting season, the very wet spring weather of 1995 offered a unique opportunity to examine hybrids ranging from 80 to 102 days relative maturity that might be suited for later than normal planting in our area. Corn hybrids with relative maturities (RM) of 100 to 115 days are typically planted in this part of the state. These results do not reflect a normal planting date and we are not promoting that corn be planted in mid June. Other germplasm is commercially available that was not included in this test. Data from this report is not to be used for promotional purposes unless all data is published in its entirety or written permission is granted in advance from South Dakota State University, Agricultural Experiment Station.

Methods: This research trial was planted in mid June and is not associated with from the Crop Performance Trials routinely planted here by Bob Hall, SDSU, Brookings, SD. The intent of this study was to evaluate nine DeKalb corn hybrids with relative maturities from 80 to 100 days. We also included six additional hybrids for a total of 15 hybrids.

The site was conventionally tilled just before planting and was previously managed as a corn-soybean ridge-till system. Hybrids were planted according to a randomized experimental design in 30-inch rows. A six-row John Deere 7100 Maximerge planter was used because of the variation in seed size among hybrids tested. Herbicides were applied preemerge and the field was cultivated once after emergence for weed control. A sidedress application of 28% N fertilizer was injected between alternate rows.

Stand counts were measured by hand counting the number of plants in 17' 5" for two adjacent middle rows in each plot. Three rows from every plot were harvested with a John Deere 3300 combine equipped with electronic scales for measuring yield from research plots to 0.01 lb accuracy. Grain moisture was taken in triplicate using a portable grain moisture meter and a single test weight was measured to the nearest 0.5 lb/bu for each plot in the field. Economic analysis was based on grain marketed directly at an elevator during harvest. Market price was \$2.80/bu with dockages of \$0.05/point above

15% moisture and $0.01/lb between 52 to 54 lb/bu and $0.02/lb below 52 lb/bu test weight on a fresh grain weight basis.

Table 1. Management practices and climatic summary for late planted short-season corn hybrid performance study. Southeast Research Farm; Beresford, SD; 1995.

Previous Crop	Soybean
Tillage	Field cultivate
Fertilizer	60 lb N/ac sidedress as 28-0-0
Seeding Rate	27,000 seeds/ac
Planting Date	Jun 15
Stand Count	Jul 19
Harvest Date	Oct 16
Weed Control	Bladex + Atrazine (PRE) Cultivate
Precipitation:	
-Annual	30.7 inches (4.8 inches above normal, Jan - Dec)
-Growing Season	20.8 inches (1.4 inches above normal, Apr - Sep)
Growing Degree Units (GDU):	
-Annual	2795 (407 below normal, Apr - Oct)
-Planting-Harvest	2256 (Jun 15 - Oct 16)
-Planting-1st freeze	2040 (Jun 15 - Sep 22 & 23, 24^{o}F)
Soil Test (fall 1994)	0-6": pH=6.3, OM=3.4%, P=21 ppm (M), K=512 ppm (VH), salts=0.60 mmho/cm, texture=fine, NO_3-N=9 lb/ac; 6-24": NO_3-N=12 lb/ac

A randomized complete block design with 15 treatments each replicated four times for a total of 60 plots were established for this study. Statistical analysis was conducted using analysis of variance. Treatment differences were determined using Least Significant Difference (LSD) at the 90% probability level. Proper rounding for data was determined by setting the number of significant digits to 1/10 the square root of the MSE.

Responses statistically analyzed for each plot were stand count, grain yield, test weight, grain moisture, relative grain yield, and economic return. Other management and climatic information for this trial is summarized in Table 1.

Results and Discussion: In general across all hybrids, good stands were established (22,700 seeds/ac), grain yield was low but respectable for the planting date and averaged nearly 70 bu/ac, with 20% moisture, and 48.5 lb/bu test weight. The relative grain yield adjusted for stand count was approximately 3 bu of grain per 1000 plants and economic returns after subtracting moisture and test weight dockages were in the neighborhood of $180/ac. Specific corn hybrid responses for this trial are shown in Table 2.

Hybrid effects were statistically important for stand count, moisture content, test weight, and economic return but not for yield or relative yield according to analysis of variance results. Most of these appear within the DeKalb hybrids because of the greater number and range of maturity tested. No differences were observed between the later maturing Dahlco hybrids and differences among the Pioneer hybrids are due to the later maturity associated with 3615.

Grain yield was relatively low, averaging only 50% of the estimated yield potential (140 bu/ac) for ideal planting conditions based on fall soil test results from 1994 (21 lb NO_3-N/ac) plus a full legume credit associated with 56 bu/ac yield from the 1994 soybean crop for this trial. Statistical analysis indicates the variances in both yield and relative yield among these hybrids were probably not important. However, LSD comparisons show 10 bu/ac and 0.79 bu/1000 plants differences among the hybrids tested. DeKalb 343, 363, 381, 401, and 471, plus the check and all Pioneer and Dahlco hybrids yielded fairly well but DeKalb 493 and 306 had poorer yields. Good stands were obtained, however, the populations were not uniform among these hybrids so relative yield per 1000 plants was also examined. The range in population was 5000 plants/ac. Populations were a little low (<22,000) for DeKalb 363, 381, 421, Pioneer 3733, and the check. DeKalb 421 was among the most efficient (3.50 bu/1000 plants) and 493 the least efficient (2.71 bu/1000 plants) hybrid.

Harvest moisture was directly related to relative maturity. DeKalb 306 dried to below 15% moisture in the field. Hybrids with relative maturity of 100 days or more contained moisture in the mid to upper 20% level at harvest. DeKalb 343 had the best test weight (53 lb/bu) but test weights for all hybrids were quite low. The most economic benefit was observed for DeKalb 343, 363, 381, 401, 421, Pioneer 3893, and 3733.

Five DeKalb and two Pioneer hybrids performed well in this trial. Both Dahlco hybrids yielded well but poor harvest moisture and test weights hampered their economic return as was observed for most of the other hybrids with a relative maturity of 94 days and greater. Surprisingly Pioneer 3733 (99 day) seemed to perform comparable to the 80- to 92-day hybrids.

Some agronomists claim that when corn is planted late it has the capability to mature with less than the full black layer GDU listed by seed companies for normal planting dates. Relative maturity had a spread of nearly 3 weeks among the hybrids tested. Published black layer GDUs ranged from 2040 to 2520. We received 81% of the entire season's GDUs between planting and harvest but only 73% of the GDUs during the time these hybrids had to grow until the first killing freeze. Hybrids that performed the best in this study tended to be a consistent group with published GDUs from approximately 2050 to 2300 plus Pioneer 3733 at 2410 GDUs.   The published GDU values needed to reach black layer are more consistent with what we received through harvest (2256) rather than through the first killing frost (2040). If performance were limited primarily by GDU then three hybrids (DeKalb 306, 343, and Pioneer 3893) would have been expected to perform well, instead of the seven we observed.

Other important factors when corn is planted late are stalk quality and ear retention. The stalks of some hybrids were weathered more than others (darker colored) in this study. There were no major lodging or ear loss problems observed at harvest.

In summary, grain yields were low and test weights light, as would be expected for this late a planting date. Hybrids with relative maturities of 92 days or less generally yielded relatively well and had among the better economic benefits in this study. While it appears several short-season corn hybrids currently available may be planted in rare or emergency situations late in the planting season, this is NOT a practice that should be encouraged. Sustainable production cannot be expected when half of the yield potential is all that can be achieved and economic losses can be severe.

Table 2. Performance of late planted short-season corn hybrids. Southeast Research Farm; Beresford, SD; 1995.

Hybrid	Relative Maturity	GDU[1]	Stand Count	Grain Yield[2]	Moisture Content	Test Weight	Relative Yield	Economic Return
	days		plants/ ac	bu/ac	%	lb/bu	bu/1000 plants	$/ac
DeKalb 306	80	2040	23,100	65	14.4	51.9	2.82	179
DeKalb 343	84	2075	23,000	73	16.2	53.0	3.19	202
DeKalb 363	86	2175	22,300	68	16.2	51.0	3.06	184
DeKalb 381	88	2300	20,600	69	16.1	50.0	3.41	187
DeKalb 401	90	2300	22,900	74	16.8	51.0	3.22	200
DeKalb 421	92	2320	19,500	67	17.0	49.8	3.50	180
DeKalb 442	94	2350	23,400	67	20.0	47.8	2.90	174
DeKalb 471	97	2440	23,300	71	22.0	45.5	3.11	175
DeKalb 493	99	2470	23,800	64	21.4	46.3	2.71	163
Check	101	2520	21,900	71	28.0	43.5	3.24	159
Pioneer 3893	90	2040	23,160	72	19.3	50.6	3.14	190
Pioneer 3373	99	2410	21,500	73	19.3	51.1	3.40	194
Pioneer 3615	102	2430	24,100	72	26.7	46.0	3.01	169
Dahlco 2580	100	2580	23,500	69	26.4	46.6	2.95	165
Dahlco 2530	100	2575	24,500	74	26.0	45.6	3.04	175
Avg.	93		22,700	70	20.4	48.6	3.11	180
LSD 0.10 n=4			2,300	7	1.5	1.1	NS	20
CV (%)			8.56	8	6.3	1.9	13.55	9

[1] Growing degree units to black layer published in seed catalog.
[2] Grain yield at 15% moisture and 56 lb/bu test weight.
(NS = not significant).

LIQUID RHIZOBIAL INOCULANTS FOR SOYBEAN PRODUCTION

R. K. Berg

Southeast Farm 9508

Introduction: Inoculation can enhance production for a legume crop like soybean when field soils contain little or no forming bacteria (bradyrhizobia) and have limited amounts of nitrogen. Once a population of these bacteria become established, however, they are generally quite competitive and it is difficult to successfully introduce more efficient strains. This research evaluatef the effectiveness of two liquid microbial (Nitragin) inoculants (Cell-Tech S and LIFT) and was sponsored in part by LiphaTech, Inc.; Milwaukee, WI.

Methods: Treatments tested were dry seed without inoculant (CK1), Cell-Tech S inoculant coated onto dry seed at 2.5 oz/bu (CELT), 20 gal/ac of water without inoculant (CK2), and 20 gal/ac of water plus LIFT at 1 oz/1000 ft of row (LIFT) . The experiment was a randomized complete block design consisting of four treatments, each replicated six times.

All plots of CK1 were the first treatment planted using only dry seed without inoculum. Planter boxes were then completely emptied and seed thoroughly mixed with the proper dose of CELT and planted. Next this seed was replaced with noninoculated seed (CK1) and planted while applying 20 gal/ac of fresh water directly over the seed to obtain the CK2 treatment. The final treatment was planted by adding the proper concentration of LIFT to the water in our fertilizer tank and running the pump to fill all hoses with inoculum solution before planting. The liquid fertilizer system on our six row ridge-till planter used for the CK2 and LIFT treatments was completely drained, rinsed with clean water several times, and calibrated before planting.

Table 1. Management practices and climatic summary for LiphaTech soybean inoculation study. Southeast Research Farm; Beresford, SD; 1995.

Previous Crop	Corn (Corn-soybean rotation)
Tillage	Fall chisel; spring field cultivate
Fertilizer	35 lb P_2O_5/ac as 10-34-0 incorporated at planting
Seeding Rate	170,000 seeds/ac
Stand Count	132,200 plants/ac
Variety	'Kenwood' (Group II)
Planting Date	Jun 01
Harvest Date	Oct 18
Weed Control	Dual + Pursuit, PPI; Poast Post; Basagran Post; Cultivate
Growing-Degree Units	
-Annual	2795 (407 below normal, Apr - Oct)
-Planting to harvest	2464 (June 1 - Oct 18)
-Planting to 1st freeze	2229 (June 1 - Sep 22, 24°F)

During early bloom (July 19, 1995) four plants from each plot were dug with a shovel and rinsed in a bucket of water before counting nodules/plant and making growth stage determinations. Five rows from every plot were harvested at maturity with a JD 3300 combine equipped with electronic scales for measuring yield from research plots. Grain moisture was taken in triplicate and a single test weight measured for each plot in the field. Seed samples from each plot were analyzed for protein and oil content (laboratory results pending). The data were statistically analyzed by Analysis of Variance to determine treatment differences using Least Significant Difference (LSD) at the 90% probability level. Additional management information is summarized in Table 1.

Results and Discussion: At early bloom each plant contained about 15 nodules on the tap and lateral roots (Table 2). The soybean crop was in the V7 stage and just beginning reproductive growth (R1). Grain production at harvest averaged 43 bu/ac with 8% moisture and a test weight of about 56.5 lb/bu. The inoculant products tested did not significantly affect any of the responses measured. Overall the mean-based analysis showed no strong evidence of major treatment effects under the conditions of this study. The initial conclusions from this study do not indicate that investing time and money inoculating soybean in the western Cornbelt at planting is worthwhile in fields that have raised soybean successfully for several decades.

Table 2. Effect of inoculation on soybean performance. Southeast Research Farm; Beresford, SD; 1995.

Treatment	Inco[1]	Nodulation[2]	Grain Yield[3]	Grain Moisture	Test Weight
		nods/plant	bu/ac	%	lb/bu
Dry Control	-	13	42.6	8.3	56.7
Cell Tech	+	14	43.0	8.4	56.7
Water	-	18	42.4	8.4	56.5
Water+LIFT	+	16	43.4	8.4	56.4
Avg		15	42.9	8.4	56.6
LSD 0.10 n=6		NS	NS	NS	NS
CV (%)		36	4.7	1.07	0.6

[1] Inoc = Inoculation; (NS = Not Significant)
[2] July 19, 1995 (Growth stage V7.0, R1)
[3] Grain yield at 13% moisture and 60 lb/bu test weight

LONG-TERM RESIDUAL PHOSPHORUS STUDY

Ron Gelderman and Jim Gerwing

Plant Science 9509

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

The objectives of this study are:

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

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

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

Methods Four soil test levels (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 low (L) 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 May 10, 1994. Identical annual P rates were applied at planting with a fertilizer opener that placed the fertilizer two inches below and two 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 was applied over the site.

In 1995, 'Marcus' soybeans were planted no-till (30" rows) at about 180,000 seeds/ac on May 19, 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. Plot size was 15 feet by 45 feet. Two of the center rows were harvested for grain with a plot combine on October 11, 1995.

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 three inch increments to a nine inch depth. A grain sample was taken for P analysis to determine phosphorus removal.

Results and Discussion The soil P tests (Fall 1994) reflect the soil test levels that were established by application of phosphorus in 1993 (Table 1). Categories for both tests are similar. The Olsen values are approximately 60% of Bray 1-P soil tests. The broadcast annual rates of 40 lb/ac and 60 lb/ac increased Bray soil test by 3 and 5 ppm, respectively.

Yields for the study are found in Table 3 and presented in graphical form in Figure 1 and 2. Rate of banded phosphate influenced soybean yields differently depending on soil test level (Table 3, Figures 1 and 2). At a very low soil test, soybean yield was raised 10 bu/ac by banding phosphorus - maximizing with the 60 lb/ac rate. At the low and medium test levels, yields increased 3 to 5 bu/ac with the 40 lb/ac rate maximizing yields. When soil tests were very high - added phosphate had little influence on yields. The additional P fertilizer is not needed when soil phosphate levels are high enough to supply needed plant P.

Placement of phosphorus had a significant influence on soybean response to rates of P. Band applied P increased yields by 4 bu/ac with applications of 40 lb/ac while broadcast P had little effect on no-till soybean (Figure 2).

Table 1. Phosphorus soil test[1] from soil test levels of long-term P study.

Soil Test Level	Bray P ppm	Category[2]	Olsen P ppm	Category
1	5	VL	3	VL
2	8	L	5	L
3	13	M	8	M
4	25	VH	15	H

[1] Sampled fall of 1994 from checks of each soil test level.
[2] VL = Very Low; L = Low; M = Medium; H = High; VH = Very High.

Table 2. Phosphorus soil tests [1] from broadcast rates of long-term P study.

$P_2 0_5$ Rate lb/ac	Bray P ppm	Category[2]	Olsen P ppm	Category
0	11	M	6	L
20	11	M	6	L
40	14	M	7	L
60	16	H	8	M

[1]Sampled fall of 1994 from checks of each soil test level.
[2]VL = Very Low; L = Low; M = Medium; H = High; VH = Very High

Table 3. Soybean yields as influenced by soil test level, annual P rates and placement, long-term P study, 1995.

Soil Test Category[1]	Annual $P_2 0_5$ Rates - lb/ac: 0	20	40	60	Avg
	Yield, bu/ac				
VL	39	44	45	49	44
L (band)	44	45	48	47	46
L (brdcst)	46	44	44	45	45
M	43	47	48	44	46
VH	45	44	46	45	45
Avg	43	45	47	46	

Pr >F: soil test level = 0.9 (NS); annual rate = 0.0072; soil test *rate = 0.0076. Placement = 0.06.

[1]VL, L, M and H = very low (5 ppm), low (8 ppm), medium (13 ppm), and very high (25 ppm), respectively.

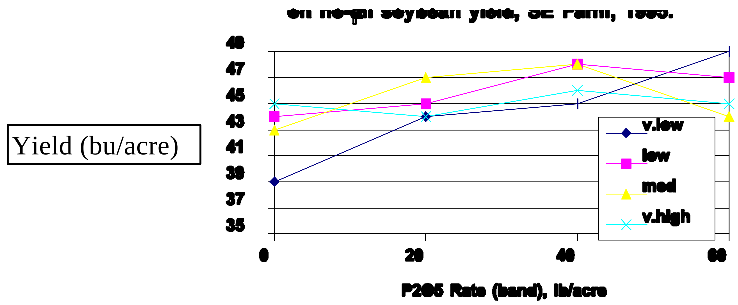
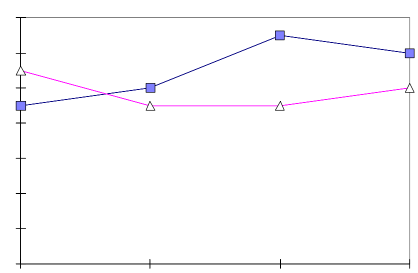


Figure 2. Influence of P placement and rate on no-till se



THE INFLUENCE OF P LEVEL AND ROW SPACING ON THE GROWTH AND GRAIN YIELD OF SOYBEAN VARIETUES

Howard J. Woodard and Anthony Bly

Plant Science 9510

Methods: A field experiment was established on an Egan silty clay loam on land rented by the Southeast Research Farm near Beresford, SD. The field was tilled twice with a field cultivator. A 75 lb/ac P_2O_5 treatment was broadcast-applied on part of the field as 14 gal/ac of 10-34-0 and incorporated by field cultivator. Three public release soybean varieties from each of maturity groups 0, I, and II were planted in either a 6", 12", or 30" row spacing at a population of 200,000 seeds/ac. Varieties for Group 0 were: 'Dawson', 'Hendricks', and 'Lambert'; for Group I: 'Granite', 'Hardin', and 'Kasota'; and for Group II: 'Kenwood94', 'Marcus95', and 'Sturdy' . All varieties were randomized within row spacing and P treatment, and replicated four times. Plot size was five feet by 42.5 feet. Weeds were controlled by post emergence herbicide applications as required. Soybean shoots were harvested within a 5.25 ft^2 area at the early bloom stage of growth (2-5 blooms). Plant tissue was dried and weighed. Grain was harvested with a small plot combine. Grain moisture and weights were determined and yield was estimated. Treatments were compared by statistics using SAS.

Results and Discussion: Wet field conditions delayed planting until May 25. Wet field conditions along with the onset *Photophthera* root rot reduced stand counts in two replications for most varieties except for 'Kasota', 'Sturdy', and 'Marcus95'. However, enough plot material was available to statistically analyze the experiment.

The 75 lb/ac P_2O_5 treatment increased early shoot dry weight, but not test weight or grain yield compared to the control treatment. Starter P applications has often been observed to increase early vegetative growth in soybeans . However, since the soil P test level was medium-high, adequate levels of residual P were available to meet crop needs without the P supplement. As row spacing increased, early shoot dry matter decreased. The greater number of plants crowded into wider rows increased competition for resources, thus lowering vegetative growth/plant as row spacing increased. Grain test weight and yield were unaffected. However, there were great differences among varieties for early shoot dry weight, test weight, and yield. Grain yield ranged from 38.9 to 46.2 bu/ac. There did not seem to be an yield advantage by maturity group. Perhaps because each of the groups were planted on the same late date, the yield advantage of the Group II soybeans was not observed because of the shorter growing season. Next year, a tillage component will be added to the experiment to determine if P uptake is affected by moisture and temperature differences between two tillage regimes.

Table 1.Comparison of soybean responses by treatment. Southeast Research Farm; Beresford, SD; 1995.

Treatments	Early Shoot Dry Weight	Test Weight	Grain Grain Yield
	$g/5.25\ ft^2$	lb/bu	bu/ac
P_2O_5 Application			
0 lb/ac	163.5 a	55.9 a	42.7 a
75 lb/ac	170.4 b	55.9 a	42.5 a
Row Spacing			
6"	185.9 a	56.0 a	42.0 a
12"	178.3 a	56.2 a	43.9 a
30"	136.8 a	55.6 a	41.8 a
Variety			
Group 0			
Dawson	153.2 c	55.0 c	38.9 d
Hendricks	154.7 bc	55.7 b	40.5 d
Lambert	181.0 ab	57.4 a	46.2 ab
Mean	*162.9*	*56.0*	*41.8*
Group I			
Granite	182.9 a	55.7 b	44.5 abc
Hardin	150.0 c	56.1 b	42.4 bcd
Kasota	166.8 abc	55.7 b	41.6 cd
Mean	*166.5*	*55.8*	*42.8*
Group II			
Kenwood94	169.8 abc	56.2 b	41.5 cd
Marcus95	174.2 abc	55.9 b	46.4 a
Sturdy	170.3 abc	55.7 b	41.3 cd
Mean	*171.4*	*55.9*	*43.0*

Comparisons of parameter responses within the same treatment which have a different LSD letter of significance are statistically different at the 10% level.

INFLUENCE OF FERTILIZER AND LIME ON SOYBEAN YIELD ON HIGH TESTING SOIL

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

Plant Science 9511

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 demonstrations reported on here were established to show the effects of each of these commonly used nutrients and lime on corn and soybean yields when applied to high testing soils.

MATERIALS AND METHODS Two experimental sites were established, one at the SE Experiment Farm near Beresford in 1988 and another at 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 1995 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 lb/ac K_2O, 25 lb/ac sulfur (as elemental sulfur), 5 lb/ac zinc (as zinc sulfate) and lime at both locations (Table 1). In addition, the Brookings site had a 40 lb/ac P_2O_5 treatment. The fertilizer treatments were applied each spring since the establishment year (1988 at Beresford and 1990 at Brookings) on the same plots. 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.

'Sturdy' soybeans were planted in 30-inch rows on May 18 at Beresford. At the Brookings site, DeKalb CX096 soybeans were planted on June 6 in 30-inch rows. Plot size was 15 feet by 50 feet at Beresford and 20 feet by 40 feet at Brookings. At Beresford an area five rows wide (12.5 ft) and 50 feet long was harvested with a field combine. A small plot combine was used to harvest an area five feet (2 rows) wide and 30 foot long from each plot at Brookings. A randomized complete block design with four replications was used at both sites.

RESULTS AND DISCUSSION Soil test levels from soil samples taken in the fall of 1994 at both sites are presented in Table 2. Potassium and sulfur soil test levels were very high at both locations and no recommendation for these nutrients would have been made by the SDSU soil testing lab. After seven years of 50 lb/ac annual K_20 applications, the K_20 soil test at Beresford has increased 71 ppm. After five years K_20 applications at Brookings, soil test levels increased 26 ppm.

Zinc soil tests were high at both locations and no fertilizer recommendations would have been made. Zinc applications raised the zinc test from 0.80 ppm in the check to 6.2 ppm at Beresford and from 1.01 to 4.25 ppm at Brookings. The lime treatment raised the pH at the Beresford site from 5.8 to 6.5 and at the Brookings site from 6.4 to 7.2. The SDSU Soil Testing Lab would not have recommended lime at either site. The phosphorus soil test level at the Brookings site was very high prior to the phosphorus application and no phosphorus would have been recommended. The annual 40 lb/ac P_2O_5 applications at this site raised soil test levels 15 ppm. There was no phosphorus treatment at Beresford.

Soybean yields for 1995 are listed in Tables 3 and 4 (Beresford and Brookings sites respectively). Soybean yields were 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 (1988-1994) and in the 1990-94 SDSU Plant Science Department Soil/Water Science Research Technical Bulletin Nos. 97 and 99.

Table 1. Fertilizer Treatments, Fertilizer and Lime Demonstration, Beresford and Brookings, 1995.

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

[1] Applied each spring, 1988-1995.
[2] Applied each spring, 1990-1995.
[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	Soil Test Level			
	Beresford[1]		Brookings[2]	
	Check	Treatment	Check	Treatment
Potassium, ppm, 0-6 in	259	330	200	226
Sulfur, lb/ac 0-6 in	6	21	10	30
lb/ac 2 ft	31	100	36	60
Zinc, ppm, 0-6 in	0.80	6.2	1.3	4.25[3]
pH, 0-6 in	5.8	6.5	6.4	7.2
Bray Phosphorus, ppm, 0-6 in	15	---	32	47
NO_3-N, lb/A 2 ft	79	---	95	---
Organic Matter, %	4.0	---	3.3	---
Salts, mmho/cm	0.30	---	0.5	---

[1] Sampled 10/28/94
[2] Sampled 11/23/94
[3] Sampled 11/10/93

Table 3. Influence of Potassium, Sulfur, Zinc and Lime on Soybean Yield, Beresford, 1995.

Fertilizer Treatment	Soybean Yield
	bu/ac
Check	39 ABC
Potassium	37 BC
Sulfur	36 C
Zinc	42 A
Lime	40 AB
Prob of > F	0.045
C.V. %	6.7
MSD, .05	4.4

Table 4. Influence of Phosphorus, Potassium, Sulfur, Zinc and Lime on Soybean Yield, Brookings, 1995.

Fertilizer Treatment	Soybean Yield
	bu/ac
Check	41
Phosphorus	41
Potassium	42
Sulfur	41
Zinc	41
Lime	43
Prob of > F	0.28
C.V. %	3.6

NITROGEN MANAGEMENT IN A CORN SOYBEAN ROTATION

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

Plant Science 9512

INTRODUCTION There is increasing concern about the effects of nitrogen fertilizer on the environment, especially groundwater quality. This concern has been intensified by reports of NO_3-N concentrations above the legal drinking standard 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 upward. Therefore, once out of the reach of crop roots, NO_3-N has the potential to move down to the groundwater with percolating water during periods of high moisture.

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 1988, 1990, 1992, and 1994. Soybean was planted in 1989, 1991, 1993, and 1995. The rates and timing of nitrogen fertilizer applied to the corn in 1994 are listed in Table 1. The treatments included a check (no N), the recommended rate applied in fall, spring, or split between spring and just prior to the final summer cultivation, and 200 and 400 lb/ac rates 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' soybean (1 lb/ac N credit for 1 bu/ac soybean) yield. The recommended nitrogen rate was 123, 62, 90, and 95 lb/ac respectively for 1988, 1990, 1992, and 1994. 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 15 and 256 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.

Appropriate preplant herbicides were incorporated prior to planting 'Sturdy' soybeans on May 18 in 30-inch rows. Yields were obtained by direct combining five rows 50 feet long from each plot. Soil samples were taken to a depth of six feet in one-foot increments on November 3, 1995 from the zero, spring recommended, 200 and 400 lb/ac N rate treatments. In addition the 400 lb/ac N rate was sampled to a depth of five feet on May 31, 1995.

RESULTS AND DISCUSSIONS Nitrate soil test results from samples taken in the fall of 1994 and 1995 are given in Table 2. In the high N rate treatment (400 lb/ac), there was 296 lb nitrate N remaining in the top foot of soil after the 1994 season. Only small amounts of N were found below one foot. The fall of 1995 sampling showed only 12 lb of NO_3-N left in the top foot. In the top two feet after the 1994 season, the total nitrate was 342 lb. After the 1995 season, the two foot total was only 25 lb. The bulk of the nitrate had moved down below three feet during the 1995 season with the highest concentration (106 lb) in the four to five foot depth. The 200 lb N treatment which also had accumulations of nitrate in the top foot after the 1994 season showed similar nitrate movement, with the high concentration of N moving from the top foot after 1994 to below four feet after 1995.

The rapid movement of nitrate through this heavy soil was likely caused by heavy rainfall during 1995. Especially significant was the three months of March, April and May where 14.9 inches of rain fell (Table 3). During this period there would have been very little evaporation, or transpiration through the crop, allowing water to move deep into soil, taking the nitrate with it. Soil samples taken to a depth of five feet on May 31 confirms that most of the nitrate movement occurred during this time period. By May 31, the 342 lb of nitrate which were in the top two feet of soil in November of 1994 had already been reduced to 46 lb per acre (Table 4). That sampling showed the highest concentration in the three to four foot depth but also 103 lb already in the four to five foot depth.

Soybean grain yields for 1995 are listed in Table 5 and 6. Soybean yields were good, averaging over 40 bu/ac. They were not influenced by previous nitrogen treatments. In two of the previous three years, very high nitrate carryover (over 200 lb) had increased soybean yield about 3 bu/ac. This year however, the leaching which occurred in the spring reduced nitrate levels to where they no longer influenced soybean yields.

These plots will be rotated back to corn in 1996 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 as well as in the Plant Science Department Soil/Water Science Research Annual Reports, 1988-1995.

Table 1. Nitrogen Fertilizer Treatments, Nitrogen Fertilizer Demonstration; Beresford, SD; 1994.

Treatment	Time of Application		
	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 9, 1994 [2] June 14, 1994 [3] Nov 9, 1993

Table 2. Fall Nitrate Soil Test Levels, Nitrogen Management Demonstration, Beresford, SD, 1995.

Depth	Fertilizer N Applied, 1988, 1990, 1992, 1994, lb/a							
	- - - - 0 - - - -		Recommended[1]		- - - 200 - - -		- - - 400 - - -	
	1994	1995	1994	1995	1994	1995	1994	1995
feet	- - - - - - - - - - - - - - Soil NO_3-N, lb/ac[2] - - - - - - - - - - - - - - - - -							
0 - 1	22	8	31	10	82	12	296	12
1 - 2	5	16	7	18	18	16	46	13
2 - 3	6	13	7	12	13	13	14	20
3 - 4	6	6	7	10	10	16	20	74
4 - 5	ND[3]	8	ND	14	ND	34	ND	106
5 - 6	ND	8	ND	15	ND	34	ND	87

[1] Rates applied were 123, 62, 90, and 95 lb N/ac in spring of 1988, 1990, 1992, and 1994 respectively.
[2] Soil sampling dates: Nov 22, 1994; Nov 3, 1995
[3] ND = Not determined

Table 3. Rainfall at the SE Experiment Farm, Beresford, Nov 1, 1994 to Oct 31, 1995.

Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct
- inches -											
0.5	0.4	0.2	0.1	4.2	4.5	5.2	1.8	3.8	3.2	2.3	4.4

Table 4. Nitrate Soil Test Levels, 400 lb/ac Nitrogen Rate, Nitrogen Management Demonstration, Beresford

	Soil NO_3-N[1]	
Sample Depth	Nov 22, 1994	May 31, 1995
ft	- - - - - - - - - - - - - - - - - lb/ac - - - - - - - - - - - - - - - - -	
0 - 1	296	12
1 - 2	46	34
2 - 3	14	111
3 - 4	20	120
4 - 5	ND[2]	103
TOTAL	376	380

[1] 400 lb/ac N applied Apr 1994
[2] ND = Not determined

Table 5. Influence of Previous Year Nitrogen Rates Applied for Corn on Soybean Yield, Beresford, 1995.

Spring 1994 Nitrogen Rate	Yield
lb/ac	bu/ac
0	42
95	40
200	41
400	42
Pr > F	0.71
CV, %	6.0

Table 6. Soybean Yields Following N Timing Treatments Placed on Corn the Previous Year, Beresford, 1995.

Time of N Application[1]	Soybean Yield (bu/acre)
Spring (Apr 1994)	40
Fall (Nov 1993)	39
Split (30 lb Apr, 5 lb June, 1994)	42
Pr > F	0.21
CV, %	5.0

[1] 95 lb N/ac in 1994, no N applied to soybean in 1995

ALFALFA CULTIVAR YIELD TEST

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An alfalfa cultivar yield experiment was conducted at the SE Research Farm during 1995. This study was planted April 22, 1994 and has 32 entries. Most of the alfalfa cultivars were entered by seed companies, whereas other entries were entered by plant breeders at SDSU and other universities. Check entries were also included as a consistent baseline among the alfalfa variety trials in the state. The check entries are ‘Vernal’, ‘Riley’, ‘Baker’, and ‘Saranac AR’. This test was conducted to determine yield performance of alfalfa cultivars and experimental lines for use in SE South Dakota.

Three harvests were obtained from this study during 1995. The first harvest was delayed by about 3 weeks because of cool wet weather during spring of 1995. Average three-cut total yield in 1995 was 4.24 T/A, and significant cultivar differences were detected for the second and third harvests (Table 1). Average yields for the three harvests in 1995 ranged from 1.02 T/A for the second harvest to 2.13 T/A for the first harvest. Yields for the public cultivars 'Vernal', 'Riley', and 'Baker' ranked near the bottom.

An important role of the South Dakota Alfalfa Cultivar Yield Test is to evaluate lines that are in experimental stages of breeding programs. Companies and universities often enter promising alfalfa lines to test their suitability to stressful conditions in South Dakota. There are nine experimental entries in the current experiment at the SE Research Farm. Results for experimental lines must be interpreted with caution. Seed for these lines are in early generations of the seed production process and natural inbreeding depression is expected as these lines are advanced to seed production stages. In essence, commercial seed derived from experimental lines may not have the same yield potential that was observed in a state variety trial.

These results are useful in selection of alfalfa cultivars for forage production. Measurements of forage yield taken over several harvests and years are usually more useful than are averages from a single harvest.

Table 1. Forage yield of 32 alfalfa cultivars planted April 22, 1994, at the Southeastern Experiment Station, Beresford, SD. Plots were fertilized on Sept. 4, 1995 with 65 lb/ac P_2O_5, according to soil analysis recommendations.

Cultivar	1995 Cut-1 22-Jun	1995 Cut-2 20-Jul	1995 Cut-3 25-Aug	1995 3-Cut Total	% of 3-Cut Total
	--------	tons DM/Acre	--------	--------	- % -
ICI 630	2.24	1.13	1.24	4.61	109
ICI 631	2.27	1.11	1.23	4.61	109
ABI923AA (experimental entry[a])	2.24	1.14	1.18	4.56	108
MS9301 (experimental entry)	2.21	1.15	1.19	4.54	107
Viking 1	2.23	1.05	1.21	4.49	106
91-12 (experimental entry)	2.25	1.06	1.18	4.49	106
Magnum IV	2.27	1.08	1.10	4.45	105
Flagship 75	2.17	1.07	1.21	4.45	105
Multi-plier	2.15	1.04	1.25	4.43	105
MS9304 (experimental entry)	2.28	1.11	1.03	4.42	104
Proof	2.24	1.03	1.14	4.41	104
620	2.21	1.09	1.10	4.40	104
ICI 645	2.07	1.11	1.17	4.36	103
Allegro	2.10	1.06	1.19	4.34	102
Avalanche	2.12	1.06	1.12	4.31	102
Evolution	2.13	1.08	1.09	4.30	101
Pioneer Brand 5454	2.13	1.11	1.03	4.27	101
Defiant	2.12	1.08	1.06	4.27	101
ABI9237 (experimental entry)	2.17	1.00	1.10	4.26	101
LegenDairy	2.27	1.05	0.90	4.23	100
Pioneer Brand 5262	2.08	1.06	1.09	4.23	100
DK 122	2.14	0.98	1.10	4.22	100
Magnum III-Wet	2.04	1.07	1.10	4.21	99
4J12 (experimental entry)	2.05	1.08	1.07	4.20	99
3452-ML	2.12	1.00	1.06	4.19	99
ABI9236 (experimental entry)	2.13	1.00	1.03	4.16	98
PC431 (experimental entry)	2.03	1.02	1.07	4.12	97
Saranac AR	1.97	0.99	1.11	4.07	96
Riley	1.85	0.90	1.15	3.89	92
Vernal	1.95	0.93	0.99	3.87	91
Baker	1.92	0.79	1.09	3.80	90
SD44 (experimental entry)	1.97	0.15	0.34	2.46	58
AVERAGE	2.13	1.02	1.09	4.24	
Maturity[b]	5.5	4.3	4.8		
CV (%)	9.9	11.4	14.7	9.4	
LSD (0.05)	NS[c]	0.16	0.22	0.56	

(a) Data for experimental lines should be used with caution. Commercial seed for these lines may not perform similarly

(b) Kalu and Fick (1983) maturity index, mean stage by count.

(c) Yields among cultivars are not statistically different at the 0.05 level of probability.

CROP PERFORMANCE TRIALS
OAT, CORN AND SOYBEAN

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Plant Science 9514

OAT:

Test results for 1995 are shown in Table 1. The yield average for this year was 71 bushels per acre compared to 66 bushels on a three-year average. The top released varieties for 1995 included 'Don', 'Jerry', 'Settler', 'Troy', and 'Valley'. Likewise the varieties 'Dane', 'Jerry', 'Newdak', 'Settler', 'Troy', and 'Valley' were the top yielders over the longer three-year period. The experimentals SD91228, SDTROY-59 and SDTROY-81 were in the top-yield group for 1995. The best bushel weight average for 1995 was exhibited by 'Hytest', and one of the experimentals.

CORN:

The average yield for the early maturity (Table 2) was 143 bushels per acre this year. Hybrids had to yield 158 bushels or more to be in the top yield group for 1995 and 165 bushels or more to be in the top yield group for 1994-95. The bushel weight average for the early test was 60 pounds. The average yield for the late maturity test (Table 3) was 156 bushels per acre this year. Hybrids had to yield 158 bushels per acre or more to be in the top yield group for 1995. There were no significant differences in yield among hybrids for 1994-95. The bushel weight average for the late maturity was 62 pounds. The early and late test yield averages were 15 to 20 bushel lower than 1994.

SOYBEAN:

The Group-I trial (Table 4) averaged 51, 47, and 44 bushels per acre for 1995, two-years, and three years, respectively. Varieties had to yield more than 52 bushels per acre to be in the top yield group for 1995 or more than 43 bushels per acre to be in the top yield group for the three year period. There were no significant varietal differences in yield for the two year period. The group II trial (Table 5) averaged 45, 50, and 49 bushels per acre for 1995, two years, and three years, respectively. Varieties had to yield more than 47 bushels per acre to be in the top yield group for 1995 or more than 45 bushels per acre to be in the top yield group for two years. There were no significant varietal differences in yield for three years.

Table 1. Oat Yield and Test Weight Average, 1993-95.

	YIELD		TWT
Variety	'95	3yr'	'95
Belle	67	.	27
Burnett	67	42	31
Dane	69	72*	29
Don	79*	62	32
Hazel	58	62	34
Hytest	59	50	37
Jerry	80*	83*	30
Monida	65	.	26
Noetic	76	70*	31
Settler	86*	69*	31
Troy	77*	78*	25
Valley	82*	77*	30
IL86-1995	84*	.	33
IL86-2004	69	.	33
MN89127	66	.	31
SD89210	61	63	33
SD89504	62	60	32
SD91008	53	.	29
SD91228	92*	.	32
SD92125	49	.	34
SDTROY-59	86*	.	30
SDTROY-81	81*	.	26
TEST AVE.:	71	66	31
LSD (5%):	16	14	
CV (%):	11	8	

*A TOP-YIELDING VARIETY

Table 2. 1995 CORN HYBRID PERFORMANCE TRIAL RESULTS, EARLY MATURITY - 110 DAYS OR LESS.

BRAND & HYBRID	YIELDS AT 15.5% MOIST. 1995 (Bu/ac)	2 -YR (Bu/ac)	1995 GRAIN MOIST. (%)	1995 BU. WT. (lb)
AGRIPRO AP 9560	177	.	17	58
DEKALB DK566	176	181	17	58
TERRA TR 1087	169	.	18	61
CENEX/LOL 618	164	172	17	61
ASGROW RX623T	160	.	17	60
PIONEER 3489	159	182	17	59
HYBRIDS ABOVE THIS LINE ARE IN THE TOP -YIELD GROUP FOR 1995				
KRUGER K9609	156	.	17	58
KRUGER K9612	155	.	18	61
DEKALB DK560	155	173	17	61
AGRIPRO AP 9507	155	.	18	61
CARGILL 6303	155	171	17	62
KRUGER K9608A	155	.	17	62
DOMESTIC DX720	155	.	17	62
CENEX/LOL 599	154	172	18	62
KRUGER K9513	154	.	18	58
WILSON E4150	153	.	17	62
KRUGER K9410	153	.	18	59
M-W GENETICS G 7610	153	.	18	59
CIBA 4394	152	176	17	62
PAYCO 754	152	169	17	59
KRUGER K9509	151	165	17	62
CARGILL 5547	150	172	17	61
STINE X2017	150	.	17	60
MYCOGEN 6060	149	.	17	61
PIONEER 3394	149	171	17	61
NC+ 4919	149	.	18	60
DOMESTIC DX602	149	.	17	61
SANDS SOI 9045	147	.	17	60
M-W GENETICS G 7480	147	.	17	62
DEKALB DK580	146	171	17	60
EPLEY EX 3600	146	167	17	59
KRUGER K9609A	146	.	18	60
KRUGER K9613A	145	.	18	60
MYCOGEN 6220	145	166	16	60
KRUGER K9507PT	144	166	18	63
EPLEY EX 3480	144	165	17	62
CARGILL 4277	144	.	16	60

Table 2. CORN TRIALS - (CONTINUED).

BRAND & HYBRID	YIELDS AT 15.5% MOIST. 1995 (Bu/ac)	2 -YR (Bu/ac)	1995 GRAIN MOIST. (%)	1995 BU. WT. (lb)
CIBA 4494	144	166	17	61
LEGEND LS8409	144	168	17	61
EPLEY EX 2417	143	157	18	60
GOLDEN HARVEST H -2502	143	.	19	60
CENEX-LOL 550PT	143	.	17	61
CENEX-LOL 534	143	.	17	58
WILSON E4079	143	.	17	59
ASGROW RX510	142	.	16	60
ICI 8541	142	.	17	60
DEKALB DK512	141	166	16	61
CARGILL 5677	141	162	16	62
TOP FARM SX2104	141	160	17	61
SANDS SOI 9074	141	.	17	59
EPLEY EX1500	141	.	17	61
RENZE 6323	141	.	17	60
RENZE 6326	141	.	17	61
SANDS SOI 9061	141	165	17	60
DEKALB DK569	141	.	17	59
KRUGER K9607	140	166	16	58
PAYCO 734	140	163	17	59
SEXAUER SX730	139	162	17	60
WILSON E4083	139	.	16	60
KRUGER K9610	139	.	17	60
STINE 9601	139	.	17	60
WILSON 1581	139	153	17	60
NORTHRUP KING N6223	139	.	17	60
KALTENBERG K6409	138	.	17	62
RENZE 6246	137	163	17	59
CENEX-LOL 492	137	.	17	63
NORTHRUP KING N5866	136	.	18	61
PIONEER 3531	136	.	17	61
SEXAUER SX675	135	165	17	60
NORTHRUP KING N4640	135	.	16	63
RENZE 6221	134	160	17	59
WILSON 1371	132	162	17	59
STINE 94-310EX	13 2	.	16	57
FONTANELLE 4824	131	.	17	60
PIONEER 3556	130	145	17	63
TERRA TR 1094	130	.	16	59
KRUGER K9506	130	.	17	60
TERRA TR1091	130	165	16	59

Table 2. CORN TRIALS - (CONTINUED).

BRAND & HYBRID	YIELDS AT 15.5% MOIST. 1995 (Bu/ac)	2-YR (Bu/ac)	1995 GRAIN MOIST. (%)	1995 BU. WT. (lb)
CENEX-LOL 600	128	.	17	59
NC+ 4044	127	.	17	57
M-W GENETICS G 7488	127	.	17	60
GOLDEN HARVEST H-2408	125	146	17	60
CIBA 4475	125	.	16	61
FONTANELLE 4865	122	.	17	60
CIBA 4365	119	.	17	64
FONTANELLE 4193	111	.	18	62
AVERAGE:	143	166	17	60
LSD (5%):	20	17	1	3
MIN. TOP YIELD VALUE*:	158	165		
COEF. OF VARIATION#:	9	7		

*TOP YIELD - YIELDS WITHIN ONE LSD VALUE OF HIGHEST YIELD.
#A MEASURE OF EXPERIMENTAL ERROR; A VALUE OF 15% OR LESS IS DESIRABLE.

Table 3. 1995 CORN TRIAL, LATE MATURITY - 111 DAYS OR MORE.

BRAND & HYBRID	YIELDS AT 15.5% MOIST. 1995 (Bu/ac)	2 -YR (Bu/ac)	1995 GRAIN MOIST. (%)	1995 BU WT (lb)
KAYSTAR KX -777	182	186	17	61
GOLDEN HARVEST H -2547	178	.	18	62
KALTENBERG K7001	177	.	18	61
CENEX-LOL 674	177	.	18	62
TOP FARM SX2115	175	.	18	61
PAYCO 834	173	177	18	61
CENEX-LOL 661	166	.	18	61
KRUGER K9615	163	.	18	62
MYCOGEN EXP4790	162	183	18	61
CARGILL 7777	162	172	18	63
RENZE 6395	162	172	19	61
KRUGER K9614	161	.	17	60
M-W GENETICS X 51120	160	.	18	61
RENZE 6345	159	173	18	62
RENZE 6386	158	.	18	62
HYBRIDS ABOVE THIS LINE ARE IN THE TOP -YIELD GROUP FOR 1995				
KRUGER K9315B/PT	156	.	19	63
SANDS SOI 9115	156	.	18	61
KRUGER K9614A	156	.	18	61
CARGILL 6997	152	.	19	62
KRUGER K9614W	152	.	19	62
PAYCO 814	148	163	17	62
MYCOGEN 7050CB	148	.	17	63
TERRA TR1130	148	165	18	62
SEXAUER SX780	143	144	18	63
NORTHRUP KING N7070	143	.	18	61
ICI 8481IT	143	.	20	62
TERRA TR1126	138	162	18	61
STINE 9702	137	.	18	62
SANDS SOI 9150	137	.	19	62
KRUGER K9514A	134	.	17	62
PIONEER 3375	115	.	18	62
AVERAGE:	156	169	18	62
LSD (5%):	25	NS**	1	NS
MIN. TOP YIELD VALUE*:	158			
COEF. OF VARIATION#:	10	7		

*WITHIN ONE LSD OF HIGHEST YIELD. **NOT SIGNIFICANT (NS).
#A MEASURE OF EXPERIMENTAL ERROR; VALUE OF 15% OR LESS IS DESIRABLE.

Table 4. SOYBEAN MATURITY GROUP -I TRIAL, SEEDED MAY 16, 1995.

--- BRAND / ENTRY ---	--- YIELD --- '95	2YR	3YR ---	---- 1994 PROT.	---- OIL
	--- bu/ac		---	-- %	--
Stine 1690	58	.	.	.	.
Stine 1590	57	.	.	.	.
Asgrow A1923	56	.	.	.	.
Public Parker, I -CK*	55	51	48	35.0	18.0
Golden Harvest X194	55	.	.	.	.
Prairie Brand PB -197	55	.	.	.	.
Jacobsen J659	53	.	.	.	.
Public Sturdy, II -CK*	53	51	.	35.5	17.1
SD93-905M	53	.	.	.	.
Pioneer 9172	53	.	.	.	.
ENTRIES ABOVE THIS LINE ARE IN THE TOP -YIELD GROUP FOR 1995					
Kaup KS1977	52	.	.	.	.
Pioneer 9171	52	48	46	33.5	18.1
Public Hardin	52	45	41	35.0	17.7
Dyna-Gro 3170	51	.	.	.	.
Terra TS194	51	.	.	.	.
Public Leslie	51	52	49	34.6	17.5
Mustang M -1190	51	.	.	.	.
Pioneer 9163	50	.	.	.	.
Terra E174	50	.	.	.	.
Renze EX19 -67	50	.	.	.	.
Prairie Brand PB -194	50	.	.	.	.
SL92-1357M	50	.	.	.	.
Public Sibley	50	47	44	35.1	17.8
Public Granite	49	52	.	34.7	17.2
Public BSR 101	49	44	44	33.9	18.1
Mustang E -1192	49	.	.	.	.
Public Bert	49	45	43	33.3	18.5
SD93-78M	48	.	.	.	.
Public Bell	48	48	46	35.4	17.8
Public Dawson, 0 -CK*	47	44	38	33.1	18.9
SD93-859	47	.	.	.	.
Mustang M -1199	47	.	.	.	.
SL93-242M	46	.	.	.	.
SL92-1323M	46	.	.	.	.
Public Kasota	45	44	41	34.8	18.2
Public Alpha	42	41	39	37.5	15.6
TEST AVERAGES:	51	47	44	34.7	17.7
LSD(5%) VALUES:	5	NS**	6		
TOP-YIELD GROUP:	>52		>43		
COEF. VARIATION$:	6	8	8		

*CHECK FOR INDICATED MATURITY GROUP. **NOT SIGNIFICANT (NS).
$A MEASURE OF EXPERIMENTAL ERROR. A VALUE OF 15% OR LESS IS DESIRABLE.

Table 5. SOYBEAN MATURITY GROUP -II TRIAL, SEEDED MAY 16, 1995.

--- BRAND / ENTRY ---	--- YIELD --- '95	2YR	3YR	---- 1994 ---- PROT.	OIL
	--- bu/ac ---			--- %	---
Mustang M-2200	54	.	.	.	.
Hoegemeyer 206	53	57	.	33.1	18.5
M-W Genetics G2150	53	.	.	.	.
Northrup King S24-92	52	51	.	32.9	21.5
Asgrow A2242	52	53	52	34.3	17.4
Kruger K2162+	52	57	.	32.9	18.8
Kruger K2162	52	56	.	34.2	18.0
Kruger K2625	52	.	.	.	.
Latham 660	51	52	51	33.9	17.7
Dyna-Gro 3210	51	.	.	.	.
Kruger K2404	51	.	.	.	.
Jacobsen J750	51	.	.	.	.
Public Parker, I-CK*	50	47	.	34.0	18.6
DeSoy D2627+	50	.	.	.	.
Prairie Brand PB-236X	50	.	.	.	.
Dekalb CX232	50	49	49	34.6	18.1
Kruger K2324	50	51	.	35.5	17.1
Public Marcus	50	52	51	34.4	18.1
Hoegemeyer 232	50	51	.	32.8	18.7
Kaup KS2474	50	.	.	.	.
Public Holt	50	50	50	34.8	17.7
Jacobsen J742	50	52	.	33.5	17.7
Kaltenberg KB241	49	49	50	33.6	22.0
Kaltenberg KB254	49	53	.	34.5	17.5
Renze EX25-31	49	.	.	.	.
Latham 480	49	.	.	.	.
Terra E210	49	.	.	.	.
Fontanelle 4052	49	51	52	34.8	17.4
Sexauer SX2351	49	49	.	33.7	18.3
Kruger K2343	49	.	.	.	.
DeSoy D2790	49	.	.	.	.
Mycogen J-251	49	51	.	33.3	18.4
Mustang M-2215	49	.	.	.	.
DeSoy D2790+	48	.	.	.	.
C & D CD222	48	52	52	35.0	17.4
Prairie Brand PB-238	48	.	.	.	.
Asgrow A2396	48	50	49	34.8	18.2
Kaup KS2164	48	.	.	.	.
Sexauer SX2561	48	.	.	.	.
Top Farm TF2236	48	.	.	.	.
Great Lakes GL2415	48	50	.	33.8	18.1
Kruger K2525	48	51	.	33.6	18.2

Table 5. SOYBEAN MATURITY GROUP -II TRIAL (CONTINUED).

--- BRAND / ENTRY ---	--- YIELD --- '95	2YR	3YR	---- 1994 ---- PROT.	OIL
	--- bu/ac ---			--- %	---
ENTRIES ABOVE THIS LINE ARE IN THE TOP -YIELD GROUP FOR 1995					
Public IA2008	47	50	.	32.9	19.2
ICI D260	47	51	50	33.6	18.1
Renze EX24 -27	47	.	.	.	.
Renze R2630	47	50	.	31.2	19.3
Renze EX25 -57	47	.	.	.	.
DeSoy D2333	47	52	51	33.5	18.7
Dekalb CX228	47	51	.	33.2	17.9
Hy-Vigor K -3903	46	53	51	34.5	17.8
Pioneer 9255	46	.	.	.	.
Kaup KS2547	46	51	50	33.9	18.0
Golden Harvest H -1269	46	.	.	.	.
Latham 410	46	.	.	.	.
Top Farm TF2000	46	48	49	34.1	18.1
Prairie Brand PB -2120	46	50	.	34.2	17.7
ProfiSeed PS2720	46	.	.	.	.
Mustang M -1200	46	53	.	34.5	17.1
Dekalb CX278	46	.	.	.	.
Terra TS253	46	.	.	.	.
Mustang M -2262	46	.	.	.	.
Pioneer 9281	46	51	.	33.4	18.6
Terra TS200	46	.	.	.	.
Kaup KS2874	45	.	.	.	.
Sands SOI 264	45	.	.	.	.
C & D CD205	45	.	.	.	.
Public Kenwood	45	51	50	34.3	18.3
Stine 2560	45	.	.	.	.
DeSoy D2690+	45	.	.	.	.
Kruger K2666	45	.	.	.	.
Payco 9225	45	48	48	34.5	17.9
M-W Genetics G2440	45	51	51	33.3	18.4
Kaup KS2665	45	.	.	.	.
Prairie Brand PB -247	45	51	.	34.6	17.3
Pioneer 9204	45	50	.	33.8	17.9
ProfiSeed PS2555	45	49	48	33.4	18.3
Kruger K2929	44	.	.	.	.
Mustang M -2220	44	.	.	.	.
Hoegemeyer 225	44	50	50	33.6	18.5
Latham 661	44	.	.	.	.
Sands SOI 237	44	.	.	.	.
Golden Harvest H -1218	44	.	.	.	.

Table 5. SOYBEAN MATURITY GROUP -II TRIAL (CONTINUED).

--- BRAND / ENTRY ---	--- YIELD --- '95	2YR	3YR	---- 1994# ---- PROT.	OIL
	--- bu/ac ---			--- %	---
Kruger K2323+	43	49	.	36.0	16.9
Fontanelle 2262	43	.	.	.	.
Sexauer SX2785	43	.	.	.	.
Payco 9327	43	48	.	33.2	18.7
Terra E255	43	.	.	.	.
Kruger K2818	43	53	.	33.9	18.0
Kruger K2021	43	52	.	33.9	18.1
Latham 720	43	.	.	.	.
Kruger K2515	43	.	.	.	.
Great Lakes GL2045	43	49	.	35.0	17.3
M-W Genetics G2540	43	.	.	.	.
Public Corsoy 79	43	39	42	34.6	18.0
Dekalb CX252	43	50	.	33.5	17.9
Public Conrad	43	46	46	33.5	17.6
C & D CD273	42	.	.	.	.
Dekalb CX267	42	48	48	32.9	18.0
Public Newton	42	44	43	33.1	17.5
Payco 9529	42	.	.	.	.
Latham 610	41	.	.	.	.
Stine 2665	41	.	.	.	.
Mustang M-2210	41	.	.	.	.
Jacobsen J858	41	.	.	.	.
Public Kenwood 94	41	44	.	34.7	17.7
Terra E285	40	.	.	.	.
Dairyland DSR244	40	.	.	.	.
Kaltenberg KB274	40	48	.	35.0	17.1
Stine 2660	40	.	.	.	.
Terra TS294	40	.	.	.	.
Dairyland DSR277	39	.	.	.	.
Public Sturdy, II -CK*	39	45	47	35.1	17.3
Sands EXP9428B	39	.	.	.	.
Renze R2996	39	.	.	.	.
Kaltenberg KB285	38	.	.	.	.
Sands EXP269	38	.	.	.	.
Fontanelle 2293	38	.	.	.	.
Hy-Vigor 2400	38	.	.	.	.
Sands EXP268A	38	.	.	.	.
Kruger K2909	37	.	.	.	.
AgriPro EX2380	36	.	.	.	.
Public Century 84	33	41	42	36.5	16.6
Public Resnik, III -CK*	30	42	40	33.0	18.0

TEST AVERAGES:	45	50	49	34.0	18.1
LSD(5%) VALUES:	7	NS**	6		
TOP-YIELD GROUP:	>47		>45		
COEF VARIATION$:	9	8	8		

*CHECK FOR INDICATED MATURITY GROUP. **NOT SIGNIFICANT (NS).
$A MEASURE OF EXPERIMENTAL ERROR. A VALUE OF 15% OR LESS IS DESIRABLE.

1995 OATS FOLIAR FUNGICIDE TRIAL

D. Gallenberg, D. Reeves, M. Thompson, and L. Hall

Plant Science 9515

INTRODUCTION: Oats are subject to attack from a variety of foliar diseases. Some of these diseases can be controlled or reduced through application of foliar fungicides. The purpose of the following study was to determine the effects of various foliar fungicide treatments on disease ratings, yield and test weight of oats.

MATERIALS AND METHODS: Trials were conducted at the Southeast Research Farm, Brookings Agronomy Farm and Northeast Research Farm during 1995. The variety Don was used in this study. The foliar fungicide treatments and number of plots were the same at all 3 locations. Treatments were replicated 4 times.

Fungicides used in the study were Tilt (propiconazole) and Dithane DF (mancozeb). Tilt is not currently labelled on oats and was applied as an experimental compound in a single application of 4 fl oz/ac at flag leaf emergence (6/13/95 at Southeast Farm, 6/14/95 at Brookings, 6/15/95 at Northeast Farm). Three mancozeb treatments were used: Mancozeb I: 1 lb/ac early (5/25/95 at Southeast Farm, 6/5/95 at Brookings, 6/8/95 at Northeast Farm); Mancozeb II: 1 lb/ac at boot (06/13/95 at Southeast Farm, 6/16/95 at Brookings, 6/19/95 at Northeast Farm), and again 10 days later; and Mancozeb III: 1 lb/ac early, 2 lb/ac at boot and again 10 days later.

Plots were rated for % disease on the flag leaf (i.e. % non-green tissue) on 7/13/95 at Southeast Farm, on 7/17/95 at Brookings and on 7/18/95 at Northeast Farm.

Plots were harvested at the end of the season. Yields (bu/ac) and test weights (lb/bu) were calculated.

RESULTS AND DISCUSSION: Data are contained in Table 1. At all 3 locations, Tilt and Mancozeb II and III significantly reduced the disease ratings and increased yield compared to the untreated check. Test weights were basically unaffected.

Crown rust was the primary disease present at all 3 locations, particularly late in the season. These data from 1995 indicate that consistent decreases in disease and increases in yield in oats can be achieved with applications of foliar fungicides. Data from previous seasons further indicates that test weight can also be increased.

Table 1: 1995 OATS FOLIAR FUNGICIDE TRIAL

	Disease Rating Scale 0-5	Yield (bu/ac)	Test Weight (lb/bu)
SE FARM			
Untreated	3.0	58.8	35.4
Tilt III	2.0	63.5	34.9
Mancozeb I	2.3	61.7	35.1
Mancozeb II	1.3	62.7	33.8
Mancozeb III	1.8	60.2	35.2
LSD $_{(.05)}$	0.8	6.9	1.2
BROOKINGS			
Untreated	2.8	53.6	31.6
Tilt III	2.0	71.8	34.4
Mancozeb I	2.8	58.9	33.1
Mancozeb II	1.3	85.4	34.5
Mancozeb III	1.0	92.2	35.3
LSD $_{(.05)}$	0.5	11.9	3.1
NE FARM			
Untreated	3.0	62.6	n/a
Tilt III	2.0	84.4	n/a
Mancozeb I	3.3	67.0	n/a
Mancozeb II	1.3	99.0	n/a
Mancozeb III	1.0	95.4	n/a
LSD $_{(.05)}$	0.8	11.1	n/a

OAT RESEARCH

Dale Reeves and Lon Hall

Plant Science 9516

Oat research at the Southeast Research Farm is used for variety release, oat foliar fungicide screening, and RFLP research. The oat foliar fungicide research is a cooperative effort with Extension pathologist Dale Gallenberg. The RFLP research involves the search for a gene marker or markers for hull percent, plant height, tiller potential, and heading date.

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, hullness, and maturity.

The quality of the oat may determine the consumer. The millers want a high protein oat; whereas, the livestock producer wants a high oil, high protein, and tall variety.

Eight nurseries which consisted of a total of 918 plots were grown at the southeast location. The Uniform Early Nursery is made up of advanced early lines, usually 1 to 3 each from several states. It is also grown in these states and provides information needed for varietal release. The Tri-State nursery is made up of 36 lines and checks, 10 lines from each state of South Dakota, North Dakota, and Minnesota. Experimental lines are selected on basis of maturity for the southeast region of the state. The breeding lines consisted of 80 F7s, 98 early F6s and 55 early Bulk F3s.

The highest yielding treatment in the oat foliar fungicide test was 8 percent greater than the check. The highest yielding experimental line yielded 97.1 bu/ac compared to 60.6 bu/ac for the check average.

AGRICHEMICAL MANAGEMENT, MOVEMENT, AND MAIZE YIELD: RIDGE-TILL vs. CHISEL-PLOW SYSTEMS.

Kalyn Brix-Davis, S.A. Clay, D.E. Clay, and R.K. Berg

Plant Science 9517

Farmers are pressured to adapt Best Management Practices (BMP) to reduce agrichemical loading into the environment, but are concerned about the effect that BMPs will have on their bottom line and future. This study evaluated the impact of two conservation tillage systems (ridge-till and chisel plow) and two herbicide application methods (band and broadcast) on corn (*Zea mays* L.) yield, weed pressure, and agrichemical movement at Centerville, South Dakota. Applying herbicides in a 10- or 15-inch band over a 30-inch corn row reduced total application by 67 to 50%, respectively. The movement of atrazine and alachlor from treated to nontreated areas was minimal and was not affected by tillage. Atrazine was not detected below the top 18 inches in the soil. Tillage practice and herbicide application method did not influence corn yields consistently during a 2-year study. These results suggest that banding herbicides in chisel or ridge tillage conservation systems provides adequate weed control when complimented with cultivation. Banding also reduces the total amount of preemergence herbicide applied to a field. By using best management practices and reducing agrichemical loading, the potential for groundwater contamination by preemergence herbicides will be minimized.

INTRODUCTION Conservation tillage leaves all previous crop residue on or within eight inches of the soil surface. In the western portion of the US corn belt, soil temperatures remain cool and soil moisture levels are relatively high during late spring and early summer. Due to these soil and climatic conditions, producers in eastern South Dakota are reluctant to adopt practices that may leave many areas too wet and too cool to plant.

Ridge-till has been proposed as a conservation tillage system that allows for quicker crop emergence when compared to conservation tillage systems such as no-till, because ridges are usually drier, better drained, and warmer than nonridged areas in the spring. Postplant cultivation within the ridge-till system may be well suited to minimize agrichemical movement because the cultivation provides weed control and may reduce the number of continuous pores in the disturbed interrow areas.

A number of the pesticides found in groundwater (EPA, 1990) are herbicides that are soil applied early in the season and include atrazine and alachlor. These herbicides are applied to reduce broadleaf and grass weeds during germination and provide excellent early season control. A strategy to reduce amounts of herbicide applied and still obtain early season weed control is to band apply preemergence herbicides to only row areas, thereby reducing herbicide inputs. Postemergence herbicides, which were seldom found in groundwater (EPA, 1990) or cultivation may be used later in the season for additional weed control. Placement of herbicides on elevated ridges, where water does not accumulate, also reduces potential movement of the chemicals out of the crop root zone (Clay et al., 1992, 1994). The objective of this study was to evaluate the impact of two conservation tillage systems (chisel and ridge-till) and two herbicide application methods (broadcast and band) on agrichemical movement, weed pressure, and corn yield in eastern South Dakota.

MATERIALS AND METHODS Plots were established near Centerville, SD in 1992 to quantify the movement of atrazine and alachlor applied in bands over corn rows in ridge and chisel till systems. In 1993, plots were planted, herbicide applied prior to the experiment being flooded for the majority of the growing season. Each treatment was replicated four times and individual plots were 60 feet by 30 feet. Soil at the Centerville site is Enet loam (Mesic Typic Haplustoll) with a pH of 6.6 and 2.6% organic matter.

Chisel tillage plots were tilled twice with a field cultivator prior to planting. Ridges were established in early spring 1992. Ridge tillage plots had the top two inches of the ridge cleaned immediately prior to planting. Planting in 30-inch rows was completed on 29 April 1992 and 4 May 1994 with Pioneer hybrid 3615 (23,000 seeds A^{-1}) and Pioneer hybrid 3417 (25,800 seeds A^{-1}), respectively.

Atrazine (Atrazine 4L) at 0.33 lb ai/acre and alachlor (Lasso 4EC) at 0.5 lb ai/acre were applied on 5 May 1992 and 10 May 1994. Alachlor and atrazine sorption data by soil depth are reported in Table 1. Herbicides were applied in a 10-inch (1992) and 15-inch (1994) band over the middle of the corn row prior to crop emergence. Total herbicide applied was 33% and 50% of recommended broadcast application rates.

Liquid nitrogen fertilizer (28-0-0) was applied at a 3-inch depth in the interrow area with a buble coulter at 70 lbs N A^{-1} at planting and 70 lbs N A^{-1} at 6-leaf corn stage each year. A cultivator with a 6-inch sweep was used for both tillage systems on 28 May 1992 (3-leaf corn stage). On 16 June 1992 and 20 June 1994, chisel plots were cultivated and ridge tillage plots ridged with a 12-inch shovel.

Soil samples were collected from row and non-wheel tracked interrow areas at 2, 5, 11, and 18 (harvest) weeks following application, and sectioned into 0-2-, 2-6-, 6-12-, 12-18-inch depth increments. In addition, 18-24-, 24-30-, and 30-36-inch depth increments were collected at 11 and 18 weeks. Soil samples were stored at 37^{o}F until laboratory analysis. Atrazine and alachlor were extracted from soil using standard techniques and the amount of herbicide quantified by gas chromatography techniques.

Weed pressure was quantified from planting to 6-leaf corn stage by counting three 8.5- by 11-inch areas and calculating the number of weeds m^{-2}. Weed biomass was collected, dried, and weighed at harvest.

Individual plots were hand-harvested from a 40-foot row area. Yield was calculated at 15.5% moisture, 56 lb bu^{-1}, and expressed as bu A^{-1}.

Table 1. Horizon depth, soil texture, and sorption coefficients for atrazine and alachlor for Enet loam (Centerville).

				Kf	
Soil	Horizon	Depth	Texture	Atrazine	Alachlor
		inch			
Enet	Ap	0-8	loam	3.01	2.40
	A	8-12	loam	2.85	2.37
	Bw	12-28	loam	2.29	2.10
	2C	28+	sand	0.81	1.06

RESULTS AND DISCUSSION

Herbicide movement through the root zone. Atrazine and alachlor movement in row and interrow areas were compared between tillage systems. In previous studies with ridge-till, it has been reported that herbicide application to ridges reduced movement compared to nonridge applications (as would be found in broadcast situations).

Immediately following herbicide application, atrazine and alachlor amounts in the top 2-inch soil sample, concentrations were near application rates (information not shown). Minimal amounts of alachlor and atrazine were detected in the interrow areas of either tillage system where chemicals were not applied (Tables 2 and 3).

Atrazine remained mostly in the band in the 0-6-inch depth. Some atrazine was detected under non-banded areas. Maximum detection depth during the season was at 12 to 18-inches 11 weeks after application. Atrazine may have moved farther in the soil than alachlor due to a lower sorption than alachlor and longer half life of 47 to 110 days.

Alachlor was detected only in the top two inches of the Enet silt loam up to 11 weeks after application (Table 3). This may be due to a relatively short half-life of alachlor, ranging from 2 to 43 days. Bands of the ridge tillage system had a higher amount of alachlor than bands of the chisel tillage for the first five weeks. Tillage did not influence depth of movement or maximum concentration detected in the soil.

These data indicate that herbicide movement in the root zone did not differ between tillage systems. The ridge elevated the corn row about six inches compared to the row of the chisel tillage. The ridge, therefore, may reduce slightly the maximum depth of movement. However in the chisel tillage system, herbicide movement may also be low because continuous pores were disrupted during spring tillage.

Table 2. Atrazine distribution in the soil profile 2, 5, 11, and 18 weeks after application (WAA) in chisel and ridge tillage systems at Centerville.

		Chisel				Ridge Tillage			
		Row		Interrow		Row		Interrow	
WAA	Depth	Con[c]	Det[a]	Con	Det.	Con	Det	Con	Det
	in	mg/m^2		mg/m^2		mg/m^2		mg/m^2	
2	6	31.4	3/3	nd[b]	---	49.0	3/3	nd	---
5	2	6.2	2/3	nd	---	33.9	2/3	5.6	---
	6	1.2	---	5.9	---	1.2	---	1.9	---
	12	nd	---	nd	---	1.9	---	1.9	---
11	2	26.6	2/2	5.4	---	18.8	2/2	0.6	---
	6	8.5	2/2	1.2	---	13.3	2/2	1.2	---
	12	2.9	2/2	1.9	---	1.9	2/2	nd	---
	18	1.9	2/2	1.9	---	1.9	2/3	0.9	---
18	2	2.8	2/3	1.8	---	0.9	2/3	nd	---
	6	2.4	---	1.2	2/3	2.4	2/3	nd	---
	12	2.0	2/3	nd	---	nd	---	nd	---

[a]Number of detects compared to total number of samples analyzed.

[b]nd denotes "No detect" of particular herbicide.

[c]Concentration (mg/m^2)

Table 3.Alachlor distribution in the soil profile 2, 5, 11, and 18 weeks after application (WAA) in chisel and ridge tillage systems at Centerville.

		Chisel		Ridge Tillage					
Row	Interrow	Row		Interrow					
WAA	Depth	Con.[c]	Det[a]	Con	Det	Con	Det	Con	Det
	in	mg/m^2		mg/m^2	mg/m^2		mg/m^2		
2	6	6.0	3/3	nd[b]	0/3	15.1	3/3	nd	0/3
5	2	3.0	---	3.0	---	22.4	---	3.0	---
11	2	2.4	2/2	nd	0/3	2.4	---	1.2	---
18	2	nd	---	nd	---	nd	---	nd	---

[a]Number of detects compared to total number of samples analyzed.
[b]nd denotes "No detect" of particular herbicide.
[c] Concentration (mg/m^2)

Weed pressure. Control plots without herbicide were compared with broadcast and band herbicide application plots to evaluate weed control effectiveness. Yellow foxtail (Setaria glauca (L.)) was the primary weed species. Broadcast herbicide application had the lowest weed counts after 6 May 1992 and for all sampling dates in 1994 (Table 4). With band application of 10-inch or 15-inch bands, weed pressure ranged from 30 to 70% of total weed number of control plots. Weed pressure in the band application was not consistently less in the chisel or ridge tillage system for the two years.

Weed biomass at harvest was less in the ridge than chisel tillage system for both years. In 1994, ridge tillage plots with no herbicide applied had 541 lbs weed biomass A^{-1} while broadcast and band treatments had no weed biomass present. Weed biomass in control plots were greater in 1994 than 1992 with banded application plots containing less biomass in 1994. This could be due to the 3-year establishment of the ridge tillage system with fewer weed seeds being available for germination.

Yield production. Yield as affected by herbicide management were different in 1992 and 1994. In 1992, control plots with no herbicide applied had the highest yield, while in 1994, control plots had the lowest yields. The grain yields in 1992 are difficult to explain given the amount of weed pressure in these plots. Within each tillage system, broadcast and band applied treatments had similar yields.

In 1994, yields in the chisel tillage system was greater than yields in the ridge tillage system. Within either tillage system, similar yields were observed for broadcast and band applied treatments.

Table 4. Weed pressure due to tillage and herbicide management system at Centerville in 1992 and 1994.

Tillage	Herb Mgmt	Date							
		1992				1994			
		6 May	19 May	8 June	25 Sep	19 May	31 May	13 Jun	27 Sep
		------number weeds m^{-2}-------			lbs A^{-1}	-------number weeds m^{-2}-------			lbs A^{-1}
Chisel	Cont	91	452	347	224	1062	1222	940	764
	Brdc	167	1	22	45	35	62	13	30
	Band	120	176	271	105	331	286	364	75
Ridge	Cont	368	1079	499	15	936	690	655	482
	Brdc	279	2	21	21	16	26	12	0
	Band	323	161	324	122	578	628	396	0

Table 5. Yield as affected by tillage and herbicide management system at Centerville in 1992 and 1994.

Tillage	Herb Management	Year	
		1992	1994
		bu A^{-1}	
Chisel	Control	180.6 a	128.5 bc
	Broadcast	153.0 ab	174.5 a
	Band	134.4 b	169.5 a
Ridge	Control	175.5 a	119.8 c
	Broadcast	166.7 ab	151.0 b
	Band	153.8 ab	132.5 bc
$LSD_{(0.05)}$[a]		39.1	22.9

[a]LSD= Least Significant Difference

CONCLUSION

Reduced tillage and herbicide management systems of agricultural production can lead to less soil and herbicide loading to non-target areas. A 50-67% reduction in herbicide applied did not drastically affect weed pressure or yield in corn under chisel or ridge tillage systems compared to broadcast application at recommended rates. More information is necessary to determine if yield would be consistently lower in ridge than chisel tillage systems for different growing seasons. Overall, these results suggest that banding herbicides in chisel or ridge tillage conservation systems provides adequate weed control when complimented with cultivation.

Other studies investigating the impact of tillage on yield have had similar results. For example, Khakural et al. (1992) reported no difference between corn yield in chisel and ridge-till management in two South Dakota soils. Other studies from Minnesota and Wisconsin also showed no yield differences between chisel and ridge till treatments (Randall and Swan, 1990; Bundy et al., 1990).

Corn yields were similar between tillage practice and agrichemical input level at Brookings. However, yearly variation was significant. The highest corn yield of 155 bu/a was obtained in 1991. Yields in 1990 and 1992 averaged 142 and 97 bu/a, respectively. The lowest average yield was 51 bu/a in 1993. Low yields in 1993 were the result of poor growing conditions with temperatures much cooler than normal (18% reduction in base 50^{o}F growing degree days) and precipitation much higher than normal (6 inches above the 30 year average).

Baker et al. (1993), however, reported a 10 to 15% decrease in corn yield when herbicides were band applied compared to broadcast applications. In our study, banding generally did not reduce corn yields. An advantage of herbicide banding (10- or 15-inch band on a 30-inch row) is that only 33 or 50% of the field is treated, reducing the total herbicide load to a field. This herbicide reduction decreased the loading rate of some preemergence herbicides to subsurface drains (Baker et al., 1993).

These results suggest that either the chisel or ridge-till conservation systems would be an option for growers in the western portion of the corn belt. Both corn yield and herbicide movement were similar between tillage systems. Banding preemergence herbicide applications resulted in weedy interrows. However, cultivation and in some cases, postemergence herbicides, were used to minimize the impact of the weeds on corn yield. By using best management practices and reducing agrichemical loading, the potential for groundwater quality contamination will be minimized.

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WEED CONTROL DEMONSTRATIONS AND EVALUATION TESTS, 1995

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Plant Science 9518

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.

1995 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.

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 90-95% control is desired if seed production is minimized. Crop response ratings (VCRR) of 20% or less usually represents 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.

Weather was an important factor in herbicide performance in 1995. Extended wet conditions delayed planting for several tests; some tests were deleted due to late planting. Tests planted in late May received heavy rainfall during the first two weeks. The initial weed flush was destroyed during seedbed preparation for tests where planting was delayed; second flush weed density was reduced somewhat.

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

1. Soybean Herbicide Demonstration
2. Velvetleaf Control in Soybeans

3.Resource Tank-Mixes on Velvetleaf
4.Tough Combinations for Velvetleaf
5.Cocklebur Control in Corn
6.Cocklebur/Soybean Demonstration
7.Cocklebur Salvage in Soybeans
8.Postemergence Volunteer Corn Control in Soybeans
9.3X Soybean Rate/Carryover
10. 3X Corn Rate/Carryover
11. Basis Combinations
12. Broadstrike Comparisons in Corn
13. Evaluation of Foxtail Removal Timing/Soybeans
14. Comparison of Grass Herbicides EPP and PRE
15. Evaluation of Burndown with Roundup and Additives
16. Additives with Galaxy
17. Additives with Pursuit
18. Comparisons of Pursuit Adjuvants
19. Evaluation of STS Soybeans
20. Evaluation of New Types of Soybeans
21. Foxtail Removal Timing No-Till
22. Reduced Input for No-Till Soybeans
23. No-Till Corn Demonstration

Experimental 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 1995 include:

1. Evaluation of Soybean Injury
2. Comparison of Galaxy Adjuvants
3. Galaxy and Basagran One-Pass Treatments vs. Standards
4. Evaluation of AC 299,263
5. Weed Control in Roundup Ready Soybeans
6. Velvetleaf Control with Stellar
7. Velvetleaf Control with NAF-75
8. Velvetleaf Control with Resource
9. Weed Control with Liberty in Transgenic Corn
10. Preemergence Grass Herbicide Comparisons
11. Tough Combinations Late Post in Corn on Velvetleaf
12. Postemergence Timing in Corn
13. Postemergence Timing in Corn (second study)
14. Interaction of Counter with SU Products

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. SOYBEAN HERBICIDE DEMONSTRATION

Demonstration
Variety: Kenwood
Planting Date: 6/15/95
PPI, PRE: 6/15/95
EPOS: 6/27/95
POST: 7/8/95
Soil: Silty clay; 3.5% O.M.; 6.0 pH
COMMENTS: Planting delayed due to wet conditions; initial weed flush

Precipitation: 1st week 0.00 inches
2nd week 0.26 inches

Grft = Green foxtail
Tawh = Tall waterhemp

Treatment	lb/A act.	1995 Plowed % Grft 8/7/95	% Tawh 8/7/95	1995 Chiseled % Grft 8/7/95	% Tawh 8/7/95	2-Yr Avg. % Fxtl % Tawh
Check	----	0	0	0	0	0
PREPLANT INCORPORATED						
Prowl+Pursuit	.875+.063	90	94	88	94	91
Pursuit	.063	88	94	88	94	88
Treflan	.75	88	85	84	86	90
Sonalan	1	90	92	86	90	92
Prowl	1.25	89	80	82	80	89
Treflan+Sen/Lex	.75+.38	86	84	86	88	88
Treflan+Command	.75+.75	86	84	86	86	87
Treflan+Pursuit	.75+.063	92	96	92	96	92
Treflan+Scepter	.75+.125	90	96	90	96	92
Broadstrike/Treflan	.91	86	96	84	94	87
Prowl+Pursuit	1.25+.032	88	94	88	90	90
Treflan+Authority	.75+.375	90	92	86	90	92
SHALLOW PREPLANT INCORPORATED						
Lasso	3	88	60	84	50	87
Dual II	2.5	82	40	78	40	87
Frontier	1.5	80	50	76	55	87
Broadstrike/Dual	2.166	84	70	74	80	88
Lasso+Treflan	2+.25	82	86	78	86	83
SHALLOW PREPLANT INCORPORATED & POSTEMERGENCE						
Command&Pursuit+ Sun-It II+28% N	.75&.031+ 1 qt+1 qt	92	96	88	90	94
PREPLANT INCORPORATED & PREEMERGENCE						
Treflan+Sen/Lex&Sen/Lex	.75+.25&.38	96	99	92	95	94
Treflan&Sen/Lex	.75&.5	92	95	84	94	91

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

Treatment	lb/A act.	1995 Plowed % Grft 8/7/95	% Tawh 8/7/95	1995 Chiseled % Grft 8/7/95	% Tawh 8/7/95	2-Yr Avg. % Fxtl % Tawh
PREPLANT INCORPORATED & POSTEMERGENCE						
Prowl&Pursuit+	1&.063+					
Sun-It II+28% N	1 qt+1 qt	90	94	86	86	93
PREEMERGENCE						
Lasso	3	65	80	60	75	75
Dual II	2.5	84	50	74	60	86
Frontier	1.5	80	40	72	50	81
Broadstrike/Dual	2.166	84	50	65	70	81
Pursuit	.063	84	50	84	75	80
Lasso+Sen/Lex	2+.5	78	88	72	85	86
Dual II+Sen/Lex	2+.5	86	86	70	82	89
Lasso+Pursuit	2+.063	84	86	76	85	87
Lasso+Command	2+.75	86	70	84	80	87
Lasso+Authority	2+.375	78	70	74	70	82
Lasso+Lorox	2+1	74	90	72	85	79
Dual II+Pursuit	1.25+.063	86	84	74	86	86
Frontier+Pursuit	1.5+.063	86	76	84	76	82
PREEMERGENCE & POSTEMERGENCE						
Lasso&Pursuit+	2&.063+					
Sun-It II+28% N	1 qt+1 qt	92	90	94	92	92
Lasso&Scepter+X-77	2&.063+.5%	88	94	76	92	88
Lasso&Basagran+COC	2&1+1 qt	74	70	70	80	79
Lasso&Blazer+X-77	2&.38+.5%	76	94	68	92	81
Lasso&Stellar+COC	2&.24+.5%	72	90	68	90	79
Lasso&Cobra+COC	2&.2+.5 qt	74	88	69	87	81
Lasso&Flexstar+28% N	2&.25+2.5%	84	86	70	85	--
Lasso&Galaxy+X-77	2&.92+.5%	86	92	74	88	89
Lasso&Pinnacle+X-77	2&.0039+.25%	78	82	70	85	83
Lasso&Classic+X-77	2&.0117+.25%	82	86	68	80	83
Lasso&Concert+	2&.0078+					
X-77+28% N	.25%+1 qt	80	90	72	90	81
Lasso&Basagran+	2&.5+					
Pursuit+COC	.032+1 qt	92	94	84	90	89
Lasso&Pinnacle+	2&.0039+					
Pursuit+X-77	.047+.25%	88	94	88	92	90
POSTEMERGENCE						
Poast Plus+COC	.187+1 qt	94	0	94	0	93
Poast Plus	.187	90	0	88	0	92
Option II+COC	.079+1 qt	94	0	94	0	95

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

Treatment	lb/A act.	1995 Plowed % Grft 8/7/95	1995 Plowed % Tawh 8/7/95	1995 Chiseled % Grft 8/7/95	1995 Chiseled % Tawh 8/7/95 % Fxtl	2-Yr Avg. % Tawh
POSTEMERGENCE (Continued) . . .						
Select+COC	.094+1 qt	94	0	94	0	95
Fusilade DX+COC	.187+1 qt	94	0	86	0	94
Fusion+COC	.166+1 qt	94	0	94	0	93
Assure II+COC	.048+1 qt	94	0	94	0	95
AC 299263+ Sun-It II+28% N	.032+.75 qt+1 qt	94	96	94	92	--
Pursuit+Sun-It II+28% N	.063+1 qt+1 qt	92	90	88	90	90
Pursuit	.063	82	80	80	75	66
Poast Plus+Galaxy+COC	.2815+.92+1 qt	84	80	82	80	89
EARLY POSTEMERGENCE & POSTEMERGENCE						
Galaxy&Poast Plus+COC	.92&.2815+1 qt	84	75	86	74	89
Poast Plus+COC&Galaxy	.2815+1 qt&.92	78	74	66	74	85
PREPLANT INCORPORATED						
Sonalan	.5	50	60	50	60	66
Prowl	.625	45	60	40	60	45
Treflan	.38	65	50	65	60	68
Pursuit	.032	60	75	65	75	48
Treflan+Pursuit	.38+.032	82	92	84	86	79
PREEMERGENCE						
Lasso	1.5	69	82	50	40	57
Dual II	1.25	78	60	72	30	57
Frontier	.75	74	50	65	30	57
POSTEMERGENCE						
Poast Plus+COC	.094+1 qt	85	0	88	0	87
Pursuit+Pinnacle+ Sun-It II+28% N	.032+.0039+ 1 qt+1 qt	78	96	74	90	62
LSD (.05)						17

Table 2. VELVETLEAF CONTROL IN SOYBEANS

RCB; 2 reps Precipitation:
Variety: Kenwood PPI: 1st week 2.41 inches
Planting Date: 5/25/95 2nd week 1.22 inches
PPI, SPPI: 5/25/95 PRE: 1st week 2.41 inches
PRE: 5/26/95 2nd week 1.22 inches
POST: 6/30/95
LPOS: 7/7/95Vele = Velvetleaf
SOIL: Silty clay loam; Rrpw = Redroot pigweed
3.0% O.M.; 6.9 pH
COMMENTS: Wet conditions delayed planting; additional tillage prior to

	% Vele	% Rrpw	% Vele	% Rrpw	Yield	
Treatment	lb/A act.	8/15/95	8/15/95	9/21/95	9/21/95	bu/A
Check	----	0	0	0	0	4
PREPLANT INCORPORATED						
Prowl	1.25	10	80	18	83	10
Treflan+Sen/Lex	.75+.38	71	88	70	82	22
Command	.75	88	10	91	10	11
Command	1	91	18	91	25	14
Commence	1.31	72	78	59	82	22
Treflan+Scepter	.75+.125	64	99	61	99	27
Prowl+Pursuit	.875+.063	70	99	53	92	27
Prowl+Pursuit	.875+.032	62	98	58	97	26
Treflan+Pursuit+Sen/Lex	.75+.032+.25	86	97	83	92	29
PREPLANT INCORPORATED & POSTEMERGENCE						
Treflan+Command&	.75+.5&					
Pursuit+Sun-It II+28% N	.031+1 qt+1 qt	91	94	84	90	28
PREPLANT INCORPORATED						
Broadstrike/Treflan	.91	95	98	96	99	38
Treflan+Command+Sen/Lex+	.75+.25+.125+					
Pursuit+Scepter	.016+.031	89	99	88	99	31
PREPLANT INCORPORATED & PREEMERGENCE						
Treflan&Sen/Lex	.75&.5	87	99	83	99	32
Treflan+Sen/Lex&Sen/Lex	.75+.25&.38	92	99	90	99	36
SHALLOW PREPLANT INCORPORATED						
Broadstrike/Dual	2.166	82	99	83	99	34
PREEMERGENCE						
Broadstrike/Dual	2.166	90	99	89	99	33
Dual II+Sen/Lex	2+.5	82	99	79	92	32
Lasso+Pursuit	2+.063	83	99	84	97	30

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

% Vele	% Rrpw	% Vele	% Rrpw	Yield		
Treatment	lb/A act.	8/15/95	8/15/95	9/21/95	9/21/95	bu/A
Command	1	90	43	94	53	22
Command+Authority	.75+.375	91	93	91	88	29
Lasso+Lorox	2+1	38	90	63	90	24
PREPLANT INCORPORATED & POSTEMERGENCE						
Treflan&Blazer+28% N	.75&.38+4 qt	53	98	61	98	29
Treflan&Galaxy+28% N	.75&.92+4 qt	92	99	92	99	35
Treflan&Basagran+28% N	.75&1+4 qt	99	99	98	92	34
PREPLANT INCORPORATED & LATE POSTEMERGENCE						
Treflan&Basagran+28% N	.75&1+4 qt	70	92	73	64	24
PERPLANT INCORPORATED & POSTEMERGENCE						
Treflan&Basagran+ Dash+28% N	.75&1+ 1 qt+4 qt	97	99	98	83	28
PREPLANT INCORPORATED & POSTEMERGENCE & LATE POSTEMERGENCE						
Treflan&Basagran+28% N& Baagran+28% N	.75&.5+4 qt& .5+4 qt	97	91	94	87	32
PREPLANT INCORPORATED & POSTEMERGENCE						
Treflan&Cobra+COC	.75&.2+.5 qt	45	98	45	96	21
Treflan&Classic+28% N	.75&.0117+4 qt	49	95	60	92	23
Treflan&Concert+ X-77+28% N	.75&.0078+ .125%+1 qt	28	99	41	98	22
Treflan&Pursuit+ Sun-It II+28% N	.75&.063+ 1 qt+4 qt	97	99	96	99	29
Treflan&Pursuit+Scepter+ Sun-It II+28% N	.75&.063+.031+ 1 qt+4 qt	80	99	70	99	31
Treflan&Basagran+Pursuit+ COC+28% N	.75&.5+.032+ 1 qt+4 qt	96	99	92	99	35
Treflan&Pursuit+Cobra+ Sun-It II+28% N	.75&.063+.063+ 1 qt+4 qt	82	99	75	99	33
Treflan&Basagran+ Pinnacle+28% N	.75&.5+ .0039+4 qt	80	99	83	97	30
Treflan&Action+COC	.75&.0045+1 qt	99	99	97	97	27
Treflan&Resource+COC	.75&.0264+1 qt	89	98	88	94	26
Treflan&Stellar+COC	.75&.121+.5 qt	50	99	60	97	20
Check	----	0	0	0	0	3
LSD (.05)		8	8	17	20	11

Table 3. RESOURCE TANK-MIXES ON VELVETLEAF

RCB; 4 reps   Yeft = Yellow foxtail
Variety: AgriPro 164   Vele = Velvetleaf
Planting Date: 6/14/95
POST: 7/8/95
Soil: Silty clay loam; 2.7% O.M.; 7.1 pH
COMMENTS: Purpose to evaluate tank-mixes with Resource. Grass and

	% Yeft	% Vele	% Yeft	% Vele	Yield	
Treatment	lb/A act.	7/26/95	7/26/95	9/14/95	9/14/95	bu/A
Check	----	0	0	0	0	54
Resource+Accent+ Beacon+COC	.0269+.0156+ .0178+1 pt	89	92	87	92	66
Resource+Accent+ atrazine+COC	.0269+.0313+ .5+1 pt	87	93	84	92	70
Resource+ Accent+COC	.0269+ .0313+1 pt	90	88	86	88	75
Resource+Laddok+COC	.0269+2+1 pt	40	98	46	93	64
Resource+2,4-D ester	.0269+.25	0	98	0	94	68
Resource+Clarity	.0269+.25	0	97	0	93	62
LSD (.05)		4	5	4	3	12

Table 4. TOUGH COMBINATIONS FOR VELVETLEAF

RCB; 4 reps Precipitation: 1st week 0.01 inches
Variety: Agri-Pro 164 2nd week 1.20 inches
Planting Date: 6/14/95
EPOS: 7/8/95Vele = Velvetleaf
Soil: Silty clay loam; Grft = Green foxtail
2.7% O.M.; 7.1 pH
COMMENTS: Purpose to evaluate tank-mix combinations with Tough for

Treatment	lb/A act.	% Vele 7/26/95	% Grft 9/20/95	% Vele 9/20/95	Yield bu/A
Check	----	0	0	0	56
EARLY POSTEMERGENCE					
Tough+COC	.70+1%	69	25	64	63
Tough+atrazine+COC	.47+.5+1%	81	43	68	59
Tough+atrazine+COC	.70+.5+1%	86	45	69	64
Tough+Banvel	.47+.25	93	34	86	50
Tough+Banvel	.70+.25	93	40	88	56
Tough+Marksman	.47+.8	97	40	94	61
Tough+Sencor	.47+.07	82	25	66	45
Tough+Sencor	.70+.07	76	25	65	47
Buctril/atrazine	.75	94	39	84	41
Marksman	1.4	94	44	92	51
LSD (.05)		8	11	7	24

Table 5. COCKLEBUR CONTROL IN CORN

RCB; 3 reps
Variety: DK 554
Planting Date: 5/25/95
SPPI, PRE: 5/25/95
EPOS: 6/22/95
POST: 6/27/95
Soil: Loam; 2.9% O.M.; 7.0 pH

Precipitation: 1st week 2.41 inches; 2nd week 1.22 inches

Cocb = Cocklebur

COMMENTS: Accent was applied over entire plot area on 6/22/95 for grass control. Heavy cocklebur. Control with most treatments was excellent; regrowth and new emergence was not a problem.

Treatment	lb/A act.	% Cocb 7/26/95
PREEMERGENCE		
Check+Dual II	2.5	0
SHALLOW PREPLANT INCORPORATED		
Dual II+Broadstrike Plus	2.5+.21	80
PREEMERGENCE		
Dual II+Broadstrike Plus	2.5+.21	85
POSTEMERGENCE		
Broadstrike Post+X-77+28% N	.21+.25%+2.5%	96
EARLY POSTEMERGENCE		
Marksman	1.4	98
POSTEMERGENCE		
Permit+X-77	.0313+.25%	93
Exceed+COC	.0357+1 qt	94
Banvel	.5	97
Buctril+atrazine	.25+.5	97
Buctril	.25	96
Shotgun	1.21	97
Atrazine+COC	1.5+1 qt	97
Tough+Banvel	.47+.25	97
Laddok S-12+COC	1.04+1 qt	93
Resolve SG+X-77+28% N	.563+.25%+1 qt	98
LSD (.05)		3

Table 6. COCKLEBUR/SOYBEAN DEMONSTRATION

RCB; 2 reps
Variety: Kenwood
Planting Date: 5/25/95
PPI: 5/25/95
PRE: 5/26/95
POST: 6/27/95
LPOS: 7/8/95
Soil: Loam; 2.9% O.M.; 6.5 pH

Precipitation:

PPI:	1st week	2.41 inches
	2nd week	1.22 inches
PRE:	1st week	2.41 inches
	2nd week	1.22 inches

Cocb = Cocklebur

COMMENTS: Very heavy, uniform weed stand. Excellent performance for several postemergence treatments. Weeds reduced yield at least 50% compared to the check. Three-year average provides ameasure of consistency.

Treatment	lb/A act.	% Cocb 8/17/95	Yield bu/A	3-Yr Avg. % Cocb	3-Yr Avg. Yield bu/A
Check	----	0	15	0	11
PREPLANT INCORPORATED					
Pursuit	.063	40	26	43	26
Broadstrike/Treflan	1.03	33	23	35	19
PREPLANT INCORPORATED & PREEMERGENCE					
Sen/Lex&Sen/Lex	.38&.25	62	33	47	28
POSTEMERGENCE & LATE POSTEMERGENCE					
Basagran+COC& Basagran+COC	.5+1 qt& .5+1 qt	98	37	93	37
POSTEMERGENCE					
Basagran+COC	1+1 qt	98	33	83	37
Cobra+COC+28% N	.2+.5 qt+4 qt	98	28	93	29
Blazer+X-77	.38+.5%	67	33	56	28
Classic+X-77	.0117+.125%	99	41	92	38
Pursuit+Sun-It II+28% N	.063+1 qt+1 qt	99	43	91	43
Pinnacle+X-77	.0039+.125%	28	27	25	22
Concert+X-77	.0078+.125%	85	41	74	40
Scepter+X-77	.063+.25%	88	43	80	40
Basagran+Pinnacle+ X-77+28% N	.5+.0039+ .25%+4 qt	85	38	74	40
Basagran+Pursuit+ COC+28% N	.5+.032+ 1 qt+2 qt	93	43	91	42

Table 6. Continued . . .

Treatment	lb/A act.	% Cocb 8/17/95	Yield bu/A	3-Yr Avg. % Cocb	3-Yr Avg. Yield bu/A
Basagran+COC	.5+1 qt	60	23	--	--
Pursuit+Sun-It II+28% N	.032+1 qt+1 qt	90	28	--	--
LSD (.05)		6	8	10	7

Table 7. COCKLEBUR SALVAGE IN SOYBEANS

RCB; 3 reps
Variety: Hardin
Planting Date: 6/14/95
LPOS: 8/16/95
Soil: Clay; 3.1% O.M.; 7.1 pH

Precipitation: 1st week 1.94 inches
2nd week 0.41 inches

Cocb = Cocklebur
Tawh = Tall waterhemp

COMMENTS: Very dense cocklebur; 12-14 in. at treatment. Late control did not increase yield even though several treatments provided very good kill of weed plants or reduced seed development. Several treatments failed to affect tall waterhemp.

Treatment	lb/A act.	% Cocb 9/7/95	% Tawh 9/7/95	Yield bu/A
Check	----	0	0	23
LATE POSTEMERGENCE				
Scepter+X-77	.063+.25%	84	0	22
Pursuit+Sun-It II+28% N	.063+1 qt+1 qt	93	0	23
Pursuit+Sun-It II+28% N	.031+1 qt+1 qt	75	0	22
Basagran+COC+28% N	1+1 qt+2 qt	91	0	19
Classic+X-77+28% N	.0117+.25%+2 qt	98	0	20
Classic+X-77+28% N	.0078+.25%+2 qt	97	0	23
Classic+X-77+28% N	.0039+.25%+2 qt	89	0	18
2,4-DB	.2	74	20	20
Cobra+COC+28% N	.2+.5 qt+2 qt	53	47	13
LSD (.05)		15	6	7

Table 8. POSTEMERGENCE VOLUNTEER CORN CONTROL IN SOYBEANS

RCB; 4 reps
Variety: Hardin
Planting Date: 6/14/95
POST: 7/8/95

Soil: Silty clay loam;
3.5% O.M.; 6.6 pH

Gr = Yellow foxtail
Voco = Volunteer corn

COMMENTS: Purpose to evaluate grass and broadleaf herbicide tank-mixes forantagonistic response for volunteer corn and green foxtail control. Several combinations produced antagonistic reactions (*); generally more noteable in early ratings during 1995 than in some past years.

Treatment	lb/A act.	% Yeft 7/26/95	% Voco 7/26/95
Check	----	0	0
POSTEMERGENCE			
Fusilade DX+COC	.094+1 qt	43	98
Option II+COC	.052+1 qt	87	98
Poast Plus+COC	.188+1 qt	91	97
Assure II+COC	.0344+1 qt	87	98
Select+COC	.094+1 qt	87	98
Fusion+COC	.0125+1 qt	85	98
Fusilade DX+Basagran+COC	.094+1+1 qt	28*	98
Option II+Basagran+COC	.052+1+1 qt	73*	94
Poast Plus+Basagran+COC	.188+1+1 qt	81*	85*
Assure II+Basagran+COC	.0344+1+1 qt	66*	98
Select+Basagran+COC	.094+1+1 qt	74*	97
Fusion+Basagran+COC	.125+1+1 qt	73*	98
Fusilade DX+Pinnacle+ Classic+X-77	.094+.0039+ .0052+.25%	41	98
Option II+Pinnacle+ Classic+X-77	.052+.0039+ .0052+.25%	80	98
Select+Pinnacle+ Classic+X-77	.094+.0039+ .0052+.25%	74*	88*
Poast Plus+Pinnacle+ Classic+X-77	.188+.0039+ .0052+.25%	92	86*
Assure II+Pinnacle+ Classic+X-77	.0344+.0039+ .0052+.25%	80	98
Fusion+Pinnacle+ Classic+X-77	.125+.0039+ .0052+.25%	77*	98
Pursuit+Sun-It II+28% N	.063+1 qt+1 qt	81	61
Fusilade DX+Pursuit+	.094+.063+		

Table 8. Continued. . .

Treatment	lb/A act.	% Yeft 7/26/95	% Voco 7/26/95
Sun-It II+28% N	1 qt+1 qt	83	93
Option II+Pursuit+	.052+.063+		
Sun-It II+28% N	1 qt+1 qt	81	86*
Poast Plus+Pursuit+	.188+.063+		
Sun-It II+28% N	1 qt+1 qt	83*	91*
Assure II+Pursuit+	.0344+.063+		
Sun-It II+28% N	1 qt+1 qt	82	98
Select+Pursuit+	.094+.063+		
Sun-It II+28% N	1 qt+1 qt	83	89*
Fusion+Pursuit+	.0125+.063+		
Sun-It II+28% N	1 qt+1 qt	83	93
LSD (.05)		7	5

Table 9. 3X SOYBEAN RATE/CARRYOVER

RCB; 4 reps — Precipitation: 1st week 0.00 inches; 2nd week 0.26 inches
Variety: Kenwood
Planting Date: 6/15/95
PPI, PRE: 6/15/95
POST: 7/14/95
Soil: Silty clay; 3.5% O.M.; 6.6 pH
COMMENTS: Purpose to evaluate crop tolerance using several herbicide Differential weed competition is not a major factor in treatment differences.

Treatment	lb/A act.	% VCRR 8/17/95	Yield bu/A
Check	----	0	19
PREPLANT INCORPORATED			
Treflan	3	8	37
Sonalan	3	10	40
Prowl	3.75	11	35
Command	3	0	40
Broadstrike/Treflan	3	11	37
PREEMERGENCE			
Lasso	9	0	36
Dual II	7.5	0	33
Frontier	4.5	3	38
Sencor	1.5	6	27
PREPLANT INCORPORATED			
Treflan+Scepter	.5+.38	4	37
Treflan+Pursuit	.5+.19	10	37
PREPLANT INCORPORATED & POSTEMERGENCE			
Treflan&Classic+X-77	.5&.0351+.25%	0	41
Treflan&Pinnacle+X-77	.5&.0117+.25%	1	38
Treflan&Cobra+COC	.5&.6+.5 qt	15	34
Treflan&Blazer+X-77	.5&1.125+.5%	0	37
Treflan&Basagran+COC	.5&3+1 qt	6	30
POSTEMERGENCE			
Resource+COC	.161+1 qt	8	28
LSD (.05)		7	8

Table 10. 3X CORN RATE/CARRYOVER

RCB; 4 reps
Variety: AgriPro 164
Planting Date: 6/15/95
PRI, PRE: 6/15/95
POST: 7/8/95
Soil: Silty clay; 3.5% O.M.; 6.6 pH

Precipitation: 1st week 0.00 inches
2nd week 0.26 inches

Grft = Green foxtail
Tawh = Tall waterhemp

COMMENTS: Purpose to evaluate crop response to herbicides applied at 3X normal use rates as a means of evaluating tolerance and

Treatment	lb/A act.	% VCRR 9/7/95	% Grft 9/7/95	% Tawh 9/7/95	Height to Node Below Ear- (in) 11/8/95	Yield bu/A
Check	----	0	0	0	34	100
PREPLANT INCORPORATED						
Eradicane	12	0	98	99	35	109
Atrazine	5	0	97	99	---	110
Bladex	9	0	98	99	35	101
PREEMERGENCE						
Lasso	9	0	92	99	---	109
Dual II	7.5	0	94	92	37	110
Surpass	7.5	0	96	99	---	105
Harness	7.5	0	94	99	---	112
Frontier	4.5	0	96	99	---	107
Broadstrike/Dual	6.5	0	93	99	---	105
Battalion	.225	0	54	99	---	109
POSTEMERGENCE						
Accent+COC+28% N	.094+1%+4 qt	0	98	99	36	100
Beacon+X-77	.108+.25%	3	74	99	---	68
2,4-D amine	1.5	25	0	98	---	93
Banvel	1.5	24	49	98	---	77
Buctril	1.125	0	0	98	---	84
Permit+X-77	.094+.25%	9	30	99	---	99
Exceed+COC	.107+1 qt	13	0	97	---	83
Basis+X-77+28% N	.0468+.25%+2 qt	60	77	99	20	22
LSD (.05)		7	8	2	3	13

Table 11. BASIS COMBINATIONS

RCB; 6 reps
Variety: AgriPro 164
Planting Date: 6/14/95
PRE: 6/15/95
EPOS: 6/27/95
Soil: Clay loam; 3.3% O.M.; 7.2 pH

Precipitation: 1st week 0.00 inches; 2nd week 0.26 inches

Grft = Green foxtail

COMMENTS: % VCRR - Visual Crop Response Rating; 0=none. Rated for leaf distortion; not apparent across any treatment. Cultivated on 7/14/95. Ratings on that date were taken before cultivation. Yields for most treatments exceeded the check or cultivation alone.

Treatment	lb/A act.	% VCRR 7/14/95	% Grft 7/14/95	% VCRR 7/24/95	% Grft 7/24/95	Yield bu/A
Check	----	0	0	0	0	85
EARLY POSTEMERGENCE						
Basis+ X-77+28% N	.0156+ .25%+2 qt	0	91	0	89	102
Basis+Banvel+ X-77+28% N	.0156+.063+ .25%+2 qt	1	87	0	84	99
Basis+atrazine+ COC+28% N	.0156+1+ 1%+2 qt	0	91	0	86	104
Basis+X-77+ 28% N&Cultivation	.0156+.25%+ 2 qt	0	90	0	90	101
Basis+Banvel+ X-77+28% N& Cultivation	.0156+.063+ .25%+2 qt+	2	87	0	90	106
Basis+atrazine+ COC+28% N& Cultivation	.0156+1+ 1%+2 qt+	0	90	0	93	107
Cultivation	----	0	0	0	73	84
PREEMERGENCE & EARLY POSTEMERGENCE						
Lasso&Banvel	2.5&.063	2	83	0	82	111
Lasso&Banvel& Cultivation	2.5&.063&	1	80	0	82	97
LSD (.05)		2	3	0	3	16

Table 12. BROADSTRIKE COMPARISONS IN CORN

RCB; 4 reps
Variety: AgriPro 164
Planting Date: 6/14/95
SPPI: 5/26/95
PRE: 6/24/95
EPOS: 7/7/95
POST: 7/14/95
Soil: Silty clay loam;
2.7% O.M.; 7.1 pH

Precipitation:

SPPI:	1st week	2.41 inches
	2nd week	1.22 inches
PRE:	1st week	0.00 inches
	2nd week	0.26 inches

Vele = Velvetleaf

COMMENTS: Purpose to evaluate Broadstrike herbicide product for velvetleaf control. Velvetleaf was uniform, light density. Postemergence applications were more effective than soil treatments. Yields were similar for most treatments in the study.

Treatment	lb/A act.	% Vele 7/26/95	% Vele 9/15/95	Yield bu/A
Check	----	0	0	56
SHALLOW PREPLANT INCORPORATED				
Broadstrike Plus	.21	45	77	56
PREEMERGENCE				
Broadstrike Plus	.21	58	74	62
EARLY POSTEMERGENCE				
Broadstrike Post+X-77+28% N	.21+.25%+2.5%	97	86	58
POSTEMERGENCE				
Broadstrike Post+X-77+28% N	.21+.25%+2.5%	92	88	52
EARLY POSTEMERGENCE				
Marksman	1.4	98	85	58
POSTEMERGENCE				
Permit+X-77	.0313+.5%	98	85	58
Peak+COC	.0267+1 qt	98	89	58
LSD (.05)		7	5	9

Table 13. EVALUATION OF FOXTAIL REMOVAL TIMING/SOYBEANS

RCB; 4 reps
Variety: Hardin
Planting Date: 6/14/95
PPI: 6/14/95
2 WEEKS: 6/30/95
3 WEEKS: 7/7/95
4 WEEKS: 7/14/95
5 WEEKS: 7/24/95
6 WEEKS: 7/31/95
COMMENTS: Heavy foxtail pressure. Treatments provided very good foxtail control. Maximum yield was maintained with removal at the 2-, 3-, and 4-week timings. Check yield was severely reduced.

Precipitation: 1st week 1.83 inches
2nd week 0.02 inches

Soil: Silty clay; 3.5% O.M.; 6.6 pH

Grft = Green foxtail

Treatment	lb/A act.	% Grft 8/16/95	Yield bu/A
Check	----	0	11
PREPLANT INCORPORATED			
Treflan	.75	84	33
PREPLANT INCORPORATED & 3 WEEKS			
Treflan&Poast Plus+ COC+28% N	.75&.25+1.25%+2.5%	99	39
POSTEMERGENCE			
Poast Plus+COC+28% N	.25+1.25%+2.5%		
2 Weeks		91	36
3 Weeks		93	34
4 Weeks		97	34
5 Weeks		91	31
6 Weeks		74	16
LSD (.05)		6	5

Table 14. COMPARISON OF GRASS HERBICIDES EPP AND PRE

RCB; 4 reps
Variety: AgriPro 164
Planting Date: 6/14/95
30EPP: 4/25/95
PRE: 6/15/95
SOIL: Clay loam;
3.3% O.M.; 7.2 pH

Precipitation:

30EPP:	1st week	0.78 inches
	2nd week	1.10 inches
PRE:	1st week	0.00 inches
	2nd week	0.26 inches

Grft = Green foxtail
Rrpw = Redroot pigweed

COMMENTS: Wet conditions delayed planting; initial weed flush destroyed with seedbed preparation prior to planting. No differential crop response noted 7/1.

Treatment	lb/A act.	% Grft 7/1/95	% Rrpw 7/1/95	% Grft 7/21/95	% Rrpw 7/21/95	Yield bu/A
Check	----	0	0	0	0	67
30 DAYS EARLY PREPLANT						
Bicep II	3.55	92	99	83	95	83
Bicep Lite II	3.75	93	99	88	94	84
Surpass 100	4.17	91	97	82	94	91
Harness Extra	3.55	87	98	79	92	84
Guardsman	2.81	90	98	81	92	81
PREEMERGENCE						
Bicep II	3.55	66	95	74	95	87
Bicep Lite II	3	64	98	79	91	85
Surpass 100	3.33	76	98	83	95	82
Harness Extra	2.84	69	97	84	93	84
Guardsman	2.51	66	97	81	90	78
LSD (.05)		7	3	4	2	9

Table 15. EVALUATION OF BURNDOWN WITH ROUNDUP AND ADDITIVES

RCB; 4 reps
POST: 6/30/95
Soil: Clay; 3.1% O.M.; 7.1 pH

Precipitation: 1st week 1.83 inches
2nd week 0.02 inches

Yeft = Yellow foxtail

COMMENTS: Purpose to evaluate effectiveness of selected adjuvants to effective than "surfactants".

Treatment	lb/A act.	% Yeft 7/21/95
Check	----	0
POSTEMERGENCE		
Roundup	.19	57
Roundup	.28	85
Roundup+X-77	.19+.5%	67
Roundup+AS	.19+17 lb/100 gal	83
Roundup+X-77+AS	.19+.5%+17 lb/100 gal	81
Roundup+Scoil	.19+1 qt	54
Roundup+COC	.19+1 qt	61
Roundup+Land Oil	.19+2 qt	64
Roundup+Deliver	.19+2.5%	82
Roundup+Deliver Xtra	.19+5%	82
Roundup+Pen-a-trate II+AS	.19+.5%+17 lb/100 gal	79
Roundup+PXDTS	.19+17 lb/100 gal	82
Roundup+New Balance+AS	.19+.25%+5 lb/100 gal	81
Roundup+New Balance	.19+.25%	72
Roundup+Cayuse Plus	.19+1 qt	85
Roundup+Pen-a-trate II+ AS+New Balance	.19+.25%+ 5 lb/100 gal	84
Roundup+Cayuse+R-11	.19+.5%+.312%	71
Roundup+PXT100	.19+1%	80
Roundup+PXT100PP	.19+1%	76
LSD (.05)		5

Table 16. ADDITIVES WITH GALAXY

RCB; 3 reps
Variety: Hardin
Planting Date: 6/15/95
POST: 7/8/95
Soil: Silty clay loam; 2.9% O.M.; 6.3 pH
COMMENTS: All treatments performed very well. Light-moderate, uniform weed pressure.

Precipitation: 1st week 0.01 inches; 2nd week 1.20 inches

Tawh = Tall waterhemp

Treatment	lb/A act.	% Tawh 7/26/95
POSTEMERGENCE		
Galaxy+Solubor	.92 qt+.25	98
Galaxy+X-77	.92 qt+.5%	94
Galaxy+COC	.92 qt+1 qt	95
Galaxy+COC+ACA	.92 qt+1 qt+.33 qt	95
Galaxy+Land Oil	.92 qt+1 qt	95
Galaxy+Choice Extra	.92 qt+.625%	97
Check	----	0
LSD (.05)		3

Table 17. COMPARISONS OF PURSUIT ADJUVANTS

RCB; 3 reps
Variety: Hardin
Planting Date: 6/14/95
POST: 7/14/95
Soil: Clay; 3.1% O.M.; 7.1 pH
COMMENTS: Very heavy cocklebur; uniform, precise differences measured. No visual differences in early season crop response.

Precipitation: 1st week 1.20 inches; 2nd week 0.68 inches

Grft = Green foxtail

Treatment	lb/A act.	% Cocb 7/26/95	% Tawh 7/26/95	Yield bu/A
Check	----	0	0	12
POSTEMERGENCE				
Pursuit+Meth Oil	.063+1.5 pt	93	87	26
Pursuit+Chaser	.063+2 qt	89	88	25
Pursuit+Nisol	.063+2 qt	89	80	21
Pursuit+TRA-0049	.063+.5%	88	85	23
Pursuit+Dyne-amic	.063+.5%	85	82	21
LSD (.05)		6	6	5

Table 18. ADDITIVES WITH PURSUIT

RCB; 3 reps Precipitation: 1st week 0.01 inches
Variety: Hardin 2nd week 1.20 inches
Planting Date: 6/15/95
POST: 7/8/95Grft = Green foxtail
Soil: Silty clay loam; 2.9% O.M.; 6.3 pH
COMMENTS: Purpose to evaluate additives with Pursuit. Redued Pursuit rate (3 oz) used to more clearly measure the additive effect. Pursuit at the full rate with recommended additive produced the highest foxtail control; differences of 5 to 10% were measured for some treatments.

Treatment	lb/A act.	% Grft 7/26/95
Check	-----	0
POSTEMERGENCE		
Pursuit	.047	82
Pursuit+Sun-It II	.047+1 qt	85
Pursuit+Sun-It II+28% N	.047+1 qt+1 qt	86
Pursuit+Sun-It II+AS	.047+1 qt+17%	88
Pursuit+Sun-It II+28% N	.063+1 qt+1 qt	92
Pursuit+Pen-a-trate II+28% N	.047+.25%+1 qt	84
Pursuit+LI201-767Q+28% N	.047+.5%+1 qt	86
Pursuit+Dispatch	.047+1.25 qt	85
Pursuit+Silwet L-77+28% N	.047+.125%+1 qt	83
Pursuit+Chaser+28% N	.047+1 qt+1 qt	84
Pursuit+Prime Oil+28% N	.047+1 qt+1 qt	83
Pursuit+Cayuse+28% N	.047+.25%+1 qt	85
Pursuit+Premier 90+28% N	.047+.25%+1 qt	83
Pursuit+Crop Oil Plus+28% N	.047+1 qt+1 qt	88
Pursuit+Spraybooster S+28% N	.047+.25%+1 qt	85
Pursuit+LI-700+28% N	.047+.25%+1 qt	87
Pursuit+Soy Wet+28% N	.047+.25%+1 qt	86
Pursuit+Herbimax+28% N	.047+1 qt+1 qt	87
Pursuit+Dash+28% N	.047+1 qt+1 qt	89
Pursuit+Land Oil+28% N	.047+1 qt+1 qt	83
Pursuit+Sun-It II+28% N+ACA	.047+1 qt+1 qt+.33 qt	77
Pursuit+Choice Extra	.047+.625%	74
LSD (.05)		5

Table 19. EVALUATION OF STS SOYBEANS

RCB; 4 reps
Variety: Hardin
Planting Date: 6/14/95
POST: 7/8/95
Soil: Silty clay loam;
2.7% O.M.; 7.1 pH

Precipitation: 1st week 0.01 inches
2nd week 1.20 inches

Yeft = Yellow foxtail
Vele = Velvetleaf

COMMENTS: Purpose to evaluate weed control performance for several herbicide programs using Concert herbicide with STS seed. The lack of foxtail control component reduced yield for those treatments.

Treatment	lb/A act.	% Yeft 7/26/95	% Vele 7/26/95	% Yeft 9/14/95	% Vele 9/14/95	Yield bu/A
Check	----	0	0	0	0	18
POSTEMERGENCE						
Concert+COC+28% N	.0078+1%+2 qt	0	92	0	90	24
Concert+Classic+ COC+28% N	.0078+.0013+ 1%+2 qt	0	96	0	87	26
Concert+Assure II+ COC+28% N	.0078+.055+ 1%+2 qt	74	95	73	86	33
Concert+Poast Plus+ COC+28% N	.0078+.188+ 1%+2 qt	94	95	94	87	43
Concert+Cobra+ COC+28% N	.0078+.063+ 1%+2 qt	0	92	0	86	23
Pursuit+Sun-It II+28% N	.063+1.5 qt+2 qt	92	89	94	89	43
Pursuit+Resource+ Assure II+Sun-It II	.063+.0269+ .055+1.5 qt	91	83	92	80	41
LSD (.05)		5	4	5	3	6

Table 20. EVALUATION OF NEW TYPES OF SOYBEANS

RCB; 2 reps
Variety: STS, Transgenic, Roundup
Planting Date: 6/15/95
PRE: 6/15/95
EPOS: 7/18/95
POST: 7/24/95
LPOS: 7/31/95
Soil: Silty clay; 3.5% O.M.; 6.0 pH
COMMENTS: Purpose to demonstrate weed control approaches using genetic tolerant conditions. Herbicides included Concert (STS seed); Liberty (Transgenic seed); and Roundup (Roundup Ready seed). Limited late weed flush.

Precipitation: 1st week 0.00 inches
2nd week 0.26 inches

Grft = Green foxtail
Tawh = Tall waterhemp

Treatment	lb/A act.	8/17/95	8/17/95
STS SEED			
Check	----	0	0
PREEMERGENCE & EARLY POSTEMERGENCE			
Dual II&Concert+ COC+28% N	2.5&.0078+ 1%+2 qt	67	96
EARLY POSTEMERGENCE			
Concert+Poast+ COC+28% N	.0078+.188+ 1%+2 qt	95	98
TRANSGENIC SEED			
Check	----	0	0
EARLY POSTEMERGENCE			
Liberty	.36	92	96
EARLY POSTEMERGENCE & POSTEMERGENCE			
Liberty&Liberty	.27&.27	98	99
PREEMERGENCE & POSTEMERGENCE			
Sen/Lex&Liberty	.38&.27	98	95
ROUNDUP READY SEED			
Check	----	0	0
EARLY POSTEMERGENCE			
Roundup+X-77	.38+.5%	97	97

Table 20. Continued . . .

Treatment	lb/A act.	% Grft 8/17/95	%Tawh 8/17/95
EARLY POSTEMERGENCE & POSTEMERGENCE			
Roundup+X-77&	.38+.5%&		
Roundup+X-77	.38+.5%	98	99
EARLY POSTEMERGENCE			
Roundup+X-77	.75+.5%	97	99
POSTEMERGENCE			
Roundup+X-77	.75+.5%	90	88
LATE POSTEMERGENCE			
Roundup+X-77	.75+.5%	97	95
LSD (.05)		7	6

Table 21. FOXTAIL REMOVAL TIMING NO-TILL

RCB; 6 reps
Variety: Kenwood
Planting Date: 6/3/95
PRE: 6/3/95
2 WEEKS: 6/22/95
3 WEEKS: 6/30/95
4 WEEKS: 7/7/95
5 WEEKS: 7/14/95
6 WEEKS: 7/24/95
Soil: Silty clay; 3.1% O.M.; 7.1 pH
COMMENTS: Delayed planting due to wet conditions and cool early season temperatures are factors in overall low yield. Reduced crop canopy was a factor in significant levels of weed competition.

Precipitation: 1st week 1.10 inches
2nd week 0.23 inches

Fxtl = Yellow foxtail

Treatment	lb/A act.	% Fxtl 8/17/95	% Fxtl 9/7/95	Yield bu/A
PREEMERGENCE				
Roundup (Check)	.75	0	0	3
Roundup+Lasso	.75+2.5	83	77	19
PREEMERGENCE & POSTEMERGENCE (3 WEEKS)				
Roundup+Lasso&	.75+2.5&			
Poast Plus+COC+28% N	.25+1.25%+2.5%	92	87	21
PREEMERGENCE & POSTEMERGENCE				
Roundup&Poast Plus+	.75&.25+			
COC+28% N	1.25%+2.5%			
(2 weeks)		83	75	22
(3 weeks)		89	78	18
(4 weeks)		81	73	15
(5 weeks)		92	82	11
(6 weeks)		92	86	7
LSD (.05)		4	6	4

Table 22. REDUCED INPUT FOR NO-TILL SOYBEANS

RCB; 4reps	Precipitation:		
Variety: Kenwood	EPP	1st week	1.06 inches
Planting Date: 5/18/95		2nd week	2.39 inches
FALL: 11/1/94	PRE	1st week	2.41 inches
EPP: 4/7/95		2nd week	1.22 inches
EPRE: 5/16/95			
PRE: 5/25/95			
POST: 6/15/95	Yeft = Yellow foxtail		
Soil: Silty clay; 3.4% O.M.; 5.7 pH	Colq = Common lambsquarters		

COMMENTS: Purpose to evaluate reduced herbicide rates in no-till where minimal weed pressure is anticipated. Weed pressure was greater than anicipated and most treatments were not satisfactory. Rates are less than those labeled for standard use.

Table 23. NO-TILL CORN DEMONSTRATION

Demonstration		Precipitation:		
Variety: Pioneer 3615		EPP	1st week	1.06 inches
Planting Date: 5/25/95			2nd week	2.39 inches
FALL: 11/1/94	PRE	1st week	2.41 inches	
EPP: 4/7/95			2nd week	1.22 inches
PRE: 5/25/95				
EPOS: 6/14/95	Fisb = Field sandbur			
POST: 6/22/95	Rrpw = Redroot pigweed			
Soil: Silty clay loam; 3.7% O.M.; 6.6 pH				

COMMENTS: Heavy grass pressure; very wet spring conditions extending into early spring delayed planting.

Table 22. Reduced Input for No-Till Soybeans

FALL	EARLY PREPLANT	EARLY PREEMERGENCE	PREEMERGENCE	POSTEMERGENCE	% Yeft 7/21/95	% Colq 7/21/95
Check					0	0
Prowl(1.5)					49	18
Prowl(1.5)+Pursuit(.032)					53	36
Prowl(1.5)				Pursuit(.032)+Sun-It II(1 qt)+ 28% N(1 qt)	78	53
	Prowl(1.5)			Pursuit(.032)+Sun-It II(1 qt)+ 28% N(1 qt)	91	71
				Pursuit(.032)+Sun-It II(1 qt)+ 28% N(1 qt)	59	50
		Roundup(.18)+2,4-D ester(.25)+ X-77(.5%)+AS(2%)		Pursuit(.032)+Sun-It II(1 qt)+ 28% N(1 qt)	76	83
			Pursuit(.032)+Sun-It II(1 qt)+ 28% N(1 qt)		78	50
	Dual II(1.25)			Pursuit(.032)+Sun-It II(1 qt)+ 28% N(1 qt)	85	58
	Micro-Tech(1.5)			Pursuit(.032)+Sun-It II(1 qt)+ 28% N(1 qt)	83	35
	Frontier(.75)			Pursuit(.032)+Sun-It II(1 qt)+ 28% N(1 qt)	71	40
	Pursuit(.032)				45	60
	Command(.5)			Pursuit(.032)+Sun-It II(1 qt)+ 28% N(1 qt)	74	79
	Broadstrike/Dual(1.2)				57	69
		Roundup(.18)+2,4-D ester(.25)+ X-77(.5%)+AS(2%)		Pursuit(.032)+Cobra(.063)+ Sun-It II(1 qt)+28% N(1 qt)	76	88
		Roundup(.18)+2,4-D ester(.25)+ X-77(.5%)+AS(2%)		Fusion(.125)+Pursuit(.032)+ Sun-It II(1 qt)+28% N(1 qt)	53	86
		Roundup(.18)+2,4-D ester(.25)+ X-77(.5%)+AS(2%)		Poast Plus(.1)+Galaxy(.46)+ COC(.625%)+28% N(.625%)	46	85
	LSD (.05)				13	13

Table 23. No-Till Corn Demonstration

			EARLY		% Fisb	% Rrpw	F
Atrazine(1)+ Dual II(2.75)(2.75 pt)					55	97	
Atrazine(1)	Dual II(2.75)				72	97	
Atrazine(1)		Dual II(2.75)			84	97	
	Atrazine(1)+Dual II(2.75)				74	97	
	Atrazine(1)+ Micro-Tech(3.25)(3.25 qt)				76	97	
	Atrazine(1)+Frontier(1.6 pt)				76	97	
	Atrazine(1)+Topnotch(2.4)(6 pt)			74	97		
	Atrazine(1)+Harness(2.4)(2.75 pt)				76	97	
	Atrazine(1)+Prowl(1.5)(3.65 pt)			78	97		
	Atrazine(1)	Dual II(2.75)			80	97	
	Broadstrike/Dual(2.4)(2.5 pt)				70	97	
	Contour(.563)(1.33 pt)				72	97	
			Contour(.563)+ Banvel(.25)+X-77(.25%)		96	97	
	Extrazine II(1)+Dual II(1.25)	Extrazine II(1)+Dual II(1)			78	97	
	Extrazine II(2)		Extrazine II(2)+COC(1 qt)		84	97	
		Gramoxone Extra(.5)+X-77(.5%)+ Extrazine II(2)+Dual II(2.25)			86	97	
		Gramoxone Extra(.5)+X-77(.5%)+ Atrazine(1)+Bladex(2)+ Acetochlor(2)(2.5 pt)			82	97	
		Gramoxone Extra(.5)+X-77(.5%)+ Microtech(2.5)	Atrazine(1.5)+COC(1 qt)	88	97		
		Gramoxone Extra(.5)+X-77(.5%)		Accent(.031)(.67 oz)+X-77(.25 %)+ 28% N(4%)+Banvel(.25)	86	97	

WET AND DRY CORN DISTILLERS GRAINS IN HIGH ENERGY RECEIVING AND STEP-UP DIETS FOR YEARLING CATTLE

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Summary

One hundred sixty-two crossbred yearling steers were fed conventional (CONV) receiving/step-up diets containing decreasing amounts of roughage (50, 40, 30, and 20% of diet dry matter) or high energy (HE) receiving/step-up diets containing only 10% roughage but decreasing amounts of corn distillers grains in wet (WDG) or dry (DDG) form (43, 30, 20, and 10% of diet dry matter). Dry matter intake of HE diets averaged 13% less than CONV diets (P<.01) through day 30 of the study. However, daily weight gains were not affected by treatment (P>.20). As a result, HE feed efficiency was 13% better than CONV through day 30 (P=.06). Numerically better performance of HEWDG fed cattle compared to those fed HEDDG were not significant (P=.17-.20). No differences in carcass characteristics were found after 126 days on a common finishing diet (P>.20). Wet and dry corn distillers grains based HE receiving/step-up diets improved feed efficiency of yearling steers during the first 30 days on feed but did not affect subsequent performance on a common finishing diet.

Key Words: Distillers Grains, Receiving, Step-up, Cattle

Introduction

Nutritional management of cattle during the first several weeks after arrival at the feedlot has a sizable impact on overall feedlot performance. Moving cattle quickly to a high energy finishing diet decreases cost of gain because purchase weight is recovered sooner and days on feed are reduced. However, increasing energy intake from high starch grain too rapidly can cause acidosis, founder, and liver abscesses which reduce rate and efficiency of weight gain. Previous South Dakota work has demonstrated that high energy diets can be fed safely throughout the receiving/step-up phase if roughage is replaced by wet corn distillers grains (WDG) which, although high in energy, contains little starch. Dry corn distillers grains (DDG) may be more practical for many cattle feeders; but, because of differences in physical characteristics and apparent lower energy value, it is not known how effectively it will substitute for the wet product.

The objectives of this study were to verify the results of previous work and to evaluate DDG as a substitute for WDG in high energy receiving/step-up diets for yearling steers.

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Materials and Methods

A group of 234 crossbred yearling steers were transported 660 miles to the feedlot and fed long grass hay ad libitum until the study was started. On the third day after arrival the steers were vaccinated (IBR, PI3, BVD, BRSV, 7-way clostridium), implanted (Revalor-S[3]), wormed (Levasole[4]), ear tagged, and weighed. From these, 162 steers were randomly allotted the same day to 18 pens and fed one of three receiving/step-up diet treatments. The treatments were 1) a conventional receiving and step-up series of diets (CONV) in which roughage (ground hay) was sequentially decreased from 50% to 40, 30, and 20%, 2) high energy diets (only 10% roughage) initially containing WDG (HEWDG) at 43% (dry matter basis) but sequentially reduced to 30, 20, and 10%, and 3) high energy diets containing DDG (HEDDG) in place of WDG (Table 1). Diets 1 through 4 were fed 7, 5, 5, and 6 days, respectively. A common finishing diet containing 10% roughage and no distillers grains was fed for 7 days prior to weighing on day 30 and for the remainder of the study. The diets contained monensin[5] and tylosin[5].

The steers were revaccinated and poured with Warbex[4] 9 days after initial processing. The on-test weight was taken after approximately 16 hours without access to feed or water. Subsequent weights were taken after 16-hour removal of feed only.

The feedlot performance data were analyzed on a pen basis as a randomized complete block design. Blocking involved housing system (semiconfinement vs conventional dirt lots). Carcass data were analyzed on an individual animal basis. Linear contrasts were used to compare CONV versus HE diets and HEWDG versus HEDDG.

Results and Discussion

Feedlot performance results are presented in Table 2. The steers were allotted randomly to pens while being processed. Despite this procedure, CONV steers weighed 10 lb less than the others at the beginning of the study. However, statistical analysis indicated that initial weight had no effect on performance differences and was not considered further. No differences were found in body weight at 86 days on test (P>.20).

Dry matter intake of HE diets averaged 13% less than that of CONV diets during the first 30 days of the study (CONV vs HE, P<.01). Numerical differences between HEWDG and HEDDG intakes did not achieve significance during this period (P=.17). No differences (P>.20) among treatments were found from day 31 through 86, but overall intake (day 1 through 86) approached significance (CONV vs HE, P=.13).

Daily weight gains were not affected by treatment at any point in the study (P>.20), differing by only .09 lb/day during the first weigh period and overall. However, this

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[5]Elanco Products, Greenfield, IN.

coupled with reduced intake through day 30 resulted in a 13% improvement in feed efficiency for HE fed steers compared to those fed the CONV diets (P=.06). Despite the lack of differences from day 31 through 86 (P>.20), efficiency tended to be better overall (P=.13), reflecting improvements earlier in the study. Numerically lower intake per pound of gain for HEWDG compared to HEDDG through day 30, although equal to a 10% difference, did not achieve significance (P=.20).

Improvements in feed efficiency are likely due to improved energy utilization. Although protein concentrations of the HE diets were greater than those of the CONV diets, protein intakes were very similar, averaging 2.36, 2.41, and 2.43 lb/day for CONV, HEWDG, and HEDDG, respectively, during the first 30 days of the study and resulted in similar weight gains. Numerical differences between HEWDG and HEDDG diets are consistent with the idea that WDG has a greater net energy content than DDG, but lack of statistical significance in this study prevents such a conclusion from being drawn.

Steers were slaughtered after 149 days on test (Table 3). No differences were found in hot carcass weight, quality grade, yield grade, or occurrence of liver abscesses (P>.20). The low incidence of damaged livers may be partly responsible for the lack of carryover effect of receiving/step-up management practices on subsequent feedlot performance. No noticeable problems with acidosis and related conditions were encountered.

In conclusion, the results from this study confirm earlier work indicating that corn distillers grain based HE receiving/step-up diets improve feed efficiency of steers considerably during the first few weeks in the feedlot without the risk of acidosis and related problems. Additionally, improvement in feed efficiency was achieved with corn distillers grains in both wet and dry forms.

Table 1. Composition of conventional (CONV) and high energy (HE) diets fed during the receiving and step-up period (dry matter basis)

	CONV diets				HE diets				Finishing diet
Ingredient	1	2	3	4	1	2	3	4	5[a]
Rolled corn	40.78	54.93	64.93	74.93	40.64	54.93	64.93	74.93	84.93
Wet/dry distillers grains	—	—	—	—	42.93	30.00	20.00	10.00	—
Alfalfa hay	25.00	20.00	—	—	—	—	—	—	—
Brome hay	25.00	20.00	30.00	20.00	10.00	10.00	10.00	10.00	10.00
Molasses	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Soybean meal	5.00	—	—	—	—	—	—	—	—
Dicalcium phosphate	.60	.05	.05	.05	—	.05	.05	.05	.05
Potassium chloride	—	.16	.16	.16	1.40	.16	.16	.16	.16
Limestone	.63	1.52	1.52	1.52	1.90	1.52	1.52	1.52	1.52
Trace mineral salt	.50	.50	.50	.50	.50	.50	.50	.50	.50
Urea	—	.79	.79	.79	—	.79	.79	.79	.79
Premix[b]	.49	.05	.05	.05	.63	.05	.05	.05	.05
<u>Analysis</u>									
Crude protein, %[c]	13.7	13.7	11.1	11.0	19.4	18.8	15.8	13.3	10.8
NE_m, Mcal/cwt[d]	75.3	79.6	83.8	88.8	92.4	93.8	93.8	93.8	93.8
NE_g, Mcal/cwt[d]	47.8	51.6	55.1	59.6	63.2	64.2	64.2	64.2	64.1

[a]Common finishing diet.
[b]Provided monensin at 14 mg, tylosin at 5 mg and vitamin A at 2321 IU per lb DM in diets 2 through 5.
[c]Chemical analysis.
[d]Calculated.

Table 2. Feedlot performance of yearling steers fed conventional (CONV) or high energy receiving/step-up diets containing wet (HEWDG) or dry corn distillers grains (HEDDG) and a common finishing diet[a]

Item	Diets			SE
	CONV	HEWDG	HEDDG	
No. of steers	54	54	54	
Initial weight, lb[b]	791	801	802	3.1
Weight at 86 days, lb	1120	1133	1130	8.5
DM intake, lb/day				
Day 1-30	19.5	16.6	17.4	.43
Day 31-86	23.3	24.0	23.0	.42
Day 1-86	21.9	21.4	21.1	.37
Weight gain, lb/day				
Day 1-30	3.43	3.50	3.42	.253
Day 31-86	3.76	4.08	4.05	.196
Day 1-86	3.78	3.87	3.82	.11
Feed:gain				
Day 1-30[c]	5.77	4.77	5.32	.294
Day 31-86	6.42	5.86	5.68	.429
Day 1-86	5.74	5.55	5.55	.097

[a]Least squares means.
[b]Linear contrast of CONV vs HE significant (P<.01).
[c]Linear contrast of CONV vs HE significant (P<.06).

Table 3. Carcass data for yearling steers fed a common finishing diet for 127 days after receiving/step-up diet treatments[a]

Item	Diets CONV	HEWDG	HEDDG	SE
Carcass weight, lb	789	796	787	9.1
Quality grade[b]	4.8	4.8	4.9	.06
Yield grade	2.8	2.9	2.9	.09
Livers, %[c]	6	7	2	

[a]Least squares means.
[b]4.0 = Select^{o}, 5.0 = Choice^{o}.
[c]Percentage of abscessed livers.

WHEAT TAILINGS IN FEEDLOT FINISHING DIETS

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Summary

One hundred twenty-eight yearling steers (average initial weight 854 lb) were fed one of four finishing diets containing (dry matter basis) either 1) 83% high moisture corn, 2) 44% high moisture corn and 37% high moisture wheat tailings, 3) 82% high moisture wheat tailings, or 4) 42% high moisture corn and 40% dry wheat tailings. Wheat tailings consisted of small wheat kernels removed during cleaning that had low test weights (41.5 to 52.0 lb/bushel) and high vomitoxin levels (17 to 42 ppm). High moisture wheat tailings were coursely cracked, reconstituted to 29% moisture, and ensiled. Dry wheat tailings were cracked only. Average daily gain declined up to 25% ($P<.01$) with increasing levels of high moisture wheat tailings as a result of a linear decline in dry matter intake ($P<.05$). Feed efficiency tended to worsen ($P<.14$). However, calculated net energy values for high moisture wheat tailings were similar to that of corn. Dry wheat tailings, on the other hand, resulted in similar intake ($P>.20$) but 15% lower average daily gain ($P<.01$) than high moisture wheat tailings fed at a comparable level and net energy values were approximately 75% of corn. Wheat tailings, regardless of form or level, decreased quality grade ($P<.05$) but did not affect dressing percent, yield grade, or liver abscesses ($P>.20$).

Key Words: Wheat Tailings, Finishing Diets, Steers

Introduction

Head blight (scab) is a recurring problem in the Northern Plains. Excessively wet growing conditions promote fungal infection of small grains resulting in shriveled kernels that often contain mycotoxins such as vomitoxin. Infected wheat is usually cleaned, concentrating the shriveled kernels in what are referred to as "tailings." Wheat tailings are characterized by low test weights and variable vomitoxin levels.

Mildly scabbed wheat appears to be utilized efficiently in high concentrate finishing diets. However, the feeding value of more severly affected wheat found in tailings is uncertain and may depend on diet level and processing.

The objectives of this study were to determine the effects of increasing levels of wheat tailings in finishing diets on yearling cattle performance and to compare coarse cracking with reconstitution plus ensiling as methods for processing wheat tailings.

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Materials and Methods

Three loads of wheat tailings were received during the course of the study. Test weights were 43.5, 41.5, and 52.0 lb/bushel, respectively. The wheat tailings were coarsely cracked with some whole kernels still evident after processing. A portion of the wheat tailings were reconstituted with enough water to reduce dry matter content to approximately 70% and stored in a silage bag.

One hundred twenty-eight yearling steers (average initial weight 854 lb) used in a previous growing trial were weighed, reimplanted with Revalor[3] and allotted to pens (8 head per pen, 4 pens per treatment). Experimental treatments consisted of finishing diets containing (dry matter basis) either 1) 83% whole, high moisture corn (HMC), 2) 44% HMC and 37% high moisture wheat tailings (HMWT), 3) 82% HMWT tailings, or 4) 42% HMC and 40% dry wheat tailings (DWT). Finishing diet compositions are shown in Table 1. Dry corn was used in the diets during the final 23 days of the 101-day trial after supplies of high moisture corn were depleted. Four receiving/step-up diets were fed from day 1 through 19. The finishing diets were formulated to contain at least 12% crude protein, .57% Ca, .38% P, and .74% K.

Table 1. Finishing diet compositions (dry matter basis)

	Treatment			
Item	100 HMC —	50 HMC 50 HMWT	— 100 HMWT	50 HMC 50 DWT
High moisture corn	82.71	44.10	—	42.08
High moisture wheat	—	37.45	81.90	—
Dry wheat	—	—	—	40.31
Molasses blend	3.10	3.28	3.49	3.13
Corn stalks	8.23	8.70	9.27	8.30
Soybean meal	2.81	1.53	—	1.46
Ground corn	—	1.69	2.79	1.62
Urea	.80	.43	—	.41
Limestone	1.03	1.43	1.45	1.38
Dicalcium phosphate	.38	.20	—	.19
Potassium chloride	.28	.36	.33	.34
Trace mineral salt	.47	.59	.56	.56
Premix[a]	.19	.24	.21	.21
Dry matter, %	75.95	71.86	67.34	80.91
Crude protein, %	12.03	13.64	15.72	13.84

[a]Provided 28 g of monensin, 8.2 g of tylosin, and 4,500,000 IU of vitamin A per ton of diet dry matter.

Initial and final weights were determined after an overnight shrink off feed and water. Carcass data were collected on a subsample of 12 steers from each treatment. All data were statistically analyzed in a manner appropriate for a completely random design.

Results and Discussion

Performance data are presented in Table 2. Feed dry matter intake was negatively affected by the replacement of corn with HMWT in the finishing diet. The linear decrease in dry matter intake across treatments 1, 2, and 3 was equal to approximately .5 lb for each 10% increase in HMWT content (P<.05). Daily gain declined in a similar manner (P<.01) with steers fed treatment 3 gaining 25% less per day than steers fed treatment 1. Steers fed treatment 2 were intermediate. There was only a tendency for poorer feed efficiency with increasing level of HMWT (P<.14). On the other hand, steers fed treatment 4 had poorer feed efficiency (P<.01) than those fed treatment 2 (HMWT vs. DWT at comparable levels) as a result of similar intakes (P>.20) but 15% lower gains (P<.01).

Table 2. Performance of steers fed finishing diets containing varying levels of dry or high moisture wheat tailings

Item	Treatment				SE
	100 HMC —	50 HMC 50 HMWT	— 100 HMWT	50 HMC 50 DWT	
No. of steers	32	32	32	32	
Initial wt, lb	854	854	854	854	
Final wt, lb	1176[a]	1143[b]	1094[c]	1100	9.9
DM intake, lb/day	22.4[d]	20.8[de]	17.9[f]	20.3[e]	.62
Daily gain, lb	3.19[a]	2.87[b]	2.38[c]	2.43[c]	.098
Feed:gain	7.02[a]	7.23[a]	7.54[ab]	8.34[b]	.254

[a,b,c]P<.01.
[d,e,f]P<.05.

Despite poorer performance, diet net energy values calculated from cattle performance and feed intake data indicated that HMWT contained as much available energy as corn. Decreased performance with increased HMWT was apparently a function of intake and not altered digestion/metabolism. Diet levels of vomitoxin contributed by added wheat tailings in treatments 2, 3, and 4 were 10, 23, and 13 ppm, respectively. Previous work has demonstrated that cattle are less susceptible to vomitoxin than other species, with no effects on feedlot performance being found at concentrations of up to 18 ppm. Much higher levels have been fed experimentally to lactating dairy cows without problem, although only for short periods of time. Other mycotoxins may have been present but were not analyzed. Faster rate of gain at a similar intake for steers fed treatment 2 compared to those fed treatment 4 reflects the benefits of reconstitution compared to coarse cracking alone. Calculated estimates of DWT net energy for maintenance and gain were 74% and 77% of corn, respectively.

A subsample of 12 steers from each treatment were slaughtered approximately 12 hours after being weighed off test (29 hours after removal of feed and water; Table 3). Neither dressing percent, yield grade nor liver score differed between treatments (P>.20). However, quality grade was .3 to .4 units lower (P<.05) for steers fed wheat tailings regardless of level or processing and may be due to the lighter weights at slaughter.

In conclusion, wheat tailings contain available energy comparable to whole corn if adequately processed. However, intake may be reduced, perhaps as a result of mycotoxin contamination, and should be monitored closely when deciding on the appropriate level to feed.

Table 3. Carcass characteristics of steers fed finishing diets containing varying levels of dry or high moisture wheat tailings

Item	Treatment				SE
	100 HMC —	50 HMC 50 HMWT	— 100 HMWT	50 HMC 50 DWT	
Dressing percent	63.2	63.4	62.7	62.8	.40
Quality grade[a]	4.5[c]	4.1[d]	4.1[d]	4.2[d]	.33
Yield grade	2.5	2.6	2.4	2.7	.16
Liver score[b]	.17	0	.08	.17	.13

[a]4.0 = Select^o, 5.0 = Choice^o.
[b]0 = no abscesses, 1 = 1 small abscess, 2 = 2+ small abscesses, 3 = severe abscesses.
[c,d]$P<.05$.

UTILIZING FAT ADDITIONS OF EITHER SOY OIL OR EXTRUDED SOYBEANS TO ADD VALUE TO LIGHT TEST WEIGHT CORN.

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Objective: To improve the feeding value of light test-weight for grow-finish swine by dietary additions of soy oil or extruded soybeans.

Justification: Due to highly variable weather conditions, light test-weight corn has been a common problem throughout the upper Midwest the past few years. Light test-weight corn is typically lower in energy than normal corn and can be severely docked at the elevator. Feeding weather stressed corn to hogs provides an alternate market for the corn producer. However, depending on how light the corn is, pig performance can be reduced. This reduction in performance is attributed to the lower energy content of light test-weight corn. This energy deficit can be alleviated by adding either soy oil or extruded soybeans to the diet, thereby also increasing the value of these two commodities. Therefore, if increasing the energy density of light test-weight corn through soy oil or extruded soybean additions improves pig performance, the soybean, corn and swine industries will all benefit.

Experimental Design: A randomized complete block design with seven treatments and three replicates/treatment were utilized, except for the 60 lb corn treatment (2 replicates/treatment). The seven dietary treatments were as follows:

1. Corn (60 lb/bu) - SBM
2. Corn (36 lb/bu) - SBM
3. Corn (36 lb/bu) - Extruded Soybeans
4. Corn (36 lb/bu) - SBM - Soybean Oil
5. Corn (44 lb/bu blend) - SBM
6. Corn (44 lb/bu blend) - Extruded Soybeans
7. Corn (44 lb/bu blend - SBM - Soybean Oil

Procedure: A total of 100 feeder pigs weighing approximately 40 pounds were allotted to treatment based on initial weight, sex, and ancestry. Pigs were housed five pigs/pen in each of the 20 pens. Pig weights and feed consumption were measured every two weeks. When the average pig weight within a pen reached 110 pounds, pigs were switched by pen from the grower to the finishing diets. Diets were formulated to meet or exceed all the pigs' nutrient requirements (Tables 1 & 2). Pigs were removed from test when average pig weight within a pen averaged 230 pounds, and then ultrasonically scanned for backfat thickness and loin eye area. Orthogonal contrasts used were:

1. 60 lb corn vs all 36 and 44 lb corn diets
2. All 36 lb corn diets vs all 44 lb corn diets
3. 36 & 44 lb corn w/ SBM vs 36 & 44 lb corn w/ extr beans & soy oil
4. 36 & 44 lb corn w/ extr beans vs 36 & 44 lb corn w/ soy oil
5. 36 lb corn w/ oil vs 44 lb corn w/ oil
6. 36 lb corn w/ extruded beans vs 44 lb corn w/ extruded beans

Table 1. Grower Diets Composition.

Ingredient	Trt 1	Trt 2	Trt 3	Trt 4	Trt 5	Trt 6	Trt 7	
Corn (60 lb)	1526.1				453.9	417.8	422.0	
Corn (36 lb)		1526.1	1392.8	1420.0	1072.2	975.0	998.0	
Soybean meal, 44%	420.4	420.4		425.0	420.4		425.0	
Extruded soybeans				554.6			554.6	
Soy Oil					101.0			101.0
Dical Phos	21.3	21.3	20.0	22.5	21.3	20.0	22.5	
Limestone	17.2	17.2	17.6	16.5	17.2	17.6	16.5	
SDSU Premix	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
Salt	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Total	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0	
Calculated %								
Lysine		.80	.80	.80	.80	.80	.80	.80
Calcium		.65	.65	.65	.65	.65	.65	.65
Phosphorus	.55	.55	.55	.54	.55	.55	.55	

Table 2. Finisher Diets Composition.

Ingredient	Trt 1	Trt 2	Trt 3	Trt 4	Trt 5	Trt 6	Trt 7	
Corn (60 lb)	1647.0				489.9	464.7	462.6	
Corn (36 lb)		1647.0	1549.0	1564.0	1157.1	1084.3	1101.4	
Soybean meal, 44%	305.3	305.3		315.0	305.3		315.0	
Extruded soybeans				403.9			403.9	
Soy Oil					73.0			73.0
Dical Phos	18.1	18.1	17.2	19.0	18.1	17.2	19.0	
Limestone	14.6	14.6	14.9	14.0	14.6	14.9	14.0	
SDSU Premix	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
Salt	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Total	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0	2000.0	
Calculated %								
Lysine		.65	.65	.65	.65	.65	.65	.65
Calcium		.55	.55	.55	.55	.55	.55	.55
Phosphorus	.50	.50	.50	.50	.50	.50	.50	

Table 3. Effect of Fat Additions on Feeding Value of Light Test-Weight Corn for Swine.

	Corn (60) SBM	Corn (36) Extr Soy	Corn (36) Oil	Corn (36) SBM	Corn (44) Extr Soy	Corn (44) Oil	Corn (44)
Grower (40-110)							
Daily Gain, lbs[ab]	1.51	1.54	1.55	1.63	1.44	1.52	1.44
Daily Feed, lbs[ac]	3.74	3.99	3.73	3.85	3.86	3.54	3.55
Feed/Gain[d]	2.47	2.60	2.41	2.37	2.69	2.33	2.46
Finisher (110-240)							
Daily Gain, lbs	2.04	1.91	1.84	1.85	1.80	1.88	2.04
Daily Feed, lbs[de]	5.94	7.22	6.36	6.45	7.15	6.31	6.69
Feed/Gain[df]	2.94	3.79	3.45	3.50	3.97	3.36	3.28
Overall (40-240)							
Daily Gain, lbs	1.81	1.75	1.70	1.74	1.65	1.71	1.77
Daily Feed, lbs[d]	5.00	5.87	5.06	5.26	5.74	5.05	5.36
Feed/Gain[df]	2.77	3.35	2.98	3.02	3.48	2.95	3.00
Carcass (240 lbs)							
10th Rib Fat, in.[cg]	.81	.77	.81	.82	.76	.79	.87
Loin Eye Area, in^2	4.92	4.86	4.80	4.71	4.98	4.89	4.69
Percent Lean[dh]	50.3	50.9	49.9	49.4	51.1	50.4	48.9

[a] Three 36 lb vs three 44 lb corn diets (P<.03).
[b] 36 lb corn w/ oil vs 44 lb corn w/ oil (P<.01).
[c] 36 & 44 lb corn w/ SBM vs 36 & 44 w/ oil or extruded beans (P<.02).
[d] 36 & 44 lb corn w/ SBM vs 36 & 44 w/ oil or extruded beans (P<.01).
[e] 60 lb corn vs all 36 & 44 lb corn diets (P<.06).
[f] 60 lb corn vs all 36 & 44 lb corn diets (P<.01).
[g] 36 & 44 lb corn w/ extruded beans vs 36 & 44 lb corn w/ soy oil (P<.08).
[h] 36 & 44 lb corn w/ extruded beans vs 36 & 44 lb corn w/ soy oil (P<.03).

Results and Discussion: Performance results are shown in Table 3. During the grower phase (40-110 lbs), there was no difference between performance of pigs receiving 60 lb corn and pigs receiving any of the other diets. However, fat additions of either extruded soybeans or soy oil reduced feed intake and improved feed efficiency of animals consuming the 36 and 44 lb corn diets. It appears that the added energy from extruded beans or soy oil is responsible for this effect. No explanation is offered why pigs fed 36 lb corn with soy oil gained faster than pigs fed 44 lb corn with soy oil. Due to that response, pigs fed 36 lb corn gained faster and consumed more feed than pigs receiving 44 lb corn diets.

Daily gain in the finisher period (110-240 lbs) was not affected by treatment. However, feed consumption was less and feed efficiency was improved for pigs consuming 60 lb corn versus all the 36 and 44 lb corn diets. While not to the level of the 60 lb corn diet, fat additions of either extruded beans or soy oil did improve efficiency and reduce feed intake of pigs fed either 36 or 44 lb corn diets. As was observed in the grower phase, the added energy was able to partially compensate for the lower energy levels of the 36 and 44 lb corn diets.

Gains for the entire period (40-240 lbs) were unaffected by treatment. Due to the response of added fat in the grower and finisher phases, fat additions of either extruded soybeans or soy oil reduced feed intake and improved feed efficiency of pigs fed 36 or 44 lb corn. However, the best feed efficiency was observed for pigs consuming the 60 lb corn diets versus all the other diets.

While loin eye area was not affected by treatment, there was a fat response in backfat thickness and percent lean in the 36 and 44 lb corn diets. While backfat thickness and percent lean were less desirable when the diet was supplemented with fat, it should be kept in mind that the values are similar to that of pigs fed 60 lb corn. In fact, the response is more probably due to the low energy diets (36 & 44 lb corn diets without fat) reducing fat thickness and increasing percent lean than fat additions hurting those parameters. Interestingly, fat thickness and percent lean were more desirable for pigs fed extruded soybeans than those receiving soy oil supplemented diets.

From this study it appears that light weight corn can be fed to grow-finish pigs without affecting gains. While feed intake and feed efficiency were negatively affected by corn test weight, fat additions of either extruded soybeans or soy oil did alleviate most of the response. With the abundance of light corn and frost damaged soybeans, the combination of these can result in a very effective method to add value to these crops. However, the decision needs to be made on an economical basis.