28th Annual

SOUTHEAST SOUTH DAKOTA
EXPERIMENT FARM

BERESFORD

PROGRESS REPORT 1988

Agricultural Experiment Station
South Dakota State University
Brookings

This twenty-eighth 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.

South Dakota Agricultural Experiment Station
Brookings, South Dakota 57007

Dr. David Bryant, Dean   Dr. R. A. Moore, Director

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INTRODUCTION . . . . .Dale R. Sorensen, Mgr.

The Southeast Research Farm, located six miles west and three miles south of Beresford is open to the public year around. There is staff at the research farm each weekday that would be glad to show you around, or feel free to look around on your own anytime. If you want to drive through on a weekend on your own, feel free to do so, or give us a call (563-2989) and we could arrange to meet you on a weekend to show you around at the farm. The farm is here for your use and to be used at any time.

What can I say about 1988 that hasn't been said on the news, at meetings, tours, and so on. It was quite unusual in that it was a very dry year, but at the time that we are preparing this report, we are approximately 4.5 inches below normal for precipitation in mid-December. Everyone may find that hard to believe, but August and September rainfall made up for some of the shortage in June and July. The shortage of moisture was not as detrimental this year as the extreme heat was during June. But really, that is enough about the past, and we are looking optimistically forward to the next crop season.

The year at the research farm was again quite busy with many little projects going on around the farm and activities during the year. The year started off with a booth at the Dakota Farm Show in Vermillion. We visited with many folks from South Dakota, Iowa and Nebraska. In late March, the District FFA Livestock Judging Contest was held at the farm with several schools from southeast South Dakota being represented. In mid-June, a 4-H livestock Judging School was held here with a large number of students ranging in all ages from the area.

At the end of June a tour was held for Ag Chemical Dealers and representatives around the area and the following day was the annual twilight tour. This year, we had a big program and the turnout of 400 people for the evening was greater than we could have expected. The rest of the year saw several small tour groups coming to the farm during the growing season and our Fall field day in September. Attendance was down for the fall field day, but that was not surprising because many people were already involved in harvest at that time.

The research conducted each year and included in this report consists of many hours of work year around by staff from the main campus at SDSU and at the SE Research Farm. The efforts of everyone involved each year are greatly appreciated. Also, if anyone has comments or suggestions pertaining to our research, how we disseminate the information, schedule and run field day and tours, or any other matter, we would be glad to hear from you. Address correspondence to:

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Table 1. Temperatures at the Southeast Research Farm - 1988

Month	1988 Ave Temperatures (F)[a] Maximum	1988 Ave Temperatures (F)[a] Minimum	36-year Average Maximum	36-year Average Minimum	Departure From 36 Year Average Maximum	Departure From 36 Year Average Minimum
January	21.4	0.0	25.6	4.3	- 4.2	- 4.3
February	25.5	4.2	32.4	10.2	- 6.9	- 6.0
March	48.8	25.6	43.6	22.6	+ 5.2	+ 3.0
April	59.8	30.0	61.1	35.5	- 1.3	- 5.5
May	79.3	52.6	73.3	47.5	+ 6.0	+ 5.1
June	89.7	63.1	82.5	57.2	+ 7.2	+ 5.9
July	87.0	62.5	87.4	62.0	- 0.4	+ 0.5
August	87.8	61.5	85.2	59.2	+ 2.6	+ 2.3
September	77.1	50.1	75.6	48.8	+ 1.5	+ 1.3
October	58.8	32.4	64.3	37.6	- 5.5	- 5.2
November	46.0	25.6	40.5	24.2	+ 5.5	+ 1.4
December	35.8	15.6	31.0	10.8	+ 4.8	+ 4.8

[a] Computed from daily observations

Table 2. Precipitation at the Southeast Research Farm - 1988

Month	Precipitation 1988 (inches)	36-year Average (inches)	Departure from 36 year Ave. (inches)
January	.95	.48	+ .47
February	.30	.96	- .66
March	.52	1.51	- .99
April	2.58	2.48	+ .10
May	2.04	3.43	-1.39
June	1.45	4.13	-2.68
July	.83	3.10	-2.27
August	5.24	2.98	+2.26
September	4.15	2.65	+1.50
October	.28	1.63	-1.35
November	1.68	1.10	+.58
December	.14	.70	-.56
Totals	20.16	25.15	-4.99

DATE OF PLANTING FOR CORN

Southeast Farm Staff

Southeast Farm 88-1

Summary

Two corn hybrids (medium and late maturity range) were planted on five dates beginning on April 15 and ending May 25. Unlike past years, yield differences between planting dates in 1988 were not significantly different. The data seems to show that for either corn hybrid planted during the last week of April, yields were hurt more by the warm and dry weather in June than the other planting dates. Planting before or after April 25 showed slightly better yields for both corn hybrids, but not large enough differences to be significantly different.

Methods: Two hybrids were tested at five different planting dates in 1988. Pioneer 3732 and Pioneer 3377 were planted on five dates through April and May. Planting was started when field conditions would allow and soil temperatures were adequate for germination of corn. A ten day interval was followed from the first planting date. Table 1 reports all other management factors for the experiment in 1987.

Table 1. Crop Management for Planting Date Study in 1988.

1987 Crop	Soybeans
Tillage	Ridge-Till
Planting Rate	24,100
Herbicide	Lasso Band
Phosphorus	25# P205 2 x 2 starter
Nitrogen	75# sidedress after emergence 75# at lay-by
Harvest	September 2 and September 22

Results and Discussion: The weather in early 1988 again made it possible to start field work early in 1988. Conditions were quite good for the first planting date of April 15. The soil temperatures, at 2 inches on the first planting date, were daytime highs above 50 degrees F and lows were not falling below 40 degrees F. Unlike 1987, these were the first days that soil temperatures at the 2" soil depth had risen above 50 degrees F. On April 22 and 23 a small amount of snow fell, and the second planting date was the 25th of April. On April 26, we received a heavy wet snow just prior to emergence of the first planting date. Stands were not reduced by the poor weather just before emergence of the first planting date. Table 2 reports yields for the 1988 growing season.

Table 2. Effect of Planting Date on Corn Grain Yield, SE Farm, 1988 1988.

Hybrid	Relative Maturity	Planting Date April 15	April 25	May 5	May 15	May 25
		- - - - - - bu/A @ 15% Moisture*				- - - -
PIO 3732	101	60	50	55	57	51
PIO 3377	116	52	45	50	55	32

* LSD .05 = NS

Comparing yields from 1988 to any one of the last three years of this study, indicates the limits the dry weather set on yield potentials. The heat units were there to grow a crop similar to 1987, but moisture was extremely limiting.

The data indicates that the weather had the largest effect on all the planting dates, but differences were not large enough to be significantly different. The earlier hybrid, for the first time, exhibited slightly higher yield levels than the late maturing hybrid for the first time across all planting dates in 1988.

Table 3 reports average yields and the average planting date for 1986 through 1988. One point to make is this is only three years' data. The first two years (1986 and 1987) were two above average corn crops and 1988 was below average. But, the data will begin to show trends that may hold up over the years. For the early hybrid, the range of planting dates is wider than for the late hybrid. The first and third planting dates are significantly different from the final date in May. The trend for the late hybrid is fairly consistent from year to year. The first planting date is significantly different from the fourth and fifth planting dates, and the second, third and fourth planting dates are significantly different from the last planting date. The differences between the May 4th and May 14th planting dates of 16 bushels is not significant, but individual years have shown us that normally this is the breaking point for this late of a hybrid. Grain moisture also goes up considerably, which is also an indicator. Most years we will see a yield decrease for a late hybrid like this when planting gets to be into the middle of May.

Table 3. Three Year Average for Planting Date Study, SE Farm, 1986-1988.

Hybrid	Relative Maturity	Average Planting Date Apr 14	Apr 24	May 4	May 14	May 24
		- - - - - bu/A @ 15%*				- - - -
Pioneer 3732	101	121	116	123	110	101
Pioneer 3377	116	143	140	139	123	94

* LSD (.05) = 20 bu/acre for differences between planting dates within a hybrid.

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PLANT POPULATIONS FOR CORN

Southeast Farm Staff

Southeast Farm 88-2

Summary

Seeding rates and hybrids were tested to determine what the optimum plant population for different corn maturity ranges would be for southeast South Dakota. Four hybrids were tested at five different seeding rates. Grain yields in 1988 were considerably lower than the past few years. Due to the drought, yields were more variable than in past years as well, making comparisons between treatments more difficult. In general, populations did not have as large an effect as would be expected for the type of growing conditions encountered in 1988.

Methods: Four hybrids were tested at five plant populations in 1988. These are the same hybrids and populations that were used for the past two years. The hybrids were Pioneer 3906 and 3732, and Curry's 1466 and 1490 with actual seeding rates of 18400, 21900, 24500, 27900 and 30200 seeds per acre. Table 1 reports all other management factors for the experiment in 1988.

Table 1. Crop Management for Plant Population Study in 1988.

1987 Crop	Corn
Tillage	Ridge-till
Planting Date	April 29
Herbicide	Lasso (Band)
Insecticide	Counter 15G
Phosphorus	25# 2 x 2 starter
Nitrogen	75# sidedress after emergence 75# sidedress at lay-by
Harvest Date	September 2 & September 22

Results and Discussion: Yield levels for 1988 were approximately one-half of yield levels in 1986, but the yields are better than what we anticipated during late June and early July. If the weather in late June would have continued into all of July, yield levels would have been decreased much lower than this. These yields were decreased to some extent because of the experiment being continuous corn rather than being rotated after soybeans. Again, as in 1987, the experiment was conducted with ridge-till methods which may also have contributed to yields not being reduced as much as would be expected. Table 2 reports yields for the population study in 1988.

Table 2. Grain Yields for Plant Population Study, SE Farm, 1988.

Hybrid	S. Dak Maturity	Seeding Rate 18,400	21,900	24,500	27,900	30,200
		- - - - bu/A @ 15% Moisture * - - - -				
PIO 3906	91	72	51	62	70	53
PIO 3732	101	71	70	61	44	49
CURRY 1466	110	61	59	54	62	54
CURRY 1490	114	66	47	42	45	48

* LSD .05 = 20 bu/A to compare yields between populations within the same hybrid.

Due to the dry conditions in 1988, most experiments on the farm had a larger degree of variability than in the past few years. This can be seen in the large LSD value at the bottom of Table 2. The 20 bushel/ acre value is the number we use to compare the yields between populations for each individual hybrid. With that number being so large this year, it implies that we had a fair amount of variability making it much more difficult to make comparisons. For the earliest hybrid (3906), there is a yield decrease when increasing the population from 18000 to 21000 plants per acre; but this does not continue throughout the populations. The three remaining populations were not significantly different from the lowest population of 18000. This makes it real hard to determine if there are any true differences, or if differences are just random variability.

For the next hybrid (3732), the yield differences make a little more sense and more like we would expect for this type of year. There is no difference between the first two populations, a slight decline in yield for the third population, but not significant, and a significantly lower yield for the two highest populations when compared to either of the two lower populations. The past two years have shown for this particular hybrid that the third population (24500) has optimized yields, with no significant yield increase at populations higher than this population (24500), but being significantly higher than the lower population.

The third hybrid (1466), did also react similar to past years, but not at the same yield levels. No significant yield differences were observed this year across any of the populations as was observed in past years. With a later maturing hybrid like this, you would expect to see a yield decrease with increasing population. This did not appear in 1988 and has not been observed in other years either, nor did an increase in population increase yields in past years when growing conditions were more ideal.

The latest maturing hybrid in this study (1490), did react like we would somewhat expect for this type of growing season. At 18000 plants per acre the grain yield was 66 bu/acre with a significant decrease in yield occurring at the third population of 24500 plants/acre. The second population did decrease yields, but not significantly, indicating that increasing population for this hybrid was going to hurt yields in 1988. The limitations on size of this experiment does not allow us to have more treatments, so it is hard to determine if a lower population for this hybrid would have been slightly higher yielding or not.

Table 3 reports yield averages for the past three years for these four hybrids and five populations.

Table 3. Three-year Average Grain Yields for Plant Populations Study, SE Farm, 1988.

Hybrid	Seeding Rate 18,400	21,900	24.500	27,900	30,200
	- - - - - bu/A @ 15% Moisture* - - - -				
Pioneer 3906	114	113	118	128	122
Pioneer 3732	122	123	122	122	125
Curry 1466	130	125	133	127	137
Curry 1490	149	136	135	130	120

* LSD .05 = 16 bu/A to compare yields between populations within the same hybrid.

Statistical analysis of the data to this point shows no significant yield differences except for the latest hybrid (Curry 1490). The two highest populations are significantly different from the lowest population. The second population (21400) is also significantly different from the highest population (30200).

This data is still not conclusive because it is only a three year average. There was a significant response to hybrids in this experiment, as can be seen when looking at the first column in the table. At 18000 plants per acre there is a substantial yield increase as the maturity range becomes later. This would be expected when all these hybrids are planted on the same day and early in the growing season. If planting was delayed later in the growing season, the late maturing hybrid would probably not yield as well. Another factor to take into consideration is that with the later maturing hybrids grain moisture will almost always tend to be higher in normal growing conditions. The past two years this has not been a problem, but that can change again quickly and turn out to be more like 1985 when we had a cooler growing season and the late maturing hybrids barely reached physiological maturity and grain with high moisture contents was a big problem at harvest.

For more information contact: Dale Sorensen, Research Manager, Southeast Research Farm, RR 3 Box 93, Beresford, SD 57004 (605) 563-2989.

DATE OF PLANTING SOYBEANS

Southeast Farm Staff

Southeast Farm 88-3

Summary

Soybean yields were greatly affected by the weather conditions of 1988. Unlike 1986 and 1987 in almost all aspects, this year yield results were opposite of the past years' results. Yields in 1986 were highest with the earliest planting date, while 1987 displayed no real yield differences between planting dates. Delaying planting in 1988 created much larger increases in soybean yields than would be expected.

Methods: This is the third year of a long term study in looking at the effect planting date has on soybean yields in southeastern South Dakota. The study consists of two soybean varieties, (Corsoy 79 and Century 84) at five different planting dates, each being ten days apart. As in the past, the first planting date is slightly earlier than normal with the second date at about the normal planting date, and on through to June. Table 1 reports all management practices for the soybean study in 1988.

Table 1. Management Practices for Date of Planting Soybeans SE Farm, 1988.

Tillage	Fall Plow
Past Crop	Corn
Herbicide	Treflan + Sencor/Lexone PPI
Seeding Rate	60 lb/acre
Harvest Date	Sept 9, Sept 21, Oct 6

Harvest was over a much longer period of time in 1988. On studies such as these, timeliness of harvest is a very important factor. If harvest was held up for every treatment to reach maturity we may bias the research one way or the other due to shattering, too low moisture, etc. This is why there was three separate harvest dates for this particular study. On September 9, the May 4th planting date of Corsoy 79 was harvested. The final four planting dates of Corsoy 79 were harvested on September 21st, as well as the first planting date of Century 84. On October 6th, the remaining four planting dates of Century 84 were harvested.

Results and Discussion: Soybean yields for 1988 were better than anticipated and planting date effects were quite surprising. Table 2 reports soybean yields and how they were affected by planting date in 1988.

Table 2. Planting Date Effects on September Yields in Southeast South Dakota, SE Farm, 1988.

Variety	Planting Date				
	May 4	May 14	May 24	June 3	June 13
	---- bu/A @ 13% Moisture* --------				
Corsoy 79	23	27	30	31	32
Century 84	28	25	28	31	24

LSD (.05) = 4 bu/acre for differences between planting dates within a variety.

For the 1986 growing season, yields were significantly increased by earlier planting. The longer growing season of 1987 created conditions which showed little differences between planting dates for planting soybeans except for the May 29th planting date for Century 84 which was significantly lower. The 1988 growing season produced the opposite results from those of 1986. Yields gradually increased as planting date was delayed for both varieties in 1988, except the June 13th planting date for Century 84. This is not surprising because Century 84 is a late Group II soybean. What was surprising was that the June 3rd planting date maximized the yield level for this variety as well as Corsoy 79.

Weather had the greatest affect on early planted soybeans in 1988 when looking at the yield results. Also, when comparing between the two varieties notice the yield difference on the first planting date (23 bu/acre compared to 28 bu/acre). The heat of June along with the dry conditions into July, did not have as large an effect on the Century 84 soybeans as compared to Corsoy 79. But, as the planting date was delayed for Corsoy 79 yield levels began increasing when compared to the first date, delaying development of the crop to more ideal conditions in August when the heat subsided and rainfall was received.

This study will be continued for several more years because of only three years of data, and varying results each year. One thing that we can learn from a year like 1988, is not to put all your eggs into one basket. The risk of crop failure can be managed to a certain degree. The selection of soybeans with varying maturity groups and planting over a time period are just a couple of ways to manage that risk. The selection of various good, solid performing varieties is a much better way to manage crop risk than to go with that one hot, new variety that may or may not work for you with your management practices.

For more information contact: Dale Sorensen, Southeast Research Farm, RR 3 Box 93, Beresford, SD 57004 (605) 563-2989.

S.E. FARM REPORT

SOYBEAN VARIETY ROW SPACING

Southeast Farm Staff

SOUTHEAST FARM 88-4

SUMMARY

Yield results for the soybean variety and row-spacing study were at lower levels than past years. Again, the weather had a great deal to do with results of the study. Because of variability across the research site, some yield differences were evident, but the variability was too large to determine if these differences were due to row-spacing, or if other factors were involved.

Methods: In 1988, the soybean variety and row spacing study was conducted off the research farm in a neighboring field. Plots were larger than normal, (25 ft x 200 ft). Soil test levels were adequate and an application of phosphorus and potassium had been incorporated with chisel plowing in the fall of 1987. The past crop in 1987 was sweet clover, and which we thought had been a good stand. After seeing the data and plots there must have been some differences in sweet clover growth because soybean yields were highly variable in 1988 and the soil in the experimental area was quite uniform.

The experiment was planted on May 12 and harvested on September 21. Treflan + Sencor/Lexone ppi was applied in April.

Results and Discussion: Results for 1988 are inconclusive and could have been affected for reasons discussed in the method. These yield results are reported in Table 1.

Table 1. Soybean Yields for Variety and Row Spacing Study, SE Farm. 1988.

Variety	Row-Spacing		
	15" Skip-Row	30" Rows	36" Rows
	----------bu/A @ 13% Moisture*----------		
Corsoy 79	23.5	20.1	25.2
Wells II	23.3	22.1**	28.0

* LSD (.05) = Not significant
** One missing plot

Over the past several years, the data has shown a definite increase in soybean yields with a decrease in row-spacing for these varieties. This year's results are quite different in that the widest row-spacing (36") tended to yield slightly higher than either the 30 inch rows or 15" skip-rows. Again, as mentioned earlier, there was a high level of variability and the yield differences are not large enough to be significantly different.

In theory, it may be possible that wider rows could yield better when the weather was this dry because of less plants per acre compared to the narrower row spacings. One of the advantages that has been stated of narrow row soybeans is that the rows cover earlier, keeping soil moisture from evaporating as easily, compared to wide rows. In 1988 this was not that critical because most of the high moisture use occurred during June when none of the soybean canopies had covered the soil surface.

For further information contact: Dale Sorensen, Research Manager, Southeast Research Farm, RR 3 Box 93, Beresford, SD 57004 (605) 563-2989.

S.E. FARM REPORT

SOYBEAN POPULATION STUDY

Southeast Farm Staff

Southeast Farm 88-5

SUMMARY

A soybean population study was initiated in 1988 to examine the effect seeding rate has on final stands and yields for soybeans. In 1988, there was no crusting problem after planting, so the main factor examined was the effect on yield. There was no significant yield differences occurring in 1988 when looking at seeding rates of 119,700 to 208,050 seeds/acre (40 to 70 lb/acre).

Methods: Many questions have been asked recently on the proper seeding rate for soybeans in this area. In 1988 a study was established to look at seeding rates for soybeans and to see how these rates handle adverse weather conditions prior to emergence. Corsoy 79 was selected as the variety to be used with seeding rates of 119,700, 148,200, 176,700 and 208,050 seeds per acre, which are the equivalent of 40, 50, 60 and 70 lbs/acre of seed, respectively. This is using seed that is the equivalent of 3000 seeds/pound which was the size for this particular lot of seed in 1988. The plots were all seeded at their respective seeding rates that the planter would give. If the weather was wet and caused the soil to crust, we could therefore determine how each seeding rate performed under these conditions as well. Table 1 reports all other management practices involved in the study.

Table 1. Management Practices for Soybean Population Study, SE Farm, 1988.

Tillage	Fall Plow
Past Crop	Small Grain
Herbicide	Treflan + Sencor/Lexone PPI
Variety	Corsoy 79
Planting Date	May 18
Row Spacing	30 inch
Harvest Date	September 9

Results and Discussion: This is the first year of this study and with the long dry spring there was no problem with emergence after planting. Crusting of the soil surface after a hard rain can be a problem some years, but not the last couple of years. Depending on the soybean variety and its growth characteristics, it may be possible that seeding rates could be lowered a small amount. But, if weather conditions created a thick crust would the lower seeding rate have enough seeds per foot to push through a crust, or would the higher seeding rates be required to make it through a crust. Table 2 reports final counts on a per acre basis for 1988 stands.

Table 2. Stand Counts for Soybean Population Study, SE Farm, 1988.

Seeding Rate lb/A	Seed/ Acre	Seed/ Foot[1]		Final Stand Plants/Acre	Plants/Foot
40	119,700	6-7	*	91,258	5.4
50	148,200	8-9	*	117,830	6.9
60	176,700	10-11	*	141,604	8.3
70	208,050	12-13	*	160,518	9.4

[1] 30 inch row

Table 2 is also broken into seeds per foot and final plants per foot for comparisons. With the type of planter we use at the farm, the stands turned out just ideally for this study.

Table 3 reports yields for the study in 1988. There were no yield differences in 1988 due to seeding rate and final populations.

Table 3. Soybean Yields for Soybean Population Study SE Farm. 1988.

Seeding Rate lb/Acre	Yield bu/Acre @ 13%
40	27
50	27
60	26
70	27

The 60 lb/acre seeding rate was one bushel less than the other three seeding rates and is not significant, but just random variability.

This study should not lead anyone to believe that they could plant less beans and work out. This is only one year and the weather after planting could have a lot to do with the outcome of the results each year. Also, the characteristics of the soybean you grow can also have a great deal to do with the seeding rate. Some soybeans will make up for a shortage of plants by branching to fill in where others do not have that growth characteristic and without enough plants, may not reach their full yield potential.

For more information contact: Dale R. Sorensen, Research Manager, Southeast Research Farm, RR 3 Box 93, Beresford, SD 57004 (605) 563-2989.

INFLUENCE OF POTASSIUM, SULFUR, ZINC AND LIME ON CORN

Jim Gerwing, Ron Gelderman, Dale Sorensen

Plant Science 88-6

INTRODUCTION

Some farmers in South Dakota are using potassium, sulfur, zinc and lime on soils which have a high soil test for these nutrients. The SDSU soil testing lab would not predict an economical response when soil test levels are high. Soil testing lab comparison studies were conducted each year for seven years at the SE Farm near Beresford and at Brookings have shown that applying a combination of these nutrients as a group was not giving an economical response on corn. Each individual nutrient alone, however, was not compared to a check plot. In 1987, a demonstration was implemented at the Southeast Farm near Beresford, South Dakota to show the effect of each of these commonly used nutrients on a high fertility soil. No corn yield increases due to the use of potassium, sulfur, zinc or lime were noted. In 1988, this demonstration was moved to another location at the farm where the treatments will be followed for several years in a corn-soybean rotation.

MATERIALS AND METHODS

The demonstration was established on the SE Farm just west of the weather station. Soil type at the site is an Egan silty clay loam. Egan soils are well drained soils formed in silty drift over glacial till.

Soil samples were taken to a depth of two feet in the spring of 1988. Samples were divided into 0-6 and 6-24 inch depths. The SDSU soil testing lab did regular and micronutrient analysis on the samples. Test results are reported in Table 1. Potassium and sulfur soil tests are considered adequate for crop growth and zinc is considered marginal to high. The pH is considered marginal here. A response to lime could be possible.

Table 1. Soil Test Levels 1988 Potassium, Sulfur, Zinc and Lime Demonstration, SE Farm

Depth	Regular Soil Tests					
	NO_3-N	P	K	OM	pH	salts
inches	----- lb/A ------			%		mmho/cm
0-6	18	32	580	3.7	5.7	0.3
6-12	19	16	450	3.0	6.0	0.3
12-24	27	8	430	1.5	7.1	0.4

Depth	Other Soil Tests						
	S	Zn	Fe	Mn	Cu	Ca	Mg
inches	lb/A	------------------ PPM ------------------					
0-6	38	.88	43	31	1.8	2858	646
6-12	38	.49	40	30	1.9	3192	758
12-24	64	.16	29	21	2.1	5494	918

The site had been in soybeans in 1987 (25 bu/A yield) and had been chisel plowed in fall. Secondary tillage (field cultivation) was done in spring immediately following broadcast application by hand of the fertilizer and lime treatments on May 2nd. Fertilizer and lime treatments are given in Table 2. All treatments received 8 lbs N and 25 lbs P_2O_5 per acre as a starter applied with the planter 2 inches beside and below the seed. Treatment 1 received no other fertilizer. Treatments 2-7 received an additional 115 lbs N/A. In addition to the N and P, treatments 3-6 received either 50 lbs K_2O, 25 lbs sulfur, 5 lbs zinc or 4000 lbs effective calcium carbonate equivalent as lime from the Sioux Falls water treatment plant. The experimental design was a randomized complete block with 4 replications. Plot size was 15' by 50'.

Table 2. Fertilizer Treatments 1988 Potassium, Sulfur, Zinc and Lime Demonstration, SE Farm

Treat. No.	N	P_2O_5	K_2O	S	Zn	Lime
	------------------------ lb/A ------------------------					
1	8	25	0	0	0	0
2	123	25	0	0	0	0
3	123	25	50	0	0	0
4	123	25	0	25	0	0
5	123	25	0	0	5	0
6	123	25	0	0	0	4000

Pioneer 3475 was planted on May 2 at 24,100 seeds per acre. The herbicides and insecticides used were Lasso banded and 2,4-D at brown silk and Counter 15G. The plots were cultivated twice and combine harvested on September 6.

RESULTS AND DISCUSSION

Corn grain yields are listed in Table 3. Extremely hot, dry conditions severely limited yields. None of the fertilizer materials, including nitrogen, had a significant effect on yield. Soil test levels for nitrogen were low and a response would have been likely if conditions would have allowed higher yields. The zinc soil test was .88 PPM. A recommendation by SOSU soil testing lab for 5 lbs zinc is made for corn if the soil test is less than 1.0 ppm. The response to zinc in the medium soil test range (.5 to 1.0 ppm) is not certain, however, and in this situation with extremely limited yield, it did not result in a yield increase. Potassium and sulfur soil tests were high enough where a yield increase to these nutrients was not expected.

This was a very difficult year to evaluate nutrient responses because of very low yields. Crop response to nutrients is partially dependent on environmental conditions, therefore these plots will be continued for several years. Hopefully moisture conditions will improve so we have a better test of crop response to these nutrients and lime at the SE Farm. The plots will be rotated to soybeans next year.

Table 3. Corn Grain Yields 1988 Potassium, Sulfur, Zinc and Lime Demonstration, SE Farm

Fertilizer Treatment lb/A	Grain Yield Bu/A
8N, 25 P_2O_5	11
123N, 25 P_2O_5	12
123N, 25 P_2O_5, 50 K_2O	9
123N, 25 P_2O_5, 25 S	12
123N, 25 P_2O_5, 5 Zn	11
123N, 25 P_2O_5, 4000 Lime	12

Significance: probability of > F=0.20

NITROGEN MANAGEMENT DEMONSTRATION

Jim Gerwing, Ron Gelderman, Dale Sorensen

Plant Science 88-7

Introduction

There is increasing concern about the effects of nitrogen fertilizer on the environment, especially groundwater quality. This concern has been intensified by more numerous 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 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 and timing on nitrogen movement below the root zone. In most situations in South Dakota, if nitrogen moves below the root zone it stays there and only rarely moves back up. Therefore, once out of reach of crop roots it has the potential to move down to the groundwater with percolating water during periods of high moisture.

Materials and Methods

The nitrogen management demonstration was established on the SE South Dakota Experiment Farm near Beresford. It is located on an Egan silty clay loam just west of the farm's weather station. Egan soils are well drained soils formed in silty drift over glacial till.

The previous crop at the site was soybeans which yielded 25 bushels per acre. The soybean stubble was chisel plowed in the fall. Soil samples were taken at the site to a depth of 8 feet in the spring of 1988 and analyzed by the South Dakota State University soil testing lab in Brookings (Table 1). Spring tillage consisted of a field cultivation immediately following broadcast application of the spring nitrogen fertilizer treatments.

Table 1. Soil Test Levels Spring, 1988 Nitrogen Demonstration. SE Farm

Depth	NO_3-N	P	K	OM	pH	salts
feet	----- lb/A		-----	%		mmho/cm
0 - .5	21	30	540	3.4	5.9	0.4
.5 - 1	21	18	410	2.9	6.2	0.4
1 - 2	24	6	380	1.6	7.1	0.5
2 - 3	12					
3 - 4	9					
4 - 5	7					
5 - 6	10					
6 - 7	11					
7 - 8	14					

Nitrogen fertilizer treatments are listed in Table 2. All plots received 8 lbs N and 25 lbs P_2O_5 as starter 2 inches from the seed at planting. The recommended nitrogen rate for a 140 bushel corn yield goal using the 2 foot deep nitrate test and 25 lbs N credit for the soybeans was 123 lbs. All nitrogen applications were broadcast by hand prior to planting and incorporated with one pass of a field cultivator except for the Split treatment. In this treatment, 30 lbs N was applied prior to planting and 93 lbs N applied at sidedress time (June 3) and incorporated by cultivation. Because the study was started in spring, the fall treatment (4) was applied in spring. In future years, the study will include a fall N treatment for comparison to spring N applications. Except for the 8 lbs liquid N applied as a starter, all nitrogen was broadcast by hand as dry urea.

Table 2. Nitrogen Fertilizer Treatment 1988 Nitrogen Demonstration. SE Farm

Treat. No.	Spring[1/]	Split[2/]	Fall	
	------	Time of Application	------	
	---------------	lbN/A	-----------	
1	8	---	---	
2	123	---	---	
3	30	93	---	
4	123 3/	---	---	3/
5	200	---	---	
6	400	---	---	

1/ prior to planting (May 2)
2/ June 3
3/ Treatment will be applied in fall in future years.

Pioneer Hybrid 3475 was planted on May 2 at 24,100 seeds per acre. Herbicides and insecticides used were Lasso banded at planting, 2,4-D at brown silk and Counter 15G. The plots were cultivated twice and combine harvested on September 6. Soils were sampled to a depth of 4 feet on September 12 and analyzed for nitrate nitrogen at the SDSU soil testing lab.

Results and Discussion

Corn grain yields are listed in Table 3. Yields were limited by extremely hot, dry weather. There were no significant differences in yield, due to either nitrogen rate or timing. Hopefully in future years of this demonstration, weather conditions will improve so there will be a larger nitrogen demand by crops, which is necessary to determine which application times will result in more efficient nitrogen fertilizer use.

Table 3. Corn Grain Yields 1988
Nitrogen Demonstration, SE Farm

Treatment lbN/A	Timing	Corn Yield bu/A
8	(check)	16
123	spring	18
123	split	18
200	spring	21
400	spring	17

Significance: probability of > F=0.20

Fall nitrate soil test levels to a depth of 4 feet are presented in Table 4. As nitrogen fertilizer rate increased from 8 lb to 400 lb/A, total nitrate in the 4 foot soil profile increased from 66 lb to 274 lb/A. Most of the residual nitrate measured, however, was in the top 6 inches of soil with only very small increases in the 2 to 4 foot soil depth. This indicates nitrate nitrogen movement below the root zone was not a problem this year. This confirms what has been noted in South Dakota in past years; when conditions are dry, nitrogen leaching is not a problem. In years with more precipitation, however, more leaching would be expected.

This demonstration will be continued over the next several years to watch nitrogen movement in soils, during years with larger amount of precipitation. It will be these types of years where nitrogen management (timing and rates) will have an influence on how much nitrogen moves through the soil.

Table 4. NO_3-N Soil Test Levels Fall 1/ 1988
Nitrogen Demonstration, SE Farm

Depth	Fertilizer N applied - lb/A			
	8	123	200	400
inches	Soil NO_3-N, lb/A			
0-6	19	47	63	153
6-12	6	14	32	35
12-24	9	17	23	29
24-36	14	21	22	25
36-48	18	27	27	32
Total	66	126	167	274

1/ Sampled September 12

FALL VERSUS SPRING NITROGEN APPLICATION ON CORN

Jim Gerwing, Ron Gelderman, Dale Sorensen

Plant Science 88-8

S.E. FARM REPORT

Introduction

Most nitrogen fertilizer used on corn in South Dakota is applied in spring. There are some advantages, however, to fall nitrogen applications. Some of these are: 1) lower N prices 2) more time for both farmers and fertilizer dealers to do a good job soil sampling and spreading fertilizer and 3) less compaction due to dryer soils in fall. One concern that many farmers have is that fall applied N will be lost, especially by leaching, before the next years crop resulting in lower crop yields. This demonstration was established in the fall of 1987 to look at the difference in corn response to nitrogen applied in fall versus spring.

Material and Methods

The demonstration was established on the SE South Dakota Experiment Farm near Beresford in the fall of 1987. The soil type at the site was a Whitewood silty clay loam. Soil samples were taken in the fall to a depth of 2 feet. The results of soil tests are given in Table 1. The 2 foot nitrate test was 33 lbs/A. The 1987 crop at the site was soybeans which yielded 25 bushels per acre. The soybean stubble was chiseled on October 28. Fall N applications were spread on the surface on November 4 and incorporated by disking on November 5. Spring nitrogen treatments were broadcast on May 2 and immediately incorporated with a field cultivator. Urea was the nitrogen source for both spring and fall applications. Nitrogen rates for both times of application were 0, 40, 80, and 120 lb nitrogen per acre. All plots received 8 lb N and 25 lb P_2O_5 as a starter at planting. A randomized complete back design was used with 4 replications. Plot size was 15 feet by 60 feet. Pioneer 3475 was planted on May 2 at 24,100 seeds per acre. Yields were determined by combine harvesting on September 9.

Table 1. Soil Test levels, Fall vs. Spring N Demonstration

Depth	NO_3-N	P	K	OM	pH	Salts
In.	----	lb/A	----	%		mmho/cm
0-6	12	14	550	3.5	7.2	0.5
6-24	21					

Results and Discussion

Corn grain yields are given in Table 2. Extremely dry conditions limited yields to about 40 bushels per acre. There was no yield response to the added nitrogen. The nitrate in soil plus that which became available from the soybean residue was adequate to produce maximum yield without adding fertilizer N. Under more normal conditions, a yield response to added nitrogen would have been expected. Because there was no response to N fertilizer, no difference between fall and spring applications would be expected. Plans are to repeat these applications in future years to help determine if fall and spring N applications will result in equal yields.

Table 2. Corn Grain Yields, Fall vs. Spring N Demonstration Beresford, SD 1988

Nitrogen rate	Time of Application Fall	Spring
lb/A	------ bu/A	-------
0	-------- 37	--------
40	41	34
80	42	40
120	33	32

Significance - N rate:NS
N timing:NS

S.E. FARM REPORT

TILLAGE AND ROTATION EFFECTS ON SOIL PHOSPHORUS AVAILABILITY TO CORN[1]

Manjula Vivekanandan and P. E. Fixen[2]

Plant Science 88-9

Today's corn producer performs less tillage than in the past and predictions indicate that even less will be done in the future. Changes in management practices involving different tillage and residue incorporation practices alter the dynamics of organic matter turnover in soil and may influence the supply of plant nutrients. To maximize efficiency, it is critical that information be available to guide fertilizer management adjustments for specific tillage and rotation systems. A tremendous amount of research on this aspect has been conducted on N management, but less research has been conducted with respect to P management. Studies carried out in South Dakota (Fixen, et al., 1987) indicated that no till (NT) systems may require a lower P soil test level for maximum economic yield than plowed systems. They reported that where annual P applications were broadcast, the soil test P level required for 95% of maximum corn yield was 15 lbs/A lower in NT than in chisel or moldboard plow (MP) systems.

The "fallow syndrome" is a phenomenon that has been recognized in the northwestern corn belt for many years. Past experiences have shown that severe early growth problems due to P deficiency of corn occur when this crop is planted in a field that has been fallowed the year before. A study conducted in southeastern South Dakota showed that soybeans likely experience a similar growth problem but to a lesser degree than corn (Fixen et al., 1984). The question remains as to what specific effect fallowing has on P nutrition. Mycorrhizal (a beneficial root fungus) association and labile organic P could be the two possible factors involved.

With these factors in mind, a study was initiated in 1986 with the following objectives: To determine the influence of tillage and previous crop on

1. soil P availability to corn;

2. labile inorganic, labile organic and soil solution P fractions;

3. and on mycorrhizal infection levels of corn.

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[1] Research supported by Pioneer Hybrid International and SDSU Agricultural Experiment Station.

[2] Grad. Research Assistant and Associate Professor, Dept. of Plant Sci., South Dakota State Univ., Brookings, SD 57007.

METHODS

A field study was conducted on a Viborg silty clay loam (Haplustoll) soil in southeastern South Dakota. These soils are deep, friable, moderately well-drained soils developed in a silty cap over glacial till. The study was laid out in a split-plot randomized block design with four replications. Five different cropping systems namely MP corn-fallow, MP corn-barley, MP continuous corn, ridge plant (RP) corn-soybean, and RP continuous corn were established in 1986. Each plot was split and soil test levels of 24 lbs/A and 89 lbs/A were established by applying 0 and 520 lbs P_2O_5/A as TSP. Along with the P treatments, 20 lbs Zn/A was also applied. The study area was planted with Pioneer 3475 on April 23 in 1987 and May 2nd in 1988, at the seeding rate of 24,500 seeds/A. A split application of liquid nitrogen as 28-0-0 was made at the rate of 75 lbs N/A at emergence and another 75 lbs N/A at lay-by stage. In the RP system 6-8" ridges were built during final cultivation (corn 18" tall). Corsoy 79 soybeans and Bowman barley were used in rotations.

Parameters measured were early dry matter production and P uptake, date of silking, grain yield, grain moisture and stover yield. Soil and root samples were collected periodically at different growth stages of corn (V2, V6, V12, R1 and R4) from all treatments. Soil samples taken at depth increments of 0-2", 2-4" and 4-6" were analyzed by Bray and Kurtz No. 1 P (Bray and Kurtz, 1945), mineralizable P (0.5 N $NaHCO_3$ extractable organic P; Bowman, 1986), soil solution P (Aslyng, 1954) and soil solution organic P - 0.01M $CaCl_2$ extractable organic P. Root samples were estimated for mycorrhizal infection rate using the grid intersection method (Giovannetti and Mosse, 1980) after cleaning the roots and staining them with trypan blue (Phillips and Hayman, 1970). Corn yield was determined by hand harvesting of 20 foot of the center two rows.

Since the 1987 and 1988 growing season were quite different, key weather parameters for the experiment site are given in Table 1 and Table 2.

Table 1. Growing season temperature data at SE site.

	Temperature (°F)							
	1987				1988			
Month	Average		Departure from 35 yr avg		Average		Departure from 36 yr avg	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
April	67.5	38.1	+6.4	+2.5	59.8	30.0	-1.3	-5.5
May	77.2	53.5	+4.1	+6.1	79.3	52.6	+6.0	+5.1
June	85.0	59.2	+2.7	+2.1	87.7	63.1	+7.2	+5.9
July	85.5	64.3	-1.9	+2.3	87.0	62.5	-0.4	+0.5
August	79.9	57.1	-5.3	-2.0	87.8	61.5	+2.6	+2.3

Source: SE Farm, Ag. Experiment Station, SDSU,

Table 2. Growing season precipitation at SE site.

	Precipitation (inches)			
	1987		1988	
Month	Total	Dep from 35 yr avg	Total	Dep from 36 yr avg
April	0.50	-1.98	2.58	+0.10
May	3.15	-0.32	2.04	-1.39
June	3.58	-0.62	1.45	-2.68
July	4.75	+1.59	0.83	-2.27
August	1.42	-1.49	5.24	+2.26
April-Aug	13.40	-2.82	12.14	-3.98

Source: SE Farm, Ag. Experiment Station, SDSU

RESULTS AND DISCUSSION

Early Growth Response

Substantial early growth response to P was observed in nearly all cropping systems at the six leaf stage in 1987 and 1988 (Table 3). Relative early growth responses averaged over both years were 367%, 91%, 56%, 5% and 26% for the plowed corn-fallow, plowed corn-barley, plowed corn-corn, ridge tilled corn-soybean and ridge tilled corn-corn systems, respectively. In the ridge plant system, the response was lower than in the moldboard system. The ranking of early dry matter response agreed with the theoretical expectations based on mycorrhizal relationships (Table 4). Early growth responses to P were inversely related to mycorrhizal infection (Fig. 1). Mycorrhizal infection was highest in the RP system when compared to MP and within MP system the fallow-corn rotation had the lowest percentage of infection. The physical disturbance of the intensely tilled system and lack of potential host plants in the corn-fallow system could be reasons for low infection rates in this system. The role of mycorrhizae in improving P nutrition of plants has been reported by many researchers (Kahn, 1972; Sanders et al., 1975; Kucey and Paul, 1980; Reid, 1984). Most of the beneficial aspects of mycorrhizae in mineral uptake are those related to increases in surface area effective in ion absorbtion; which is an important factor influencing plant response to P fertilizer.

Table 3. Early growth response of corn to P as effected by cropping systems, 1987-1988

Tillage System	Previous Crop	Early Growth Response 1987	1988	Avg.
		%		
Moldboard	Fallow	384	350	367
Moldboard	Barley	119	62	91
Moldboard	Corn	53	59	56
Ridge plant	Soybean	8	2	5
Ridge plant	Corn	23	29	26

* Dry matter production at 6-leaf stage expressed as:
$(P_{520} - P_0)/P_0 \times 100$

FIG. 1 MYCORRHIZAL INFECTION VS
EARLY GROWTH RESPONSE OF CORN TO P(V6)

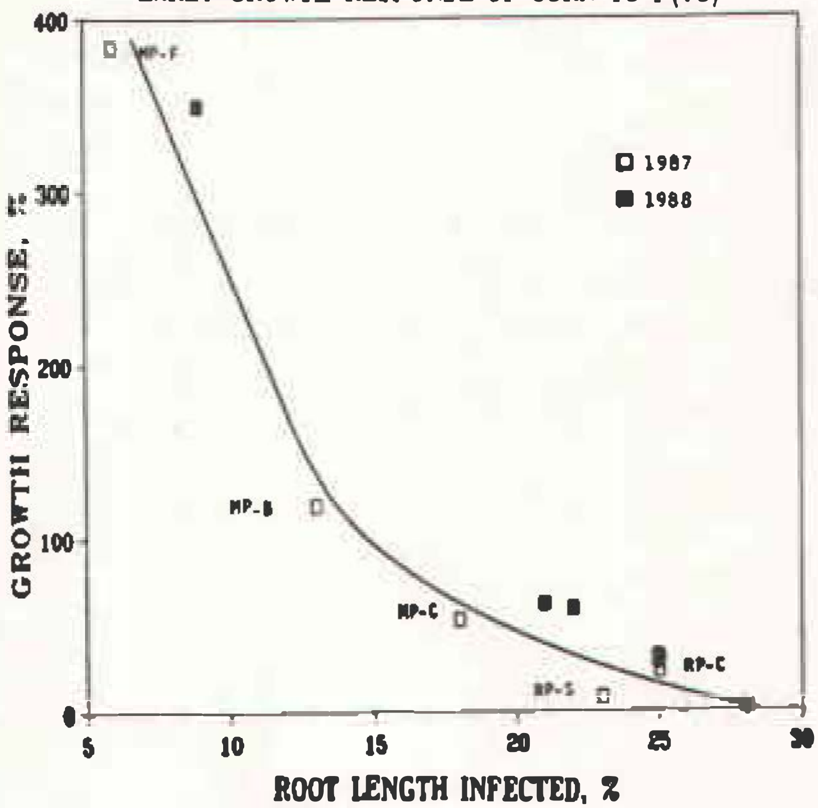


Table 4. Influence of residual P on mycorrhizal infection of corn in five cropping systems, 1987-1988.

Tillage	Previous Crop	Mycorrhizal Infection at V6: 1987[1] P_0	1987 P_{520}	1988 P_0	1988 P_{520}	Mycorrhizal Infection at R1: 1987 P_0	1987 P_{520}	1988 P_0	1988 P_{520}
		%[2]				%			
Moldboard	Fallow	6	-	9	2	19	-	21	10
Moldboard	Barley	13	-	21	7	32	-	29	14
Moldboard	Corn	18	-	22	10	40	-	31	15
Ridge plant	Soybean	23	-	28	13	50	-	43	20
Ridge plant	Corn	25	-	25	11	51	-	42	16
	$LSD_{.10}$	5.1		4.1		3.2		6.3	

[1] Applied in the fall of 1985.
[2] % of root length infected.

Grain Yield Response

The grain yield responses to P in 1987 (Table 5) were 29 bu/A, 7 bu/A, 31 bu/A, -4 bu/A and 21 bu/A for MP corn-fallow, corn-barley, corn-corn, and RP corn-soybean, corn-corn rotations, respectively (LSD .10 = 18). Grain yield did not follow the trend observed in early dry matter production. There were significant yield responses to P observed for corn following fallow and continuous corn in the MP system and in continuous corn in the RP system. Although there was a tremendous early growth response to P observed for different crop rotations and tillage systems, the crop appeared to catch up later in the season thus not reflecting the same pattern in the grain yield. In 1988, over all yield (Table 5) was drastically reduced due to the severe drought conditions experienced during the growing season (growing season precipitation for months of May, June and July were 2.04", 1.45", and .83" which were -1.39", -2.68", -2.27" below the 36 year average for the experiment site - Table 2). Therefore, no significant P effects could be detected (P and P X System effects were NS at the 0.30 level). However, the system averages over high and low P for the above rotations were 58 bu/A, 36 bu/A, 25 bu/A, 42 bu/A and 33 bu/A. These differences were likely caused by variations in water use by previous crops and by water conservation in the RP systems.

Table 5. Influence of cropping system and P on corn grain yield, 1987-1988.

		Grain Yield					
	Previous	1987			1988		
Tillage	Crop	P_0	P_{520}	Response	P_0	P_{520}	Avg.
		bu/A					
Moldboard	Fallow	141	170	29	63	53	58
Moldboard	Barley	153	160	7	39	33	36
Moldboard	Corn	127	158	31	31	19	25
Ridge plant	Soybean	179	175	-4	39	45	41
Ridge plant	Corn	135	156	21	28	38	33
	$LSD_{.10}$			18			8

Effect on P Fractions

The influence of cropping systems on Bray P from check plots for the years 1987 and 1988 are presented in Table 6. Amongst the five systems Bray P was highest in RP corn-soybean system (18.1 ppm and 15.4 ppm) and was lowest in MP corn-corn system (10.7 ppm and 8.6 ppm) for the years of 1987 and 1988. As expected Bray P in all systems was lower in 1988 when compared to 1987. The seasonal changes in Bray P averaged over the systems for both years are given in Fig. 2. There was a noticeable drop in Bray P over time in both years in the high P plots. The drop in Bray P over time in check plots was considerably less. The data for soil solution inorganic P was not ready for this paper. Therefore, this fraction will not be discussed here.

FIG. 2 SEASONAL CHANGES IN BRAY P

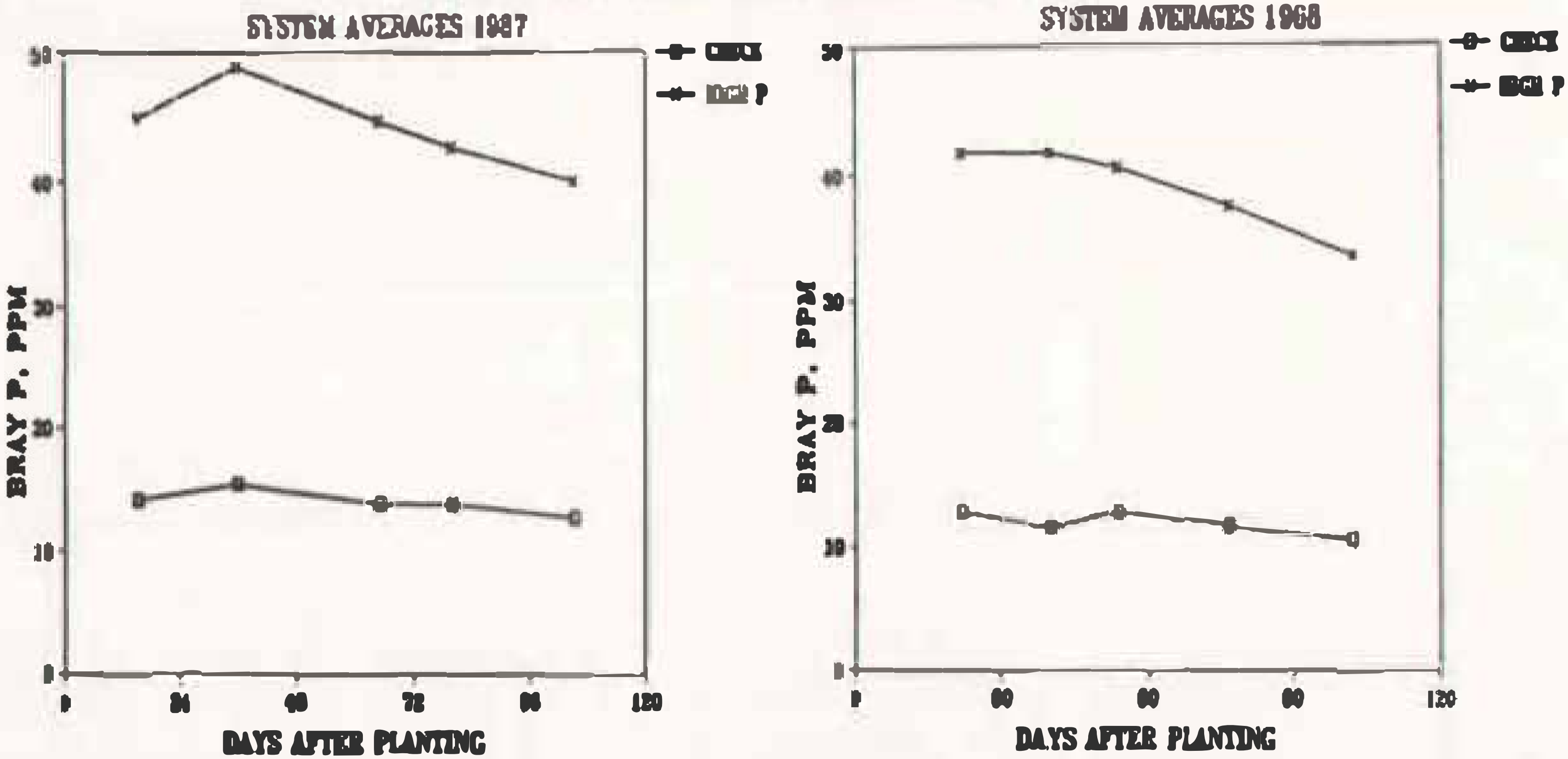


Table 6. Influence of cropping systems on the seasonal average of Bray and Kurtz P in the check plots.

Tillage	Previous Crop	Year 1987	Year 1988
		Bray P, ppm	
Moldboard	Fallow	14.7	12.9
Moldboard	Barley	12.8	10.7
Moldboard	Corn	10.7	8.6
Ridge plant	Soybean	18.1	15.4
Ridge plant	Corn	13.1	11.4
	$LSD_{.10}$	3.3	4.7

The effect of cropping systems on mineralizable P in check plots is given in Table 7. In both years, the mineralizable P was highest in RP corn-soybean rotation and was followed by the MP corn-barley rotation. The lowest mineralizable P was found in the MP corn-corn rotation. It is interesting to note that the grain yield responses in 1987 were inversely related to mineralizable P at all planting times (Table 7 and Fig. 3). Mineralizable P appears to play an important role in determining grain yield response in these systems.

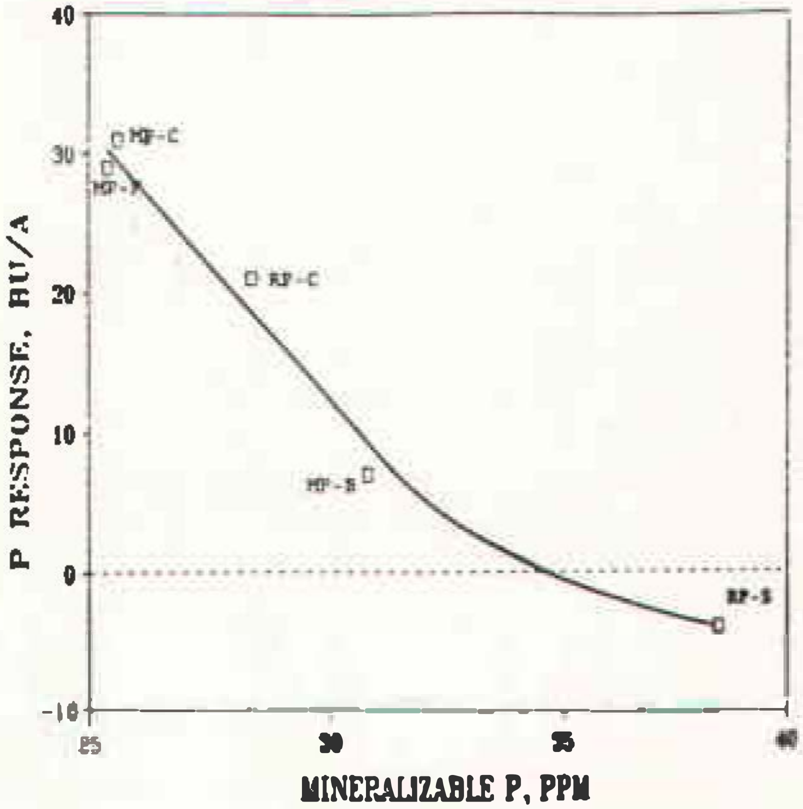
All P fractions (Bray P and mineralizable P) measured and mycorrhizal infection rates were highest in the RP corn-soybean rotation making it a favorable rotation for P management.

Table 7. Influence of cropping systems on the seasonal average of mineralizable P in the check plots.

Tillage	Previous Crop	Year 1987	Year 1988
		Mineralizable P, ppm	
Moldboard	Fallow	25.4	30.8
Moldboard	Barley	30.8	35.4
Moldboard	Corn	25.6	27.6
Ridge plant	Soybean	38.4	36.1
Ridge plant	Corn	28.4	31.8
	$LSD_{.10}$	5.3	8.8

FIG. 3 YIELD RESPONSE VS MINERALIZABLE P

AVERAGED OVER TIME, 1987



S.E. FARM REPORT

EFFECTS OF STARTER FERTILIZATION OF CORN UNDER VARYING CULTURAL AND ENVIRONMENTAL CONDITIONS, 1988

Paul E. Fixen and Brad G. Farber

Plant Science 88-10

Few agricultural areas of the United States contain the diverse set of climatic conditions found in South Dakota. The warm humid environment of the southeast corner grades into the semiarid central and western reaches of the state. South Dakota farmers grow corn in the most variable climate found in the corn belt. Yield levels vary tremendously across years and locations, ranging from no grain (harvested for silage) to over 200 bu/A.

Superimposed on this variable climate we find an increasingly diverse set of cultural practices. Areas that have historically been moldboard plowed now may be chisel plowed, disked, ridge planted with no additional tillage, or even planted with no tillage at all. Most information available indicates that an increase in this diversity is likely in the future.

The efficacy of starter fertilizer on corn in South Dakota, at this time, is exceedingly difficult to predict. Recent studies in South Dakota have shown that the importance of starter fertilizer increases when tillage is reduced. However, other data shows that under certain environmental conditions, starter fertilization can actually decrease corn yields. A need exists to better predict the probability of both positive and negative starter responses under the variable climatic, cultural, and soil conditions of South Dakota.

Objectives:

1. Develop a model based on field data that predicts early season corn growth response to starter fertilizer.

2. Develop a model that predicts the portion of early growth response that carries through to total dry matter production at maturity and grain yield.

3. Develop starter response probabilities for geographic regions of South Dakota.

Methods:

Arrangements were made with cooperating farmers to plant the experiments. Two treatments were included at each of 9 sites (with and without starter) and planted in strips across the field. The paired strips were repeated four times to provide an estimate of natural variability. A multitude of soil, crop, and weather parameters were measured and cultural practices were recorded in order to describe in detail the total environment of each site. Some of the parameters are reported in Tables 1 through 4.

Results:

Site locations and cultural practices are recorded in Table 1. Four sites were ridge planted, two were in disk systems, two were in chisel systems, and one was plowed. Residue cover varied from a low of 3% to a high of 45% for an irrigated site.

Soil test results are shown in Table 2. Soil test P levels are reported incrementally to a 12-inch depth and vary from 5.5 ppm (low) to 55 ppm (very high) for the 0-6" depth.

Table 1. Site locations and cultural practices.

Site No.	County	Planting date	Hybrid	Relative maturity Days	Tillage system[1]	Prev. crop	Residue cover[2] %
3788L	Clay	5/2	P 3475	108	RP	Soy	24
3788H	Clay	5/2	P 3475	108	RP	Soy	24
7088	Hamlin	5/3	P 3737	100	MP	Barley	3
7188	Union	5/2	P 3475	108	RP	Soy	25
7288	Hand	5/14	J 5400	105	DK	Wheat	20
7388	Hutchinson	5/4	Keltgen	105	CH	Wheat	4
7788	Lake	4/28	P 3475	110	RP	Soy	45
8288	Beadle	4/29	K 2750	112	DK	Sudan	25
8688	Roberts	5/5	S 1701	101	CH	Soy	16

[1] MP = moldboard plow, CH = chisel plow, DK = disk, RP = ridge plant
[2] After planting.

Table 2. Soil test results at planting and soil bulk densities.

Site No.	NO_3-N 0-2'	NO_3-N 2-4'	Organic matter	Surface pH	Ext. K	Bulk Density[1] 0-6"	Bulk Density[1] 6-12"	Bray 1 P 0-3"	Bray 1 P 3-6"	Bray 1 P 6-12"
	--lbs/A--		%		ppm	---g/cm^3---		-----ppm-----		
3788L	96	29	3.9	6.5	360	1.15	1.23	6	5	4
3788H	96	29	3.9	6.5	360	1.15	1.23	13	12	10
7088	120	21	4.5	6.9	335	1.03	1.13	17	20	18
7188	75	16	3.8	6.9	288	1.25	1.19	23	5	5
7288	56	34	3.8	6.2	530	1.33	1.40	53	45	18
7388	67	46	3.2	6.4	465	1.28	1.42	46	19	6
7788	95	23	4.3	5.7	203	1.07	1.17	69	28	13
8288	84	67	1.6	6.2	243	1.45	1.63	59	48	33
8688	163	47	4.7	7.5	253	1.17	1.27	26	24	21

[1] In row of growth stage V12.

The 1988 corn growing season was dominated by the data shown in Table 3. Much of the state experienced hot dry conditions in May, June and part of July. Even though rain finally fell during July and August, in many cases it was too late to benefit the crop. This is illustrated by Figure 1. The sum of May and June precipitation explained 98% of the variability in corn yield of the starter treatments across these 9 sites. The regression analysis illustrates that grain yield increased 62 bu/A for every inch of precipitation up to two inches. This unusually large response to water at first seems impossible. However, sufficient water during this period could have allowed the plants to utilize the rain occurring later in the region. Insufficient water early likely had severe negative effects on the number of rows of kernels per ear (set by the V12 stage) and possibly number of kernels per row (set by V17). These data illustrate that cultural practices that conserved water during the early part of the season could have had dramatic effects on grain yield in 1988.

FIGURE 1. INFLUENCE OF EARLY SEASON PRECIPITATION ON CORN YIELD OF STARTER TREATMENTS, 1988.

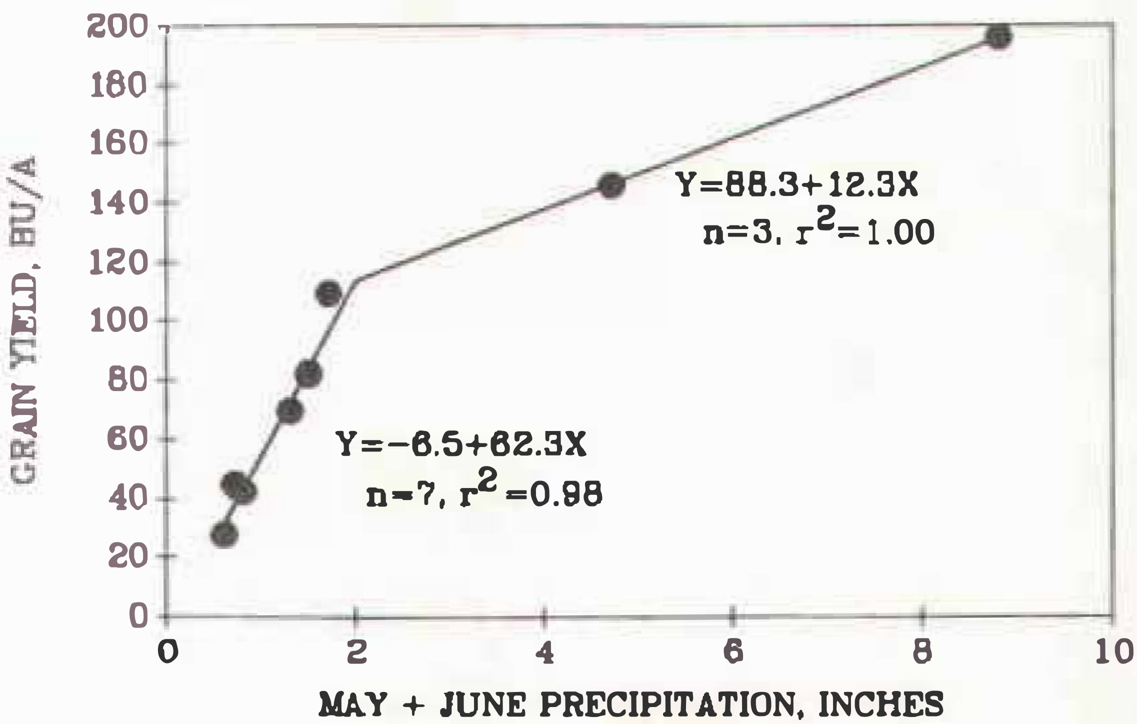


Table 3. Precipitation and water use.

Site No.	Growing season precipitation or irrigation[1] May	June	July	Aug.	Sept.	Total	Soil water use[2]	Estim. water use	Check bu/In
	------------------------Inches								
3788L	0.0	1.5	0.8	5.2	0.0	7.5	3.7	11.2	7.1
3788H	0.0	1.5	0.8	5.2	0.0	7.5	4.1	11.6	6.9
7088	3.8	1.7	1.1	4.1	0.25	11.0	5.4	16.4	6.6
7188	0.5	0.8	0.7	4.8	0.0	6.8	3.9	10.7	5.3
7288	0.0	0.6	6.1	1.7	0.0	8.4	3.0	11.4	3.0
7388	0.0	0.8	0.5	2.0	0.0	3.3	6.7	10.0	4.3
7788	2.4	6.4	8.1	11.8	2.0	30.7	1.4	32.1	6.2
8288	4.2	0.5	1.4	1.1	0.0	7.2	10.4	17.6	7.6
8688	0.1	0.6	0.8	3.2	1.8	6.5	4.3	10.8	3.9

[1] Between initial and final soil moisture samples.
[2] Initial-Final soil water content, 0-4 ft.

The location and rate of starter nutrients applied are shown in Table 4 and response is summarized in Table 5. Even though May and June were abnormally warmer in 1988, large and consistent early growth response was measured. This may have been caused by unusually large shoot/root ratios caused by the elevated temperatures resulting in an increased demand for nutrients per unit of root length. Under these conditions, a concentrated band was likely necessary to meet the plant demand.

Table 4. Fertilizer applied at each site.

Site No.	Starter Location[1]	N	P_2O_5	K_2O	Total N	Broadcast P_2O_5	K_2O
	Inches	------------------------lbs/A					
3788L	2x2	7	25	0	157	0	0
3788H	2x2	7	25	0	157	0	0
7088	2x2	12	41	0	112	0	0
7188	0x1	12	41	0	72	0	0
7288	0x0	6	19	0	106	34	0
7388	3x2	5	15	5	63	40	17
7788	2x2	14	39	17	234	0	0
8288	2x2	8	27	0	85	20	40
8688	2x2	8	32	16	108	0	0

[1] Position of band relative to seed (to side x below).

Grain yield increases of 13 bu/A were measured at two sites while no yield decreases were detected. One of the sites showing a yield increase had a Bray 1 P test level of 54 ppm (107 lbs/A) which is extremely high. This result is in agreement with other studies conducted from 1984 to 1986 in eastern South Dakota which indicate that starter response by corn is independent of soil test level. Total dry matter production (silage yield) was increased at three sites by use of starter fertilizer.

Table 5. Starter effects on early growth and yield, 1988.

Site No.	Early Growth, V6-V8			Grain Yield			Total Dry Matter		
	Check	Starter	Resp.	Check	Starter	Resp.	Check	Starter	Resp.
	---g/plant---		--%-	--------bu/A------			--1000 lbs/A--		%
3788L	6.8	7.8	15*	79	82	3	8.9	9.2	3
3788H	7.3	9.0	23**	80	83	3	9.0	9.4	4
7088	2.6	3.6	38**	108	109	1	10.0	9.8	-2
7188	6.4	9.4	47**	57	70	13*	7.0	8.1	16*
7288	4.8	7.4	54**	34	28	-6	4.6	4.4	-4
7388	8.4	12.4	48**	43	42	-1	5.2	5.1	-2
7788	5.0	7.3	46**	190	196	6	18.0	18.5	3
8288	3.1	6.8	119**	133	146	13**	11.8	13.2	12**
8688	3.3	3.8	15**	42	45	3	6.9	7.8	13**

** Response significant at 0.10 level.
 * Response significant at 0.20 level.

Summary:

In a hot droughty year, starter fertilizer increased early growth of corn at all sites and grain yield at two sites. No yield decreases were measured. Responses were not related to soil test levels.

5.E. FARM REPORT

RESIDUAL EFFECTS OF P FERTILIZATION

B. G. Farber, P. E. Fixen, R. H. Gelderman,
B. Lawrensen and R. Nettleton

Plant Science 88-11

SUMMARY

Several states in the North Central Region have established long-term phosphorus studies. These experiments were designed to evaluate the residual effects of P fertilizer and also generate P soil test calibration data in a situation where a range of soil test calibration data exists in one soil. These data are extremely useful for evaluating year-to-year fluctuations in crop response to soil test P and establishing response probabilities at one given soil test level. Valuable lessons can also be learned from such studies that relate to short-term and long-term P management decisions.

Methods:

The long-term P study in South Dakota is located south of the office building on the Southeast Experiment Farm near Beresford. The soil is classified as an Egan silty clay loam (Udic haplustoll). These are deep, friable, well-drained soils developed in a silty cap over glacial till. From 1964 to 1967 five rates of P (0, 10, 20, 40, and 80 lbs P/A) were broadcast and plowed down annually to establish a range of soil test levels. Various crops have been grown in the study with the major ones being corn and alfalfa. A couple years of soybeans and sorghum were included over the 22-year period. Since 1982 the study has been planted to corn and moldboard plowed each fall.

The study area in 1988 was planted to Pioneer 3732 on April 29, 1988 at a rate of 24,100 seeds/A. Weed control consisted of a Lasso banded over the row at planting. Counter was banded for insect control. An application of 75 lbs/A nitrogen as 28-0-0 was made at lay-by.

RESULTS AND DISCUSSION

General soil test changes:

Table 1 shows the changes that have occurred in selected soil test properties over the past 22 years. Soil pH (0-4") has declined from 6.0 to 5.4 and may be at a point where a small response to lime addition could be seen. These soils normally must be quite low in pH before lime response is measured due to high subsoil pH and abundant exchangeable cations with limited exchangeable or soluble aluminum at any given pH level. Organic matter has remained constant while ammonium acetate extractable K has declined 150 lbs/A (still interpreted as very high).

Table 1. Changes in soil test results over 22 years.

Year	pH	Organic Matter	Bray & Kurtz No. 1 P	NH_4OAc K
		%	------------lbs/A	--------------
1964	6.0	2.7	16[1]	597
1986	5.4	2.8	15[2]	455

Depth 0-4"

[1] Rep 4 excluded.
[2] Check plots only.

Initial soil test P averaged 16 lbs/A for reps 1 to 3 and measured 17, 14, 16, and 26 lbs/A for reps 1 through 4, respectively. Part of rep 4 is a Tetonka soil (Argiaquic argialboll) with a lower pH and with considerably more P initially. The check plot from this rep had dropped to the level of the other reps by 1973. Essentially no change in soil test P levels occurred over the 22-year period for three of the four reps.

Fertilizer effects on grain yield and moisture content:

Corn grain yields and grain moisture were not influenced by soil test P level differences in 1988 (Table 2). Grain yields, however, were reduced considerably due to the severity of the 1988 drought.

Table 2. Influence of soil test P level on corn grain moisture in 1988 and grain yield in 1982-1988.

Soil Test P Level	Grain Yield								Grain Moisture
	1982	1983	1984	1985	1986	1987	1988	Avg.	1988
lbs/A[1]	-------------------			bu/A[2]			-------------------		%
15(L)	97	102	103	119	113	108	26	95	16.3
20(M)	103	97	101	117	113	112	27	96	15.7
19(M)	94	103	102	126	111	107	23	95	15.6
28(H)	93	106	109	131	113	113	28	99	14.0
56(VH)	84	107	117	129	114	115	23	98	17.9

[1] Bray and Kurtz No. 1, Summer 1988, 0-4"
[2] At 15.5% moisture

Corn yields from 1982 through 1988 show that the 28 lb/A soil test level has averaged 4 bu/A more corn than the 15 lb/A level (Table 2). These data also show that the response to P varied considerably across years with no response in 1982, 1983, 1986, 1987 and 1988, a small response in 1984 and a good response in 1985. This illustrates that P fertilization needs to be evaluated over a long-term period. Residual effects of the P fertilizer (in this case applied 20 years ago) cause this input to act in part as a capital investment like tile installation. The cost of P fertilization should not be attributed to a single crop because benefits may be seen for several years.

S.E. FARM REPORT

Pop-up Versus 2 x 2 Starter for Ridge Planted Corn and Soybeans

P. E. Fixen, B. G. Farber and D. R. Sorensen

Plant Science 88-12

Current South Dakota recommendations state that fertilizer should not be placed in seed contact with soybeans, and N + K_2O should not exceed 10 lb/acre for corn due to potentially delayed emergence or stand reduction. Many growers today are interested in banding with their planters but do not have starter openers. Also, in ridge-till and no-till systems, surface soil disturbance at planting is not desirable due to weed control factors. Since a conventional starter disc opener in a "2x2" placement penetrates deeper than any other tool on the planter, it frequently causes significant disturbance of the row area. For these reasons, interest in pop-up fertilization has increased.

Comparison of pop-up and "2x2" placements is necessary to determine if their effectiveness varies. The deeper placement of the "2x2" may make it more effective when the soil surface dries out.

Objectives

a. Compare the emergence, early growth, and grain yield resulting from pop-up placement to 2x2 placement for corn and soybeans in ridge till.

b. Determine the effect of soil test P level on placement response.

c. Determine soil moisture content incrementally in the ridge through the season and relate these data to placement response.

Methods

The study was located in the southeast corner of the research farm on a Viborg silty clay loam soil. Viborg soils are deep, friable moderately well-drained soils developed in a silty cap over glacial till (Pachic Haplustoll, fine-silty, mixed mesic). Results of soil tests taken in the spring of 1988 are reported in Table 1.

Table 1. General soil test results, spring, 1988.

Depth	NO_3-N	Organic matter	pH	Elec. cond.	Extr. K
	lbs/A	%		mmho/cm	lbs/A
0-6"	26	3.9	6.5	1.0	720
6-24"	70	2.5	7.3	0.6	520
24-48"	29	0.6	8.2	0.6	345

Reps 1-4; Corn in 1988.

Cultural practices are reported in Table 2. Weed control was excellent in both corn and soybeans. The study was conducted in a split block design with four replications and two factors in a factorial arrangement resulting in nine treatments. Three soil test levels were utilized from an earlier study at this site. Bray and Kurtz No. 1 soil test values for the ridge center are reported by depth increments in Table 3. The resulting average for the top six inches ranged from 14 to 27 lbs/A (Low to High). The second factor involved three placements which consisted of a check, fertilizer placed with the seed (pop-up) and 2x2 starter (two inches to the side and two inches below the seed). The fertilizer used was 10-34-0 at a rate to deliver 25 lbs P_2O_5/A and 7 lbs of N. Check plots were 6 rows wide and 40 feet long while the fertilized plots were 3 rows wide and 40 feet long. The plots were planted with a 6-row planter that was plumbed to deliver fertilizer to the seed on 3 rows and to the 2x2 disk opener on 3 rows. Yields were determined by hand harvesting 20 feet of the inside two rows of each plot for corn. Soybean yields were determined likewise except that a plot combine was used for harvest.

Table 2. Cultural practices in 1988.

Practice	Corn	Soybeans
Past crop	soybeans	corn
Variety	Pioneer 3475	Corsoy 79
Planting date	May 2	May 16
Row spacing	30"	30"
Seed rate	24,100	146,000
Final plants/acre	22,800	155,000
Herbicide	Lasso band, Banvel post	Dual band
Insecticide	Counter 15 G	none
Harvest date	Sept. 6	Sept. 27
Cultivations	one	two
Sidedress 28% N, lbs/A	150	0

Table 3. Soil test P levels in the ridge in the fall of 1987.

Depth	Corn in 1988[1] Treatment				Soybeans in 1988[2] Treatment			
	L	M	H	Avg.	L	M	H	Avg.
Inches	lbs/A							
0-3	13	17	25	18	17	22	28	22
3-6	10	15	23	16	13	19	29	20
6-9	10	18	25	18	14	25	40	26
9-12	6	10	16	11	12	15	29	19
0-6	12	16	24		15	21	29	

[1] Reps 1-4
[2] Reps 5-8

Soil moisture was monitored incrementally in the ridge by taking weekly gravimetric samples until June 16 and biweekly from June 16 to August 11. The gravimetric values were converted to volumetric values using bulk density measurements taken at the V12 growth stage. The resulting soil moisture contents were adjusted for precipitation events occurring between sampling dates.

Results

The figure shows the soil moisture contents in the ridge throughout the season for both soybeans and corn. The 1 to 2 inch depth corresponds to seed depth while the 3 to 4 inch depth corresponds to the 2x2 depth. The 3-4 inch depth was slightly wetter than the 1-2 inch depth through the V6 stage. The difference increased to nearly 7% by V12 after which the 1 to 2 inch depth became very variable. The soil moisture data is summarized in Table 4 for corn. From VO to V6, the moisture contents were similar from one inch depth down to 8 inches. This is the most critical stage for P uptake by corn and the water differences are relatively minor for either diffusion or root growth. Differences were greater from the V6 to V12 stage, however, by this time the P uptake demand per unit of root length has usually greatly decreased.

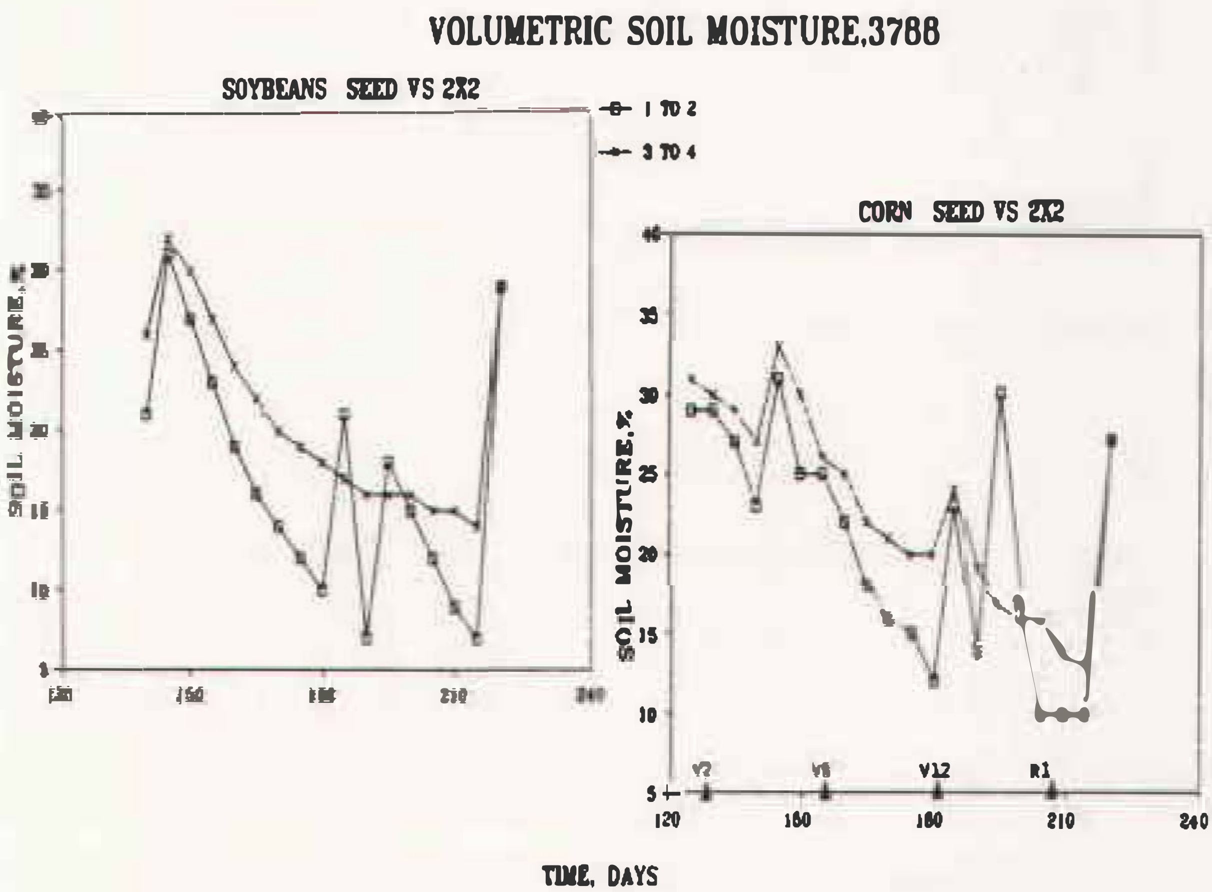


Table 4. Average soil moisture contents by depth increment in ridge-till corn, 3788.

Depth Increment	Growth Stage		
	V0-V6	V6-V12	V12-R1
inches		%	
0-1	21	17	16
1-2	27	18	17
2-3	28	20	16
3-4	29	22	18
4-6	31	24	17
6-8	34	27	19

Volumetric basis; samples taken between plants in the row of check treatment and adjusted for precipitation effects between sampling times.

No emergence effects were detected for corn, however, significant differences were found for soybeans (Table 5). Soybeans having a 2x2 starter reached 50% emergence one day earlier than either the pop-up treatment or the check. Final stands were not affected by the treatments.

Table 5. Influence of fertilizer band placement on emergence of soybeans in a ridge-till system, 1988.

	Days to reach indicated emergence			Final
Treatment	50%	75%	90%	stand
Check	7.8	8.9	10.7	156
Pop-up	7.8	8.9	10.3	153
2 x 2	6.8	8.2	9.7	155

100% emergence = 156,000 PPA.

Early growth (V6) was measured for the corn plots (Table 6). Both an increase in soil test level and P placement enhanced early growth. At the low soil test level, seed placed P provided slightly more early growth than 2x2 starter.

Table 6. Early growth response of corn to P, 1988.

Soil test	Placement			
level	Check	2 x 2	Seed	Avg.
	grams/plant			
L	6.8	7.8	8.5	7.7
H	7.3	9.0	9.4	8.6
Avg.	7.1	8.4	9.0	

LSD .10: Placement = 1.1, Soil test level = 0.5, Plac. x STL = 0.7, CV = 6%. Growth stage = V6.

Grain yields were not significantly influenced by either soil test level or P placement in this study in 1988 (Table 7). However, both corn and soybeans trended higher as soil test levels increased. Corn grain moisture at harvest was not influenced by P management (data not shown).

Table 7. Grain yield response to P placement and soil test level, 1988.

Soil test level	Corn Placement Check	2x2	Seed	Ave.	Soybeans Placement Check	2x2	Seed	Avg.
				bu/A				
L	78	82	91	84	24	24	24	24
M	98	87	99	95	24	25	27	25
H	100	83	103	95	26	25	25	26
Avg.	92	84	98		25	25	25	
$LSD_{.10}$ Placement				ns				ns
Soil test level				ns				ns
Plac. *STL				ns				ns
CV,%				16				8

Summary

Since this is the first year of this comparison, no conclusion should be drawn. However, it should be pointed out that in a dry, hot year like 1988, seed placement of 10-34-0 at a rate of 25 lbs P_2O_5/A did not result in any damage to either corn or soybeans. The moist undisturbed seed bed provided in a silty clay loam soil in the ridge plant system may have been partially responsible for the lack of detrimental effects.

S.E. FARM REPORT

OAT RESEARCH

D. L. Reeves
Plant Science 88-13

We started a preliminary herbicide testing program this year in cooperation with the extension weeds workers. This is our southern site. This year we used 6 varieties and 9 treatments. The treatments included MCPA at 1/2 and 1 lb. rates, 2,4-D Amine at 1/2 and 1 lb., Bronate at 3/4 and 1 1/2 lb., and a Banvel + MCPA mix.

There are three objectives to this program. One is to see how oats are reacting to environmental conditions when sprayed on a given year. The second is to see how our selections approaching release as a variety respond to commonly used herbicides. The third is to see what could be expected in the field if a sprayer overlapped when spraying oats.

Two treatments caused significant yield and test weight reductions this year. The high rates of 2,4-D gave the lowest yield and test weight for each variety. The high rate of Banvel + MCPA also reduced yields, but not as severely. Test weights of this treatment were very similar to the high 2,4-D rate.

Treatment	Rate (lb/A)	Yield (bu/A)	Test Weight (lb/bu)
unsprayed		38	22.1
Banvel + MCPA	1/4, 1/2	31	20.8
2,4-D amine	1	27	20.6

There was also a significant treatment x variety interaction for yield and test weight indicating all varieties did not respond the same. It is not known whether these results are typical. Plans are to continue this test at three locations next year.

We continue to use this location as our best testing site for our early maturity selections. A severe epidemic of barley yellow dwarf virus (red leaf) caused great losses in some entries this year. The good part was it permitted us to select entries having good resistance to red leaf. An encouraging point was the excellent resistance some of our advanced lines had to red leaf.

Two regional tests are grown here. The Uniform Early Oat Performance Nursery is a USDA coordinated test grown in several states. The Tristate test includes only 10 new entries from each of the Dakotas and Minnesota. Overall, this continues as an important testing site in our oat breeding program.

S.E. FARM REPORT

AGRONOMIC EVALUATION OF SOME DROUGHT TOLERANT ALTERNATIVE OR EMERGENCY FORAGE CROPS

Arvid Boe and Kathy Robbins

Plant Science 88-14

Introduction

In the northern Great Plains, cool-season grass pastures decline in productivity and forage quality in mid-to late summer. Some currently used practical solutions to forage shortages during the summer period include perennial warm-season grass pastures and warm-season annual grass pastures.

Summer annual legumes have been used for soil improvement, pasture, hay and silage in the southern United States. Mungbeans (Vigna radiata) have been grown quite extensively in Oklahoma for food and forage, and cowpeas (Vigna unguiculata)
are grown on about 200,000 acres annually in the U.S., with Georgia, California, and Texas accounting for about 65% of the total acreage. They are grown primarily as a vegetable and a dry bean, but have been utilized for hay, silage, and pasture.
Both crops grow well on infertile, sandy soils and are tolerant of drought and hot weather.

Objectives of this research were to evaluate effects of row spacing and plant population (density) on forage production of cowpeas and mungbeans. Data obtained should be useful for determining the adaptability of these legumes to forage production systems in southeastern South Dakota.

Experimental Approach

Cowpeas and mungbeans were planted at 2 rates (100,000 and 200,000 pure live seeds/acre) in 3 row-spacing (10-, 20-, and 30-inch) treatments, replicated 3 times in randomized complete block design. Planting date was June 2 and harvest date was August 16. Plants were in early pod stages at harvest, but mungbeans were more mature than cowpeas.

Results

As was found in a similar study in 1987 at Beresford, forage yields for both cowpeas and mungbeans increased with decreased row-spacing, indicating superiority of narrow rows for forage production (Table 1). The forage yield advantage of narrow rows may be due to less intra-row plant competition in the narrow rows. Distances between plants in wide rows were closer than distances between plants in narrow rows at the same planting rates.

Cowpeas significantly outyielded mungbeans at Beresford in both 1987 and 1988, but these yield differences were not as great at Brookings and Highmore. These data indicate that similar evaluations of more cultivars of each species should be beneficial for identifying cultivars that are well-adapted to specific regions of the state.

Forage yields of the 100,000 and 200,000 pure live seeds/acre seeding rates were similar, indicating no practical advantage to the higher seeding rate. Stand establishment was excellent for both planting rates at all locations in both years. However, increased plant density in the high seeding rate plots was generally offset by larger individual plant size in the low seeding rate plots. As part of the study, data were also collected on forage yield components and leaf-to-stem ratio. Results were inconclusive and suggest further research is needed to determine if population density and inter-and intra-row spacing can be utilized to influence forage quality in these species.

Discussion

This study indicated cowpeas and mungbeans offer great potential as summer annual or emergency forage crops in southeast South Dakota. These annual legumes produced at least 3 tons of dry matter/acre during the drought year of 1988 from a planting made in early June and harvested for forage in mid-August. During the severe droughts of the mid 1930's, when most crops were failures, mungbeans grew well in central Oklahoma, and cowpeas are also well-known for their ability to grow in areas with heat and drought stresses too extreme for other annual legumes.

Both species have been successfully utilized as hay and silage. Hay from these legumes may be somewhat stemmy, but no fermentation or palatability problems have been associated with mungbean silage.

Seed costs have been low ($2.00-$5.00/acre; 15-20 lbs/acre at $18.00-$30.00/100 lbs), but will fluctuate with domestic production. Both species can be easily planted with conventional equipment. A grain drill was used to plant evaluation plots adjacent to experimental plots and excellent stands of both species were obtained. In Oklahoma, mungbeans are drill-planted after winter wheat to provide a later summer or early fall hay or silage crop (Leroy Mack, Johnston Seed Co., Enid, OK; personal communication). Additional studies are needed to determine if double-cropping with small grains is a viable alternative in our area.

The encouraging results of this preliminary research have provided strong incentive for additional studies on these and other annual legume and grass species. New forage that complement or supplement our traditional perennial grasses and legumes add flexibility to forage production systems and can be extremely valuable to forage producers in the climatically unpredictable northern Great Plains.

Table 1. Mean Dry Matter Yields for 2 Annual Legumes Grown in 3 Row Spacings at Beresford, SD in 1988

Legume*		Row-spacing (inches)*		
Cowpea	Mungbean	10	20	30
------tons/acre----		----------tons/acre-------		
4.5a	3.2b	4.3a	3.9b	3.3c

*Means in same row followd by a different letter are significnatly different by LSD .05.

FABABEAN RESEARCH PROJECT

Dale R. Sorensen

During the 1988 growing season research plots and large plantings were used to study how the fababean reacts to South Dakota. A 20 acre field of fababeans were grown for the first time to have enough plant material to conduct livestock research. Small variety plots with two row-spacings were also established to look at variety adaptability and row-spacing efforts.

Table 1 reports forage yields for 1988 for four varieties at two row-spacings (7 and 14 inch). The research plots were planted on April 13th.

Table 1. Fababean Forage Yields at Two Row-Spacings, SE Farm, 1988.

Variety	Ackerperle		Herzfreya		Aladin		Diana	
Row-Spacing	7"	14"	7"	14"	7"	14"	7"	14"
	tons/acre @ 65% Moisture*							
	3.3	3.8	3.2	2.8	2.5	2.4	2.6	2.3

*LSD .05 = 0.6 Tons/Acre

Due to the extreme heat in June of 1988, yields were down considerably compared to past years when we were able to plant in April. The fababean does fine with dry conditions, but extreme heat is detrimental to the development of this crop. Ackerperle and Herzfreya are both more recently developed varieties and did exhibit better yield capabilities than the Aladin and Diana varieties.

The large planting of fababeans (20 acres) were harvested at the same time as the small plots and yields were comparable from the 20 acres that were comparable to our small research plots.

In August, when the rain began to fall, fababeans were again planted into ground that we had grown small grain on in 1988. Instead of using the grain drill, we planted the fababeans with a unit planter in 15 inch rows. Because of the seed size, the grain drill does damage the seeds where the old plate planter does not have any problem in handling that size seed and causing any damage to the seed.

This planting of fababeans came up well and continued growing until November 10th, when the night time temperature got down to 20 degrees F. There were several nights below 32 degrees F prior to that, but the plant recovered each time. The actual killing frost for these fababeans in 1988 was 20 degrees F. These fababeans were harvested on November 14th and the yield for this area which was unreplicated worked out to .95 tons dry matter per acre (1.56 tons/acre @ 65% moisture). This was a surprising yield considering they were planted in mid-August and harvested in early November. These fababeans also would have been good for grazing during the fall because they would continue to grow. This work will be carried on for the 1989 growing season.

S.E. FARM REPORT

TILLAGE AND ROTATION FOR CORN AND SOYBEANS

O. H. Rickerl and D. R. Sorensen

PLANT SCIENCE 88-15

Summary: A field study was initiated at the Southeast Experiment Farm to determine the long term effects of tillage and crop rotation on yield and soil characteristics. Tillage treatments were moldboard plow, ridge-till and no-till or chisel plow. Crop sequences included continuous corn and soybeans as a standard of comparison for rotated corn and soybeans. Preliminary results from 1988 indicated that rotation in a ridge-till system produced the highest corn yields. Ridge-tillage also caught more snow and stored more soil surface moisture than other systems.

Methods: This study was initiated in the spring of 1987. Crop treatments were established as continuous corn, continuous soybeans, rotated corn-soybeans, and rotated soybean-corn. All plots were cultivated and ridge-till plots were ridged at second cultivation. Other tillage treatments were fall moldboard plowed and no-till. Fertilizer and pesticide application followed recommended practices (Table 1).

Table 1. Management Practices for Tillage Rotation Study, 1988

	Corn	Soybeans
	Pioneer 3732	Century 84
Planting Date	May 6	May 13
Herbicide	Lasso+Atrazine (Pre)	Lasso+Sencor/Lexone (Pre)
Fertilizer	25 # P2O5 Starter	25# P2O5 Starter
Harvest Date	September 8	October 6

With tillage and crop treatments established, data collection began in the fall of 1987. Soil moisture at 0-6, 6-24, and 24-48 inches was determined from probe truck sampled cores. Crop residue was measured as a percent of ground cover after fall tillage and again after spring planting. The snow trapped by stubble and residue was also recorded.

In 1988 tillage treatments were changed slightly. All corn plots were ridged at cultivation, but soybean plots were not. Fall tillage was moldboard plowed, and chisel plow replaced the no-till treatment. Nitrogen application was 90 pounds/acre in corn following soybeans and 120 pounds/acre in corn following corn. Pesticide application followed recommended practices. Plots were mechanically harvested to determine yields.

Results and Discussion: Table 2 lists soil moisture content at 3 depths in the fall of 1987 and 1988. In 1987, ridge-till plots

Table 2. Soil moisture at 3 depths in the fall of 1987 and 1988 as affected by crop rotation and tillage.

			Crop and Rotation			
			Corn		Soybean	
Year	Tillage	Depth inches	Continuous	Soybean Rotation	Continuous	Corn Rotation
			- - - - - - - - - - % - - - - - - - - - -			
1987	Moldboard plow	0-6	17.0	NA*	18.5	NA
		6-24	17.0	NA	14.8	NA
		24-48	14.0	NA	15.2	NA
	Ridge-till	0-6	18.2	NA	19.0	NA
		6-24	17.8	NA	19.5	NA
		24-48	12.5	NA	13.8	NA
	No-till	0-6	18.0	NA	17.5	NA
		6-24	16.0	NA	16.5	NA
		24-48	12.8	NA	12.8	NA
1988	Moldboard plow	0-6	17.6	18.6	17.1	17.4
		6-24	20.8	21.2	16.9	17.1
		24-48	13.2	13.2	13.1	12.4
	Ridge-till	0-6	21.2	21.9	19.1	18.8
		6-24	19.4	18.9	17.6	18.5
		24-48	12.2	12.4	11.6	12.2
	Chisel	0-6	21.7	19.4	21.0	17.9
		6-24	24.8	20.7	17.4	18.4
		24-48	13.8	13.0	13.3	12.8

*NA - Not applicable since 1987 was the first crop year.

had a slightly higher percent soil moisture, in the top two increments, than the other tillage treatments. At the 24-48 inch depth, however, ridge-till had less moisture than other treatments with the exception of no-till soybeans. In 1988 surface moisture was generally higher in ridge-till plots. The exceptions were continuous cropping in the chisel plow treatment, which had been no-till the previous fall. Deeper increments indicated that ridge-till treatments were dryer than moldboard plow or chisel plow.

Table 3. Crop residues in the fall of 1987 and spring of 1988 as affected by crop and tillage.

	Crop and Season			
	Corn		Soybeans	
Tillage	Fall	Spring	Fall	Spring
	- - - - - % Ground Cover - - - - -			
Moldboard Plow	11	6	5	2
Ridge-Till	73	52	66	40
No-till/Chisel Plow	70	58	36*	16

* 1987 plots were no-till, and 1988 plots were chisel plow

Crop residues are recorded in Table 3. Residues decreased over the winter for both crops and in all tillage systems. Soybean residue was less than corn and was much less effective at trapping snow (Table 4). Ridges with corn stubble trapped 2 to 4 more inches of snow than the other combinations.

Table 4. Maximum snow depth during the 1987-88 winter, as affected by crop and tillage.

	Crop	
Tillage	Corn	Soybeans
	- - - - - - inches - - - - - - -	
Moldboard plow	6	6
Ridge-till	9	6
No-till	7	5

Corn yields (Table 5) were low due to the drought, but were also lower than the same hybrid planted nearby, but a week later. Rotation improved corn yields regardless of tillage treatment with the biggest difference occurring in the ridge tillage treatment. Soybean yields showed little response to tillage or rotation treatments.

Table 5. Corn and soybean yields in 1988 as affected by crop rotation and tillage.

	Crop Rotation			
	Corn		Soybean	
Tillage	Continuous	Soybean Rotation	Continuous	Corn Rotation
	- - - - - - - - bu/acre - - - - - - - - - - -			
Moldboard plow	22	27	19	19
Ridge-till	24	33	21	20
No-till	22	26	19	18

TILLAGE AND LANDSCAPE POSITION EFFECTS ON CORN AND SOYBEAN YIELD

T. E. Schumacher and D. Sorensen

Plant Science 88-16

Tillage systems which leave a high residue cover on the surface generally perform as well as, or better than other systems with little or no residue cover. This is especially the case on soils which are well suited to crop production. However, there has been some hesitation about using conservation tillage systems in areas where soil temperatures remain cool and soil moisture levels are relatively high during the early part of the growing season. Due to the rolling topography of Eastern South Dakota, well-drained and less well-drained soils occur in an intricate pattern across most fields. This study is designed to provide information on the benefits and difficulties associated with selected tillage systems on soils which have different moisture and temperature environments, (well-drained vs. less well-drained). The study also provides information for evaluating a method for selecting corn hybrids which are more tolerant of stress environments. The line source irrigation selection method for evaluating corn hybrids was conducted at a seperate location.

<u>Methods.</u> The two soils in the study are an Egan soil located east of the farm feedlot and a Wentworth soil located in the lower landscape position in the southeast part of the farm. The Egan soil is formed in silty glacial drift and has a silty clay loam surface texture. The Wentworth soil is similar to the Egan soil however it is typically found in lower positions in the landscape and has deeper silty horizons. Tillage systems include ridge till (RT), no till (NT), and a fall moldboard plow - disk (MP) system. A starter phosphorous fertilizer was applied to half of each tillage plot at a rate of 25 lbs P_2O_5 / acre. Yield was determined by machine harvesting the center rows of each treatment. There were four replications of each treatment. The cultural practices are outlined in Table 1. Soil test results were used to determine application rates of fertilizer. Test results are given in Table 2 for the two soils.

Table 1. Cultural practices for 1988.

Practice	Corn
Variety	Pioneer 3475
Planting Date	May 4,5
Row Spacing	30 in.
Planting Rate	24,000 s/a
Herbicide	Dual-Bladex Band
Insecticide	Counter
Harvest Date	September 7

Table 2. Soil Test Results, Fall 1987.

	NO3-N	P	K	Soil
	------------lb/A-------------			
0-6"	20	38	608	Egan
6-24"	35			
0-6"	21	18	615	Wentworth
6-24"	31			

Six corn hybrids were also included in each tillage plot and phosphorous starter subplot for both soils.

Results and Discussion. Yield data for the Egan and Wentworth soils are given in Tables 3, 4, and 5. There was no effect of tillage system on yield on the Egan soil for both rotations. The overall yield potential was very low due to the drought and high temperatures at pollination. The beneficial effects of the conservation tillage systems on moisture conservation are more likely to occur under less stressful conditions. There was no effect of P starter on the Egan soil. As expected the corn - soybean rotation had a higher yield than the continous corn rotation. The advantage of the rotation was most noticeable with the conservation tillage systems.

A starter response was observed on the Wentworth soil. The response depended on tillage system and rotation. Overall yields were lower on the Wentworth soil compared to the Egan. This occured even though the Wentworth soil is located in a lower landscape position than the Egan soil. This may have been a result of compaction from prior years. However the effect of the Wentworth soil on yield appeared to be variety specific. The six hybrids which were evaluated for the selection methodology study yielded equally well on the Egan and the Wentworth soils at 40 and 38 bu/A, respectively. The importance of the starter and tillage interaction is difficult to assess because of the low yield environment in 1988.

Table 3. Corn yield on the Egan soil.

	----- Rotation ------		
Tillage	C-C	C-S	Ave.
	---------Bu/A---------		
RT	36	55	46a
NT	34	59	47a
MP	46	49	48a
AVE	39	54	

Table 4. Corn yield on the Wentworth soil for the Continuous Corn Rotation.

Tillage	Starter	No Starter	Ave.
	Bu/A		
RT	27	28	28
NT	35	26	31
MP	25	24	25
AVE	29	26	

TxP $LSD_{.10}$ = 5 bu/A

Table 5. Corn yield on the Wentworth soil for the Corn - Soybean Rotation.

Tillage	Starter	No Starter	Ave.
	Bu/A		
RT	37	26	32
NT	19	29	24
MP	29	26	28
AVE	28	27	

TxP $LSD_{.10}$ = 8 bu/A

Yield data for the hybrids which are being used to evaluate stress selection methods are given in Table 7. A tillage and phosphorous interaction was also observed on the Wentworth soil in this study across all of the hybrids. The no till treatment had the greatest yield in absence of P starter at 45 bu/A compared to 34 and 31 bu/A for the ridge till and moldboard plow treatments, respectively. The addition of starter resulted in a similar yield of 43 bu/A for each tillage treatment on the Wentworth soil.

Table 6. Hybrid yield data.

Hybrid	Soil Egan	Wentworth
	Bu/A	
FR23xCM105	34	44
LH38xCM105	45	41
W64AxCM105	41	33
FR23xA632	45	40
W64AxA632	26	27
LH38xA632	46	44
$LSD_{.10}$ =	5	7

The results from 1988 indicate that under conditions of severe stress the three tillage systems produce similar yields. Reduced tillage systems tend to have a beneficial effect on soil properties over time. This study is in its second year and will be continued to evaluate the long term effects of the tillage systems on soil properties and productivity.

1988 PERFORMANCE TRIALS ON SMALL GRAINS GRAIN SORGHUM, SOYBEANS AND CORN AT THE SOUTHEAST EXPERIMENT FARM

J. J. Bonnemann
Plant Science 88-17

INTRODUCTION

Variety or performance trials with four major types of crops were conducted at the Southeast Farm during the 1988 crop year. Data from all trials and for other areas around the state are found in publications for each type of crop.

Trials of spring wheat and oats were conducted at the farm in 1988, Table 1. Results of the trial are found in EC 774 (rev. 1989 Variety Recommendations, Small Grain and Flax.

The 1988 Grain Sorghum Performance results for the SE Farm are reported in Table 2. Yield results and other data for farm trials on grain sorghum can be found in Plant Science Pamphlet #13, 1988 Grain Sorghum Performance Trials.

Soybean trials were conducted at several locations in southeast South Dakota including the Southeast Farm. These sites were Freeman, Elk Point and Ellis, (northwest of Sioux Falls). Tables 3 and 4 consist of data from the 81 varieties tested just at the Southeast Farm. Results for the other locations and other areas of South Dakota can be found in EC 775 (rev.) 1989 Variety Recommendations, Soybeans.

Over 100 hybrids were compared in the corn performance trial located at the SE Farm in 1988. Yields ranged from approximately 35 to 86 bu/acre (Tables 5 & 6). Growing conditions were not the most ideal in 1988, but dry down was again ahead of normal. Yields of all corn performance trials in 1988 for all locations as well as 2, 3, and 4 year averages can be found in Plant Science Pamphlet #12, 1988 Corn Performance Trials.

More information on these crops can be found by listing the publication as underlined, and sending to: Bulletin Room, SDSU, Brookings, SD 57007. These publications should also be available at your county extension office.

Table 1. Small Grain Performance Trails, SE Farm, 1988.

OATS			SPRING WHEAT		
	BU/A			BU/A	
VARIETY	1988	3-YR	VARIETY	1988	3-YR
Benson	27	43	Alex	5	22
Burnett	31	40	Amidon	9	27
Don	59	84	Angus	7	27
Hazel	65	80	Butte 86	10	29
Hytest	34	51	Celtic	9	29
Kelly	40	49	Challenger	13	28
Lancer	28	49	Chri	8	23
Lyon	15	35	Guard	15	32
Monida	--	--	Leif	6	--
Moore	27	4	Len	11	28
Nodaway 70	34	36	Leo 747	12	27
Ogle	61	74	Marshall	11	29
Otana	--	--	Nordic	13	34
Otee	63	60	Norseman	9	29
Porter	41	51	Prospect	12	31
Preston	49	66	Shield	13	34
Proat	27	55	Stoa	10	33
Sandy	21	45	Telemark	13	30
Starter	45	71	Wheaton	12	30
Steele	26	58	2369	14	31
Trucker	21	45	2375	14	--
Valley	37	--	2385	13	--
Webster	51	66			
Wright	30	58	Test Average	11	29
			Test LSD (5%)	3	7
Test Average	40	57			
Test LSD (5%)	6	24			

Planted - April 8
Harvested - July 14

Table 2. 1988 Grain Sorghum Trail, SE Farm, 1988

Variety Name	CWT Yield	Test Weight	Plant Height	Moisture Percent	Headed Mo/Da
Cargill 3385	58.9	62.1	40.7	17.1	7/20
Interstate 665	58.1	58.7	41.3	14.5	7/16
Cargill 630	57.5	61.8	39.7	17.5	7/20
Seedtec ST3101	56.6	58.7	41.3	15.2	7/16
Seedtec WS203	54.9	61.5	42.3	15.5	7/17
Interstate 856	53.5	58.9	39.3	14.7	7/14
Cargill X77001	53.3	60.5	39.3	15.3	7/17
Dahlgren DC-33B	52.7	60.9	39.3	16.3	7/18
Interstate 668	51.5	60.5	38.3	15.2	7/19
Cargill 2285	51.1	60.6	34.3	16.8	7/19
Cargill 1022	49.9	61.9	39.0	17.4	7/20
Dahlgren DG-27B	49.3	60.3	40.3	15.1	7/17
Conti-Seed Silverado	41.6	60.0	37.0	27.3	8/4
Cargill 40	39.5	61.3	38.7	23.8	7/27
Overall Mean	52.0	60.6	39.4	17.3	7/20

LSD (.05) = 5.1 Bu/A
CV = 6.0%
Planted May 16
Harvested - September 26

Table 3. 1988 Group I Soybean Performance Trial, SE Farm

Variety Name	Mat. Group	Yield Bu/A	Plant Height	Mature Mo/Da
Fontanelle 3914	I	39.4	24	9/14
Riverside 1405	I	34.1	23	9/11
Mustang M-1140	I	33.7	22	9/11
Curry 175	I	33.5	25	9/11
Profiseed PS150	I	33.0	23	9/11
BSR 101	I	32.8	26	9/10
Profiseed PS1755	I	32.7	23	9/11
Hy-Vigor K-2180(BL)	I	31.4	26	9/13
Agripro EX1969	I	31.4	24	9/9
Corsoy 79 CK	II	30.5	26	9/11
Fontanelle 3850	I	29.7	24	9/8
Lakota	I	29.6	27	9/7
Weber 84	I	29.6	21	9/9
Agripro AP1776	I	29.2	24	9/9
Hy-Vigor Rowking(BL)	I	29.1	27	9/10
Hardin	I	28.0	25	9/6
Sibley CK	I	27.5	23	9/6
Profiseed PS2198	I	27.1	22	9/9
Hodgson 78	I	27.0	24	9/8
Mustang M-1180A(BL)	I	27.0	24	9/9
Mustang M-1150	I	26.6	23	9/8
Dawson CK	0	23.7	22	8/30
Prairie Brand PB171	I	23.4	21	9/8
Overall Mean		30.1	24	9/9

LSD (.05) = 4.5 Bu/A
C.V. = 10.6%
Planted May 16
Harvested Oct 6

Table 4. 1988 Group II Soybean Performance Trial, SE Farm

Variety Name	Mat. Group	Yield Bu/A	Plant Height	Mature Mo/Da
Sands SOI 287	II	43.0	25	9/16
Hoegemeyer 237	II	41.4	24	9/13
S-Brand S-46G	II	40.9	26	9/12
Dekalb CX226	II	40.6	23	9/12
Agripro AP2324	II	40.3	26	9/16
Golden Harvest X277	II	40.3	24	9/10
Diamond D201	II	40.1	26	9/11
S-Brand S-45J	II	40.0	24	9/16
S-Brand S-45D+	II	40.0	27	9/11
Star 8829	II	39.0	26	9/13
DeKalb CX264	II	38.9	24	9/16
Platte	II	38.7	28	9/16
Riverside 303C	II	38.5	27	9/12
Hy-Vigor Ex-3-903K-BL	II	38.4	27	9/11
Elgin 87 CK	II	38.3	24	9/14
Preston	II	38.1	26	9/16
Sands SOI 277	II	37.7	26	9/11
Profiseed PS1152	II	37.7	26	9/16
Pioneer 9272	II	37.7	24	9/18
Century 84	II	37.1	23	9/15
Prairie Bnd PE275-BL	II	36.7	23	9/16
Beeson 80	II	36.6	26	9/15
Pioneer 9251	II	36.5	24	9/13
Latham L-770	II	36.5	24	9/14
Sands SOI 268	II	36.4	26	9/15
Stine 2750	II	36.3	22	9/17
Dahlgren DG-3285	II	36.2	29	9/17
Northrup King S27-10	II	36.1	25	9/11
McCurdy 260B BL	II	35.9	25	9/14
BSR 201	II	35.8	28	9/14
Wells II	II	35.8	27	9/12
Diamond D200	II	35.6	27	9/12
Mustang M-1225	II	35.5	25	9/14
Mustang EXP-13	II	35.4	25	9/12
Agripro AP2190	II	35.4	26	9/15
Curry CBS-270	II	35.3	23	9/11
Hoegemeyer 281	II	35.1	25	9/11
Northrup King S23-03	II	35.1	28	9/11
Mead CK	III	35.0	25	9/20
Golden Harvest X261	II	34.9	26	9/12
Star 8826	II	34.9	25	9/14
Hack	II	34.6	23	9/14
Dahlgren DG-3220	II	34.6	25	9/10
Mustang M-1220A	II	34.2	26	9/10

Table 4. 1988 Group II Soybeans Continued

Variety Name	Mat. Group	Yield Bu/A	Plant Height	Mature Mo/Da
Nebsoy	II	34.2	27	9/14
Golden Harvest H1233	II	34.1	24	9/17
Fontanelle 4309	II	33.7	24	9/17
Northrup King B236	II	33.7	25	9/14
Hoyt (S-D)	II	33.7	18	9/16
Agripro AP2021	II	33.5	24	9/14
Elgin	II	33.2	20	9/13
Latham L-650	II	33.1	23	9/13
Miami	II	32.3	27	9/13
Harcor	II	30.8	29	9/12
Sibley CK	I	30.4	25	9/6
Corsoy 79 CK	II	29.9	24	9/11
Curry CBS-202	II	29.1	23	9/9
Diamond D190	II	25.2	23	9/4
Overall Mean		36.0	25	9/13

LSD (.05) = 5.0205
CV = 10.0%
Planted - May 16
Harvested October 6

Table 5. Corn Performance Trial, Early, Southeast Farm, 1988.

Brand and Hybrid	Type and Cross	Yield Bu/A	Percent Moisture	Performance Score Rating
Fontanelle 4035	E 2X	85.6	17.9	1
Hoegemeyer SX2566	E 2X	82.2	16.1	2
Pioneer 3379	M 2X	79.3	21.2	4
Tecnagene DF6805	M 2X	79.0	14.2	3
Agripro AP525	M 2X	77.3	19.9	5
Hoegemeyer SX2628	M 2X	77.1	20.3	6
Golden Harvest X723	M 2X	74.6	17.8	8
Northrup-King S5750	M 2X	74.6	15.6	7
Cargill 6227	M 2X	74.2	20.7	12
Asgrow/O'Gold RX626	L 2X	72.7	14.5	9
Pioneer 3615	M 2X	70.8	12.9	10
Pioneer 3585	M 2X	69.9	12.6	11
Tecnagene DF6807	M 2X	69.8	15.9	13
Lincoln EX 105	M 2X	69.1	17.4	17
Northrup King N4545	M 2X	67.9	13.2	14
Seedtec ST7446	M 2X	67.8	14.3	16
Betagold Karla	M 2X	67.3	13.0	15
Top Farm 1106	M 2X	66.8	14.5	18
Kaltenburg K6300	M 2X	66.0	16.3	21
DeKalb DK535	M 2X	65.4	14.0	19
Terra TR 164E	M 2X	65.0	13.5	20
Golden Harvest X615	M 2X	64.8	20.8	28
Terra TR 1040	M 2X	64.3	18.0	26
Betagold Hanna	M 2X	64.2	13.3	22
Northrup King S5340	M 2X	64.1	18.1	27
Pioneer 3569	M 2X	62.8	13.1	23
Interstate IS543	M 2X	62.6	14.1	24
DeKalb DK547	M 2X	62.5	14.2	25
Curry 1460	M 2X	62.4	17.7	30
Sigco 1814	L 2X	62.1	19.1	35
Interstate IS613	L 2X	62.1	17.8	31
Asgrow/O'Gold RX578	L 2X	62.0	15.9	29
Top Farm 109	M 2X	61.7	18.3	34
S-Brand SS-44	M 2X	61.2	18.8	38
Fontanelle 4230	M 2X	60.7	17.4	37
NC+ 4131	E 2X	60.0	17.4	40
Seedtec ST7440	M 2X	59.9	14.5	33
Fontanelle 4030	E 2X	59.8	14.1	32
Dahlgren DC-535	M 2X	59.5	18.4	42
Tecnagene DF6802	M 2X	59.1	13.6	36
Betagold Maria	M 2X	58.4	18.2	44
Interstate IS593A	L 2X	58.2	17.1	43
Hoegemeyer SX2617	M 2X	58.1	14.7	41
Sigco 1701	M 2X	58.0	13.2	39
Pfister 2300	M 2X	55.9	18.2	48
Kaltenburg K5200	M 2X	55.1	13.4	46
Garst 8708	M 2X	55.0	12.5	45

Table 5. Corn Performance Trial Continued

Brand and Hybrid	Type and Cross	Yield Bu/A	Percent Moisture	Performance Score Rating
Agripro 680	M 2X	54.8	18.4	50
Hawkeye SX43	M 2X	54.0	18.1	51
Agripro AP364	M 2X	53.6	14.6	49
Crow's 344	M 2X	53.2	13.0	47
Cargill 6127	M 2X	52.8	16.2	52
Wilson 1500B	M 2X	51.8	18.0	53
Pioneer 3475	M 2X	49.0	12.7	54
Terra TR 103E	M 2X	48.8	13.1	55
Pfister 2250	M 2X	47.9	15.5	56
SDAES Check 4	E 2X	36.2	11.6	57
Means		63.1	16.0	

LSD .05 = 17.3 Bu/A
CV - 19.7%
Planting Date - May 4
Harvest Date - October 12

Table 6. 1988 Corn Performance Trial, (Late) SE Farm, 1988

Brand and Variety	Type and Cross	Yield Bu/A	Percent Moisture	Performance Score Rating
Wilson 1670	L 2X	77.3	20.5	1
S-Brand SS-54A	L 2X	77.0	21.4	2
NC+ 4616	M 2X	74.3	20.8	3
Fontanelle 4280	M 2X	72.5	19.9	5
Wilson 1640	L 2X	72.3	19.0	4
Hoegemeyer SX2673	L 2X	71.8	24.4	8
Dahlgren DC-541	L 2X	70.4	19.2	6
Northrup King N6348	L 2X	70.2	20.5	7
Asgrow/O'Gold Rx746	L 2X	68.3	19.7	9
Supercrost Exp 8110	L 2X	67.3	21.2	10
S-Brand SS-57A	L 2X	64.7	20.3	11
Cargill 7877	L 2X	63.5	20.4	13
Tecnagene DF8812	L 2X	63.2	19.5	12
Horizon 7113	L 2X	62.8	20.9	15
Kaltenberg K7500	L 2X	62.0	19.2	14
Crow's 488	L 2X	61.8	19.7	16
Curry SC1479	L 2X	61.5	21.1	20
Curry SC1480	L 2X	61.4	19.3	17
Jacques 7770	L 2X	61.1	19.4	19
Horizon 7115	L 2X	61.0	18.9	18
Hoegemeyer SX2632	L 2X	59.2	20.0	22
Supercrost 4386	M 2X	58.6	17.9	21
McCurdy 6660	L 2X	58.6	19.3	23
Jacques 7820	L 2X	57.0	24.2	28
S-Brand SS-62A	L 2X	55.7	22.5	29
DeKalb T1100	L 2X	55.6	19.8	26
Terra-TR1125	L 2X	55.4	19.1	25
Supercrost 2989	L 2X	54.8	17.4	24
Jacques 6770	L 2X	53.9	17.2	27
Cargill 7993	L 2X	50.8	21.7	30
Dahlgren DC-545	L 2X	50.3	22.0	33
Tecnagene DF8814	L 2X	50.1	21.6	32
Interstate IS663	L 2X	49.8	23.0	35
DeKalb DK636	L 2X	49.3	22.2	36
S-Brand SS-60C	L 2X	48.8	18.7	31
Top Farm SX1112	L 2X	47.9	17.4	34
Lincoln 5422	L 2X	46.9	23.7	40
Hawkeye SX56	L 2X	46.8	23.2	39
Interstate IS613	L 2X	46.4	17.7	37
Garst 8555	L 2X	45.5	17.6	38
Cargill 6927	L 2X	44.2	19.0	41
Continental 8707	L 2X	44.2	24.1	42
Northrup King S7751	L 2X	42.9	23.1	44
Kaltenberg K7400	L 2X	42.4	21.6	43
SOAES Check 1	L 2X	38.8	23.5	46
Golden Harvest H2486	L 2X	38.1	15.6	45
NC+ 5990	L 2X	37.6	22.3	47
Terra TR1120	L 2X	34.9	22.7	48
Means		56.4	20.5	

LSD .05 17.2 Bu/A CV - 21.9%

Planted May 4 Harvested - October 12

Table 1. Continued

Cultivar	1986 2-cut Total	1987 3-cut Total	1988 Forage Yield (tons DM/A) Cut 1 6/14	Cut 2 7/14	Cut 3 8/23	3-Cut Total	3 Year Avg	% Relative Performance[a]
MTO S82[b]	2.77	5.07	1.86	0.56	0.09	2.51	3.45	91
Rangelander	2.52	4.87	2.24	0.61	0.07	2.93	3.44	91
Vernal	2.10	5.52	1.75	0.30	0.12	2.17	3.26	86
MTO N82[b]	1.93	4.96	2.18	0,52	0.09	2.79	3.23	85
Roamer	1.99	4.90	1.94	0.56	0.09	2.59	3.16	84
Drylander	1.80	4.70	1.86	0.32	0.05	2.23	2.91	77
Average	2.48	5.92	2.14	0.65	0.14	2.94	3.78	
LSD (0.05)	0.55	0.77	NS	NS	0.08	NS	0.59	

[a] % Relative performance = cultivar 3 yr average yield/3 yr average of all cultivars.

[b] Experimental line, currently not marketed.

Table 2. Forage yield of 35 alfalfa cultivars planted April 22, 1987 at the Southeast Research Station, Beresford, SD.

Cultivar	1987 1-Cut Total	1988 Yield (tons DM/A) Cut 1 6/14	Cut 2 7/14	Cut 3 8/23	3-Cut Total	2 year Avg	% Relative Performance[a]
SX 217	0.93	2.74	1.31	0.62	4.67	2.80	124
DK 135	1.03	2.64	1.31	0.41	4.36	2.70	119
MTO S82[b]	0.77	2.99	1.18	0.43	4.59	2.68	118
Vernal	0.69	2.79	1.28	0.43	4.50	2.60	115
Sarana[c]	0.80	2.82	1.16	0.34	4.32	2.56	113
GH 737	0.87	2.37	1.07	0.71	4.15	2.51	111
Dynasty	0.95	2.61	1.13	0.33	4.07	2.51	111
FSRC H-170[b]	0.79	2.45	1.14	0.53	4.11	2.45	108
FSRC H-172[b]	0.84	2.55	1.06	0.43	4.03	2.44	107
120	0.76	2.55	1.04	0.50	4.10	2.43	107
Mohawk	0.65	2.50	1.11	0.49	4.10	2.38	105
Cimarron	0.78	2.43	1.09	0.44	3.96	2.37	105
Iroquois	0.62	2.49	1.11	0.51	4.11	2.36	104
636	0.71	2.53	1.12	0.35	4.00	2.36	104
Commandor	0.77	2.50	1.00	0.45	3.94	2.36	104
XPH 2001	0.72	2.44	1.05	0.43	3.92	2.32	102
Fortress	0.97	2.34	0.93	0.37	3.64	2.30	102
Big 10	0.94	2.53	0.86	0.26	3.66	2.30	102
Blazer	0.79	2.58	0.78	0.35	3.71	2.25	99
Arrow	0.69	2.41	0.98	0.40	3.79	2.24	99
FSRC IH-171[b]	1.03	1.96	0.93	0.46	3.35	2.19	97
Dart	0.73	2.33	0.90	0.40	3.63	2.18	96
5432	0.64	2.30	1.05	0.35	3.70	2.17	96
SX 424	0.67	2.47	0.97	0.24	3.67	2.17	96
NAPB 31	0.71	2.40	0.91	0.27	3.58	2.14	94
MTO N82[b]	0.52	2.61	0.92	0.15	3.68	2.10	93
526	0.59	2.34	1.03	0.23	3.61	2.10	93
FSRC H-174[b]	0.77	2.21	0.93	0.24	3.38	2.08	92
Apollo Supreme	0.67	2.21	0.84	0.33	3.38	2.03	90
Saranac AR	0.65	2.21	0.82	0.27	3.30	1.98	87
WL 225	0.88	2.22	0.67	0.13	3.03	1.96	86
Salute	0.64	2.19	0.71	0.27	3.17	1.90	84
532	0.62	2.08	0.79	0.22	3.08	1.85	82
Endure	0.63	2.10	0.70	0.19	3.00	1.82	80
Magnum III	0.94	1.88	0.57	0.13	2.57	1.76	78
Average	0.76	2.42	0.98	0.36	3.77	2.27	
LSD (0.05)	NS	NS	NS	NS	NS	NS	

[a] % Relative performance = cultivar 2-yr average yield/2-yr average of all cultivars.

[b] Experimental line, currently not marketed.

HERBICIDE DEMONSTRATIONS AND HERBICIDE RESEARCH 1988

L. J. Wrage and P. O. Johnson

Plant Science 88-19

CORN AND SOYBEAN HERBICIDE DEMONSTRATION

L. J. Wrage and P. O. Johnson

PURPOSE:

Evaluate performance of labeled and experimental herbicides for weed control and crop tolerances. Demonstration plots provide side-by-side comparisons. Plots were used in field tours and data collected is being presented in educational meetings.

METHODS:

	Corn	Soybeans
Plot Design:	Demonstration	Demonstration
Plot Size:	20' x 50'; each tillage	20' x 50'; each tillage
Previous Crop:	Corn	Corn
Soil:	Silty clay loam; 3.2% OM; 6.2 pH	Silty clay loam; 3.2% OM; 6.2 pH
Crop:	Pioneer 3906	Hardin
Planted:	5/5/88	5/13/88
Cultivation:	None	None
Herbicide: PPI:	5/5/88	5/13/88
PRE:	5/5/88	5/13/88
EPOST:	5/27/88	N/A
POST:	6/7/88	6/8/88
Evaluated:	6/24/88	6/29/88
Rainfall: 1st week	.28 inches	.03 inches
2nd week	.03 inches	1.67 inches

RESULTS:

Herbicides were broadcast over chiseled or plowed seedbed. Spring tillage was the same for both crop sites.

Foxtail was heavy; significant yellow foxtail was present in late fall. Tall waterhemp was heavy. Variation between plowed and disked seedbed were not consistent. Half of each plot was cultivated; evaluations are for uncultivated treatments.

Corn: Rainfall during the first two weeks after planting was less than required for maximum performance for some preemergence treatments. However, several treatments performed very well. Fourteen plots in the plowed seedbed and 4 plots in the disked seedbed rated above 95% control for both grassy and broad-leaved weeds.

Soybeans: Significant rainfall was received the second week after planting; germination of some weed seeds had started during the first week. Control was generally 5 to 15% less than experienced with more favorable moisture. Twenty treatments in both disked and plowed seedbed exceeded 90% control on both grassy and broadleaved weeds.

Table 1 . Corn Herbicide Demonstration

		1988**				3-Year Average			
		Disked		Plowed		Disked		Plowed	
Treatment	lb/A act.	Gr	Bdlf	Gr	Bdlf	Gr	Bdlf	Gr	Bdlf
		% Control							
PREPLANT INCORPORATED									
Check	----	0	0	0	0	0	0	0	0
Eradicane	4	97	89	96	94	82	62	86	70
Eradicane+atrazine	4+1	97	97	96	98	88	91	91	94
Eradicane+Bladex	4+2	96	95	97	96	87	85	93	91
Eradicane+Bladex+atrazine	2+1.6+.5	92	98	95	98	--	--	--	--
Eradicane+Bladex+atrazine	4+.5+1.5	98	98	98	99	91	93	96	97
Sutan+	4	89	76	92	82	84	57	75	53
Sutan+ +atrazine+Bladex	4+.5+1.5	91	92	96	97	86	89	95	96
SHALLOW PREPLANT INCORPORATED									
Atrazine	2.5	79	93	90	96	81	90	90	95
Atrazine+Bladex	.75+2.25	72	90	89	82	--	--	--	--
Lasso	3	88	85	96	87	67	60	81	67
Dual	2.5	86	79	94	82	73	48	85	58
PREEMERGENCE									
Atrezine	2.5	64	94	89	96	76	89	89	94
Bladex	3	82	41	92	58	69	44	87	61
Check	----	0	0	0	0	0	0	0	0
Dual	2.5	89	78	90	82	82	54	90	75
Lasso	3	93	83	94	88	78	59	92	78
Prowl	1.5	80	69	90	74	65	62	84	68
Remrod	6	95	80	96	83	77	41	92	58
*Tophand	2.34	94	91	98	98	--	--	--	--
*Tophand+atrazine	1.41+1	91	94	95	97	--	--	--	--
Lasso+atrazine	2+1	84	92	96	97	75	84	94	94
Lasso+atrazine+Banvel	2+1+.5	90	96	94	96	--	--	--	--
Lasso+Bladex	1.25+2	90	87	90	86	82	75	93	90
Lasso+Bladex	2+2	94	92	94	92	--	--	--	--

Table 1 Continued

Treatment	lb/A act.	1988** Disked Gr	1988** Disked Bdlf	1988** Plowed Gr	1988** Plowed Bdlf	3-Year Average Disked Gr	3-Year Average Disked Bdlf	3-Year Average Plowed Gr	3-Year Average Plowed Bdlf
Dual+atrazine	2+1	90	95	92	94	81	83	91	91
Dual+Bladex	2+2	82	76	90	86	81	75	91	84
Atrazine+Bladex	.75+2.25	84	88	94	90	80	73	90	84
Ramrod+Bladex	4+2	94	80	96	84	81	65	93	78
Lasso+Bladex+atrazine	2+1.5+.5	96	94	97	94	82	77	92	93
Dual+Bladex+atrazine	2+1.5+.5	92	91	96	90	81	80	92	90
Prowl+Bladex+atrazine	1+.6+.6	96	97	98	98	--	--	--	--
EARLY POSTEMERGENCE									
Prowl+atrazine	1.5+1	86	98	81	95	79	91	86	94
Prowl+Bladex	1.5+1.5	89	96	84	96	80	77	89	81
Prowl+Bladex+atrazine	1+.6+.6	84	94	86	95	--	--	--	--
Atrazine+COC	1.5+1 qt	85	97	96	96	66	90	88	95
Bladex+X-77	2+.5%	84	95	94	97	79	65	91	70
Tandem+Bladex+X-77	.5+1.5+.5%	88	98	96	98	81	63	92	69
Tandem+Bladex+atrazine+X-77	.5+1+.5+.5%	76	93	78	93	80	68	86	77
Bladex+atrazine+X-77	1.5+.5+.5%	62	82	78	70	70	77	85	75
PREEMERGENCE & EARLY POSTEMERGENCE									
Ramrod&Banvel+Bladex	4&.25+1.5	96	98	98	98	--	--	--	--
Ramrod&Banvel	4&.5	90	93	96	98	63	89	90	95
PREEMERGENCE & POSTEMERGENCE									
Ramrod&Banvel	4&.25	82	92	92	94	59	86	84	87
Ramrod&2,4-D amine	4&.5	82	82	94	93	59	79	83	85
Ramrod&Basagran+COC	4&1+1 qt	86	94	96	96	58	78	84	83
Ramrod&Basagran+ atrazine+COC	4&.52+.52+1 qt	83	90	97	98	--	--	--	--
Ramrod&Buctril	4&.38	82	88	98	98	57	71	82	81
Ramrod&Buctril+atrazine	4&.25+.5	90	95	98	98	64	86	88	90
Ramrod&Banvel+atrazine	4&.25+.5	81	92	94	94	62	88	84	84
Ramrod&Buctril+Bladex	4&.25+.5	92	93	94	96	64	86	86	82
Ramrod&Banvel+atrazine	4&.5+1	92	98	96	98	--	--	--	--
POSTEMERGENCE									
*M6316+COC	.0039+1 qt	68	92	65	98	--	--	--	--
EARLY POSTEMERGENCE & POSTEMERGENCE									
*Banvel&Exp. #1+X-77	.5&.0625+.25%	94	98	95	99	--	--	--	--

* Experimental ** Average 3 ratings/plot
Gr = Green foxtail, yellow foxtail
Bdlf = Tall water hemp, rough pigweed, lambsquarter

Table 2 . Soybean Herbicide Demonstration

		1988**				3-Year Average			
		Disked		Plowed		Disked		Plowed	
Treatment	lb/A act.	Gr	Bdlf	Gr	Bdlf	Gr	Bdlf	Gr	Bdlf
		- - - - - - - - -% Control - - - - - - -							
PREPLANT INCORPORATED									
Check	----	0	0	0	0	0	0	0	0
Vernam	2.5	69	83	74	83	54	67	75	67
Treflan	.75	95	90	90	88	82	79	85	84
Sonalan	1	96	92	95	93	85	82	89	88
Prowl	1.25	94	89	92	90	86	83	84	82
Treflan+Sencor/Lexone	.75+.38	94	98	95	98	86	92	92	92
Command	1	82	65	89	70	--	--	--	--
Commence	1.31	93	92	92	90	--	--	--	--
Treflan+Command	.75+.75	90	95	91	90	--	--	--	--
Amiben+Command	1.8+.5	88	95	90	81	--	--	--	--
Command+Sencor/Lexone	.75+.25	93	98	93	84	--	--	--	--
*Treflan+Pursuit	.75+.06	98	99	98	99	--	--	--	--
Treflan+Scepter	.75+.067	96	99	95	98	--	--	--	--
Treflan+Scepter	.75+.125	98	99	98	99	--	--	--	--
Sonalan+Scepter+Sencor/Lexone	.75+.067+.25	99	99	99	99	--	--	--	--
Sonalan+Scepter+Command	.75+.067+.5	98	99	98	99	--	--	--	--
Commence+Sencor/Lexone	1.31+.3	96	99	97	99	--	--	--	--
*Prowl+Pursuit	1+.078	96	99	98	98	--	--	--	--
SHALLOW PREPLANT INCORPORATED									
Lasso	3	81	87	90	81	70	71	84	73
Dual	2.5	80	77	85	70	68	51	85	63
Dual+Command	2+.75	83	77	88	78	--	--	--	--
Lasso+Treflan	2+.75	89	89	93	96	--	--	--	--
*Lasso+Pursuit	2+.078	95	99	95	98	--	--	--	--
Lasso+Scepter	2+.125	93	99	94	99	--	--	--	--
PREPLANT INCORPORATED & PREEMERGENCE									
Treflan+Sencor/Lexone& Sencor/Lexone	.75+.25&.38	98	99	97	98	87	91	96	97
Treflan&Sencor/Lexone	.75&.5	98	99	96	98	89	93	95	97
PREEMERGENCE									
Amiben	3	62	70	93	86	67	79	90	89
Lasso	3	91	86	90	70	81	80	89	80
Dual	2.5	84	78	86	61	85	77	86	73
Lasso+Sencor/Lexone	2+.5	82	91	78	81	79	89	82	89
Dual+Sencor/Lexone	2+.5	81	91	70	45	81	87	75	78
*Lasso+Pursuit	2+.063	97	99	83	97	--	--	--	--
Lasso+Scepter	1.5+.067	84	97	74	96	--	--	--	--
Lasso+Scepter	2+.125	88	98	84	95	--	--	--	--

Table 2 Continued.

Treatment	lb/A act.	1988** Disked Gr	Bdlf	Plowed Gr	Bdlf	3-Year Average Disked Gr	Bdlf	Plowed Gr	Bdlf
		- - - - - - - - -% Control	- - - - - - -						
PREEMERGENCE (Continued)									
Lasso+Amiben	2+2	91	93	92	93	85	87	92	95
Lasso+Lorox	2+1	70	75	84	80	71	76	80	80
Lasso+Amiben+Sencor/Lexone	3+2+.25	95	97	97	99	83	90	96	98
*Cinch+Sencor/Lexone	1.3+.43	89	96	91	97	--	--	--	--
*Cinch+Scepter	1.3+.125	84	62	88	80	--	--	--	--
Check	----	0	0	0	0	0	0	0	0
PREEMERGENCE & POSTEMERGENCE									
*Lasso&Pursuit+X-77	2&.063+.25%	91	87	89	89	--	--	--	--
Lasso&Basagran+COC	2&1+1 qt	77	89	79	87	74	90	87	93
Lasso&Blazer/Tackle+X-77	2&.5+.5%	85	94	85	95	87	94	91	95
Lasso&Cobra+X-77	2&.2+.125%	79	97	78	98	--	--	--	--
*Lasso&M6316+X-77	2&.0625+.25%	85	98	82	96	--	--	--	--
Lasso&Blazer/Tackle+ Basagran+X-77	2&.38+.25+.5%	84	97	85	98	83	94	88	97
Lasso&Classic+X-77	2&.016+.25%	78	98	81	98	--	--	--	--
POSTEMERGENCE									
Fusilade 2000+COC	.187+1 qt	61	0	65	0	72	0	77	0
Poast+COC	.2+1 qt	81	0	77	0	86	0	88	0
Whip+COC	.15+1 qt	76	0	75	0	--	--	--	--
Assure+COC	.0875+1 qt	79	0	85	0	--	--	--	--
*Assure+M6316+X+77	.0875+.0625+.25%	42	96	48	95	--	--	--	--
Poast+Blazer/Tackle+ Basagran+COC	.3+.25+.5+1 qt	92	94	90	95	89	90	90	87

* Experimental ** Average 3 ratings/plot

Gr = Green foxtail, yellow foxtail

Bdlf = Tall waterhemp, rough pigweed, lambsquarter

VELVETLEAF CONTROL IN SOYBEANS

L. J. Wrage and P. D. Johnson

PURPOSE:

Evaluate labeled and experimental herbicides for velvetleaf control in soybeans. Treatments included low rate combinations.

METHODS:

Plot Design:		RCB; 2 reps
Plot Size:		10' x 50'
Previous Crop:		Corn
Soil:		Silty clay loam; 3.2% OM; 6.9 pH
Crop:		Hardin
Planted:		5/13/88
Cultivation:		None
Herbicide:	PPI:	5/13/88
	PRE:	5/13/88
	POST:	6/8/88
	LPOS:	6/15/88
Evaluated:		6/15/88
Rainfall:	1st week	.03 inches
	2nd week	1.67 inches

RESULTS:

Plots were established in an area with light natural infestation. Velvetleaf was overseeded before tillage and before final incorporation pass. Weed stand was heavy and uniform. Differential control was apparent. Competition reduced yield over 20 bu/A. Soil incorporated treatments that included Command, Sencor/Lexone, Scepter or Pursuit provided the most consistent control. Several exceeded 95% control. Performance may be 5 to 10% less in very heavy soil with a long term history for velvetleaf.

Table 3. Velvetleaf/Soybean Screening

		1988		2-Year Average	
Treatment	lb/A act.	% Control Vele	Yield bu/A	% Control Vele	Yield bu/A
PREPLANT INCORPORATED					
Check	----	0	3.6	0	13.9
Prowl	1.25	50	6.5	29	18.7
Vernam	2.5	30	4.7	41	17.3
Treflan+Sencor/Lexone	.75+.38	99	18.4	97	35.2
Command	.75	86	20.2	91	37.0
Command	1	92	19.3	96	34.2
Commence	1.31	88	16.4	88	32.5
Check	----	0	7.3	--	----
*Commence+Pursuit	1.31+.063	94	16.2	--	----
Commence+Scepter	1.31+.063	90	17.5	--	----
Commence+Scepter+ Sencor/Lexone	1.31+.063+.25	98	13.0	--	----
Commence+Sencor/Lexone	1.31+.38	98	22.0	97	36.8
Salute+Command	1.125+.56	98	25.0	--	----
Sencor/Lexone+Command	.25+.55	97	27.8	97	38.6
Amiben+Command	2+.55	92	25.3	94	35.5
Treflan+Scepter	.75+.063	80	23.0	--	----
Treflan+Scepter	.75+.125	90	24.2	92	34.4
*Prowl+Pursuit	1+.063	97	21.3	98	28.4
Sonalan+Scepter+ Sencor/Lexone	1+.063+.25	98	21.8	--	----
Sonalan+Scepter+Command	1+.063+.5	89	15.1	--	----
SHALLOW PREPLANT INCORPORATED					
Lasso+Scepter	2+.125	84	18.4	--	----
*Lasso+Pursuit	2+.063	90	18.6	--	----
Lasso+Command+Scepter	1.5+.25+.0937	92	19.0	--	----
PREPLANT INCORPORATED & PREEMERGENCE					
Treflan&Sencor/Lexone	.75&.5	82	18.0	--	----
Treflan+Sencor/Lexone& Sencor/Lexone	.75+.25&.38	98	14.9	98	28.5
PREEMERGENCE					
Lasso+Sencor/Lexone	2+.5	74	9.6	84	27.8
Dual+Sencor/Lexone	2+.5	72	12.5	83	27.4
Lasso+Scepter	1.5+.0937	66	9.5	--	----
Lasso+Scepter	2+.125	66	13.9	--	----
*Lasso+Pursuit	2+.063	75	12.9	--	----

Table 3 Continued

Treatment	lb/A act.	1988 % Control Vele	1988 Yield bu/A	2-Year Average % Control Vele	2-Year Average Yield bu/A
PREEMERGENCE (Continued)					
Amiben	3	82	23.7	82	32.5
Lasso+Lorox	2+1	32	7.3	40	13.8
Lasso+Amiben	2+2	82	16.2	82	29.1
Check	----	0	7.8	0	11.7
PREPLANT INCORPOORATED & POSTEMERGENCE					
Treflan&Tackle/ Blazer+28% N	.75&.5+1 gal	59	11.1	--	----
Treflan&Tackle/ Blazer+Basagran+28% N	.75&.25+.5+1 gal	58	12.8	--	----
Treflan&Basagran+28% N	.75&1+1 gal	82	13.8	--	----
Treflan&Basagran+COC	.75&.75+1 qt	62	10.7	73	24.8
Treflan&Basagran+28% N	.75&.75+1 gal	83	11.1	87	27.7
Treflan&Basagran+ Dash+28% N	.75&.75+1 qt+1 gal	82	16.6	87	28.4
PREPLANT INCORPORATED & POSTEMERGENCE & LATE POSTEMERGENCE					
Treflan&Basagran+28% N& Basagran+28% N	.75&.5+1 gal& .5+1 gal	75	18.5	85	30.9
PREPLANT INCORPORATED & POSTEMERGENCE					
Treflan&Cobra+28% N	.75&.2+1 gal	71	15.1	--	----
Treflan&Cobra+COC	.75&.2+1 pt	72	12.6	--	----
Treflan&Classic+28% N	.75&.0117+1 gal	54	7.0	--	----
Treflan&Classic+X-77	.75&.0117+.25%	40	10.4	--	----
*Treflan&M6316+X-77+28% N	.75&.0039+.25%+1gal	55	8.8	--	----
*Treflan&M6316+Classic+ X-77+28% N	.75&.0039+.0026+ .25%+1 gal	55	13.4	--	----
*Treflan&Pursuit+X-77	.75&.063+.25%	54	14.0	--	----
*Treflan&Pursuit+ X-77+10-34-0	.75&.063+ .25%+1 gal	60	14.0	67	28.6
*Treflan&Tackle/Blazer+ Pursuit+X-77	.75&.25+.045+.25%	50	5.9	--	----
*Treflan&Tackle/Blazer+ Pursuit+X-77	.75&.25+.063+.25%	42	9.1	--	----
*Treflan&Tackle/Blazer+ Pursuit+28% N	.75&.25+.063+1 gal	68	16.2	--	----
PREPLANT INCORPORATED & LATE POSTEMERGENCE					
Treflan&Amiben	.75&2.7	0	10.9	--	----
Check	----	0	4.3	--	----
Check	----	0	4.8	--	----

* Experimental   Vele = Velvetleaf

VELVETLEAF CONTROL IN CORN

L. J. Wrage and P. O. Johnson

PURPOSE:

Evalute labeled and experimental herbicides for velvetleaf control in corn. Treatments included low rate combinations.

METHODS:

Plot Design:		RCB; 2 reps
Plot Size:		10' x 50'
Previous Crop:		Corn
Soil:		Silty clay loam; 3.2% OM; 6.2 pH
Crop:		Pioneer 3615
Planted:		5/10/88
Cultivation:		None
Herbicide:	PPI:	5/10/88
	PRE:	5/10/88
	EPOS:	6/1/88
	POST:	6/8/88
	LPOS:	6/14/88
Evaluated:		6/25/88
Rainfall:	1st week	0.00 inches
	2nd week	1.70 inches

RESULTS:

Uniform, heavy weed pressure. Partial natural infestation, overseeded before tillage and final, shallow tillage. Infestation reduced yield over 60%. Eradicane and atrazine combination treatment at planting or an atrazine containing treatment followed by a postemergence herbicide were generally the most effective systems. The effect of early season competition was apparent. Yields indicate the crop failed to respond when weeds were removed with several postemergence treatments which included no planting-time control. An atrazine rate response was evident with some treatments. Crop injury was noted with 2,4-D. The two-year average compares performance for 1987-88.

Table 4. Velvetleaf/Corn Screening

Treatment	lb/A act.	1988 Control % Vele	1988 Yield bu/A	2-Year Average Control % Vele
PREPLANT INCORPORATED				
Check	----	0	41.4	0
Eradicane	4	76	87.4	78
Eradicane	6	83	93.9	87
Eradicane+atrazine	4+1.5	90	104.8	90
Eradicane+Bladex	4+2	96	93.9	93
Eradicane+Bladex+atrazine	4+1.5+1	90	104.8	90
Bladex	3	77	83.0	--
Atrazine	3	94	89.5	96
PREPLANT INCORPORATED & POSTEMERGENCE				
Eradicane&atrazine+COC	4&1.5+1 qt	90	98.3	84
Eradicane&2,4-D amine	4&.5	92	87.3	86
PREEMERGENCE				
Atrazine	3	64	55.7	72
Prozine	4	65	58.9	--
Bladex+atrazine	3+1	55	61.1	72
Lasso+Bladex	2+2	48	54.5	63
Dual+atrazine	2+1	50	41.5	--
Dual+atrazine	2+2	49	65.8	--
Dual+atrazine+Bladex	2+1+1.5	51	51.3	64
Atrazine+Banvel	1+.5	88	52.4	--
EARLY POSTEMERGENCE				
Prozine	4	90	72.1	--
Prowl+Bladex	1.5+1.5	96	77.5	--
Atrazine+COC	1+1 qt	45	38.3	62
Atrazine+COC	2+1 qt	69	62.3	80
Bladex+X-77	2+.25%	77	40.4	82
Bladex+atrazine+X-77	1.5+.5+.25%	84	45.8	91
PREEMERGENCE & POSTEMERGENCE				
Ramrod&Banvel	5&.5	64	57.9	81
Ramrod&Buctril+atrazine	5&.38+.5	92	65.5	95
Ramrod&Buctril+atrazine	5&.38+1.5	89	61.2	94
Ramrod&Banvel+atrazine	5&.25+.5	48	55.7	73
Ramrod&Banvel+atrazine	5&.25+1.5	60	60.0	80
Ramrod&Laddok+28% N	5&1.04+1 gal	82	35.0	--
Ramrod&Laddok+Dash	5&1.04+1 qt	68	45.9	--
Ramrod&Laddok+COC	5&1.04+1 qt	75	61.1	--

Table 4 Continued

Treatment	lb/A act.	1988 Control % Vele	1988 Yield bu/A	2-Year Average Control % Vele
PREEMERGENCE & POSTEMERGENCE (Continued)				
*Ramrod&M6316+COC	5&.0078+1 qt	45	32.8	--
*Ramrod&M6316+COC	5&.0156+1 qt	58	39.3	--
PREEMERGENCE & LATE POSTEMERGENCE				
Ramrod&Banvel	5&.25	89	35.0	84
Ramrod&2,4-D amine	5&.5	84	24.0	80
Ramrod&Buctril	5&.38	82	40.4	77
PREEMERGENCE & POSTEMERGENCE & LATE POSTEMERGENCE				
Ramrod&Buctril+atrazine& Buctril	5&.38+1.2&.25	96	35.0	98
Check	----	0	27.3	--
Check	----	0	25.1	--
LSD (.05)		15.6	33.1	16.2

*Experimental
Vele = Velvetleaf

INTERACTION OF HERBICIDE RATES WITH ROW CULTIVATION IN CONVENTIONAL TILLAGE

L. J. Wrage and P. O. Johnson

PURPOSE:

- Evaluate input levels of herbicide and cultivation on weed control, crop yield and returns in conventional till corn-soybean rotation.
- Determine the long-term effect of reduced levels of weed control on crop yield.
- Determine if herbicide rates can be reduced when used with cultivation.

Producers and research data indicate herbicide rates can be reduced in certain situations. However there is no consideration for long-term effects on weed population and no indication the practice can be continued each year as weed pressure increases. Row cultivation is one option to at least part of the herbicide inputs; however the level of each is not documented.

METHODS:

The study is designed in a corn-soybean rotation. Three herbicide levels representing 100%, 75% and 50% of labeled rate for a preplant, preemergence, and a banded and postemergence treatment are included for each crop. Each herbicide treatment includes 2 cultivation levels. The rotation is designed so the same herbicide and cultivation level will be maintained each year.

		Corn	Soybean
Plot Design:		RCB; 3 reps	RCB; 3 reps
Plot Size:		20' x 100'	20' x 100'
Soil:		Silty clay loam; 2.9% OM; 6.0 pH	Silty clay loam; 2.9% OM; 6.0 pH
Crop:		Northrup King 4545	Corsoy 79
Planted:		5/10/88	5/13/88
Herbicide:	PPI:	5/10/88	5/13/88
	PRE:	5/10/88	5/13/88
	POST:	6/1/88	6/1/88
Evaluated:		9/23/88	9/23/88
Rainfall:	1st week	0.00 inches	0.03 inches
	2nd week	1.70 inches	1.67 inches

RESULTS:

Weed pressure was generally light but uniform. Green foxtail and tall waterhemp were predominant. Weed control was evaluated by visual estimates and plant counts. Yields were harvested with field plot combine. The seedbed and soil conditions were excellent; crop stand uniform.

Even light weed pressure appeared to reduce yield. Reduced herbicide rates were adequate when one cultivation was added. Cultivation proved to be especially effective for this season's conditions. A very dry mid-season reduced later weed flushes. Data in succeeding years will determine if reduced herbicide inputs with cultivation will be adequate if weed populations increase.

Table 5. Corn Cultivation Study

Treatment	Cultivation	lb/A act.	Plants/sq yd Gr	Plants/sq yd Bdlf	% Control Gr	% Control Bdlf	Yield bu/A
PREPLANT INCORPORATED							
Eradicane+Bladex		2+1	1.67	0.67	97	97	66.3
Eradicane+Bladex		3+1.5	0.17	0.00	99	99	71.9
Eradicane+Bladex		4+2	0.00	0.00	99	99	67.1
Eradicane+Bladex	1 Cult.	2+1	0.33	0.00	99	99	79.6
Eradicane+Bladex	1 Cult.	3+1.5	0.17	0.00	99	99	77.2
Eradicane+Bladex	1 Cult.	4+2	0.17	0.00	99	99	70.2
---------------	2 Cult.		10.83	2.00	87	93	60.1
PREEMERGENCE							
Lasso (Band)	2 Cult.	3	0.83	0.50	97	97	68.1
POSTEMERGENCE							
Bladex	2 Cult.	2	1.00	0.33	97	98	71.2
PREEMERGENCE							
Lasso+Bladex		1+1	3.83	3.50	92	90	68.5
Lasso+Bladex		1.5+1.5	3.50	2.83	94	90	62.1
Lasso+Bladex		2+2	2.67	2.50	94	91	64.9
Lasso+Bladex	1 Cult.	1+1	0.50	0.33	98	98	68.1
Lasso+Bladex	1 Cult.	1.5+1.5	0.50	0.50	98	96	70.6
Lasso+Bladex	1 Cult.	2+2	0.50	0.17	98	99	72.3
LSD (.05)			4.05	1.61	4.0	3.1	22.3

Gr = Green foxtail
Bdlf = Tall Water Hemp

Table 6. Soybean Cultivation Study

Treatment	Cultivation	lb/A act.	Plants/sq yd Gr	Plants/sq yd Bdlf	% Control Gr	% Control Bdlf	Yield bu/A
PREPLANT INCORPORATED							
Sonalan+Sen/Lex		.5+.125	0.83	2.67	98	89	29.6
Sonalan+Sen/Lex		.75+.25	1.50	1.17	97	94	27.1
Sonalan+Sen/Lex		1+.38	1.17	0.33	97	97	28.8
Sonalan+Sen/Lex	1 Cult.	.5+.125	0.17	0.17	99	99	29.1
Sonalan+Sen/Lex	1 Cult.	.75+.25	0.17	0.00	99	99	31.3
Sonalan+Sen/Lex	1 Cult.	1+.38	0.17	0.00	99	99	27.1
---------------	2 Cult.	-----	1.50	5.33	95	83	24.9
PREEMERGENCE							
Dual (Band)	2 Cult.	2.5	0.50	1.17	97	95	27.9
POSTEMERGENCE							
Poast+Blazer+COC	2 Cult.	.2+.5+1 qt	3.00	4.50	93	83	26.6
PREEMERGENCE							
Dual+Sen/Lex		1+.25	10.00	2.00	81	91	23.2
Dual+Sen/Lex		1.5+.38	3.83	1.00	91	92	26.9
Dual+Sen/Lex		2+.5	3.50	1.33	90	95	26.4
Dual+Sen/Lex	1 Cult.	1+.25	1.17	1.83	96	91	29.3
Dual+Sen/Lex	1 Cult.	1.5+.38	1.83	0.00	96	98	32.5
Dual+Sen/Lex	1 Cult.	2+.5	0.83	0.50	98	97	31.0
	LSD (.05)		4.48	3.13	6.5	11.3	4.2

Gr = Green foxtail
Bdlf = Tall Water Hemp

COCKLEBUR SCREENING/SOYBEANS

L. J. Wrage and P. O. Johsnon

PURPOSE:

Evaluate labeled and experimental herbicides for cocklebur control in soybeans.

METHODS:

Plot Design:		RCB; 2 reps
Plot Size:		10' x 50'
Previous Crop:		Soybeans
Soil:		Silty loam; 2.9% OM; 6.0 pH
Crop:		Hardin
Planted:		5/17/88
Cultivation:		None
Herbicide:	PPI:	5/17/88
	PRE:	5/17/88
	EPOS:	6/8/88
	POST:	6/14/88
Evaluated:		8/11/88
Rainfall:	1st week	1.70 inches
	2nd week	0.00 inches

RESULTS:

Natural infestion. Treflan applied prior to planting. Heavy, uniform stand. Data based on visual observation reported for labeled herbicides. Several treatments provided excellent control. Differences visually apparent. Crop leaf response was less than for other years and was not recorded.

Table 7. Cocklebur/Soybean Screening

Treatment	lb/A act.	% Control Cocklebur	Yield bu/A
PREPLANT INCORPORATED			
Check	----	0	15.9
Scepter	.125	92	26.9
*Pursuit	.063	80	22.3
Sencor/Lexone	.38	82	21.9
PREPLANT INCORPORATED & PREEMERGENCE			
Sencor/Lexone&Sencor/Lexone	.38&.25	72	23.3
POSTEMERGENCE			
Basagran+COC	1+1 qt	98	25.6
POSTEMERGENCE & EARLY POSTEMERGENCE			
Basagran+COC&Basagran+COC	.5+1 qt&.5+1 qt	96	26.5
POSTEMERGENCE			
Cobra+COC	.2+1 pt	92	23.8
Tackle/Blazer+X-77	.5+.5%	62	20.2
Classic+X-77	.0117+.25%	90	25.2
Scepter+X-77	.125+.25%	94	25.5
*Pursuit+X-77	.063+.25%	94	24.0
*M6316+X-77	.0039+.25%	35	19.0
Rescue+COC	1.5+1 qt	82	23.8
Rescue+Tackle/Blazer+X-77	.75+.125+.5%	82	22.6
LSD (.05)		22.1	5.6

*Experimental

BLACK NIGHTSHADE HERBICIDE EVALUATION

L. J. Wrage and P. O. Johnson

PURPOSE:

To compare labeled herbicides for black nightshade control in soybeans. Herbicides are used at rates specified for this weed.

METHODS:

Plot Design:		RCB; 4 reps
Plot Size:		10' x 50'
Previous Crop:		Corn
Soil:		Silty loam; 2.9% OM; 6.0 pH
Crop:		Hardin
Planted:		5/17/88
Cultivation:		None
Herbicide:	PPI:	5/17/88
	PRE:	5/17/88
	EPOS:	6/14/88
	POST:	6/20/88
Evaluated:		10/6/88
Rainfall:	1st week	1.70 inches
	2nd week	0.00 inches

RESULTS:

Black nightshade emerged slowly. Density was light but uniform. Tall waterhemp became a significant weed and affected yield in 1988 more than nightshade. Five treatments exceeded 90% control. Late emerging nightshade was a problem in postemergence treatments lacking residual. Preplant incorporated treatments were usually superior to the same herbicides applied preemergence in 1988.

Table 8. Black Nightshade Herbicide Evaluation

Treatment	lb/A act.	1988 % Control Blns	1988 % Control Tawh	1988 Yield bu/A	3-Year Average % Blns	3-Year Average Yield bu/A
PREPLANT INCORPORATED						
Check	----	0	0	7.4	0	19.8
Treflan	.75	0	87	30.0	13	35.4
Sonalan	1.25	46	94	28.5	49	30.8
Lasso	3.5	86	87	27.1	89	36.2
Dual	3	67	87	27.6	80	36.1
Sonalan+Lasso	1.25+2.5	83	96	30.2	87	32.6
Sonalan+Dual	1.25+2	77	95	28.6	87	28.4
*Prowl+Pursuit	1+.063	98	96	29.3	--	----
Prowl+Scepter	1.25+.12	96	98	30.8	--	----
Command+Sonalan	.75+1.25	34	92	28.6	--	----
SHALLOW PREPLANT INCORPORATED						
Treflan+Lasso	.5+2	56	76	24.7	--	----
PREPLANT INCORPORATED & PREEMERGENCE						
Sonalan&Amiben	1.25&2	89	98	29.2	90	31.4
Sonalan&Lasso	1.25&2.5	92	99	29.3	94	31.3
Sonalan&Dual	1.25&2	79	98	29.9	89	32.2
PREEMERGENCE						
Amiben+Dual	2+2	64	95	27.2	84	33.1
Lasso+Amiben	2.5+2	68	89	30.3	84	36.1
Dual	2.5	45	66	10.4	61	27.2
Amiben	3	57	92	30.6	74	33.9
Lasso	3	61	69	23.6	81	34.1
PREPLANT INCORPORATED & EARLY POSTEMERGENCE						
Treflan&Cobra+X-77	.75&.2+.125%	94	96	30.0	--	----
Check	----	0	0	11.1	0	20.3
PREPLANT INCORPORATED & POSTEMERGENCE						
Treflan&Blazer+X-77	.75&.5+.5%	41	99	29.2	54	33.9
Treflan&Basagran+COC	.75&1+1 qt	29	94	25.4	44	33.2
Treflan&Blazer+ Basagran+X-77	.75&.125+.25+.5%	28	96	29.1	64	34.9
*Treflan&Pursuit+X-77	.75&.063+.25%	90	95	27.0	--	----
Treflan&Scepter+X-77	.75&.125+.25%	64	96	29.1	--	----
Treflan&Classic+X-77	.75&.0117+.25%	6	92	27.9	--	----
LSD (.05)		12.1	5.7	6.8	10.6	5.2

*Experimental

Blns = Blacknight shade

Tawh = Tall Water Hemp

INTERACTION OF HERBICIDE RATES WITH ROW CULTIVATION IN RIDGE-TILL

L. J. Wrage and P. O. Johnson

PURPOSE:

- Evaluate input levels of herbicide and cultivation on weed control, crop yield and returns in ridge-till corn-soybean rotation.
- Determine the long-term effect of reduced levels of weed control.
- Determine if herbicide rates can be reduced with normal operations in ridge-till systems.

Producers frequently suggest weed problems are reduced after 2-4 years of successful ridge-till. This study will evaluate the effectiveness of cultivation with several levels of herbicide inputs.

METHODS:

Three herbicide levels representing 100%, 75% and 50% of full labeled rate for preemergence herbicides and a banded application are compared to an untreated check. The same level of herbicide input will be maintained each year in the corn-soybean rotation.

Plot Design:	RCB; 3 reps	RCB; 3 reps
Plot Size:	25' x 100'	25' x 100'
Previous Crop:	Corn	Corn
Soil:	Silty clay loam; 3.1% OM; 6.0 pH	Silty clay loam; 3.1% OM; 6.0 pH
Crop:	Pioneer 3704	Century 84
Planted:	5/5/88	5/13/88
Herbicide: PRE:	5/5/88	5/13/88
Evaluated:	9/23/88	9/23/88
Rainfall: 1st week	0.28 inches	0.03 inches
2nd week	0.00 inches	1.67 inches

RESULTS:

Weed pressure was light; the area has been well managed and established in ridges previously. No significant differences in weed control or crop yield were noted in this initial year of the study. Crop yield was less on the ridge-system compared to the conventional companion study; some may be due to varietal differences. Some moisture stress could have occured in the ridges during the hot, dry mid-season period.

Table 9. Ridge-Till Study Corn

Treatment	lb/A act.	Plants/sq yd Gr	Plants/sq yd Bdlf	% Control Gr	% Control Bdlf	Yield bu/A
PREEMERGENCE						
3 Cultivations	-----	0.67	0.17	98	98	33.0
Lasso+Sencor/Lexone	1+.25	0.33	0.83	97	95	30.9
Lasso+Sencor/Lexone	1.5+.38	0.17	0.33	98	97	29.2
Lasso+Sencor/Lexone	2+.5	0.33	0.17	98	98	32.3
Lasso (Band) + Sencor/Lexone (Band)	2+.5	0.83	0.33	96	96	35.7
LSD (.05)		0.63	0.92	1.8	3.2	7.2

Table 10. Ridge-Till Study Soybeans

Treatment	lb/A act.	Plants/sq yd Gr	Plants/sq yd Bdlf	% Control Gr	% Control Bdlf	Yield bu/A
PREEMERGENCE						
Dual+Sencor/Lexone	1+.25	0.00	0.00	99	99	25.7
Dual+Sencor/Lexone	1.5+.38	0.00	0.00	99	99	22.2
Dual+Sencor/Lexone	2+.5	0.00	0.00	99	99	23.0
Dual (Band) + Sencor/Lexone (Band)	2+.5	0.00	0.17	99	99	23.0
3 Cultivations	----	0.17	0.83	97	95	20.6
LSD (.05)		0.24	0.32	1.8	1.5	5.7

Gr = Green foxtail
Bdlf = Red Root Pigweed

HERBICIDE CARRYOVER

L. J. Wrage and P. O. Johnson

PURPOSE:

Evaluate 1988 corn response to 1987 soybean herbicide treatments for velvetleaf control.

METHODS:

Plot Design:		RCB; 2 reps
Herbicides Applied:	PPI:	5/14/87
	PRE:	5/14/87
Herbicides 1988:		None
Crop 1988:		Corn - Pioneer 3704
Planted:		5/5/88
Cultivation:		1X
Soil pH:		6.9
O.M.		3.0
texture:		Silty clay loam
Precipitation:		
5/1/87 to 6/15/88		25.14 inches
Normal for this period		32.11 inches

RESULTS:

Corn was planted no-till as filler crop across 1987 soybean velvetleaf herbicide test area. No fall or preplanting tillage. Visual evaluations and measurements are reported for selected soil applied treatments.

No differences were noted at emergence to about 12-inch stage. Stunting in some treatments became apparent and remained evident for several weeks. Height differences were not visually apparent at harvest. Stand count and yield varied considerably but were not statistically significant.

Table 11. 1987-88 Herbicide Carryover

Treatment(1987)	lb/A act.	Stand Count 10-14-88	Yield bu/A	Normal Plant Height** 6-15-88	Stunted Plant Height** 6-15-88	Ear Height** 10-14-88
PREPLANT INCORPORATED						
Prowl	1.25	72	108.2	38.5	----	26.4
Vernam	2.5	66	86.4	37.0	----	26.5
Treflan+Sen/Lex	.75+.38	78	126.9	39.0	----	29.3
Command	1	68	104.6	37.0	----	27.1
Commence	1.31	62	106.3	37.5	----	29.2
Treflan+Command	.75+.75	72	107.3	----	----	25.6
Prowl+Scepter	1.25+.125	72	107.8	24.5	16.5	26.3
Squadron	3	54	80.7	25.5	19.0	24.8
Treflan+Scepter	.75+.125	72	112.4	23.5	15.0	29.8
*Treflan+Pursuit	.75+.09	72	114.9	26.5	20.0	29.2
*Prowl+Pursuit	1+.078	76	129.1	25.5	18.0	30.7
*Sen/Lex+Pursuit	.25+.078	66	102.0	26.5	19.5	27.1
SHALLOW PREPLANT INCORPORATED						
Dual+Scepter	2+.125	70	90.5	24.5	14.0	27.3
Dual+Command	2+.75	70	96.9	39.5	----	28.9
Lasso+Command	2+.75	64	82.4	36.0	----	26.9
Lasso+Command	2+.5	52	79.4	34.5	----	28.1
PREEMERGENCE						
Dual+Sen/Lex	2+.5	70	91.3	34.5	----	27.6
LSD (.05)		19.0	40.8	6.0	7.5	5.2

*Experimental
**Measured in inches

NO-TILL CORN AND SOYBEAN HERBICIDE DEMONSTRATION

L. J. Wrage and P. D. Johnson

PURPOSE:

To compare performance of labeled herbicide programs in three no-till systems: corn on soybean residue, soybeans in corn residue and soybeans in grain stubble. Treatments represent preplant residual, preemergence and postemergence systems that are most promising. The herbicide treatments for corn include some treatments with low atrazine rates to allow rotation to soybeans. Plots are utilized for producer tours and in field training events.

METHODS:

Corn on Soybean Residue

Plot Design:		Demonstration
Plot Size:		20' x 100'
Previous Crop:		Soybeans
Soil:		Silty clay loam; 3.2% OM; 6.2 pH
Crop:		Pioneer 3704
Planted:		5/5/88
Herbicide:	FALL:	10/26/87
	EPP:	3/31/88
	PRE:	5/5/88
	POST:	5/27/88
Evaluated:		6/29/88
Rainfall:	1st week	0.28 inches
	2nd week	0.00 inches

Soybean on Corn Stalks

Plot Design:		Demonstration
Plot Size:		20' x 100'
Previous Crop:		Corn
Soil:		Silty clay loam; 3.2% OM; 6.2 pH
Crop:		Century 84
Planted:		5/13/88
Herbicide:	FALL:	10/26/87
	EPP:	3/31/88
	PRE:	5/13/88
	POST:	6/7/88
Evaluated:		6/29/88
Rainfall:	1st week	0.03 inches
	2nd week	1.67 inches

Soybeans in Grain Stubble

Plot Design:		Demonstration
Plot Size:		20' x 100'
Previous Crop:		Oats
Soil:		Silty clay loam; 3.2% OM; 6.2 pH
Crop:		Century 84
Planted:		5/13/88
Herbicide:	FALL:	10/26/87
	EPP:	3/31/88
	PRE:	5/13/88
Evaluated:		6/29/88
Rainfall:	1st week	0.03 inches
	2nd week	1.67 inches

RESULTS:

Foxtail, tall waterhemp and redroot pigweed remain sufficiently heavy for evaluation. The plot areas have been maintained in no-till for five seasons; with only maintenance herbicide levels in the filler year. Velvetleaf are hand rogued from the plot area. Data are presented in the following tables:

Corn on Soybean Residue: Several treatments were excellent, exceeding 95% control on all species. These required no additional inputs for weed control. The effectiveness of atrazine continues to be apparent. Reduced atrazine rates to .5 lb/A require considerable replacement herbicide input.

Soybeans on Corn Residue: Weed control is more variable and generally less efffective in this rotation than when soybeans are no-tilled into grain stubble. Only two treatments exceeded 90% control; these rated 80% would require additional herbicide and/or cultivation and those under 80% are unsatisfactory.

Soybeans on Grain Stubble: Weed control in this system continues to be outstanding for several treatments. Crop growth is also excellent. Several combinations of fall or spring early preplant treatments were nearly weed free the entire season. Some black nightshade was noted in plots with Prowl or Surflan and metribuzin.

NO-TILL CORN DEMONSTRATION
Southeast Research Farm
1988

FALL	EARLY PREPLANT	PREEMERGENCE	POSTEMERGENCE	% Control Gr	% Control Bdlf
Atrazine (3)				92	99
Atrazine (1.5)	Dual (2.5)			96	99
Atrazine (2)+Dual (2.5)				91	99
	Atrazine (3)			95	99
	Atrazine (2)+Dual (2.5)			96	99
	Atrazine (2)+Lasso MT (2.5)			98	99
	Atrazine (2)	Dual (2.5)		96	99
	Atrazine (1.33)+Dual (1.5)	Atrazine (.66)+Dual (1)		99	99
	Atrazine (.5)+Bladex (1.5)+ Dual (1.5)	Atrazine (.5)+Bladex (1)+ Dual (1)		99	99
	Bladex (2)+Dual (1.5)	Bladex (1)+Dual (1)		85	95
	Atrazine (.5)+Bladex (1.5)		Atrazine (.5)+ Bladex (1.5)+ X-77 (.125%)	90	98
		Gramoxone (.5)+X-77 (.5%)+ atrazine (1.5)+Dual (2)		86	94
		Gramoxone (.5)+X-77 (.5%)+ atrazine (.5)+Bladex (2)+ Dual (2.5)		83	95
		Roundup (.75)+atrazine (1)+ Bladex (2)+Lasso MT (2.5)		81	96
		2,4-D est (1)+crop oil (1 qt)+ Atrazine (1)+Bladex (2)+ Lasso MT (2.5)		84	95
		Gramoxone (.5)+ X-77 (.5%)+Lasso MT (2.5)	Atrazine (1.5)+oil (1 qt)	85	98

Gr = Yellow foxtail Bdlf = Tall water hemp, common lambsquarter

NO-TILL SOYBEANS IN CORN STALKS DEMONSTRATION

Southeast Research Farm

1988

FALL	EARLY PREPLANT	PREEMERGENCE	POSTEMERGENCE	% Control Gr	% Control Bdlf
Dual (2.5)		Sen/Lex (.5)		60	91
Dual (1.5)		Dual (1)+Sen/Lex (.5)		54	90
	Dual (1.5)	Dual (1)+Sen/Lex (.5)		58	92
	*Dual (1.5)	Dual (1)+Pursuit (.063)		94	96
	Scepter (.125)+Dual (1.5)	Dual (1)		88	87
	*Pursuit (.063)+Dual (2)	Dual (1)		97	98
	Dual (3)+Sen/Lex (.38)	Sen/Lex (.33)		98	96
		*Gramoxone (.5)+X-77 (.5%)+ Lasso MT (2.5)+Pursuit (.063)		95	[illegible]
		Gramoxone (.5)+X-77 (.5%)+ Lasso MT (2.5)+Scepter (.125)		93	80
		Gramoxone (.5)+X-77 (.5%)+ Dual (2.5)+Sen/Lex (.5)		62	89
		Roundup (.75)+Lasso MT (2.5)+ Sen/Lex (.5)		56	90
		2,4-D est (.75)+Roundup (.18)+AS+ Lasso MT (3)+Sen/Lex (.5)+oil (1 qt)		66	10
	*Dual (2.5)		Pursuit (.063)	86	25
	*Dual (2.5)		Classic (.0417)+Pinnacle (.0625?)+ X-77 (.125%)+28% N (3 qt)	70	5?
		Roundup (.18)+AS+2,4-D est (.75)+ crop oil (1 qt)	Poast (.3)+Blazer (.5)+ Basagran (.75)+X-77 (.125%)	65	45
		Gramoxone (.5)+X-77 (.5%)	Fusilade 2000 (.187)+Blazer (.5)+ Basagran (.75)+X-77 (.125%)	30	10

* Experimental

Gr = Yellow foxtail   Bdlf = Tall water hemp, common lambsquarter

NO-TILL SOYBEANS IN STUBBLE DEMONSTRATION
Southeast Research Farm
[illegible]

FALL	EARLY PREPLANT	PREEMERGENCE	% Control Gr	% Control Bdlf
Scepter (.125)+Dual (2.5)			98	99
Scepter (.125)	Dual (1.5)	Dual (1)	99	99
	Scepter (.125)+Dual (1.5)	Dual (1)	96	98
	*Pursuit (.063)+Dual (1.5)	Dual (1)	99	99
	Preview (.62)+Dual (1.5)	Dual (1)	96	97
	Scepter (.125)+Prowl (1.5)		96	99
	*Pursuit (.063)+Prowl (.15)		97	98
	Prowl (1.5)+Sencor/Lexone (.38)	Sencor/Lexone (.33)	95	96
	Surflan (1.5)+Sencor/Lexone (.38)	Sencor/Lexone (.33)	93	98
	Lasso MT (1.5)+Sencor/Lexone (.38)	Lasso MT (1)+Sencor/Lexone (.33)	90	94
	Lasso (1.5)+Sencor/Lexone (.38)	Lasso (1)+Sencor/Lexone (.33)	84	94
	Dual (1.5)+Sencor/Lexone (.38)	Dual (1)+Sencor/Lexone (.33)	93	95
	*Harness (1.5)+Sencor/Lexone (.38)	Harness (1)+Sencor/Lexone (.33)	96	97
	Dual (1.5)	Dual (1)+Amiben (2)+Sencor/Lexone (.25)	92	91
		Gramoxone (.5)+X-77 (.5%)+ Dual (2.5)+Sencor/Lexone (.5)	85	94
		Roundup (.75)+Lasso MT (2.5)+ Sencor/Lexone (.5)	90	93

* Experimental

Gr = Yellow foxtail   Bdlf = Tall water hemp, common lambsquarter

S.E. FARM REPORT

Evaluation of Insecticide Performance on Various Insecticide Histories Garretson and Hurley, South Dakota, 1988

David Walgenbach, Billy Fuller
and Mark Boetel
Plant Science 88-20

In 1985, an insecticide history study was initiated by establishing four insecticide histories (Counter, Dyfonate, Furadan, and Lorsban) at Hurley, SD. This field had been reported to be a Lorsban problem in 1984 with a history of four prior annual applications. Each of these history areas was 0.7 acres. Also in 1985, five insecticide histories (Broot, Counter, Dyfonate, Furadan, and Lorsban) were established in a field near Garretson, SD. The Garretson Field had been reported to be a Dyfonate-Furadan problem field in 1983-84 with a history of alternate annual applications of Furadan and Dyfonate. Each of these history areas was 1.2 acres.

In 1986, 1987 and 1988 these history treatments were maintained. A portion of each of the history plots was removed from these history regimes each year to test the efficacy of six major corn rootworm compounds (Broot, Counter, Dyfonate, Furadan, Lorsban, and Thimet) at 2 rates (0.75 and 1.0 lbs AI/acre). The design in all areas was a randomized complete block with four (Hurley) or five (Garretson) replication. Treatment plots were 45 feet by one row. All insecticides were applied in a 7-inch band with modified Noble metering units mounted on a John Deere 71 Flexiplanter. The 1985 through 1988 data sets show the performance of major insecticides on their own and 3 and 4 alternate use patterns.

Efficacy of the various treatments was assessed by examining five roots from each plot for rootworm feeding damage using the Iowa 1 to 6 scale. Plant stand and height measurements were taken in June for all treatments. Yield data was collected at Hurley and Garretson. A mechanical failure of the center pivot irrigation system during a critical pollination period at Hurley resulted in the production of sterile ears. Thus, yield results for Hurley were not included in this report for 1988.

Table 1. Initial efficacy ratings for rootworm compounds used in the subsequent 3-yr history study at Garretson and Hurley, SD, 1985.

Location	Rootworm compound	Formu- lation	Rate (lbs/ac)	Percent root protection
Garretson[a]	Counter	15G	1.0	72
	Lorsban	15G	1.0	43
	Dyfonate	20GM	1.0	46
	Furadan	15G	1.0	49
	Thimet	20G	1.0	40
	Broot	15GX	1.0	51
Hurley[b]	Counter	15G	1.0	83
	Lorsban	15G	1.0	63
	Dyfonate	20GM	1.0	63
	Furadan	15G	1.0	65
	Thimet	20G	1.0	64
	Broot	15GX	1.0	72

[a]Report to have experience a Dyfonate-Furadan problem in 1983 and 1984 following a 10-yr history of alternate use of these compounds.

[b]Reported to have experience a Lorsban problem in 1984 which followed a 4-yr history of using this compound.

Table 2. Efficacy of six major rootworm compounds in respect to the established rootworm insecticide history at Garretson, SD.

Established[a] history	Rootworm compound	Formu-lation	Rate (lbs/ac)	Percent root protection 1986	1987	1988
Dyfonate	Counter	15G	1.0	73	73	68
	Lorsban	15G	1.0	63	65	69
	Dyfonate	20GM	1.0	41	71	65
	Furadan	15G	1.0	50	71	69
	Thimet	20G	1.0	32	66	--
	Broot	15GX	1.0	58	63	69
Counter	Counter	15G	1.0	59	68	69
	Lorsban	15G	1.0	54	61	49
	Dyfonate	20GM	1.0	42	64	81
	Furadan	15G	1.0	43	54	39
	Thimet	20G	1.0	45	66	--
	Broot	15GX	1.0	53	70	53
Furadan	Counter	15G	1.0	73	76	82
	Lorsban	15G	1.0	52	71	71
	Dyfonate	20GM	1.0	40	68	76
	Furadan	15G	1.0	25	27	25
	Thimet	20G	1.0	33	56	--
	Broot	15GX	1.0	41	55	44
Lorsban	Counter	15G	1.0	77	70	77
	Lorsban	15G	1.0	44	65	78
	Dyfonate	20GM	1.0	53	71	66
	Furadan	15G	1.0	28	57	40
	Thimet	20G	1.0	52	59	--
	Broot	15GX	1.0	48	55	57
Broot	Counter	15G	1.0	75	76	68
	Lorsban	15G	1.0	54	71	78
	Dyfonate	20GM	1.0	47	71	78
	Furadan	15G	1.0	33	41	24
	Thimet	20G	1.0	40	69	--
	Broot	15GX	1.0	37	50	30

[a]Plots were established in a field reported to have experienced Dyfonate-Furadan failure in 1983-84; and the five history plots were initiated during the Spring of 1985.

Table 3. Efficacy of six major rootworm compounds in respect to the established rootworm insecticide history at Hurley, SD.

Established history[a]	Rootworm compound	Formu-lation	Rate (lbs/ac)	Percent root protection 1986	1987	1988
Dyfonate	Counter	15G	1.0	73	73	68
	Lorsban	15G	1.0	63	65	69
	Dyfonate	20GM	1.0	41	71	65
	Furadan	15G	1.0	50	71	69
	Thimet	20G	1.0	32	66	--
	Broot	15GX	1.0	58	63	69
Counter	Counter	15G	1.0	59	68	69
	Lorsban	15G	1.0	54	61	49
	Dyfonate	20GM	1.0	42	64	81
	Furadan	15G	1.0	43	54	39
	Thimet	20G	1.0	45	66	--
	Broot	15GX	1.0	53	70	53
Furadan	Counter	15G	1.0	73	76	82
	Lorsban	15G	1.0	52	71	71
	Dyfonate	20GM	1.0	40	68	76
	Furadan	15G	1.0	25	27	25
	Thimet	20G	1.0	33	56	--
	Broot	15GX	1.0	41	55	44
Lorsban	Counter	15G	1.0	77	70	77
	Lorsban	15G	1.0	44	65	78
	Dyfonate	20GM	1.0	53	71	66
	Furadan	15G	1.0	28	57	40
	Thimet	20G	1.0	52	59	--
	Broot	15GX	1.0	48	55	57
Broot	Counter	15G	1.0	75	76	68
	Lorsban	15G	1.0	54	71	78
	Dyfonate	20GM	1.0	47	71	78
	Furadan	15G	1.0	33	41	24
	Thimet	20G	1.0	40	69	--
	Broot	15GX	1.0	37	50	30

[a]Plots were established in a field reported to have experienced Dyfonate-Furadan failure in 1983-84; and the five history plots were initiated during the Spring of 1985.

The following replaces Table 3 in section 88-20

Table 3. Efficacy of six major rootworm compounds in respect to the established rootworm insecticide history at Hurley, SD

Established[a] history	Rootworm compound	Formulation	Rate (lbs/ac)	Percent root protection		
				1986	1987	1988
Dyfonate	Counter	15G	1.0	73	77	70
	Lorsban	15G	1.0	69	76	69
	Dyfonate	20GM	1.0	48	59	50
	Furadan	15G	1.0	50	69	56
	Thimet	20G	1.0	59	50	--
	Broot	15GX	1.0	69	68	62
Counter	Counter	15G	1.0	64	75	71
	Lorsban	15G	1.0	61	70	52
	Dyfonate	20GM	1.0	62	68	62
	Furadan	15G	1.0	--	57	74
	Thimet	20G	1.0	41	65	--
	Broot	15GX	1.0	65	73	62
Furadan	Counter	15G	1.0	70	--	76
	Lorsban	15G	1.0	53	--	71
	Dyfonate	20GM	1.0	48	--	56
	Furadan	15G	1.0	31	--	46
	Thimet	20G	1.0	50	--	--
	Broot	15GX	1.0	56	--	26
Lorsban	Counter	15G	1.0	72	76	71
	Lorsban	15G	1.0	56	65	61
	Dyfonate	20GM	1.0	65	61	58
	Furadan	15G	1.0	39	52	52
	Thimet	20G	1.0	60	58	--
	Broot	15GX	1.0	68	74	52

[a]Plots were established in a field reported to have experience Dyfonate-Furadan failure in 1983-84; and the five history plots were initiated during the Spring of 1985.

European Corn Borer Trials

A corn (Pioneer 3475) field near Delmont, SD was chosen for evaluating 29 European corn borer (ECB), Ostrinia nubilalis Hubner, treatments. On 5 May 1988, the crop was sown with 96.5 cm (38 in) row spacing. Preapplication counts indicated a uniform distribution of first-, second-, or third-instar ECB larvae in 30% of those corn stalks sampled.

Treatments (2 untreated controls, 2 liquid, and 25 granular compounds) were established to evaluate their efficacy in controlling first brood ECB larvae. Granular compounds were applied (18 June 1988) to single row plots (0.9 cm by 30.5 m) in a randomized complete block design with 4 replications. Granules were placed in the whorl of the corn plants from a highboy using a pnematic applicator powered by a 3.5 horse power engine. Nobel head metering units were mounted on a modified chain driven apparatus which regulated the amount of granular insecticide released. Liquid compounds (Pounce 3.2 EC) were applied with a 3 gal CO_2 backpack sprayer.

Insecticide application rates were computed on a broadcast basis using band width of 12 inches applied directly in the whorl. These rates may be different from those reported by other investigators where treatments are computed on a linear area basis (linear ft of row) that are utilized for establishing corn rootworm application rates. The broadcast application rates are approx- imately one-third the rootworm application rates.

At the 48th day (5 August 1988) postapplication, twenty corn stalks were randomly chosen from each plot. These plants were split vertically and examinded for ECB tunnelling damage. The number and length of ECB cavities were recorded and analyzed using the General Linear Model (GLM) procedure with means compared by Duncans Multiple Range Tests.

No phytotoxic response from these treatments were observed in this study. Data indicated that 20 treatments were significantly ($P < 0.05$) less damaged when compared to the untreated control which sustained the least ECB injury of the two untreated control plots (Table 4). Pounce 3.2 EC, Lorsban 5G, and the high rate (0.5 lbs AI/acre) of Chlorpyrifos were observed as the three most effective treatments in reducing first-brood ECB damage in corn.

Table 4. First-brood European corn borer (ECB) control using ground application (High-boy) of treatments into whorl-stage corn at Delmont, SD, 1988.

Treatment	Pounds AI/acre	Formu-lation	Total ECB cavities	Corn yield (bu/acre)
Pounce	0.150	3.2EC	0.025 a	142.2 abcde
Pounce	0.100	3.2EC	0.234 ab	143.2 abcde
Chlorpyrifos	0.500	7.5G	0.375 abc	151.0 abcd
Lorsban	0.750	15G	0.475 bcd	143.2 abcde
Lorsban	1.000	15G	0.475 bcd	140.2 abcde
Force	0.100	1.5G	0.525 bcde	139.7 abcde
Dyfonate	1.000	20G	0.534 bcdef	144.0 abcde
Pounce	0.125	1.5G	0.575 bcdef	145.0 abcde
Counter	0.750	15G	0.638 bcdefg	154.2 abc
Counter	1.000	15G	0.638 bcdefg	147.5 abcd
Thimet	1.000	20G	0.709 cdefg	148.8 abcd
XRD-429	0.250	2G	0.825 cdefgh	155.0 ab
Force	0.125	1.5G	0.863 defghi	160.5 a
Thimet	0.750	20G	0.875 defghi	143.2 abcde
XRD-429	0.063	2G	0.938 defghij	160.3 a
Lorsban	0.500	15G	0.963 efghij	121.5 e
SC0567	0.750	10G	0.963 efghij	133.5 bcde
Brace	0.500	10G	0.975 efghij	134.2 bcde
B-8451	1.000	15G	1.013 fghi	150.5 abcd
SC0567	0.500	10G	1.063 ghij	130.2 dce
Furadan	1.000	15G	1.213 hijk	151.2 abcd
Pounce	0.100	1.5G	1.300 ijk	159.2 a
B-8451	0.750	15G	1.358 jk	144.5 abcde
XRD-429	0.125	2G	1.363 jk	154.2 abc
Furadan	0.750	15G	1.588 kl	143.2 abcde
1st check plot	-----	----	1.588 kl	139.0 abcde
SC0567	1.000	10G	1.625 kl	143.2 abcde
Chlorpyrifos	0.250	7.5G	1.959 lm	145.5 abcd
2nd check plot	-----	----	2.263 m	128.2 de

Table 5. Second-brood European corn borer (ECB) control using a a central pivot injector systems for application of treatments at Delmont, SD, 1988.

Treatment	Pounds AI/acre	Formu-lation	Total ECB cavities	ECB larvae 26 days post application	Corn yield (bu/acre)
Untreated	---	--	1.44 a	0.88 a	146.4 a
Dipel	1.5	ES	0.60 bc	0.41 bc	138.2 ab
Dipel	2.0	ES	0.34 c	0.25 c	125.8 c
Dipel	2.5	ES	0.50 bc	0.19 c	130.8 bc
Lorsban	1.5	4L	0.81 b	0.54 b	149.8 a

S.E. FARM REPORT

EFFECT OF LIMIT FEEDING HIGH ENERGY GROWING DIETS ON THE EFFICIENCY OF METABOLIZABLE ENERGY UTILIZATION

J. J. Wagner[1]

Animal and Range Sciences 88-21

Summary

One hundred twenty-eight Angus steer calves were utilized in a study to examine the effect of limit feeding on efficiency of metabolizable energy (ME) utilization during the growing phase and subsequent performance during the finishing phase. Steers limit-fed a high concentrate diet exhibited more rapid daily gains than steers full-fed the same amount of energy from a high roughage diet (2.15 vs 1.74 lb per head, respectively). Feed conversion was improved by limit feeding compared with full feeding (6.09 vs 10.19, respectively). The efficiency of ME utilization was also improved. Limit-fed steers gained .1242 lb per Mcal ME compared with .0956 lb per Mcal ME for the full-fed steers. Limit-fed cattle also required fewer days on feed (102 vs 117, respectively), gained weight more rapidly (3.43 vs 3.00 lb per head daily, respectively) and more efficiently (6.66 vs 7.53, respectively) than full-fed cattle during the finishing phase.

(Key Words: Limit Feeding, Growing Programs, Metabolizable Energy.)

Introduction

Limit-fed, high energy diets have been successfully used to grow light cattle. Gain is limited by limiting the amount of dry matter offered to cattle. As a result, feed efficiency is generally improved by limit feeding.

In order to effectively utilize limit-fed growing programs, producers must be able to predict feedlot performance with reasonable accuracy. Target sale weights and average daily gains must be met in order to allow use of the various forward pricing techniques and to allow backgrounders to consistently produce a uniform feeder steer at a predicted date.

In previous trials at the Southeast South Dakota Experiment Farm, observed performance of limit-fed cattle has been greater than that predicted by the net energy system, suggesting that the efficiency of energy utilization was improved through limit feeding. Therefore, the objectives of this research were to compare the efficiency of metabolizable (ME) utilization for limit-fed versus full-fed cattle and to determine the impact of limit feeding on subsequent performance during the finishing phase.

Materials and Methods

One hundred twenty-eight Angus steer calves that had been on a 31-day receiving trial (60% concentrate diet) were weighed following an overnight withdrawal of feed and water, blocked into two weight categories and allotted to 16 pens. Experimental diets are shown in Table 1. Cattle in four of the heavyweight pens and four of the lightweight pens were fed ad libitum amounts of a high roughage diet (1.03 Mcal ME per lb dry matter). The remaining eight pens of cattle were fed limited amounts of a high concentrate diet (1.326 Mcal ME per lb dry matter). The high concentrate diet was offered to each weight category of limit-fed cattle in an amount intended to provide similar daily ME intake as that consumed by each weight category of full-fed cattle.

Cattle were weighed on day 14, day 28 and at the completion of the 84-day trial. Final weight was obtained after an overnight withdrawal of feed and water. Interim weights were obtained after overnight withdrawal of water only.

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[1]Assistant Professor.

TABLE 1. DIETS FED TO STEERS[a]

Ingredient	Diet Limit-fed	Diet Full-fed
Ground high moisture corn	69.190	5.193
Corn silage	8.667	45.943
Alfalfa-grass hay	8.667	45.943
Supplement		
Soybean meal	11.161	
Ground corn		2.263
Limestone	1.004	
Trace mineralized salt[b]	.800	.500
Molasses	.400	.100
Vitamin A, D, E premix[c]	.063	.040
Rumensin 60[d]	.024	.015

[a] Percentage of diet dry matter.
[b] Composition, minimum percentage, NaCl 96.0, Zn .350, Mn .209, Fe .200, Mg .150, Cu .003, I .007 and Co .005.
[c] Composition, IU per lb, vitamin A 2,000,000, vitamin D 400,000 and vitamin E 200.
[d] Composition, 60 g monensin per lb.

Data were analyzed as a randomized block design. Variables of interest for the growing phase were average daily gain, dry matter intake, feed efficiency, ME intake and the efficiency of ME utilization. Variables of interest for the finishing phase were average daily gain, feed efficiency, dry matter intake, days on feed and carcass quality and cutability traits.

Results and Discussion

Interactions between weight group and treatment were not significant. Therefore, treatment means were computed across weight categories. Performance of steers during the growing phase is displayed in Table 2. By design of the trial, full-fed cattle consumed more dry matter than limit-fed cattle (17.63 vs 13.04 lb per head daily, respectively). Full-fed cattle consumed slightly more ME than did the limit-fed cattle. Average daily gain was greater (P<.0001) for the limit-fed cattle than for the full-fed cattle (2.15 vs 1.74 lb per head daily, respectively).

TABLE 2. PERFORMANCE OF STEERS DURING GROWING PHASE

Item	Diet Limit-fed	Diet Full-fed	Probability
Initial weight, lb	607	606	.6417
Dry matter intake, lb	13.04	17.63	.0001
Average daily gain, lb	2.15	1.74	.0001
Feed/gain	6.09	10.19	.0001
Daily ME intake, Mcal[a]	17.30	18.16	.0068
Gain/ME, lb/Mcal	.1242	.0956	.0001

[a] ME = metabolizable energy.

Feed efficiency and the efficiency of ME utilization was improved by limit feeding. Limit-fed cattle required 6.09 lb dry matter per pound of gain compared to 10.19 lb required by the full-fed cattle. Efficiency of ME utilization was .1242 lb of gain per lb of dry matter for the limit-fed cattle and .0956 lb of gain per pound of dry matter for the full-fed cattle.

Improved efficiency of energy utilization may be due to a true improvement in the efficiency of ME utilization or it may be due to inaccurately estimating the ME content of one or more of the diet components. Average daily Rumensin intake was 188 mg/head for the limit-fed cattle and 159 mg/head for the full-fed cattle. This may have contributed to the improvement in ME use.

Performance of limit-fed cattle was generally greater than that of full-fed cattle during the finishing phase (Table 3). Cattle that had been limit-fed during the growing phase achieved 14.3% greater ($P<.05$) average daily gains, required 15 fewer ($P<.05$) days on feed and were 26 lb heavier ($P<.05$) at slaughter than cattle that had been full-fed during the growing phase. Dry matter intake was similar for both groups of cattle. Feed efficiency was markedly improved for the limit-fed cattle compared with the full-fed cattle (6.66 vs 7.53, respectively).

TABLE 3. PERFORMANCE OF STEERS DURING FINISHING PHASE[a]

	Growing diet		
Item	Limit-fed	Full-fed	Probability
Days on feed	102	117	.0386
Slaughter weight, lb	1126	1100	.0333
Dry matter intake, lb	22.43	22.30	.8319
Average daily gain, lb	3.43	3.00	.0256
Feed/gain	6.66	7.53	.0162
Hot carcass weight, lb	707	694	NS[b]
Rib eye area, in^2	12.52	12.22	NS
Marbling score, units[c]	6.02	6.03	NS
Percent choice	92.54	96.30	NS
Yield grade, units	3.15	3.16	NS

[a] Least-square means adjusted to a common fat thickness.
[b] NS = nonsignificant.
[c] Small^0 = 5.00, modest^0 = 6.00 and moderate^0 = 7.00.

ECONOMIC ANALYSIS OF USING MIXING EQUIPMENT FOR GROWING HEIFERS

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Animal/Range Sciences 88-22

Summary

Seventy-two Simmental cross and Charolais cross heifers (475 lb) were utilized in a growing study to estimate the economic value of using a mixer wagon and feed scale to feed light cattle a high roughage diet. Cattle fed the mixed diet gained an additional 22.6 lb on 61.2 lb less dry matter over the 133-day trial than did cattle fed the unmixed diet. Annual ownership and repair costs were assumed to equal $2356. If yearling feeder cattle sold for $80/cwt and if corn, hay and corn silage were worth $90, $80 and $25 per ton, respectively, it would take a minimum of 114 head on feed for 133 days each year to pay annual costs for the wagon. The economic analysis of the data from this trial suggests that even relatively small cattle feeding operations should strongly consider investing in a mixer wagon with a scale.

(Key Words: Feedlot, Mixing Equipment, Economic Analysis.)

Introduction

Many farmer feeders do not have feed scales or mixer wagons to feed cattle. They feel that they cannot afford the expense of this feeding equipment. They feed by what is often referred to as the "front end loader and scoop shovel method". Roughage is often measured by volume using a front end loader or large round bale. Likewise, grain and supplement are measured by volume using bushels, buckets, bags or a scoop shovel.

There are two potential problems associated with feeding by this method. First, feeding by volume can result in tremendous variation in the amount of dry matter offered to cattle, particularly if high silage diets are used. Second, producers are unable to adequately mix diet components under this system. Cattle are given the opportunity to select their own diet. Some cattle may eat predominately roughage. Other cattle may eat predominately concentrate. Other cattle may eat some combination in between.

Weighing of feed commodities and feeding them as a completely mixed ration allows cattle feeders more control over the diet. Intake may be stabilized and every mouthful of feed that the cattle eat may contain a proper balance of carbohydrate, protein, vitamins and minerals. Performance by cattle fed known amounts of a completely mixed diet will likely be greater than that by cattle fed diet components separately. Differences in performance relative to feed costs and other operating expenses will determine if purchasing, operating and maintaining a mixer wagon and scale is economical for farmer feeders.

The objective of this research was to determine performance differences between cattle fed completely mixed diets with feed deliveries weighed out at each feeding versus cattle fed by volume unmixed diets. A second objective was to evaluate the economics of using a mixer wagon with scales for farmer feeder operations.

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Materials and Methods

Beginning in mid-October, a total of 72 Simmental cross and Charolais cross heifers (475 lb) were purchased from four South Dakota locations and transported to the Southeast South Dakota Experiment Farm near Beresford. Upon arrival, cattle were allowed access to long stem grass hay and water overnight. During a two week receiving period, heifers were fed a standard 60% concentrate starter diet. Once all cattle were assembled, they were shrunk overnight, weighed, ear tagged, vaccinated (IBR, BVD, PI_3, 7-way clostridial bacterin), dewormed, stratified by weight and breed and allotted to eight 9-head pens. The trial started November 4, 1987, and lasted 133 days.

Four pens of heifers were fed ad libitum amounts of a completely mixed grower diet (Table 1). The appropriate amounts of corn silage, ground hay, high moisture corn and supplement for all four pens were weighed into the mixer wagon (Schwartz three auger mixer, 2 ton capacity) and thoroughly mixed prior to feeding. Precise amounts of this total mixed ration were weighed out to each of the four pens of heifers. The four remaining pens of heifers were fed the same diet. Total amount of feed offered to these cattle was approximately the same as the total amount of feed offered to the cattle fed the completely mixed diet. Feed commodities were not mixed prior to feeding and individual feed deliveries to each pen were estimated by volume. The total amount of corn silage, ground hay, high moisture corn and supplement needed for all four pens was weighed out and placed in a separate pile for each commodity. One fourth of each pile, as estimated by volume, was placed into the feed bunk for each pen using a front end loader and scoop shovel. All feed for a particular pen was placed in the same bunk. Corn silage, hay, corn and supplement were layered in the bunk in that respective order.

TABLE 1. DIET FED TO HEIFERS DURING GROWING STUDY

Ingredient	Percentage[a]
Corn silage (35% dry matter)	39.27
Alfalfa-grass hay (16% crude protein)	39.27
Ground high moisture corn (72% dry matter)	15.10
Supplement	
Corn grain	5.58
Trace mineralized salt[b]	.50
Cane molasses	.25
Rumensin 60[c]	.02
Vitamin A-30[d]	.01

[a] Dry matter basis.
[b] Composition, minimum percentage, NaCl 96.0, Zn .350, Mn .209, Fe .200, Mg .150, Cu .003, I .007 and Co .005.
[c] Contains 60 grams monensin per lb.
[d] Contains 30,000 IU vitamin A per gram.

Results and Discussion

Table 2 displays the performance of heifers. Average daily gain was approximately 10.3% greater ($P<.05$) for the heifers fed the completely mixed diet. Statistical analyses were not possible on feed intake and feed conversion data. Feed deliveries to each of the four unmixed pens were estimated by volume and assumed to be the same for each pen. Average daily dry matter intake of the cattle fed the mixed diet was about 2.7% less than the intake of the cattle fed the unmixed diet. Feed conversion was improved by 11.8% for the cattle fed the completely mixed diet. Over the entire trial these differences in performance amounted to 22.6 lb additional gain per head on 61.2 lb less dry matter for the heifers fed the completely mixed diet.

Economic Analysis. Although the use of a scale-mixer wagon improves the productivity of the cattle being fed, it is a matter of economics as to whether one should invest in such equipment. The following discussion is to help in determining the minimum size of operation which can profitably adopt this technology.

TABLE 2. PERFORMANCE OF HEIFERS FED EITHER MIXED OR UNMIXED DIETS

Item	Treatment		SEM[a]
	Mixed	Unmixed	
Initial weight, lb	476	474	6.37
Average daily gain, lb[b]	1.82	1.65	.06
Daily dry matter intake, lb	16.59	17.05	NE[c]
Feed/gain	9.12	10.38	NE

[a] Standard error of the mean.
[b] P<.05.
[c] Nonestimable.

The first step in the analysis is to determine the cost of owning and operating a scale-mixer wagon. The information presented in Table 3 represents an Arts-Way[5] mixer wagon equipped with an electronic scale and other most frequently needed options. The prices and technical data were obtained from an Arts-Way vendor, literature and from the Agricultural Engineers Yearbook.

TABLE 3. ESTIMATED OWNERSHIP AND REPAIR COSTS OF A MIXER WAGON

List price	$12,779			
Cash price (20% discount)		$10,223.20		
State sales tax (3%)		306.70		
Total cash cost			$10,529.90	
Less salvage value (15%)			1,579.48	
Depreciable value			8,950.42	
Annual depreciation (10 year life)				$ 895.04
Annual repair (5% of list price)				638.95
Housing				73.92
Interest on average investment at 12% ($10,529.90 + $1,579.48) x (.12/2)				726.56
Insurance ($2.00 per thousand)				21.06
Total annual ownership and repair cost				$2,355.54

The cost of the tractor used with the mixer wagon is not included in this analysis. For the size of wagon being evaluated here, a 30 to 40 horsepower tractor is sufficient. Mixing time is short, usually about 10 minutes, and may be done as the wagon is towed to the feed bunk. For the analysis at hand, it was assumed the cost of the tractor needed for the wagon was about the same as the cost saved by not using the present equipment to deliver the feed to the bunk.

The feeding trial shows that during the 133-day feeding period cattle fed the mixed diet gained 22.6 more lb on less feed than did the control group. If these extra pounds are sold as feeder cattle at $.80 per pound, an extra $18.08 is generated per head. Ignoring for the time being that less feed was used, it will take a minimum

[5] Arts-Way is a registered trademark for Arts-Way Manufacturing company, Inc., Armstrong, IA. No endorsement of this product is intended or implied.

of 130.3 head on feed for 133 days per year to pay the ownership and operating cost of the wagon ($2356/$18.08 = 130.3). Stated in terms of additional beef produced, it will take 2,944.4 additional lb of beef produced per year to pay the annual costs of the wagon.

If the price of the animals being fed declines, it will take more head or pounds to cover the costs of the wagon. For example, if the price of feeders sold is only $.60 per lb, it will take 3,926 more lb to pay for wagon costs. This translates into 173.7 head when each animal gains an additional 22.6 lb by market time, up from the 130.3 head when the price is $.80. The figure may be used to estimate the increased production in pounds, at various sale prices, needed to cover the annual costs of owning and using a scale-mixer wagon.

When including the feed saved, the number of head needed to pay for the wagon is reduced slightly. The more costly the feed, the fewer head it takes to justify the use of a scale-mixer wagon. With the ration used and feeds priced at $2.50 per bushel for corn, $80 per ton for hay and $25 per ton for corn silage, the 61.2 lb of feed (dry matter basis) saved per head has a value of $2.59. When adding this to the $18.08 additional sales per head, it will take 114 head on feed for 133 days per year to pay for the wagon. If the prices of these feeds are decreased to $2.00 for corn, $20 per ton for silage and $50 per ton for hay, feed savings amount to $1.89 per head. If the 22.6 additional lb of gain are sold at $.60 per lb and the feed savings are included, then at least 152.5 head need to be fed annually to pay the annual cost of a wagon.

With performance data available only for growing heifers, it would be very risky to estimate by extrapolation the benefits of a scale-mixer wagon for finishing cattle. The rations are different and we lack the data to determine the increased productivity, if any, when feeding high concentrate rations as are used in finishing. Feeding less bulky finishing rations may likely result in less increase in productivity from mixing, meaning less value from the wagon. Likewise, the price of slaughter cattle is usually less than for feeder cattle, resulting in the increased production being sold at a lower price. On the other side, with the higher cost per cwt of finishing rations, each pound of feed saved means greater benefit from a wagon. Using mixing equipment may allow feeders to use higher concentrate diets, thus improving average daily gain. Any increase in the rate of gain means less days on feed and lower operating costs on the animal being finished, a plus for this piece of equipment. So at this time we cannot make a determination as to the net economic benefit of such a wagon in the finishing lot.

Other Considerations When Investing in a Mixer Wagon. The life of the wagon was estimated at 10 years or 10,000 loads. This would be 1,000 loads per year or 2.74 loads per day. Repair costs will likely increase and life decrease as use is increased above 1,000 loads per year. However, less use will not necessarily mean less repair per year. Deterioration from weather and acid from feeds will not decrease with less use and, in fact, may increase. Obsolescence is a function of time only, so it is not affected by level of use. From this we can conclude that costs will remain about constant with decreased use, while each load in excess of 1,000 loads per year will increase depreciation and repair costs by $1.53.

In this experiment, approximately 2.30 bushels of feed were required per head per day. Therefore, it took about 306 bushels of feed per head over the 133 days. With a 175-bushel wagon, this is about 1.75 loads per head to bring them from starting weight to sale weight. Using the $80 per cwt sale price and the high prices for feeds, the break-even level of production to cover annual costs of the wagon is about 114 head per year. Thus, at the break-even level of production the wagon would be used for only 199.5 loads per year. Therefore, use could be increased five times and not have an appreciable increase in annual costs of the wagon. Even with cattle selling at $60 per cwt and low priced feeds, there is plenty of reserve capacity. At the lower prices, the break-even level is 152.5 head per year, which would require only 267 loads per year. This would allow for a 375% increase in use without increasing annual costs. A 175-bushel wagon should feed 570 head for 133 days of this ration with a thousand loads. A producer who is is putting more pounds of gain on each animal will obviously be feeding fewer cattle from starting weight to sale weight per thousand loads.

The time and labor required using a scale-mixer wagon is another aspect which should be evaluated. While it may take more time to load a mixer wagon with a scale due to the weighing process, the time traveling between the feed bunks and feed storage area with the loader may be reduced. Whether there is a net gain or loss in time depends on the current feed handling techniques vis-a-vis the new. Because most farmers have an older, small tractor which can easily handle the mixer wagon, no additional investment is likely to be needed above the cost of the wagon.

In conclusion, the evidence of this experiment indicates that a mixer wagon equipped with a scale can be a profitable investment for feedlot operators feeding high roughage rations to light cattle. With feeder cattle selling in the $.70 to $.80 range, the break-even level of production is 110 to 160 head on feed for 133 days per year but will depend on how much improvement a particular operation can gain due to more accurate feeding and the value of feed saved.

S.E. FARM REPORT

EFFECTS OF ADMINISTERING PROGESTERONE OR PROGESTERONE AND GnRH BEFORE PUBERTY ON AGE AT PUBERTY AND REPRODUCTIVE RESPONSE IN CROSSBRED BEEF HEIFERS

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Summary

One hundred six crossbred heifers were utilized to determine prepubertal treatment of progesterone or progesterone plus Gonadotropin Releasing Hormone (GnRH) on age at puberty, conception to a synchronized estrus and conception during the breeding season. Days to puberty were 369.5 ± 6.2, 363.1 ± 9.9 and 360.4 ± 7.8 for control, progesterone primed and progesterone plus Gonedotropin Releasing Hormone (GnRH), respectively. There was no difference (P>.05) in age of puberty, number cycling before synchronization or conception rate during a 35-day breeding season. The percentage of heifers conceiving to synchronized estrus was lower (P<.10) for control compared to progesterone or progesterone plus GnRH treated heifers. Injecting GnRH at breeding had little (P>.05) effect on increasing conception rates to the synchronized estrus or during the breeding season.

(Key Words: Beef Heifers, Puberty, GnRH, Progesterone, Fertility.)

Introduction

Decreasing the time to puberty in beef heifers should result in increased conception rate early in the breeding season, since the heifer would be cycling for a longer period of time prior to breeding. Also, older and larger calves would result at weaning, and a longer period of time would be available for the heifer to begin cycling before the second breeding season. Some research has been conducted administering reproductive hormones to heifers before puberty, resulting in varying results on decreasing time to puberty. A management procedure to decrease time to puberty resulting in increased reproductive efficiency in first calf beef heifers would be economically important to the cow-calf producer. The purpose of this study was to evaluate several hormones administered before puberty and their effects on age at puberty and subsequent reproductive performance in crossbred beef heifers.

Materials and Methods

One hundred six crossbred beef heifers were randomly allotted to one of three groups. One group was the control and did not receive hormone therapy. A second group was progesterone primed before puberty (9 days Synchro-Mate B). The third group was progesterone primed and injected with Gonadotropin Releasing Hormone (GnRH) at SMB removal. Each of the treatment groups were divided and one-half of each group given GnRH injections at trial initiation. Blood was collected via jugular venipuncture weekly from October until all heifers were synchronized for breeding in May. Blood samples were centrifuged and the serum harvested and analyzed by radioimmunoassay for progesterone levels to determine when cycling was initiated. On May 9 all heifers were synchronized with Synchro-Mate B and inseminated 48 hours after implant removal. At breeding each of the three prepubertal groups were divided and one-half of each group injected with GnRH and the other

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one-half control. One week after AI, the heifers were exposed to bulls for 28 days. Eighty-one days after AI the heifers were rectally palpated and conception date estimated.

Results and Discussion

There was no difference (P>.05) in age to puberty between the three prepubertal treatment groups (Table 1). Also, no difference (P>.05) existed between the three prepubertal groups in the number of heifers cycling before estrous synchronization. Collectively, 54 of the 106 heifers were cycling before synchronization. After synchronization and breeding, all heifers but one that did not conceive started cycling. This may be due to the progesterone implant and estradiol injection associated with SMB synchronization.

TABLE 1. EFFECTS OF PROGESTERONE PRIMING AND PROGESTERONE PRIMING + GNRH ON REPRODUCTIVE DEVELOPMENT IN CROSSBRED BEEF HEIFERS

	Control	Progesterone	Progesterone + GnRH
Number of heifers	34	36	36
Days to puberty	369.5 ± 6.2	363.1 ± 9.9	360.4 ± 7.8
Cycling before synchronization[a]	17 (50.0)	17 (47.2)	20 (55.6)

[a] Values in parenthesis are percentages.

Conception rates to the synchronized estrus and for the breeding season are presented in Table 2. The lowest conception rate to synchronized estrus was in the control heifers (P<.10). Both control treatment groups prepubertal had lower conception rates than progesterone primed or progesterone primed plus GnRH groups. There was no difference (P>.05) in conception rate for the breeding season for the prepubertal treatments or the GnRH injection at breeding. Average conception rates from the prepubertal treatments to synchronized estrus were 47.1, 61.1 and 69.4% for control, progesterone primed and progesterone primed plus GnRH, respectively, and for the breeding season 82.4, 91.7 and 80.6% for control, progesterone primed and progesterone primed plus GnRH, respectively.

Progesterone priming or progesterone priming plus GnRH had little effect on age to puberty or reproductive performance in beef heifers. Also, little advantage existed by injecting heifers with GnRH at the time of insemination.

TABLE 2. CONCEPTION RATE TO SYNCHRONIZED AI AND BREEDING PERIOD FOR BEEF HEIFERS TREATED WITH PROGESTERONE AND GNRH BEFORE PUBERTY AND GNRH AT BREEDING

Prepuberty	Breeding	No. of heifers	Conception rate to synchronized estrus[a]	Conception rate for breeding season[a]
Control	Control	18	8 (44.4)[b]	14 (77.8)
Progesterone	Control	17	10 (58.8)[c]	15 (88.2)
Progesterone + GnRH	Control	19	14 (73.7)[c]	15 (79.0)
Control	GnRH	16	8 (50.0)[b]	14 (87.5)
Progesterone	GnRH	17	11 (64.7)[c]	14 (82.4)
Progesterone + GnRH	GnRH	19	12 (63.2)[c]	18 (94.7)

[a] Values in parenthesis are percentages.
[b,c] Values in columns with unlike superscripts differ (P<.10).

EFFECTS OF CORN COB ADDITIONS TO CORN-SOYBEAN MEAL DIETS WITH AND WITHOUT ADDED SYNTHETIC LYSINE ON THE PERFORMANCE OF FINISHING PIGS

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Different components of fiber have characteristic chemical and physical properties which may affect fiber digestion and utilization by the pig. Because fiber is not readily broken down into its base units by mammalian enzymes, dilution of the energy content of the diet occurs when fiber is present in swine diets. Hemicellulose, cellulose and lignin are three major components of fiber that are found in various proportions in different fiber sources. Corn cobs are relatively high in hemicellulose and low in lignin. Further, varying amounts of cob are common in corn grain fed to swine.

The objectives of the present study were to (1) evaluate the response of finishing pigs fed corn-soybean meal diets containing 0, 4 or 8% added ground corn cobs and (2) determine the effects of added synthetic lysine on the performance of pigs fed diets containing added corn cobs.

(Key Words: Finishing Pigs, Fiber Source, Corn Cobs, Synthetic Lysine.)

Experimental Procedure

A total of 140 feeder pigs (40 lb avg wt) were purchased from two sources through the Sioux Falls Stock Yards and transported to the confinement facility at the Southeast South Dakota Research Farm near Beresford. Pigs received a corn-soybean meal based receiving diet containing 20% oats and 10 g/ton irginiamycin to an average weight of about 75 lb. One hundred twenty pigs were then allotted to five treatments from outcome groups based on weight, sex and feeder pig source. Each dietary treatment was fed to four replicate pens of six pigs per pen. Treatments were produced from the addition of 0, 4, or 8% ground corn cobs and 0 or about .13% lysine from L-lysine·HCl to the basal corn-soybean meal diet (Table 1). Ground corn cobs and synthetic lysine each replaced corn in the basal diet formulation. The resulting dietary treatments were:

1. Corn-soybean meal control
2. Diet 1 plus 4% ground corn cobs.
3. Diet 2 with .13% synthetic lysine.
4. Diet 1 plus 8% ground corn cobs.
5. Diet 4 plus .14% synthetic lysine (isolysinic with diet 3).

Average initial weight across all replicates was 74.28 lb. Pigs received the same dietary treatment until the study was terminated on day 84. Pen average weight across all treatments was 230.9 lb upon termination of the study. Pig weights were recorded every 14 days and feed weighed back every 28 days. The study was conducted during the months of November through January of 1987.

TABLE 1. COMPOSITION OF EXPERIMENTAL DIETS

% added cobs:	0	4		8	
% added lysine:	0	0	+.13	0	+.14
Ground corn	79.13	75.13	75.13	71.13	71.13
Soybean meal, 44%	16.20	16.20	16.20	16.20	16.20
Corn cobs, ground		4.0	4.0	8.0	8.0
Animal fat	2.0	2.0	2.0	2.0	2.0
Dicalcium phosphate	.93	.93	.93	.93	.93
Limestone	.75	.75	.75	.75	.75
Premix	.75	.75	.75	.75	.75
Salt	.25	.25	.25	.25	.25
Total	100	100	100	100	100
Calculated analysis:					
Crude protein, %	14.0	14.0	14.0	14.0	14.0
Lysine, %	.65	.64	.77	.63	.77
Crude fiber, %	2.94	4.29	4.29	5.64	5.64
ADF %	4.01	5.45	5.45	6.89	6.89
NDF %	9.40	12.56	12.56	15.72	15.72
ME, kcal/lb	1504	1471	1471	1437	1437

[a] Lysine added as L-lysine*HCl to the premix.

The effects of dietary treatment on pig performance by 28-day period and overall are shown in Table 2. The addition of ground corn cobs alone did not appear to depress pig performance during any of the experimental periods examined. Additions of ground corn cob either with or without added synthetic lysine did not affect (P>.10) average daily gain (ADG), average daily feed intake (ADF) or feed efficiency (feed/gain) for the initial and second 28-day periods.

During the third 28-day period (day 56 to 84), pigs fed added cobs had gains that were similar (P>.10) to those fed the basal diet except when synthetic lysine was added in combination with the highest level of cobs. Pigs fed 8% added cobs with added lysine gained (P<.05) more slowly than pigs fed any other diet with cobs added, while those fed the basal diet were intermediate. Dietary treatment had no (P>.10) effect on ADF during the third feeding period. Pigs fed 8% added cobs without added lysine tended to gain more (P<.10) efficiently than pigs fed the basal diet. The addition of synthetic lysine and 8% added cobs tended to produce less (P<.10) efficient pig gains than any of the other diets containing added cobs, while pigs fed the basal diet were intermediate.

Overall, pigs fed 4% cobs in combination with added lysine had greater (P<.05) ADG than those fed the basal or 8% added cobs with added lysine diets. The addition of lysine to the diet containing 8% added cobs produced pig gains that were lower (P<.05) than either diet with cobs and not lysine added, while those fed the basal diet were intermediate. Because feed intake was not affected (P>.10) by dietary treatment, a trend was observed for feed efficiency. For pigs fed diets with 8% added cobs, the addition of synthetic lysine tended to depress (P<.10) feed efficiency. However, lysine did not depress feed efficiency when added in the presence of 4% added cobs, as feed/gain was similar (P>.10) for pigs fed the 4% added cobs with added lysine and 8% added cobs without lysine diets. Pigs fed the basal and 4% added cobs without lysine diets were intermediate for feed efficiency.

TABLE 2. EFFECT OF ADDED COB AND(OR) LYSINE ON THE PERFORMANCE OF PIGS

% added cob:	0	4		8	
% added lysine:	0	0	+.13	0	+.14
Initial 28-day period					
Avg daily gain, lb	1.55	1.53	1.61	1.44	1.47
Avg daily feed, lb	4.72	4.72	4.73	4.73	4.72
Feed per gain	3.06	3.09	2.95	3.31	3.20
Second 28-day period					
Avg daily gain, lb	2.26	2.32	2.34	2.28	2.17
Avg daily feed, lb	7.45	7.81	7.43	7.53	7.44
Feed per gain	3.30	3.85	3.19	3.31	3.44
Third 28-day period					
Avg daily gain, lb	1.71[ab]	1.83[a]	1.85[a]	1.85[a]	1.59[b]
Avg daily feed, lb	7.13	7.37	7.18	7.02	7.05
Feed per gain	4.23[de]	4.06[ef]	3.89[ef]	3.82[f]	4.51[d]
Overall 84-day period					
Avg daily gain, lb	1.83[bc]	1.89[ab]	1.93[a]	1.85[ab]	1.73[c]
Avg daily feed, lb	6.41	6.63	6.42	6.40	6.37
Feed per gain	3.51[de]	3.52[de]	3.34[e]	3.47[e]	3.69[d]

[a,b,c] Means in the same row without a common superscript differ ($P<.05$).
[d,e,f] Means in the same row without a common superscript differ ($P<.10$).

The lack of a depression in daily gains resulting from the addition of corn cobs to the diet was not surprising in this study. Fiber additions to swine diets typically result in a dilution of the metabolizable energy (ME) content of the diet. Feed intake may be increased to maintain the same level of ME intake (within physiological limits) which allows the same rate of gain to be maintained, but results in poorer feed efficiency. Outside temperatures should have had a minimal effect on the results of this study in view of the fact that pigs were housed in an environmentally modified building. Corn cobs are relatively high in hemicellulose as indicated by the high neutral detergent fiber (NDF) and low acid detergent fiber (ADF) content. This high hemicellulose content may account for some of the responses obtained in the present study.

The overall growth response obtained from the addition of a moderate level of corn cobs (4%) and synthetic lysine was not expected. Conversely, lysine appeared to have a negative effect on both gains and feed efficiency when added in the presence of the higher (8%) level of ground corn cobs.

Additional studies are planned to further investigate the effects of various sources and types of fiber on the performance of growing pigs.

Summary

A total of 120 purchased feeder pigs averaging about 74 lb initially were utilized in an 84-day study to evaluate the effect of adding 0, 4, or 8% ground corn cobs and 0 or about .13% synthetic lysine on pig performance. Pigs were allotted to five dietary treatments replicated four times. Dietary treatment had no effect ($P>.10$) on the performance of pigs for the initial 56 days of the study or on feed consumption for any period studied. Compared to the corn-soybean meal basal diet, the addition of either 4 or 8% ground corn cobs did not reduce the performance of pigs. Among treatment groups fed added cobs, the addition of synthetic lysine to the diet with 8% added cobs resulted in poorer gains ($P<.05$) and feed efficiency ($P<.10$) by pigs.

EFFECT OF SPACE ALLOWANCE ON PERFORMANCE OF FINISHING PIGS FED TO A HEAVIER WEIGHT (250 LB)

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The practice of feeding pigs to heavier weights has increased in the recent past. Packers prefer pigs that are heavier than the 200 to 220 lb finished weight range of years past. This is because the overhead coats for slaughtering a 200-lb pig are the same as for a 250-lb pig, provided the packer can physically handle heavier and larger pork carcasses.

Eight square feet per pig is the current recommended pen space allowance for finishing pigs housed in confinement. However, the data used to determine this recommendation were from studiea in which pigs were marketed at about 220 lb. Thus, the per pig pen space allowance for pigs taken to heavier weights may be greater than 8 sq ft.

The objective of this experiment was to determine the space requirement of finishing swine fed to an average of 250 lb using daily gain, feed consumption and feed efficiency averages as response criteria.

(Key Words: Finishing Pigs, Performance, Pen Space.)

Experimental Procedures

A total of 90 pigs weighing about 109 lb were transported from the SDSU Swine Research Unit at Brookings to the confinement unit at the Southeast South Dakota Research Farm near Beresford. Pigs were randomly assigned to one of three treatments from outcome groups based on weight, sex and ancestry. Each treatment was replicated in three pens containing ten pigs per pen. Treatments were produced by altering pen space to provide either:

1. Six square feet of pen space per pig (4 ft X 15 ft).
2. Eight square feet of pen space per pig (5.33 ft X 15 ft).
3. Ten square feet of pen space per pig (6.67 ft x 15 ft).

Although the desired pen dimensions were obtained by altering the width of the original pen, a rectangular shape was maintained in each resulting pen. Pigs were fed a common diet (Table 1) for the entire study. Each pen of pigs was provided with three feeder spaces and one nipple waterer. The study was terminated by pen at pen average weights of about 250 lb.

An effort was made to record pig weights and feed consumption every 2 weeks. However, this was not possible for the entire study due to mechanical problems with the weighing equipment. In the event that a pig was removed from the study, pen dimensions were adjusted accordingly in order to maintain a constant pen space allowance for the entire trial. A pen of pigs constituted an experimental unit. This study was conducted during the summer of 1988.

Results

The effects of pen space on the performance of pigs for the entire study are presented in Table 2. Pigs provided with 6 sq ft of pen space tended to gain more slowly ($P<.07$) and gained less ($P<.05$) efficiently than pigs provided with either 8 or 10 sq ft of space. Overall average daily feed consumption means were similar ($P>.10$) for all treatment groups.

TABLE 1. COMPOSITION OF EXPERIMENTAL DIET, %

Ingredient	Percent of diet
Ground corn	81.58
Soybean meal, 44%	16.02
Limestone	.99
Dicalcium phosphate	.91
Salt	.25
Vitamin-trace mineral premix	.25
Total	100
Calculated analysis:	
Protein, %	14.0
Lysine, %	.67
Calcium, %	.65
Phosphorus, %	.50
Metabolizable energy, kcal/lb	1503

Average initial and final weights for each treatment group are also shown in Table 2. The accompanying coefficients of variation (CV) for these weights may be of particular interest. Within pen weight variation was similar at the beginning of the study. Although not tested statistically, the CV for final weight suggests that within pen weight variation was not affected by space allowance for the overall weight range studied.

Results of this study tend to support the current recommended space allowance of 8 sq ft per pig. These date suggest that 6 sq ft may be inadequate and 10 sq ft per pig to be unnecessary for finishing pigs fed to pen average weights of about 250 lb. Further, overcrowding appeared to affect gains and feed efficiency without depressing feed consumption.

TABLE 2. EFFECTS OF PEN SPACE ON THE PERFORMANCE OF PIGS FED FROM 109 TO 249 LB

Item	Space allowance per pig, sq ft		
	6	8	10
Initial wt, lb	109.2	109.2	109.2
CV for initial wt, %[a]	5.11	5.20	5.09
Final wt, lb	245.7	251.0	249.8
CV for final wt, %[a]	4.35	4.37	5.47
Avg daily gain, lb	1.28[c]	1.39[b]	1.38[b]
Avg daily feed, lb	5.14	5.27	5.03
Feed/gain	4.01[d]	3.79[e]	3.66[e]

[a] Average coefficient of variation for pig weights within a pen.
[b,c] Means in the same row without a common superscript differ (P<.07).
[d,e] Means in the same row without a common superscript differ (P<.05).

Summary

A total of 90 pigs were utilized to study the effect of either 6, 8 or 10 sq ft of pen space per pig on the performanc finishing pigs from 109 to 250 lb. Overall, pigs provided with 6 sq ft of space tended to gain more (P<.07) slowly an more (P<.05) feed per lb of gain than pigs given 8 or 10 sq ft of space. Feed intake was not affected (P>.10) by pen variation within a pen did not appear to be affected by overcrowding in this study.

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