20th Annual

SDSU

SOUTHEAST SOUTH DAKOTA EXPERIMENT FARM

PROGRESS REPORT 1980

Agricultural Experiment Station
South Dakota State University
Brookings

This twentieth 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

Delwyn Dearborn, Dean R.A. Moore, Director

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TWENTIETH ANNUAL PROGRESS REPORT
SOUTHEAST SOUTH DAKOTA EXPERIMENT FARM

Table of Contents

Introduction . . . . Fred E. Shubeck
Research Manager

1980 was an unusual year. A late frost on May 8 injured the first alfalfa crop and a hail storm on June 6 destroyed most of the soybeans and small grains. Soybeans and part of the corn were replanted. On August 25, a second hail storm destroyed the replanted beans and part of the corn. In addition, the seasons rainfall was 7.73 inches below normal by the end of July. The amount of hail damage varied with different locations on the farm. Experiments in areas with less hail damage were harvested and yields recorded in the annual report. Great care should be taken when applying these results because similar environmental conditions may not occur again for several years.

The hail storms severely damaged buildings, certain pieces of equipment, shade trees, and fruit trees in addition to the grain and forage crops. A conservative estimate of damage would be $20,000. Asphalt shingles were replaced on several roofs. Green thumb personnel replaced damaged siding and painted several out-buildings and also the office building. Attempts were made to salvage as much of the crop as possible. After the first hail storm, remains of the oats, wheat, barley, and alfalfa were cut for silage. This amounted to approximately 98 tons. After the second hail storm, corn, sorghum, and sunflowers were cut for silage. This added 800 more tons to our feed supply. Sunflowers survived the first hail storm quite well but most of the heads were cut off by the second storm.

The new feedlot is nearly complete. This facility will greatly improve the Experimental Farm's research potential for cattle feeding research. A new type of high density shelterbelt was planted on the north and west sides of the feedlot. Rows were planted in pairs six feet apart with 35 feet between each pair. This arrangement allows snow to accumulate in the wider spaces without breaking off or tearing down branches of trees that occurs occasionally with normal row spacing.

Most of the scheduled crop tours and field days were cancelled because of the two hail storms. However, one group from the Sioux City area had left for a scheduled tour of eastern South Dakota and the Experiment Farm before the hail storm occurred. These visitors were shown pictures and slides of previous years results.

A total of 41 meetings were held in the office building in 1980. These included extension clubs, adult education meetings, judging schools, elections, and other local groups.

For the first time, the solar drying was used to dry barley. One filling of corn was also dried. Both crops were grown on neighboring farms outside the hailed area.

In summary, we had a very difficult year. Very little agronomic data was obtained. We had some good experiments in progress on replanting and double cropping that were initiated after the first hail storm, but the second hail storm destroyed them. We tried to make the best of the situation by utilizing crop remains for silage.

Table 1. Temperatures at the Southeast Experiment Farm

Month	1980 Av. Temperature (F)[1] Maximum	Minimum	28 Year Average Maximum	Minimum	Departure from 28 Year Average Maximum	Minimum
January	28.8	8.5	25.1	4.0	+3.7	+4.5
February	26.0	6.3	31.9	10.3	-5.9	-4.0
March	39.4	19.2	43.2	22.0	-3.8	-2.8
April	63.7	34.6	61.2	35.5	+2.5	- .9
May	75.3	45.7	73.6	47.3	+1.7	-1.6
June	82.2	56.4	82.9	57.3	- .7	- .9
July	90.5	61.3	87.9	62.1	+2.6	- .8
August	84.0	59.2	85.9	59.7	-1.9	- .5
September	77.1	48.4	76.0	49.2	+1.1	- .8
October	60.7	31.5	65.5	40.4	-4.8	-8.9
November	50.7	24.9	46.3	24.1	+4.4	+ .8
December	31.8	10.2	31.5	11.2	+ .3	-1.0

1Computed from daily observation.

Table 2. Precipitation at the Southeast Experiment Farm

Month	Precipitation 1980 (inches)	28-year Average (inches)	Departure from 28-yr. Ave.(inches)
January	.21	.49	- .28
February	.94	1.11	- .17
March	.30	1.40	-1.10
April	.98	2.36	-1.38
May	2.17	3.22	-1.05
June	2.12	3.93	-1.81
July	1.25	3.19	-1.94
August	6.49	3.00	+3.49
September	1.09	2.64	-1.55
October	1.18	1.58	- .40
November	.03	1.01	- .98
December	.54	.68	- .14
Total	17.30	24.61	-7.31

PLANT POPULATIONS FOR CORN

F. Shubeck and B. Lawrensen

Objectives of Experiment

1. What planting rates 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 Frundts 8500A, 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

April 23	- The total plot area was fertilized on fall plowing with 80+40+20 (oxide) and spike tooth harrowed immediately to incorporate.
May 5	- Field cultivated with mulcher attachment.
May 6	- Planted all five plant populations - 10M, 12M, 14M, 16M, 18M and the five varieties - Pio 3709, Pio 3932A, Frundts 8500A, Curry's SC150, YW 35A. INSECTICIDE - Counter 15G HERBICIDE - Lasso II (banded)
June 2-5	- Started and finished thinning overplanted plant population to the desired number of plants per acre.
June 6	- Cultivated all corn plots (first hail storm).
June 25	- Cultivated all corn plots.
August 25	- Second hail storm 5:45pm - 6:15pm.
October 2-3	- Combined all plots.

Table 3. Effect of Plant Populations and Hybrids on Corn Yields.

Hybrid	Plants Per Acre (Final) 10,000	12,000	14,000	16,000	18,000	Average
Pioneer 3709	45.0	52.2	55.6	49.7	48.4	50.2
Pioneer 3932A	42.4	35.8	44.3	35.7	35.8	38.8
Curry's SC-150	38.3	47.7	42.0	35.6	33.4	39.4
Frundts 8500A	44.9	43.1	44.7	38.7	38.1	41.9
YW 35A	46.1	49.6	45.7	38.2	34.2	42.8
Average	43.3	45.7	46.5	39.6	38.0	

Discussion and Interpretation of Table 3

This experiment was not replanted after the first hail storm of June 6. Ears of most varieties were well dented by August 25, the date of the second hail storm. Injury to this corn was less than in other experiments where corn was in the milk or early dough stage when the second storm occurred. The seasons moisture on September 1 was 6.08 inches below average.

In the light of such adversities, it is surprising that corn could yield as much as it did. Extreme care should be used, though, in interpreting and using the data. Under these conditions, populations of 14,000 plants per acre were adequate. Yields of most hybrids tested, appeared to decrease where populations were brought up to 16,000 or 18,000. One hybrid, P 3709 (reported to be drought tolerant) performed better than the other hybrids at populations of 14, 16, and 18 thousand. This would suggest that use of a truly drought tolerant hybrid would minimize the yield decrease normally expected if high populations were planted and a serious drought occurred.

Special features of other hybrids in the test such as multi-ear tendency, ability to increase ear size, short height, and big tall full season, were largely obscured by the two hail storms and drought.

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

April 15 - Rotary chopped all corn stalks and grain sorghum plots.
April 16 - Chisel plowed with sweeps all corn, soybeans, oats, and grain sorghum plots.
April 18 - Tandem disked and spike tooth harrowed all of the plots that were chisel plowed with sweeps.
Note: Early snow storm of November 19-21 made fall tillage impossible.
April 21 - All oat plots drill seeded (in the specified rotated plots). Applied fertilizer on oats.
Variety - Lancer
Alfalfa - Vernal
Sweet Clover - Madrid
May 19 - Tandem disked corn, soybean, and grain sorghum areas to level and control weeds.
May 20 - All corn, soybean, and grain sorghum plots spiked tooth harrowed.
May 20 - Corn plots planted.
Variety - PIO 3732
Herbicide - Lasso II (banded)
Insecticide - Dyphonate 20G
May 21 - Planted all bean plots.
Variety - Wells
Herbicide - Lasso II (banded)
May 23 - Sprayed all soybean plots with Sencor 50WP at the rate of 1# product per acre.
May 27 - Sprayed all oat plots with Brominal Plus at the rate of 1 pint per acre - except those under planted with alfalfa and sweet clover.
June 3 - Planted all grain sorghum plots:
Variety - NK 2023
Herbicide - Ramrod 20G (banded)
Insecticide - Furadan 10G (banded)
June 6 - Hail storm
June 9 - Field cultivated all soybeans plots.
Note: Soybeans were severely damaged.

June 10 - Replanted all soybean plots.
Variety - Wells
Herbicide - None

June 13 - Cultivated all corn plots (first time).

June 19 - Cultivated grain sorghum (first time).

June 23 - Sidedressed with ammonium nitrates all the specified corn and grain sorghum plots.

June 25 - Cultivated all corn plots (second time).

June 26 - Cultivated all soybean plots (Replant - first time).

July 28 - Cultivated all soybeans((second time).

August 13 - Sprayed all corn plots with 24-D ester to control broadleaved weeds.

August 25 - Hail storm.
Note: This was the second storm of the season.

Discussion and Interpretation of Table 4

No soybeans yields were reported because of hail damage. Alfalfa and grain sorghum were also damaged so severely that no yields were reported.

Oats plots were damaged by the first hail storm but not as severely as soybeans. Effect of good management practices are apparent in oats plots even though yields were limited. For example, fertilizer raised yield of oats by 16 bushels per acre, in a corn-oats sequence. Where oats followed soybeans (rotation 5) oats yields went up to 55 bushels without fertilizer.

Corn yields were brought to a low of 15 bushels per acre by the hail and drought, but noted that fertilizer still gave substantial yield increase of corn grain.

Table 4. Effect of Cropping Sequence and Fertilizer on Crop Yield, 1980

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			15.0				
1 Continuous corn	Corn	6 +11 +10	70		38.0				
2 Corn-oats	- - -	0 + 0 + 0		20.0	33.0				
2 Corn-oats	Corn	6 +11 +10	70		47.0				
	Oats	30 + 7 + 0		36.0					
3 Corn-corn-oats+alf hay	- - -	0 + 0 + 0		45.0	28.0	26.0			*
3 Corn-corn-oats+alf hay	Corn	6 +11 +10			39.0				
	Corn	6 +11 +10	70			36.0			
	Oats	15 +26 + 0		56.0					
	Alf. resid	0 + 0 + 0							*
4 Oats+sweet clover-corn	- - -	0 + 0 + 0		20.0	20.0				
4 Oats+sweet clover-corn	Oats	30 + 7 + 0		32.0					
	Corn	6 +11 +10			41.0				
5 Corn-soybean-oats	- - -	0 + 0 + 0		55.0	25.0		*		
	Corn	6 +11 +10	70		39.0				
	Soybeans	6 +11 +10					*		
	Oats	30 + 7 + 0		65.0					
6 Corn-oats-soybeans	- - -	0 + 0 + 0		18.0	41.0		*		
6 Corn-oats-soybeans	Corn	6 +11 +10	55		51.0				
	Oats	20 + 7 + 0		39.0					
	Soybeans	6 +11 +10					*		
7 Continuous gr. sorghum	- - -	0 + 0 + 0						*	
7 Continuous gr. sorghum	Sorghum	6 +11 +10	70					*	

* Crops destroyed by hail.

CHISEL PLOW CORN AND SOYBEANS

F. Shuběck 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?

Methods and Procedures (Corn after Soybeans)

April 23 - All of the specified spring treatments completed in the corn and soybean plots.
May 12 - On soybean stubble the specified tillage treatments were performed.
May 13 - Spike tooth harrowed all plots in readiness for planting.
May 16 & 19 - Planted all 4 reps.
Variety - PIO 3732
Herbicide - Lasso II (banded)
Insecticide - None - because of the corn-bean rotation
Fertilizer - 100#/acre of 8-32-16 banded
Cultivated twice
Hail storms - June 6, August 25
September 29 - Harvested all corn plots.

Table 5. Effect of Tillage Treatments on Yield of Corn (Corn after Soybeans).

	Tillage Treatments In Fall	In Spring	Corn Bu/A
1.	------------------------	Disk-drag	46
2.	------------------------	Sweeps-drag	40
3.	------------------------	Plow-disk-drag	45
4.	Plow (moldboard)	Disk-drag	39
5.	Chisel plow with twists	Disk-drag	42
6.	Chisel plow with twists	Disk-drag	41
7.	Chisel plow with twists	Sweeps-drag	38
8.	Chisel plow with sweeps	Sweeps-drag	36
9.	------------------------	Disk-drag	46
10.	Chisel plow with sweeps*	Sweeps-drag	36

* 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 were applied as a sidedressing when corn was about 12 inches high.

Discussion and Interpretation of Table 5

Great care should be taken when drawing conclusions from an experiment that experienced two hail storms.

Under these conditions, fall tillage of soybean stubble was not very beneficial for increasing yield of corn. Many other comparisons can be made but their validity is questionable.

In this experiment a corn-soybean sequence was followed. Yields of soybeans were 2 to 3 bushels per acre and were not recorded.

TILLAGE TREATMENTS WITH DRYLAND CORN-SOYBEANS ROTATION

Beresford, South Dakota
1980 (second year)

Experimental Plan

Shallow tillage treatments (spring):

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

Deep tillage treatments:

(a) S treatment: subsoiled in fall of 1978
(b) N treatment: not subsoiled

Soil: Well drained loam

Note: Very considerable hail damage occurred. Soybeans were severely damaged. Corn yields are reported, but firm conclusions are not appropriate. Statistical analysis was not conducted on the 1980 data.

Plant population at harvest: 17,800 mature plants per acre.

Table 6. Corn Yields in Bushels Per Acre.

	Plow		Chisel		Disk		Roto	
	S	N	S	N	S	N	S	N
Rep 1	36.1	47.3	42.1	38.7	44.7	39.6	52.5	53.3
Rep 2	40.4	45.6	44.7	56.8	46.4	43.9	66.2	61.9
Rep 3	59.3	51.6	43.9	47.3	49.9	58.5	51.6	53.3
Rep 4	55.9	43.9	55.9	41.3	51.6	61.9	46.4	49.9
AVG	47.9	47.1	46.6	46.0	48.2	51.0	54.2	54.6
TOTAL AVG	47.5		46.3		49.6		54.4	

Subsoiling Averages: Subsoiled - 49.2
Not Subsoiled - 49.7

Analysis of Results

A copy of the 1979 report is included for reference. In both the 1979 and 1980 results, the shallowest tillage treatments (ROTO and DISK) 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 Dept.
Principal Cooperator: Fred E. Shubeck, Southeast Experiment Farm

(Included as a part of the
1980 REPORT for reference purposes)

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

Tables 7 and 8. Corn and Soybean Yields in Bushels Per Acre.

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	Soybeans:	subsoiled	44.85
	not subsoiled	98.71		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 Dept.
Principal Cooperator: Fred E. Shubeck, Southeast Experiment Farm

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 on May 15 and in the soybeans on May 29. 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 5-8 inches deep (except Lasso, Dual, and atrazine preplant treatments incorporated 3-4 inches deep with one disking) and harrowed. Plots were planted in 30-inch rows the same day. In the corn, precipitation totaled .5 inches and .05 inches for the first and second week after planting, respectively. For the soybeans, precipitation totaled 1.53 inches and .98 inches for the first and second week after planting, respectively. The soybean plots were rotary-hoed approximately 10 days after planting to aid emergence. Post-emergence treatments were June 20 in the corn and on July 8 in the soybeans.

Weed pressure was moderate and variable. Annual grass species included green and yellow foxtail. Major broadleaved species were smooth, rough, and prostrate pigweed, lambsquarters and kochia. The plots were not cultivated.

Results

The performance of corn and soybeans 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 (1978,79,80) average for early season weed control is included.

Weed control differences in 1980 were apparent. The strengths and weakness of each treatment can be assessed. Over 90% control of both grasses and broadleaved weeds was achieved with several combination treatments.

Table 9. Corn Demonstration Southeast - Beresford. 1980.

Treatment	lb/A a.i.	Percent Weed Control 6/27/80 Gr	Bdlf	3 year avg.	
PREPLANT INCORPORATED					
Check	--	0	0	0	0
Eradicane	4	98	84	97	73
Eradicane+atrazine	3+1	99	98	97	97
Eradicane+Bladex	3+1.5	96	91	97	95
Sutan+	4	96	63	94	63
Sutan++atrazine	4+1	95	91	94	95
Sutan++Bladex	4+1.5	94	87	95	94
Sutan++atrazine+Bladex	4+.5+1.5	95	94	96	96
PREPLANT INCORPORATED (shallow)					
Lasso	3.5	72	72	89	91
Dual	2.5	75	65	89	69
atrazine	2.5	58	98	95	98
PREEMERGENCE					
atrazine	2.5	71	91	66	95
Bladex	3	84	64	80	80
Dual	2.5	93	65	95	67
Lasso	3	90	72	94	64
Prowl	2.5	40	84	63	88
Propachlor	6	94	73	94	74
atrazine+Bladex	1+2	88	96	88	96
Lasso+atrazine	2+1	92	95	92	97
Lasso+Bladex	2+1.5	83	90	90	91
Lasso+atrazine+Bladex	2+.5+1.5	88	93	88	93
Lasso+Sencor+Bladex	2+.25+1.5	96	98	96	98
Dual+atrazine	2+1	94	96	97	97
Dual+Bladex	2+1.5	96	95	93	91
Prowl+atrazine	2+1	89	90	84	95
Prowl+Bladex	2+1.5	85	92	90	95
Propachlor+atrazine	5+1	91	93	95	97
Propachlor+Bladex	5+1.5	89	94	94	97
PREEMERGENCE & POST					
Propachlor&Banvel	4&.5	85	96	92	96
Propachlor&Banvel	4&.25	83	92	90	93
Propachlor&2,4-D amine	4&.5	79	80	90	90
Check	---	0	0	0	0
POST					
atrazine+oil	1.5+1 gal	40	99	61	98
Bladex+W.A.	1.5+.5%	63	93	47	84

Table 10. Soybeans Herbicide Demo - Southeast Farm 1980

Treatment	lb/A a.i.	Percent Weed Control 8/21/80			
		Gr	Bdlf	3-year avg.	
PREPLANT INCORPORATED					
Check	---	0	0	0	0
Lasso	3.5	77	68	86	55
Dual	2.5	85	55	91	52
Treflan	.75	87	75	91	85
Tolban	1	83	84	89	86
Basalin	1	86	80	90	83
Prowl	1.25	80	77	89	83
Vernam	2.5	88	80	89	72
Treflan+Amiben	.75+2	94	88	95	92
Treflan+Modown	.75+2	95	92	95	91
Treflan+Sencor/Lexone	3/4+3/8	96	91	96	94
Treflan+Amiben+Sencor/ Lexone	.75+1.5+.25	95	88	0	0
PREPLANT INCORPORATED & PRE					
Treflan&Sencor/Lexone	.75&.5	99	98	98	98
Treflan&Modown	.75&2	99	99	97	99
Treflan&Amiben	.75&2	99	98	0	0
Preemergence					
Amiben	3	81	80	86	88
Lasso	3	76	75	88	77
Dual	2.5	74	70	85	64
Surflan	1.25	35	48	0	48
Lasso+Sencor/Lexone	2+.5	66	71	85	88
Lasso+Amiben	2+2	74	75	88	89
Lasso+Modown	2+1.5	71	55	85	80
Lasso+Lorox	2+1	66	68	83	80
Lasso+Furloe	2+2	61	25	78	61
Lasso+Premerge	2+4.5	57	40	78	72
Dual+Sencor/Lexone	2+.5	68	75	83	87
Dual+Lorox	2+1	76	68	0	0
Lasso+Lorox+Sencor/Lexone	2+1+.25	62	90	0	0
PREEMERGENCE & POST					
Lasso&Alanap+2,4-D	2&1.25+1/16	70	68	0	0
Lasso&Basagran	2&1	75	80	84	89
Lasso&Blazer	2&.5	74	92	0	0
Lasso&Dyanap	2&2.25	64	73	82	85
Check	---	0	0	0	0

EFFECT OF DEGREE OF TILLAGE ON NEED FOR ADDED PHOSPHORUS

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

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 indicated 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. The 1980 cropping year is the first year in which the tillage sequence has been complete.

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 1980 are reported in Table 11.

   These tests are averages of samples taken from the 0+0+0 treatment plots in each tillage treatment area. The nitrate-nitrogen (NO_3-N) levels are more than adequate for the yield of corn produced in 1980. The supply of available phosphorus is at such a level that yield increases from added phosphorus are not likely when corn is grown under a normal tillage program. The potassium supply is high. A comparison of the tests made for each of the tillage treatments show that the treatments for one year did not greatly effect the soil test values.

Table 11. Soil Tests on Samples* Taken in the Spring of 1980 from the Tillage Plots

Tillage Treatment	Depth** (inches)	NO_3-N lb/A	O.M. %	P lb/A	K lb/A	pH	Sol. Salts mmho/cm	Texture
Fallow	0-24 0-48	185 256	2.7	31	673	6.5	.9	Silty Clay Loam
Continuous	0-24 0-48	143 238	2.8	20	638	6.8	1.1	Silty Clay Loam
Corn-Oats	0-24 0-48	155 223	2.8	29	693	6.6	.75	Silty Clay Loam
Minimum Tillage	0-24 0-48	201 289	2.7	35	727	6.9	1.5	Silty Clay Loam

* The 0+0+0 treatments were the only plots sampled.

** The designation "depth" applies to the NO_3-N test only. All other tests were made on the 0-6" depth sample.

2. The methods of tillage used in the experiment are:
   (a). Minimum tillage (Waffle Coulter).
   (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. In 1980, all corn plots were treated with Lasso II granules and Counter at recommended rates. Weed control was not consistent and foxtail was a problem in some areas.

4. 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 14 at a rate of 18,000 seeds per acre. The variety used was Pioneer 3732.

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 Waffle Coulter just ahead of the planter and no other tillage.

8. The weather encountered was less than ideal. The plots were subjected to hail on 2 occasions.

Results and Discussion

Yields and ear corn moisture are reported in Table 12. The differences in yield due to treatments are not large enough to be considered statistically different. Variations within treatments were relatively large. This is probably the reason yields from some of the treatments are not considered statistically different. The large variations in yield may have been in part due to the 2 hailstorms the crop received during the growing season. The weed control was not consistent throughout the plots which may also have contributed to the variations in yield. The yield increases caused by the phosphorus treatments on the fallow plots were relatively large but somewhat inconsistent. Large differences in early growth due to added phosphorus were noted in the fallow and corn-oat tillage treatment plots. These differences were not noted in the other two tillage treatment plots.

Severe moisture stress was noted on these plots in late July and early August. The minimum tillage plots appeared to have less stress at this time than the other plots. This may in part be due to a lower plant population in this tillage area. The minimum tillage plots had a plant population of approximately 2000 plants per acre less than the other tillage treatment areas.

The effect of the phosphorus treatments on the moisture content of the ear corn was small except on the fallowed plots where added phosphorus reduced the amount of moisture found in the ears at harvest time.

The effects of the tillage treatments can be compared by noting the average yields and moisture contents for each tillage treatment. This shows the corn-oat rotation and the fallow treatments to have the highest yields and the lower percent moisture content of the ears at harvest time. These differences are not large enough to be considered real from a statistical point of view. It will be interesting to see if these differences hold true in the forthcoming years.

Table 12. Effect of Degree of Tillage and Starter Phosphorus on the Yield of Corn, and Percent Moisture in Ears.

Amount of Added Phosphorus lb/A of P_2O_5	Yield[L1] bu/A	Ear Corn Moisture[L2] %
	FALLOW 1979	
0	82	26.5
10	91	22.3
20	85	21.0
30	100	19.8
40	91	22.7
60	99	21.4
Average	91	22.3
	CONTINUOUS CORN	
0	81	23.5
10	82	24.1
20	80	23.6
30	76	25.0
40	85	25.7
60	83	23.6
Average	81	24.3
	CORN-OAT ROTATION	
0	94	22.6
10	100	20.8
20	95	20.4
30	86	20.8
40	95	22.9
60	98	21.9
Average	95	21.6
	MINIMUM TILLAGE	
0	86	24.5
10	82	23.9
20	74	22.2
30	81	22.9
40	76	24.3
60	87	22.9
Average	81	23.5

L1 Yield calculated at 15% moisture.

L2 Moisture sample taken by the selection of 8 ears of corn which were weighed, dried, and weighed again.

SCABIES RESEARCH WITH INJECTABLE IVERMECTIN

J. Bailey, G. Kuhl, H. Miller, H. Shave
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Department of Animal Science Report
CATTLE 81-10

Introduction

Scabies is a parasitic skin disease caused by tiny mites resulting in skin irritation. These mites are spread from animal to animal by direct contact. The mites puncture the skin and feed on the body fluids released from the wounds. These fluids ooze from wounds and dry to form scabs. Hence the name "scabies". This disease costs the cattle industry millions of dollars each year.

Cattle with scabies lick, rub, and scratch themselves to relieve the intense itching. They often lose weight and are more susceptible to complications such as pneumonia. As the number of mites increase, the animal's hair falls out or is rubbed off and lesions spread. If not treated, large areas of the body may be covered with thick, rough crusts.

Scabies is a year-round problem. However, in warm weather skin lesions may disappear because mites are less active. This improvement is only temporary; and, as environmental temperature gets colder, the mites become active and lesions return.

Under normal conditions, mites will survive for a maximum of 3 days off the host animal. It is possible for mites to spread from fences or trucks that have been in contact with infected animals. However, the greatest possibility of spread is directly animal to animal.

Current Methods of Treatment and Control

Treatment is best accomplished by complete immersion of infected animals in an approved pesticide. Two dippings 12 to 14 days apart are required for treating infected cattle.

Pesticides approved by the USDA for scabies control are toxaphene, prolate, and Co-Ral. Lime sulfur solution is also on the approved list but is seldom used because the dipping solution must be heated to be effective.

The South Dakota Livestock Sanitary Board has approved toxaphene as the official pesticide used in the control program within South Dakota.

Nonquarantined cattle may move interstate with only one dip. The organophosphate compounds (prolate and Co-Ral) have not proven as effective as toxaphene on a single treatment basis.

Recent EPA regulations have caused concern over the future use of toxaphene, and it is problematic how much longer it will be available.

Experimental Use of Ivermectin

Merck, Sharp, and Dohme Inc. has been researching an entirely new concept in parasite control. A new antiparasitic agent called "Ivermectin" has shown high efficacy against a wide spectrum of parasites in several species of animals.

Ivermectin is produced by the fermentation of Streplomyces avermitilis. It is actually an antibiotic with no antibacterial activity but is effective against certain internal and external parasites by both oral and injectable routes of administration.

A research trial was developed at SDSU to evaluate the effectiveness of Ivermectin in the treatment of cattle scabies. The study was conducted cooperatively by the SDSU Animal Disease Research and Diagnostic Laboratory, the Department of Animal Science, and the South Dakota Livestock Sanitary Board (SDLSB) in conjunction with Merck, Sharp, and Dohme.

Twenty scabies-infected calves with substantial skin lesions were obtained in close coordination with the SDLSB. The calves were transported to the Southeast South Dakota Experiment Farm under quarantine in March, 1980. The cattle consisted of 14 steers and 6 heifers averaging about 500 pounds.

At the start of the trial, each calf was individually ear tagged and weighed. An initial skin scraping was taken to verify the presence of mites and establish a positive diagnosis of Psoroptic scabies. The calves were then randomly-allotted to six pens with one heifer randomly assigned to each pen. The pens were double fenced to prevent contact between adjacent lots. The cattle in three of the pens were subcutaneously injected on day 1 with 200 micrograms per kilogram body weight (1 ml./cwt.) of MK-933, the experimental Ivermectin compound, while the animals in the other three pens served a untreated controls.

Subsequently, eight skin scrapings were collected from each calf at weekly intervals to determine the presence or absence of the scabies mites. A calf profile chart was made for each calf to show the sites of lesions on the body and where each scraping was made. The skin scrapings were examined microscopically at the SDSU Veterinary Diagnostic Laboratory using the Maceration-flotation technique.

Daily feed consumption and weekly body weight records were obtained during the 8-week trial. The ration consisted of 4 lb. cracked corn and 1 lb. of a 38% commercial protein supplement per head daily plus a full feed of corn silage. The Ivermectin-treated cattle were always handled through the work facilities

first for weighing and skin scrapings to avoid possible reinfection from the untreated controls. The chute was cleaned and sprayed with toxaphene after the cattle were worked each week. Care was taken to insure that these cattle remained isolated from other livestock.

The results of the skin scrapings are shown in Table 13. All animals tested positive for mites on the initial scraping At the second scraping on day 8, only three of the treated animals were diagnosed positive. On subsequent scrapings, no mites were found on any of the Ivermectin-treated cattle. Itching and skin irritation decreased and by day 28 of the trial, hair and skin on the treated animals appeared normal.

Table 13. Results of Skin Scrapings Taken From Control and Ivermectin-Treated Calves

Animal	Skin scraping date								
no.	3/31	4/7	4/14	4/21	4/28	5/5	5/12	5/19	5/26
					Control Calves				
1	+	+							
2	+	+			+				+
3	+	+							
4	+	+							
5	+								
6	+	+	+	+	+	+		+	+
7	+	+							
8	+	+	+						
9	+	+					+	+	+
10	+	+	+						
					Treated Calves				
11	+								
12	+								
13	+	+							
14	+								
15	+	+							
16	+								
17	+								
18	+								
19	+	+							
20	+								

+indicates presence of mites. No sign depicts absence of detectable mites in scrapings.

In contrast to the treated calves, some of the control animals continued to be positive for mites throughout the entire 8-week trial. In April, environmental temperature reached the 90's for several days. Since mite activity is reduced by warm temperatures, the absence of any detectable mites on some control animals after the third or fourth week may have been due to the unseasonably warm weather during April. Even though live mites were not found on some controls mid-way through the trial, skin condition and hair coat did not substantially improve, with the skin remaining leathery and thickened. Body weight gain and feed consumption of the treated and control calves were not notably different.

Data from this trial were forwarded to Merck, Sharp, and Dohme for inclusion in the submission to FDA concerning clearance of Ivermectin for scabies control.

After termination of the 8-week trial, the control animals were injected with Ivermectin at the same dosage (200 mcg./kg.) as the previously treated animals. Following this treatment, control animals responded in the same manner as the previously treated cattle, and within a month their skin was nearly normal in appearance.

At the request of SDLSB, animals were retained after the initial 8-week study to evaluate the long-term effectiveness of the drug. The cattle were combined into one large pen and kept on feed through the summer and fall to determine if all of the scabies mites were actually killed by the Ivermectin or if cold weather would reactivate any dormant mites that may have survived.

Cattle were examined by the State Veterinarian and SDSU Veterinary Diagnostic Laboratory personnel on December 16 to evaluate the final health status. All cattle were determined to be free of any clinical signs of scabies. Thus, it appears that Ivermectin is effective in the treatment and control of cattle scabies.

EFFECTS OF SEX AND HORMONAL IMPLANT ON BEEF CARCASS CHARACTERISTICS AND PALATABILITY

J. D. Stout, D. H. Gee, G. L. Kuhl
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Department of Animal Science Report
CATTLE 81-7

Summary

A comparison of crossbred bulls, steers, and heifers indicated that bulls have heavier carcasses, larger rib eyes and a more desirable yield grade. The USDA quality grade of the bulls was one-third of a grade lower than for the steers and heifers. The sensory and palatability characteristics showed no significant differences among sexes. Implanted bulls as compared to non-implanted bulls showed more desirable taste panel scores for tenderness, juiciness, and overall panel desirability.

Introduction

Today's calorie and price conscious American consumer is seeking trim, lean, competitively priced meat products. As grain becomes more scarce in an effort to feed worldwide populations and the demand for animal protein increases, it may become necessary to increase the amount of beef produced and at the same time increase production efficiency. The current increased demand for ground beef and processed meat items may encourage producers to look at some alternatives in beef production.

Procedure

Ninety-eight Charolais cross cattle were used to evaluate the effect of sex and implant on carcass characteristics and palatability. The cattle consisted of 24 bulls, 22 steers, and 52 heifers all artificially sired by the same Charolais bull. All animals were raised under South Dakota conditions and given Ralgro implants twice during the preweaning period. Immediately postweaning all animals were divided by sex as nearly as possible into eight equal groups. One-half of the animals in each pen were randomly selected to be implanted with Synovex according to the required sex treatment on the label. The cattle were fed in outside concrete lots with fence-line bunks and cable fences.

The cattle were fed identical diets of 75% Cold-Flo ammonia-treated corn silage and 25% cracked shelled corn (as fed) plus a commercial supplement for the first 73 days. The cattle were then switched to a ration of 75% whole shelled corn and 25% of the same corn silage (as fed) plus supplement for the remainder of the trial. The cattle previously implanted were reimplanted at the start of the finishing phase.

At the conclusion of the feeding trial, the cattle were slaughtered at a commercial packing company. A USDA grader provided the quality and yield grade information at the packing plant. The wholesale rib from one side of each carcass was transported to the SDSU meat lab. The rib was used to provide detailed information regarding the fat, bone, and lean content of the carcasses. In addition, samples were taken from the rib to provide for Warner-Bratzler shear, proximate analysis and taste panel evaluation.

Results

The mean values for carcass characteristics according to sex are reported in Table 14. Bulls and steers were significantly heavier and thus produced heavier carcasses than heifers. The bulls were about 1% higher in dressing percent than the other sexes. The rib eye size was largest for the bulls followed by the steers and heifers. Fat thickness showed no significant differences among sexes. The heifers had a significantly higher percentage of kidney, heart, and pelvic fat. The marbling scores were highest for the heifers followed by the steers. The steers and heifers qualified for the USDA choice quality grade, while the bulls graded high good. Yield or cutability grade showed no significant differences among the sexes.

Table 15 shows the mean values for the separable lean, fat, and bone components of the 9-10-11 rib. Previous research has indicated that the 9-10-11 rib components are highly ($P<.001$) related to corresponding tissue components of the total carcass. As indicated in Table 15, bulls had a higher percentage bone than the steers or heifers. The bulls had significantly less subcutaneous, intermuscular, and intramuscular fat as well as less total fat. Heifers and steers had about the same percent lean, whereas bulls had a significantly higher amount of lean. The data showed no significant differences for muscle-to-bone ratios among the sexes.

Table 16 presents the sensory and palatability characteristics of bull, steer, and heifer carcasses. There were no significant differences in any of the values reported in table 16 which indicates no major palatability differences among bulls, steers, and heifers. The bulls showed a trend toward decreased tenderness, slightly more connective tissue and less flavor desirability. However, the bulls showed a trend toward increased overall eating desirability and lower cooking losses.

Table 17 displays the mean values for sensory and palatability characteristics by sex and hormonal treatment. Significant differences were found with regard to tenderness, in that implanted bulls were more tender than their nonimplanted controls, while heifers and steers showed the reverse effect when implanted. Juiciness and the amount of connective tissue also followed the same trend. Overall eating desirability also indicated that implanted bulls were more desirable than the nonimplanted bulls. However, in the

case of the steers and heifers, the nonimplanted cattle had higher overall desirability scores than the implanted cattle. These data suggest that implanted bulls may more closely resemble steer and heifer quality, palatability, and sensory characteristics.

Table 14. Carcass Characteristics of Crossbred Bulls, Steers, and Heifers

Trait	Bulls	Steers	Heifers
Live wt., lb.***	1271[a]	1233[a]	1127[b]
Carcass wt., lb.***	817[a]	782[a]	711[b]
Dressing percent	64.3	63.4	63.1
Rib eye area, sq. in.***	15.1[a]	14.3[ab]	13.7[b]
Fat thickness, in.	.20	.21	.24
Kidney, heart and pelvic fat,%***	2.4[a]	2.7[ab]	3.2[b]
Marbling score**	Slight+[a]	Small+[b]	Small-[ab]
Quality grade**	Good+[a]	Choice-[b]	Choice-[ab]
Yield grade	1.8	2.0	2.1
Days of age***	441[a]	441[a]	430[b]

* P<.05 level of significance.
** P<.01 level of significance.
*** P<.001 level of significance.
a,b Means with similar superscript letters do not differ significantly from each other (P<.01).

Table 15. Mean Values for Separable Components of 9-10-11 Rib by Sex

Trait	Sex classification		
	Bulls	Steers	Heifers
Bone, %*	13.8[a]	13.2[ab]	12.9[b]
Fat, %**	30.2[A]	34.7[B]	34.8[B]
Subcutaneous, %***	6.4[A]	7.9[B]	8.4[B]
Intermuscular, %***	21.6[A]	24.4[B]	23.4[B]
Intramuscular, %***	1.4[A]	1.5[B]	1.8[B]
Lean, %***	56.0[A]	52.1[B]	52.2[B]
Muscle-to-bone ratio	4.1	4.0	4.1

* P<.05 level of significance.
** P<.01 level of significance.
*** P<.001 level of significance.
a,b Means with similar superscript letters do not differ significantly from each other (small letters = P<.05; capital letters = P<.01).

Table 16. Mean Values for Sensory and Palatability Characteristics by Sex

Trait	Sex classification		
	Bulls	Steers	Heifers
Juiciness[a]	5.4	5.2	5.2
Tenderness[b]	5.3	5.8	5.5
Connective tissue amount[c]	4.8	5.2	5.2
Flavor desirability[d]	5.3	5.7	5.6
Overall desirability[d]	5.1	5.5	5.5
Cooking loss, %	28.3	30.3	29.9
Shear, kg.	4.7	4.0	4.3

[a] Extremely dry = 1, slightly juicy = 5, extremely juicy = 8.
[b] Extremely tough = 1, slightly tender = 5, extremely tender = 8.
[c] Abundant = 1, slight = 5, none = 8.
[d] Extremely desirable = 1, slightly desirable = 5, extremely desirable = 8.

Table 17. Mean Values for Sensory and Palatability by Sex and Hormonal Treatment.

	Bulls		Steers		Heifers	
	Cont.	Impl.	Cont.	Impl.	Cont.	Impl.
Juiciness*	5.0	5.7	5.2	5.2	5.4	5.1
Tenderness***	4.7[A]	5.9[B]	5.9[B]	5.7[B]	6.0[B]	5.0[AB]
Connective tissue amount	4.6[a]	6.1[ab]	5.3[b]	5.1[ab]	5.5[b]	4.9[ab]
Flavor desirability	5.3	5.4	5.8	5.6	5.7	5.2
Overall desirability*	4.8[A]	5.4[AB]	5.6[B]	5.4[AB]	5.7[B]	5.3[AB]
Cooking loss, %	29.4	27.2	30.6	30.0	29.6	30.2
Shear, kg.	4.9	4.6	3.7	4.2	3.8	4.8

* P<.05
*** P<.001.
a,b Means with similar superscript letters do not differ significantly from each other (small letters = P<.05; capital letters = P<.01).

SOLAR DRYING

R. Hanson

High moisture barley dried in a solar bin.

Objective of Experiment:

1. Determine feasibility of direct harvesting of high moisture barley and eliminating one harvesting operation (windrowing).

2. Determine feasibility of utilizing solar drying system on high moisture barley.

3. Effects on germination and quality of high moisture barley dried in a solar drying system.

Methods and Procedures

High moisture barley was direct harvested using a 105 JD Combine and stored in a 23.5' diameter metal drying bin equipped with a perforated floor, stirrator and 10 HP centrifugal fan.

After filling, the fan and stirrator were started and let run continually until grain dried to a safe storage moisture. No other source of heat was utilized in this trial other than solar.

Bushels of barley dried and KWH used per bushel:

Wet bushels in bin		1476.88
Moisture at filling	July 16	25.5%
Moisture when removed	July 24	11.5%
Total moisture removed (8 days)		14.0 % points

KWH used 1560
Cost = 1560 KWH X .03 per KWH + $46.80
Cost per bu. = $46.80 + 1476.88 Bu. = .03 per Bu.
Cost per point = .03 per bu. + 14 pts. removed = .00214 or .2 of one cent

The effects on germination of high moisture barley dried in a solar bin were favorable. A five-month germination test at SDSU Seeds Lab. was 90%.

Advantages

1. Less harvesting cost by elimination of windrowing.

2. More grain harvested per acre due to less shatter loss and earlier harvesting.

3. Opens up the possibility of double cropping if moisture is available.

4. Utilizes solar dryer more efficiently.

Solar Drying Corn:

2771.49 Bushels of wet corn was stored in a 23.5' diameter solar drying bin equipped with a perforated floor, stirrator and 10 HP centrifugal fan.

The corn entered the bin at 19% average moisture. The fan and stirrator were then started and let run during the day light hours when the outside air temperature reached 40° and let run until 5:00 p.m. This was done until a safe storage moisture level was reached.

Average % moisture going into Bin	19.0	
Average % moisture end of drying	15.0	
Total moisture removed	4.0	% points

Total KWH used:	230	stirrator
	830	fan
	1060	Total

1,060 X .03 per KWH = 31.80

31.80 ÷ 2771.49 Bu. = Cost per bu. .01
Cost per point .0025

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, R. Narem and R. Assmus

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 effects of the treatments on 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. The water table flucuates from 3-7 feet in this area.
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 high 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. The NO_3^-N is reported to a depth of 4 feet in 1980. The samples 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-di-sulphonic 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 twelfth 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. Neither grain nor silage yields were harvested in 1980 due to hail damage.

Results and Discussion

Tests made on the surface samples taken from these plots in the spring of 1980 are shown in Table 18. This table shows variations found in the organic matter, phosphorus, potassium and pH tests due to fertilizer treatments. The addition of phosphorus and potassium fertilizer has increased the test values. Note the 0+0+0 treatment as compared to the other treatments. The addition of the nitrogen fertilizer has lowered the pH of these soils. Note the pH (5.7) of the 240+25+70 treatment as compared to the 0+0+0 and the 0+25+70 treatments, which have a pH of 6.8 and 6.9 respectively.

The effects of the fertilizer treatments on the amount of NO_3^-N found in the soil after the 1979 crop had been harvested and in the spring before the 1980 crop was planted are reported in Tables 19 and 20. This provides an opportunity to evaluate the effect of the winter months (November-May) on the total NO_3^-N present and its location in the soil profile. More NO_3^-N is found in 0-6 layer in the spring than in the fall. This is likewise true for the 6-12 inch layer in most cases. An overall view of the effect of the winter and the movement of the NO_3^-N in the soil can be obtained by looking at the averages of all the treatments. These averages indicate that a movement of NO_3^-N from the lower depths to the surface or near the surface does occur. In some cases more NO_3^-N is found in the 4 foot profile in the spring then in the fall. This is probably due to mineralization taking place during periods of warm weather early in the spring.

A supply of 100 lb of NO_3^-N per acre in the top 4 feet of soil should provide enough nitrogen to produce 80 to 90 bushel of corn per acre without adding any additional nitrogen fertilizer. Only the 0+0+0 and the 20 lbs of N per acre treatments had less than 100 lbs of NO_3^-N per acre accumulated in the top 4 feet by the spring of 1980. Unfortunately, hail destroyed the crop in 1980 so no yields were taken. Soil samples were taken in the fall of 1980 but have not been tested to date.

The accumulation of NO_3^-N in these soils provides valuable information concerning management of nitrogen fertility. The fact that as the rate of nitrogen addition increased, the rate of accumulation of NO_3^-N also increased, leads to the conclusion that the crops being grown did not adequately utilize the nitrogen supplied. This was to be expected at the higher rates of application but not at the lower rates. However, it should be kept in mind that dry weather and hail has limited the yields for the past few years except in 1979.

Table 18. Effect of Fertilizer Treatments on Soil Test Values 1980

Treatment $N+P_2O_5+K_2O$ lb/A	O.M. %	P lb/A	K lb/A	pH
		Low Rates*		
0+0+0	3.5	15	645	6.8
20+25+70	3.3	43	825	6.7
40+25+70	3.4	38	883	6.5
60+25+70	3.3	35	798	6.6
80+25+70	3.4	35	828	6.4
		High Rates**		
0+25+70	2.7	55	795	6.9
80+25+70	2.8	44	925	6.5
160+25+70	2.9	30	808	6.6
240+25+70	2.9	46	780	5.7

* The low rates of treatments were started in 1975

** The high rates of treatments were started in 1968.

Table 19. The Effect of Adding Rates of Nitrogen Fertilizer on the Amount of Nitrate-Nitrogen Present in the Fall of 1979 and the Spring of 1980.

Depth in Inches	AMOUNT OF NITROGEN APPLIED EACH YEAR IN POUNDS PER ACRE* 0+0+0 Time of Sampling F-79	S-80	20+0+0 Time of Sampling F-79	S-80	40+0+0 Time of Sampling F-79	S-80	60+0+0 Time of Sampling F-79	S-80	80+0+0 Time of Sampling F-79	S-80	Average F-79	S-80
					NO_3^-N lb/A							
0-6	9	13	15	32	8	59	10	72	9	86	10	52
6-12	6	9	10	15	8	20	8	21	9	26	12	18
12-18	4	5	10	6	5	7	6	9	7	9	6	7
18-24	6	4	6	4	6	5	11	7	12	9	8	6
24-30	7	4	9	4	7	5	14	8	13	11	10	6
30-36	6	4	10	4	7	4	15	8	14	12	10	6
36-42	6	4	14	4	8	5	15	12	15	11	12	7
42-48	7	4	15	4	10	6	14	15	14	10	12	8
											80	110
0-24	25	31	41	57	27	91	35	109	35	130		
24-48	26	16	48	16	32	20	58	43	56	44		
0-48	51	47	89	73	59	111	93	152	91	174		

* Treatments have been repeated on the same plots for the past 5 years (1975-1980).

Table 20. The Effect of Adding High Rates of Nitrogen* Fertilizer over an 11 year Period on the Amount of Nitrate-Nitrogen Present in the Fall of 1979 and the Spring of 1980.

Depth in Inches	Amount of Nitrogen Applied Each Year in Pounds Per Acre									
	0+0+0 Time of Sampling		80+0+0 Time of Sampling		160+0+0 Time of Sampling		240+0+0 Time of Sampling		Average	
	F-79	S-80	F-79	S-80	F-79	S-80	F-79	S-80	F-79	S-80
					NO_3^-N lb/A					
0-6	7	21	12	104	45	166	75	157	35	112
6-12	5	11	12	23	47	70	99	77	41	45
12-18	5	4	12	22	46	74	75	55	35	39
18-24	6	4	31	31	101	96	124	91	66	56
24-30	7	4	48	44	127	102	169	96	88	62
30-36	7	5	44	44	133	105	162	105	87	65
36-42	10	8	42	36	123	97	132	150	77	73
42-48	14	9	38	34	107	90	201	139	90	68
									519	520
0-24	23	40	67	180	239	406	273	380		
24-48	38	26	172	158	490	394	620	490		
0-48	62	66	239	338	729	800	993	870		
Time of Sampling	Nov. 1979	May 1980								

* Treatments have been repeated on the same plots for the past 12 years (1968-1980).

HIGH pH - PHOSPHATE CARRIER EXPERIMENT

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The objective of this experiment was to determine if certain phosphorus carriers were more effective in increasing growth and yield of corn grown on high pH soils.

Methods and Materials

1. The experiment was established on a Viborg silty loam (Pachic Haplustolls). Viborg soils are nearly black with thick surface horizons occurring on level to gently sloping surfaces in slight depressions, swales, and heads of drainage ways. This site was along a drainage way.
2. The tests on samples taken from this site at planting time are as follows:

Depth in Inches	NO_3-N lb/A	O.M. %	P lb/A	K lb/A	pH	Soluble Salts mmhos/cm	Texture
0-6	83	3.7	42	778	7.7	1.5	silt loam
6-24	163						

The pH values remained fairly constant to a depth of 4 feet except on the west side of the experiment where a pH greater than 8.0 was encountered at all depths except the 0-6 inch depth. The soluble salt content increased with depth. At most sampling sites, the concentration of salts at the 4 foot depth was considered high enough to interfere with the growth of corn.

3. The corn variety used was Pioneer 3732 planted at 17,000 seeds per acre on May 15th. Counter insecticide was applied at the recommended rates and no herbicide was used. Weed control was reasonably good. The stand was fairly uniform and insect damage was minimal.
4. Two hail storms seriously damaged the crop and probably caused part of the relatively large experimental error. The supply of available water was limited during the last part of July and the first part of August.
5. Three rates of phosphorus fertilizer application were made.

lb of P_2O_5 per acre	
(1)	10
(2)	20
(3)	40

6. The fertilizer materials used to supply the rates of P_2O_5 applied are as follows:

		pH
(1)	17-44-0	1.5
(2)	18-46-0	8.0
(3)	11-48-0	4.0
(4)	0-45-0	2.8
(5)	0-0-0	---

   Ammonium nitrate was used to make the amount of nitrogen applied to each plot equal. The 17-44-0 is an experimental fertilizer and was supplied by the Tennessee Valley Authority.
7. Leaf samples were taken at silking time for plant analysis. These analyses have not been completed to date.
8. The corn yields were harvested by hand on September 17th.

Results and Discussion

The effects of the rates of phosphorus application and the types of fertilizer materials used to supply the phosphorus on the yields of corn are shown in Table 20.

This data shows that the added phosphorus fertilizer increased the yields of corn when 20 and 40 lb of P_2O_5 was applied per acre. It also shows that the type of fertilizer material used, makes a large difference in the amount of yield increase. The 17-44-0 type fertilizer was more effective in raising corn yields than were any one of the other three fertilizers. The 17-44-0 fertilizer material is relatively more acid than the other phosphorus materials. Possibly the lower pH enhances the availability of the phosphorus in a high pH soil It is hoped this experiment can be continued in 1981 to determine if these yield trends continue.

Table 21. The Effect of Phosphorus Applied and the Carrier Used to Supply the Phosphorus on the Yield** of Corn. SE Farm, 1980.

Treatment lb of P_2O_5/A	Phosphate Fertilizer Material 17-44-0	18-46-0	11-48-0	0-45-0	Average
	bu/A				
0*	69	69	69	69	69
10	79	68	61	69	69
20	83	71	88	82	81
40	89	73	76	69	77
Average	84	71	75	73	

* A treatment without any added fertilizer was present in each block of fertilizer treatments. The reported yield is an average of these 9 treatments.

** Yields calculated on a moisture content of 15%.

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