19th ANNUAL

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SOUTHEAST SOUTH DAKOTA EXPERIMENT FARM

PROGRESS REPORT 1979

AGRICULTURAL EXPERIMENT STATION
SOUTH DAKOTA STATE UNIVERSITY
BROOKINGS

This nineteenth annual report of the research program at the Southeast South Dakota Experiment 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

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NINETEEN ANNUAL PROGRESS REPORT
SOUTHEAST SOUTH DAKOTA EXPERIMENT FARM

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Introduction .... Fred E. Shubeck
Research Manager

The year 1979 was a good year for oats, corn, and soybeans. Both oats and corn yielded over 100 bushels per acre with the best treatments and varieties. Soybean yields approached 60 bushels per acre - some of the highest ever obtained at the Experiment Farm. These exceptionally high yields occurred even though spring work was delayed due to cold wet weather and the fall harvest was very difficult to complete, especially on the imperfectly drained soils. In addition, the partial summer fallow after the 1978 hail storm and the cold wet spring in 1979, caused some of the most severe phosphate deficiency symptoms in corn early in the season that have ever occurred at the Experiment Farm. Fertilizer responses were substantial even though no fertility was removed by crops that were destroyed by hail the previous year. Growing degree days were somewhat below normal by midsummer, but were brought up to normal by early fall. Rainfall in June and July was a little below normal but August had 5.11 inches.

A total of six crop tours and field days were conducted at the Experiment Farm in 1979. A tour by non-English speaking French Nationals proved to be very interesting.

The concrete manure tank was built east of the hog house, even though a high water table caused serious and continuous problems. A drainage system consisting of gravel and drain tile was installed both under the floor and along the footings.

Work on the new cattle feedlot is progressing with all the dirt work completed to insure good drainage. The water and electricity lines were installed and about half of the posts are in place.

The solar dryer was filled with corn four times this year. The first three were dried and the fourth fill was cooled and will be dried next spring when there is more solar heat.

A total of 42 meetings were held in the office-laboratory building. These included extension clubs, 4-H clubs, adult education meetings, judging schools and other local groups.

Several of the farm buildings were painted last summer by Green Thumb members. They also painted the interior of the office building.

Greater use was made of the Eberhardt Silo Press Bags this year. Three bags were filled with small grain silage: one each of oats, wheat, and barley. The fourth was filled with shelled corn, treated with Pro Sil.

Table 1. Temperatures at the Southeast Experiment Farm

Month	1979 Av. Temperature (F)[1] Maximum	1979 Av. Temperature (F)[1] Minimum	27 Year Average Maximum	27 Year Average Minimum	Departure from 27 Year Average Maximum	Departure from 27 Year Average Minimum
January	10.9	-10.2	25.0	3.8	-14.1	-14.0
February	14.9	-7.2	32.1	10.5	-17.2	-17.7
March	36.3	18.2	43.3	22.1	-7.0	-3.9
April	55.1	32.2	61.1	35.5	-6.0	-3.3
May	66.9	41.9	73.5	47.4	-6.6	-5.5
June	79.6	54.4	82.9	57.3	-3.3	-2.9
July	84.2	60.0	87.8	62.2	-3.6	-2.2
August	80.0	57.9	85.9	59.7	-5.9	-1.8
September	78.0	49.3	75.9	49.2	+2.1	+0.1
October	62.1	33.5	65.6	40.7	-3.5	-7.2
November	40.7	20.4	46.1	24.1	-5.4	-3.7
December	37.4	16.4	31.5	11.3	+5.9	+5.1

[1]Computed from daily observation.

Table 2. Precipitation at the Southeast Experiment Farm

Month	Precipitation 1979 (inches)	27-year Average (inches)	Departure from 27-yr. Av. (inches)
January	1.11	.50	+0.61
February	.48	1.12	-0.64
March	3.68	1.44	+2.24
April	1.87	2.41	-0.54
May	4.01	3.26	+0.75
June	2.69	3.99	-1.30
July	1.56	3.26	-1.70
August	5.11	2.87	+2.24
September	1.88	2.70	-0.82
October	3.30	1.59	+1.71
November	1.88	1.04	+0.84
December	.13	.68	-0.55
Total	27.70	24.86	+2.84

RATES OF NITROGEN AND DATES OF PLANTING CORN

F. Shubeck and B. Lawrensen

Objectives of Experiment

1. Will planting dates influence response to fertilizer?
2. What is the optimum rate of nitrogen fertilizer for a soil with a medium amount of organic matter?
3. Will optimum rate of nitrogen application be influenced by drought?
4. Will high nitrogen rates influence disease or insect damage?
5. Will soil temperatures serve as a dependable guide to determine optimum date to plant corn?

Methods and Procedures

October 24, 1978	- Rotary chopped stalks and plowed all of the plot area
April 30, 1979	- Sprayed total plot area with Eradicane + Aatrex 4L (4+1 A.I.)
Planting dates	- May 3, May 21, May 29, and June 5, 1979
Variety	- Pioneer 3541 (109 day)
Herbicide	- Lasso II Granules (banded)
Insecticide	- Furadan 10G (banded)

Broadcast fertilizer was applied previous to each planting date, then tandem disked, and spike tooth harrowed before each planting date. All the fertilizer was applied broadcast; no side band starter was used.

November 13-15, 1979 - Harvested all plots

Table 3 Effect of Fertilizer and Planting Dates on Yield of Corn (High Nitrogen Rates)

Broadcast Fertilizer Treatment	Planting Dates May 3	May 21	May 29	June 5	Average
0 + 0 + 0	113	107	114	86	105
0 + 11 + 58	117	113	110	101	110
80 + 11 + 58	140	132	127	118	129
160 + 11 + 58	144	135	129	111	130
240 + 11 + 58	141	133	124	101	125
Average	131	124	121	103	

Discussion and Interpretation of Table 3

80 lbs. of nitrogen applied annually was sufficient to produce 129 bushels of corn per acre in 1979. Additional nitrogen was ineffective for increasing yields.

The optimum planting date has varied considerably in the past. For most years, a moderately early planting date (about May 8-10) has been the most successful. However, in some of the drier years (1975-1976) later plantings produced more corn because of the rainfall distribution.

In 1979, the earliest planting date (May 3) gave the highest yield. Each delay in planting reduced yields, especially after the end of May. Attempts to relate an optimum planting date to soil temperatures have been successful in some years. Exceptions have occurred when abnormal climatic conditions develop later on in the season like drought, excessively cool or hot temperatures, subsoil moisture reserves or bad rainfall distribution.

Table 4 Effect of Fertilizer and Planting Dates on Yield of Corn (Low Nitrogen Rates)

Broadcast Treatment	Planting Dates				
N + P + K_2O	May 3	May 21	May 29	June 5	Average
0 + 0 + 0	107	103	93	73	94
20 + 11 + 58	123	113	120	99	114
40 + 11 + 58	121	118	123	115	119
60 + 11 + 58	145	129	133	113	130
80 + 11 + 58	142	130	130	113	129
Average	128	119	120	103	

Discussion and Interpretation of Table 4

The earliest planting date (May 3) again produced the most corn and also the largest response to nitrogen. When applications were made annually, 60 lbs. of N per acre increased yields about the same as 80 lbs. It should be remembered that a July 5 hailstorm in 1978, severely limited yields and associated nutrient removal in that year, especially with the three earliest planting dates.

Table 5 Effect of Fertilizer and Planting Dates on Ear Moisture at Harvest

Broadcast Fertilizer Treatment	Planting Dates				
N + P + K_2O	May 3	May 21	May 29	June 5	Average
0 + 0 + 0	19.0	21.0	23.5	24.4	22.0
0 + 11 + 58	17.8	20.1	23.1	24.4	21.4
80 + 11 + 58	17.6	19.9	23.1	25.1	21.4
160 + 11 + 58	18.8	20.0	23.2	25.5	21.9
240 + 11 + 58	18.6	21.2	23.4	26.6	22.5
Average	18.4	20.4	23.3	25.2	

Discussion and Interpretation of Table 5

Nitrogen fertilizer did not delay maturity of corn, measured by % ear moisture at harvest. Percent moisture in ears increased as planting dates were delayed.

PLANT POPULATIONS FOR CORN

F. Shubeck and B. Lawrensen

Objectives of Experiment

1. What planting rate should be used with a heat tolerant hybrid like P-3709 in a series of dry years with no subsoil moisture at planting time? Would it be wise to keep populations up a little higher than you would for a hybrid without the heat tolerant feature?
2. Is it better to select a semi-prolific hybrid like Agriseed 6072, reduce the planting rate in a dry spring and let the prolific characteristic take care of any unexpected improved growing conditions?
3. How about a "shortie" hybrid - say about 5 1/2 to 6 feet tall like YW-35A? Do we really need a big tall plant when moisture is limited? "Shortie" wheats have been very good for this limited rainfall area, maybe a "shortie" corn would prove to be beneficial.
4. Can the population problem be solved by using a single ear per stalk hybrid with a strong ability to increase ear size, like P-3932A, if conditions improve?
5. Is it best to use a big tall full season corn (115 day) like Curry's SC-150 with erect leaves to make maximum use of sunlight at high plant populations?

Methods and Procedures

Area was fall plowed
April 30 - Sprayed total plot area with Eradicane + Aatrex 4L at recommended rates
May 14 - Broadcast 80 + 40 + 20 (oxide) and tandem disked to incorporate
May 16-17 - Entire area tandem disked, spike tooth harrowed. Planted all 5 varieties and plant populations (10M - 18M)
Insecticide - Furadan 10G (banded)
Cultivated all plots once
November 15 - Harvested all plots

Table 6. Hybrids Used with Important Features of Each

Hybrid	Special Plant Characteristics	Days to Maturity
Pioneer 3709	Heat and drought tolerant	105
Pioneer 3932A	Ability to increase ear size	93
Agriseed 6072	Multi-ear tendency	100-103
Curry's SC-150	Big, tall full season	115
Yield Warranty 35A	"Shortie" about 5 1/2 to 6 ft.	95

Discussion and Interpretation of Table 6.

Previous work at the Southeast Experiment Farm has shown that optimum plant populations may vary widely from year to year with changing environmental conditions. It is virtually impossible to accurately guess rainfall and temperature pattern three months in advance. The amount of subsoil moisture at planting time will help to decide planting rates but this is not always exactly known. This experiment is centered on hybrids with unique characteristics that may help reduce the necessity of trying to out guess the weather, when trying to determine how many kernels to drop per acre.

Table 7. Effect of Plant Populations and Hybrids on Corn Yield

Hybrid	Plants Per Acre (Final)					
	10,000	12,000	14,000	16,000	18,000	Average
P-3709	93	96	91	103	107	98.0
P-3932A	89	89	89	102	96	93.0
Agriseed 6072	87	90	105	107	104	98.6
Curry's SC-150	94	99	107	116	114	106.0
YW 35A	94	93	100	104	101	98.4
Average	91.4	93.4	98.4	106.4	104.4	

Discussion and Interpretation of Table 7.

It's difficult to surpass the yield of a big full season corn planted at it's optimum rate.

If the big full season corn is not at it's optimum rate, other earlier hybrids can produce more bushels per acre.

Even in a year with over 100 bushels per acre potential, 16,000 plants per acre were sufficient for maximum yields of most hybrids.

With Agriseed 6072 (multi-ear) there was very little difference in yield over a 4,000 plants per acre range (14,000-18,000). This hybrid was not the only one showing a multi-ear tendency this year in the lower range of plant populations.

The early maturing hybrids (YW-35A and P-3932A) were able to produce over 100 bushels per acre at their best populations.

DATE OF PLANTING EARLY, MEDIUM, AND LATE MATURING CORN HYBRIDS

F. Shubeck and B. Lawrensen

Objectives of Experiment

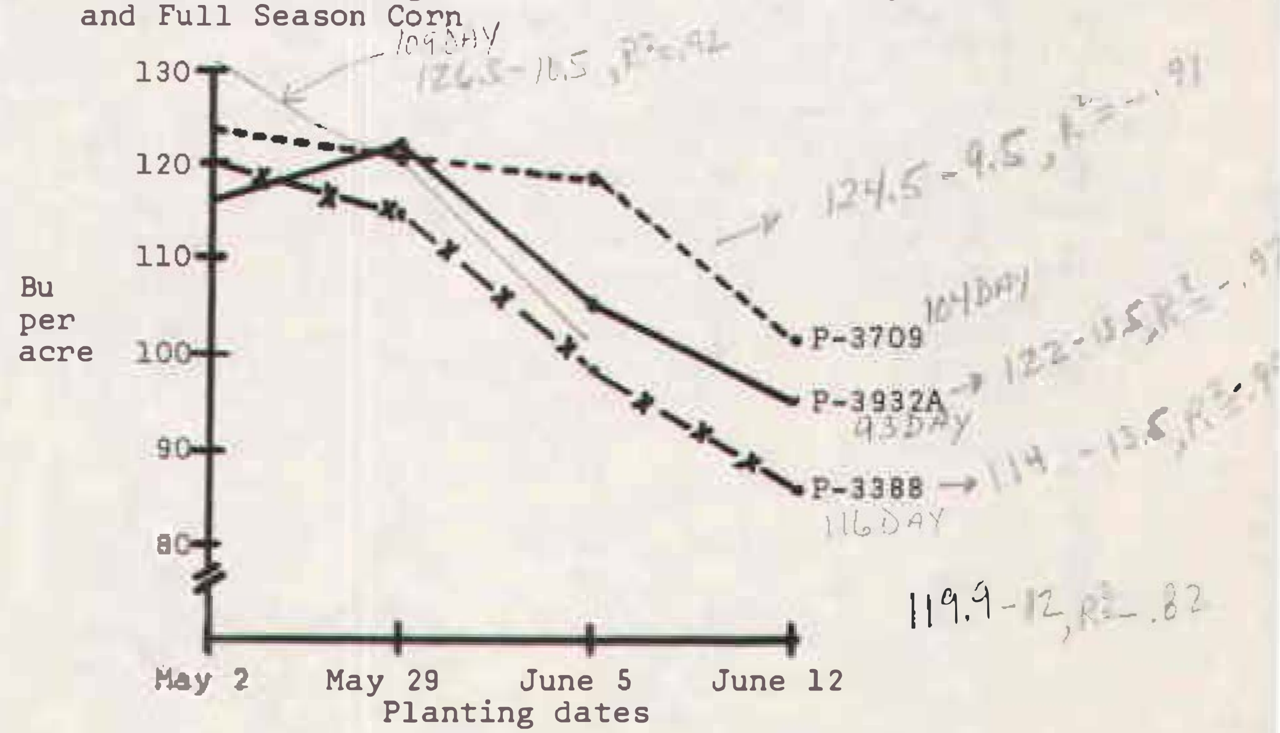
1. If planting is delayed by a cool, wet spring, when should a short or mid-season hybrid be substituted for a full season hybrid.
2. Is there any yield advantage for planting an early maturing hybrid early? Or late?
3. How late can an early, medium, or late maturing hybrid be planted without decreasing yield?

Methods and Procedures

July 5, 1978 - Hail storm
August 25, 1978 - All plots were rotary chopped because of severe hail damage - unfit for experimental use. Plowed same day.
May 15, 1979 - Sprayed plot area with Eradicane + Bladex at the recommended rate. Tandem disked to incorporate. Fertilized with 80 + 40 + 20.
Planting dates - May 22, May 29, and June 5
Varieties - Pio 3388, Pio 3932A, Pio 3709
Herbicide - Lasso II (banded)
Insecticide - Furadan 10G
All plots cultivated twice

November 16, 1979 - Harvested all plots

Figure 1. Effect of Planting Dates on Yields of Early, Mid, and Full Season Corn



Discussion and Interpretation of Figure 1.

P-3932A is an early hybrid for this area(93 day) with a reported large potential flex-range in ear size. P-3709 may be considered a mid-season number (104 day) that has some degree of drought tolerance. P-3388 is a full season (115-117 day) hybrid.

This is the first year for this study. It was located on an imperfectly drained site. Wet conditions in the spring forced planting to be delayed until May 22. The combination of a partial fallow the previous year due to the July 5 hail storm and a cool wet spring caused severe phosphorus deficiency symptoms to appear early in the season even though 80+40+20 (oxide) was broadcast and disked in. With warmer temperatures, the phosphorus deficiency symptoms disappeared and good yields were obtained.

For the full season corn (P-3388), yields decreased when planted after May 22. Reduction in yield was more dramatic when planted after May 29. The full potential of this hybrid may not have been reached with a planting date as late as May 22. Note results in Rates of Nitrogen and Planting Date study where we were able to plant on May 3.

The mid-season hybrid (P-3709) maintained good yields up to the June 5 planting date and then had a rapid decline with more delays in planting.

The early hybrid (P-3932A), did quite well when planted by the end of May, but didn't do as well as expected on the June 5 planting.

Results with an experiment of this type will probably vary from year to year depending on weather. One way to characterize temperature aspects of weather and to relate temperature to planting date results is through growing degree days. By July 30, there were a few growing degree days below normal. By the end of August, this deficiency increased but with more heat in September, the growing degree days went above normal by September 30. There were small variations in October but the total was close to normal.

On the basis of only one year's results, it appears that if planting is delayed much after mid-May, it might be best to switch to an earlier hybrid.

Table 8. Effect of Planting Dates on Ear Moisture at Harvest for an Early, Mid, and Full Season Hybrid

Variety Maturity Rating	Planting Dates May 22	May 29	June 5	June 12	Average
93 day	18.8	19.1	19.8	22.4	20.0
104 day	21.4	22.3	23.9	27.2	23.7
115-117 day	27.8	29.9	31.8	34.3	31.0
Average	22.7	23.8	25.2	28.0	24.9

Discussion and Interpretation of Table 8.

Table 8 was included to show the range in ear moisture percentages for the different hybrids.

Ear moisture percentages were quite similar for the first three planting dates with the early hybrid. For the full season hybrid there was a fairly uniform increase in ear moisture with each delay in planting.

SILAGE REMOVAL AND SOIL DEPLETION

F. Shubeck and B. Lawrensen

Objectives of Experiment

1. By removing all crop residues from the soil but fertilizing adequately, how long can we continue raising corn without an appreciable yield decrease?
2. Can we maintain yields by returning an amount of manure equal to that generated by the feed produced plus additions of commerical fertilizer?

Methods and Procedures

July 5, 1978 - Hail storm - destroyed the corn
July 31, 1978 - Plots could not be used for experimental purposes. Rotary chopped all corn grain plots and removed silage plots with a flail chopper.
August 18, 1978 - Spread all specified plots with manure and commercial fertilizer. Plowed all plots same day.
April 30, 1979 - Sprayed total plot area with Eradicane + Aatrex at recommended rates. Tandem disked to incorporate.
May 4, 1979 - Planted plots
Variety - Pioneer 3541
Insecticide - Furadan 10G (banded)
Herbicide - none banded in the row
Cultivated twice
November 14, 1979 - Harvested plots
November 20, 1979 - Removed stalklage from all silage plots.

Table 9. Effect of Commerical Fertilizer and Manure Applications on Corn Yields with Intensive Soil Depletion Management

Removed From Plot	Fertilizer Treatment N + P + K	Tons of Silage/Acre	Bu. of Corn/Acre
Corn Grain Only	0 + 0 + 0	- - -	125
Corn Grain Only	5 tons manure/acre	- - -	141
Corn Grain Only	0 + 0 + 0	- - -	121
Corn Grain Only	100 + 17.6 + 33.2	- - -	136
Grain and Stover	0 + 0 + 0	8.3	123
Grain and Stover	5 tons manure/acre	9.9	147
Grain and Stover	0 + 0 + 0	8.0	124
Grain and Stover	100 + 17.6 + 33.2	10.1	144

Discussion and Interpretaion of Table 9.

This experiment was initiated in 1975. No grain was harvested in 1978 due to the July 5 hail storm.

There were some increases in both grain and silage when commercial fertilizer or manure was applied.

There were no decreases in grain yield in plots where silage was removed as compared to those where corn grain only was removed. It appears that on these moderately well-drained soils with thick, deep A horizons, a lot of silage can be removed without lowering yield of subsequent crops.

CHISEL PLOW SOYBEANS AND CORN

F. Shubeck and B. Lawrensen

Objectives of Experiment

1. How much tillage is necessary for optimum yields?
2. Will fall tillage increase soil moisture storage?
3. Can yields with chisel plowing be maintained comparable to that from moldboard plowing?
4. Which is the best type of chisel points to use - sweeps, twists, or straight narrow points?

Procedure (Corn after Soybeans)

July 5, 1978 - Hail storm completely ruined all plots. The fall tillage treatments were started a bit early especially the rotary chopping of hailed corn stalks.
August 24, 1978 - All specified treatments completed
May 23-24, 1979 - Spring tillage
May 25, 1979 - Planted plots
Variety - Pioneer 3709
Insecticide - Dyphonate 20G (banded)
Herbicide - Lasso II (banded)
Fertilizer - 100 lbs. of 8-32-16 (starter banded in specified plots)
100 lbs. of Nitrogen per acre sidedressed

Cultivated twice
September 8, 1979 - Harvested plots

Table 10. Effect of Tillage Treatments on Yield of Corn (Corn after Soybeans)

	Tillage Treatment In Fall	In Spring	Corn Bu/A
1.	- - - - - - - - - - - - - - -	Disk-drag	120
2.	- - - - - - - - - - - - - - -	Sweeps-drag	116
3.	- - - - - - - - - - - - - - -	Plow-disk-drag	125
4.	Plow (moldboard)	Disk-drag	126
5.	Chisel plow with twists	Disk-drag	117
6.	Chisel plow with twists	Disk-drag	120
7.	Chisel plow with twists	Sweeps-drag	119
8.	Chisel plow with sweeps	Sweeps-drag	117
9.	- - - - - - - - - - - - - - -	Disk-drag	118
10.	Chisel plow with sweeps*	Sweeps-drag	109

* Treatment ten was unfertilized all other corn plots received 100 lbs. per acre of 8-32-16 (oxide) as a sideband starter. In addition, 100 lbs of nitrogen per acre was applied as a sidedressing when corn was about 12 inches high.

Discussion and Interpretation of Table 10.

Two treatments where the moldboard plow was used (nos. 3 and 4) had the highest average yield of corn. This is somewhat different than previous years where reduced tillage methods on soybean ground were adequate for maximum yield of corn.

There were increases in corn yield due to fertilizer with every tillage treatment.

The spring disk-drag only treatment yielded about as much corn as fall chisel plowing plus spring disk and drag. The fall chisel plowing on soybean ground was of little value this year.

Procedure (Soybeans after Corn)

July 5, 1978 - Hail storm beat all soybean plants into the ground
August 24, 1978 - All specified fall treatments finished
June 4, 1979 - Spring tillage treatments finished
Planted same day
Variety - Wells
Herbicide - Lasso II (banded)
Fertilizer - 100 lbs/acre of 8-32-16 starter
Cultivated twice
October 1, 1979 - Harvested plots

Table 11. Effect of Tillage Treatments on Yield of Soybeans (Soybeans after Corn)

Tillage Treatment In Fall	In Spring	Soybeans Bu/A
1. - - - - - - - - - - -	Disk-disk-drag	39
2. - - - - - - - - - - -	Chop-sweeps-disk-drag	44
3. - - - - - - - - - - -	Disk-moldboard plow-disk-drag	42
4. Disk- moldboard plow	Disk-drag	43
5. Disk- twists	Disk-drag	43
6. Chop-twists	Disk-drag	42
7. Chop-twists	Sweeps-drag	42
8. Chop-sweeps	Sweeps-drag	41
9. Disk	Disk-drag	42
10. Chop-twists*	Sweeps-drag	39

* Treatment ten was unfertilized. All other plots received 100 lbs. per acre of 8-32-16 (oxide) as a sideband starter.

Discussion and Interpretation of Table 11.

The yield of soybeans was excellent this year with only small variations due to tillage treatments.

There were little or no yield increases in favor of the extra chisel plow tillage done in the fall.

Procedure (Corn after Oats)

July 5, 1978 - Hail storm destroyed grain
August 23, 1978 - Fall tillage completed
May 23-24, 1979 - Spring tillage
May 25, 1979 - Planted
Variety - Pioneer 3709
Insecticide - Dyphonate 20G (banded)
Herbicide - Lasso II (banded)
Fertilizer - 100 lbs/acre of 8-32-16 (oxide) starter banded
100 lbs/acre of nitrogen sidedressed

Cultivated twice
September 8, 1979 - Harvested plots

Table 12. Effect of Tillage Treatments on Yield of Corn (Corn after Oats)

	Tillage Treatments In Summer	In Spring	Corn Bu/A
1.	Chisel plow-sweeps	Disk-drag	123
2.	Chisel plow-twists	Disk-drag	123
3.	Moldboard plow	Disk-drag	135
4.	- - - - - - - - - -	Moldboard plow-disk-drag	124
5.	- - - - - - - - - -	Chisel plow-sweeps-disk-drag	116
6.	- - - - - - - - - -	Chisel plow-twists-disk-drag	121
7.	- - - - - - - - - -	Disk-disk-drag	114
8.	- - - - - - - - - -	Chisel plow-sweeps-disk-drag	75*

* Received no fertilizer. All other plots were fertilized with 100 lbs of 8-32-16 (oxide) at planting and 100 lbs Nitrogen sidedressed.

Discussion and Interpretation of Table 12.

Note that this is a corn-oats, rather than a corn-soybean sequence. In the past, when two full season crops like corn and soybeans were used, fall tillage was done late in the season, except when a hail storm occurred as in 1978. Effects on following crops from late fall tillage have been inconsistent at the SE Farm. Therefor, a shorter season crop like oats was introduced to see if early fall or summer tillage would be more effective.

Some of the summer tillage treatments performed after the small grain was destroyed by hail, appeared to have a more favorable effect than comparable spring treatments on yields of the next crop - corn. Moldboard plowing again produced some of the highest yields.

There was a substantial increase in corn due to the fertilizer treatment.

DATE OF PLANTING SOYBEANS

F. Shubeck and B. Lawrensen

Objectives of Experiment

1. Will early planting dates decrease yields of early maturing soybean varieties?
2. Does day length and time of planting seriously effect soybean yield?
3. Can a planting date be selected for early maturing varieties that will prevent improper day length from triggering permature flowering?

Methods and Procedures

July 5, 1978	- Hail storm totaled out all plots which are in a corn-soybean rotation
August 25, 1978	- Rotary chopped hailed corn and plowed total plot area
May 3, 1979	- Spike tooth harrowed plot area to level soil. Sprayed with Treflan at 1.5 pints/A. The total area was tandem disked to incorporate the Treflan. Each planting date was worked previously to planting.
Planting dates	- May 4, May 15, May 22, May 29, June 5, and June 12
Varieties	- Corsoy, Hodgson, Evans, Wells
Herbicide	- Lasso II (banded)
October 2, 1979	- Harvested plots

Table 13. Effect of Planting Date on Yield of Soybeans

Variety	Planting Dates						
	May 4	May 15	May 22	May 29	June 5	June 12	Average
Evans	38	37	45	44	38	39	40.1
Hodgson	51	50	54	56	48	52	51.8
Corsoy	48	45	57	51	50	51	50.3
Wells	46	42	49	41	44	43	44.2
Average	46	44	51	48	45	46	

Discussion and Interpretation of Table 13.

There were some interesting developments with this experiment under 1979 conditions. Mid-season plantings yielded more than either early or late planting dates. An early soybean, Hodgson yielded as much as the full season varieties, Corsoy and Wells. Hodgson matures about a week earlier than Corsoy. In previous years, yields from the earlier maturing Hodgson were usually several bushels below those of Corsoy. The two full season soybeans usually yielded more than the two early maturing varieties and had a different response curve for planting dates. For 1979, optimum planting dates were about the same for all the varieties.

BROADCAST VS DRILLING SEED FOR OATS

B. Lawrensen and F. Shubeck

Objectives of Experiment

1. In a series of dry years like 1975 and 1976, will seeding oats with a press drill be better than broadcasting seed at a little higher rate?
2. Will stands and tillering be comparable with the two methods if seeding rates are similar?
3. How much should seeding rates be adjusted for broadcasting, when reduced tillage methods are used for seedbed preparation? (Soybean ground, disked once and spike tooth harrowed)

Methods and Procedures

Soybean stubble was fertilized with 30+15+0 on all drill and broadcast seeded plots. This was tandem disked and spike tooth harrowed after the April 19th broadcast seeding of oats.

June 14, 1979 - Sprayed area with Brominal+ at the rate of one pint per acre
July 31, 1979 - Harvested plots

Table 14. Effect of Seeding Methods and Rates on Oats Yield

Rate of Seeding Bu/A	Seeding Method: Drill	Broadcast
2	81	85
3	78	81
4	80	82

Discussion and Interpreation of Table 14.

With a well prepared seedbed on soybean ground, the broadcast method of seeding oats yielded as much as the drilling method.

For 1979 condition, two bushels of seed per acre gave as much oats as heavier seeding rates. In 1977, yields increased with each increase in seeding rates.

SOYBEAN ROW SPACING

B. Lawrensen and F. Shubeck

Objectives of Experiment

1. Is there a yield advantage in narrowing rows from 30 inches down to 7 inches?
2. What can we expect for intermediate row spacings between 30" and 7" like 14", 9", or 21"?
3. Is planting soybeans with a small grain press drill (7" spacings) without cultivating a desirable practice?
4. Or is it better to use a skip row method allowing room for tractor wheels and a cultivator in the "skipped" rows?

Methods and Procedures

May 3, 1979 - Sprayed plot area with Treflan at the rate of 1 1/2 pints/acre. Tandem disked to incorporate.

June 1, 1979 - Tandem disked and spike tooth harrowed in readiness for planting.

June 1, 1979 - Planted plots
Variety - Wells
Row spacings - 7", 14", 21", 30" and 15" skip row
Note: Soybeans planted in narrow rows limits cultivating unless special equipment is available.

June 26, 1979 - Cultivated 30" rows

October 5, 1979 - Harvested plots

Table 15. Comparison of Soybean Yields From Several Different Row Spacings

Row Spacings	Bu/A
30" (planted with tool bar planter)	54
21" (planted with tool bar planter)	44
15" skip row (with tool bar planter)	51
14" (planted with JD double disk press drill)	48
9" (planted with Noble shoe type grain drill)	50
7" (planted with JD double disk press drill)	50

Discussion and Interpretation of Table 15.

An attempt was made to keep plant populations at 150,000 for all row spacings. This was difficult to do using different machines and different row spacings. The 21" and 14" spacings had several thousand plants below the intended number and this could account for the lower yield in these plots, especially with a variety like Wells with an upright growth pattern and no widespread branching.

It also points out difficulties for farmers who may plan on switching from one row spacing to another. The metering devices on some machines make it difficult to come up with the desired populations as row spacings are changed. There was no indication of higher yields with row spacings less than 30 inches.

DATE OF PLANTING SUNFLOWERS

F. Shubeck and B. Lawrensen

Objectives of Experiment

1. Will delayed planting help to control or to reduce the insect problem?
2. Can we expect a decrease in yield due to late planting even if insect damage is reduced?

Methods and Procedures

	- Fall plowed
May 3, 1979	- Sprayed plot area with Treflan (1.5 pints per acre) double tandem disked to incorporate.
Planting dates	- May 4, May 15, May 22, May 29, June 5, June 12, June 19, June 28, July 5, July 11
Variety	- Sigco 894A (Soil was disked and dragged before each planting)
Cultivated	- as needed
October 12, 1979	- Harvested plots

Table 16. Effect of Planting Date on Sunflower Yield

Planting date	Lbs seed per acre
May 4	2057
May 15	1788
May 22	1734
May 29	1157
June 5	888
June 12	877
June 19	812
June 28	935
July 5	378
July 11	402

Discussion and Interpretation of Table 16.

Note the wide range in planting dates. The purpose for having such a wide range was to explore the possibility of getting the flowers past the critical stage both before and possibly after the main invasion of the head moth and other destructive insects. Insect damage has been a major problem at the Experiment Farm and this date of planting experiment is an attempt to reduce the severity of the problem without the use of chemicals.

Late planted sunflowers were quite successful last year with little or no insect damage. They were planted July 11, after the first crop was destroyed by hail.

In 1979, the very early planting (May 4) did fairly well. Delays in planting caused a consistent decline in yields. Insect damage was severe and secondary infections were prevalent with most of the planting dates. Damage from insects could have been reduced by spraying, but ~~then~~ the effect of planting dates on insects would have been obscured. The response curve of corn, for delayed planting in 1979, was similar to that for sunflowers but decreases in corn due to delayed planting were not so exaggerated. This would suggest that with sunflowers, climatic conditions probably played an important role, as well as insect populations, in cutting down the yield in the June-July plantings.

Until more data is obtained on planting date and insect control, it may be best to plant at the normal time, watch for insect build up, and spray accordingly.

CONTINUOUS SOYBEANS

B. Lawrensen and F. Shubeck

Objectives of Experiment

1. What are the possibilities of growing continuous soybeans for increasing soil nitrogen and at the same time produce an excellent cash crop? Approximately one pound of nitrogen is returned to the soil for each bushel of soybeans raised.
2. Will disease and insects gradually build up in the soil and reduce yields?
3. Soybeans do not respond to large quantities of commercial nitrogen like corn. Could we raise continuous beans, cut down on the need for nitrogen fertilizer yet increase nitrogen reserves from symbiotic soybean nitrogen?

Methods and Procedures

July 5, 1978 - Hail storm completely destroyed corn and soybeans
August 1, 1978 - Rotary chopped hail damaged corn
August 21, 1978 - Plowed total plot area
May 21, 1979 - Fertilized all corn and soybean plots with the specified fertilizer
May 21, 1979 - Planted corn and soybean plots
Varieties - Corn - Golden Harvest 2500
  Insecticide - Thimet 15G (banded)
  Herbicide - Lasso II (banded)
 Soybeans - Wells
  Herbicide - Lasso II (banded)
September 29, 1979 - Harvested plots

Table 17. Effect of Cropping Sequence on Yields of Soybeans and Corn

Cropping Sequence	Fertilizer	Bushels Corn per acre	Bushels Beans per acre
Continuous beans	check	---	37
Continuous beans	Fertilized*	---	37
Rotation beans & corn	check	107	41
Rotation beans & corn	Fertilized**	114	44

* Soybeans were fertilized with 75 lbs. of 8-32-16 (oxide) per acre broadcast.
** Corn was fertilized with 80-30-20 (oxide) broadcast and disked in.

Discussion and Interpretation of Table 17.

No beans or corn were harvested from these plots in 1978 due to the July 5 hail storm.

Soybeans in rotation yielded more than continuous beans. The overall yields and also the differences were very similar to those of 1977. Perhaps yield decreases due to raising continuous soybeans will stabilize rather than oontinue on a downhill slide with each additional year.

There appeared to be a yield increase due to fertilizer treatment with rotation soybeans but not with continuous soybeans.

ALFALFA VARIETY TRIAL

G. L. Holborn, J. G. Ross, T. J. Heilman, A. A. Boe

The alfalfa variety trial includes 49 entries replicated three times. The plot was seeded May 2, 1974, which followed a preplant application of eptam and 10-30-0 (N-P-K). Subsequent years a 0-90-30 (N-P-K) fertilizer was applied. The experimental design was a triple lattice. It was seeded with a V-Belt Drill in plots 4 feet wide and 20 feet long.

Mean yields ranged from .82 to 1.21 tons per acre under a one harvest regime in 1975. Because of the drought, no harvests were made in 1976. In 1977, 1978 and 1979 two harvests were taken each year. It should be noted that in 1977 the first harvest contributed on an average only 30 percent of the total yield. This harvest was made the first week in June and moisture was inadequate prior to this harvest. However, subsequent above average rainfall promoted vigorous regrowth. Total mean yields ranged from 1.66 to 2.09 tons per acre. Valor and Vernal were the top yielding varieties in the test in 1977. Nineteen seventy eight total mean yields ranged from 3.30 to 4.41 tons per acre. Titan and Waterman-Loomis 305 were the overall highest yielders while Dawson, Kanza and Ladak 65 were the highest yielding public varieties. Nineteen seventy nine total mean yields ranged from 3.29 to 5.32. Klondike was the overall highest yielder, while Dawson and Vernal were the highest yielding public varieties. The top average yielders over four years and seven cuts were Klondike, Dawson, Waterman-Loomis 216 and Vernal.

Precipitation was near average in both 1978 and 1979. Nineteen seventy eight temperatures were only slightly below normal but 1979 temperatures averaged nearly five degrees below normal through the growing season.

Statistical values are listed below:

	Percent Stand 1976	Oven Dry Tons per Acre 1975 1 Cut	1977 2 Cuts	1978 2 Cuts	1979 2 Cuts
Mean	98	0.99	1.88	3.79	4.11
LSD (0.05)	ns	0.14	0.16	.66	.98
C.V. %	2	9.00	6.00	10.00	15.00

Table 18. Alfalfa Variety Trial

Source	Entry	Percent Stand 1976	Oven Dry Tons per Acre 1975 1 Cut	1977 2 Cuts	1978 2 Cuts	1979 2 Cuts
Acco	235	99	1.00	1.96	3.75	4.63
Acco	436	99	.87	1.70	3.49	3.64
Asgrow	Aztec	99	.98	1.88	3.86	4.34
Asgrow	Kodiak	99	1.02	1.77	3.66	3.29
Barzan	Flandria	98	.89	1.73	3.30	3.51
Barzan	Norseman	98	1.16	1.83	3.76	3.19
Cal/West	Bonus	99	.96	1.76	3.62	3.63
Cal/West	Vista	99	.85	1.96	3.34	4.07
DeKalb	131	97	.95	1.82	3.38	4.10
DeKalb	123	96	1.02	1.89	4.00	4.21
DeKalb	153	99	.91	1.71	3.95	4.45
FFR	Tempo	99	.95	1.81	4.03	4.03
FFR	Weevelchek	99	1.11	1.97	3.81	3.82
Farm Seed Research	A-9	99	.89	1.95	3.60	3.99
Farm Seed Research	A-37	99	.99	1.88	3.86	3.93
Farm Seed Research	A-40	99	.96	1.92	3.70	4.00
Jacques	J-60	98	1.03	1.85	3.99	4.45
Jacques	J-70	99	.84	1.82	3.46	4.19
Jacques	JX-80	99	.98	1.86	3.73	4.15
Land O'Lakes-Felco	Valor	99	1.09	2.06	3.93	4.34
Land O'Lakes-Felco	Pacer	97	1.06	1.98	4.01	4.60
Northrup, King	Glacier	99	.82	1.78	3.35	4.35
Northrup, King	Thor	99	1.04	1.88	3.73	4.71
Northrup, King	Warrior	97	.93	1.85	3.76	3.93
J. C. Robinson	Gold n' Pure	99	.91	1.80	3.66	3.77
North American PB	Anchor	98	.87	2.01	3.97	4.26
North American PB	Nugget	99	1.08	1.92	4.01	3.68
North American PB	Titan	99	1.21	1.97	4.41	4.10
Sexauer	A-7	97	.93	1.92	3.67	4.61
Sexauer	A-10	99	1.08	1.96	3.77	3.64
Sexauer	BH-22	99	1.14	1.99	3.99	4.45
Security	Langmeiller	97	.87	1.78	3.77	3.33
Teweles	Klondike	97	1.02	1.88	3.92	5.32
Teweles	Superstan	97	.86	1.83	3.66	3.83
Teweles	Americana	99	.86	1.89	3.70	4.03
Waterman-Loomis	215	99	1.06	1.67	3.80	4.30
Waterman-Loomis	216	99	1.08	1.72	4.13	4.77
Waterman-Loomis	318	99	.97	1.61	3.57	4.05
Waterman-Loomis	305	98	1.09	1.86	4.28	4.42
Waterman-Loomis	307	99	.99	1.92	3.86	3.96
FFR	Scout	97	1.11	1.89	3.68	3.57
Funk's	G-777	98	.83	1.76	3.88	3.58
Agate		97	1.01	2.00	3.76	4.67
Dawson		97	1.02	1.93	4.06	4.86
Iroquois		97	1.03	1.90	3.81	4.59
Kanza		97	.96	1.78	4.02	3.41
Ladak 65		98	1.10	1.97	3.97	4.15
Saranac		99	.96	1.86	3.51	3.95
Vernal		97	1.14	2.05	3.72	4.73

MOST PROFITABLE ROTATION

B. Lawrensen and F. Shubeck

Objectives of Experiment

1. How much will commercial fertilizer increase net profits?
2. Is it more profitable to add nitrogen from a commercial source or grow a legume in a rotation?
3. Which cropping sequence will bring the greatest net returns?
4. Will previous crops have much effect on the available moisture at spring planting time?

Methods and Procedures

July 5, 1978 - Hail storm completely destroyed all crops
Aug. 1-2, 1978 - Rotary chopped all severely hail damaged crops
Aug 18, 1978 - Plowed all rotation crops
April 23-24 - Performed all specified drill seeding of oats
Variety - Noble (rate 2.5 bu/acre)
Sweet clover - Madrid
Alfalfa - Vernal
May 22, 1979 - Tandem disked and spike tooth harrowed all corn, soybean, and grain sorghum plots
May 22, 1979 - Planted corn
Variety - Pioneer 3732
Herbicide - Lasso II (banded)
Insecticide - Dyphonate 20G (banded)
May 23, 1979 - Planted all soybean plots
Variety - Wells
Herbicide - Lasso II (banded)
June 4, 1979 - Planted all grain sorghum plots after tillage
Variety - NK 2023
Herbicide - Bexton 20G (banded)
Insecticide - Furadan 10G (banded for greenbug control)
Cultivation of corn, soybeans, grain sorghum plots - twice

August 1 - Harvested oats
October 1 - Harvested soybeans
October 26 - Harvested grain sorghum
November 7 - Harvested corn

Table 19. Effect of Cropping Sequence and Fertilizer on Crop Yield, 1979

Cropping Sequence	Crop Receiving Fertilizer	Fertilizer lbs/A N + P + K	N Side Dress lbs/A	Oats Bu/A	1st Year Corn Bu/A	2nd Year Corn Bu/A	Soy-beans Bu/A	Sor-ghum Bu/A	Hay Tons/A
1 Continuous corn	- - -	0 + 0 + 0			119.0				
1 Continuous corn	Corn	6 +11 +10	70		137.0				
2 Corn-oats	- - -	0 + 0 + 0		58.0	107.0				
2 Corn-oats	Corn	6 +11 +10	70		131.0				
	Oats	30 + 7 + 0		75.0					
3 Corn-corn-Oats+alf hay	- - -	0 + 0 + 0		71.0	120.0	130.0			0.71
3 Corn-corn-oats+alf hay	Corn	6 +11 +10			132.0				
	Corn	6 +11 +10	70			138.0			
	Oats	15 +26 + 0		92.0					
	Alf resid.	0 + 0 + 0							0.92
4 Oats+sweet clover-corn	- - -	0 + 0 + 0		55.0	104.0				
4 Oats+sweet clover-corn	Oats	30 + 7 + 0		65.0					
	Corn	6 +11 +10			113.0				
5 Corn-soybean-oats	- - -	0 + 0 + 0		62.0	118.0		37.0		
	Corn	6 +11 +10	70		136.0				
	Soybeans	6 +11 +10					48.0		
	Oats	30 + 7 + 0		83.0					
6 Corn-oats-soybeans	- - -	0 + 0 + 0		58.0	128.0		40.0		
6 Corn-oats-soybeans	Corn	6 +11 +10	55		137.0				
	Oats	20 + 7 + 0		84.0					
	Soybeans	6 +11 +10					46.0		
7 Continuous grain sorghum	- - -	0 + 0 + 0						86.0	
7 Continuous grain sorghum	Sorghum	6 +11 +10	70					102.0	

Discussion and Interpretation of Table 19.

Note the yield of corn in rotation 6, where corn followed soybeans. Unfertilized plots yielded 128 bushel per acre. Fertilizer applications increased the yield 9 bushels more. The crop after soybeans is in a favored spot in the rotation.

Seeding and insect problems limited yield of alfalfa.

Soybeans gave a strong response to fertilizer. In previous years there was a fairly consistent increase in bean yields due to fertilizer but the magnitude was less than in 1979.

Fertilizer increased yields of grain sorghum. Over-all sorghum yields were not as high as those of corn. In dryer years, sorghum has produced more grain than corn.

Unfertilized oats yielded 62 bushels per acre when they followed soybeans. This is about 4 bushels more than in the corn-oats sequence (rotation 2). Use of legumes and fertilizer were successful for increasing oats yields as much as 26 bushels (rotation 6).

Fertilizer Rates on Sunflowers

Q. S. Kingsley

OBJECTIVE: Determine the most favorable fertility level for sunflower production.

CROP YEAR HISTORY:

Planted: May 16 Harvested: Sept. 28
Variety: Interstate 894 Replications: Four (4)
Soil Preparation: Chisel plow and disk
Plant Population: 16,000 per acre, 36-inch rows
Fertility: 0-0-0; 0-20-0; 20-20-0; 40-20-0 and 80-20-0 (all starter applied).
Herbicide: Tolban, 1 qt/A disked in
Insecticide: None Cultivations: One
Rainfall: May 16 to Sept. 28 - 12.38 inches
Soil Type: Viborg silty clay loam

RESULTS:

Table 20. Fertility Levels for Sunflower Production, SESD Research Station, Beresford, SD - 1979.

Treatment Lbs/A $N-P_2O_5-K_2O$	Yield Lbs/A	% Oil	Test Weight
0-0-0	1790.8	45.2	31.2
0-20-0	1880.5	44.1	30.8
20-20-0	1826.3	43.9	30.5
40-20-0	1893.4	44.1	30.6
80-20-0	1971.5	45.0	30.4
LSD(.05)	133.6		
CV	6.5		

All yields corrected to 10% moisture.

DISCUSSION:

This experiment was planted May 16 when the soil temperature and moisture were adequate for rapid germination. A preplant weed control using Tolban at 1 quart per acre or 1/2 pound actual ingredient was applied and disked in twice. The fertilizer was applied at planting time 2 inches to the side and 2 inches below the seed. No insecticide was applied on the sunflower plants.

The yield difference between fertilizer amounts in 1979 were small and not significantly different. The largest difference in yield occurred between the 0-0-0 and 80-20-0 treatments. A yield difference of 180.7 pounds may be attributed to the application of nitrogen and phosphorus. This increase did not pay for the cost of the fertilizer, but residual fertility may be left for next years crop. The residual left after the 80-20-0 treatment was 63 pounds of nitrate nitrogen, 70 pounds of phosphorus and 870 pounds of potassium in the top 2 feet of soil.

An oats haylage program would fit well following sunflowers. In this way, the volunteer sunflowers would be cut down and add to the bulk. Late dough oats plus the volunteer sunflowers contains about 7.5 percent protein. Some wilting is needed.

Sunflower Varieties 1979

Q. S. Kingsley

OBJECTIVE: To test various sunflower varieties grown in the state for yield and percent oil content.

CROP YEAR HISTORY:

Planted: May 16 Harvested: Sept. 28
Variety: Various Fertilizer: 80-20-0
Replications: Four (4) Soil Preparation: Chisel plow and disk
Herbicide: Tolban, 1 qt/A disked in
Insecticide: None
Plant Population: 16,000 plants/A in 36-inch rows
Cultivations: One
Soil Type: Viborg silty clay loam
Rainfall: May 16 to Sept. 28 - 12.38 inches

RESULTS:

Table 21. Sunflower Varieties, National Trials, SESD Research Station, Beresford, 1979.

Oil Seed Variety	SESD Beresford Dryland		
	#/A	% Oil	Test Wt.
RBA 300G	2124	42.1	31.5
Sun Hi S 301A	2116	46.6	32.4
Dahlgren 844	2116	42.1	31.5
Sheyenne 898	2071	44.9	32.5
Golden Harvest 10	2051	41.3	31.6
Interstate 7775	2045	42.6	32.3
Dahlgren 704	2031	42.6	31.3
RBA 4000	2017	42.5	31.0
Sunbred 254	2006	42.6	32.9
Sheyenne 893	1992	43.9	33.0
Jacques 501	1939	43.2	31.4
Master Farmer 700	1913	42.9	32.0
Hysun 101	1907	41.1	32.5
Hybrid 894	1899	43.0	31.3
Cenex 897	1877	43.4	31.2
Cenex 907	1877	40.3	31.7
Cal/West 034	1873	42.5	32.0
Sun Hi S304	1873	42.3	31.4
Cargill 204	1848	42.6	31.8
Sigco 241A	1814	43.1	33.2
4 Winds 900	1814	42.9	31.0
Interstate 3107	1795	44.1	32.8
4 Winds 1100C	1795	42.9	32.5
Sigco 894A	1781	41.5	31.0
Cargill 205	1775	42.6	32.6
Sunbred 265	1769	43.7	32.7
Jacques 701	1749	42.9	32.3
Master Farmer 800	1735	41.5	31.7
Hybrid 903	1690	40.3	31.2
Golden Harvest 20	1670	42.6	32.3
Averages	1899	42.7	32.0
LSD(.05)	200		
CV	8.2		

All yields corrected to 10% moisture.

SOLAR CORN DRYING

B. Lawrensen and F. Shubeck

Objectives of Experiment

1. Demonstrate feasibility of using a solar-heat low-temperature drying bin to dry corn in southeastern South Dakota.
2. Assist manufacturer in designing and manufacturing an improved solar collector.
3. Compare costs and energy from solar drying to other methods of drying corn.

Methods and Procedures

A 23.5 foot diameter metal drying bin was constructed in 1976 with a capacity of 5000 bushels. A 10 H.P. centrifugal fan and a 20 kilowatt electric heater were installed. A black-coated metal solar collector was mounted on the southern two thirds of the drying bin wall. Air was drawn from between the solar collector and the wall of the bin into a "fan house". From there it is blown under a perforated floor in the bin and up through the shelled corn. The solar collector was factory-built and features a black, co-polymer plastic coating which is expected to be longer lasting than black paint.

The bin was loaded four different times. Three "fills" were dried and the fourth left in the bin to be dried in the spring when air temperatures rise above 50°F. The third fill was high lysine corn that was raised on the Farm. This is the first year an attempt was made to dry more than one fill.

Table 22. KWH Used for Drying Corn in the Solar Bin

	1st filling	2nd filling	3rd filling	4th filling
Fan	6410	4660	2350	--
Stirring augers	200	390	30	--
Heating unit	7090	6400	2920	--
Total KWH used	13,700	11,450	5300	--
Date filled	Oct. 16	Nov. 16	Dec. 10	Dec. 28
Date emptied	Nov. 16	Nov. 21	Dec. 26	--
Days drying time	31	5	16	--

Table 23. Bushels of Corn Dried and KWH Used Per Bushel

	1st fill	2nd fill	3rd fill	4th fill
Wet bushels in bin[1]	4694	3293	1194	2848
Dry bushels taken from bin[2]	3805	3075	1024	--
% Shrink[3]	18.9	6.6	14.2	--
% Moisture corn at filling	26.2	22.5	25.6	22.8
% Moisture corn when removed	15.0	16.0	14.2	--
% Moisture removed	11.2	6.5	11.4	--
KWH used	13700	11450	5300	--
Cost per bushel[4]	$.067	$.080	$.102	--
Cost per bushel point[5]	$.006	$.012	$.009	--

1 - lbs. wet corn ÷ 56 lbs.
2 - lbs. dry corn ÷ 56 lbs.
3 - (bu. wet corn - bu. dry corn) ÷ bu. wet corn
4 - (KWH x .023) ÷ wet bushels
5 - cost per bushel ÷ moisture removed

Discussion and Interpretation of Tables 22 & 23.

The cost per point of moisture removed from each bushel varied with air temperature and amount of sunshine received during each of the three periods.

Cost per bushel for electricity for drying the three fills was 6.7, 8.0, and 10.2 cents respectively.

The cost per point of moisture removed in each bushel was 0.6 for the 1st fill, 1.2 for the 2nd fill, and 0.9 cents for the third. The cost per point for the 1st fill (Oct. 16 - Nov. 18) was similar to that of the first and only fill in 1977.

TILLAGE TREATMENTS WITH DRYLAND CORN-SOYBEANS ROTATION

Beresford, South Dakota
1979 (first year)

EXPERIMENTAL PLAN

Shallow Tillage Treatments:

(a) Plow treatment: spring moldboard plow, disk twice and drag
(b) Chisel treatment: fall chisel plow, spring disk twice and drag
(c) Disk treatment: spring disk twice and drag
(d) Roto treatment: shallow spring roto-till

Deep Tillage Treatments:

(a) S treatment: fall subsoil
(b) N treatment: not subsoil

Soil: well drained loam

RESULTS (Bushel Per Acre Yields)

CORN

	Plow		Chisel		Disk		Roto	
	S	N	S	N	S	N	S	N
Rep 1	92.56	91.07	92.10	99.19	102.15	104.65	108.79	107.37
Rep 2	80.75	96.81	98.60	100.37	109.45	106.43	101.42	96.64
Rep 3	107.09	92.16	98.24	97.03	98.26	96.09	106.59	102.98
Rep 4	105.47	99.03	94.76	92.11	95.88	92.88	107.53	104.57
Avg.	96.47	94.77	95.93	97.18	101.44	100.01	106.08	102.89
Total Avg.	95.62		96.56		100.73		104.49	

SOYBEANS

	Plow		Chisel		Disk		Roto	
	S	N	S	N	S	N	S	N
Rep 1	44.72	41.07	34.84	37.34	45.93	43.50	51.05	48.63
Rep 2	44.83	39.94	45.86	44.39	47.15	45.81	48.55	53.32
Rep 3	47.37	49.78	33.53	41.07	44.72	45.96	47.04	45.71
Rep 4	47.40	43.56	48.39	39.86	46.02	44.55	40.18	41.14
Avg.	46.08	43.59	40.66	40.67	45.96	44.96	46.71	47.20
Total Avg.	44.83		40.66		45.46		46.96	

Subsoiling Averages

Corn:	subsoiled	99.98
	not subsoiled	98.71
Soybeans:	subsoiled	44.85
	not subsoiled	44.11

ANALYSIS OF RESULTS

There were no statistically significant yield differences due to tillage at the 5% confidence level. Considering the results, it can be observed that subsoiling did not appear to affect yields to any great extent. It can also be observed that the shallowest tillage treatments (DISK and ROTO) appeared to be as good or better than the somewhat deeper tillage treatments (PLOW and CHISEL) from the standpoint of yield.

EXPERIMENT STATION PROJECT

Project 755, Evaluation and Development of Equipment for Reduced Tillage Systems.

PERSONNEL

Project Leader: Tom S. Chisholm, Agricultural Engineering Department
Principal Cooperator: Fred E. Shubeck, Plant Science Department

STANDARD VARIETY SMALL GRAIN TRIALS

J. J. Bonnemann

Three spring small grain trials were seeded at the Southeast Experiment Farm in 1979 - barley, oats, and spring wheat.

The trials were seeded on April 21, 1979. Conditions were most favorable for the oats as yields of all entries averaged over 99 Bu/A. The average of all barley varieties was about 41 Bu/A and the spring wheats averaged about 32 Bu/A. The barley yields suffered most from the periods of high temperatures although test weights were good. Spring wheats were most affected at the filling stage as the test weight average for all entries was only 58 lb/A. Harvest was completed by late July.

The data included in this report are bushels per acre, test weight, and the available several-year averages. Results are found in tables 24, 25, & 26.

Table 24. 1979 Standard Variety Oat Trials

Variety	Bushels per acre 1977	1978	1979	Test Weight 1979
Burnett	a	b	87.5	36
Holden			98.0	38
Nodaway 70			107.0	40
Froker			94.8	37
Chief			104.3	37
Otee			95.8	35
Dal			87.2	35
Noble			101.8	37
Stout			102.6	34
Spear			99.7	37
Lyon			98.3	36
Bates			103.6	37
Wright			93.4	37
Otana			94.0	37
Lancer			105.6	38
Lang			94.6	35
Benson			95.8	35
Moore			104.3	35
Marathon			90.0	33
E-77			90.1	38
Mean			99.2	36
LSD .05			7.0	
CV - %			5.0	

a - 1977 trial lost to residual herbicide damage
b - 1978 trial was hailed out

Table 25. 1979 Standard Variety Barley Trials

Variety	Bushels per acre 1977	1978	1979	2 yr	Test Weight 1979	2 yr
Liberty	34.6	a	34.1	34.4	47	44
Firlbecks III	37.9		44.3	41.1	51	50
Larker	27.4		47.4	37.4	50	43
Primus II	26.9		35.5	31.2	49	45
Bonanza	22.6		42.6	32.6	48	44
Prilar	25.4		39.1	32.2	48	42
Beacon	25.3		40.0	32.6	46	41
Park			42.8		47	
Glenn			41.7		45	
Morex	26.8		41.8	34.3	47	41
Menuet			50.0		51	
Mean			40.7		49	
LSD .05			8.6			
CV - %			15.0			

a - 1978 crop hailed out

Table 26. 1979 Standard Variety Spring Wheat Trials

Variety	Bushels per acre 1977	1978	1979	2 yr	Test Weight 1979	2 yr
Standard/mid-tall						
Fortuna	23.3	a	33.6	28.4	61	59
Chris	20.0		31.1	25.5	59	58
Waldron	26.6		33.3	29.9	58	57
Eureka	24.1		34.0	29.0	59	59
Butte	10.8		39.3	30.4	62	58
James	14.9		35.1	25.0	59	56
Coteau	21.7		30.2	25.9	60	59
Semi-dwarfs						
Era	23.0		30.2	26.6	59	58
WS 1809	26.4		31.0	28.7	58	57
Wared			34.4		59	
Olaf	26.4		32.3	29.3	60	59
Kitt	30.1		34.3	32.2	59	58
Bounty 309	26.3		33.3	29.8	59	57
Profit 75	19.9		28.8	24.3	58	58
Prodax	35.9		26.0	30.9	54	55
Protor	26.2		36.0	26.1	59	59
Angus	26.5		33.5	29.5	61	59
Len				35.1		53
Funks W444	20.1		29.1	24.6	59	56
WS 25	20.7		29.1	24.9	58	58
Solar			32.2		60	
Sexauer Aim			36.9		60	
Sexauer 906-R			24.0		55	
Mean			32.3		58	
LSD .05			5.6			
CV - %			12.3			

a - 1978 crop was hailed out

CORN PERFORMANCE TRIALS

J. J. Bonnemann

Eighty-nine proprietary and experimental corn hybrids were included in the 1979 corn performance trial at the Southeast Experiment Farm.

The corn was drilled in single rows, 32 feet long, 36 inches apart on May 16, 1979. Two seeding rates were established with final counts of 15,700 and 19,385 plants per acre. No statistical difference was found in favor of either population, so the yield reported is the mean of the two seeding rates. Harvest was by picker-sheller on October 25, 1979.

The trial mean yield was 148.7 Bu/A of No. 2 shelled corn. The open fall permitted the plants to fully develop, however it slowed dry down of the ears and stalks. The average moisture in the shelled corn at harvest was 24.7%.

Additional information will be found in the upcoming circular, 1979 Corn Performance Trials. The trial results are presented in Table 27.

Table 27. Corn Performance Trials, Area E., Beresford, SD

Brand and Variety	Type and Cross	Yield B/A	Pct. Root Lodged	Pct. Stalk Lodged	Pct. Ears Dropped	Percent Moisture	Performance Score Rating
Pride 7715	L 2X	179.3	0.0	0.6	0.0	28.3	1
Curry 50-1505	L 2X	176.4	0.0	0.6	0.0	29.3	2
Mc Curdy MSX 84	L 2X	171.9	0.0	2.5	0.0	27.9	4
SDAES EX 108	M 2X	169.1	0.0	5.3	0.0	27.8	9
Northrup King PX74	L 2X	168.9	0.0	0.0	0.0	27.7	6
Acco UC8201	L 2X	168.3	0.0	0.7	0.0	27.9	8
P-A-G SX333	L 2X	167.5	0.0	1.9	0.0	29.1	12
RBA 111	L 2X	165.9	0.0	1.3	0.0	27.1	11
Sokota TX180	L 2X	165.2	0.0	1.3	0.0	28.3	13
Kaltenburg KX 58	M 2X	164.3	0.0	1.9	0.0	21.8	3
Cargill 949	L M2X	163.8	0.0	0.0	0.0	28.2	15
Northrup King PX72	L 2X	163.8	0.0	1.3	0.0	30.4	20
Funks G-4507	L 2X	162.7	0.0	4.5	0.0	29.4	24
Sokota TS62A	M 2X	160.1	0.0	1.3	0.0	20.8	5
Cenex 2380	L 2X	159.9	0.0	2.5	0.0	27.3	21
RBA Super 4	L 2X	159.3	0.0	2.6	0.0	26.8	22
Wilson 1800	L 2X	159.3	0.0	3.9	0.0	28.1	29
Funks G-4323	M M2X	158.9	0.0	0.6	0.0	20.6	7
Mc Curdy 5596	M 2X	158.8	0.0	1.3	0.0	21.9	10
De Kalb XL-62AA	L 2X	157.0	0.0	0.6	0.0	26.6	25
Sokota TX82	L 2X	156.4	0.0	1.3	0.0	28.7	39
Curry SC-150	L 2X	156.1	0.0	0.0	0.0	27.9	36
Mc Curdy MSX 77	L 2X	155.5	0.0	3.8	0.0	27.1	38
Curry SC-1455	M 2X	155.4	0.0	1.3	0.0	23.4	17
Kaltenburg KX76	L 2X	154.8	0.0	0.6	0.0	28.9	43
Blaney B606	M 2X	154.6	0.0	0.0	0.0	22.0	16
Blaney B507	M 2X	154.0	0.0	0.0	0.0	21.1	14
Lynks LX4305	L 2X	153.1	0.0	1.9	0.0	23.7	26
Northrup King PX69A	L 2X	152.7	0.0	1.9	0.0	24.0	30
Lynks LX4220A	M 2X	152.6	0.0	0.6	0.0	22.3	19
Curry TC-347	L 3X	152.0	0.0	2.0	0.0	26.8	46
Trojan TXS 115A	L 2X	151.9	0.0	1.3	0.0	28.5	55
Funks G-4449	L 2X	151.5	0.0	1.3	0.0	23.9	32
Disco SX-24	M 2X	151.3	0.0	0.6	0.0	23.0	27
Kaltenburg KX68	M 2X	151.1	0.0	0.7	0.0	21.7	23
Curry SC-1444	M 2X	150.9	0.0	1.3	0.0	20.7	18

Table 27. Continued

Brand and Variety	Type and Cross	Yield B/A	Pct. Root Lodged	Pct. Stalk Lodged	Pct. Ears Dropped	Percent Moisture	Performance Score Rating
SDAES Check 1	L 2X	150.9	0.0	1.3	0.0	28.7	57
Cargill 924	M M2X	150.7	0.0	0.0	0.0	23.9	33
Acco UC7951	L 2X	150.5	0.0	3.9	0.0	29.8	65
Cargill 872	M M2X	150.5	0.0	2.6	0.0	23.0	35
Fontanelle 420	M 2X	150.1	0.0	0.7	0.0	23.0	31
P-A-G SX397	M 2X	149.3	0.0	4.5	0.0	22.9	40
Acco UC4201	M 2X	149.1	0.0	1.9	0.0	25.9	54
De Kalb XL-54	M 2X	148.5	0.0	0.0	0.0	25.5	51
Wilson 1400A	M 2X	148.1	0.0	1.9	0.0	21.9	36
Lynks LX4120	M 2X	147.6	0.0	0.6	0.0	20.6	28
De Kalb XL-55A	M 2X	147.6	0.0	3.9	0.0	22.9	45
Mc Curdy 6475	M 2X	147.5	0.0	0.6	0.0	24.6	52
Mc Curdy MSX 60	L 2X	147.4	0.0	0.6	0.0	26.3	56
Pride 7710	L 2X	147.1	0.0	0.0	0.0	30.0	74
Asgrow RX549	M 2X	146.9	0.0	0.7	0.0	23.9	49
Jacques JX180	L 2X	146.6	0.0	1.5	0.0	28.0	68
Cargill 934	L 2X	146.6	0.0	1.3	0.0	26.2	59
Cenex 2157	M 2X	146.3	0.0	0.0	0.0	21.3	37
Fontanelle 430	M 2X	145.9	0.0	0.6	0.0	21.9	42
Curry SC-1422	M 2X	145.8	0.0	0.0	0.0	23.0	47
Blaney B606 EWX	M 2X	145.3	0.0	2.6	0.0	20.7	41
Cornelius C39SX	M 2X	145.0	0.0	2.1	0.0	22.2	50
Fontanelle 450	L 2X	144.7	0.0	0.6	0.0	27.1	70
Asgrow RX90	L 2X	144.7	0.0	5.1	0.0	28.7	77
P-A-G SX249	M M2X	144.2	0.0	1.3	0.0	24.5	58
RBA 104	M 2X	143.6	0.0	0.0	0.0	21.1	44
Pride 6678	L 2X	143.1	0.0	3.2	0.0	23.9	60
Trojan T 1120	L 2X	142.9	0.0	1.3	0.0	27.6	75
Sokota TX64	L 2X	142.8	0.0	1.3	0.0	20.6	48
Funks G-4444	M 2X	142.2	0.0	0.0	0.0	21.2	53
Pride 6609	M 2X	141.7	0.0	6.3	0.0	23.3	71
P-A-G SX277	M M2X	141.5	0.0	1.4	0.0	24.3	67
Western KX-70	L 2X	141.5	0.0	2.0	0.0	28.1	81
Mc Curdy 76-99	L 3X	141.4	0.0	1.3	0.0	24.4	69
Acco UC6601	L 2X	141.1	0.0	0.7	0.0	24.7	72
De Kalb XL-32AA	M 2X	140.4	0.0	1.3	0.0	23.0	64

Table 27. Continued

Brand and Variety	Type and Cross	Yield B/A	Pct. Root Lodged	Pct. Stalk Lodged	Pct. Ears Dropped	Percent Moisture	Performance Score Rating
Jacques JX 177	M 2X	139.9	0.0	0.7	0.0	22.7	63
Trojan T 1058	M 2X	139.1	0.0	2.0	0.0	21.7	62
Fontanelle 400	M 2X	139.0	0.0	0.6	0.0	21.8	61
P-A-G 547	M 3X	137.3	0.0	1.3	0.0	23.9	76
Cargill 892	M M2X	137.1	0.0	1.3	0.0	24.9	79
Northrup King PX49	M 2X	137.1	0.0	1.9	0.0	21.6	73
Disco SX-18	M 2X	136.1	0.0	3.8	0.0	23.0	78
De Kalb XL-25A	M 2X	135.7	0.0	1.3	0.0	19.9	66
Northrup King PX603	M 3X	134.7	0.0	3.2	0.0	24.5	83
Acco UC3301A	M 2X	134.6	0.0	1.3	0.0	23.3	80
Cenex 2371	L 2X	133.2	0.0	0.7	0.0	27.3	86
Trojan TXS 102	M 2X	130.4	0.0	2.6	0.0	21.3	82
SDAES Check 2	L 2X	128.8	0.0	4.7	0.0	21.2	84
Wilson 1016	E 2X	127.4	0.0	1.9	0.0	22.8	87
SDAES Check 3	M 2X	119.4	0.0	0.6	0.0	17.2	85
Western KX-620	L 2X	117.1	0.0	2.6	0.0	28.4	88
SDAES Ex 109	M 2X	102.9	0.0	1.3	0.0	23.7	89
Mean		148.7		1.6		24.7	
LSD (.05)		16.7		CV = 8.0%			

SOYBEAN PERFORMANCE TRIALS

J. J. Bonnemann and G. W. Erion

Two soybean trial sites are located in Southeastern South Dakota. Group II and Group III, Northern Uniform and Northern Uniform Preliminary Tests are grown at these sites. These trials include entries from USDA and State breeders in the major soybean producing states and they screen potential new public releases. Standard varieties and proprietary entries are also included in the trials at these sites. The proprietary entries, varieties, or blends, are the choice of the participating companies and a nominal fee is charged to partially offset trial costs.

The trials were seeded at the SE Farm and Elk Point on May 24 and May 25, respectively. Harvest was on October 16-17 at Elk Point and October 17-19 at the SE Farm. Rain interrupted harvest at the SE Farm.

Excellent yields were obtained at the Southeast Experiment Farm while yields at Elk Point were somewhat less. The average yields were 54.3 and 42.0 Bu/A at the SE Farm and Elk Point, respectively. Precipitation distribution caused some stress at Elk Point. September was above normal for temperature at both sites and a killing frost did not occur until mid-October. The extended growing period permitted the later maturing entries to mature and produce good yields.

Many public and proprietary entries yielded very well. Corsoy has the best long-term average of the public Group II soybeans at the SE Farm. Several lines just released also had excellent yield records in 1979, most of them later in maturity than Corsoy.

The Group III soybeans have a better yield record at Elk Point for the past several years. We have not had an early killing frost during this period and this has permitted the later maturing soybeans to mature and produce better yields. Several newly released lines also had excellent yields at Elk Point in 1979. When soybeans are drilled in narrow rows, 7 to 9 inches apart, and a good fertility and chemical weed control program are used, some of the new semi-dwarf soybeans may do quite well. These semi-dwarfs were developed for high yield environments in solid seedings, not for rows 30 or more inches apart.

The yields and other agronomic data from the trials are shown in Tables 28, and 29, for Centerville and Elk Point, respectively. Results of all soybean performance trials are avilable in Plant Science Pamphlet #51, 1979 Soybean Performance Trials.

Table 28. 1979 Soybean Performance Trial, Southeast Experiment Farm, Beresford, SD

Identification of Entries[1]			1979 Field Data			Average Yield in Bu/acre		
Standard Varieties			Maturity Date (mo-day)	Plant Height (inches)	100 seed weight (grams)	1979	1975-79[c]	1977-79[c]
Entry	Days to Mature[2]	Maturity Group[3] [a]						
Swift	0	0	9-21	32	17.4	42.8		
Weber (I.C.)	+ 7	I	9-23	31	15.8	53.9		
Coles	+ 10	I	9-24	35	20.3	52.6		50.7
Harcor	+ 10	II	9-24	36	17.0	52.6	38.6	53.6
Hodgson 78	+ 6	I	9-24	33	18.5	49.3		
Vickery	+ 10	II	9-24	34	16.4	46.0		
Corsoy 79	+ 10	II	9-25	36	17.2	53.1		
Hark	+ 11	I	9-25	37	17.1	46.9	32.8	45.4
Corsoy	+ 10	II	9-26	36	17.8	55.2	37.0	52.1
Wells II	+ 12	II	9-27	34	19.3	54.3		
Nebsoy	+ 13	II	9-28	36	21.7	56.2		
Sloan	+ 15	II	9-28	34	21.3	52.3		55.6
Beeson 80	+ 16	II	9-29	34	21.5	59.1		
Century	+ 15	II	10-2	37	21.8	56.1		
Amcor	+ 18	II	10-2	39	19.5	62.2		
Wayne	+ 24	III	10-3	38	20.0	51.1	37.6	49.5
Woodworth	+ 25	III	10-3	40	16.4	56.6	37.8	53.2
Will	+ 24	III	10-3	39	19.0	54.7		
Cumberland	+ 27	III	10-6	37	21.6	54.4		
Proprietary Entries:								
Brand	Entry	[b]						
Peterson Brand	105P (B)	II	9-24	35	17.2	52.8	38.1	51.2
Pfizer	PGI CX155	I-II	9-24	37	17.1	43.9		44.7
Pfizer	PGI CB200(B)	I-II	9-24	37	17.4	50.6		
NAPB	Agripro 18(B)	II	9-24	36	18.0	49.9		
NAPB	Agripro AP200	II	9-24	36	18.7	52.7		
NAPB	Agripro AP225C	II	9-24	35	20.9	50.1		

Table 28. Continued 1979 Soybeans, Beresford, SD

Identification of Entries[1]			1979 Field Data			Average Yield in Bu/acre		
			Maturity Date	Plant Height	100 seed weight	1979	1975-79[c]	1977-79[c]
Proprietary Entries: (cont'd)			(mo-day)	(inches)	(grams)			
Brand	Entry	Maturity Group[3]						
		b(cont'd)						
ACCO	201 (B)	II	9-24	37	19.1	55.2		
NAPB	Migro HP 20-20		9-24	35	20.3	53.2		
Hy-Vigor	Rowtunda (I.C.)	II	9-24	34	20.0	55.5		
Pride	B216	II	9-25	36	18.4	57.3	39.1	56.1
Peterson Brand	3100 (B)	II	9-25	37	17.8	56.1	39.2	53.0
Peterson Brand	2477	II	9-25	35	17.9	62.0		
Hy-Vigor	900 (B)	II	9-25	36	18.8	47.1		
Northrup King	S1492	II	9-26	34	18.4	57.9		54.6
Pride	B220	II	9-26	37	18.9	55.4		
Pfizer	PGI 2ER-75 (B)	II	9-26	38	19.7	54.8		52.7
Jacques	J104 (B)	II	9-26	37	18.4	54.3		
Hy-Vigor	903 (B)	II	9-26	36	18.9	55.1		
Hy-Vigor	905 (B)	II	9-26	38	19.0	53.0		
Northrup King	S 1474	II	9-27	35	21.2	54.6	39.9	53.7
Northrup King	S 2596	II	9-27	32	20.8	59.6		
Peterson Variety	2877	II	9-27	35	18.7	57.6		
Curry	C-210A	II	9-27	37	20.1	57.8		
Northrup King	Multi 52 (B)	II	9-28	36	16.8	52.1		
SRF	200	II	9-28	41	17.7	52.3	37.5	48.6
Fontanelle	4444	II	9-28	36	19.2	53.6		
Hy-Vigor	907 (B)	II	9-28	40	18.1	53.8		
NAPB	Migro HP 25-25		9-29	37	23.3	55.6		
Curry	C-300B (B)	II	9-29	38	22.2	59.2		
Peterson Brand	3105 (B)	II	10-1	38	18.4	59.9		

Table 28. Continued 1979 Soybeans, Beresford, SD

Identification of Entries[1]			1979 Field Data: Maturity Date (mo-day)	Plant Height (inches)	100 seed weight (grams)	Average Yield in Bu/acre: 1979	1975-79[c]	1977-79[c]
Proprietary Entries: (cont'd)								
Brand	Entry	Maturity Group[3]						
		b(cont'd)						
Fontanelle	4747	II	10-2	36	17.1	59.8		
Curry	C-310A	II	10-2	36	21.0	54.2		
ACCO	301 (B)	III	10-6	38	20.4	58.8		
					Mean, B/A -	54.3		
					LSD (.05) -	8.5		
					C.V.-% -	9.7		

1 - Listed in order of 1979 maturity
2 - Expected relative maturity at this site compared to Swift when not exposed to a killing frost
3a- Maturity Group from USDA classification: I = early, II = midseason, III = late at Beresford
3b- Information supplied by the company
NOTE - Shattering potential: 1 = no loss for all entries

(B) - blend
c - 1978 hailed out
(I.C.) - good tolerance to iron chlorosis

Table 29. 1979 Soybean Performance Trial, Ed Curry, cooperator, Elk Point, SD

Identification of Entries[1]			1979 Field Data			Average Yield in Bu/acre		
			Maturity Date (mo-day)	Plant Height (inches)	100 seed weight (grams)	1979	1976-79	1978-79
Standard Varieties								
Entry	Days to Mature[2]	Maturity Group[3]						
		a						
Corsoy	+ 10	II	9-26	35	16.3	42.0	40.7	46.6
Corsoy 79	+ 10	II	9-26	36	16.1	36.3		
Wells II	+ 13	II	9-28	35	18.2	39.5		45.3
Harcor	+ 11	II	9-28	38	14.4	44.4		
Nebsoy	+ 13	II	9-30	33	16.4	38.5		42.9
Beeson 80	+ 13	II	10-1	36	19.5	45.1		
Sloan	+ 14	II	10-2	37	16.3	41.9		41.2
Century	+ 15	II	10-3	36	16.7	42.3		
Wayne	+ 19	III	10-4	39	17.0	35.7	40.9	41.3
Woodworth	+ 20	III	10-4	39	15.4	44.7	42.0	45.1
Cumberland	+ 25	III	10-9	37	19.1	45.2		45.2
Pella	+ 24	III	10-9	37	18.8	55.6		
Will	+ 18	III	10-9	38	17.9	50.3		
BSR 301	+ 21	III	10-11	38	16.8	41.0		
Oakland	+ 24	III	10-13	37	19.2	43.9		47.3
Williams	+ 28	III	10-13	40	18.3	44.5	40.0	43.0
Elf (SD)	+ 24	III	10-13	32	15.8	46.4		46.2
Calland	+ 24	III	10-14	38	19.0	39.2	40.4	41.2
Union	+ 30	IV	10-14	41	19.0	42.3	38.2	41.2
Proprietary Entries:								
Brand	Entry	b						
ACCO	201 (B)	II	9-25	37	17.0	42.7		47.0
Hy-Vigor	Rowtunda (I.C.)	II	9-25	36	17.2	40.2		
Peterson Brand	105P (B)	II	9-26	35	15.5	36.9	41.0	45.2
Peterson Brand	2477	II	9-26	37	16.0	45.0		48.2
Asgrow	A2440	II	9-27	37	14.4	43.2		
Peterson Brand	3100 (B)	II	9-27	36	15.8	39.4	41.6	43.9
Land O'Lakes	GO-44 (B)	I	9-27	35	16.8	41.4		44.9
Hy-Vigor	900 (B)	II	9-27	36	16.0	40.6		

Table 29. Continued 1979 Soybeans, Elk Point, SD

Identification of Entries[1]			1979 Field Data			Average Yield in Bu/acre		
Proprietary Entries: (cont'd)			Maturity Date (mo-day)	Plant Height (inches)	100 seed weight (grams)	1979	1976-79	1978-79
Brand	Entry	Maturity Group[3]						
		b(cont'd)						
Hy-Vigor	903 (B)	II	9-27	37	16.8	42.3		
Hy-Vigor	905 (B)	II	9-27	37	16.5	38.0		
Asgrow	A2575	II	9-28	37	17.2	42.0		46.3
Pride	B216	II	9-28	34	15.9	40.8		
Pfizer	PGI 2ER-75 (B)	II	9-28	36	16.3	41.1		
Jacques	J104 (B)	II	9-28	35	14.5	38.1		
Northrup King	Multi 52 (B)	II	9-29	36	15.9	38.4		45.3
SRF	150P	I	9-29	37	15.7	42.8		44.2
SRF	250	II	9-29	33	14.8	42.3		
Land O'Lakes	Dixon	II	9-29	35	14.9	37.8	40.5	42.4
Schettler	TC 204 (B)	II	9-29	36	16.3	40.2		
Hy-Vigor	907 (B)	II	9-29	39	18.0	35.6		
Northrup King	S 1492	II	9-30	34	15.0	43.6	40.5	46.0
Northrup King	S 1474	II	9-30	36	17.5	43.0		45.5
Land O'Lakes	GO-42 (B)	II	9-30	38	18.1	43.9	41.2	44.3
Asgrow	A2656	II	10-1	36	19.1	43.5	42.6	45.9
Northrup King	S2596	II	10-1	34	19.3	44.8		
SRF	200	II	10-1	41	16.7	48.9		45.1
Peterson Variety	2877	II	10-1	41	17.2	43.1		48.4
Pfizer	PGI CB244 (B)	II	10-1	36	18.1	38.7		
NAPB	Agripro 2818 (B)	II	10-1	39	20.8	39.1		
VR	Duke	II	10-1	35	17.9	43.7		
Peterson Brand	3105 (B)	II	10-2	38	16.6	43.6		
VR	Burr	II	10-2	36	17.0	39.5		
NAPB	Migro HP 25-25		10-2	39	19.0	43.6		
Curry	C-[illegible]10A	II	10-2	36	19.5	41.1		
Curry	C-300B (B)	II	10-2	36	17.2	43.3		
Pfizer	PGI CX290	II	10-3	38	16.6	41.2		
NAPB	Agripro 20	II	10-3	39	19.7	39.7		

Table 29. Continued 1979 Soybeans, Elk Point, SD

Identification of Entries[1]			1979 Field Data			Average Yield in Bu/acre		
			Maturity Date	Plant Height	100 seed weight	1979	1976-79	1978-79
Proprietary Entries: (cont'd)			(mo-day)	(inches)	(grams)			
Brand	Entry	Maturity Group[3]						
		b(cont'd)						
VR	Boss	III	10-3	38	18.0	41.1		
Curry	C-310A	II	10-3	35	18.8	40.4		
NAPB	Agripro 27	III	10-5	36	18.4	42.3		
VR	Classic I	II	10-5	37	14.8	38.9		
Asgrow	A 3127	III	10-6	35	15.3	51.0		47.4
Schettler	Liberty (B)	III	10-7	37	18.1	40.5		44.4
NAPB	Agripro 35	III	10-9	39	16.8	43.5		38.0
NAPB	Agripro 25	III	10-10	36	18.7	39.4		44.5
NAPB	Migro HP 30-30		10-10	38	17.8	45.7		
ACCO	301	III	10-12	38	18.9	42.3		44.5

Mean, B/A - 42.0
LSD (.05) - 7.3
C.V.-% - 12.5

1 - Listed in order of 1979 maturity
2 - Expected relative maturity at this site compared to Swift when not exposed to a killing frost
3a- Maturity Group from USDA classification:
I & II - early to midseason; III - full season to late;
IV - late at Elk Point
3b- Information supplied by the company
NOTE - Shattering potential: 1 = no loss for all entries

(SD) - semi-dwarf
(B) - blend

GRAIN SORGHUM PERFORMANCE TRIALS

J. J. Bonnemann and G. W. Erion

The 1979 grain sorghum trial at the Southeast Experiment Farm included 43 entries, both proprietary and public. The trial was seeded on May 24 and harvested on September 24. The row spacing was 36 inches. A recommended herbicide and insecticide were banded at seeding time for weed and insect control.

Yields were excellent in 1979 and quality very good. The trial mean yield was 6140 pounds per acre. The trials had been nipped only lightly by frost when they were harvested and moisture averaged 28.7%. The cloudy, cooler weather early in the crop year delayed maturity and the average heading date of August 2 was at least a week later than normal for the trial. The dry, warm September aided full development of nearly all entries as most were below 35% moisture on September 20.

Additional information will be found in the upcoming circular, 1979 Grain Sorghum Performance Trials. The results for the 1979 Southeast Farm trial are found in Table 30.

Table 30. 1979 Grain Sorghum Performance Trials, Area E. Southeast Experiment Farm, Centerville, Clay County, SD

Brand & Variety	Yield, lb/A	Test Wt. lb/B	Height, inches	Percent Moisture, 9/20/79	Date Headed
Disco 198R	7355	60	53	29.5	8/4
Frontier 395R	7350	61	49	29.6	8/2
YW GBT606	6975	59	48	29.5	8/1
Cenex 310T	6970	59	48	28.9	8/1
Disco 202R	6830	57	54	35.+	8/7
Asgrow Corral	6780	61	50	31.9	8/3
Disco 194R	6735	61	49	28.9	7/30
Warner W-564T	6680	60	45	28.5	7/31
Western WS-220	6640	58	51	35.+	8/7
Asgrow Bug-Off E	6605	58	49	29.6	8/1
Disco 200R	6550	59	49	29.7	8/2
DeKalb C-42a+	6530	58	49	32.2	8/3
Northrup King Brand 2030	6520	56	44	28.0	7/29
Trojan M550G	6445	58	52	30.8	8/1
Frontier 4000R	6420	57	49	29.4	8/2
YW GBT 607	6410	56	55	31.1	8/2
Disco 196R	6380	58	53	31.9	8/2
Acco R 1014	6345	56	45	28.4	7/27
Warner W-601T	6315	58	51	28.5	7/31
Cenex 333	6315	58	47	27.7	7/31
Growers GSA 1060	6280	58	46	21.0	7/27
Cargill 30	6275	59	47	30.9	7/30
Growers GSA 1100	6270	58	55	31.5	8/3
Acco GR1028	6220	58	46	31.1	8/2
Asgrow Dorado E	6165	56	46	25.3	7/26
Cenex 322T	6125	59	50	30.1	8/4
Warner W-545T	6075	57	39	27.3	7/27
Cenex 228T	6060	61	44	28.6	7/31
Warner W-636T	5960	56	39	26.6	8/1
Acco GR1018	5930	60	43	30.0	8/1
DeKalb B-38+	5915	62	48	26.7	7/24
P-A-G 4433	5910	58	46	31.0	8/1
Northrup King Brand 2018	5825	55	46	25.9	7/26
Cenex 320T	5760	57	42	27.4	8/1
Western WS-215	5670	57	45	32.0	8/6
Trojan M548G	5615	58	45	25.5	7/30
Acco X-6353	5575	58	40	33.4	8/7
Acco X-6355	5280	57	44	35.+	8/8
Pride P808GB	5225	58	50	26.2	7/27
SDAES SD 106	5125	56	41	16.7	7/19
P-A-G 854	5105	57	41	21.3	7/28
Cargill 20	4755	55	39	20.3	7/27
SDAES SD 104	3695	58	47	19.4	8/2
Means	6140	58	47	28.7	8/2
LSD (.05)	865			CV - % = 8.7	

PERFORMANCE OF HERBICIDES IN CORN AND SOYBEANS

W. E. Arnold and L. J. Wrage

Herbicide demonstration plots provide side-by-side comparison of herbicide treatments. Treatments include herbicides presently labeled and those which may be approved in the near future. Demonstration plots are the final step in the herbicide evaluation program. Rates and application methods for each are based on results obtained in previous years' screening tests.

Methods

Preplant and preemergence treatments were applied in the corn and soybean plots on May 24. A plot sprayer delivering 20 gpa water and 40 psi pressure was used. Preplant treatments were incorporated immediately with two tandem diskings set to cut 5-6 inches deep (except Lasso, Dual, atrazine and Cobex preplant treatments incorporated 3-4 inches deep with one disking) and harrowed. Plots were planted in 30-inch rows the same day. Precipitation totaled .6 inches and .2 inches for the first and second week after planting, respectively. Post-emergence treatments were applied June 26.

Weed pressure was moderate to light. Annual grass species included green and yellow foxtail. Major broadleaved species were smooth, rough and prostrate pigweed, lambsquarters and kochia. Kochia became more apparent in late season. The plots were not cultivated.

Results

The performance of corn and soybean herbicide treatments is presented in the following tables. Evaluations are based on an average of two visual estimates for each weed listed. Late season evaluations provide a means of comparing residual weed control. A 3-year (1977, 78, 79) average for early season weed control is included.

Weed control differences in 1979 were apparent. The strengths and weaknesses of each treatment can be assessed. Over 90% control of both grasses and broadleaved weeds was achieved with several combination treatments.

Table 31. Corn Herbicide Demonstration Plots

		Percent Weed Control						
	lb/A	6/27/79			9/19/79		3-Yr. Avg.	
Treatment	a.i.	Pxcl	Kochia	Lmbsq	Gr	Bdlf	Gr	Bdlf
PREPLANT INCORPORATED								
Check	---	0	0	0	0	0	0	0
Eradicane	4	98	0	98	90	0	97	75
Sutan+	4	98	0	98	95	10	90	68
Eradicane+atrazine	4+1	98	94	98	90	90	97	97
Eradicane+Bladex	4+1½	98	93	98	94	88	98	97
Sutan++atrazine	4+1	98	96	98	96	96	94	97
Sutan++Bladex	4+1½	98	98	98	97	94	96	96
Sutan++atrazine+Bladex	4+½+1	96	98	98	94	96	---	---
Lasso	3½	98	70	98	95	60	---	---
Dual	3	98	30	98	92	45	---	---
atrazine	2½	70	96	98	70	98	76	98
PREEMERGENCE								
atrazine	2½	65	98	98	60	94	68	98
Bladex	3	70	84	90	75	80	83	91
Lasso	3	98	30	30	92	30	97	72
Dual	2½	96	15	84	92	25	97	78
Prowl	2	65	84	98	70	90	80	91
Ramrod/Bexton/Propachlor	5	95	84	45	96	40	95	79
Lasso+atrazine	2+1	94	98	98	94	95	94	98
Lasso+Bladex	2+1½	93	98	75	92	93	95	94
Lasso+Banvel	2+½	94	99	99	80	90	95	98
Dual+atrazine	2+1	90	99	98	78	94	94	98
Dual+Bladex	2+1½	90	98	75	75	85	---	---
Prowl+atrazine	1½+1	80	99	99	70	92	86	98
Prowl+Bladex	1½+1½	75	99	99	65	90	85	97
Propachlor+atrazine	4+1	98	99	99	80	92	97	99
Propachlor+Bladex	4+1½	99	99	99	92	94	---	---
POST-EMERGENCE								
atrazine+oil	1½+1	65	98	98	30	90	68	98
Bladex+Wetting Agent	1½+½%	30	50	98	40	90	---	---
PREEMERGENCE & POST								
Propachlor&2,4-D amine	4&½	98	93	98	80	95	96	97
~~Propachlor&Banvel~~	4&¼	98	93	94	80	95	96	96
Propachlor&Banvel	4&½	98	95	95	80	95	---	---
Propachlor&Basagran	4&1	98	93	93	78	90	---	---
Check	---	0	0	0	0	0	0	0

Table 32. Soybean Herbicide Demonstration Plots

Treatment	lb/A a.i.	Percent Weed Control 6/27/79 Gr	Bdlf	3-Yr. Avg. Gr	Bdlf
PREPLANT INCORPORATED					
Check	--	0	0	0	0
Treflan	3/4	93	86	91	88
Tolban	1	90	80	91	86
Prowl	1½	94	79	91	86
Basalin	1	94	80	91	85
Cobex	½	91	79	90	85
Vernam	2½	92	48	88	73
Lasso	3½	95	42	--	--
Dual	2½	96	48	--	--
Treflan+Modown	3/4+2	94	89	--	--
Treflan+Amiben	3/4+2	96	95	--	--
Prowl+Sencor/Lexone	1+3/8	96	97	--	--
Tolban+Sencor/Lexone	1+3/8	94	94	--	--
Treflan+Sencor/Lexone	3/4+3/8	94	94	94	93
PREPLANT INCORPORATED & PRE					
Treflan&Sencor/Lexone	3/4&1/2	96	98	97	98
Treflan&Lorox	3/4&1	94	86	92	89
PREEMERGENCE					
Amiben	3	85	90	90	93
Lasso	3	90	62	92	84
Dual	2½	96	58	--	--
Lasso+Amiben	2+2	94	95	96	97
Lasso+Lorox	2+1	89	78	93	89
Lasso+Modown	2+1½	88	88	94	94
Lasso+Premerge	2+4½	82	80	90	87
Lasso+Sencor/Lexone	2+½	92	96	96	98
Dual+Sencor/Lexone	2+½	97	98	--	--
Prowl+Sencor/Lexone	1+½	77	94	--	--
Modown	2	20	88	38	89
PREEMERGENCE & POST					
Lasso&Basagran	2&1	82	92	92	95
Lasso&Dyanap	2&2½	85	84	93	91

POST-EMERGENCE PHOSPHORUS ON CORN

R. Schoper, R. Gelderman, P. Carson, and R. Nettleton

Phosphorus deficiency symptoms have frequently been noted on corn following a year of fallow. While the reasons for the apparent phosphorus deficiency are not completely understood, it is known that small amounts of phosphorus included in a starter fertilizer will correct the problem.

Following the hailstorm on July 5, 1978 in the area around the Southeast Experiment Farm, farmers either replanted or fallowed hailed areas. Land which was fallowed the last half of 1978 and planted to corn in 1979 generally showed severe phosphorus deficiency symptoms when no starter fertilizer containing phosphorus was applied.

Objectives

1. Determine whether phosphorus fertilizer applied after corn emergence could improve early growth and grain yield.
2. Observe differences in corn response to three different phosphorus fertilizer carriers.

Methods

The experimental area was located on the Harlan Nielsen farm three miles east of the Southeast Farm. The soil was a Viborg silty clay loam. Viborg soils are nearly black, silty clay loams with thick surface horizons occurring on level to gently sloping areas, in slight depressions, swales and heads of drainage ways. The slopes are less than 3%, the surface is concave or plane,and the soils develop in glacial till. The area, in 1978, was in soybeans and then fallowed following the July hailstorm.

Soil analysis indicated a very high level of soil nitrates (180 lb/A of NO_3^-N in the 0-6 inch layer), a medium phosphorus test (25 lb/A) and a near neutral soil pH (6.6).

The experimental design consisted of four replications of four different fertilizer treatments arranged in a randomized complete block design. In addition to a check treatment, three phosphorus carriers including concentrated superphosphate (0-46-0),ammonium polyphosphate (11-37-0),and urea phosphate (17-44-0) were applied at a rate of 20 pounds of P_2O_5 per acre on June 18, 1979. The ammonium polyphosphate (11-37-0) was applied as a spray application on the leaves and the soil within the plots. The other materials were dry and were broadcast on the surface. Plants exhibited extreme phosphorus deficiency symptoms at the time of fertilizer application.

Results

Application of phosphorus produced a trend towards increased grain yield; however, differences are small and must be considered due to experimental variation (Table). Both treated and untreated corn recovered from early deficiency symptoms by late July and no visual differences between treatments were noted at the time of maturity.

Table 33. The Influence of Post-Emergence Application of 20 Pounds of Phosphorus on Corn.

Phosphorus Source	Grain Yield[L1]	Grain Moisture[L2]	Plant Population at harvest
	bu/A	%	
Check	118	31.7	15599
0-46-0	124	31.4	14864
11-37-0	121	32.1	14946
17-44-0	121	30.0	14191
Significance	ns	ns	ns

L1 - Yields calculated at 15% moisture.

L2 - Moisture sample taken by cutting a section out of the center of 8 ears of corn. This includes a section of the cob.

POTASSIUM FERTILIZER USE ON HIGH LIME SOILS

R. Schoper, P. Carson, R. Gelderman, R. Nettleton

Soil test summaries for Southeastern South Dakota indicate that most soils are well supplied with potassium. Lack of response by corn to broadcast applications of potassium fertilizers on high testing soils is well documented; however, the use of potassium in starter fertilizers has not been adequately studied. The primary objective of this experiment is to provide a portion of the information necessary to refine potassium fertilizer recommendations for corn.

Methods

The experimental area was located on a Badus silty clay loam soil at the Southeast Farm. Badus soils are deep, friable, somewhat poorly drained soils that occur on flats or in shallow basins. They may be saline. In this case, the salinity was not high. Soil analysis on samples taken at the initiation of the experiment are as follows:

NO_3-N lb/A 0-24"	NO_3^-N lb/A 0-48"	O.M. %	P lb/A	K lb/A	pH	Soluble Salts mmho/cm
61.1	144.3	3.5	20	727	7.5	2.0

The nitrogen supply was adequate for the yield obtained, the available phosphorus was considered medium and the potash was considered high.

The experimental design consisted of four replications of two broadcast potassium treatments (0 and 240 lb/A K_2O) and four starter potassium treatments (0, 10, 20, and 30 lb/A K_2O) arranged in a split plot randomized block design. All starter potassium rates were in combination with 10 lb/A of nitrogen and 20 lb/A phosphorus (P_2O_5) and were placed in a band two inches below and two inches to the side of the seed.

Adequate weed and insect control was maintained through the use of Lasso II and Dyfonate applications at planting. Pioneer 3541 was planted on May 21 at a population of approximately 17,000 plants per acre.

Results

Yield data from this experiment in 1979 indicated no significant differences or trends due to potassium fertilizer treatments (Table 34). The moisture contents of the ears at harvest time show that the starter fertilizer did not consistently influence it but that the 240 pound per acre broadcast application caused a small consistent increase in moisture content. The fertilizer treatments had no influence on the final plant population that could be considered significant. Further testing will be necessary to determine the value of potassium in starter fertilizers in Southeastern South Dakota.

Table 34. The Effect of Broadcast and Starter Potassium on Corn Yield,Moisture Content and Plant Population at Harvest

Broadcast Potassium	Starter Potassium lb/A K_2O				Average
	0	10	20	30	
lb/A K_2O	bu/A L1				
0	134	132	137	129	133
240	135	128	132	124	130
Average	134	130	135	126	
	Moisture Content Percent L2				
0	26.5	26.8	26.7	27.3	26.8
240	29.4	29.4	27.3	28.3	28.6
Average	27.9	28.1	27.0	27.8	
	Harvest Population-Plants Per Acre				
0	15899	17532	16335	16008	16443
240	17424	16117	16008	15137	16089
Average	16661	16825	16008	15572	

L1 - Yields calculated at 15% moisture.

12 - Moisture sample taken by cutting a section out of 8 ears of corn. This includes a section of the cob.

CORN VIRUSES DETECTED AT THE SOUTHEAST EXPERIMENT FARM, 1979

W.S. Gardner, F.E. Shubeck, V.L. Jons, and J.J. Bonnemann

New corn virus disease problems are being detected each year in the United States and in other parts of the world. Some of these diseases are not serious threats while others indicate a potential for causing great yield reductions.

In 1978, at Brookings, corn was infected with maize dwarf mosaic virus (MDMV) if the seed was planted in late June or early July. In order to determine the response of corn hybrids to MDMV, 190 corn lines submitted to the South Dakota Experiment Station for yield testing, were planted on July 3, 1979. The response of the hybrids at the Southeast Farm was as follows: 15 remained free from MDMV symptoms; 43 ranged from 3% to 15% susceptible; 48 ranged between 16% to 30% susceptible; 54 ranged from 31% to 50% susceptible; while 30 were from 52% to 89% susceptible.

Twenty samples of corn leaves showing mosaic symptoms from N28 inbred corn border rows were indexed by inoculation to corn, wheat, and Johnson grass. Nineteen samples indicated presence of MDMV-Strain B, and one sample contained MDMV-Strain A (Johnson grass strain).

Ten samples of leaves from N28 showing distinct fine white stripes on upper leaves were indexed by electron microscopy and mechanical inoculation to corn, wheat, and Johnson grass. All samples contained virus particles with MDMV morphology and all indexed positive for MDMV-B. Some of these N28 corn plants also contained a virus tentatively identified as wheat striate mosaic virus. This leafhopper transmitted virus was first identified from a disease of wheat in South Dakota in 1950. This is the first time the disease has been found in field grown corn.

These experiments proved the existence of viruses infecting corn at the Southeast Farm for the first time. The viruses do not appear to be a threat to production in South Dakota unless the corn is planted later than mid-June. Maize dwarf mosaic virus also infects most sorghum and sudan varieties. These also should not be affected unless they are planted later than mid-June. Our corn and sorghum crops appear to avoid MDMV when they are planted on normal dates. Plant resistance occurs at tassel and heading stages and aphid vectors are not effective in transmitting MDMV to maturing plants. Losses from late infections are very light.

EFFECT OF DEGREE OF TILLAGE ON NEED FOR ADDED PHOSPHORUS

R. Gelderman, F. Shubeck, B. Lawrensen, P. Carson,
R. Nettleton, R. Narem, and D. Beck

Early growth of corn on fallow land has often been observed to be slow. Corn plants frequently exhibit purple color associated with phosphorus deficiency. It has been known for many years that application of phosphorus fertilizer at planting time with a planter equipped with a fertilizer attachment will greatly improve the early growth of corn and will sometimes increase yield. The cause or causes of this poor early growth are not clearly understood. Observations made at the Southeast Experiment Farm in 1977 caused us to suspect that degree of tillage may influence the need for added phosphorus. These plots were established in 1978 with hail destroying them in July of that year which resulted in a partial fallow for the entire area. This does not make the degree of tillage variation as great in 1979 as it should be in other years.

The objectives of this experiment are to determine what, if any, effect the degree of tillage has on the need for added phosphorus and to determine if high yields can be obtained and maintained with limited tillage under South Dakota growing conditions.

Methods and Procedures

1. The experiment is located on an Egan silty clay loam northeast of the office building at the Southeast Experiment Farm. Egan soils are deep, friable, well drained silty clay loams developed in a silty cap over glacial till. The tests on the soil samples taken from the experimental area in the spring of 1979 are reported in Table 35.

Table 35. Soil Test Results[L1]

	NO_3^-N lb/A	O.M. %	P lb/A	K lb/A	pH	Salts mmho/cm
0-24"	149	3.3	23	725	6.8	1.0
0-48"	236					

L1 - These figures are averages of tests from the four plots planted to corn.

These tests are averages from the composite samples taken from each tillage site and the deep samples from each site. The nitrate-nitrogen levels are more than adequate for the yield of corn produced in 1979. The supply of available phosphorus is at such a level that a yield increase from added phosphorus is not likely when corn is grown under a normal tillage program. The potassium supply is high.

2. The methods of tillage used in the experiment are:
   (a). Minimum tillage (Buffalo Till).
   (b). Corn grown in a corn-oat rotation (conventional tillage).
   (c). Continuous corn (plow, disk, plant).
   (d). Fallow-corn rotation (stubble plowed, kept black, and disked before planting).

3. All plots planted into corn (except those in fallow and oats in 1979) were treated with Lasso II granules and Dyfonate at recommended rates.

4. The fertilizer application was the same on all plots. The total amounts of applied fertilizer are as follows:

   Pounds per acre of
   $N+P_2O_5+K_2O$

   100+ 0+20
   100+10+20
   100+20+20
   100+30+20
   100+40+20
   100+60+20

   These treatments provide six rates of phosphorus application plus a constant amount of added nitrogen and potassium. Ten pounds of the nitrogen, all of the phosphorus and the potassium were applied with the fertilizer attachment on the planter at planting time. The remainder of the nitrogen fertilizer was applied as a broadcast application before planting. The oat and fallow plots were not fertilized.

5. All plots were planted on May 16 at a rate of 18,000 seeds per acre. The variety used was Pioneer 3541.

6. Conventional tillage is considered to be a sequence of chopping stalks and plowing in the fall (if possible) and disking and dragging before planting in the spring.

7. Minimum tillage involved the use of a Buffalo Till typeplanter and no other tillage.

Results and Discussion

Yields, ear corn moisture, and harvested plant populations have been compiled for the various plots and subplots in Table 36. There were no significant variations in any of these categories either between tillage systems or between different P applications within a tillage system. The average yield for each tillage (Table 36) shows the corn-oat rotation yields to be lower than the yields found for the other degrees of tillage. These yield differences are not statistically significant but a trend may be indicated.

Since no statistical differences in yields were observed due to tillage and fertilizer treatments, the four tillage treatment yields were averaged by fertilizer treatments. This data (Table 37) shows a small increase due to added phosphorus until the 60 lb rate of addition is reached. This may or may not be a trend. This work will be continued in 1980.

Table 36. The Effect of the Degree of Tillage and Use of Starter Applied Phosphorus on Yield of Corn.

Amount of Added Phosphorus lb/A of P_2O_5	Yield[L1] bu/A	Ear Corn[L2] Moisture %	Population[L3] Plants Per Acre
	Fallow in 1978		
0	144	23.2	18622
10	139	22.0	18186
20	144	21.8	17206
30	150	21.4	18622
40	145	21.6	17751
60	136	21.6	18077
Average	143	21.9	18077
	Conventional		
0	145	24.8	18186
10	140	22.3	17315
20	148	21.5	18077
30	144	23.2	18077
40	155	22.5	17860
60	153	21.3	17424
Average	147	22.6	17823
	Corn-Oat Rotation		
0	124	20.3	16880
10	142	21.4	17533
20	135	20.5	16444
30	139	20.5	16553
40	144	19.7	18186
60	125	26.0	16444
Average	135	21.4	17006
	Minimum Tillage		
0	141	25.6	17315
10	138	26.2	16226
20	149	25.2	17337
30	149	24.5	17206
40	147	26.7	18440
60	136	25.8	16771
Average	143	25.6	17216

Table 36. Continued

L1 - Yield calculated at 15% moisture.

L2 - Moisture sample taken by cutting a section out of the center of 8 ears of corn. This includes a section of cob.

L3 - Plant count at harvest time.

Table 37. The Effect of Added Phosphorus on the Yield of Corn.

Treatment lb of P_2O_5 Applied	Yield* bu/A
0	139
10	140
20	144
30	146
40	148
60	138

* Yield calculated at 15% moisture

RESIDUAL PHOSPHORUS - CORN YIELD RESPONSE

P. Carson, B. Lawrensen, R. Gelderman,
R. Nettleton, D. Beck, and R. Narem

Objectives

1. Determine the effect of residual fertilizer phosphorus on corn yields.
2. To monitor changes in the P soil test as phosphorus is removed through crop yields.

Methods and Procedures

1. The experiment is located on an Egan silty clay loam south of the office building at the Southeast Experiment Farm. Egan soils are deep, friable, well drained silty clay loams developed in a silty cap over glacial till.
2. This experiment was established in 1964 to study the effect of various rates of phosphorus (P) fertilizer on the yield of corn. From 1964-1967 five rates of P (0, 23, 45, 91, and 182 lbs per acre of P_2O_5) were broadcast and plowed down annually. Each of the phosphorus treatments was divided into thirds, with one-third receiving about 23 lbs. of P_2O_5 as a starter fertilizer from 1964 through 1967, one-third receiving 10 lbs of zinc per acre in 1964 and 1965 plus 23 lbs of P_2O_5 as a starter fertilizer, and one-third receiving no additional fertilizer. In the spring of 1978 an additional 30 lbs of P_2O_5 was applied to the plots which had zinc applied in the 1960's.
3. This land has been in various crops since 1967, such as soybeans, sorghum, oats, and alfalfa. The soil on the experimental area was sampled in the spring of 1973 and after the first cutting of alfalfa in 1977. The results of the 1977 tests for available phosphorus are listed in the accompanying Table 38. A more complete evaluation of the tests made on these samples is reported in the 1977 Southeast Experiment Farm Progress Report. Another soil sampling is being planned for 1980.
4. After having been planted to alfalfa since 1973, the plots were plowed in the spring of 1979, about May 1, and were seeded to corn May 15. The corn was seeded in 30 inch rows with an approximate population of 14,000 plants per acre. Lasso II granules were banded at a rate of seven pounds per acre for weed and alfalfa control. Dyfonate 20G was banded at a rate of one pound per acre actual for rootworm control. No additional fertilizer was added.

In general the weather was favorable for the production of corn in 1979. The plants showed moisture stress once or twice during the season (late June or July). Gophers caused some stand damage, especially around the edges of the experimental area.

The corn was harvested October 25 with excellent yields on all plots. Measurements for yield, percent moisture of the ear corn, harvested plants per acre, and percent phosphorus in leaf tissue were taken.

Results and Discussion

The effects of the levels of available soil phosphorus as affected by past phosphate fertilizer addition on the yield, moisture content of the ears at harvest time, plant population at harvest and the percent phosphorus in leaves at silking time are reported in Table 38.

Different applications of phosphorus in 1964-67 have left varying amounts of residual P in the soils of the plots. However, this seemed to make no difference in any of the categories measured. The amount of soil test available P has probably decreased since the soil tests were taken in 1977, except for the zinc treatment which has had supplemental P added. Although, P soil tests for treatments 0+0+0 and 0+92+0 are in the low and medium categories, no yield response is noted here. Apparently adequate soil phosphorus for 130 bushel corn is being obtained.

Table 38. Effect of Levels of Available Soil Phosphorus on the Yield of Corn, Percent Moisture in Ear Corn, Plant Populations at Harvest, and Percent Phosphorus in the Leaves at Silking Time of Corn Grown at the Southeast Experiment Farm, 1979

Treatments[L1]	Soil Test Value lbs of P/A[L2] 0-4"	Yield of 15% Moisture Corn bu/A	Ear Corn Percent Moisture[L4]	Plants[L5] Per Acre	% P[L6] in Tissue
		0+0+0[L3]			
A 0+0+0	9	130	28.4	13068	.26
B Starter P	12	127	29.1	12197	.27
C Zinc	10	132	28.4	13068	.27
Average	10	130	28.6	12777	.27
		0+92+0			
A 0+0+0	22	120	29.9	11652	.29
B Starter P	31	120	27.8	10890	.30
C Zinc	22	122	28.9	12414	.29
Average	25	121	28.9	11652	.29
		0+183+0			
A 0+0+0	32	126	28.1	11870	.29
B Starter P	34	129	27.2	12632	.31
C Zinc	27	135	27.3	13177	.31
Average	31	130	27.5	12559	.30
		0+366+0			
A 0+0+0	46	128	28.4	12959	.30
B Starter P	52	129	27.2	13286	.29
C Zinc	49	130	28.6	14375	.29
Average	49	129	28.1	13539	.29
		0+733+0			
A 0+0+0	102	130	28.0	14593	.31
B Starter P	97	124	27.8	12741	.28
C Zinc	95	132	28.3	14266	.29
Average	98	128	28.0	13867	.29

FOOTNOTES ON NEXT PAGE

Table 38. Continued

L1 - A = no starter fertilizer.
B = 10 lbs of P_2O_5 applied per year as a starter fertilizer for 4 years (1964-1967).
C = Zinc added at the rate of 10 pounds of zinc per acre (1964 & 1965).

L2 - Available phosphorus measured by the Bray #1 weak acid method. Dilution ratio 1:7. Soil samples taken in 1977.

L3 - Total amount of phosphorus (P_2O_5) added over a 4 year period (1964-1967).

L4 - Moisture sample taken by cutting a section out of the center of 8 ears of corn. This includes a section of the cob.

L5 - Plant count at harvest time.

L6 - % P measured in leaf samples taken at silking.

EFFECT OF RESIDUAL AND APPLIED PHOSPHORUS ON ALFALFA YIELDS - 1978

P. Carson, B. Lawrensen, R. Gelderman,
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Introduction and Objectives

Large applications of available phosphorus cause an increase in the soil test value for available phosphorus. It is important to monitor and evaluate the effects of fertilizer additions on the soil test values, yields and quality of crop produced. This long-time study has several objectives:

1. What effect will large phosphorus applications have upon Bray-1 phosphorus soil tests.
2. To monitor changes in the P soil test as phosphorus is removed through crop yields.
3. Determine the effect of various soil phosphorus levels on yield of crops.

This year (1978) a new treatment was added with the objective to compare how a specified rate of added phosphorus compared to residual soil test P values.

Procedure

The experiment is located on the Southeast Experiment Farm on an Egan silty clay loam near Beresford, SD. Egan soils are deep, friable, well-drained silty clay loams developed in a silty cap over glacial till.

The soil analysis (Table 39) of samples taken from this site at the time of establishment showed a medium organic matter and phosphorus levels, a high potassium level, and a slightly acid pH.

Table 39. Soil Tests at Time of Establishment (1964)

	O.M. %	P lbs/A	K lbs/A	pH
Surface	2.7	16	597	6.0
Sub-Surface	2.3	10	498	6.2

The experiment was established in 1964. From 1964 through 1967, five rates of P (0, 10, 20, 40, and 80 pounds per acre of P) were broadcast and plowed down annually. Each of the phosphorus treatments were subdivided into thirds, with one-third receiving 10 pounds of P as a starter fertilizer from 1964-1967, one-third receiving 10 pounds of zinc per acre in 1964 and 1965, and one-third receiving no additional fertilizer. No phosphorus has been applied on these plots since 1967 except in (1978) when 30 pounds of P per acre was applied on the one-third that received zinc in 1964 and 1965.

The experimental area has been seeded to various crops since the study began and has been in alfalfa (Iroquois since 1973).

The soil in the study area has been analyzed for phosphorus in the spring of 1973 and after the first cutting in 1977. These results are reported in Table 40. The data indicates that the phosphorus soil test values have fallen since the addition of phosphate fertilizer was discontinued in 1967.

The experimental design is a split-plot randomized complete block, with four replicates; the split being between starter treatments in each rate.

A self-propelled forage harvestor was used to take the 1978 yield samples. The samples from each plot were 4.5' x 15'. The hay was collected and weighed in the field. A sub-sample was taken from each plot for moisture content and future analysis.

Results

The 1978 yield results from each cutting are shown in Table 41. The second cutting was destroyed by a hail storm. The averages for the total of the three cuttings would indicate a gradual yield increase in 12% hay as the level of phosphorus application increased. The check yield was approximately 8700 pounds of hay compared to 10,400 pounds at the highest P rate, approximately a 20% yield increase. Average sub-treatment yields overall rates exhibit little differences. The starter P (30 pounds of P in 1978) treatment did show approximately a 500 pound yield increase over the other two treatments. The 1978 30 pound phosphorus treatment had approximately a 600 pound hay increase over the check in the low and high rates. All other rates did not exhibit any advantage to the phosphorus added in 1978. It appears that 40 pounds per acre of added P increased the yield as much as any of the higher rates. Apparently enough residual phosphorus still exists in the higher rates to supply the phosphorus necessary for near maximum plant growth.

The phosphorus content of the hay samples taken at harvest time are reported in Table 42. As the rate of broadcast phosphorus increase the phosphorus content of the hay increased. The sub-plot treatments containing added phosphorus did cause an increase in the phosphorus content of the hay at the lower (0 and 40 pound per acre) rates of broadcast phosphorus application.

These plots will be plowed and the entire area planted to corn in 1979.

Table 40. The Effect of Past Fertilizer Treatments on Soil Test Values for Pounts of Available Phosphorus Per Acre[L1] on Samples Taken in 1973 and in 1977; Southeast Farm.

Starter & Zinc Treatment L3	Total Pounds of P Added in Broadcast Application[L2] 0 Sampling Year 1973	0 Sampling Year 1977	40 Sampling Year 1973	40 Sampling Year 1977	80 Sampling Year 1973	80 Sampling Year 1977	160 Sampling Year 1973	160 Sampling Year 1977	320 Sampling Year 1973	320 Sampling Year 1977
0-4"										
A	12	9	27	22	40	32	60	46	121	102
B	15	12	36	31	45	34	71	52	131	97
C	10	10	25	22	38	27	59	49	125	95
4-8"										
A	9	7	22	14	35	19	57	36	122	84
B	12	7	36	13	42	20	77	42	134	88
C	9	5	22	13	37	16	57	32	127	85
8-12"										
A	4	4	13	8	13	7	32	9	39	12
B	7	5	18	9	14	8	26	11	44	12
C	5	4	13	7	16	6	23	10	37	13
12-16"										
A		3		7		6		7		5
B		5		11		7		9		5
C		4		6		5		5		7
16-20"										
A		3		8		6		8		7
B		6		6		4		11		6
C		3		6		5		7		6
	Average of 0-8" for all sub-treatments A, B, & C; 1977 sampling									
0-8"	11	8	28	19	34	25	64	43	127	92
0-12"	1	7	24	15	27	19	51	32	98	65

L1 - Soil test used was Bray Weak Acid Test
L2 - Fertilizer applied over a four year period at the rates of 0, 10, 20, 40, & 80 lbs P/year.
L3 - A No starter
B 10 lbs of P applied per year for four years (1964-67) as a starter fertilizer
C Zinc added at the rate of 10 lbs of zinc per acre in 1964 & 1965 (L3 treatments applied to surface soil only). These plots also received 10 lbs of P per acre in 1964 & 1965.

Table 41. The Effect of Residual Phosphorus Fertilizer on the Yield of Alfalfa Hay; Southeast Experimental Farm, 1978.

Mainplot Treatments[L1] lb of P added	Subplot Treatments[L2]	1st Cutting	3rd Cutting	4th Cutting	Total Yield
		lb Hay (12% moisture)			
0	0+0+0	4106	2251	2061	8418
	starter P	4162	2395	2172	8730
	30# P + Zn	4492	2443	2142	9075
	Average	4253	2363	2125	8742
40	0+40+0	4253	2382	2439	9123
	starter P	4272	2498	2260	9030
	30# P + Zn	4638	2261	2284	9183
	Average	4388	2380	2327	9495
80	0+80+0	4822	2695	2370	9888
	starter P	4271	2571	2260	9102
	30# P + Zn	4436	2605	2451	9492
	Average	4510	2624	2360	9495
160	0+160+0	4620	2302	2357	9279
	starter P	4473	2339	2493	9305
	30" P + Zn	4675	2113	2363	9150
	Average	4589	2251	2404	9360
320	0+320+0	4932	2546	2641	10119
	starter P	4840	2704	2780	10323
	30# P + Zn	4968	2953	2845	10767
	Average	4913	2734	2755	10403
	F test	ns	ns	ns	ns

L1 Amount of phosphorus (P) added each year for four years.

L2 Sub-plot treatments, see procedures for details of treatments.

Table 42. The Effects of Residual Phosphate Fertilizer on the Percent Phosphorus Content of the Hay; Southeast Experimental Farm, 1978.

Mainplot Treatment[L1] lb of P added	Subplot Treatment[L2]	1st Cutting	3rd Cutting	4th Cutting
0	0+0+0	.226	.337	.251
	starter P	.244	.349	.266
	30# P + Zn	.257	.355	.276
	Average	.242	.347	.264
40	0+0+0	.250	.379	.288
	starter P	.255	.381	.290
	30# P + Zn	.272	.382	.298
	Average	.258	.380	.292
80	0+0+0	.274	.387	.302
	starter P	.278	.405	.308
	30# P + Zn	.293	.401	.294
	Average	.282	.398	.301
160	0+0+0	.284	.398	.318
	starter P	.273	.402	.326
	30# P + Zn	.302	.405	.312
	Average	.286	.401	.319
320	0+0+0	.320	.434	.371
	starter P	.323	.433	.375
	30# P + Zn	.334	.440	.356
	Average	.326	.436	.368

L1 Amount of phosphorus (P) added each year for four years.

L2 Sub-plot treatments, see procedures for details of treatments.

LIME EXPERIMENT

P. Carson, B. Lawrensen, F. Shubeck,
R. Gelderman and R. Nettleton

The use of lime on soils having pH's greater than 6.2 is considered uneconomical in most states. However, interest in it's use remains high in some areas of South Dakota. Past experiments have not shown yield increases large enough to justify its use (see SDSU Experiment Station Bulletin 643). Because the interest in the use of lime has remained high, an experiment was established in 1974 at the Southeast Experiment Farm to further evaluate its need as a soil amendment.

Objectives

1. Determine the effect of added lime on the yield of corn.
2. Determine the effect of added lime on the pH of the soil.

Methods

1. Lime in the form of Niobrara chalk was applied in the spring of 1974 to an Egan silty clay loam east of the office building at the Southeast Experiment Farm. Egan soils are deep, friable, well-drained, silty clay loams developed in a silty cap over glacial till. To obtain a well-drained site, the ends of two ranges were used. One half of the experiment being in each range.
2. Soil tests on samples taken in 1974, 1977, and 1979 for pH, available phosphorus and nitrate-nitrogen are found in Table 43. These tests are an average of the plots from the entire experiment. Some differences still exist between the two ranges, but the differences are not as great as when the experiment was started in 1974.
3. The fertilizer and lime were broadcast on the surface and plowed under just before planting in 1974. The fertilizer treatments used in the experiment are listed in Table 43. The lime application will not be repeated for the duration of the experiment, but the phosphorus application will be repeated each year. Nitrogen was applied at the rate of 100 lbs per acre before planting in 1979.
4. Experimental design used was randomized block.
5. Weeds were controlled with LassoII 15G at 7 lbs per acre applied in a band at planting time. There were two cultivations. Weed control was excellent.
6. Soil insects were controlled with Dyfonate 20G in a band at 1 lb/A of active material at planting time.
7. Variety was Pioneer 3541.
8. This land semi-fallowed in 1978 because of a hailstorm on July 5th. This land was disked, dragged, and planted in the spring of 1979.

9. Corn was planted on May 16th with a John Deere tool-bar planter. The row width was 30 inches, seed was planted for a 16,000 plant population per acre.
10. Yields of corn grain were taken on October 18th. Forty feet of row was harvested in each case. Samples for moisture were taken at harvest time.
11. Leaf samples were taken at silking time and plant samples were taken when the plants were approximately 15" in height. These samples were taken for analysis.

Results and Discussion

Table 43 shows the effects of the lime added in 1974 and the yearly additions of phosphorus on the pH, the available P and the nitrate-nitrogen in the plots. The lime additions of 2 and 4 T/A had little effect on pH. Available phosphorus was sufficient on all plots, and very high on those plots fertilized at 120 lbs of P_2O_5 per acre. The additions of lime and P_2O_5 had no significant effect upon the amount of NO_3^-N in the soil.

Neither the lime nor the phosphorus had any significant effect upon the yield of corn, ear corn moisture percent, or plant populations, as shown in Table 44. The phosphorus content in the leaves, taken when the plants were 15" tall, did increase with increases in P_2O_5 application. Though it seemed to have no effect on yields there is concern that the higher P contents (.40% and up) may cause P-induced zinc deficiency. It was observed that the phosphorus treated plots had early growth that was vastly superior to those plots not receiving added phosphorus.

Finally, it can observed in Table 45 , that the lime and phosphorus treatments have not had a great influence on the yield of corn for the past five years. This is true in good years as well as poor years.

Table 43. The Effect of Lime Added in 1974 and Phosphorus Added Each Year on the Soil Test Values for pH[L1], Available[L2] Phosphorus and Nitrate-Nitrogen in the Soil. Southeast Experimental Farm, 1979.

Fertilizer Treatment $N+P_2O_5+K_2O$ lb/A	Lime Tons/A	pH 0-6			Available Phosphorus lb of P/A			Nitrogen in top 2 feet lb of NO_3N/A
		1974	1977	1979	1974	1977	1979	1979
0+0+0	-	6.4	5.9	6.4	36	31	33	226
0+0+0	2		6.5	6.4		28	27	271
0+0+0	4		6.6	6.5		30	32	247
0+30+0	-		6.0	6.3		39	50	258
0+120+0	-		6.1	6.4		90	135	248
0+30+0	2		6.4	6.5		38	53	221
0+30+0	4		6.6	6.5		50	53	238
0+120+0	2		6.3	6.4		89	139	223
0+120+0	4		6.5	6.5		114	149	283

L1 pH determined on a 1:1 water to soil extract.

L2 Available phosphorus determined by the Bray #1 Weak Acid Method.

Table 44. The Effects of Added Lime and Phosphorus on Yields of Grain, Moisture Content of Ears at Harvest, Plant Population at Harvest the Percent Phosphorus in Plants at the Fifteen Inch Stage of Growth of Corn Grown at the Southeast Experiment Farm, 1979

Fertilizer $N+P_2O_5+K_2O$ lb/A	Lime Tons/A	Yield[L1] bu/A	Ear Corn Moisture[L2] %	Plant Population in plants/A	Phosphorus Percent in 15" plants
0+0+0	-	123	25.4	15028	.314
0+0+0	2	114	24.3	14810	.370
0+0+0	4	125	23.6	14266	.350
0+30+0	-	131	21.6	15682	.385
0+120+0	-	115	18.6	15464	.532
0+30+0	2	134	21.0	14484	.405
0+30+0	4	121	22.0	13613	.401
0+120+0	2	124	24.7	15682	.500
0+120+0	4	125	18.0	15355	.465
Stat Sig.		ns	ns	ns	

L1 - Yields calculated at 15% moisture

L2 - Moisture sample taken by cutting a section out of the center of 8 ears of corn. This includes a section of the cob.

Table 45. The Effects of Added Lime and Phosphorus on Yields* of Corn for Five Years at the Southeast Experiment Farm, 1979

Fertilizer $N+P_2O_5+K_2O$ lb/A	Lime Tons/A	1974	1975	1976	1977	1979	5 Year Mean
			bu/A				
0+0+0	0	43	12	18	116	123	62
0+0+0	2	46	9	13	113	114	59
0+0+0	4	44	7	19	117	125	62
0+30+0	-	43	6	17	114	131	62
0+120+0	-	27	5	11	108	115	53
0+30+0	2	45	6	17	120	134	64
0+30+0	4	34	6	13	116	121	58
0+120+0	2	42	5	12	115	124	60
0+120+0	4	39	3	12	111	125	58

* Yields calculated at 15% moisture.

PRE-EMERGENCE HERBICIDE EVALUATION ON SOYBEANS

W.E. Arnold, M.A. Wrucke, S.R. Gylling, and J.A. Holmdal

Research plots for evaluating pre-emergence herbicides in soybeans, were established at the Southeast South Dakota Research and Extension Center at Beresford. Four herbicides were included at various application rates and combinations, giving a total of 9 treatments. Four replications were arranged in a randomized complete block design. "Evans" soybeans were planted in 30" rows on May 24. Pre-emergence herbicides were applied to a dry surface soil on May 25, using a tractor mounted sprayer (3 MPH, 32 PSI, 10' swath, and 20 GPA). Weather conditions at the time of application were: air temperature 57°F, relative humidity 51%, clear sky, wind 6-8 mph, soil moisture (2" depth) moist, and soil temperature (2" depth) 48°F. Total rainfall for the 1st and 2nd weeks after application were: 0.65" and 0.00", respectively. The soil is a silty clay loam (7% sand, 57% silt, 36% clay) with 4.7% organic matter, pH 7.9 and is poorly drained. Weed control was evaluated June 30. The results are shown in the table. Both MC 10982 and MC 10108 appeared to be more effective for controlling redroot pigweed and common lambsquarter than bifenox.

Table 46. Pre-emergence Herbicide Evaluation on Soybeans

		% Weed Control		
Treatment	Rate	Green Foxtail	Redroot Pigweed	Common Lambsqtr.
MC-10982	0.25	60	95	60
MC-10982	0.38	68	98	67
MC-10982	0.50	63	97	78
MC-10982	0.38	88	97	92
Alachlor	2.00			
MC-10108	0.25	48	92	46
MC-10108	0.38	40	97	77
MC-10108	0.50	65	97	81
MC-10108	0.35	96	98	96
Alachlor	2.00			
Bifenox	1.50	46	89	[illegible]
Weedy Check	0.0	0	[illegible]	[illegible]
Handweeded Check	0.0	99	99	[illegible]
LSD (.05)		27	3	17

SOYBEAN HERBICIDE EVALUATION

W.E. Arnold, M.A. Wrucke, S.R. Gylling, and J.A. Holmdal

Research plots were established to evaluate pre-emergence and post-emergence herbicides for weed control in soybeans at the Southeast South Dakota Research and Extension Center at Beresford. Seven herbicides were included at various application rates and in combination, giving a total of 16 treatments. Four replications of 10' x 40' plots were arranged in a randomized complete block design. "Evans" soybeans were planted in 30" rows on May 24. Pre-emergence treatments were applied May 25 using a tractor mounted sprayer (3 MPH, 32 PSI, 10' swath, and 20 GPA). Weather conditions at the time of treatment were: air temperature 57°F, relative humidity 52%, clear sky, wind 6-8 mph, soil surface dry, soil (2" depth) moist, and soil temperature (2" depth) 48°F. Post-emergence treatments were applied June 21 using a bicycle sprayer (3 MPH, 32 PSI, 10' swath, and 20 GPA). Weather conditions at the time of application were: air temperature 68°F, relative humidity 66%, clear sky, wind 1-2 mph, leaf surface moist, soil moisture (2" depth) wet, and soil temperature (2" depth) 64°F. Redroot pigweed seedlings were 1-4" tall and common lambsquarter seedlings were 2-4" tall. Total rainfall for the 1st and 2nd weeks after application were 0.65" and 0.00", respectively for pre-emergence treatments and 0.14" and 0.00", respectively for post-emergence treatments. The soil is a silty clay loam (7% sand, 57% silt, 36% clay) with 4.7% organic matter, pH 7.9 and is poorly drained. Weed control and crop evaluations were made June 30. The results are shown in Table 47. CP 55097 controlled common lambsquarter better than alachlor. However, it tended to injure soybeans more than alachlor. BAS 47900 H controlled redroot pigweed very effectively but did not control common lambsquarter. The addition of bentazon to BAS 47900 H improved the control of common lambsquarter.

Table 47. Soybean herbicide evaluation. (Arnold, Wrucke, Gylling, and Holmdal)

Treatment	Rate	Growth Stage	% Weed Control Rrpw	% Weed Control Colq	% Stand Reduc.	% Crop Injury
CP-55097	2.00	Pre	98	55	0	30
CP-55097	3.00	Pre	98	75	0	27
Alachlor	3.00	Pre	97	11	0	15
Metribuzin	0.50	Pre	98	98	0	25
CP-55097	2.00	Pre				
Bas 47900 H	0.50	Pre	92	7	0	0
Bas 47900 H	0.75	Pre	95	22	0	0
Bas 47900 H	1.00	Pre	96	40	0	0
Bentazon	0.75	Post	97	48	0	0
Bas 47900 H	0.50	Pre				
Bentazon	0.75	Post	98	50	0	0
Bas 47900 H	0.75	Pre				
Bentazon	0.50	Post	97	40	0	0
Bas 47900 H	0.75	Pre				
Bentazon	0.75	Post	75	15	0	0
Mbr 12325	0.13	Post				
Bentazon	0.75	Post	78	15	7	0
Mbr 12325	0.25	Post				
Bentazon	0.75	Post	72	68	10	0
Citowett Plus	.2%	Post				
Mbr 12325	0.13	Post				
Bentazon	0.75	Post	76	67	10	0
Citowett Plus	.2%	Post				
Mbr 12325	0.25	Post				
Bentazon	0.75	Post	79	74	15	0
Mbr 12325	0.13	Post				
Crop Oil	1 qt/A	Post				
Bentazon	0.75	Post	81	69	20	0
Mbr 12325	0.25	Post				
Crop Oil	1 qt/A	Post				
Handweeded Check	0.0	Post	99	99	0	0
Weedy Check	0.0		0	0	0	0
LSD (.05)			10	24	3	3

EFFECTS OF RATES OF NITROGEN ADDITION ON THE CONCENTRATION OF NITRATE-NITROGEN IN THE SOIL PROFILE

R. Gelderman, F. Shubeck, B. Lawrensen, P. Carson, R. Nettleton, R. Schoper, and R. Narem

Objectives

1. Study and record the effects of rates of nitrogen addition on the accumulation and movement of NO_3-N in the soil profile.
2. Determine the effect of large amounts of nitrogen fertilizer on the pH of the soil.
3. Measure the effects of the treatments on the nitrogen concentration in the leaves.
4. Determine the effects of the treatments on the nitrogen concentration in the entire plant at maturity.

Materials and Methods

1. This experiment is located on a Viborg silty clay loam on the southeast corner of the Experiment Farm. Viborg soils are deep, friable, moderately well-drained, silty, clay loam soils developed in a silty cap over glacial till.
2. Two experiments are involved in this study, one involving a number of low rate N applications and the other a sequence of high N applications. The experiments are adjacent and related. The rate experiment began in 1969. The low rate experiment began in 1975.
3. Soil samples in the heavy rates of application were taken to a depth of 6 feet each year since 1969, except in 1979 when they were taken to a depth of 4 feet because of wet soil conditions. They are only being taken to a depth of 4 feet in the low rate experiment.
4. The samples were dried as soon as possible after taking, in a forced air oven at a temperature not to exceed 115°F.
5. Nitrate-nitrogen was determined by the n-phenol-disulphonic acid method until 1973. Since then the nitrate electrode method has been used.
6. The longer duration experiment with high rates of nitrogen is in its eleventh year. The nitrogen fertilizer used has been ammonium nitrate. The additions of P_2O_5 (25 lbs/A) and K_2O (70 lbs/A) have remained constant on both experiments. All plots except the 0+0+0 treatment have received the same amounts of P and K.
7. Leaf samples were taken for analysis when the corn was in the early silk stage of growth. The leaf opposite and below the ear was taken for the samples. Leaves were dried in a forced air oven, ground, and nitrogen content determined by the Kjeldahl method.
8. Silage was harvested from the second planting date treatment. A sample of silage was taken from each plot for moisture determination. The sample was ground and a nitrogen determination was made on it.

Results and Discussion

The effects of nitrogen fertilizer on the nitrate-nitrogen (NO_3^-N) content of the soils are reported in Tables 48 and (the two experiments haveing annual applications of fertilizer ranging from 0-80 lb/A and 0-240 lb/A, respectively). In the low rate experiment there are very small differences in the amounts either in the top two feet or the top four feet. In past samplings, differences have been present corresponding to the different rates of N applied. The reason for the low amounts of NO_3^-N in 1979 was the large corn harvest. After no harvest (due to hail) in 1978 there were very high yields this past year at all application rates. Yields were high enough to use practically all of both residual N and fertilizer N on all plots.

The high rate experiment, unlike its partner, still shows very significant amounts of NO_3^-N throughout the profile as application rates increase. Residual N also seems to be moving downward in the profile. For instance, the amount of NO_3^-N in the 48-72" range in the plot annually receiving 240 lb N increased from 117 lbs in the fall, 1977 to 288 lbs in fall, 1978.

Year by year accumulations of NO_3^-N in the soil profiles under the different treatments of the high rate experiment are shown in Figure 2 and Table 49. The most noticeable feature on the graph is a large decrease in NO_3^-N between 1977 and 1978 in the plot which had 240 lbs of N applied. No explanation for that drop is offered at this time.

Tests on nitrogen concentration in the leaves at silking time and in the silage are being conducted, but results are not available for publication. These results will be added to future reports.

A summary of NO_3^-N content (fall of 1978), corn grain yields and silage yields (1979) are provided in Table 50. A maximum yield of approximately 130 bu/A was attained with the 60 lb rate of application. Additions of nitrogen higher than the 60 lb. rate did not increase the yield. Fertilizer nitrogen rates had no consistent effect on yield.

Table 48. The Effects of Adding High Rates of Nitrogen[L1] Fertilizer Over a 11 Year Period on the Amount of Nitrate-Nitrogen Present in the Soil. Southeast Experiment Station, 1979.

	Amount of Nitrogen Applied Each Year in Pounds Per Acre															
	0+0+0 Sampling Time				80+0+0 Sampling Time				160+0+0 Sampling Time				240+0+0 Sampling Time			
	F-77	S-78	F-78	F-79	F-77	S-78	F-78	F-79	F-77	S-78	F-78	F-79	F-77	S-78	F-78	F-79
	NO_3^--N lb/A															
0-6	10	12	28	7	33	44	37	12	25	141	67	45	162	162	97	75
6-12	10	11	18	5	46	16	25	12	71	40	80	47	153	55	65	99
12-18	5	7	9	5	47	14	16	12	134	33	61	46	165	60	55	75
18-24	4	4	9	6	60	19	16	31	169	44	68	101	194	91	63	124
24-30	4	4	11	7	35	31	18	48	214	76	80	127	267	138	71	169
30-36	4	4	7	7	31	47	26	44	136	116	103	133	241	204	88	162
36-42	4	4	7	10	31	40	41	42	86	124	140	123	144	255	132	150
42-48	5	4	7	14	17	23	45	38	44	99	157	107	76	191	201	139
48-54	5		11		9		31		15		88		48		122	
54-60	6		18		8		20		12		54		33		85	
60-66	7		12		9		14		14		43		21		54	
66-72	12		17		13		13		18		24		15		28	
0-24	28	33	64	23	185	93	93	67	398	258	276	239	629	367	279	373
0-48	44	49	97	62	298	234	222	239	878	672	754	729	1356	1156	771	993
0-72	74		154		337		299		937		962		1473		1059	
Date of Sampling	Nov. 77	May 78	Nov. 78	Nov. 79												
Yield of Corn bu/A	85	0	0	110	87	0	0	129	91	0	0	130	90	0	0	125

L1 Treatments have been repeated on the same plots for the past 11 years. During this time plots receiving 80 lbs of nitrogen each year have received 880 lbs of nitrogen per acre. All plots receive a uniform amount of P_2O_5 (25#) and K_2O (70#) per acre per year.

Table 49.

The Effect of Adding Rates of Nitrogen Fertilizer on the Amount of Nitrate-Nitrogen Present in the Soil Profile 1977-1979, Southeast Experimental Station, 1979.

Depth in Inches	Nitrogen Added Each Year; lb /A[L1 & L2] 0+0+0[L3] Time of Sampling				20+0+0 Time of Sampling				40+0+0 Time of Sampling				60+0+0 Time of Sampling				80+0+0 Time of Sampling			
	F-77	S-78	F-78	F-79	F-77	S-78	F-78	F-79	F-77	S-78	F-78	F-79	F-77	S-78	F-78	F-79	F-77	S-78	F-78	F-79
0-6	5	11	16	9	5	15	14	15	4	26	18	8	15	29	31	10	10	44	28	9
6-12	5	7	8	6	5	11	8	10	6	12	10	8	16	19	19	8	15	21	20	9
12-18	4	4	4	4	4	5	4	10	5	8	8	5	26	14	10	6	24	14	17	7
18-24	4	4	4	6	4	4	4	6	6	6	5	6	30	12	12	11	38	14	16	12
24-30	4	4	4	7	4	4	4	9	4	5	6	7	18	16	13	14	23	17	13	13
30-36	4	4	4	6	4	4	4	10	4	4	6	7	6	15	14	15	13	22	13	14
36-42	4	4	4	6	4	4	4	14	4	4	6	8	4	12	11	15	7	18	14	15
42-48	4	4	4	7	4	4	4	15	4	4	6	10	4	8	11	14	4	9	14	14
0-24	16	26	32	25	17	34	30	41	21	52	41	27	88	74	71	35	87	92	80	35
0-48	31	42	48	49	31	50	46	89	36	69	65	59	119	124	120	92	134	157	133	91
Time of Sampling	Nov. 77	May 78	Nov. 78	Nov. 79																
Yield of Corn bu/A	89	0	0	94	96	0	0	114	9	0	0	119	90	0	0	130	88	0	0	129

L1 Each plot received a uniform amount of P_2O_5 (25#/A) and K_2O (70#/A) broadcast and 4 of N, 16 # of P_2O_5 and 8 # of K_2O per acre, as a starter fertilizer.

L2 Treatments have been repeated on the same plots for the past five years.

L3 This set of plots did not receive any P or K fertilizer.

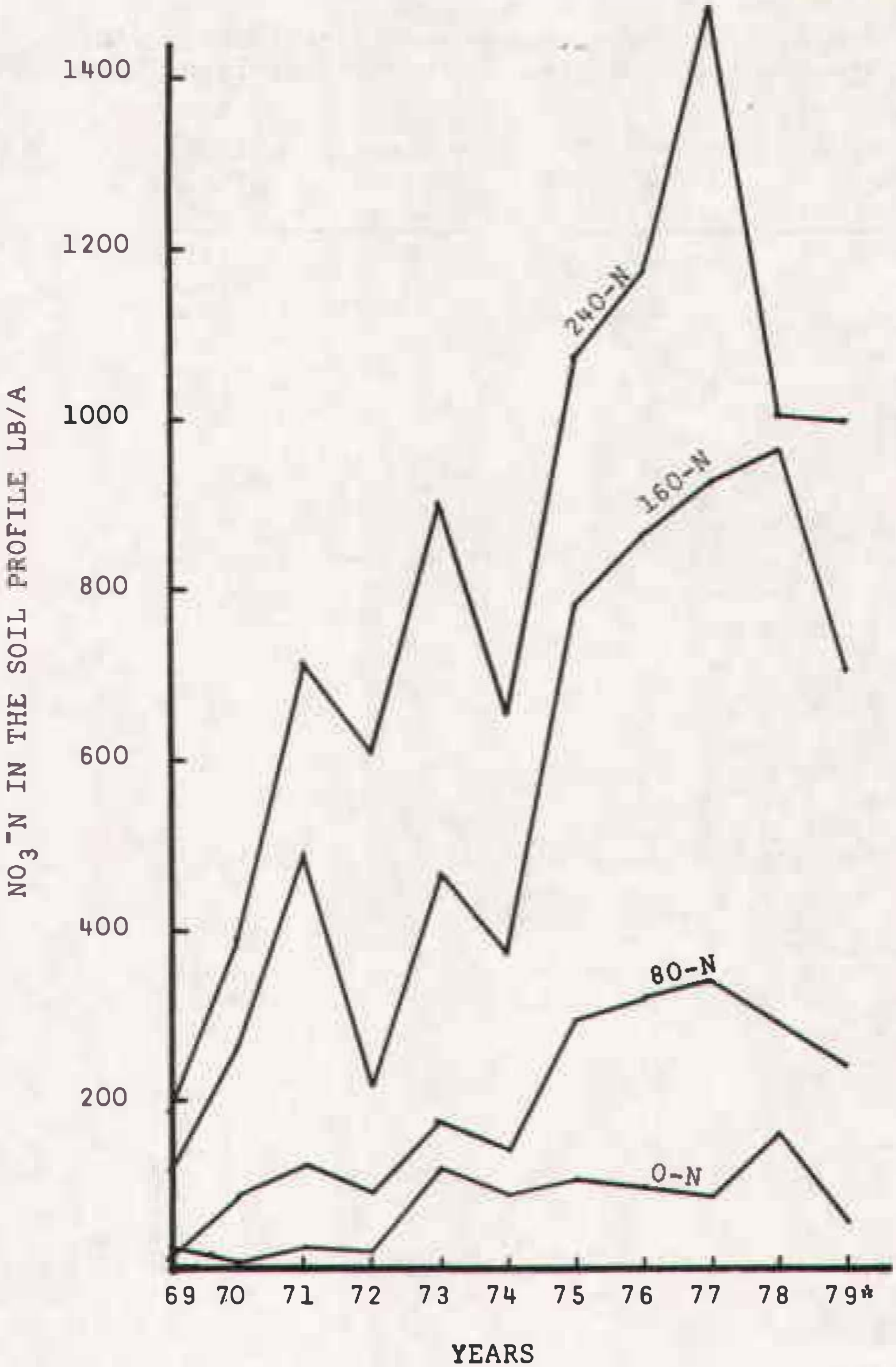


FIGURE 2. The Effect of Rates of Added Nitrogen on the Amount of Nitrate-Nitrogen in the 6 foot Profile at the End of the 11 Year Period; Southeast Experiment Farm, 1979

* 1979 - sampled to only 4'

Table 50. The Effect of Added Nitrogen Fertilizer on the Yields of Corn Grain and Silage, Southeast Experiment Farm, 1979

Nitrogen Treatments[L1] lbs of Nitrogen Added Per Acre	NO_3^-N[L2] in the Top 4 feet	Corn Grain Yield bu/A	Silage[L3] Yield tons/A
0	97	110	15.6
20	45	114	16.4
40	65	119	16.0
60	120	130	16.4
80[L4]	133	129	17.8
80[L5]	222	129	18.9
160	754	130	15.6
240	771	125	17.5

L1 - 25 lb of P_2O_5 + 70 lb of K_2O per acre broadcast on all plots except 0+0+0.

L2 - NO_3^-N found in profile in the fall of 1978.

L3 - Tons per acre of 60% moisture silage.

L4 - This treatment has been applied for five years.

L5 - This treatment has been applied for eleven years.

EFFECT OF RATES OF NITROGEN ON THE YIELDS OF BROMEGRASS

P. Carson, R. Nettleton, D. Beck, and R. Gelderman

Objectives

1. Determine the effects of added nitrogen on the yield of bromegrass over a period of years.
2. Determine if continued high yields will lower soil tests for phosphorus and potassium.

Methods and Materials

1. The experiment was established in 1977 on an old stand of bromegrass near the east edge of the experiment farm on a Viborg silty clay loam. The Viborg soils are deep, friable, moderately well-drained silty clay loams developed in a silty cap over glacial till. The soil test on the soil samples taken from the experimental site at the time the experiment was established are as follows:

Table 51. Soil Tests

Depth	P lb/A	K lb/A	pH	Salts mmhos/cm
0 - 6	7	970	6.8	0.38
6 -12	3	560	6.7	0.30
12-18	4	390	7.0	0.28
18-24	6	360	7.5	0.28
24-30	3	260	7.7	0.30
30-36	4	260	8.0	0.38
36-42	3	220	8.2	0.40
42-48	11	190	8.3	0.35

2. Fertilizer nitrogen in the form of ammonium nitrate was applied by broadcasting in the spring of 1977. None was applied in 1978. In late April of 1979, the rates of nitrogen were reapplied. They are as follows:

Treatment No.	lb/A
1	0
2	80
3	160
4	320

3. No additional phosphorus or potassium was applied. Plots will be split at a later date to apply these two elements to determine if a yield response occurs from this addition.
4. Yield samples of hay were harvested on July 13, 1979 with a self-propelled forage harvester. The harvested material was weighed in the field and a small sample taken for moisture and protein determination.

Results and Discussion

Yields of 12% hay were limited, due to the plots being inadvertently burned in early May. This caused considerable damage to the existing growth which was mowed off.

The effect of the added nitrogen treatments on the yield of 12% hay is shown in Table 52. As the rate of applied nitrogen increased, the yield also increased.

Addition of 80 lbs of nitrogen increased yield 87% over check yield. An additional 80 lbs. of nitrogen increase yield 97% over the 80 lb rate. The last 160 lbs of nitrogen increased yield 60% over the 160 lb rate. Yields were not as high at the lower rates as we would expect (Figure 3). This leads to the conclusion that considerable nitrogen was used in the growth that occurred before burning. The influence of nitrogen fertilizer on bromegrass yields can be evaluated through the use of Tukey's hsd test (See table 52).

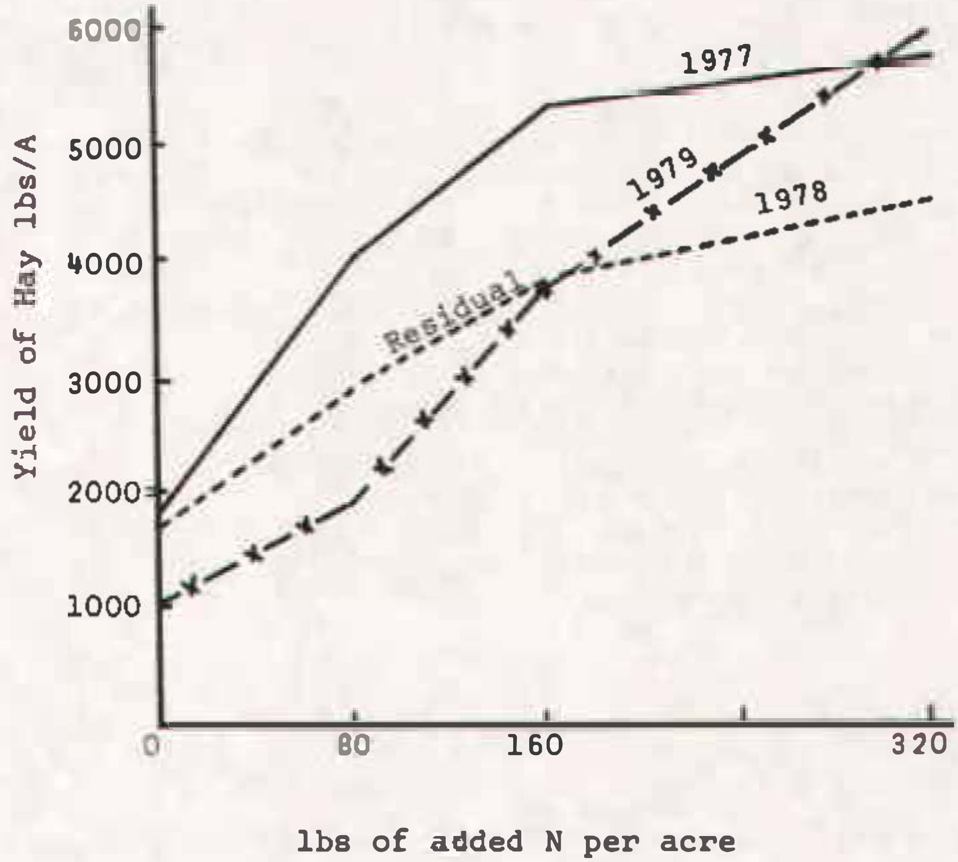
It is planned to continue this experiment for a period of years to determine if the yields can be maintained at a high level with only the addition of nitrogen fertilizer. Continued soil tests will monitor phosphorus and potassium levels. These two elements may be added as treatments later on.

Table 52. The Influence of Added Nitrogen Fertilizer on the Yield of Hay, Southeast Experiment Farm, 1979.

Treatment lb N/A	Yield lb 12% Hay/A
0	1018 a*
80	1911 a
160	3774 b
320	6050 c

* The numbers followed by the same letter are not significantly different at the .05 level of confidence according to Tukey's hsd test.

Figure 3. Influence of Added Nitrogen on Yield of Bromegrass Southeast Experiment Farm, 1979.



SMALL GRAIN FERTILIZER TRIALS - YANKTON COUNTY

F. Shubeck, D. Reid, V. Miller, P. Carson,
R. Nettleton, R. Gelderman, R. Schoper, and R. Narem

Introduction

These trials are a part of the Southease Experiment Farm's program. The plots were established in cooperation with the Crop Improvement Association to evaluate the effects of added nitrogen and phosphorus on the yields of wheat, oats, and barley varieties grown under Yankton County growing conditions. This provides an opportunity to evaluate the response of varieties to added fertilizer at a site other than the Southeast Experiment Farm.

Procedure

The experiments were conducted on the Human Services Center farm just north of Yankton, SD. The site was located on a Houdek silty clay loam. Houdek soils are deep, well-drained, nearly level loamy soils which are formed on glacial till uplands. The soil tests on the samples taken at planting time are as follows:

NO_3^-N (0-24")	94 lb/A (high)
Organic Matter	2.7% (medium)
Phosphorus (P)	35 lb/A (high)
Potassium (K)	550 lb/A (high)
pH	7.0 (neutral)
Texture	Silty clay loam

The previous year's crop on this land was small grain. The seed bed was prepared by plowing and disking. The experiment was seeded April 23, 1979.

Each plot 4 x 25 feet in size. The treatments consisted of fertilizer applications on 3 varieties of wheat, 3 varieties of oats, and 3 varieties of barley. Each variety received six fertilizer treatments, which are as follows:

	N	+	P_2O_5	+	K_2O
	(lbs per acre)				
1.	0	+	0	+	0
2.	0	+	30	+	0
3.	30	+	0	+	0
4.	30	+	30	+	0
5.	60	+	0	+	0
6.	60	+	30	+	0

Each treatment was replicated three times. The purpose of repeating treatment combinations is to provide a numerical estimate of experimental error, or unexplained variations in yield. The variety and fertilizer treatments are listed in the yield tables.

All of the fertilizer phosphorus and 10 lbs of the nitrogen (on those plots receiving nitrogen) were applied with the drill. The rest of the N was broadcast. The plots were sprayed with MCP plus Bromoxynil on May 31. Broadleaf weed control was good, but some green foxtail was present. The plots were harvested on different dates according to maturity.

Results

A. Wheat

The results of the fertilizer treatments upon the yield and test weights of three varieties of wheat (WS 1809, James, and Olaf) are shown in Table 53. Effects were very small, but a significant difference in yield due to fertilizer treatment occurred. The reason for the small response to fertilizer may be the fairly high amounts of residual nutrients as shown in the soil test.

B. Oats

The effects of the applied fertilizer on the yield and test weights of three varieties of oats (nodaway-70, Spear, and Wright) are shown in Table 54. Again, differences are small, in this case no significant differences were found in yield or test weight either between varieties or between different fertilizer treatments.

C. Barley

The effects of the applied fertilizer on the yield and test weights of three varieties of barley (Primus II, Mores, and Larker) are shown in Table 55. Barley seems to have shown more response to the different fertilizer treatments than oats or wheat. This is especially evident in the yield differences in Primus II and Morex barley. Yields of Morex varied from 54 bu/A with no fertilizer to 71 bu/A when 60+30+0 was added. While the difference from fertilizer was significant in those two varieties it was not in the third variety, Larker. The figures show that Larker was more efficient in using available nutriets than the other two varieties. The addition of fertilizer only served to bring yield levels of Primus II and Morex up to the level of Larker.

Test weights also were influenced by addition of fertilizer, with the largest increase being in Morex which increased from 42.2 lb/bu to 45.2 lb/bu as the amount of fertilizer increased.

The yields expected (those considered possible with the amount of available nitrate-nitrogen that was present) and the yields actually obtained at this site are very close (39 bushels of wheat expected and 38 obtained, etc.). See Table 56. The addition of 30 pounds of nitrogen per acre supplied more nitrogen for the growth of wheat and oats than the plants could utilize.

Whereas, 30 pounds of nitrogen supplied enough for 65 bushels of barley per acre and 68 bushels were harvested. The application of 60 pounds of nitrogen supplied more available nitrogen than other environmental conditions permitted any of the crops to utilize.

Table 53. The Effects of Applied Fertilizer on the Yields and Test Weights of Three Varieties of Wheat, Yankton County, 1979.

Treatment $N+P_2O_5+K_2O$ lb/A	YIELD Variety WS 1809	James	Olaf	Average	TEST WEIGHT Variety WS 1809	James	Olaf	Average
	bu/A				lb/bu			
30+30+0	42	41	43	42 b*	57.1	56.3	56.8	56.8a*
60+30+0	42	43	42	42 b	56.1	55.8	56.2	56.1a
30+0+0	39	40	43	41 ab	56.3	56.3	57.0	56.6a
60+0+0	39	41	40	40 ab	56.2	56.0	56.7	56.3a
0+30+0	39	40	41	40 ab	56.0	56.5	56.8	56.4a
0+0+0	35	39	40	38 a	55.7	56.7	57.7	56.7a
Average	39	40	42	40	56.3	56.3	56.9	56.1

* Tukey's honestly significant difference: Fertilizer treatment yields not followed by the same letter are significantly different at the .05 level. This means that 1 chance in 20 exists that these yield differences are not different.

Table 54. The Effects of Applied Fertilizer on the Yields and Test Weights of Three Varieties of Oats, Yankton County, 1979.

Treatment $N+P_2O_5+K_2O$ lb/A	YIELD Variety Nodaway-70	Spear	Wright	Average	TEST WEIGHTS Variety Nodaway-70	Spear	Wright	Average
	bu/A				lb/bu			
60+30+0	84	91	90	89	35.7	33.8	34.0	34.5
30+30+0	84	93	86	88	36.2	34.2	33.5	34.6
30+0+0	83	91	83	86	36.0	33.2	33.3	34.2
60+0+0	81	89	82	84	35.8	33.5	33.7	34.3
0+30+0	87	90	81	86	35.0	32.7	33.0	33.6
0+0+0	82	85	81	83	35.5	32.7	33.0	33.7
Average	84	90	84	86	35.7	33.4	33.4	34.2

Table 55. The Effects of Applied Fertilizer on the Yields and Test Weights of Three Varieties of Barley, Yankton County, SD 1979.

Treatment $N+P_2O_5+K_2O$ lb/A	YIELD Variety				TEST WEIGHT Variety			
	Primus II	Morex	Larker	Average	Primus II	Morex	Larker	Average
	bu/A				lbs/A			
60+30+0	72	71 b*	74a*	72	46.3a*	45.0 c*	46.8 b*	46.0
30+30+0	67	70 b	74a	70	45.5a	45.2 c	46.3ab	45.7
30+0+0	65	62 ab	68a	65	45.5a	44.2 bc	45.0a	45.2
60+0+0	69	66 ab	72a	69	46.5a	44.7 c	45.8ab	45.3
0+30+0	66	54 a	69a	63	46.8a	42.5ab	45.8ab	45.0
0+0+0	55	54 a	64a	58	45.5a	42.2a	45.0a	44.2
Average	66	63	70	66	45.9	44.0	45.8	45.2

* Tukey's honestly significant difference: Fertilizer treatment yields not followed by the same letter are significantly different at the .05 level. This means that 1 chance in 20 exists that these yield differences are not different.

Table 56. The Estimated and Actual Yield of Three Crops with Two Rates of Nitrogen Added, Yankton County, 1979.

	Soil NO_3^-N lb/A	Expected Yield	Actual Yield	30 lb of N added		60 lb of N added	
				Expected	Actual	Expected	Actual
Wheat	94	39	38	52	41	64	41
Oats	94	72	83	95	87	118	86
Barley	94	59	58	65	68	81	71

Oats and barley show small yield increases (compare the 30+0+0 and 30+30+0 treatments) to added phosphorus. Yield increases of this nature can be expected even with a high soil test in years of above average climatic conditions. This year was considered above average.

EFFECT OF N-SERVE* ON CORN - 1979

R. Gelderman, R. Schoper, P. Carson,
H. Kittems, and R. Nettleton

Objectives

1. To evaluate the effects of added nitrogen with and without added nitrapyrin (N-Serve)* on corn yields.

Methods and Procedures

1. The experiment was established on the Leonard Johnson farm near Crooks, SD, in Minnehaha County (NW1/4 of SW 1/4 of Sec. 35; R50W; T130N).
2. The site was located on a Moody silt loam. Moody soils are deep, well-drained soils developed from loess. The slope ranged from 3 to 6% on this site.
3. The soil tests on samples taken from the experimental site in the fall of 1978 are shown in Table . The amount of nitrate-nitrogen (NO_3^-N) in the top two feet was 39 lb/A, which is considered low. The NO_3^-N in the top four feet of soil amounted to 78 pounds per acre which is considered medium. All other tests are considered high or satisfactory for the plow layer depth.

Table 57. Soil Tests for Minnehaha County N-Serve Experiment, 1979

NO_3-N lb/A-2'	NO_3^-N lb/A-4'	O.M. %	P lb/A	K lb/A	pH	Soluble Salts mmho/cm	Texture
39	78	3.1	54	550	6.2	0.2	silt loam

4. The 1978 crop was small grain and the soil had been chiseled before the fertilizer was applied.
5. The fertilizer used to supply the nitrogen was anhydrous ammonia**. It was knifed to a depth of five inches in late October of 1978.
6. The N-Serve was applied at the rate of 1 quart per acre. The nitrogen fertilizer rates used were 0, 50, 100, and 150 lbs of N per acre. In the case of the check, no N-Serve was applied.

* Trademark of DOW Chemical Co., Midland MI. The material was supplied by DOW Chemical Co.

** Supplied by the CENEX Bulk Blending Plant at Ellis, SD

7. The treatments were arranged in a split plot randomized complete block design with the split being between N-Serve and no N-Serve treatments in each whole plot (Rates of Nitrogen). The treatments were replicated four times.
8. The corn variety used was Dekalb XL23. Sutan plus Bladex as a herbicide and Furadan as insecticide were applied at recommended rates. Land preparation, planting and crop care for the corn in the plots were completed by the cooperator as he managed the remainder of the field.
9. Plant leaf samples were taken at the time of pollination for analysis. The leaf opposite and below the ear was taken, dried and analyzed for total nitrogen.
10. The plots were hand harvested for grain on October 16, 1979. Ear mid-section samples were taken for moisture determination.

The 1979 growing conditions were excellent for corn production except for the wet soil conditions which generally delayed planting until late May. Plot stand was 15,000 plants per acre.

Results and Discussion

The effects of nitrogen and rates of N-Serve added on grain yield, percent leaf nitrogen and percent ear moisture are shown on Table 58. The F test for treatment (N-Serve vs no N-Serve) was not significant at the 0.05 level. This means that differences in yields were so small that we cannot differentiate between them statistically. The effects of the added rates of nitrogen produced yield differences large enough to be considered statistically significant although the interaction between N-Serve treatment and rates of nitrogen was not.

Table 58. Effect of N-Serve and Nitrogen Rates on Corn Grain Yields, Percent Leaf Nitrogen and Percent Ear Moisture in Minnehaha County site, 1979.

Nitrogen Applied lb N/A	Yield* bu/A		% Leaf N		% Ear Moisture	
	no N-Serve	N-Serve	no N-Serve	N-Serve	no N-Serve	N-Serve
0	109	108	2.95	2.91	29.0	29.7
50	117	126	3.02	3.16	28.7	29.2
100	114	115	3.25	3.23	29.5	29.6
150	118	117	3.25	3.25	28.7	29.7
Average	115	117	3.12	3.14	28.9	29.5

* Yield calculated at 15% moisture.

Table 59. The Effect of Rates of Nitrogen on Corn Yield, Minnehaha County Site, 1979.

Nitrogen Applied lb N/A	Yield bu/A
0	108a*
50	122 b
100	114ab
150	118ab

* Turkey's honestly significatn difference; treatments are not followed by the same letter are significantly different at the 0.05 level.

The non-significance of the N-Serve treatments allows the two treatments for each nitrogen rate to be averaged. Table shows that the check and the 50 pound rate are significantly different at the 0.05 level. This difference is not fully understood because the higher rates are not significantly different from the check or the 50 pound rate. With a level of 78 pounds of available nitrogen (NO_3^-N) present in the soil, a yield increase would not be expected with nitrogen additions greater than 100 pounds per acre.

The percent leaf nitrogen reaches a peak at the 100 pound N rate. The lower end of the nitrogen sufficiency range (2.75-3.50%) was exceeded in all samples tested.

In summary, N-Serve did not increase the yield of corn at this site in 1979 when added with different rates of nitrogen from anhydrous ammonia. The addition of 50 pounds of nitrogen per acre did cause a small yield increase and rates of nitrogen up to 100 pounds per acre increased the nitrogen content of the leaf samples taken at silking time.

HERBICIDE CONTROL OF VOLUNTEER CORN IN SOYBEANS

W.E. Arnold, M.A. Wrucke, S.R. Gylling, and J.A. Holmdal

Plots were established to evaluate volunteer corn control in soybeans at the Southeast South Dakota Research and Extension Center at Beresford. Two herbicides were applied at various dosages, for a total of 8 treatments. Four replications were arranged in a randomized complete block design. "Evans" soybeans were planted in 30" rows on May 17. Preemergence treatments were applied to a dry surface soil on May 21 using a tractor mounted sprayer (3 MPH, 32 PSI, 10' swath, and 20 GPA). Weather conditions at the time of treatment were: air temperature 51°F, relative humidity 64%, clear sky, wind 4-6 mph, soil moisture (2" depth) moist, and soil temperature (2" depth) 49°F. Post emergence herbicides were applied June 5 using a bicycle sprayer (3 MPH, 32 PSI, 10' swath, and 20 GPA). Weather conditions at the time of treatment were: air temperature 55°F, relative humidity 45%, clear sky, wind 0-2 mph, leaf surface dry, soil moisture (2" depth) moist, and soil temperature (2" depth) 54°F. Weed heights were: volunteer corn 5" and common lambsquarter 7.5". Total rainfall for the 1st and 2nd weeks after application were: preemergence 0.00" and 0.65", respectively; post emergence 1.27" and 0.87", respectively. The soil is a silty clay loam (22.8% sand, 49.28% silt, 27.92% clay) with 3.8% organic matter, 5.9 pH, and is well drained. Weed control was evaluated June 28. The results are shown in the table. KK 80 did not control the foxtail species nor volunteer corn when applied preemergence. However, when applied post emergence, KK 80 controlled the foxtail species and volunteer corn at 1.0. KK 80 appeared to control volunteer corn better than diclofop.

Table 60. Herbicide control of Volunteer Corn in Soybeans.

Treatment	Rate	Growth Stage	% Weed Control Corn	% Weed Control Gr. Foxtail
Diclofop	0.75	Post	43	60
Diclofop	1.00	Post	70	85
Diclofop	1.25	Post	80	88
KK 80	2.00	Pre	7	17
KK 80	1.00	Pre	7	7
KK 80	1.00	Post	95	90
KK 80	0.50	Post	76	72
KK 80	2.00	Post	96	97
Handweeded Check	0.0	Post	99	99
Weedy Check	0.0		0	0
LSD (.05)			16	23

EVALUATION OF SOYBEAN HERBICIDES

W.E. Arnold, M.A. Wrucke, S.R. Gylling, and J.A. Holmdal

Plots were established to evaluate weed control in soybeans at the Southeast South Dakota Research and Extension Center at Beresford. Eight different herbicides were included at various application rates and in combinations, giving a total of 19 different treatments. Four replications of 10' x 40' plots were arranged in a randomized complete block design. "Evans" soybeans were planted in 30" rows on May 21. Preplant incorporated treatments were applied May 21 using a tractor mounted sprayer (3 MPH, 32 PSI, 10' swath, and 20 GPA) and incorporated immediately. Weather conditions at the time of treatment were: air temperature 57°F, relative humidity 70%, partly cloudy sky, wind 7-9 mph, soil surface dry, soil moisture (2" depth) moist, and soil temperature (2" depth) 50°F. Pre-emergence treatments were applied May 23 using the tractor mounted sprayer. Weather conditions at the time of treatment were: air temperature 65°F, relative humidity 55%, clear sky, wind 0-2 mph, soil surface dry, soil moisture (2" depth) moist, and soil temperature (2" depth) 50°F. Early post-emergence herbicide treatments were applied June 5 using a bicycle sprayer (3 MPH, 32 PSI, 10' swath, and 20 GPA). Weather conditions at the time of treatment were: air temperature 66°F, relative humidity 45%, clear sky, wind 6-8 mph, leaf surface dry, soil moisture (2" depth) moist, and soil temperature (2" depth) 59°F. Common lambsquarters were 1" tall at the time of treatment. Total rainfall for the 1st and 2nd weeks after application was: 0.00" and 0.65", respectively for the preplant incorporated and the pre-emergence treatments and 1.27" and 0.88", respectively for the early post-emergence treatments. The soil is a silty clay loam (22.8% sand, 49.28% silt, 27.92% clay) with 3.8% organic matter, pH 5.9, and is weel drained. Weed control was evaluated June 28. The results are shown in Table 61. BAS 90520 H effectively controlled foxtail species when applied post-emergence. CP 55097 was somewhat more effective for controlling the foxtail species than alachlor and controlled common lambsquarter better. AC-206.784 tended to be more effective when applied preplant incorporated at compared to pre-emergence.

Table 61. Evaluation of soybean herbicides. (Arnold, Wrucke, Gylling, and Holmdal)

Treatment	Rate	Growth Stage	% Weed Control Grft	Rrpw	KOCZ
Bas 90520 H	0.50	POST	94	0	11
Crop Oil	1 qt/A	POST			
Bas 90520 H	1.00	POST	94	0	15
Crop Oil	1 qt/A	POST			
Bentazon	0.75	POST	40	94	88
Crop Oil	1 qt/A	POST			
Bentazon	0.75	POST	97	97	88
Bas 90520 H	0.50	POST			
Crop Oil	1 qt/A	POST			
Bentazon	0.75	POST	97	97	61
Bas 90520 H	1.00	POST			
Crop Oil	1 qt/A	POST			
CP-55097	2.00	Pre	93	33	98
CP-55097	3.00	Pre	94	52	98
AC-206.784	3.00	PPI	95	86	96
Metribuzin	0.38	PPI			
AC-206.784	3.00	Pre	91	60	92
Metribuzin	0.38	Pre			
AC-206.784	3.50	PPI	96	92	96
Metribuzin	0.38	PPI			
AC-206.784	3.50	Pre	92	61	96
Metribuzin	0.38	Pre			
Pendimethalin	1.25	PPI	93	89	92
Metribuzin	0.60	PPI			
Pendimethalin	1.25	PPI	98	95	98
Metribuzin	0.60	Pre			
Chloramben	2.00	PPI	95	93	93
Pendimethalin	1.25	PPI			
Chloramben	2.00	Pre	96	94	97
Pendimethalin	1.25	PPI			
Chloramben	1.50	PPI	95	92	93
Pendimethalin	1.00	PPI			
Metribuzin	0.25	PPI			
Handweeded Check	0.0	Post	99	99	99
Weedy Check	0.0		0	0	0
LSD (.05)			13	12	11

EVALUATION OF PREPLANT INCORPORATED AND PRE-EMERGENCE SOYBEAN HERBICIDES

W.E. Arnold, M.A. Wrucke, S.R. Gylling, and J.A. Holmdal

Research plots for evaluating preplant incorporated and pre-emergence herbicides in soybeans were established at the Southeast South Dakota Research and Extension Center at Beresford. Ten herbicides were included at various application rates and combinations, giving a total of 12 treatments. Four replications were arranged in a randomized complete block design. "Evans" soybeans were planted in 30" rows on May 24. Preplant incorporated herbicides were applied to a moist surface soil on May 24 and incorporated immediately after application. Weather conditions at the time of treatment were: air temperature 46°F, relative humidity 88%, clear sky, wind 0-1 mph, and soil temperature (2" depth) 48°F. Pre-emergence herbicides were applied to a dry surface soil on May 25. Weather conditions at the time of treatment were: air temperature 57°F, relative humidity 50%, clear sky, wind 6-8 mph, soil moisture (2" depth) moist, and soil temperature (2" depth) 48°F. All herbicides were applied using a tractor mounted sprayer (3 MPH, 32 PSI, 10' swath, and 20 GPA). Total rainfall for the 1st and 2nd weeks after application were 0.65" and 0.00", respectively. The soil is a silty clay loam (7% sand, 57% silt, 36% clay) with 4.7% organic matter, pH 7.9 and is poorly drained. Weed control was evaluated June 30. The results are shown in Table 62.

Table 62. Evaluation of preplant incorporated and preemergence soybean herbicides. (Arnold, Wrucke, Gylling, and Holmdal)

Treatment	Rate	Growth Stage	% Weed Control		
			Grft	Rrpw	KOCZ
Trifluralin Bifenox	0.75 1.50	PPI PPI	95	83	90
Metribuzin Ethalfluralin	0.33 0.75	PPI PPI	96	91	95
Trifluralin Fluridone	0.75 0.08	PPI PPI	88	84	93
Trifluralin Fluridone	0.75 0.15	PPI PPI	91	81	92
Metribuzin Trifluralin Fluridone	0.38 0.75 0.15	PPI PPI PPI	95	93	96
Metribuzin EL 5219	0.33 0.94	Pre Pre	90	90	97
Chloramben EL 5219	2.00 0.94	Pre Pre	90	88	91
Metribuzin Oryzalin	0.33 1.00	Pre Pre	83	78	90
MC-10982	0.38	PPI	47	20	27
MC-10982	0.50	PPI	68	45	59
Trifluralin MC-10982	.75 0.38	PPI PPI	89	88	90
Trifluralin MC-10108	0.75 0.50	PPI Pre	97	98	97
Handweeded Check	0.0	Post	99	99	99
Weedy Check	0.0		0	0	0
LSD (.05)			23	18	20

SMALL GRAIN VARIETY TRIALS - YANKTON COUNTY, 1979

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Introduction

This trial is a satellite experiment from the Southeast Experiment Farm that was established in cooperation with the Crop Improvement Association to evaluate many of the varieties currently being grown in this and other areas of the state under Yankton County growing conditions. This provides an opportunity to evaluate these varieties under the growing conditions encountered west of the Experiment Farm.

Methods

1. The experiments were conducted on the Human Service Center Farm just north of Yankton, SD.. The site was located on a Houdek silty clay loam. Houdek soils are deep, well-drained, nearly level loamy soils which have formed on glacial till uplands. The soil test on the samples taken at planting time are as follows:

NO_3^--N (0-24")	94 lb/A (high)
Organic Matter	2.5% (medium)
Phosphorus (P)	38 lb/A (high)
Potassium (K)	430 lb/A (high)
pH	7.0 (neutral)
Texture	silty clay loam

   Fertility was considered high.
2. The previous year's crop on this land was small grain. The seedbed was prepared by plowing and disking. The experiment was seeded April 23, 1979.
3. Each plot was 4 x 25 feet. The treatments consisted of 17 varieties of spring wheat, 6 varieties of durum wheat, 19 varieties of oats and 5 varieties of barley. Each variety was planted 3 times within the area. The purpose of planting each variety 3 times is to provide a numerical estimate of what is known as "experimental error", or unexplained variations in yield. When differences in the yield of two varieties are greater than this value, it can be said that the yields are "really different" with a high degree of confidence.
4. Fertilizer was applied with the seed to all varieties at a uniform rate to insure that fertility was not a limiting factor. The plots were planted with a small press drill made for experimentation that makes it possible to seed one variety after another, with no mixing of varieties. The plots were sprayed with MCP

and Bromoxynil to control weeds. Control of broadleaf weeds was good. Some green foxtail was present. The plots were harvested with a small self-propelled combine on different dates according to maturity.

5. The supply of available moisture was good throughout most of the growing season. Hot, dry weather during early July speeded the ripening and filling process.

Results and Discussion

Comparisons of the yields and test weights for each type of small grain (spring wheat, oats, barley and durum wheat) are found in their respective tables. These yields are considered above average for the area. The yields are grouped according to relative maturities of the varieties.

The wheat yields (Table 63) were considered above average. They varied from 32 bu/A for Prodax and Profit-75 (medium-maturing varieties) to 48 bu/A for Butte (early variety). The average yields of the early and late maturing varieties are 8-9 bu/A higher than the medium maturing varieties. The cause for these yield differences cannot be positively stated. However, it may have been caused by hot, dry weather during the time the medium maturing varieties were filling. This could also explain the lower average test weights of the medium maturing varieties.

Oat yields would also be considered above average for the area, ranging from 55 bu/A for Multiline E to 94 bu/A for Lang. Severe lodging was noted on the variety Multiline E. This was due to the necessity of harvesting this variety when it was overly mature. An evaluation of the differences in yield due to variety can be obtained through the use of Duncan's multiple range test, which is found in Table 64. The early maturing varieties produced the lower average yield (81 bu/A) followed by the late and medium maturing groups with yields of 85 and 90 bu/A, respectively. High yielding varieties are found in each maturity group. Grain test weight values do not vary consistently with maturity groups.

The barley yields are also considered above average. The yields ranged from 60 bu/A for Glen to 74 bu/A for Larker. There was a large yield difference bwtween Glen and Larker; enough to consider these two yields statistically different. These differences can be evaluated with the Duncan's multiple range test in Table 65. Glen's test weight was significantly lower than the remainder of the test weights (Table 65).

The durum yields were slightly above average. The yields ranged from 33 to 41 bu/A. Rugby and Vic had significantly higher yields than other varieties (Table 66). Yields and test weights did not vary much between the early maturity and the medium maturity groups. The differences in yield and test weights can be evaluated from Table 66.

In summary, the yields from this variety test plot were higher than average for the area. In general, enough moisture, fertility, and growing degree days were present for excellent yields. The growing conditions on this site provided the opportunity for the genetic difference in the plants to be expressed. This is reflected in the yields and test weights. A few days of hot weather in July may have limited yields and test weights in some cases.

Table 63. The Effect of Wheat Varieties on the Yields and Test Weights of Wheat Grown Under Yankton County Weather Conditions, 1979.

Variety	Yield bu/A		Test Weight lb/bu	
Early-Maturing Varieties				
Protor	40	c*	55.8	d*
James	41	cd	56.3	de
WS 1809	42	cd	57.2	efg
Butte	48	e	60.2	h
Average	43		57.4	
Medium-Maturing Varieties				
Prodax	32	a	51.2	a
Profit-75	32	a	52.5	b
WS-25	33	ab	52.0	ab
Bounty 309	35	b	54.5	c
Waldron	39	c	56.3	de
Average	34		53.3	
Late-Maturing Varieties				
SD 2355	35	b	51.8	ab
Eureka	41	cd	56.5	de
Angus	42	cd	58.0	fg
Coteau	42	cd	58.2	g
Len	43	cd	57.0	ef
Olaf	43	d	56.8	de
Era	43	d	58.0	fg
Solar	43	d	57.2	efg
Average	42		57.5	

* Duncan's multiple range test: Varieties not followed by the same letter are significantly different at the .05 level. That is, 1 chance in 20 exists that they are not statistically different.

Table 64. The Effect of Oat Varieties on the Yields and Test Weights of Oats Grown Under Yankton County Weather Conditions, 1979.

Variety	Yield bu/A		Test Weight lb/bu	
Early-Maturing Varieties				
Multiline E	55	a*	33.5	fgh*
Otee	80	bc	36.0	i
Nodaway-70	84	bcde	36.2	i
Bates	93	de	33.2	defg
Lang	94	e	32.0	bcde
Average	81		34.2	
Medium-Maturing Varieties				
Noble	85	bcde	34.2	gh
Stout	87	bcde	32.3	bcdef
Lancer	89	bcde	32.8	cdefg
Chief	91	cde	33.5	fgh
Benson	92	cde	31.5	bc
Spear	93	de	34.2	gh
Burnett	93	de	34.7	h
Average	90		33.3	
Late-Maturing Varieties				
Otana	78	b	32.7	cdef
Marathon	82	bcd	29.2	a
Dal	82	bcd	31.2	b
Froker	85	bcde	33.3	efgh
Wright	86	bcde	33.5	fgh
Lyon	88	bcde	31.8	bcd
Moore	92	cde	31.5	bc
Average	85		31.9	

* Duncan's multiple range test: Varieties not followed by the same letter are significantly different at the .05 level. That is, 1 chance in 20 exists that they are not statistically different.

Table 65.
The Effect of Barley Varieties on the Yields and Test Weights of Barley Grown Under Yankton County Weather Conditions, 1979.

Variety	Yield bu/A	Test Weight lb/bu	Maturity Evaluation
Glen	60 a*	43 a	Medium-Early
Primus II	67 ab	46 b	Early
Park	67 ab	45 b	Medium-Early
Morex	70 ab	45 b	Medium
Larker	74 b	46 b	Medium

* Duncan's multiple range test: Varieties not followed by the same letter are significantly different at the .05 level. This means that 1 chance in 20 exists that they are not different.

Table 66.
The Effect of Durum Wheat Varieties on the Yields and Test Weights of Durum Wheat Grown Under Yankton County Weather Conditions, 1979.

Variety	Yield bu/A	Test Weight lb/bu
Early-Maturing Varieties		
Botno	34 a*	58.2 bc*
Edmore	34 a	58.7 c
Rugby	41 b	58.5 c
Medium-Maturing Varieties		
Calvin	33 a	57.3 b
Cando	34 a	56.0 a
Vic	39 b	59.2 c

* Duncan's multiple range test: Varieties not followed by the same letter are significantly different at the .05 level. That is, 1 chance in 20 exists that they are not statistically different.

STARTER FERTILIZER ON CORN

P. Carson, R. Gelderman, F. Shubeck, and R. Nettleton

It has been observed that planting corn on fallow slows the early growth of corn. It has also been observed that early growth of corn can be improved by applications of phosphorus with a planter equipped with a fertilizer attachment. Will corn consistently respond to starter fertilizer? If so, what elements are responsible?

Objectives

1. To determine how much phosphorus is need to improve the early growth of the corn grown on fallowed land.
2. To determine if combinations of N, P, & K as a starter have an effect on yield of corn.
3. To determine which element is responsible for any yield response to starter.

Methods

1. The experiment was located on an Egan silty clay loam south of the office building at the Southeast Experiment Farm. Egan soils are deep, friable, well-drained, silty clay loams developed in a silty cap over glacial till. Soil tests taken just after planting time are listed in Table 67.

Table 67. Soil Tests - Starter Corn Experiment - 1979

NO_3^-N lb/0-2'	NO_3^-N lb/0-4'	O.M. %	P lb/A	K lb/A	pH	Soluble Salts mmho/cm
117	200	2.5	22	450	6.3	0.5

Because of the previous year's fallow, nitrate-nitrogen in the top four feet was adequate to produce at least 100 bushels of corn. The phosphorus supply (22 lb/A) was in the medium range and the potassium supply of 450 lb/A was very high.

2. The land was fallowed in 1978 because of a hail storm in early July. The seedbed was prepared by disking before planting.
3. The fertilizer treatments were applied with a corn planter that places the fertilizer beside and below the seed. Approximately 1 1/2 to 2 inches of soil separated the seed and the fertilizer. the fertilizer treatments used are listed below:

Table 68. Fertilizer Treatments - Starter Corn Experiment
Southeast Experiment Farm, 1979

Treatment No.	Identification	Rate of Fertilizer applied in lbs/A N	+	P_2O_5	+	K_2O
1.	$N_2P_2K_2$	3	+	7	+	5
2.	$N_2P_2K_4$	3	+	7	+	21
3.	$N_2P_4K_2$	3	+	27	+	5
4.	$N_2P_4K_4$	3	+	27	+	21
5.	$N_4P_2K_2$	12	+	7	+	5
6.	$N_4P_2K_4$	12	+	7	+	21
7.	$N_4P_4K_2$	12	+	27	+	5
8.	$N_4P_4K_4$	12	+	27	+	21
9.	$N_3P_3K_3$	6	+	14	+	11
10.	$N_1P_3K_3$	0	+	14	+	11
11.	$N_5P_3K_3$	24	+	14	+	11
12.	$N_3P_1K_3$	6	+	0	+	11
13.	$N_3P_5K_3$	6	+	54	+	11
14.	$N_3P_3K_1$	6	+	14	+	0
15.	$N_3P_3K_5$	6	+	14	+	43
16.	$N_1P_1K_5$	0	+	0	+	43
17.	$N_1P_5K_1$	0	+	54	+	0
18.	$N_1P_5K_5$	0	+	54	+	43
19.	$N_5P_1K_1$	24	+	0	+	0
20.	$N_5P_1K_5$	24	+	0	+	43
21.	$N_5P_5K_1$	24	+	54	+	0
22.	$N_5P_5K_5$	24	+	54	+	43
23.	$N_1P_1K_1$	0	+	0	+	0

In addition to the starter fertilizer, 100 pounds of nitrogen were applied as a broadcast application before planting.

4. The experimental design was a two replication composite.
5. Weed control consisted of Lasso applied at planting time and two cultivations. Weed control was good.
6. Soil insects were controlled by the use of Dyfonate applied at planting time.
7. Variety used was Pioneer 3541.
8. The corn was planted May 16th with a John Deere tool-bar planter. Row width was 30 inches and approximately 18,000 seeds per acre were planted.
9. Corn was harvested by hand on October 24th: 40 feet of row was harvested for grain. Mid-sections of the ear were taken for moisture determination.
10. Leaf samples were taken at silk on July 27th.
11. Weather for the production of corn was excellent; a although, dry weather from mid-June to the last of July caused some stres

Table 69. Effects of Starter Fertilizer Rates and Ratios on the Yield of Corn, Moisture Content of the Ears, the Final Plant Population at Harvest Time, and Percent Leaf N, P, and K; on Corn Grown on the Southeast Experiment Farm, 1979.

No.	Designation	Fertilizer added[L3] lb/A N + P_2O_5 + K_2O	Yield[L1] bu/A	Moisture[L2] Content %	Plant Population	% Leaf N	- P	- K
1.	$N_2P_2K_2$	3 + 7 + 5	141	21.0	18513	3.46	.371	4.50
2.	$N_2P_2K_4$	3 + 7 + 21	138	19.2	15899	3.18	.300	4.38
3.	$N_2P_4K_2$	3 + 27 + 5	144	21.9	16552	3.21	.366	4.69
4.	$N_2P_4K_4$	3 + 27 + 21	131	20.4	17859	3.17	.384	4.51
5.	$N_4P_2K_2$	+ 7 + 5	136	21.6	15682	3.25	.371	4.44
6.	$N_4P_2K_4$	12 + 7 + 21	145	19.8	18295	3.37	.405	4.38
7.	$N_4P_4K_2$	12 + 27 + 5	145	21.8	18077	3.46	.443	4.62
8.	$N_4P_4K_4$	12 + 27 + 21	137	20.7	15899	3.51	.418	4.69
9.	$N_3P_3K_3$	6 + 14 + 11	131	22.4	15681	3.42	.352	4.56
10.	$N_1P_3K_3$	0 + 14 + 11	150	18.0	17859	3.50	.346	4.57
11.	$N_5P_3K_3$	24 + 14 + 11	149	18.7	16988	3.39	.472	4.13
12.	$N_3P_1K_3$	6 + 0 + 11	136	21.2	15899	3.22	.339	4.07
13.	$N_3P_5K_3$	6 + 54 + 11	141	22.2	17859	3.33	.411	4.38
14.	$N_3P_3K_1$	6 + 14 + 0	149	21.5	19384	3.37	.419	4.13
15.	$N_3P_3K_5$	6 + 14 + 43	155	27.5	17423	3.21	.327	4.69
16.	$N_1P_1K_5$	0 + 0 + 43	146	21.6	17641	3.43	.308	4.69
17.	$N_1P_5K_1$	0 + 54 + 0	134	20.7	17424	3.24	.359	4.19
18.	$N_1P_5K_5$	0 + 54 + 43	143	21.9	17424	3.27	.421	5.25
19.	$N_5P_1K_1$	24 + 0 + 0	143	24.6	18513	3.42	.305	4.32
20.	$N_5P_1K_5$	24 + 0 + 43	141	23.3	17859	3.21	.328	4.37
21.	$N_5P_5K_1$	24 + 54 + 0	140	20.6	17424	3.55	.545	4.44
22.	$N_5P_5K_5$	24 + 54 + 43	130	19.6	17424	3.44	.496	4.82
23.	$N_1P_1K_1$	0 + 0 + 0	147	22.1	17859	3.35	.236	4.07

L1 - Yields calculated at 15% moisture.
L2 - Moisture sample was taken by cutting a section out of the center of 8 ears of corn. This includes the cob.
L3 - Fertilizer applied with a planter that placed the fertilizer beside and below the seed.

Results and Discussion

Yields in bushels per acre of 15% moisture corn, percent moisture in ears at harvest time, plant population at harvest time, and percent N, P, and K in the leaf are reported in Table 69.

Grain yields were excellent, ranging from 130 to 155 bushels per acre with the average yield at 142 bushels per acre. The check (N+P+K) was one of the highest yielding plots. No definite yield trends can be established among treatments. It should be noted that on this fallowed ground, growth differences could clearly be identified early in the season. These differences in growth were still apparent until after silking. The growth responses were associated with the added phosphorus. These same differences have been noted in previous years on corn following fallow.

Grouping of yields by rates of application of the different fertilizer elements provides a means of further evaluating these treatments. These groupings are shown graphically in Figure 5 . Again, no clear picture of the effect of rate or source of starter fertilizer emerges. We see a rather large increase (4 bushels above check) for phosphorus at the third rate. However, this falls within the experimental error of measurement.

The phosphorus effect is grouped separately over the past few years in Figure 4. To get the true yield for 1975, subtract 100 from values shown. The reason for this is to reduce the length of vertical axis in the diagram. In the years of 1975 and 1977, the yields of corn showed a general decline as additional phosphorus was added. The effect on yields for 1979 is not as clear.

A grouping of percent N, P and K in the % leaf at silking by rates of application is shown in Table 70. No consistent differences in nitrogen content are shown. However, as rates of P and K increased in the starter, the percent P and K in the leaf also increased. Therefore, the added P and K are being taken up by the plant although they did not influence the yield.

A look at past work at the Southeast Experiment Farm with starter fertilizers on corn may put the data in perspective. A starter fertilizer experiment has been conducted on the farm every year since 1962. The response to a starter fertilizer in these years is shown in Table 71. The fertilizers in these experiments contained N, P, and K.

Table 70. The Influence of Starter Fertilizer on Percent of N, P, and K of leaf at silking time. Southeast Experiment Farm, 1979.

Rates of Fertility	N %	P %	K %
1	3.36	.303	4.23
2	3.26	.361	4.56
3	3.31	.383	4.34
4	3.40	.402	4.49
5	3.40	.446	4.76

Table 71. The Effect of Starter Fertilizers on the Yield Response of Corn, Southease Experiment Farm,1963-74.

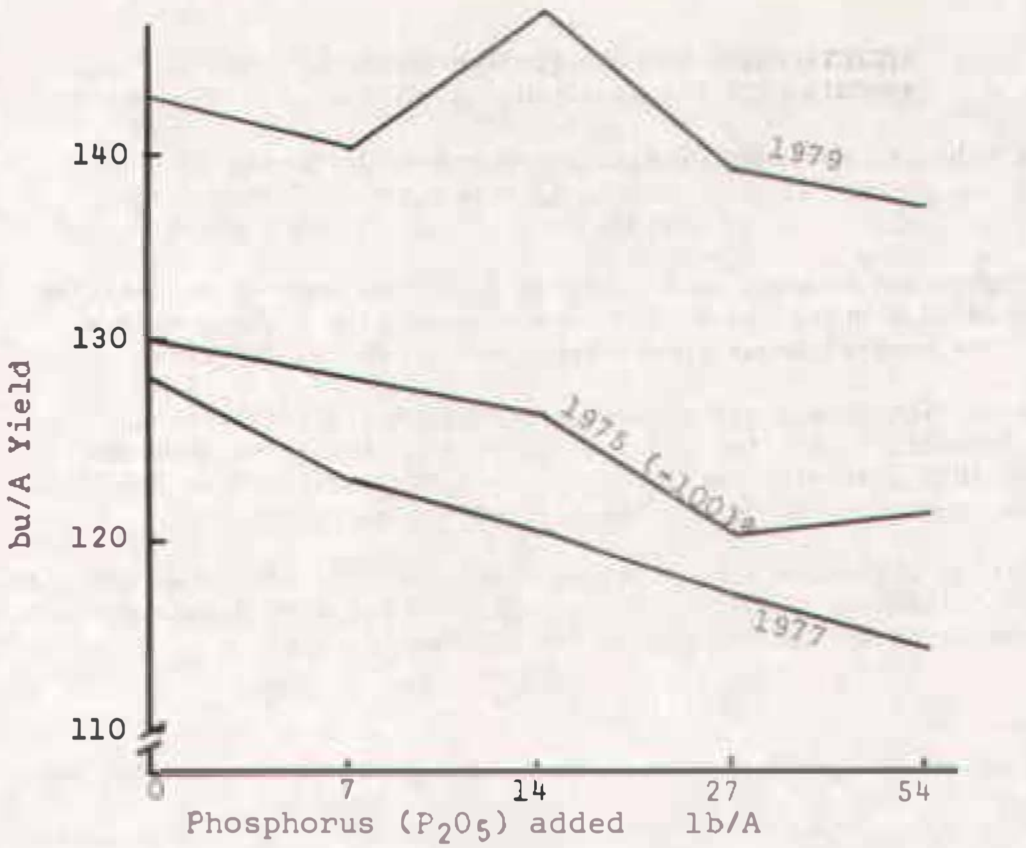
Year	Average Response bu/A	June Temperature Deviation from Long-Time Average
1963	-10	+1.8
1964	+ 7	-1.7
1965	+ 5	-0.3
1966	- 2	----
1967	+ 3	-2.1
1968	0	+3.2
1969*	---	-1.3
1970	- 5	+5.5
1971	- 7	+5.8
1972	+ 8	-3.7
1973	+18	-1.0
1974	+ 5	-4.4

* No data

The average response in bu/A of corn over the 11 year period was minus 5.5 bushels for those years when the June temperature was average (approx. 70-75°F) or above. When the June temperature was average the average response to starter was a plus 7.6 busels per acre. This correlation between June temperature and starter response is true in every year except 1966. With this in mind, the 1979 June temperature was 3.2 degrees below the average; however, no yield increase was noted. This year appears to be one of the exceptions to the trend as was 1966.

The average yield response to starter in Table 71 is fairly small in most years. The overall average is only a two bushel increase when starter is added. Because of this long time average the use of a starter fertilizer is considered questionable under these growing conditions. However, as Table 71 shows, many of those years that did respond had fairly large yield increases.

In summary then, we did not receive a clear yield increase due to the addition of a starter fertilizer to corn following fallow in 1979. There were large growth differences early in the season but these did not translate into yield differences. Many years of data on starter response would show a small average increase due to the addition of starter; although, in any individual year, a very large increase may occur. It appears the positive response of corn to a starter fertilizer is related to a low June temperature.



* Subtract 100 bu/A to get true yield for 1975

Figure 4. The Effect of Increasing the Amount of Phosphorus Contained in the Starter Fertilizer on the Yield of Corn. Southeast Experiment Farm, 1979

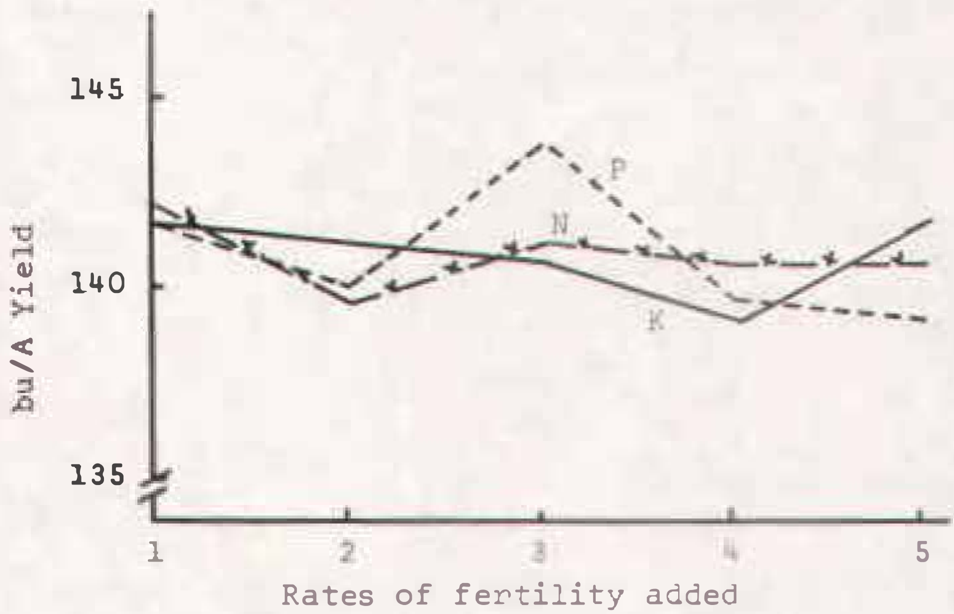


Figure 5. The Effects of Starter Fertilizer on Corn Yield. Each point is average of all values with that same element and same rate. Southeast Experiment Farm, 1979.

EFFECTIVENESS OF COLD-FLO ANHYDROUS AMMONIA WITH FORAGE SORGHUM SILAGE

G. Kuhl, C. Carlson, G. Williamson and B. Jorgensen

Summary

Forage sorghum was treated with Cold-Flo anhydrous ammonia at ensiling time and compared with untreated silage supplemented with soybean meal at feeding time. One hundred Angus steers were used in the 91 day trial.

There was no significant difference in average daily gain with the two silages. However, cattle fed the ammonia treated forage sorghum consumed less feed than controls, resulting in a substantially better (16.7%) feed conversion by steers on the ammonia treated silage ration.

The results of this experiment indicate that Cold-Flo anhydrous ammonia is efficiently utilized as a non-protein nitrogen source with forage sorghum silage. More study is needed to verify this original finding.

Introduction

The application of liquid anhydrous ammonia to corn plant material has been demonstrated by several agricultural experiment stations to be a highly effective and economical means of increasing the crude protein content of corn silage.

In order to apply anhydrous ammonia as a liquid, a condensation chamber (Cold-Flo Converter) has been developed which converts pressurized anhydrous ammonia to a super-cold liquid. This has the advantage of decreasing losses of the ammonia. This system has been patented by USS Agri Chemicals and has received FDA approval for use with "freshly chopped corn plant material" as a source of non-protein nitrogen. However, research with other types of silages is lacking.

The objective of this study was to evaluate the feedlot performance of cattle fed Cold-Flo anhydrous ammonia treated forage sorghum silage or untreated (control) silage supplemented with soybean meal at time of feeding. Since forage sorghum is lower in energy than corn silage, it was of great interest to determine whether ammonia would be efficiently utilized as a crude protein source with this type of silage.

Experimental Procedures

Late planted Pioneer 956 forage sorghum was harvested in late October, 1978 and ensiled in two 18 x 50 ft. concrete upright silos. One silo was filled with untreated (control) silage, while the other had liquid anhydrous ammonia applied at the blower. An anhydrous ammonia field applicator equipped with a regulator supplied the ammonia. A Cold-Flo Converter was connected between the regulator and the forage intake of the blower.

Initially, several loads of chopped forage sorghum were weighed and their unloading times measured. From this information, the average unloading rate was calculated, and the ammonia regulator flow rate set to apply about 10 lb. per ton of silage. However, the amount of anhydrous ammonia ultimately applied averaged 12.5 lb. per ton, due to variations in regulator efficiency and unloading rate. The forage sorghum yielded 9.2 tons per acre with an average dry matter content of 36%. Crude protein content of the control silage averaged 7.9%, dry basis.

One hundred Black Angus steers from a single herd in western South Dakota were used for the study. The short yearlings were allotted into 4 pens of 25 head each with shrunk body weight obtained after an 18 hour stand without feed and water. The steers were housed in an enclosed barn with access to outside concrete lots. All steers were implanted with Ralgro, poured with a half-dose of Warbex for lice control and wormed with a TBZ feed additive prior to start of the trial on March 30, 1979. One animal died of pneumonia during the trial.

Two pens of cattle received a full feed of control silage plus 2 lb. of soybean meal and 6 lb. of cracked corn per head daily, while the other 2 pens were full fed the anhydrous ammonia treated silage plus 8 lb. of cracked corn per head daily. All cattle received 1 oz. of a high iodine, trace mineral salt to control foot rot and ½ lb. of a custom supplement per head per day. The supplement consisted of 65% ground corn, 22% dicalcium phosphate, 10% trace mineral salt and 3% of a Rumensin-Vitamin A premix to provide 200 milligrams of Rumensin and 30,000 IU of Vitamin A per head daily. All steers received 1 lb. of a 38% protein supplement, 2½ lb. of alfalfa hay and 0.2 lb. of a high level antibiotic (AS-700) per head daily during the first 4 days of the trial.

Results

The results of the 91 day trial are presented in the table. Average daily gain of the steers fed the two silages were very similar (2.24 vs. 2.18 lb.). However, the cattle fed the anhydrous ammonia treated forage sorghum consumed about 7.5 lb. (24%) less silage than the control silage fed steers, while maintaining comparable weight gains. Thus, the total pounds of feed required per pound of gain was about 17.5 lb. with the control silage and about 14.6 lb. with the ammonia treated silage, or about 16.7% better feed efficiency with the latter ration, on an as-fed basis.

These results suggest that anhydrous ammonia is an effective silage additive for forage sorghum. However, additional studies are necessary to confirm these original research findings. It should be noted that the Cold-Flo anhydrous ammonia treatment of forage sorghum is not technically approved by FDA at this time.

TABLE 72. EFFECTIVENESS OF COLD-FLO ANHYDROUS AMMONIA WITH FORAGE SORGHUM SILAGE

Item	Control	Ammonia-Treated
No. Steers	50	49
Initial Shrunk Wt., lb.	625.9	623.4
Final Shrunk Wt., lb.	829.8	821.7
Avg. Daily Gain, lb.	2.24	2.18
Avg. Daily Ration, lb. (as-fed):		
Silage	30.80	23.33
Cracked Corn	6.02	7.87
Soybean Meal	1.86	----
Supplement	0.52	0.52
Trace Mineral Salt	0.05	0.05
TOTAL	39.25	31.77
Lb. Feed/Lb. Gain (as-fed):		
Silage	13.74	10.71
Cracked Corn	2.69	3.61
Soybean Meal	0.83	----
Supplement	0.23	0.24
Trace Mineral Salt	0.02	0.02
TOTAL	17.51	14.58

EFFECT OF CEMENT DUST AND REIMPLANTING ON FINISHING HEIFER PERFORMANCE

G. Kuhl, C. Carlson, G. Williamson and L. Embry

Summary

Eighty crossbred yearling heifers were used to determine the possible benefit of including 2% cement kiln dust in a typical high concentrate finishing ration. The value of 1 vs. 2 Ralgro implants during a 151 feeding period was also evaluated.

Cattle on the cement dust ration gained 13% slower and ate 6.3% less feed per day than control heifers, resulting in an 8.5% poorer feed conversion to gain with cement dust. Carcass quality and yield grades were not significantly affected by cement dust in the ration.

In this study, no benefit was observed from implanting heifers twice during a 151 day feeding period as compared with a single implant, in terms of finishing trial performance or carcass characteristics.

Introduction

Recently, certain studies have indicated that including cement kiln dust, a waste byproduct of the cement industry, in the rations of livestock may increase performance. However, the trials to date are far from consistent, with some experiments showing no effect and others actually decreasing performance by adding cement dust to rations. While the possible mode(s) of action of cement dust is unknown, several theories have been proposed, including its action as a buffer and as a source of certain trace minerals. It appears that considerable variation exists in the mineral composition and possible growth promoting effects of cement dust from various states and plants.

Thus, the objective of this trial was to compare the performance of finishing heifers fed a high concentrate ration with and without 2% cement dust from the South Dakota Cement Plant.

In addition, this study presented an opportunity to evaluate whether 2 successive Ralgro implants during a 151 day feeding period would promote better performance than a single initial implant.

Experimental Procedures

Eighty crossbred yearling heifers averaging about 780 lb. were used for this 77 day study. The heifers had been utilized on a corn silage additive trial at the S.E. Farm prior to this experiment. The cattle were allotted to 8 pens of 10 head each, with shrunk body weights obtained after an 18 hour stand without feed and water. Four pens were assigned to the cement dust ration and 4 pens to the control ration. Two pens of cattle on each ration were reimplanted with Ralgro on the first day of the trial. All heifers had been implanted with Ralgro 74 days previously.

The control ration consisted of 80% whole shelled corn, 10% chopped, poor quality alfalfa hay, 5% wet beet molasses and 5% pelleted custom supplement. The cement dust ration was identical to the control ration, except that 2% cement dust and 78% corn was fed. The wet molasses was used in the rations to minimize fines and prevent separation of the cement dust from the rest of the ration. The custom mixed supplement contained 75% ground corn, 5% dry cane molasses, 11.7% limestone, 6% trace mineralized salt and 2.3% Rumensin-Vitamin A premix. The premix provided 30,000 IU of Vitamin A per lb. of supplement and 30 grams of Rumensin per ton of complete ration. The cattle were slowly brought up on the high concentrate rations by decreasing the hay and increasing the shelled corn over the first 12 days of the experiment.

Analyses of the major ration feedstuffs yielded the following average values for moisture and crude protein, respectively: alfalfa hay, 10.6% and 16.2%; shelled corn, 11.6% and 11.0%; and supplement, 10.0% and 9.6%. The cement dust which was obtained from the S.D. Cement Plant stockpile in Rapid City contained 0.45% moisture, 33.9% calcium and 0.04% phosphorus.

The heifers were fed in open, sloped concreted lots without access to enclosed shelter. Daily feed records were kept on each pen and individual heifer weights were obtained at monthly intervals. The experiment was terminated after 77 days on feed, at which time the average full body weight of the heifers was about 1,000 lb. The cattle were sold on a grade and yield basis so that detailed carcass data could be obtained.

Results

The feedlot performance and carcass characteristics of heifers as influenced by cement dust in the ration and by reimplanting is shown in the table. Averaged across implant groups, the daily gain of heifers on the control ration was 2.70 lb. compared with 2.32 lb. for the cement dust fed cattle. Thus, feeding 2% cement dust in the ration decreased rate of gain by about 13%. Daily feed consumption was also decreased an average of 6.3% with cement dust, and the amount of feed required per lb. of gain was increased 8.5%.

These results are consistent with recent Alabama and Oklahoma trials in which feedlot performance was decreased by adding 2-3.5% cement dust to high concentrate finishing rations.

Carcass characteristics were not significantly influenced, except for lower carcass weights, by including cement dust in the ration. Thus, there does not appear to be any advantage to adding South Dakota cement dust to high concentrate finishing rations, at least at levels approaching 2% of the ration. Indeed, this trial suggests that feedlot performance will be adversely affected. It should be noted that cement dust is not approved as a feed additive in livestock rations.

In this study, no benefit was achieved by implanting cattle twice with Ralgro during a 151 feeding period when compared with a single initial implant. Indeed, rate of gain and feed efficiency of the reimplanted cattle was slightly lower, although these results were not significantly different.

Overall, the crossbred heifers graded 82.5% low choice or better, and over 76% yield graded #1 and #2.

TABLE 73. EFFECT OF CEMENT DUST AND REIMPLANTING ON FINISHING HEIFER PERFORMANCE

Item	Control		Cement Dust	
	1 Implant	Reimplant	1 Implant	Reimplant
No. Heifers	20	20	20	20
Initial Shrunk Wt., lb.	779.6	779.0	777.0	779.0
Final Shrunk Wt., lb.	999.8	974.2	960.2	952.0
Avg. Daily Gain, lb.	2.86	2.54	2.38	2.25
Avg. Daily Ration, lb. (as-fed):				
Shelled Corn	18.64	17.83	16.46	16.68
Chopped Hay	3.86	3.76	3.62	3.68
Wet Molasses	1.20	1.14	1.08	1.10
Supplement	1.17	1.12	1.06	1.08
Cement Dust	---	---	0.43	0.44
TOTAL	24.87	23.85	22.65	22.98
Lb. Feed/Lb. Gain (as-fed):	8.70	9.42	9.44	10.22
Hot Carcass Wt., lb.	607.4	589.8	578.4	580.2
Fat Thickness, in.[a]	0.40	0.39	0.44	0.38
Rib Eye Area, sq. in.	11.74	12.25	11.35	11.92
Quality Grade[b]	19.2	19.0	19.0	19.3
Yield Grade	2.56	2.62	2.72	2.52
% Liver Abscesses	45	30	45	25

[a] Fat thickness measured over rib eye between the 12th and 13th ribs.

[b] Quality grade score: 18 = High Good, 19 = Low Choice, 20 = Avg. Choice

COMPARISON OF CORN VS. SUNFLOWER SILAGES WITH GROWING HEIFERS RECEIVING SYNOVEX-H OR MGA

G. Kuhl, C. Carlson, G. Williamson and F. Shubeck

Summary

Two groups of crossbred heifer calves were used to study the relative feeding value of corn and sunflower silages. Heifer feedlot performance with Synovex-H and MGA was also compared.

Heifers fed sunflower silage gained 28% slower, but also consumed considerably less silage, resulting in comparable feed efficiencies with the two silages. Palatability was definitely lower with the sunflower silage.

The feedlot performance of heifers receiving Synovex-H or MGA was very similar.

The crossbred heifers were from Hereford-Angus and Simmental-Angus cows bred to one purebred Charolais bull. The Hereford-Angus cross calves gained about 13% faster and 13% more efficiently than the Simmental-Angus cross heifers.

Introduction

While sunflower silage is not commonly used in feedlot rations at present, the recent marked increase in sunflower production in South Dakota has stimulated renewed interest in sunflowers as a forage crop. This interest has been spurred by concerns regarding the feeding value of sunflower silage in the event the crop can not be used as a cash crop, due to insect damage or lack of maturity.

Studies conducted 40-60 years ago with the mammoth sunflower varieties indicated tremendous yield capability; however, the feeding value of sunflower silage was generally only about 70-80% of corn silage due to palatability problems resulting in reduced dry matter intake. The advent of the new oilseed and confectionery varieties requires an evaluation of their value as whole plant forage.

The objective of this study was to compare the feedlot performance of calves fed sunflower and corn silages. In addition, the relative value of Synovex-H and melengestrol acetate (MGA) as growth stimulants was examined with 2 different groups of exotic crossbred heifers.

Experimental Procedures

The silages used in this study came from late planted sunflower and corn crops. Hail damage to the original crops required that these crops be replanted in mid-July. The corn silage yielded about 4.1 tons per acre at 66% moisture in early October. Sigco 8903, an oilseed variety of sunflowers was harvested for silage on October 25. Difficulty was experienced in getting the sunflowers sufficiently dry to allow proper direct-cut harvesting and ensiling. Considerable leaf loss occurred before the heavy stalks were dry enough to allow proper ensiling. The sunflower silage yielded about 5 tons per acre at 65% moisture.

Two groups of crossbred heifer calves were available from a South Dakota State University cow-calf management project at the Fort Meade Station. Twenty-eight heifers were out of Simmental-Angus cows, while another 28 head were from Hereford-Angus dams. All cows were artifically bred to one purebred Charolais bull. Thus, the breed groups consisted of one-half or three-fourths exotic breeding.

The calves had been implanted once with Ralgro during the suckling phase at Fort Meade, but were not creep fed. The heifers were treated for external parasites and received a three-way and IBR vaccination prior to weaning. The calves were then shipped to the research feedlot and backgrounded on 1/3 alfalfa hay and 2/3 forage sorghum silage until the start of the trial. A high level antibiotic (AS-700) was fed during the first three weeks after arrival.

The experiment was initiated on December 18, 1978. Each breed group was uniformly allotted into 4 pens on the basis of shrunk body weight obtained after an 18 hour stand without feed or water. Two pens of heifers from each breed group received sunflower silage while the other 2 pens were fed corn silage. One pen of each breed group and silage type combination was implanted with Synovex-H, while the other lot received MGA at 0.35 mg. per head per day from a commercial, pelleted, supplement fed at a constant 1.5 lb. per heifer daily. The Synovex-H implanted calves received a comparable commercial supplement at the same level but without MGA. Both supplements contained 32% crude protein, 4.0% calcium, 1.2% phosphorus, 3.5% salt and 20,000 IU Vitamin A per lb.

Initial plans were to simply full feed the two silages along with the appropriate supplement. However, feed intake was rather poor on the sunflower silage, so 3 lb. of cracked corn per head was added to all rations daily as of the 11th day of the trial. The level of cracked corn was subsequently boosted to 5 lb. per head per day on January 22, in order to improve ration palatability and reduce the effects of record low temperatures on animal performance.

The heifers were fed in open, sloped concrete lots without access to enclosed shelter. Daily feed records were kept on each pen and individual heifer body weights were obtained at monthly intervals throughout the 71 day trial.

Results

The comparative feedlot performance of heifers fed either sunflower or corn silage and receiving Synovex-H or MGA is shown in the table. When averaged across growth stimulant groups, the sunflower silage ration resulted in about 28% slower gains (0.86 vs. 1.20 lb.) than the corn silage ration. Daily feed intake was considerably reduced on the sunflower ration (32.6 vs. 47.1 lb. as-fed) with about 28% less sunflower silage consumed than corn silage per day. Lower palatability and high oil content of the sunflower silage was likely responsible for the lower intake. About one-half of the sunflower silage dry matter consisted of seed which contained about 38% oil. Overall, feed conversion was not significantly affected by silage type; however, relatively more grain and supplement was required per lb. of gain on the sunflower ration due to lower intake and rate of gain with this silage compared to corn silage.

Further experimentation is needed with sunflower silage to determine optimum stage of maturity for ensiling sunflowers and to evaluate different feeding levels and mixtures to improve sunflower silage palatability and feeding value.

No material differences were observed between Synovex-H and MGA in terms of daily gain, feed consumption or feed efficiency when averaged across silage types.

The Hereford-Angus cross heifers gained 13.4% faster than the Simmental-Angus cross calves with little difference in feed intake, resulting in over 13% better feed conversion by the half-blood exotic heifers. The extremely cold weather conditions resulted in greatly reduced feedlot performance during this trial.

TABLE 74. COMPARISON OF CORN VS. SUNFLOWER SILAGES WITH GROWING HEIFERS RECEIVING SYNOVEX-H OR MGA.

Item	Corn Silage		Sunflower Silage	
	Synovex-H	MGA	Synovex-H	MGA
No. Heifers	14	14	14	14
Initial Shrunk Wt., lb.	588.8	590.0	587.8	589.5
Final Shrunk Wt., lb.	670.2	678.1	652.6	647.9
Avg. Daily Gain, lb.	1.15	1.24	0.91	0.82
Avg. Daily Ration, lb. (as-fed):				
Silage	41.9	42.4	27.5	27.8
Cracked Corn	3.5	3.5	3.5	3.5
Supplement	1.5	1.5	1.5	1.5
TOTAL	46.9	47.4	32.5	32.8
Lb. Feed/Lb. Gain (as-fed):				
Silage	36.6	34.2	30.3	34.7
Cracked Corn	3.1	2.8	3.9	4.4
Supplement	1.3	1.2	1.6	1.8
TOTAL	41.0	38.2	35.8	40.9

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