Southeast South Dakota Experiment Farm

17th Annual Progress Report 1977

Agricultural Experiment Station
South Dakota State University
Brookings

This seventeenth 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 nine 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.

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SEVENTEENTH ANNUAL PROGRESS REPORT
SOUTHEAST SOUTH DAKOTA EXPERIMENT FARM

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Introduction .... Fred E. Shubeck
Research Manager

In 1977 there was an abrupt turn around in weather conditions from the two preceding dry years. The amount of rainfall and its distribution was adequate for good yields of small grains, soybeans, and corn. Reserves of subsoil moisture were replenished.

Soil and air temperatures together with wind velocity and direction are recorded automatically at the Experiment Farm. It was interesting to read the charts when storms passed through the area noting extremes in wind and temperature.

Most of the trees in the new orchard planted in 1976 survived the dry weather and made good growth in 1977. They were watered once a week in July and August of the planting year and the base covered with 2-4 inches of hay during the winter months.

The office-laboratory building was used for many community activities. A total of 38 meetings were held in this facility by Extension Clubs, 4-H Clubs, Adult Educational meetings, Judging Schools and other local groups. In addition, a college level Soils Course was taught during the winter, using both the laboratory and meeting room.

A total of eight different Crop Tours or Field Days were conducted at the Experiment Farm in 1977. Among the highlights were tours by a group of Swedish Nationals and the Swedish Ambassador.

The concrete floor in the new steel building was finished. The residential building at the Experiment Farm was scraped and painted. Repairs were made in the residence, granary and corn crib. Plans for remodeling the hog house were modified to try a newer system of manure handling.

An Eberhardt Silo Press machine was brought in for a demonstration on September 22, 1977, at Field Day. Two bags of silage were filled.

Enough corn was raised on the north quarter of the Experiment Farm to fill the Solar Drying Bin. This was the second year for solar drying corn.

The Southeast Experiment Farm Board of Directors requested a planning meeting to be held with County Agents and two farmers from each of the southeastern South Dakota Counties. The purpose of the meeting was to focus attention on present problems and the need for new research.

Tables 1 and 2 summarize temperatures and precipitation data for 1977. Daily readings were taken and data summarized by Experiment Farm personnel.

Table 1. Temperatures at the Southeast Experiment Farm

Month	1977 Av. Temperature (F)[1] Maximum	Minimum	25 Year Average Maximum	Minimum	Depature from 25 Year Average Maximum	Minimum
January	18.2	-5.5	26.1	4.9	-7.9	-0.6
February	39.8	12.9	33.4	11.7	+6.4	+1.2
March	47.6	26.6	43.7	22.4	+3.9	+4.2
April	66.3	41.1	61.6	35.6	+4.7	+5.5
May	77.3	54.5	73.9	47.7	+3.4	+6.8
June	82.5	56.6	83.1	57.6	-0.6	-1.0
July	88.2	62.2	88.1	62.4	+0.1	-0.2
August	80.0	54.4	86.3	59.8	-6.3	-5.4
September	75.4	50.3	75.7	49.1	-0.3	+1.2
October	57.8	35.0	65.9	41.3	-8.1	-6.3
November	38.5	20.6	46.4	24.4	-7.9	-3.8
December	24.9	8.5	31.5	11.4	-6.6	-2.9

[1]Computed from daily observation.

Table 2. Precipitation at the Southeast Experiment Farm

Month	Precipitation 1977 (inches)	25-year Average (inches)	Departure from 25-yr. Av. (inches)
January	.13	.48	-0.35
February	.33	1.17	-0.84
March	2.75	1.39	+1.36
April	2.62	2.40	+0.22
May	3.22	3.24	-0.02
June	3.46	4.13	-0.67
July	3.86	3.04	+0.82
August	2.60	2.78	-0.18
September	4.00	2.77	+1.23
October	1.88	1.57	+0.31
November	1.34	1.03	+0.31
December	0.40	0.71	-0.31
Total	26.59	24.71	+1.88

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

November 5, 1976 - Rotary chopped stalks and plowed plot area
March 23, 1977 - Tandem disked
April 25, 1977 - Sprayed with 2.5 - 3.0 lbs. per acre of aatrex 4 L and tandem disked
Planting dates - April 29, May 10, May 19, and June 2, 1977
Variety - Golden Harvest H 2500
Herbicide - Bexton 20G (banded)
Insecticide - Furadan 10G (banded)

Broadcast fertilizer was applied one or two days before each planting, then disked in and spike tooth harrowed. All plots were cultivated twice.

October 28,29, 1977 - Harvested all plots

Table 3. Effect of Fertilizers and Planting Dates on Yield of Corn (High nitrogen rates)

Broadcast Treatment	Planting Dates				
N + P + K	April 29	May 10	May 19	June 2	Average
0 + 0 + 0	73	99	99	83	88.5
0 + 25 + 70*	62	85	98	86	82.8
80 + 25 + 70*	43	87	106	83	79.8
160 + 25 + 70*	49	91	102	87	82.3
240 + 25 + 70*	66	90	100	82	84.5
Average	58.6	90.4	101.0	84.2	

*Received 4 lbs. N, 7 lbs. P, and 7 lbs. K per acre as a starter sideband in addition to the broadcast treatment

Discussion and Interpretation of Table 3.

The optimum planting date has varied considerably in the past. For several years, the moderately early date (about May 8-10) gave the most corn. In the drought years of 1975-76, later planting dates were more successful. In 1977, the two midseason planting dates gave the highest yield with a dramatic reduction resulting from the earliest (April 29) planting date.

There were no increases in yield due to fertilizer with the two earliest and the latest planting dates. Corn yields the past two years were exceptionally low so very little fertility was removed from the soil. There appeared to be a small increase from fertilizer with the May 19 planting date and 80 lbs. of N per acre was sufficient.

Table 4. Effect of Fertilizer and Planting Dates on Yield of Corn (Low nitrogen rates)

Broadcast Treatment	Planting Dates				
N + P + K	April 29	May 10	May 19	June 2	Average
0 + 0 + 0	75	89	88	86	84.5
20 + 25 + 70*	69	96	103	99	91.8
40 + 25 + 70*	56	90	102	98	86.5
60 + 25 + 70*	59	90	103	93	86.3
80 + 25 + 70*	65	88	109	92	88.5
Average	64.8	90.6	101.0	93.6	87.5

*Received 4 lbs. N, 7 lbs. P, and 7 lbs. K per acre as a starter sideband in addition to the broadcast treatment

Discussion and Interpretation of Table 4.

Results due to planting dates with low rates of nitrogen were similar to results due to planting dates with high rates of nitrogen (Table 3.). Highest yields occurred with the May 19 planting date. Responses to the first increment of nitrogen occurred with the last three planting dates.

Table 5. Soil Temperatures and Corn Emergence Dates

Planting Date	Soil Temperature at 2:00 PM 2"Deep Degrees Fahrenheit	Emergence Date
April 29	57	May 8
May 10	70	May 15
May 19	71	May 26
June 2	76	June 7

Discussion and Interpretation of Table 5.

In 1977 there were no apparent delays in seedling emergence due to early planting. Soil temperatures were comparatively high in the early part of the growing season. The earliest planting date had a soil temperature above 55 degrees Fahrenheit (the point where corn can germinate and make appreciable growth). Corn got off to a fast start in the spring and by mid-summer it was from one to two weeks ahead of an average seasons growth.

Nevertheless, the earliest planting date did not produce the most corn.

BROADCAST VS. DRILLING SEED FOR OATS

B. Lawrensen and F. Shubeck

Objectives of Experiment

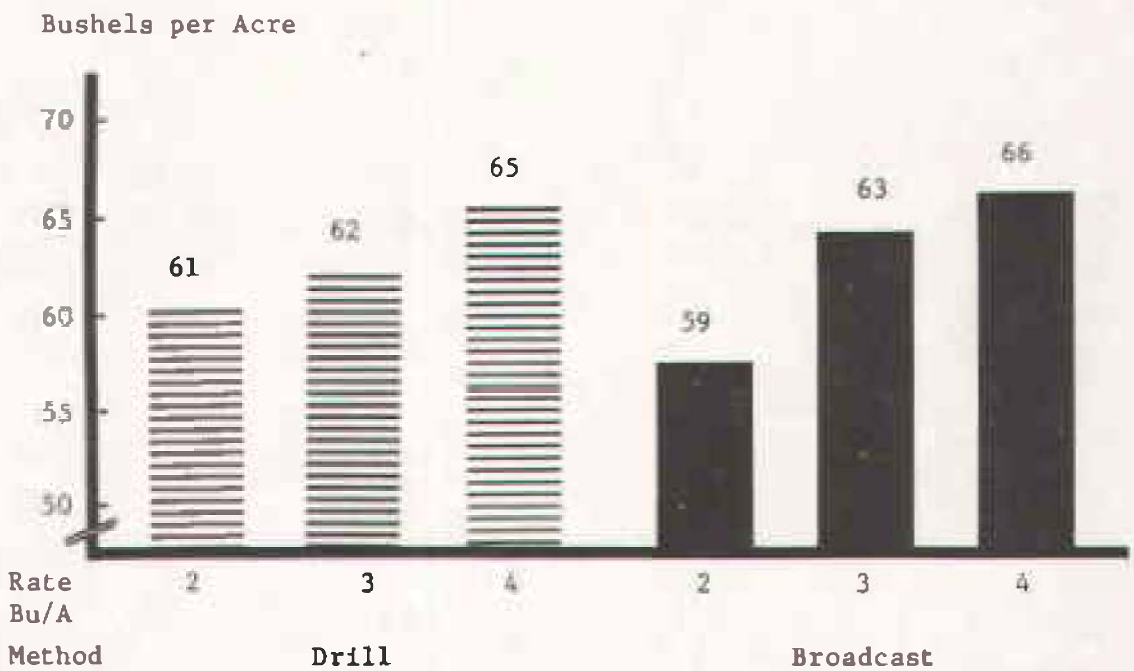
1. In a series of dry years like 1975 and 1976, will seeding oats with a press drill be better than broadcasting seed at a little higher rate?
2. Will stands and tillering be comparable with the two methods if seeding rates are similar?
3. How much should seeding rates be adjusted for broadcasting, when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

Methods and Procedures

Soybean ground was disked, dragged and planted April 22 after 30 lbs. N and 15 lbs. P per acre were broadcast.

Variety was Noble.

Figure 1. Effect of Seeding Methods and Rates on Oats Yield



Discussion and Interpretation of Figure 1.

There was a small but consistent yield increase as seeding rates were increased both for drilling and for broadcasting of seed.

With the two heaviest rates of seeding, the two seeding methods yielded about the same. With the smallest rate, drilling average 2 bushels more in yield than broadcasting.

This is the first year for the above experiment. Results in subsequent years may be different.

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 13 - broadcast 80 + 40 + 20 (oxide) and disked
April 25 - sprayed area with aatrex 4 L (2.5-3.0 lbs. per acre active ingredient) and tandem disked
May 11 - Disked and harrowed
May 12 - planted
cultivated all plots twice
October 31 - harvested

Table 6. Hybrids Used With Important Features of Each

Hybrid	Plant Characteristics	Days to Maturity
Pioneer 3709	Heat & 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 SE Experiment Farm has shown that optimum plant populations vary widely from year to year with changing environmental conditions. It is virtually impossible to accurately guess rainfall and temperature patterns three months in advance. The amount of subsoil moisture at planting time will be of some help

in deciding planting rates but this information is not always accurately known. This experiment is centered on special corn hybrids, each with a unique characteristic that may help to solve the problem "How many plants per acre should I have?"

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

Hybrid	Plants Per Acre					
	10,000	12,000	14,000	16,000	18,000	Average
P-3709	89	87	97	90	104	93.4
P-3932A	88	94	114	107	115	103.6
Agriseed 6072	86	91	100	90	102	93.8
Curry's SC-150	92	88	101	90	92	92.6
YW 35A	78	80	93	93	101	89.0
Average	86.6	88.0	101.0	94.0	102.8	

Discussion and Interpretation of Table 7.

Compensating qualities of the different hybrids as multi-eared tendency and ability to increase ear size, were adequate for maintaining top yields with populations of 14,000 plants per acre when environmental conditions set yields in the 100-114 bushel per acre range.

The 5 1/2 to 6 foot "shortie" corn (YW-35A) needed more than 14,000 plants to reach its peak production under 1977 conditions.

Yields from the early maturing numbers compared favorably with the full season hybrid.

CHISEL PLOW SOYBEANS AND CORN

F. Shubeck and B. Lawrensen

Objectives

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 (Soybeans)

Fall tillage performed November 5, 1976
Spring tillage May 26, 1977
Planted May 31, 1977
- 100 lbs. of 8-32-16 banded in specified plots
- Variety - Corsoy
- Herbicide - Lasso II banded in row

Two cultivations
Combined October 14, 1977

Procedure (Corn)

Fall tillage performed November 4-5, 1976
Spring tillage May 24, 1977
Planted May 25, 1977
- 100 lbs. 8-32-16 banded in row
- Variety - Pioneer 3709
- Insecticide - Furadan 10G banded
- Herbicide - Lasso II banded

Sidedressed 100 lbs. N per acre June 8, 1977
Three cultivations
Harvested October 24, 1977

Table 8. Effect of Tillage treatments on Yield of Soybeans

	Tillage Treatment In Fall	In Spring	Soybeans Bu/A
1.	- - - - - - - - - -	Disk-Disk-Drag	38
2.	- - - - - - - - - -	Chop-Sweeps-Disk-Drag	37
3.	- - - - - - - - - -	Disk-Moldboard Plow-disk-drag	40
4.	Disk-moldboard plow	Disk-drag	38
5.	Disk-twists	Disk-drag	34
6.	Chop-twists	Disk-drag	34
7.	Chop-twists	Sweeps-drag	34
8.	Chop-sweeps	Sweeps-drag	36
9.	Disk	Disk-drag	36
10.	Chop-twists*	Sweeps-drag	33

*Treatment 10. was unfertilized. All other plots received 100 lbs. per acre of 8-32-16 (oxide) as a sideband starter.

Discussion and Interpretation of Table 8.

With moisture sufficient for 40 bushel bean yields, there was a substantial increase in yield due to the fertilized treatment.

Moldboard plowing in the spring appeared to yield slightly more than the other tillage treatments. When cornstalks were left standing over the winter and tillage preparations for beans done in the spring, yields were slightly higher compared to those plots where tillage was performed in the fall.

In corn-bean sequence, the late fall tillage after crops are removed seldom has increased yields over spring tillage.

Table 9. Effect of Tillage Treatments on Yield of Corn

In Fall — Tillage Treatment	In Spring	Corn Bu/A
1. - - - - - - - - - - - - - - -	Disk-Drag	97
2. - - - - - - - - - - - - - - -	Sweeps-drag	92
3. - - - - - - - - - - - - - - -	Plow-disk-drag	96
4. Plow (moldboard)	Disk-drag	93
5. Chisel plow with twists	Disk-drag	97
6. Chisel plow with twists	Disk-drag	94
7. Chisel plow with twists	Sweeps-drag	90
8. Chisel plow with sweeps	Sweeps-drag	88
9.-------------------------	Disk-drag	95
10. Chisel plow with sweeps*	Sweeps-drag	88

*Treatment 10. 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 18 inches high.

Discussion and Interpretation of Table 9.

This experiment involves a corn soybean sequence and the treatments above are those performed on soybean ground preparing for corn.

There were no clear cut yield advantages in favor of late fall tillage.

There may be some yield differences due to use of twists or sweeps but the trend is not well established.

Fertilizer increased corn yields but the increase varied with different tillage methods.

SOYBEAN ROW SPACING

B. Lawrensen and F. Shubeck

Objectives of Experiment

1. Is there a yield advantage in narrowing rows from 30 inches to 7 inches?
2. Will planting soybeans with a small grain press drill (7" spacings) without cultivating be a desirable practice?

Methods and Procedures

April 13, 1977 - moldboard plowed
May 31, 1977 - disked and harrowed
May 31, 1977 - planted
Variety - Corsoy
Herbicide - Lasso II banded in 30" rows
Lasso E.C. sprayed over all pre-emergence on 7" rows at 3 qt. per acre
Two cultivations in 30" rows
October 16, 1977 - harvested

Table 10. Comparison of 30" to 7" Row Spacings for Soybeans

Row Spacing	Bu/Acre
30" (planted with tool bar planter)	42.0
7" (planted with press drill)	42.4

Discussion and Interpretation of Table 10.

Seven inch row spacings yielded about the same as 30 inch spacings.

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 commercial fertilizer?

Methods and Procedures

April 19, 1977 - Spread manure (5 ton per acre)
Broadcast commercial fertilizer
Moldboard plowed
April 25, 1977 - Sprayed aatrex 4 L at 2.5 - 3.0 lbs. per acre A.I.
Disked
May 5, 1977 - Planted, Pioneer 3388
Herbicide - Lasso II banded
Insecticide - Furadan 10G banded
Cultivated twice
October 5, 1977- Took silage yield
October 11, 1977 Ear corn harvested

Table 11. Effect of Commercial Fertilizer and Manure applications on Corn Yield with Intensive Soil Depletion Management

Removal From Plot	Fertilizer Treatment $N+P_2O_5+K_2O$	Tons of Silage/Acre	Bu. of Corn/Acre
Ear Corn Only removal	0 + 0 + 0		90
Ear Corn Only removal	5 tons manure/acre		109
Ear Corn Only removal	0 + 0 + 0		92
Ear Corn Only removal	100+40+40		104
Grain & Stover removal	0 + 0 + 0	11.4	93
Grain & Stover removal	5 tons manure/acre	16.0	98
Grain & Stover removal	0 + 0 + 0	12.9	89
Grain & Stover removal	100+40+40	15.8	112

Discussion and Interpretation of Table 11.

In 100 years of farming in South Dakota, approximately 1/2 of the soil organic matter was lost. It is a matter of deep concern regarding possible reductions in soil productivity if organic matter from both grain and stover are removed each year and fed to livestock. The practice of feeding all crop residues will probably continue accompanied by an associated loss in soil organic matter.

This experiment is an attempt to evaluate the seriousness of removing all crop residues as we begin to use the last remaining half of our soil organic matter reserves.

Where both grain and stover were removed, five tons of manure per acre were not adequate to maintain top yields because plots receiving commercial fertilizer yielded 14 bushels per acre more.

Where only ear corn was removed, the manure treatment was more nearly adequate because these plots yielded about as much as those receiving 100 lbs. of N, 40 lbs. P_2O_5 and 40 lbs K_2O per acre.

Silage yields were increased by both manure and commercial fertilizer.

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 srop? Approximately one pound of nitrogen is returned to the soil for each bushel of beans 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

April 11, 1977 - Moldboard plowed
May 9, 1977 - Broadcast fertilizer, disked harrowed and planted corn
Variety - Pioneer 3388
Herbicide - Lasso II banded
Insecticide - Furadan 10G banded
May 26, 1977 - Tandem disked harrowed and planted soybeans
Variety - Corsoy
Herbicide - Lasso II banded
Cultivated beans and corn twice
Harvested corn on October 14 and beans on October 16, 1977

Continuous beans and rotation beans received 75 lbs. of 8-32-16 or 6-24-12 (oxide) per acre each year. In the rotation of corn and beans, fertilized corn received 80-30-20 (oxide) each year.

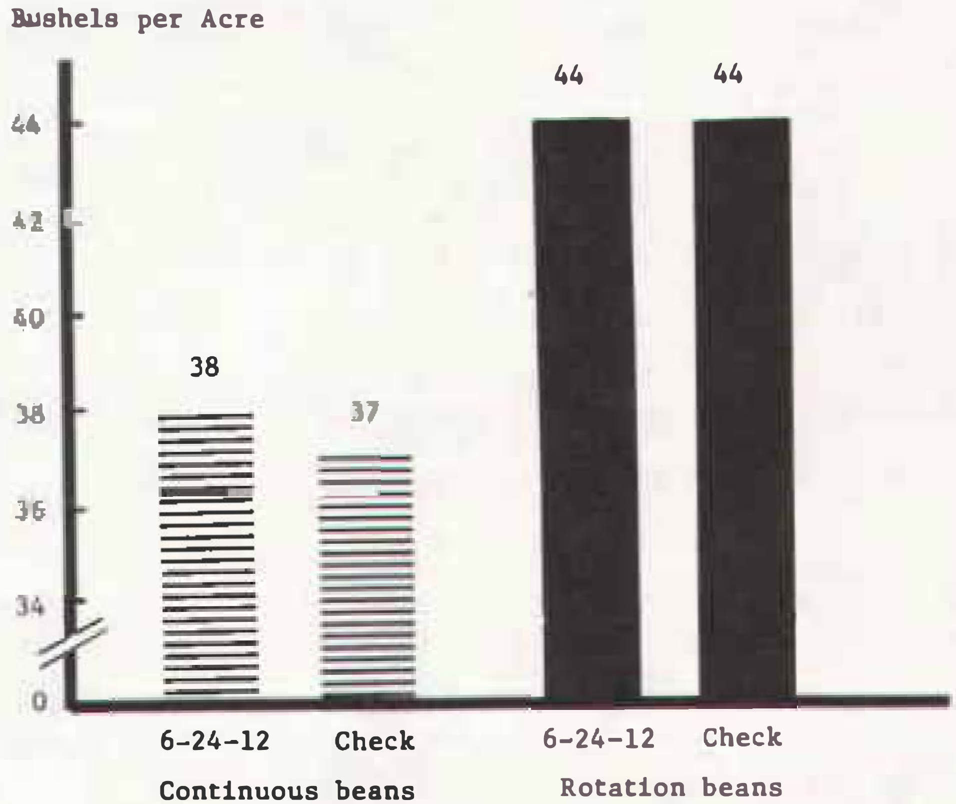
Table 12. Effect of Cropping Sequence on Yields of Soybeans and Corn

Cropping Sequence	Fertilizer	Bushels of Corn per acre			Bushels of Beans per acre		
		1975	1976	1977	1975	1976	1977
Continuous beans	check	--	--	--	33	29	37
Continuous beans	Fertilized*	--	--	--	35	29	38
Rotation beans & Corn	check	25	19	102	38	32	44
Rotation beans & Corn	Fertilized**	29	20	101	40	32	44

*Soybeans were fertilized with 100 lbs. of 8-32-16 (oxide) per acre broadcast

**Corn was fertilized with 80-30-20 (oxide) broadcast and disked in

Figure 2. Effect of Cropping Sequence on Yield of Soybeans



Discussion and Interpretation of Table 12. and Figure 2.

Table 12. summarizes results of this experiment for 3 years. In the dry years of 1975 and 1976, yields of beans surpassed those of corn. In the more favorable year, 1977, corn yielded over 100 bu. per acre but did not respond to commercial fertilizer. This may be attributed to accumulation of plant food during the two dry years due to commercial fertilizer applications and legume nitrogen fixation by soybeans in addition to the normal break down of soil organic matter and nutrient release.

Rotation beans in a corn-bean sequence consistently yielded more than continuous beans. Fertilizer response by beans was not so consistent over the three year period.

Figure 2. graphically illustrates the rather large yield difference between rotation beans and continuous beans obtained in 1977. Perhaps it will not be feasible to continuously plant an intertilled legume like soybeans to raise the nitrogen level of the soil over an extended period of years.

DATE OF PLANTING SOYBEANS

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 premature flowering?

Methods and Procedures

March 25 - Plowed plot area
April 29 - Broadcast treflan at 1.5 pints per acre & tandem disked
May 2 - Fertilized area: 50 lbs. 34-0-0, 150 lbs. 0-46-0 and 50 lbs. 0-0-60 per acre
Planting - Before each planting plots were tandem disked and spike tooth harrowed, Lasso II was banded in row at planting
Cultivation - First 3 plantings were cultivated twice. Later plantings were cultivated once
October 13 - All plots harvested

Table 13. Effect of Planting Dates on Yield of Soybeans

Variety	Planting Dates						
	May 5	May 11	May 18	May 25	June 1	June 8	Average
Corsoy	32	33	37	34	37	38	35.2
Wells	33	33	37	37	37	37	35.7
Chippewa	28	27	33	33	32	34	31.2
Hodgson	29	30	35	34	34	36	33.0
Average	30.5	30.8	35.5	34.5	35.0	36.3	

Discussion and Interpretation of Table 13.

May 5 and May 11 planting dates were too early for both early and full season beans.

In previous years there was a greater yield reduction from planting early varieties too early than from planting full or mid-season varieties too early.

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

March 23 - Rotary chopped corn & sorghum plots
March 28 - Plowed corn,sorghum and oat plots
April 18 - Tandem disked & spike tooth harrowed total plot area
April 19 - Drilled oats
Variety - Noble oats
Sweet clover - Madrid
Alfalfa - Vernal
May 13 - Tandem disked & spike tooth harrowed corn, soybean & sorghum plots
May 16 - Planted corn plots
Variety - Pioneer 3709
Herbicide - Lasso II banded
Insecticide - Furadan 10G banded
May 23 - Sprayed oats plots without legume seedlings with MCPA (3/4 pints) plus banvel (1/8 pint) per acre
May 24 - Tandem disked and spike tooth harrowed soybean plots
May 26 - planted soybeans
Variety - Corsoy
Herbicide - Lasso II banded
May 31 - Planted sorghum plots
Variety - NK 233
Herbicide - Ramrod 20G banded
Insecticide - Furadan 10G banded for systemic control of greenbug
June 6 - Cultivated corn & bean plots
June 7 - Sidedressed nitrogen in corn and sorghum plots
June 20,22 - cultivated sorghum corn and soybean plots
July 5 - cultivated sorghum and soybeans
July 13 - combined oats
July 20 - sprayed grain sorghum with Meta-Systox-R at 2 pints per acre for greenbug control
Oct. 17 - Harvested soybeans and sorghum
Nov. 1 - Picked corn plots

Table 14. Effect of Cropping Sequence and Fertilizer on Crop Yield, 1977

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			81.0				
1 Continuous corn	Corn	6 +11 + 10	70		93.0				
2 Corn-oats	- - - -	0 + 0 + 0		31.0	91.0				
2 Corn-oats	Corn	6 +11 + 10	70		91.0				
	Oats	30 + 7 + 0		31.0					
3 Corn-corn-oats+alf hay	- - - -	0 + 0 + 0		68.0	85.0	89.0			1.38
3 Corn-corn-oats+alf hay	Corn	6 +11 + 10			82.0				
	Corn	6 +11 + 10	70			95.0			
	Oats	15 +26 + 0		63.0					
	Alf residual	0 + 0 + 0							2.04
4 Oats+sweet clover-corn	- - - -	0 + 0 + 0		56.0	90.0				
4 Oats+sweet clover-corn	Oats	30 + 7 + 0		46.0					
	Corn	6 +11 + 10			88.0				
5 Corn-soybean-oats	- - - -	0 + 0 + 0		38.0	87.0		35.0		
5 Corn-soybean-oats	Corn	6 +11 + 10	70		82.0				
	Soybeans	6 +11 + 10					37.0		
	Oats	30 + 7 + 0		40.0					
6 Corn-oats-soybeans	- - - -	0 + 0 + 0		43.0	93.0		35.0		
6 Corn-oats-soybeans	Corn	6 +11 + 10	55		91.0				
	Oats	20 + 7 + 0		44.0			38.0		
	Soybeans	6 +11 + 10							
7 Continuous grain sorghum	- - - -	0 + 0 + 0						78.0	
7 Continuous grain sorghum	Sorghum	6 +11 + 10	70					123.0	

Discussion and Interpretation of Table 14.

When continuous corn was fertilized, yields were equal to or better than corn yields in rotations.

Oats yields in legume rotations were higher than in the corn-oats sequence.

Alfalfa yields were low due to poor stands obtained the year previously.

There was a small but consistent increase in soybean yield due to fertilizer.

The biggest increase in yield due to fertilizer occurred in the continuous grain sorghum plots.

Control of Sunflower Head Moth Using Lannate

B. H. Kantack and B. Lawrensen

Sunflower head moth is the most serious insect affecting cultivated sunflowers in South Dakota. Infestations of this insect have occurred each year since domestic sunflowers have been grown in South Dakota. Control of this insect is difficult to obtain and the degree of control is never 100 percent. Timing and choice of insecticides for use against this insect is very important. At the present time only three insecticide materials are registered for control of sunflower head moth, these are Supracide, Thiodan and Methyl parathion. For good control of sunflower head moth two applications of either Supracide or Thiodan are necessary, starting at the time of onset of bloom and a second application applied a week later. If Methyl parathion is used it usually requires three sprays at three to five day intervals to obtain control. The amount of water used per acre is very important and a minimum of five gallons of water per acre when ground equipment is used to treat the sunflower fields.

Another management factor which will aid in control of this insect is choosing a hybrid variety with a short pollination period so that the plants are pollinated in a relatively short period of time so they do not have to be protected for an extended period of time. Growers should select hybrid varieties that are high in self-pollinating ability as yields may be depressed on open pollinated or nonself-pollinating hybrid varieties by application of insecticides during the bloom period.

Evaluation of Lannate

In an attempt to evaluate the efficacy of Lannate against sunflower head moth, two dosages rates were applied to an experimental sunflower planting at the Beresford, South Dakota Experiment Station. Treatments were applied July 28, 1977 using a John Blue high clearance sprayer equipped with T-Jet 8003 nozzles. Twenty gallons of spray per acre were delivered at 20 pounds psi traveling at a speed of three miles per hour. Larval counts were taken in the untreated checks on August 12, 1977, by counting the number of larvae from five randomly selected heads in each of the four replicates. Each plot consisted of six 30 inch rows, 200 feet long. The sunflower variety planted was Sexauer's Sun-Hi 304. Final harvest weights were taken September 26, 1977, by harvesting 1/1000 of an acre in each replicate.

Results

The degree of infestation as measured on August 12, 1977 showed an average of 211 larvae per head. Larval development

ranged from newly hatched larvae to half-grown larvae in the heads. The infestation became so heavy that some of the larvae migrated down the stems and burrowed in the leaf axils into the plant stalk itself. Results are shown in Table 15. As indicated by the harvested yields in Table 15, the 1.8 pounds per acre AI dosage gave a higher degree of control with the yield difference of 879 pounds over the untreated check. It should be emphasized that Lannate is not registered for control of sunflower insects at this time and that this was an experiment to collect data for possible registration at a future date. Thus this insecticide cannot be used in commercial sunflower production in South Dakota.

Table 15. Control of Sunflower Head Moth Using Two Dosage Rates of Lannate

Treatment lbs. AI/Acre	Yields lbs. Seed/Acre Replicate 1	2	3	4	Average lbs. Seed/Acre	Estimated Profit from Treatment*
Lannate 1.8	3310	2890	2930	2880	3002	78.69
Lannate 0.45	2680	2280	2510	2420	2472	20.39
Untreated	1690	2340	2530	1930	2123	- -

Treatments applied July 28 and August 4, 1977, using a John Blue high clearance sprayer equipped with T-Jet 8003 nozzles applying 20 gallons of spray per acre at 20 psi traveling three miles per hour.

Cost of application - Estimated $18.00
Yields taken September 26, 1977
Average larvae 211/head, 5 heads evaluated per replicate in untreated check on August 12, 1977
Plot size - 6 rows, 38" row width, 200 feet in length.
Variety - Sexauer Sun-Hi 304

*Based on $ .11 per pound market

PROGRESS REPORT - SOLAR DRYING BIN

William H. Peterson
Extension Ag. Engineer

The solar drying bin was used again in the fall of 1977. It is 23 1/2 feet in diameter with nominal capacity of 5000 bushels, with a full perforated floor, 10 hp centrifugal fan and 20 kilowatt electric heater. The system is designed to operate as a low-temperature drying system, with 5 to 7 degree temperature rise in the drying air. The fan will provide 2 cfm (cubic feet per minute) of air for each bushel when the bin is full or shelled corn. This is the recommended airflow for one day loading of the bin with 24 percent moisture shelled corn.

The bin has a solar collector consisting of a galvanized corrugated steel sheet mounted on the southern two thirds of the bin, five inches out from the bin wall. The collector has a black co-polymer coating to absorb sunlight. The heat from the sun is picked up by the airstream moving on the back side of the metal sheets.

The bin was loaded on November 1 and 2 with 4394 bushels of shelled corn (calculated from weights and moisture content). Moisture content averaged 18.8 percent. It had been hoped to load corn at a higher moisture content, but the press of other work delayed corn harvest.

Temperatures were recorded hourly during the day and once at midnight in eleven locations. The temperature rise in the drying air at noon on a sunny day using no electric heat was approximately 7 degrees F, with 2 degrees of this being supplied by the 10 hp fan and 5 degrees from the solar collector. This is about the same temperature rise as can be secured by operating the 20 kilowatt electric heater.

A strip of polyethelene plastic was stretched over a section 3 feet wide on the west side of the bin to see if this would improve collector efficiency. In the afternoon it increased temperature rise by at least 1 degree F compared with an uncovered section beside it. This indicates that output of the solar collector could be increased by 20 percent by covering the entire collector with polyethelene plastic.

The fan was operated continuously for the first week, and the stirring device operated most of this time. The static pressure under the drying floor was 3 3/8 inches, compared with an expected static pressure of 4 3/8 inches with no stirring. This indicated that stirring had reduced the resistance to airflow through the corn by about 22 percent. Static pressure rose only slightly in four weeks after the stirring was stopped.

The fan was off during the blizzard of November 8 and 9, and drying was resumed on November 15, operating only during the daytime (because of the cold temperatures) on days with at least partial sunshine.

At this time the humidistat, which samples the drying air and controls the electric heater, was turned down to an approximately 60 percent setting. The fan run on 10 of the following 15 days. The fan operated approximately 86 hours and the heater automatically 37 hours in this time.

On December 1, it was decided that the corn had dried sufficiently so that it was safe to cool it to 25 degrees and wait until April to finish drying. The fan had consumed 2830 kilowatt-hours, and the heater 2100 kilowatt-hours in drying the corn down from 18.8 percent moisture to an average of 15.7 percent in the bin. The corn at the top of the bin was at 17.1 percent and that one foot from the bottom was at 13.4 percent.

Cost of drying this far, with electricity at 2¢ per KWH, was 2.24 cents per bushel, or 0.72 cents per bushel "point".

Corn in the bin will be checked periodically during the winter, and drying will be finished in the spring, using the same management as for fall operation.

EFFECT OF RATES OF NITROGEN ON THE YIELDS OF BROME GRASS

Paul Carson, E.J. Williamson, Jay Goos,
Robert Nettelton, Ron Gelderman

Objective

1. Determine the effects of added nitrogen rates on the yield of brome grass this year and over a period of years.
2. Determine the effects of the added nitrogen on the protein content of the hay produced.

Methods & Materials

1. The experiment was established on an old stand of brome grass 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 15. Laboratory Characteristics of Soil at Experimental Site

Depth of Samples in inches	Available P lbs/A	Available K lbs/A	pH 1-1 dilution	Salts mmhos/cm.
0-6	7.3	970	6.8	.38
6-12	3.3	558	6.7	.30
12-18	3.8	385	7.0	.28
18-24	5.8	360	7.5	.28
24-30	2.5	258	7.7	.30
30-36	4.0	258	8.0	.38
36-42	2.5	220	8.2	.40
42-48	3.8	193	8.3	.35

2. Fertilizer nitrogen in the form of ammonum nitrate was applied by broadcasting in early April. The following rates per acre of nitrogen were applied.

Treatment No.	lbs/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 with rates of these elements to be applied at that time.
4. Yield samples of hay were harvested June 20th with a small plot mower. An area 2.5 X 15' was taken from each plot. The samples were weighed in the field and samples were taken for moisture content. These moisture samples were later ground for nitrogen analysis.

Results and Discussion

The effect of the added nitrogen treatments on the yield of hay, the percent protein content and the lbs of protein in the hay are shown in Table 15. A very large yield increase (2148 lbs/A) occurred when the 80 lbs of nitrogen was added. Increasing the application to 160 lbs per acre increased the yield of hay another 1257 lbs. The yield increase for the 320 lb/A application rate was relatively small (404 lbs of hay/A). These yields indicate that as the rate of nitrogen application increased above 80 lbs per acre, the amount of yield increase decreased.

It should be pointed out that as the rate of nitrogen application increased the protein percent and the amount of protein produced per acre increased. The amount of protein produced per acre is influenced by the protein percent and the yield of hay.

Table 16. The effect of added nitrogen fertilizer on the yield of Hay, the protein percent of the hay and the amount of protein present in the hay - Southeast Farm, 1977.

Treatment lbs of added nitrogen per acre	Yield of Hay 12% Moisture	% Protein Present	lbs of Protein Produced per acre
0	1982	7.7	146
80	4040	7.8	316
160	5297	10.0	504
320	5701	12.6	716

CV = 11.2%
LSD .05 = 747.5
LSD .01 =1074.0
LSD.001 =1580.0
hsd .05 =1632.9

It is planned to continue this experiment over a period of years to determine if the yields can be maintained at a high level with only the addition of nitrogen fertilizer.

IRON FERTILIZATION OF SOYBEANS

R. J. Goos, E. Adams, P. Carson, F. Shubeck & B. Lawrensen

Objective

1. Determine if soybeans with severe iron-deficiency symptoms will respond to Iron foliar fertilization.

Methods and Procedures

1. Soils. South Dakota soils generally contain sufficient amounts of iron for plant growth. However, under high pH (high lime) and somewhat poor drainage conditions, iron may not be in a plant available form. Chlorosis or yellowing of the beans sometimes occur under these conditions. Such an area was noted at the S.E. Experimental Farm in 1977. The chlorotic soybeans were growing on a somewhat poorly drained soil called Bodus. Bodus soils are deep, friable, somewhat poorly drained soils that occur on flats or in shallow basins. They may be saline.
2. Stage of Growth. The chlorotic condition was noted at the 2 - 3 leaf stage of growth.
3. A randomized complete block design having replications was used. The following treatments were applied:
   1. 0.5 lbs of Fe Chelate
   2. 1.0 lbs of Fe Chelate
   3. 1.5 lbs of Fe Chelate
   4. 0.5% Ferrous sulfate sprayed to leaf saturation
   5. 0.5% Manganese sulfate sprayed to leaf saturation
   6. Non-fertilized check
4. The fertilizer was applied on June 21, when the plants were in the three-trifoliate stage of growth with a knap sack type sprayer.
5. Plots were harvested in October by hand and threshed with a small plot thrasher.

Results

The effect of iron fertilization on soybean yields is presented in Table 17. The fertilizer treatments did not influence yields, and most plants seemed to "grow out" of the deficiency, although a few scattered plants looked iron-deficient up to leaf shedding (Sept.)

Research from other states has shown consistent iron-fertilizer soybean yield response if deficient-looking plants are sprayed with iron chelate before the soybeans reach the third-trifoliate leaf stage. Catching the deficiency that early in the growing season takes careful observation and top management on the part of the soybean producer. Iron deficiencies on soybeans are most likely to be found on high pH and somewhat poorly drained soils in South Dakota. Early detection of the problem and quick application of an Iron Chelate may improve yields.

Table 17. Effect of Iron Foliar Fertilization on Soybean Yields S.E. Farm, 1977

Treatment	Ave. Yield (bu/A)
Check - No fertilizer	34.1
0.5 lbs/A Fe chelate	33.5
1.0 lbs/A Fe chelate	33.5
1.5 lbs/A Fe chelate	35.8
0.5% $FeSO_4$	31.5
0.5% $MnSO_4$	33.2

Least significant Difference (.05) = 3.1 bu/Acre
C.V. = 7.6%

LIME EXPERIMENT

Paul Carson, Burt Lawrensen, Fred Shubeck
Ron Gelderman and Robert Nettleton

The use of lime on soils having pH's greater than 6.2 is considered uneconomical in most states. However, interest in its 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 Experimental Farm to further evaluate its value 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. The tests on the soil samples taken in 1974 from each of these halves are shown in Table 18. A considerable difference in the fertility exists between the soils from these two ranges. This can be noted in the tests for available phosphorus, and for exchangeable potassium.
2. Soil samples (0-6 & 6-12") were taken from each plot in the spring of 1977 to determine the effect of the added lime on the pH of the soil and of the added phosphorus on the soil test for available phosphorus. These results are found in Table 19.
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 in Table 20. 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 55 lbs per acre before planting in 1977.
4. Experimental design used was randomized block.
5. Weeds were controlled with Lasso II 15G at 8 lbs per acre applied in a band at planting time; Aatrex 4L was applied before planting. There were two cultivations. Weed control was excellent
6. Soil insects were controlled with Furadan 10G in a band at 1 lb/A of active material at planting time.

Table 19. The Effect of Lime added in 1974 and Phosphorus added each year on the soil test values for pH[L1] and available[L2] phosphorus in the soil. Southeast Experimental Farm 1977.

Fertilizer Treatment lbs/A $N + P_2O_5 + K_2O$	Tons/A Lime	pH 0-6	pH 6-12	Available Phosphorus 0-6	Available Phosphorus 6-12
0+ 0 + 0		5.9	6.2	31	13
0+ 0 + 0	2	6.5	6.6	28	14
0+ 0 + 0	4	6.6	6.6	30	12
0+ 30 + 0		6.0	6.2	39	13
0+ 120 + 0		6.1	6.3	90	30
0+ 30 + 0	2	6.4	6.5	38	26
0+ 30 + 0	4	6.6	6.7	50	15
0+ 120 + 0	2	6.3	6.4	89	24
0+ 120 + 0	4	6.5	6.5	114	24

L1 pH determine on a 1:1 water to soil extract
L2 Available phosphorus determined by the Bray #1 weak acid method.

Fertilizer Applied N + P + K, lb/A	Lime Applied Tons/A
0 + 0 + 0	-
0 + 0 + 0	2
0 + 0 + 0	4
0 + 30 + 0	-
0 + 120 + 0	-
0 + 30 + 0	2
0 + 30 + 0	4
0 + 120 + 0	2
0 + 120 + 0	4

Table 18. Soil Tests on Samples Taken from the Experiment Site at Seeding Time in 1974, Southeast Experiment Farm

Depth of Sample inches	NO_3-N ppm	N/A lbs.	O.M. %	Phos-phorus lbs/A	Potas-sium lbs/A	pH 1:1	Salts mmhos/cm	Tex-ture
				East 1/2 of Experiment				
0 - 6	24.6	44	3.7	56	1000+	6.3	0.52	sicl
6 - 12	36.0	65	3.4	22	600	6.3	0.50	sicl
12- 18	30.0	54	2.4	7	470	6.8	0.50	sic
18- 24	24.6	44	1.9	4	580	6.9	0.44	sic
24- 30	24.6	44	1.3	4	540	7.6	0.60	sic
30- 36	31.0	56	0.9	1	410	8.0	0.65	c
36- 42	27.0	49	0.7	1	400	8.0	1.20	c
42- 48	41.0	74	0.6	1	460	7.9	1.30	sic
				West 1/2 of Experiment				
0 - 6	21.0	38	3.7	16	740	6.5	0.80	sicl
6 - 12	12.4	22	3.1	14	620	6.4	0.52	sicl
12- 18	5.8	11	2.1	9	480	6.7	0.40	sic
18- 24	4.8	9	1.6	9	570	7.2	0.56	sic
24- 30	4.4	8	1.2	6	590	7.4	0.56	sic
30- 36	5.2	9	0.9	5	490	7.7	0.58	sic
36- 42	7.6	14	0.6	4	410	8.0	0.50	scl
42- 48	4.4	8	0.4	3	340	8.3	0.42	sl

7. Variety was Pioneer 3388.
8. The seedbed was prepared in the conventional manner, that is fall plowing, disking, and dragging in the spring.
9. Corn was planted May 9 with John Deere tool-bar planters. The row width was 30 inches, plant population 15,000 at planting time.
10. Yield of corn grain and silage were taken. The silage was harvested September 15 and the grain October 13. Fifty foot row was harvested in each case. Samples for moisture in both the grain and silage were taken at harvest time.
11. Leaf samples were taken for analysis at silking time.
12. The weather encountered was excellent for the growth of corn.

Results

The effects of the added lime and added phosphorus on the soil values in 1977 are shown in Table 19. The addition of lime either 2 or 4 tons per acre increased the pH from 5.9 to approximately 6.5. The addition of 30 lbs of P_2O_5 (broadcast) each year for four years (1974-1977) increased the soil test value only slightly (30 to 40 lbs per acre). The higher rate of application (120 lbs/A for 4 years) increased the soil test value to approximately 100 lbs/A. The addition of lime had little or no effect on the test value for available phosphorus.

The yield in bushels per acre of 15% moisture corn, the percent moisture in the ear at harvest, the yield of silage (60% moisture) and the plant population at harvest are shown in Table 20. The yield difference for both grain and silage due to treatments are small and probably due to experimental error.

This leads to the conclusion that the added lime and phosphate fertilizer had no effect on the yields of grain and silage. Likewise these treatments had no consistent effect on the moisture content of the ears at harvest nor on the final plant population. It should be pointed out that the available soil phosphorus of all plots is 30 lbs/A or above. A response to added phosphorus at these levels of available phosphorus is not expected. Growth differences due to treatments were noted early in the season. These differences could not be seen or measured at time of harvest.

Table 20. The Effects of added Lime and Phosphorus on the yields of Grain and Silage, the moisture content of the Ears at Harvest and the plant population at harvest for corn grown at the Southeast Experiment Farm, 1977.

Treatment Number	Fertilizer $N + P_2O_5 + K_2O$ lbs/A.	Lime Tons/A	Yields[L1] bu/A	Ear Corn % Moisture[L2]	Silage Yield 60% Moisture Tons/A	Plant Population in plants per acre
1.	0 + 0 + 0	-	116	21.5	13.0	12,643
2.	0 + 0 + 0	2	113	21.2	13.9	12,775
3.	0 + 0 + 0	4	117	21.5	13.1	12,807
4.	0 + 30 + 0	-	114	20.7	13.4	12,545
5.	0 +120 + 0	-	108	20.4	13.4	12,894
6.	0 + 30 + 0	2	120	20.1	13.0	13.155
7.	0 + 30 + 0	4	116	21.1	13.0	12,817
8.	0 +120 + 0	2	115	20.3	13.4	13,155
9.	0 +120 + 0	4	111	21.1	13.6	13,939
Sig. Calculated at 1% level			ns.	ns.	ns.	ns.
Coefficient of variability			5.2%	6.2	21.0	39.6

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.

EFFECTS OF RATES OF NITROGEN ADDITION ON THE CONCENTRATION OF NITRATE-NITROGEN IN THE SOIL PROFILE AND THE NITROGEN CONTENT OF THE LEAVES AND SILAGE, SOUTHEAST EXPERIMENTAL FARM, 1977.

Ron Gelderman, Earl Adams, Robert Nettleton, Fred Shubeck
Burt Lawrensen and Paul Carson

The "Date of Planting and Rates of Nitrogen for Corn" study being carried on by Fred Shubeck and Burt Lawrensen reported elsewhere in this publication provides an opportunity to study the accumulation and movement of NO_3-N in the soil profile, the effects of the treatments on leaf analysis and the up-take of nitrogen by the crop.

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 effect 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. The experiment is located on a Viborg silty clay loam on the South East corner of the Experimental Farm. Viborg soils are deep, friable, moderately well drained silty clay loam soils developed in a silty cap over glacial till.
2. Soil samples have been taken to a depth of 6 feet each year since 1969 in the heavy rate of application experiment. They are only being taken to a depth of 4 feet in the low rate experiment.
3. The samples were dried as soon as possible after taking, in a forced air oven at a temperature not to exceed 115°F.
4. Nitrate-nitrogen was determined by the n-phenol-di-sulphonic acid method until 1973. Since then the nitrate electrode method has been used.
5. Two experiments are involved in this study. The experiments are adjacent and related. They were started at different times. The treatments for each experiment are listed under the year of establishment.
6. The longer duration experiment with high rates of nitrogen is in its ninth year. This means that the plots receiving 160 lbs of nitrogen per acre have had 1440 lbs per acre of nitrogen added during this time. The nitrogen fertilizer used has been ammonium nitrate. Even though this experiment is in the ninth year, the samples were taken after eight years of fertilization and cropping. The additions of P_2O_5 (25#/A) and K_2O (70#/A) have remained constant on both experiments. All plots except the 0 + 0 + 0 treatments in each experiment receive the same amount of P and K each year. A plot receiving no additional nitrogen but receiving

P and K is a part of the high rate experiment.

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 the leaf samples. Leaves were dried in a forced air oven, ground and nitrogen content determined by the Kjeldahl method.
8. Silage was harvested from the 2nd planting date treatments. Yields were reported by Shubeck and Lawrensen in 1976. 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 additions on the nitrate-nitrogen (NO_3-N) content of the soils are reported in Table 21. ~~(three years~~ after application, low rates, 0-80 lbs/A) and Table 22. (after 8 years annual fertilization, high rates, 0-240 lbs/A). The data in Table 21. shows that all rates of added nitrogen increased the amount of NO_3-N found in the soil profile at the end of the third growing season. The larger amounts of NO_3-N found in the 40, 60 and 80 lbs of nitrogen addition treatments were concentrated in the top 12 inches when the samples were taken in the fall. The NO_3-N was distributed throughout the top 24 inches when these same plots were sampled the following spring, May 1977. The increase in the total amount of nitrogen found in comparative soil profiles was greater in those profiles receiving less added nitrogen (compare the check [0+0+0] plot and the 80 #/A addition plot). No explanation is offered at this time for the variation noted. In all cases, but the 80 #/A rate of application, the amount of NO_3-N found was higher when the plots were sampled in the spring than when they were sampled in the fall. The fact that increased amounts of NO_3-N were noted in the soil profile for all treatments is probably partially due to the low corn yield produced in 1976.

The experiment (high rate) that was conducted over an eight year period (Table 22.) shows the accumulation of NO_3-N in the soil profile. The amount of this accumulation increases as the rate of nitrogen application increases. Most of the NO_3-N is found above the 48 inch level but there is some evidence that NO_3-N has moved to depths below this level. Note especially the 48-60 inch depths for the 160 and 240 lb application rates.

The high rates (0-240 lbs/A) of nitrogen addition were sampled in May of 1977 at the time of the second planting (approximately May 10). These samples were taken to a depth of 4 feet. The results are found in Table 21. so a comparison of the May 1977 and November 1976 samples can be easily made. The amount of NO_3-N found in the samples taken in May 1977 is higher than the amount found in samples taken from those plots the previous fall , 80# rate. The differences in NO_3-N amounts between fall and spring are large.

The year by year accumulation of the NO_3-N in the soil profiles under different treatments is shown in Figure 3. The results from the longer duration higher rates of application plots are the only values shown. The NO_3-N content of the soils have been increasing. The decreases noted in values for the years 1972 and 1974 are associated with higher corn yields. This is illustrated by placing the yields from 160 lb/A application rate for each year near the point on the graph. These yield values have a line drawn under them. Note that the NO_3-N contents found in the profile after the higher yields (1972 and 1974) were lower. The year 1976 was also a dry year as is evidenced by the low yields of corn. No satisfactiry explanation of why the NO_3-N content found in the soil profiles in 1976 did not continue to increase is offered at this time.

The nitrogen contents of the leaves at silking time are shown in Table 23. These values are all below that considered to be sufficient (2.75%). Because of the fact that at least some of these plots had quantities of available nitrogen in the soil profile that would be considered sufficient to excessive, one must assume that this leaf analysis did not provide a measure of the supply of nitrogen available to the plants. It should be noted that the percent nitrogen does increase as the amount nitrogen available to the plants increased. It is thought that the samples may have been taken too late for the proper evaluation.

The percent nitrogen in the silage, the silage yields and the nitrogen contained in the silage are shown in Table 23. The percent nitrogen in the silage increased as the supply of nitrogen available to the plants increased. This percentage of nitrogen along with the yields of silage provides a basis for the calculation of the nitrogen removal by the crop. Even at the relativly low yields obtained in 1976, more nitrogen was present in the crop than was added with the exception of the 240 lb rate of addition.

It should be noted that the crop produced by the P + K treatments contained 150 lbs of nitrogen. If all plots produced 150 lbs of available nitrogen through mineralization of soil organic matter, then the amount of fertilizer nitrogen not utilized in the growth of the crop varies from 1 to 165 lbs per acre. The increase in NO_3-N from 1975 (Figure 3) to 1976 does not account for this NO_3-N at the higher rates of addition.

Figure 3. The Effect of Rates of Added Nitrogen on the Amount of Nitrate-Nitrogen in the 6 foot Profile at the End of Eight Years Period; Southeast Experimental Farm, 1977.

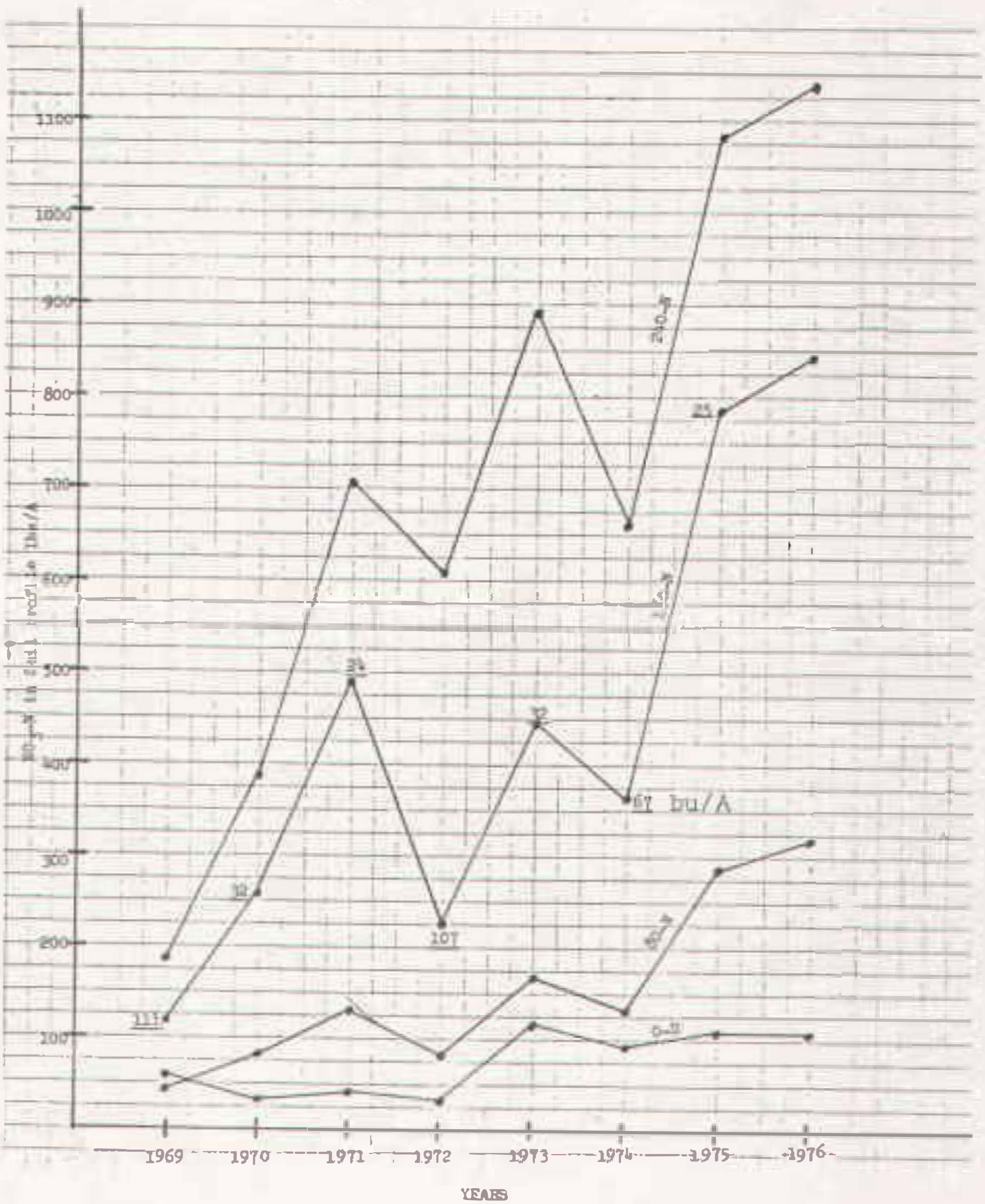


Table 21. The Effects of adding low rates of Nitrogen Fertilizer on the amount of Nitrate-Nitrogen Present in the Soil Profile after 3 cropping Seasons and the level Present the following Spring. Southeast Experimental Station, 1977.

Depth in inches	Nitrogen added each year, lbs/A[L1] 0+0+0[L4]		20+0+0[L2]		40+0+0[L2]		60+0+0[L2]		80+0+0[L2]	
	Sampling Time[L3]		Sampling Time[L3]		Sampling Time[L3]		Sampling Time[L3]		Sampling Time[L3]	
	Fall 76	Spring 77	Fall 76	Spring 77	Fall 76	Spring 77	Fall 76	Spring 77	Fall 76	Spring 77
0- 6	20	17	25	14	43	13	85	30	130	17
6-12	6	15	9	17	16	27	22	42	30	22
12-18	4	10	4	14	8	27	16	35	13	17
18-24	4	13	4	9	6	18	11	21	11	26
24-30	4	15	4	6	4	8	8	10	10	16
30-36	4	17	4	4	4	5	6	9	9	13
36-42	4	12	4	4	4	4	6	8	7	9
42-48	4	4	4	4	4	12	5	10	6	8
Totals										
0-24	34	55	42	57	73	85	134	128	184	82
0-48	50	103	58	75	89	114	159	165	216	128
Corn Yields										
1976 Bu/A	33.5		32.5		35.8		31.5		34.0	

L1 Each plot received a uniform amount of P_2O_5 (25#) and K_2O (70#) per acre broadcast.
L2 Received 4 lbs of N, 16 lbs of P_2O_5 and 8 lbs of K_2O as a starter fertilizer
L3 Fall samples were taken in Nov. & Spring samples were taken late in May.
L4 The plot did not receive any P or K fertilizer.

Table 22. The Effects of adding High rates of Nitrogen Fertilizer over an 8 year period on the amount of Nitrate-Nitrogen Present in the Soil Profile at the End of the Growing Season and the Following Spring, Southeast Experimental Station, 1977.[L1]

Depth in inches	Nitrogen added Each Year, lbs/A[L2]							
	0+0+0[L3]		80+0+0		160+0+0		240+0+0	
	Sampling Time		Sampling Time		Sampling Time		Sampling Time	
	Fall 76	Spring 77	Fall 76	Spring 77	Fall 76	Spring 77	Fall 76	Spring 77
0 - 6	15	21	96	26	210	81	312	72
6 - 12	7	24	21	53	63	139	101	163
12 - 18	6	18	21	62	76	132	102	188
18 - 24	6	8	26	71	102	134	134	160
24 - 30	5	5	26	73	105	139	142	144
30 - 36	6	4	24	38	87	114	100	149
36 - 42	9	5	20	23	56	61	75	98
42 - 48	8	4	19	15	37	33	53	57
48 - 54	11		16		26		39	
54 - 60	12		16		21		30	
60 - 66	10		17		17		23	
66 - 72	12		16		15		19	
Totals								
0 - 24	34	71	164	212	451	486	649	583
0 - 48	62	89	253	361	736	833	1019	1031
0 - 72	107	-	318	-	815	-	1130	-
Yield of corn 1976 bu/A	27.8		21.5		25.5		23.5	

L1 Samples were taken in November and May 77

L2 Treatments have been repeated on the same plots for the past 8 years. During this time plots receiving 80 lbs of nitrogen each year have received 640 lbs of nitrogen per acre. All plots receive a uniform amount of P_2O_5 (25#) and K_2O (70#) per acre per year.

L3 This plot received the P & K listed in L2.

1974 Rate of Nitrogen Applied, lbs/A
0 + 0 + 0
20 + 0 + 0
40 + 0 + 0
60 + 0 + 0
80 + 0 + 0

1969 Rate of Nitrogen Applied, lbs/A
0 + 0 + 0
80 + 0 + 0
160 + 0 + 0
240 + 0 + 0

Table 23. The Effect of added Nitrogen Fertilizer on the nitrogen content of corn leaves at Silking time; the nitrogen content of silage at harvest time and the amount of nitrogen contained in the crop[L1], Southeast Experimental Farm, 1977.

Nitrogen Treatments [L2] lbs of Nitrogen added per acre	in the top 4 feet [L1]	leaf N. %	Silage N %	Silage[L3] Yield 1976 T/A	Nitrogen Contained in Crop lbs/A
0 (No P or K)	50	1.80	1.02	6.1	124
0	62	1.77	1.21	6.2	150
20	58	1.92	1.08	7.3	158
40	89	2.02	1.26	7.5	189
60	159	2.07	1.32	6.8	180
80[L4]	216	2.22	1.30	8.1	211
80[L5]	253	2.13	1.53	6.4	196
160	736	2.22	1.59	6.2	197
240	1019	2.27	1.68	6.7	225

L1 Samples taken in November 1976
L2 25# of P_2O_5 + 70# of K_2O broadcast on all but the 0 + 0 + 0 plots each year
L3 Silage calculated on a 60% moisture basis
L4 This treatment has been applied for 3 years
L5 This treatment has been applied for 8 years

Spring Wheat Breeding

D. L. Keim, G. B. Bucheneau and K. Sellers

Objective: To evaluate promising spring wheat lines developed by the breeding program at South Dakota State University.

Trial dimension: 50 entries, 3 replication, plots 5 feet wide x 25 feet long. Seeded 4-12-77, harvested 7-16-77.

Table 24. Varieties Tested in Breeders Yield Trial I Grown at Centerville in 1977.

Entry No.	Variety	Yield Bu/A	Test Weight lb/bu	Head Date June	Height (Inches)
29	ERA	40.6	60	9	23
27	PRODAX	38.1	58	8	25
47	OLAF	36.1	59	9	24
33	WALDRON	34.3	58	8	31
4	PROTOR	33.4	59	7	25
50	CHRIS	33.4	59	9	29
31	BTY309	32.3	60	10	26
49	ELLAR	31.6	60	9	31
32	BUTTE	31.4	62	8	33
48	KITT	30.9	58	10	22
45	EUREKA (SD 2185)	30.6	59	10	29
35	W.S. 25	27.3	58	8	25
1	POLK	23.8	60	10	27
46	W.S. 1809	17.4	58	9	25
	Average	30.4			
	LSD .05	8.2			
	C.V.	16.8%			

SEED PRODUCTION OF WARM SEASON GRASSES

James G. Ross and Burton Lawrensen

Breeder seed of summer switchgrass has been produced at the Southeast South Dakota Experiment Farm for a number of years. This has proven to be an excellent location for seed production of this variety. In 1977 invasion of the cool season grass, smooth bromegrass, as well as annual weeds, was controlled by burning in early May followed by application of 1.5 lb. of actual atrazine per acre. On the last week of May, 70 lbs. per acre of nitrogen (N) was applied since growth did not start until that time. Canadian thistles were controlled by spraying with 2,4-D throughout the summer. Seed was harvested in early October.

In June 1974, approximately one-fourth acre was seeded in rows 42 inches apart to breeders seed to an unreleased variety of big bluestem, SD42. This variety was selected from native collections made in southeastern South Dakota for forage and seed production. These rows were cultivated in 1975 and seed was harvested in October in following years for testing and possible later release. Big Bluestem, once the dominant native grass of eastern South Dakota, is now found only in small colonies along road ditches or sometimes in a native pasture which has not been overgrazed. Relict colonies of the highest forage producing plants are found in road ditches in favorable moisture conditions. These relicts are fast disappearing because of the efficiency of the road making equipment which effectively destroys all roadside vegetation. This wild grass is being domesticated by selection for high seed set mong these high forage yielding plants and also selection for lack of hairiness which makes the seed more easily processed. With improvement of these characteristics the splendid forage production of big bluestem should be available for use in a cultivated grass variety. SD43 has many of the desirable characteristics that will make big bluestem an acceptable domesticated grass.

RESIDUAL PHOSPHORUS - ALFALFA RESPONSE

P. Carson, B. Lawrensen, R. Gelderman, E. J. Williamson
J. Goos and R. Nettleton

Objectives

1. Determine the effect of different levels of available phosphorus on the yield of alfalfa.
2. Determine how long it takes a crop having a high phosphorus requirement to reduce the present levels of available phosphorus in the soil as measured by the Bray weak acid soil test.

Methods and Procedures

1. The experiment is located on an Egan silty clay loam South of the office building at the Southeast Experimental 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 effects of various rates of phosphorus (P) fertilizer on the yield of corn. From 1964 through 1967 four rates of P (10, 20, 40, and 80 lbs per acre of P) were broadcast and plowed down annually. No phosphorus has been broadcast on these plots since 1967. Each of the phosphorus treatments was divided into thirds with one-third receiving about 10 lbs of P as a starter fertilizer from 1964 through 1967, one-third receiving 10 lbs of zinc per acre in 1964 and 1965, and one-third receiving no additional fertilizer. It should be noted that the amounts of fertilizer applied are reported as lbs of P per acre. If you wish to convert the amounts of P to P_2O_5, divide the value by .44.
3. This land has been cropped to various crops since 1967; such as, soybeans, sorghum and oats. It is presently seeded to alfalfa. The experimental area was soil sampled in the Spring of 1973 and after the first cutting in 1977. The tests for available phosphorus for both years are reported in Table 25. The 1973 samples were taken to a depth of 12 inches and the 1977 samples were taken to a depth of 20 inches. The samples were taken in four inch increments both times.
4. The 1977 soil samples were also tested for available potassium and pH. The tests are summarized as follows:

	Fertilizer Treatments (lbs of available P added per acre) 0	40	80	160	320
Available K	723	834	720	764	775
pH	6.4	6.1	6.3	6.2	6.2
Available P	9	22	32	46	102

These tests indicate that the supply of available potassium is excellent and that the added phosphorus has had little if any effect on either the supply of available potassium or the pH of these soils.

5. Alfalfa has been grown on this site since 1973. The plots were seeded to Iroquois alfalfa in the spring of 1973.

   It was hoped that one or more cuttings could be harvested in 1973. Dry weather made it impossible to follow through with this idea. The north two alleys were seeded with Vernal. The south two replications were seeded at a higher rate of seeding than the north two replications. Balan was applied at the rate of 1.38 lbs of actual material per acre to control early weeds. The Balan did not control the weeds. This was probably due to the dry weather encountered just after seeding. By June 28th plants present varied all the way from just emerging to plants 12" high and blooming. Sweet clover, dandelions, wild oats, tan weed, lambsquarter, and pigeon grass were present. Tan weed and sweet clover were the only ones considered serious. The field was clipped to help control the weeds and to give the smaller seedlings a chance to become established.

   Two crops were harvested each year in 1974 and 1975. No Crop was harvested in 1976 because of the dry weather and 3 crops were harvested in 1977. The second and third crops in 1977 were very small. The samples for yield have been taken by mowing a 30" x 15' area with a small sickle type mower until the second and third cutting in 1977 when a selfpropelled forage harvester was obtained, which took a sample 54" x 15'. The hay was collected and weighed in the field. A sample was taken from each plot to determine moisture content at harvest time and to supply a plant sample for future analysis.

Results and Discussion

The reporting of the phosphorus soil tests from samples taken in 1973 and 1977 in Table 25. provides a means of observing the effect of the fertilizer phosphorus additions made 1964-1967 on the soil test levels in the soil and also the effect of four years of cropping on these soil test levels. In all cases, the soil test level was lowered by the four years of cropping.

These tests show that added fertilizer not only influenced the test values in 0-4" layer, but also had an effect on the tests from the 4-8" and 8-12" layers. The 1977 sampling depth was increased to 20 inches. The fact that the test values were not greatly affected in the area below 12" leads to the conclusion that the greater phosphorus tests in the soils of the 0-12" layer are due largely to mixing by cultivation. This land has been plowed to a depth of approximately 10 inches each time it has been plowed.

Comparing the average values for the 0-8" or the 0-12" layers (found at the bottom of Table 25.), for the 1973 and 1977 samplings provides an estimate of the reduction in soil test values due to 4 years cropping to alfalfa. The reduction in test values increases as the soil test values increase. The soil test values for the check

(0+0+0) plots are lowered 2 to 3 lbs of P whereas in the 0+360+0 lb plots it was reduced approximately 25 to 30 lbs of P. A yield increases from added phosphorus is noted for any amount of added P when that yield is compared to the yield of the 0+0+0 plots.

The effects of the different levels of available soil phosphorus on the yields of hay are reported in Table 26. These results are reported by cuttings and the total for the year. The first cutting in 1977 was average to a little below. It was about 2 tons per acre. The other 2 cuttings were small averaging about 3/4 of a ton per acre. This resulted in a total production of yields ranging from 5652 lbs per acre for the 0+0+0 treatment to 7902 lbs per acre for the 0+320+0 treatment. At these yield levels, there is no advantage for a soil test higher than approximately 25 lbs per acre of P.

The application of different rates of phosphorus fertilizer in 1964 through 1967 has established different levels of available phosphorus in the soil, as was shown in Table 25. The plotting of the yield data against the soil test Value (Figure 4) provides a measure of the effect of these soil tests on the production of alfalfa. This graph indicates that no yield increase is expected when the soil test value is 25#/A or greater. The very high test (95#/A) shows a yield increase above those at the 25 to 50 test level. This higher yield is not great enough to be considered practical. When the alfalfa was seeded, it was hoped that the production would be high so the crop would exert more pressure on the supply of available phosphorus. So far, this has not happened. A higher yield level may require higher soil test level for available phosphorus to support it.

Table 25. The Effect of Past Fertilizer Treatments on Soil Test Values for Lbs. of Available Phosphorus per acre[L1] on Samples Taken in 1973 and in 1977; Southeast Experimental Farm.

Starter & Zinc Trt. L3	Total lbs of P Added in Broadcast Application[L2]: 0 — Sampling Year 1973	0 — 1977	40 — Sampling Year 1973	40 — 1977	80 — Sampling Year 1973	80 — 1977	160 — Sampling Year 1973	160 — 1977	320 — Sampling Yr. 1973	320 — 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	13
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, and 80 lbs of P per year

L3 A No starter
B 10 lbs of P applied per year for four years (1964-1967) as a starter fertilizer
C Zinc added at the rate of 10 lbs of zinc per acre in 1964 and 1965
(L3 treatments applied to surface soil only)

Table 26. Effect of Levels of Available Soil Phosphorus on the Yield of Alfalfa Hay; Southeast Experiment Farm.

Treatments[L4]	Soil Test Value lbs of P/A[L1]	1st cut lbs of Hay/A	2nd cut lbs of Hay/A	3rd cut lbs of Hay/A	Total Hay Produced[L2]
	0-4" depth	0+0+0[L3]			
A 0 + 0 + 0	9	3560	1229	863	5652
B Starter P	12	4046	1393	892	6331
C Zinc	10	3877	1438	863	6178
		0+40+0			
A 0 + 0 + 0	22	4515	1623	1449	7587
B starter P	31	4284	1589	1198	7071
C Zinc	22	4495	1446	1152	7093
		0+80+0			
A 0 + 0 + 0	32	3734	2006	1075	6815
B starter P	34	4400	1818	1002	7220
C Zinc	27	4114	1563	1129	6806
		0+160+0			
A 0 + 0 + 0	46	4264	1782	1077	7123
B starter P	52	4413	1747	1064	7224
C Zinc	49	4113	1677	1229	7019
		0+320+0			
A 0 + 0 + 0	102	4607	1840	1455	7902
B starter P	97	4372	1898	1417	7687
C Zinc	95	4467	1816	1353	7636
Stat. Significance		ns	ns	ns	.05
C.V. %		8.71	16.2	25.28	9.9
LSD (.1) lbs/A					842
LSD (.05) lbs/A					1016
hsd lbs/A					1852

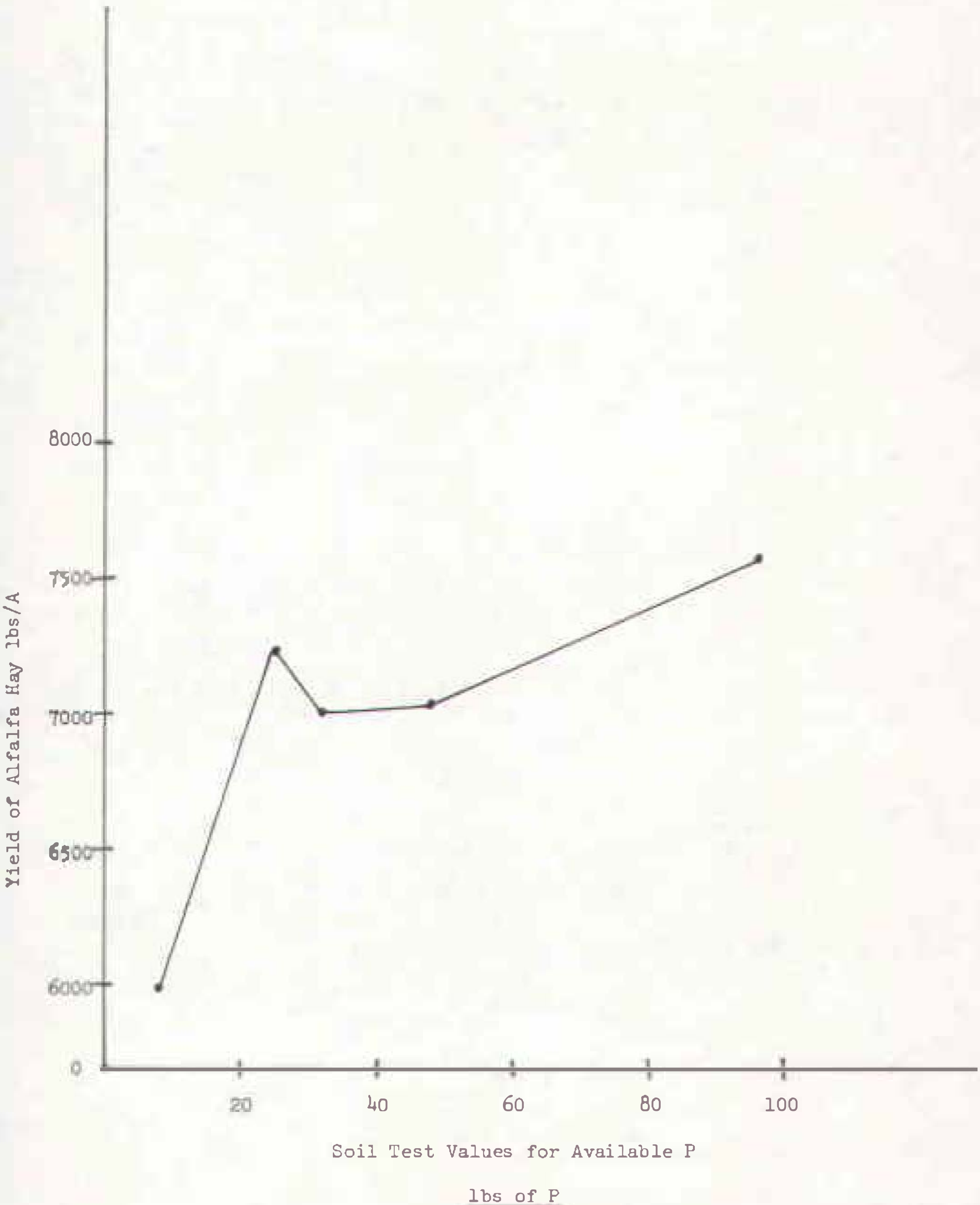
L1 Available phosphorus measured by the Bray#1 weak acid method. Dilution ratio of 1:7

L2 Yield measured as lbs of 12% moisture hay

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

L4 A = no starter fertilizer
B = 10 lbs of P_2O_5 applied per year as a starter fertilizer for four years (1964-1967)
C = zinc added at the rate of 10 lbs of zinc per acre in 1964 and 1965

Fig.4. The Effect of Soil Test Value on the Yield of Alfalfa Hay.
Southeast Experimental Farm, 1977.



STANDARD VARIETY SMALL GRAIN TRIALS

J. J. Bonnemann

Three spring small grain trials were seeded at the Southeast Experiment Farm in 1977 - - spring wheat, oats and barley.

The trials were seeded on April 11, 1977. It was soon evident that growth of the oats trials was being hurt. It was determined that an herbicide used on the prior crop, soybeans, was still in the soil and the oat trials were suffering from residual carryover. The oat trials were abandoned. Yields and quality were not exceptional as periods of stress occurred soon after seeding and shortly before harvest.

The data included in this report are bushels per acre, test weight and available several-year averages. The results are found in Tables 27,28.

CORN PERFORMANCE TRIALS

J. J. Bonnemann

A total of 80 corn hybrids, proprietary and experimental, were included in the 1977 corn performance trial at the Southeast Experiment Farm.

The corn was drilled in single rows, 32 feet long, 36 inches apart on May 16. Harvest was by picker-sheller on October 20, 1977. Two seeding rates were established with final count of 13,615 and 16,905 plants per acre. As no statistical significance was found for one population over the other, the yield reported is the mean of the two populations.

The mean yield of the trial was 88.8 B/A. A brief period of stress was noted in July that depressed yields to some extent. Stalk lodging was higher than usual, partially caused by borer damage and also excessively high winds shortly before harvest. The average moisture was 21.8% for all entries.

The results are presented in Table 29. Additional information will be found in an upcoming circular, 1977 Corn Performance Trials.

Table 27. 1977 Standard Variety Spring Wheat Trial

Variety	Beresford S.D. Bushels per acre 1975	1976	1977	3 yr.	T. W. 1977	3 yr.
Standard						
Fortuna	14.0	26.7	23.3	21.3	57	56
Chris	14.7	20.9	20.0	18.5	57	55
Waldron	16.6	25.0	26.6	22.7	55	54
Tioga	14.5	24.4	16.4	18.8	57	55
Ellar	15.2	25.1	21.2	20.5	54	54
Butte		21.4	10.8		55	
Semi-dwarf						
Era	17.8	25.1	23.0	22.0	58	55
Bonanza	15.0	23.9	14.6	17.8	53	55
WS 1809	17.0	27.7	26.4	23.7	56	56
Bounty 208		23.8	17.3		56	
Olaf	15.1	28.0	26.4	23.2	57	57
Kitt	15.2	22.7	30.1	22.1	57	55
Bounty 309	17.1	24.7	26.3	22.7	55	56
Profit 75	13.1	23.4	19.9	18.8	57	56
Prodax	17.3	21.6	35.9	24.9	56	54
Protor	14.8	23.1	26.2	21.4	58	57
Funks W444			20.1		55	
WS 25		22.5	20.7		57	
Durums						
Rolette	14.4	23.1	34.8	24.1	61	59
Ward	17.4	22.0	27.6	22.3	60	58
Crosby	20.0	22.5	33.4	25.3	61	59
Rugby	18.9	28.2	31.2	26.1	60	59
Botno	19.2	23.4	34.4	25.7	60	58
Cando (semi)		22.2	27.8		59	
Mean, B/A			25.0			
CV - %			19.3			
LSD (.05)			7.8			

Table 28. Standard Variety Barley Trial

Variety	Bushels per Acre 1975	1976	1977	3 yr.	T. W. 1977	3 yr.
Liberty	29.5	48.1	34.6	37.4	41	43
Firlbecks III	31.1	43.4	37.9	37.5	49	46
Larker	31.3	41.4	27.4	33.4	36	42
Primus II	35.6	41.7	26.9	34.7	41	45
Bonanza	37.1	32.2	22.6	30.6	40	41
Prilar	30.5	41.1	25.4	32.3	37	42
Beacon	32.3	39.8	25.3	32.5	36	40
Manker	33.5	30.4	16.3	26.6	37	42
Mean, B/A			28.2			
CV - %			21.4			
LSD (.05)			8.6			

Table 29. - 1977 Corn Performance Trial, Southeast Experiment Farm, Beresford,S. Dak.

Brand & Variety	Type & Cross	Yield B/A	Percent Root Lodged	Percent Stalk Lodged	Percent Moisture
Cargill 920	2 X	117.65	0.7	16.1	21.7
Cenex 2333	2 X	115.56	0.0	28.8	20.2
Funks G-4449	2 X	104.11	2.2	10.1	23.0
Mc Curdy 76-93	2 X	103.35	0.0	15.2	22.0
Sdaes Check =1	2 X	101.57	0.0	6.4	24.4
Funks G-4445	2 X	101.23	3.8	27.5	21.8
Funks G-4503	2 X	99.51	0.8	10.6	25.3
Pioneer 3388	M2 X	98.97	0.0	8.4	22.2
Trojan TXS 111	2 X	97.57	0.0	6.7	21.6
P-A-G 314	2 X	96.70	0.0	8.0	24.3
Northrup-King PX 48	2 X	95.79	0.0	25.6	22.7
Pride R-793	3 X	95.57	0.7	7.3	23.9
Trojan TXS 108A	M2 X	95.40	0.0	8.3	21.3
Northrup-King PX 585	3 X	94.85	0.0	13.4	19.9
Mc Curdy 76-94	2 X	94.74	0.7	23.4	21.1
Trojan TXS 115A	2 X	94.68	0.0	5.8	25.5
Mc Curdy 76-74	2 X	93.86	0.0	7.0	25.5
Cargill 890	M2 X	93.71	0.0	18.4	21.5
Acco UC 6601	2 X	93.43	0.0	15.2	22.2
Disco SX 26A	2 X	93.29	0.0	11.2	19.7
Northrup-King PX 74	2 X	92.76	0.0	5.1	24.8
Pioneer 3709	M2 X	92.65	0.0	6.5	19.9
Mc Curdy MSX 84	2 X	92.45	0.7	3.6	24.7
Payco SX 990	2 X	92.42	0.0	14.0	21.6
Funks G-4507	2 X	92.35	0.7	6.6	24.8
Pride 7715	2 X	92.04	0.0	2.2	25.0
Sokota TS-74	2 X	91.77	0.0	8.2	20.7
Mc Curdy MSX 60	2 X	91.77	0.0	6.4	22.9
Asgrow RX61A	2 X	91.58	0.0	21.3	17.7
Cargill 863	M2 X	91.58	3.9	25.0	20.1
Cenex 2201	2 X	91.34	0.0	13.5	20.7
Northrup-King PX 606	3 X	91.12	0.0	10.1	22.7
Mc Curdy MSX 50	2 X	91.04	0.7	5.0	20.2
Wilson 1016	2 X	90.93	3.1	35.2	21.8
P-A-G SX 424	2 X	90.66	0.0	14.6	21.3
Master Farmer MF 114	2 X	89.88	0.7	6.6	26.2
Asgrow RX 58	2 X	89.88	0.0	27.6	21.9
Northrup-King PX 46	2 X	89.77	0.0	16.0	19.7

Table 29. Continued

Brand & Variety	Type & Cross	Yield B/A	Percent Root Lodged	Percent Stalk Lodged	Percent Moisture
Fontanelle 450SC	2 X	89.33	0.0	5.9	22.8
Curry SC-147	2 X	89.23	0.0	6.8	22.9
Sokota TS-82	2 X	89.17	0.0	3.6	25.7
YW 49	2 X	88.39	2.2	4.3	20.5
Acco UC 3301A	2 X	88.06	1.5	28.6	22.8
Wilson 1400	2 X	87.95	0.7	2.2	20.5
Kaltenburg KX 68	2 X	87.58	0.0	6.6	19.3
Pride R-803	3 X	87.55	0.7	7.9	22.1
Green Acres L17	4 X	87.06	0.0	13.0	23.3
Disco SX 27	M2 X	87.00	0.0	14.8	23.7
Fontanelle 440Asc	2 X	86.96	0.0	10.0	21.1
Cenex 2300	2 X	86.92	0.8	20.6	20.3
Payco SX 865	2 X	86.56	3.4	21.0	22.6
YW 48C	M2 X	86.06	0.0	7.0	19.9
Payco 3X 811	3 X	85.99	0.0	6.1	19.6
P-A-G SX 397	2 X	85.66	0.7	21.0	21.1
Fontanelle 400 SC	2 X	84.99	0.8	26.9	22.1
Curry SC0145-1	2 X	84.57	0.0	5.1	20.1
Acco UC 3301	2 X	84.28	0.8	34.9	22.4
Pride R-777	3 X	84.16	0.7	11.7	22.9
Green Acres 7723	4 X	84.01	0.0	11.9	22.5
Mc Curdy MSX 42	2 X	83.93	0.0	23.3	21.0
Asgrow RX 2345	2 X	83.49	0.0	17.2	16.8
Disco SX 30	2 X	83.46	0.0	9.1	24.5
Curry TC-348	3 X	83.28	0.0	9.4	23.3
Sokota SK-79	3 X	83.19	0.8	7.9	24.1
Trojan TXS 102	2 X	82.67	0.0	26.5	22.3
Master Farmer MF 94	2 X	82.26	0.0	7.3	18.9
Funks G-4444A	2 X	82.25	0.7	22.4	22.3
Green Acres M 414	4 X	82.07	0.0	16.4	23.6
Sdaes Check =2	2 X	81.31	0.8	25.4	22.4
Funks G-4321	2 X	81.16	0.0	27.6	20.4
Green Acres 447	M3 X	81.06	0.0	9.0	22.2
Cenex 3139A	3 X	80.54	0.0	10.7	20.2
Master Farmer MF 100	3 X	79.24	0.8	22.2	20.6
Northrup-King PX 65	2 X	78.37	0.0	8.1	20.6
YW 35A	M2 X	76.35	0.9	10.3	16.0
Green Acres 774C	4 X	76.11	0.0	16.3	26.2

Table 29. Continued

Brand & Variety	Type & Cross	Yield B/A	Percent Root Lodged	Percent Stalk Lodged	Percent Moisture
Master Farmer MF 105	2 X	70.74	0.0	27.6	22.3
Master Farmer MF 92	3 X	70.46	0.0	8.8	18.1
SDAES Check =3	2 X	69.35	0.0	14.3	16.8
YW 490	3 X	67.05	0.0	6.1	20.5
MEANS		88.8		13.6	21.8

GRAIN SORGHUM TRIALS

J. J. Bonnemann and G. W. Erion

Thirty entries, proprietary and public, were included in the 1977 grain sorghum performance trial at the Southeast Experiment Farm. The trial was seeded on May 24 and harvested September 26. The row spacing was 36 inches. A recommended herbicide and insecticide was used at seeding for weed and insect control.

Yields were excellent and the test weight and quality very good. The mean yield of the trial was 5970 pounds per acre. The period of stress that hurt the corn trials in mid-July apparently had little effect on the grain sorghum trials.

The 1977 trial results appear in Table 30. This and additional data will appear in an upcoming circular, 1977 Grain Sorghum Performance Trials.

Table 30. 1977 Grain Sorghum Performance Trial, Area E, Southeast Experiment Farm, Centerville, Clay County, South Dakota

Brand & Variety	Yield lb/A	Test Wt. lb/B	Height, inches	Percent Moisture 9/19/77	Date Headed
DeKalb C-42a+	7025	59	48	23.6	7/25
P-A-G 4432	6905	59	46	22.0	7/21
Trojan M 56G	6670	60	50	33.9	7/30
ACCO R 1019	6635	60	45	27.5	7/24
DeKalb X-748	6625	59	48	27.8	7/24
Northrup-King NK 1580	6470	61	42	17.4	7/18
Growers 1180	6440	61	47	23.9	7/28
ACCO GR 1028(GBR)	6235	58	46	30.4	7/24
Growers 1210A	6220	60	49	26.3	7/26
Growers E 110	6155	61	44	19.0	7/18
Northrup-King NK 180	6150	60	46	16.5	7/19
ACCO R 1014	6100	57	44	22.1	7/21
DeKalb B-35	6030	59	43	20.6	7/20
ACCO GR 1018(GBR)	6005	59	47	30.0	7/24
DeKalb B-38+	6000	59	46	21.0	7/19
Pioneer 8790	5955	59	41	17.6	7/19
Trojan M 55G	5890	60	52	27.3	7/25
Pioneer 8592	5810	61	47	23.9	7/22
Warner W-561T	5780	60	49	23.6	7/25
SDAES RS 610A	5690	60	49	32.6	7/24
Asgrow Bug-Off E	5680	56	50	27.0	7/24
Trojan M 54	5665	60	44	19.1	7/19
Pioneer 8712	5650	60	42	20.8	7/18
Northrup-King NK X3207	5615	55	37	15.3	7/17
Warner W-601T	5590	57	53	24.0	7/25
SDAES RS 506	5490	59	54	29.5	7/18
SDAES RS 455	5445	59	50	17.7	7/14
SDAES NB 505	5364	60	45	16.6	7/18
SDAES SD 106	5110	57	39	16.4	7/15
SDAES SD 104	4740	58	38	19.1	7/14
Mean	5970				
LSD (.05)	90		CV - 8.5%		

SOYBEAN PERFORMANCE TESTING

J. J. Bonnemann and G. W. Erion

Two soybean trial sites are located in Southeastern South Dakota for testing of Group II and Group III Northern Uniform and Northern Uniform Preliminary Tests as well as standard varieties and proprietary entries. The proprietary entries are included for a nominal fee to partially off-set trial costs.

The trials were seeded at Elk Point and the SE Farm on May 20 and May 24, respectively. Harvest was on October 25 and 26 at the SE Farm and Elk Point, respectively.

Yields at the SE Farm were good to excellent while yields at Elk Point were not quite as good. Precipitation was more limited in the Elk Point area and possibly reduced the yield potential. Some of the later maturing entries were delayed in maturing by the cooler temperatures of August, September and October.

Corsoy, Wells and Harcor have the best yield records of the Group II standard varieties at Centerville. Wayne has the best yield record of the Group III varieties. Several proprietary lines have performed well also. In 1977 the later varieties or entries were favored by the lateness of the season and longer growing period at the SE Farm.

At Elk point the Group III varieties have the higher yield record for a period of years. The long season also favored the later maturing proprietary entries at Elk Point in 1977 but normal date of freezing may have found many very green.

The yield results of the trials are shown in Tables 31,32 for Centerville and Elk Point, respectively. Results of all performance trials are available in Plant Science Pamphlet #36, 1977 Soybean Performance Trials.

Table 31. 1977 Soybean Performance Trial, Southeast Experiment Farm, Beresford, SD

Identification of Entries[1]			1977 Field Data: Maturity Date (mo.-day)	Plant Height (inches)	Poten. Shatter Loss[4]	100 seed wgt. (grams)	Average yield in Bu/acre: 1974	1975	1976	1977	1974-77	1976-77
Standard Varieties:												
Entry	Maturity Group[2]	Days to Mature[3]										
M68-49	0	+ 3	9-19	30	1	17.7				47.9		
Hodgson	I	+ 6	9-20	33	1	13.1	22.5	32.7	9.7	46.1	27.7	27.9
Corsoy	II	+10	9-21	37	1	12.8	26.9	33.4	10.4	49.1	29.9	29.7
Hark	I	+11	9-21	34	1	16.7	23.9	28.8	11.6	44.1	27.1	27.8
Coles	I	+11	9-21	38	1	17.3		16.0	49.0			32.5
Wells	II	+14	9-21	38	1	15.7	25.2	32.3	27.9	49.7	31.3	33.8
Harcor	II	+12	9-22	39	1	13.1	25.3	33.9	13.1	54.7	31.7	33.9
Beeson	II	+17	9-26	37	1	18.7	21.9	32.2	13.9	48.9	29.2	31.4
Amsoy 71	II	+15	9-27	40	1	15.0	25.2	32.5	14.4	49.1	30.3	31.7
A73-25050	II	+16	9-28	38	1	17.6				58.9		
Marion	II	+18	9-28	35	1	23.3				61.6		
[5] Wayne	III	+24	10-4	40	1	17.9	26.4	30.3	21.1	48.0	31.4	34.5
Woodworth	III	+25	10-5	40	1	14.8	21.9	32.4	12.5	49.8	29.1	31.1
Proprietary Entries:												
Brand	Entry											
Peterson-Pioneer	118-11		9-19	31	1	14.5			11.4	51.0		31.2
Pfizer-Clemens	12 E (B)		9-19	33	1	12.9				49.1		
Pfizer-Clemens	CX 155		9-20	36	1	13.1				45.6		
Pfizer-Clemens	CB 188 (B)		9-20	38	1	12.7				48.2		
Pfizer-Clemens	CX 282		9-20	34	1	14.4				48.3		
FFR	1117		9-21	33	1	15.7				49.2		
Peterson-Pioneer	3100 (B)		9-21	37	1	15.0		36.9	13.7	50.1		31.9
Pfizer-Clemens	CX 114		9-21	39	1	13.6				51.0		
Pfizer-Clemens	CX 175		9-21	37	1	12.8				54.9		
SRF	200		9-22	36	1	13.3	27.8	35.3	17.4	45.0	31.4	31.2

Table 31(continued). Beresford, SD

Peterson-Pioneer	105P (B)	9-22	39	1	13.7		36.5	13.4	49.6		31.5
Peterson-Pioneer	2477	9-22	38	1	14.7				51.7		
Pfizer-Clemens	2ER-75 (B)	9-22	39	1	13.8				50.7		
SRF	150P	9-23	39	1	13.8				53.3		
Northrup, King	S 1474	9-24	37	1	15.5	25.3	34.5	17.8	52.9	32.6	35.3
Northrup, King	Multivar 51(B)	9-24	36	1	15.7		37.0	15.5	56.0		35.7
Pride	B 216	9-24	36	1	15.5		34.8	9.5	55.0		32.2
Pride	PK 205 (B)	9-24	39	1	14.5				46.6		
Pride	PK 305 (B)	9-24	39	1	15.6				53.4		
Pfizer-Clemens	CX 276	9-24	38	1	16.2				51.1		
Pfizer-Clemens	E23-14	9-25	37	1	19.0				49.9		
Pfizer-Clemens	E94-7	9-26	37	1	19.4				50.4		
Northrup, King	S 1492	9-26	34	1	15.0			10.0	51.5		30.7
FFR	224	10-2	35	1	16.5				54.2		
FFR	1050	10-3	35	1	17.7				50.1		
Coyote	HK 73	10-4	39	1	17.1				50.8		

Mean, B/A	50.7
CV - %	12.1
LSD (.05)	N.S.

1 - Listed in order of Maturity in 1977

2 - Maturity Group from USDA classification: I=early, II=mid-season, III=late at Beresford

3 - Expected relative maturity at this site compared to Swift when not exposed to a killing frost.

4 - Shattering potential: 1=no loss, 2= up to 5%, 3=5-10%, 4=10-20%, 5= 20% or more.

(B)=blend

Table 32. 1977 Soybean Performance Trial, Ed Curry, Cooperator, Elk Point, SD

Identification of Entries[1]			1977 Field Data					Average yield in Bu/acre				
			Maturity Date (mo-day)	Plant Height (inches)	Poten. Shatter Loss	100 seed wgt.	1974	1975	1976	1977	1974-77	1976-77
Standard Varieties:												
Entry	Maturity Group[2]	Days to Mature[3]										
Hark	I	+11	9-21	41	1	15.1	35.6	37.0	22.3	36.7	32.9	29.5
Corsoy	II	+10	9-22	43	1	14.1	39.7	43.1	31.4	38.2	38.1	34.8
Coles	I	+11	9-23	42	1	16.5			23.3	38.2		30.7
Amsoy 71	II	+15	9-23	46	1	16.1	35.3	36.3	33.1	36.6	35.3	34.8
Wells	II	+14	9-23	42	1	15.8	35.8	39.7	36.3	37.1	37.2	36.7
Beeson	II	+17	9-26	43	1	19.3	35.9	38.9	30.9	34.7	35.1	32.8
A73-25050	II	+16	9-27	39	1	16.1				40.5		
Woodworth	III	+25	9-29	43	1	15.9	37.4	35.5	40.4	37.4	37.7	38.9
Wayne	III	+24	10-1	44	1	17.5	36.9	31.0	43.7	37.1	37.1	40.4
Calland	III	+27	10-1	43	1	18.5	36.3	31.5	39.5	39.5	36.7	39.5
Williams	III	+28	10-3	44	1	18.3	38.2	29.7	37.5	36.3	35.4	36.9
Union (L21)	III	+28	10-5	45	1	18.1			37.8	32.5		35.1
Proprietary Entries												
Brand	Entry											
Prizer-Clemens	CX 114		9-21	41	1	13.9			31.3	38.5		34.9
Land O'Lakes	GO-42		9-21	33	1	15.7	36.5	45.0	35.7	40.7	39.5	38.2
FFR	1117		9-21	37	1	15.4				34.6		
Asgrow	A 2575		9-22	42	1	14.9				36.0		
Peterson-Pioneer	2477		9-22	42	1	15.2				35.1		
Pfizer-Clemens	2ER-75 (B)		9-22	44	1	15.2			29.0	49.1		34.5
Pfizer-Clemens	12 E (B)		9-22	40	1	16.2				39.9		
Pfizer-Clemens	CX 282		9-22	37	1	15.3				29.1		
Pfizer-Clemens	CB 188 (B)		9-22	42	1	13.9				32.5		
Pfizer-Clemens	CX 155		9-22	41	1	14.3				37.9		
Pfizer-Clemens	CX 175		9-22	42	1	14.0				36.5		
Pfizer-Clemens	E23-14		9-22	40	1	17.7				33.9		
Land O'Lakes	GO-44		9-23	43	1	13.7				37.0		
Peterson-Pioneer	3100 (B)		9-23	41	1	14.8		39.1	38.5	32.4		35.4
Peterson-Pioneer	105P (B)		9-23	45	1	15.1		39.0	35.6	38.0		36.8

Table 32 (continued). Elk Point, SD

Northrup, King	S 1492	9-23	39	1	15.2			26.4	42.7		34.5
Asgrow	A 2440	9-24	40	1	14.2			38.8	39.9		39.4
Asgrow	A 2656	9-24	42	1	17.2		40.6	38.4	33.7		36.0
Land O'Lakes	Dixon	9-25	41	1	14.5	39.8	42.8	39.9	37.4	38.0	38.6
Northrup, King	S 1474	9-26	40	1	16.2	34.3	45.4	43.5	36.1	39.8	39.8
Northrup, King	Multivar 51(B)	9-26	43	1	16.4		38.9	38.8	38.9		38.8
Northrup, King	Multivar 61(B)	9-26	44	1	17.4				39.1		
Peterson-Pioneer	2877	9-26	43	1	15.6				39.5		
Pfizer-Clemens	CX 276	9-26	45	1	16.9				38.2		
Pfizer-Clemens	E94-7	9-26	41	1	19.3				36.0		
Asgrow	A 3001	9-29	44	1	20.2				41.2		
FFR	1050	9-29	37	1	17.8				37.2		
Sexauer	SX 28	9-29	39	1	15.9			34.6	41.6		38.1
FFR	224	10-1	40	1	17.2				39.5		
Sexauer	SX 32	10-7	45	1	15.9			42.9	38.5		40.7

Mean, B/A	37.2
CV - %	14.2
LSD (.05)	N.S.

1 - Listed in order of Maturity in 1977
2 - Maturity Group from USDA classification: I&II= early to mid-season
III=full season to late at Elk Point
3 - Expected relative maturity at this site compared to Swift when not exposed to a killing frost.
4 - Shattering potential: 1=no loss, 2=up to 5%, 3=5-10%, 4=10-20%, 5=20% or more.
(B) = Blend

PERFORMANCE OF HERBICIDES IN CORN AND SOYBEANS

W. E. Arnold and L. J. Wrage

Herbicide demonstration plots make it possible to compare labeled herbicide treatments available to growers. These demonstration plots are used primarily for observation purposes by tour groups or individuals throughout the season. The plots are also evaluated for weed control. The treatments are based on results obtained in previous years' screening tests.

Methods

The plot area was fall plowed and tandem disked and harrowed in the spring. The soil was fine and firm. Preplant and preemergence treatments were applied on the corn and soybean plots on May 18. Post-emergence treatments were applied June 7. All herbicides were applied with a plot sprayer using 20 gpa water. Preplant treatments were incorporated immediately with two tandem diskings set to cut 5-6 inches deep (except Cobex--3-4 in.) and harrowed. Pioneer 3709 corn or Corsoy soybeans were planted in 30 inch rows on May 18. Rainfall occurred the day after planting, totaling nearly two inches within 5 days after planting.

Weed pressure was moderate. Annual grasses included green and yellow foxtail. Annual broadleaves most common were rough, smooth and prostrate pigweed and lambsquarters. The plots were not cultivated.

Results

The performance of corn and soybean herbicide treatments in 1977 is presented in the following tables. A 3-year (1975, 76, 77) average is included as a measure of consistency. Plots were evaluated June 30. Visual weed control estimates reported are an average of ratings made at two locations in each plot.

Several herbicide treatments provided outstanding weed control as many treatments provided over 95% control. Combination or overlay treatments provided a high degree of grass and broadleaved weed control. The excellent performance can be attributed to several factors that were highly favorable for soil-applied herbicides. The soil was fine, level and tilled just prior to treatment. Ample rain fall was received soon after application. The weed species present are considered to be susceptible to many of the herbicides. Differences in broadleaved control would be greater if more troublesome broadleaved weeds such as velvetleaf or cocklebur would have been present. General weed control would have been reduced if the soil would have been lumpy or covered by plant residue or if rainfall had been less or delayed for several days after treatment.

Table 33. Corn Herbicide Demonstration Plots, 1977

Treatment	lb/A a.i.	Percent Weed Control 6/30/77 Gr	Percent Weed Control 6/30/77 Bdlf	3-Yr. Avg. Gr	3-Yr. Avg. Bdlf
PREPLANT INCORPORATED					
Check	--	0	0	0	0
Eradicane	4	99	90	98	92
Eradicane + Atrazine	4 + 1	99	99	--	--
Eradicane + Bladex	4 + 1½	98	99	--	--
Sutan+	4	82	78	90	79
Sutan+	6	95	75	--	--
Sutan+ + Atrazine	4 + 1	94	99	95	98
Sutan+ + Bladex	4 + 1½	96	95	92	95
AAtrex/Atrazine	2½	78	99	87	99
Check	--	0	0	0	0
PREEMERGENCE					
AAtrex/Atrazine	2½	75	99	78	96
Bladex	3	92	96	90	91
Ramrod/Bexton/Propachlor	5	98	90	98	86
Lasso	3	99	98	99	92
Dual	3	99	98	--	--
Prowl	2	90	95	92	90
Lasso + Atrazine	2 + 1	99	99	99	99
Lasso + Bladex	2 + 1½	99	99	98	99
Lasso + Banvel	2 + ½	99	98	98	98
Dual + Atrazine	2 + 1	99	98	--	--
Prowl + Atrazine	1½ + 1	93	99	--	--
Prowl + Bladex	1½ + 1½	94	99	--	--
Prowl + Banvel	1½ + 3/8	90	96	--	--
Ramrod + Atrazine	4 + 1	99	99	98	99
POST-EMERGENCE					
Atrazine + oil	1½ + 1	60	99	73	98
Bladex	1½	84	98	80	94
(Ramrod-pre)& 2,4-D amine	½	99	99	--	--
(Ramrod-pre)& Banvel	¼	98	99	--	--
(Ramrod-pre)& 2,4-D + Banvel	½ + ¼	99	99	--	--
Check	--	0	0	0	0

Gr = annual grasses
Bdlf = annual broadleaved weeds

Table 34. Soybean Herbicide Demonstration Plots, 1977

Treatment	lb/A a.i.	Percent Weed Control 6/30/77 Gr	Bdlf	3-Yr. Avg. Gr	Bdlf
PREPLANT INCORPORATED					
Check	--	0	0	0	0
Treflan	3/4	86	83	93	86
Cobex	½	87	84	93	86
Tolban	1	89	84	94	85
Basalin	1	89	85	--	--
Prowl	1½	87	85	--	--
Vernam	2½	85	84	89	81
Treflan + Sencor/Lexone	3/4 + 3/8	88	86	94	90
Treflan + Sencor/Lexone	3/4 + ½	80	75	--	--
PREPLANT INC. AND PRE					
Treflan & Sencor/Lexone	3/4 & ½	97	97	98	97
Treflan & Sencor/Lexone	3/4 & 3/8	96	96	--	--
Treflan & Lorox	3/4 & 1	87	85	94	91
Treflan & Modown	3/4 & 2	91	97	96	97
PREPLANT INC. AND POST					
Treflan & Basagran	3/4 & 1	86	91	93	92
Check	--	0	0	0	0
PREEMERGENCE					
Amiben	3	94	93	95	87
Lasso	3	99	96	98	85
Lasso + Sencor/Lexone	2 + ½	99	99	97	94
Lasso + Maloran	2 + 1½	98	99	--	--
Lasso + Lorox	2 + 1	96	96	96	89
Lasso + Modown	2 + 2	97	95	--	--
Lasso + Amiben	2 + 2	97	97	--	--
Lasso + Preemerge	2 + 4½	91	86	94	84
Lasso + CIPC	2 + 3	96	96	--	--
Antor	3	94	20	--	--
Modown	2	25	95	52	92
Sencor/Lexone	½	84	90	87	93
PREEMERGENCE & POST					
Lasso & Basagran	2 & 1	99	98	--	--
Lasso & Dynap	2 & 4½	96	93	--	--
Check	--	0	0	0	0

Gr = annual grasses
Bdlf = annual broadleaved weeds

FOLIAR FERTILIZATION OF SOYBEANS

R. Jay Goos, P. Carson, F. Shubeck, B. Lawrensen

Introduction

Work in other states has shown that soybean yields were increased by spraying N, P, K, and S fertilizer on the plant foilage during the seedfilling stages of growth. The 1976 experimental work in South Dakota using this approach did not produce yield increases. Four soybean foliar fertilization experiments were established at the Southeast Farm in 1977. The purpose, methods and results of each experiment will be discussed separately.

The four experiments were located at the same site on a Viborg silty clay loam. Viborg soils are deep, moderately well drained soils formed from silty materials over glacial till. The soil test values for the experimental area were as follows:

Texture	Organic Matter	Lbs/Acre P	lbs/Acre K	pH	E.C.
Silty clay loam	3.7% (high)	35 (high)	770 (high)	6.6 (slightly acidic)	1.7 (nonsaline)

These tests are all high, so soil fertility should not be a limiting factor in plant growth.

The row width was 30 inches. Herbicide used in all experiments was Lasso II banded. Weeds were not a factor in the growth of these soybeans. All spray applications were made after 6:00 P.M. or before 9:00 A.M.

I. Foliar fertilization Variety Trial

Objective

1. Determine the response of soybean varieties to foliar fertilization.

Methods

1. Six varieties commonly grown were treated with foliar fertilizer. These varieties were: Hodgson, Harcor, Corsoy, Wells, Wayne, and Calland.
2. Split-plot design with 3 replications was used. Half of each plot received three equal (25 gallons of solution each time) applications of foliar fertilizer. Total nutrient application per acre (sum of all three applications) was 70 lbs of N, 17 lbs P_2O_5, 28 lbs of K_2O and 4 lbs of S.
3. Source of nutrients was urea, potassium polyphosphate, and potassium sulfate. Tween 80 surfactant was added at 0.1%.
4. The first application was made on each variety when tiny seeds were beginning to form at the top four nodes of the

plant (growth stage R5)*, and at weekly intervals until three applications had been made.

Results

The effect of foliar fertilization of six soybean varieties is presented in Table 35. All experiments have experimental error. The experimental error is estimated by the Least Significant Difference (LSD). Differences between treatments were not as great as the LSD value. Since the difference in yield due to treatments are less than the LSD, it is concluded that application of foliar fertilizer did not increase the yield of any of the varieties used in this experiment in 1977 at this location.

II. Foliar Fertilizer Formulation Trial

Objectives

1. Determine if source of nutrients makes a difference in foliar fertilizer yield response.
2. Determine if source of nutrients makes a difference in the amount of leaf burn induced.

Methods

1. Three different foliar spray solutions were mixed. Each had an analysis of 10% N, 2.4% P_2O_5, 4.0% K_2O, and o.6% S.
2. Nutrient materials used were:
   Formula -1- urea, potassium polyphosphate, potassium sulfate.
   Formula -2- urea, potassium nitrate, 11-37-0 liquid, ammonium sulfate.
   Formula -3- urea, 11-37-0 liquid, ammonium sulfate, and potassium chloride.
   All three formulas contained .1% Tween 80 surfactant.
3. Three applications rates were used for each spray application: 0, 25, and 37.5 gallons per acre. This level of spraying was repeated twice, so every plot received a total of 0, 50, or 75 gallons per acre of each of the formulas 1, 2, or 3.
4. The first application was made when the plants were in growth stage R5, and the second application was made a week later.
5. Randomized complete block design with three replications was used.
6. Leaf burn was measured by visual rating.
7. The soybean variety used was a Corsoy/Chippewa 64 blend.

Results

The effect of three foliar fertilizer formulations on soybean yields is presented in Table 36. The effects of the three formulations on yield were similar. The rates of the three formulations did not increase the yields. All differences in yield were less than the estimated experimental error.

* Fehr, W. R., et al. 1971, Stage of Development descriptions for soybeans Crop Science 11: 929-931.

All the formulations induced equal amounts of leaf burn. The first 25 gallon per acre caused death of less than 2% of the leaf tissue and the 37.5 gallon per acre application caused less than 5% leaf area injury.

III. Sucrose Additive Trial

Objectives

1. Determine if sucrose reduces leaf burn when used as a foliar fertilizer additive.
2. Determine if sucrose promotes yield response to foliar fertilization.

Methods

1. Three rates of foliar fertilization and three rates of sucrose additive were compared in a 3 X 3 factorial experiment.
2. The three fertilizer rates were: 0, 25, and 50 gallons/Acre applied at each time of application.
3. The three sucrose rates were: 0, 25, and 50 pounds per acre dissolved in the liquid fertilizer.
4. Fertilizer analysis was 10-2.4-4.0-.6. Sources of nutrients were urea, potassium polyphosphate, and potassium sulfate. Tween 80 was the surfactant at .1%.
5. The above rates of fertilizer were applied at each of two application dates. Thus, every plot received 0, 50 or 100 gallons per acre of foliar fertilizer and either 0, 50, or 100 lbs per acre of sucrose.
6. The cultivar was a Corsoy/Chippewa 64 blend. This experiment was replicated 4 times.
7. Leaf burn was estimated with a visual rating.

Results

The effect of foliar fertilization and sucrose on leaf burn is shown in Table 37.

Sucrose reduced leaf burn, from 12.5 to 7.5% at the 50 gallon per acre rate and from 32.5 to 18.8% at the 100 gallon rate. No significant yield boost was evident from the sucrose treatments as shown in Table 38.

The heaviest fertilizer rate significantly depressed yields, as shown in Table 39. This was due to the amount of leaf burn induced.

Sucrose does reduce leaf burn, as has been shown in other studies. However, the burn-reducing qualities of sucrose do not promote foliar fertilization yield response.

IV. Yield Increase Trial

Objective

1. To determine if a soybean yield increase to foliar fertilizer can be detected.

Methods

1. All other foliar fertilization experiments at the Southeast Farm have looked at yield of foliar fertilizer with other factors (varieties, formulations, or additives). This experiment used the most successful treatments developed at other universities and was replicated 12 times to minimize experimental error.
2. The treatments were as follows:

Treatment No.	gallons/Acre of foliar fertilizer applied On the 1st application	on the 2nd application
1	0	0
2	25	0
3	0	25
4	25	25

3. Fertilizer analysis 10-2.4-4.0-.6. Source of nutrients was: urea, potassium polyphosphate, and potassium sulfate. The surfactant was .1% Tween 80.
4. Soybean variety was a Corsoy/Chippewa 64 blend.
5. The first application was made when the plants reached growth stage R5, and the second application was made a week later.
6. Randomized complete block design was used.

Results

The effect of foliar fertilization of soybeans is found in Table 40. The calculated experimental error (2.3 Bu/Acre) was quite low. Treatment 2 did give a statistically significant yield boost of 3.2 bushels per acre, or, approximately a 10% yield increase. It is not known why only treatment 2 gave a yield response.

It should be remembered that this response was not achieved in other experiments, and that the magnitude of this response was not large enough to pay for this treatment.

Summary

Six foliar fertilization of soybeans experiments were conducted in 1976 and 1977. Five of those experiments showed no yield benefit. One experiment showed a small yield benefit (3.2 Bu/Acre). On the basis of this reseaeah and other foliar fertilization research in South Dakota, the value of foliar fertilization of soybeans using the techniques now available, is questionable. The responses achieved in Iowa and Minnesota have not been duplicated under South Dakota conditions.

Table 35. Effect of Foliar Fertilization on Yield of Soybean Varieties

Variety	Yield of Soybeans Not Foliar Fertilized	Yield of Soybeans Foliar Fertilized
Hodgson	30	27
Harcor	28	28
Corsoy	26	26
Wells	29	34
Wayne	30	31
Calland	31	29

LSD (.05) = 6.2 Bu/Acre
C.V. = 11.7%

Table 36. The Effect of Three Foliar Fertilizer Formulations on Soybean Yields, Southeast Farm, 1977.

Treatment	Formula	Soybean Yield (Bu/Acre)
CHECK-No fertilizer treatment		29.7
2 applications of 25 gallons/Acre each	Formula 1	32.9
	Formula 2	32.1
	Formula 3	31.2
2 applications of 37.5 gallons/Acre each	Formula 1	29.8
	Formula 2	30.0
	Formula 3	30.1

LSD (.05) = 4.7 Bu/Acre - no significant differences
C.V. = 8.6%

Table 37. The Effect of Foliar Fertilization and Sucrose on Leaf Burn, Southeast Farm, 1977.

Total Rate of Foliar Fertilizer (gal/acre)	Total Rate of Sucrose (lb/ac)	Leaf Burn (visual rating) (%)
0	0	0
0	50	0
0	100	0
50	0	12
50	50	12
50	100	8
100	0	33
100	50	28
100	100	19

Table 38. The Effect of Sucrose on Soybean Yields, SE Farm, 1977
(Average of all Fertilizer Applications)

Total Sucrose Application (lb/Acre)	Soybean Yield (Bu/Acre)
0	26
50	26
100	27

C.V. = 9.8%
LSD (.05) = 2.6 bu/Acre
No significant differences

Table 39. The Effect of Foliar Fertilizer Rate on Soybean Yields, Southeast Farm, 1977.
(Average of all Sucrose rates)

Total** Foliar Fertilizer Application (Gallons/Acre)	Soybean Yield (Bu/Acre)
0	28
50	27
100	24*

* This treatment is significantly lower than the check. Yield reduction was greater than the experimental error.
** Sum of two individual applications.

C.V. = 7.0%
LSD (.05) = 1.9 Bu/Acre

Table 40. Effect of Foliar Fertilization on Soybean Yields

Treatment No.	Rate of 10-2.4-4.0-.6 applied: 1st application (gal/acre)	Rate of 10-2.4-4.0-.6 applied: 2nd application (gal/acre)	Soybean Yield (bu/acre)
1	0	0	30
2	25	0	33*
3	0	25	30
4	25	25	31

* This treatment yield was statistically higher than the check (.05).

LSD (.05) = 2.3 Bu/Acre
C.V. = 9.0%

ALFALFA VARIETY TRIAL

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

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. Experimental design was 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 two harvests were taken. 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. Vernal yielded significantly more than Saranac and Kanza among the publicly released varieties and significantly more than 24 of those 42 privately released, Table 41.

Statistical values are listed below:

	Percent Stand 1976	Oven Dry Tons per Acre 1975 1 Cut	Oven Dry Tons per Acre 1977 2 Cut
Mean	98	0.99	1.88
LSD (0.05)	ns	0.14	0.16
C.V. %	2	9.00	6.00

Table 41. Alfalfa Variety Trial

Source	Entry	Percent Stand 1976	Oven Dry Tons per Acre 1975 1 Cut	Oven Dry Tons per Acre 1977 2 cut
Acco	235	99	1.00	1.96
Acco	436	99	.87	1.70
Asgrow	Aztec	99	.98	1.88
Asgrow	Kodiak	99	1.02	1.77
Barzan	Flandria	98	.89	1.73
Barzan	Norseman	98	1.16	1.83
Cal/West	Bonus	99	.96	1.76
Cal/West	Vista	99	.85	1.96
DeKalb	131	97	.95	1.82
DeKalb	123	96	1.02	1.89
DeKalb	153	99	.91	1.71
FFR	Tempo	99	.95	1.81
FFR	Weevelchek	99	1.11	1.97
Farm Seed Research	A-9	99	.89	1.95
Farm Seed Research	A-37	99	.99	1.88
Farm Seed Research	A-40	99	.96	1.92
Jacques	J-60	98	1.03	1.85
Jacques	J-70	99	.84	1.82
Jacques	JX-80	99	.98	1.86
Land O'Lakes-Felco	Valor	99	1.09	2.06
Land O'Lakes-Felco	Pacer	97	1.06	1.98
Northrup,King	Glacier	99	.82	1.78
Northrup,King	Thor	99	1.04	1.88
Northrup,King	Warrior	97	.93	1.85
J. C. Robinson	Gold n' Pure	99	.91	1.80
North American PB	Anchor	98	.87	2.01
North American PB	Nugget	99	1.08	1.92
North American PB	Titan	99	1.21	1.97
Sexauer	A-7	97	.93	1.92
Sexauer	A-10	99	1.08	1.96
Sexauer	BH-22	99	1.14	1.99
Security	Langmeiller	97	.87	1.78
Teweles	Klondike	97	1.02	1.88
Teweles	Superstan	97	.86	1.83
Teweles	Americana	99	.86	1.89
Waterman-Loomis	215	99	1.06	1.67
Waterman-Loomis	216	99	1.08	1.72
Waterman-Loomis	318	99	.97	1.61
Waterman-Loomis	305	98	1.09	1.86
Waterman-Loomis	307	99	.99	1.92
FFR	Scout	97	1.11	1.89
Funk's	G-777	98	.83	1.76
Agate		97	1.01	2.00
Dawson		97	1.02	1.93
Iroquois		97	1.03	1.90
Kanza		97	.96	1.78
Ladak 65		98	1.10	1.97
Saranac		99	.96	1.86
Vernal		97	1.14	2.05

ESTIMATING SOLAR RADIATION USING CLOUD DATA
FROM GEOSTATIONARY SATELLITE

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Objectives

To know the spatial distribution of solar radiation throughout the Great Plains (1) for use in large-scale estimates of potential evapotranspiration and photosynthesis (2) in order to improve the accuracy of cropforecasting models for crops such as corn, wheat, and sorghum.

Methods

On June 1, 1977, NOAA-NESS began recording estimates of cloud cover (%) and optical brightness for 50-km square grid patterns for the Great Plains. These estimates were recorded by satellite about 8 times daily. This test ran through August 15, 1977.

During this test period, ground truth solar radiation data were recorded at hourly integrated intervals for approximately 50 locations throughout the Great Plains. Twenty of these pyranometer installations were set up on a temporary basis (for the duration of the test) by Blackland Research Center at Temple, Texas. Cooperating State and Federal agricultural experiment and extension centers provided the sites and personnel who helped insure that the units operated properly for the entire length of the study. One of these installations was located at the S.E. South Dakota Experiment Farm.

Remarks

In exchange for cooperation received, Blackland has provided each cooperating center with a copy of the ground truth data taken at that location. The data is listed according to location number by Julian date and represents daily totals of solar radiation measured in langleys/day (cal cm^{-2}).

This is a federally funded program being conducted by the Agricultural Research Service - USDA in cooperation with the National Oceanic and Atmospheric Administration - U.S. Department of Commerce.

Conclusions

The ground truth data collected this summer will provide an excellent comparison against the satellite data. Although a preliminary experiment conducted during December 1976 has shown hourly estimates to be subject to large errors, especially for partly cloudy conditions, daily estimates of solar radiation can be made with reasonable accuracy.

UTILIZATION OF DROUGHT-STRICKEN CORN AS SILAGE

G. Kuhl, L. Embry, C. Carlson and F. Shubeck

Corn silage is a very versatile and palatable feed that fits well into many cattle feeding programs. Because of insufficient rainfall in several areas of the country in recent years, many additional acres of corn have been ensiled due to the low potential yield of grain. Harvesting drought-stricken corn as silage results in at least partial salvage of the crop. Many farmers have expressed concern about the nutritional value of drought-damaged corn silage and how it can be best incorporated into feedlot rations for optimal performance and maximal economic return.

Corn silage typically contains a considerable portion of grain. However, the amount of grain in silage may vary from essentially none for a severely drought-stricken crop to as much as 50% of the silage dry matter from a high-yielding corn crop. In view of the large difference in energy values of corn fodder and corn grain, the energy values of silage-based rations would be expected to be influenced to a considerable degree by the proportion of grain in the corn silage. However, when the corn plant fails to produce ears, or when grain yield is markedly reduced, there is some concentration of available nutrients in the stalk and leaves. Even though much research has been conducted with corn silage fed to growing and finishing cattle, questions still remain as to the most appropriate amount of additional corn grain to feed with silage, especially when the silage contains minimal amounts of grain.

The objective of this study was to examine the response of feedlot cattle to various levels of added corn grain when fed whole-plant silage from drought-stricken corn.

Procedures

Sixty-four yearling Hereford-Angus steers averaging about 550 lb. were purchased through a feeder cattle auction market for the experiment initiated on February 17, 1977. The cattle were allotted into 8 pens of 8 head each on the basis of shrunk weight obtained after an 18-hour stand without feed and water.

Four experimental treatments representing different levels of added cracked corn were studied, with 2 pens assigned to each treatment. The 4 experimental rations were as follows:

	Dry Matter Basis		As Fed Basis	
Treatment	Corn Silage	Corn Grain	Corn Silage	Corn Grain
#1	100%	---	100%	---
#2	75%	25%	88%	12%
#3	50%	50%	72%	28%
#4	25%	75%	46%	54%

The corn silage was from drought-stricken corn with an estimated grain yield of about 4-5 bushels/acre and a silage yield of about 3-3.5 tons/acre. Average dry matter content of the silage was about 34% with an average protein content of 10.9%, dry basis. The corn grain was purchased locally as needed. It averaged 13% moisture.

A custom mixed 32% crude protein supplement was fed at the rate of 2 lb. per head daily throughout the trial. The composition of the supplement was 18% ground corn, 68% soybean meal (44% protein), 7% dicalcium phosphate, 2% limestone, 5% trace mineral salt and a source of vitamin A (10,000 IU/lb. suppl.) and Rumensin. The level of Rumensin in the supplement was adjusted periodically in order to maintain the equivalent of about 30 g. of Rumensin per ton of air-dry feed in all rations.

The cattle were vaccinated for blackleg, malignant edema and red nose (IBR) and implanted with Synovex-S at the beginning of the experiment.

The cattle on the 100% corn silage ration were full-fed silage from the beginning of the experiment, whereas the steers on the other treatments were brought up to a full feed of grain and corn silage gradually. The increase to full feed on the high-grain (75% corn grain, dry basis) ration was accomplished over a 10-day period. The cattle were fed in open, sloped concrete lots without access to shelter. Daily feed records were kept on each pen. The cattle were weighed at monthly intervals throughout the trial.

The experiment was terminated for each treatment group when their average full body weights approached 1150 lb. The cattle were marketed through a packing plant on a grade and yield basis such that individual carcass measurements could be obtained.

Results

The experimental results are presented in Table 42. Average final shrunk body weights were 1082, 1113, 1140 and 1106 lb. for the cattle fed 100, 75, 50 and 25% of their ration dry matter as drought-stricken corn silage.

Percent shrink resulting from the 18-hour stand without feed and water tended to be greater on the high-silage rations.

As expected, cattle on the all-silage ration required the longest time (286 days) on feed, while the high-grain fed steers took the least time (208 days). Average daily gain was proportional to the amount of added grain in the rations.

The overall daily gains (based on shrunk initial and final body weights) of the 4 experimental treatments were 1.94, 2.24, 2.57,

Table 42 Utilization of Drought-Stricken Corn as Silage

	Percent Corn Silage in the Ration Dry Matter[a]			
	100%	75%	50%	25%
No. Animals	16	16	16	16
Days on Feed	286	260	238	208
Initial Shrunk wt., lb.	527	529	529	530
Final Shrunk wt., lb.	1082	1113	1140	1106
Avg. Daily Gain, lb.	1.94	2.24	2.57	2.76
Avg. Daily Ration: lb.:				
Corn Silage	53.7	42.7	30.4	14.4
Corn Grain	—	5.8	11.8	16.5
Suppl.	2.0	2.0	2.0	2.0
Feed/100 lb. Gain, lb.:				
Corn Silage	2771	1900	1186	524
Corn Grain	—	257	461	596
Suppl.	103	88	78	72
Carcass Wt., lb.	645	689	718	719
Dressing Percent	58.1	59.7	61.6	63.0
Fat Thickness, in.[b]	0.67	0.82	0.82	0.85
Rib Eye Area, sq. in.	11.20	11.35	11.88	12.25
Yield Grade	3.63	4.21	4.18	4.12
Quality Grade[c]	19.2	20.2	20.8	19.7

[a]Balance of ration composed of cracked corn, plus 2 lb/head/day of supplement.

[b]Measured over rib eye between 12 and 13th rib.

[c]19=Low Choice; 20=Avg. Choice

and 2.76 lb. for the 100, 75, 50 and 25% corn silage rations, respectively. The daily gains achieved by the high-silage fed steers tended to fall off more sharply than that of their high-grain fed counterparts as the cattle approached finished weights. This observation appeared to be related in part to the erratic climatic conditions which only the high-silage fed steers were exposed to in late fall. The cattle were also somewhat overfinished at slaughter, as can be observed from the tabulated carcass data. The nutritional impact of carrying cattle too long is a substantially increased maintenance requirement for energy along with excessive fat deposition, thereby resulting in depressed terminal performance. For example, the average daily gains (based on filled feedlot weights) achieved on the experimental rations up to mean body weights of 1025-1050 lb. were 2.30, 2.46, 2.78 and 2.99 lb. for the 100, 75, 50 and 25% corn silage rations, respectively.

The average daily feed consumption results are shown in the table. Based on these data, the average dry matter intakes of the 4 sets of steers were 19.54, 20.96, 22.12 and 20.93 lb. for the 100% through 25% corn silage rations, respectively. The amount of feed required per 100 lb. gain is also presented in the table. Using data of this type, one can calculate the feed costs per 100 lb. gain based on any given set of feed prices. For example, if we value drought-stricken corn silage at $15/ton, #2 corn at $2.00/bushel and the 32% protein supplement at $150/ton, including handling and processing, then the feed costs per 100 lb. gain in this experiment would have been $28.51, $30.03, $31.21 and $30.62 for the 100, 75, 50 and 25% corn silage rations, respectively.

The carcass results are shown at the bottom of the table. Dressing percent (warm carcass weight/final filled weight x 100) decreased with

increasing levels of corn silage in the ration, a result attributed primarily to the greater gut fill with increasing amounts of roughage in the ration. Level of corn silage feeding appeared to have little influence on carcass fat thickness, rib-eye area, grade or yield grade independent of carcass weight differences resulting from ration treatment effects on dressing percent. The cattle on all rations graded an average of low choice or higher. Carcass maturity, firmness, rib-eye color, % kidney fat and the incidence of liver abscesses were not significantly related to the level of corn silage feeding.

Summary and Conclusions

Sixty-four yearling black-baldy steers (16 per treatment) were fed four rations consisting of 100, 75, 50 and 25% corn silage (dry matter basis), with the balance of the ration being made up of cracked corn, in order to examine the feedlot performance of cattle fed drought-damaged corn silage supplemented with various levels of added grain. All cattle received 2 lb. per head daily of a 32% protein meal in order to provide supplemental protein, minerals, vitamin A and Rumensin.

Results of this experiment illustrate that good performance can be obtained by feeding drought-stressed corn silage to growing and finishing cattle. Average daily gain ranged from 1.94 lb. on the all corn silage ration to 2.76 lb. on the highest grain ration. Based upon this experiment and other studies conducted at this station and elsewhere, the feeding value of drought-stricken corn silage will usually be 75-95% that of normal corn silage, depending upon the length, timing and severity of drought damage. This indicates that while drought-stressed corn silage is low in grain content, a higher than normal amount of available energy must be

present in the stalks and leaves in order to support the level of performance observed. Thus, the major impact of drought conditions on the ensiled corn crop is that of reduced tonnage per acre and increased harvesting costs per ton rather than on decreased feeding value.

Carcass measurements revealed little influence of level of added grain in the ration on carcass characteristics when differences in carcass weight were taken into account.

This experiment indicates that drought-damaged corn silage will likely be higher than normal in crude protein. Because of this, farmers are advised to have their corn silage analyzed for protein so that rations can be properly formulated with the minimal protein supplementation necessary.

This study demonstrates that drought-stricken corn silage can be effectively utilized in feedlot rations as a means of salvaging a poor corn grain crop while at the same time permitting more complete feedlot utilization of the forage and grain from an acre of corn.

FORAGE FINISHING TRIALS

V. Anderson and C. Dinkel

Objectives

1. Compare the performance of Exotic crossbred cattle finished on high concentrate vs. all forage rations.
2. Compare the performance of British vs. Exotic crossbred cattle finished on an all forage ration.

Method / Procedure

The all forage trials were started on November 23, 1976 when 29 head of exotic cross and 17 head of British cattle were shipped to the S.E. Experiment Farm from Brookings. The concentrate trial was conducted at Brookings.

All exotic cross cattle were produced by one Limousin sire artifically mated to Angus, Charolais, and Angus-Charolais crossbred cows at the SDSU Beef Breeding Unit. The straightbred British cattle were produced from natural and artifically mated cows at the SDSU Beef Unit.

The forage vs. concentrate trial was conducted with half sib exotic cross cattle. Ten steers and 19 heifers were fed the all forage ration while 40 steers and 30 heifers were fed the concentrate ration. One steer on the concentrate ration died.

The British vs. exotic crossbred all forage trial compared 8 steers and 9 heifers of British breeds with the 10 steer and 19 heifer exotic crossbreds. The British bred animals had been subjected to some selection pressure.

The forage fed animals were pen fed ad libitum in sex groups while the concentrate fed animals were individually fed ad libitum.

The forage ration consisted of 75% corn silage (35.77% DM) and 25% alfalfa hay (18.78% Protein). The 1976 drought silage was estimated to yield 5-10 bushels of corn per acre.

The initial concentrate ration consisted of 58% cracked corn, 20% ground alfalfa, 16% oats, 4% soybean meal and 2% Vitamin A premix. The steers and heifers were individually switched to a higher energy ration consisting of 83% cracked corn, 10% ground alfalfa, 5% soybean meal and 2% Vitamin A premix when they reached 700 lb. and 625 lb. respectively. Steers and heifers were fed for an additional 140 and 119 days respectively, prior to slaughter.

The concentrate fed animals were slaughtered first and an attempt was made to slaughter the forage fed counterparts at the same weight. The forage fed steers shrunk more than expected resulting in an 86 lb. difference in slaughter weight. (Table 43).

An attempt was made to slaughter the British animals when 80% would grade choice. Excessive shrink was experienced in British steers and heifers also.

All animals were slaughtered at John Morrell and Company in Sioux Falls. The right half of each exotic crossbred carcass was shipped to the South Dakota State University Meat Lab for cutting into closely trimmed semi-boneless retail cuts. Retail cut yield for the two exotic crossbred groups was adjusted for differences in initial weight. Carcass data from the British animals were collected at Morrell's with the assistance of the USDA grading service.

Results

Results of the trials are shown in Table 43.

Exotic Crossbred Concentrate vs. Forage

The forage fed cattle gained 1.83 lb/day and 1.62 lb/day for steers and heifers respectively while the concentrate fed animals gained 2.46 lb/day and 2.26 lb/day for steers and heifers respectively.

Yield grade for forage fed carcasses averaged 1.3 for both steers and heifers. Concentrate fed cattle had an average yield grade of 1.4 and 1.2 respectively for steers and heifers.

Quality grade on forage fed carcasses averaged low good for steers and high standard for heifers. Concentrate fed carcasses averaged low good for both steers and heifers.

British vs. Exotic Crossbred On All Forage

Exotic cross steers and heifers gained 1.83 lb/day and 1.62 lb/day respectively while British steers and heifers gained 1.64 lb/day and 1.40 lb/day respectively.

Yield grade averaged 1.3 for exotic steers and heifers while British carcasses yield graded 2.3 and 1.9 for steers and heifers respectively indicating a higher percentage of fat on the carcass.

Quality grade for exotic cross steers and heifers averaged low good and high standard respectively, while British carcasses averaged high good and low choice for steers and heifers respectively.

Table 43 Forage Finishing Trials

Ration Breed Group	Concentrate Exotic Cross	Forage Exotic Cross	Forage British
Steers			
No. head	39	10	8
Initial wt. (lb.)	539	553	454
Final wt. (lb.)	1105	1019	977
ADG (lb/day)	2.46	1.83	1.64
Lb. feed/lb. gain	6.34	24.85	27.52
Lb. TDN/lb. gain	4.76	7.83	8.63
Lb. TDN/lb. retail cut	5.73	8.78	—
Avg. days on feed	230	255	319
Dressing %	65.7	60.0	56.7
Yield Grade	1.4	1.3	2.3
Quality Grade	G-	G-	G+
Heifers			
No. head	30	19	9
Initial wt. (lb.)	510	545	409
Final wt. (lb.)	894	887	734
ADG (lb/day)	2.26	1.62	1.40
Lb. feed/lb. gain	6.78	24.75	28.27
Lb. TDN/lb. gain	5.25	7.76	8.87
Lb. TDN/lb. retail cut	5.36	7.83	—
Avg. days on feed	170	211	232
Dressing %	65.4	59.3	59.2
Yield Grade	1.2	1.3	1.9
Quality Grade	G-	St+	Ch-

ANIMAL WASTE MANAGEMENT AND CROP YIELDS

M. L. Horton, R. E. Beyer, C. G. Carlson and J. L. Wiersma

The animal waste management project which was initiated on the Southeast Farm during the fall of 1973 was continued through 1977. No additional field work is planned; however, a comprehensive completion report will be prepared prior to June 1978.

Beef manure at rates up to 80 tons per acre was applied to field plots prior to the 1974 and 1975 growing season. No manure has been applied to the plots since 1975. During the 1974 through 1977 crop seasons, corn has been used as the test crop. Both silage and ear corn yields have been determined.

Drought conditions during 1975 and 1976 drastically affected corn growth and yield. Improved rainfall during 1977 resulted in the best corn yields since initiation of the project.

The field plots were planted on May 10, 1977, at a population of approximately 15,000 seeds per acre using Pioneer 3709 seed. Insecticides and herbicides were used at the recommended rate. Starter fertilizer was used for all plots with additional fertilizer applied to the check plots at the recommended rate as determined by soil test.

Plant heights were recorded on four dates as shown in the results. Leaf samples were collected from all plots on July 19 for chemical analysis. The leaf chemical analyses were performed by the Station Biochemistry Laboratory on the SDSU campus.

The corn on the plots was harvested for silage on August 29 and for ear corn on September 28.

The soil in all plots was sampled for chemical analysis on June 2 and 3, 1977 and following harvest on November 21 and 22, 1977. Chemical analyses were performed by the Water Quality Laboratory on the SDSU campus.

Results are reported under the following headings:

I. Plant Population and Heights
II. Leaf Analysis Results
III. Silage and Grain Yields
IV. Summary

I. Plant Population and Height

The plant population at harvest for all treatments is summarized in Table 44.

Table 44. Plant (corn) Population at Harvest

	Treatment	Population Plants/acre
Check		13,542
20L*	Low salt 20 tons manure/acre/yr	13,542
20H**	High salt 20 tons manure/acre/yr	13,011
40L	Low salt 40 tons manure/acre/yr	13,276
40H	High salt 40 tons manure/acre/yr	13,808
60L	Low salt 60 tons manure/acre/yr	12,745
60H	High salt 60 tons manure/acre/yr	13,276
80L	Low salt 80 tons manure/acre/yr	13,808
80H	High salt 80 tons manure/acre/yr	13,276

*Low salt treatments were 0 to 0.25% NaCl added to the ration.
**High salt treatments were 0.5 to 0.75% NaCl added to the ration.

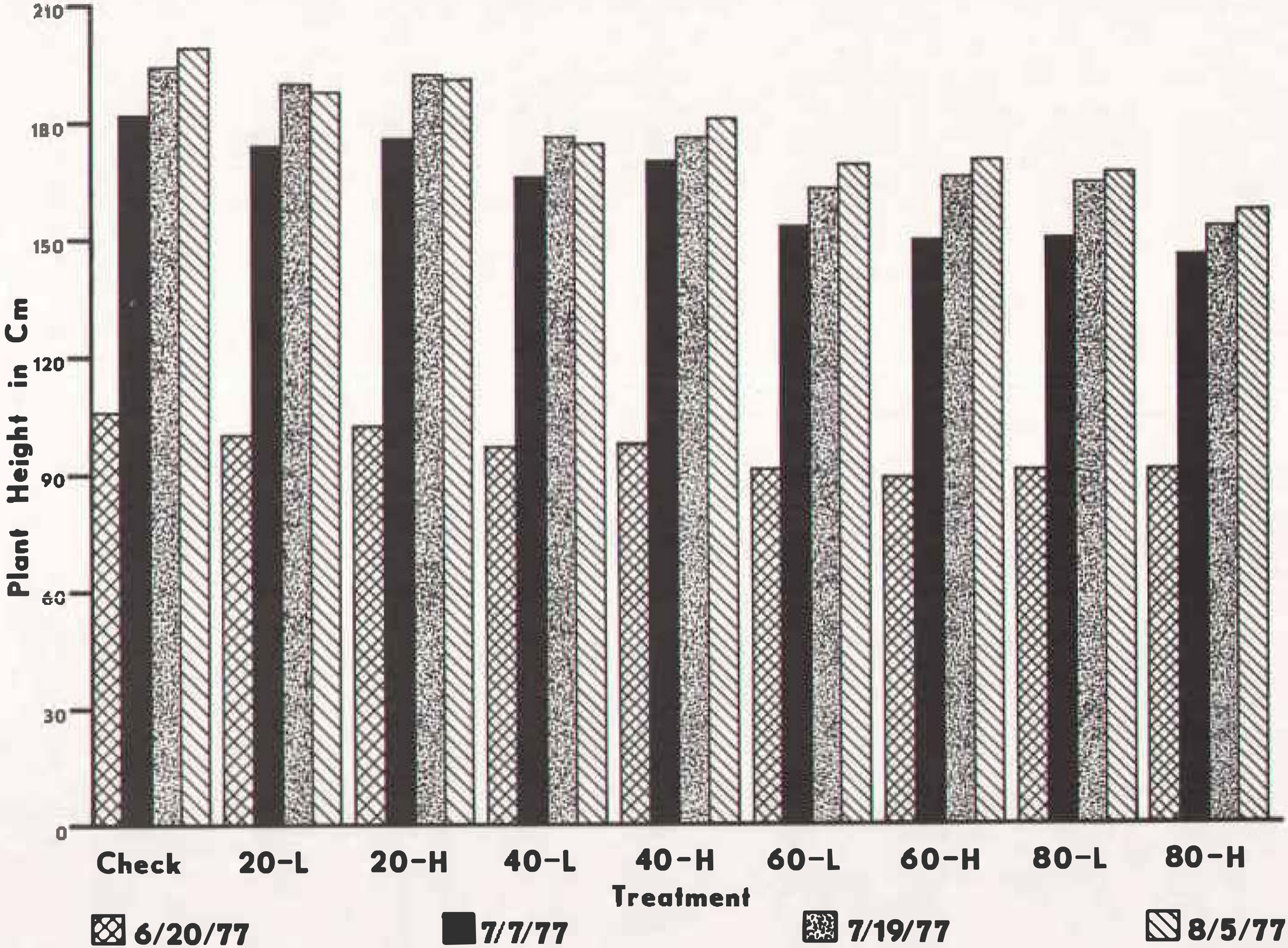
Plant populations were relatively uniform across all treatments. Although populations were generally low, no treatment affect is evident.

Plant heights were determined on four dates during 1977--June 20, July 7, July 19 and August 5. The results are summarized in Fig. 5 .

The trend on all four measurement dates was toward reduced plant heights with increased rates of applied manure. The 60 and 80 t/a treatment heights are statistically different from the check heights at the 95% probability level for all dates. At the last measurement date (August 5) all treatments had significantly reduced heights compared with the check.

II. Leaf Analysis Results

Results of leaf analyses for water content, calcium, nitrogen, magnesium and potassium are shown in Table 45. Chemical results are reported as percent based on a moisture free sample.



210
180
150
120
90
60
30
0
Plant Height in Cm
Check
20-L
20-H
40-L
40-H
60-L
60-H
80-L
80-H
Treatment
6/20/77
7/7/77
7/19/77
8/5/77

Table 45. Treatment Averages for Leaf Analyses

Treatment	Moisture % AR	Calcium % MF	Total N % MF	Magnesium % MF	Potassium % MF
Check	74.16[1]	.56[2]	3.028[3]	.398[4]	1.680[5]
20L	74.39	.58	3.036	.305	1.950
20H	74.43	.61	3.058	.290	1.938
40L	73.54	.62	3.168	.310	1.795
40H	74.45	.56	3.075	.278	1.930
60L	74.26	.49	3.135	.300	2.023
60H	75.89	.55	3.150	.268	2.130
80L	72.63	.54	3.210	.330	1.875
80H	73.19	.50	3.160	.298	2.013

AR = as received
MF = moisture free
[1]No significant differences between check and treatment plots.
[2]No significant differences between check and treatment plots.
[3]All treatment plots except 20L, 20H and 40H significantly different from check at 95% probability.
[4]All treatment plots significantly different from check at 95% probability.
[5]All treatment plots except 40L significantly different from check at 95% probability.

No significant differences were found between the check and manure treatments for water content and calcium content. All treatment levels greater than 40 tons/acre resulted in significantly increased nitrogen contents at the 95% probability level. All treatments resulted in significantly reduced magnesium contents in the leaves as compared to the check. All treatments except the 40L treatment gave significantly increased potassium contents in the leaves as compared with the check.

III. Silage and Grain Yields

Silage yield results and statistical comparisons are shown in Table 46.

Table 46 . 1977 Silage Yields in Tons Dry Matter/acre

	Check	20 L	20 H	40 L	40 H	60 L	60 H	80 L	80 H
	4.43	4.50	4.31	4.04	3.72	3.45	3.28	3.72	3.24
	3.16	4.38	4.47	3.35	3.72	3.37	3.18	3.50	3.47
	4.30	3.62	4.58	4.23	3.63	2.80	3.76	2.96	2.87
	4.05	4.63	4.20	3.56	3.77	3.12	3.11	3.37	2.65
Ave.	3.99	4.28	4.39	3.80	3.71	3.19*	3.33*	3.39*	3.06*

*Plots significantly different from check at 95% probability.

Silage yields were significantly less for 60 and 80 ton/acre treatments when compared to the check at the 95% confidence level.

Corn grain (ear) yields are shown in Table 47 . Statistical analysis gave significant differences with reduced yields for 40, 60 and 80 ton/acre plots when compared to the check at the 95% confidence level.

Table 47 . 1977 Corn Yields in Bu/acre

	Check	20 L	20 H	40 L	40 H	60 L	60 H	80 L	80 H
	98.04	95.05	74.66	75.59	65.33	67.08	52.31	64.86	51.29
	85.91	98.41	66.70	64.08	80.40	75.53	66.98	59.00	51.21
	89.67	71.81	89.62	63.72	64.82	56.81	79.46	40.71	49.36
	71.37	62.74	79.25	44.33	62.09	57.18	47.65	44.18	46.89
Ave.	86.25	82.00	77.56	61.93*	68.16*	64.15*	61.60*	52.19*	49.69*

*Plots significantly different from check at 95% probability.

IV. Summary

1. Plant heights tended to decrease with increasing rates of applied beef manure.

2. Beef waste application rates exceeding 40 tons/acre applied each year significantly reduced the yield of silage and ear corn. The causes of the reduced yields are uncertain; however, increased soil salinity levels may be a contributing factor.

3. When heavy applications (exceeding 20 tons/acre) of manure are used in crop production, careful monitoring of soil salinity and soil nutrient levels is necessary to maintain crop yield levels.

N + P + K STARTER FERTILIZER ON CORN AFTER FALLOW

Ron Gelderman, Burt Lawrensen, Fred Shubeck,
Jay Goos, Robert Nettleton and Paul Carson

It has been observed many times that planting corn on fallow slowed the early growth of corn. It has also been observed that the early growth of the corn can be improved by the applications of phosphorus with a planter equipped with a fertilizer attachment. The amount of phosphorus needed to correct the poor early growth is not known.

Objectives

1. To determine how much phosphorus is needed to improve the early growth of the corn grown on fallowed land.
2. To determine the cause of the poor early growth of the corn.
3. To determine if combinations of N, P and K as starter fertilizers can have an effect on the yield of corn.

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 on samples taken at planting time are as follows:

Depth in inches	NO_3-N #/A	O.M. %	P #/A	K #/A	pH 1-1 dilution	Soluble salts mmho/cm
0-6	24	2.8	22	455	6.1	.48
6-12	62	2.8	11	365	6.3	.53
12-18	59	1.9	5	280	6.9	.53
18-24	63	1.5	6	300	7.2	.55
24-30	82	1.3	9	285	7.5	.53
30-36	79	.8	13	265	7.6	.53
36-42	46	.9	15	300	7.9	.48
42-48	34	.6	11	280	8.0	.55

Total (0-48") 449
Total (0-24") 208

Nitrates found in the top 0-24 inches (208#/A) at the beginning of the growing season was enough to supply the needs of 100 bu/A corn crop. The next 24 inches (24-48") contained another 240 lbs of nitrate-nitrogen at planting time. The phosphorus supply (22 lbs/A) was in the medium range and the potassium supply 455 lbs/A was very high.

2. The land was fallowed in 1976 and disked just 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:

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.	N1P5K5	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
24.	$N_4P_4K_4$	12	+ 27	+ 21 + Fe

In addition to the starter fertilizers used 55 lbs of nitrogen was applied as a broadcast application before planting.

4. The experimental design used was a composite.
5. Weed Control.
   (a) Aatrex broadcast on surface before planting.
   (b) Lasso II applied in a band at planting time.
   (c) Two cultivations.
   Weed control was excellent.
6. Soil insects were controlled by use of Furadan applied at planting time in a band.
7. Variety used was Golden Harvest H 2500.
8. Corn was planted May 5 with John Deere tool-bar planters.

Row width was 30 inches and approximately 16,000 seeds per acre were planted.

9. Corn was harvested by hand on October 13. Fifty feet of row was harvested for grain.
10. Leaf samples were taken early in the season and at silking time.
11. Weather for the production of corn was excellent.

Results and Discussion

Yields in bushels per acre of 15% moisture corn, percent moisture in the ears at harvest time, and plant population at harvest time are reported in Table 46.

Grain yields were excellent - ranging from 100 to 134 bushels per acre. The highest yield was obtained on the plot receiving no additional fertilizer. On fallowed land, starter fertilizers in any combination did not increase the final yield in 1977. The experiment is on a site that did produce a yield increase when starter fertilizers were added in 1975. It should also be pointed out the growth differences due to treatments were observed early in the growing season. These growth differences appeared to be associated with added phosphorus.

Grouping of yields by rates of application of various elements regardless of the accompanying element or elements provides a means of further evaluating these treatments. These groupings are shown in Table 47. The check yield (134 bu/A) is included in these groupings. This data indicates that 6 lbs of N/A caused a small increase in yield. Higher rates of N caused a decrease. As the rate of added phosphorus increased, the yield decreased. Any rate of added potassium increased the yield 8 to 12 bu/A. Rates of the individual fertilizer elements had no consistent effect on the moisture content of the ears at harvest.

This data can be further evaluated through the use of 3 dimensional diagrams which provide a means of seeing the relationships or interactions between 2 fertilizer elements on yield. Diagrams are included which show these relationships between N & P, N & K, and P & K. Figure 6 shows the relationship between N & P. In general, as the rate of phosphorus increased the yield decreased regardless of how much nitrogen was applied. Note a sharp line depicting the yield due to added phosphorus when no nitrogen was applied. This is considered to be due to experimental error. The addition of nitrogen caused a general decrease in yields when high rates of phosphorus were applied; however, a small increase is shown with the lower rates of added nitrogen when no phosphorus was applied. The addition of starter phosphorus did produce a yield increase on this site in 1975. In 1975, the average June temperature was 3° below the long-time average (69.5°F). The 1977 average June temperature was normal to slightly above. Thus, this data supports the earlier work of Shubeck reported in these annual reports, which showed that yield increases could be expected from starter fertilizer when the average June temperature is below normal and that either no yield increase or lower yields resulted from added phosphorus when the June temperatures are average to above average.

The nitrogen-potassium relationships or interactions are shown in Figure 7. Increasing the rate of potassium added at the high rate of added nitrogen caused a small yield increase, whereas, when no nitrogen was added increasing the rate of added potassium decreased the yield. Increasing the rate of added nitrogen reduced the yield irrespective of the amount of potassium added.

The potassium-phosphorus relationship or interaction is shown in Figure 8. Increasing the rate of potassium application first caused a yield increase and then a yield decrease. This was true when combined with any rate of added phosphorus. Increasing the rate of added phosphorus caused a yield decrease. Some variations of this general statement exist. These may be due to experimental error.

These data and charts indicate that a starter fertilizer would not increase the yield of corn grown under these conditions in 1977. With two dry years preceding the experiment, one of them summerfallowed, combination of N, P and K were ineffective for increasing corn yields.

Table 46. Effects of Starter Fertilizer Rates and Ratios on the yield of corn, moisture content of the Ears, and the Final Plant Population at Harvest Time; Southeast Experimental Farm, 1977.

No.	Designation	Rate lbs/A[L3] N	+	P_2O_5	+	K_2O	Yield[L1] bu/A	Moisture[L2] Content 0/0	Plant Population
1	$N_2P_2K_2$	3	+	7	+	5	120	24.1	14.114
2	$N_2P_2K_4$	3	+	7	+	21	123	22.7	14,114
3	$N_2P_4K_2$	3	+	27	+	5	122	23.4	13,939
4	$N_2P_4K_4$	3	+	27	+	21	121	22.6	12,546
5	$N_4P_2K_2$	3	+	7	+	5	129	22.9	12,720
6	$N_4P_2K_4$	12	+	27	+	21	119	24.2	14,637
7	$N_4P_4K_2$	12	+	27	+	5	114	23.4	13,591
8	$N_4P_4K_4$	12	+	27	+	21	109	21.9	13,068
9	$N_3P_3K_3$	6	+	14	+	11	123	23.5	13,939
10	$N_1P_3K_3$	0	+	14	+	11	128	22.7	13,591
11	$N_5P_3K_3$	24	+	14	+	11	123	22.8	13,591
12	$N_3P_1K_3$	6	+	0	+	11	134	23.1	14,985
13	$N_3P_5K_3$	6	+	54	+	11	119	22.5	15,682
14	$N_3P_3K_1$	6	+	14	+	0	100	23.4	13,591
15	$N_3P_3K_5$	6	+	14	+	43	128	23.0	13,417
16	$N_1P_1K_5$	0	+	0	+	43	128	24.1	13,068
17	$N_1P_5K_1$	0	+	54	+	0	116	22.3	13,417
18	$N_1P_5K_5$	0	+	54	+	43	127	23.3	16,031
19	$N_5P_1K_1$	24	+	0	+	0	116	24.6	14,462
20	$N_5P_1K_5$	24	+	0	+	43	130	23.7	13,068
21	$N_5P_5K_1$	24	+	54	+	0	98	22.6	14,636
22	$N_5P_5K_5$	24	+	54	+	43	108	22.8	14,114
23	$N_1P_1K_1$	0	+	0	+	0	134	23.9	13,417
24	$N_4P_4K_4$ + Fe	12	+	27	+	21+Fe	103	23.6	13,591

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.

Table 47. Effect of Increasing Rates of a Specific Fertilizer Element (without regard for the Accompanying Elements) on yield and Percent Moisture Content of Ears at Harvest. Southeast Experimental Farm, 1977.

Fertilizer Applied	Yield[L1]	Moisture[L2]
Lbs of N/A		
0	122	23.2
3	122	23.2
6	126	23.0
12	115	23.2
24	115	23.3
Lbs of P_2O_5/A		
0	128	23.9
7	123	23.5
14	120	23.1
27	117	22.8
54	114	22.7
Lbs of K_2O/A		
0	113	23.4
5	121	23.5
11	125	22.9
21	115	23.0
43	124	23.4

L1 Yields calculated at 15% moisture
L2 Moisture sample was taken by cutting a section out of the center of eight ears of corn. This includes the cob.

FIGURE 6. THE EFFECTS OF N & P APPLIED AS A STARTER FERTILIZER ON THE YIELD OF CORN GROWN AT THE SOUTHEAST EXPERIMENTAL FARM, 1977.

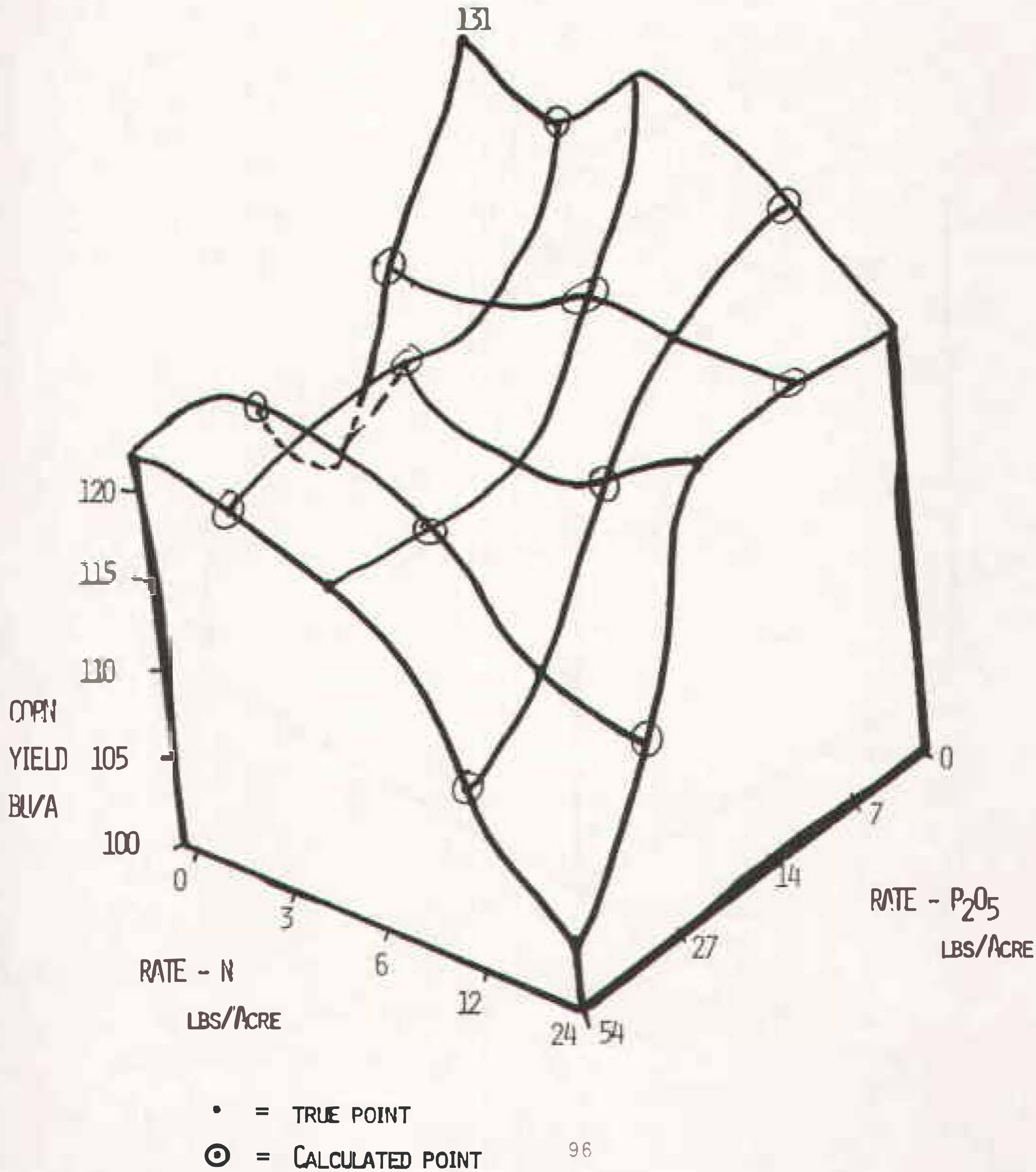
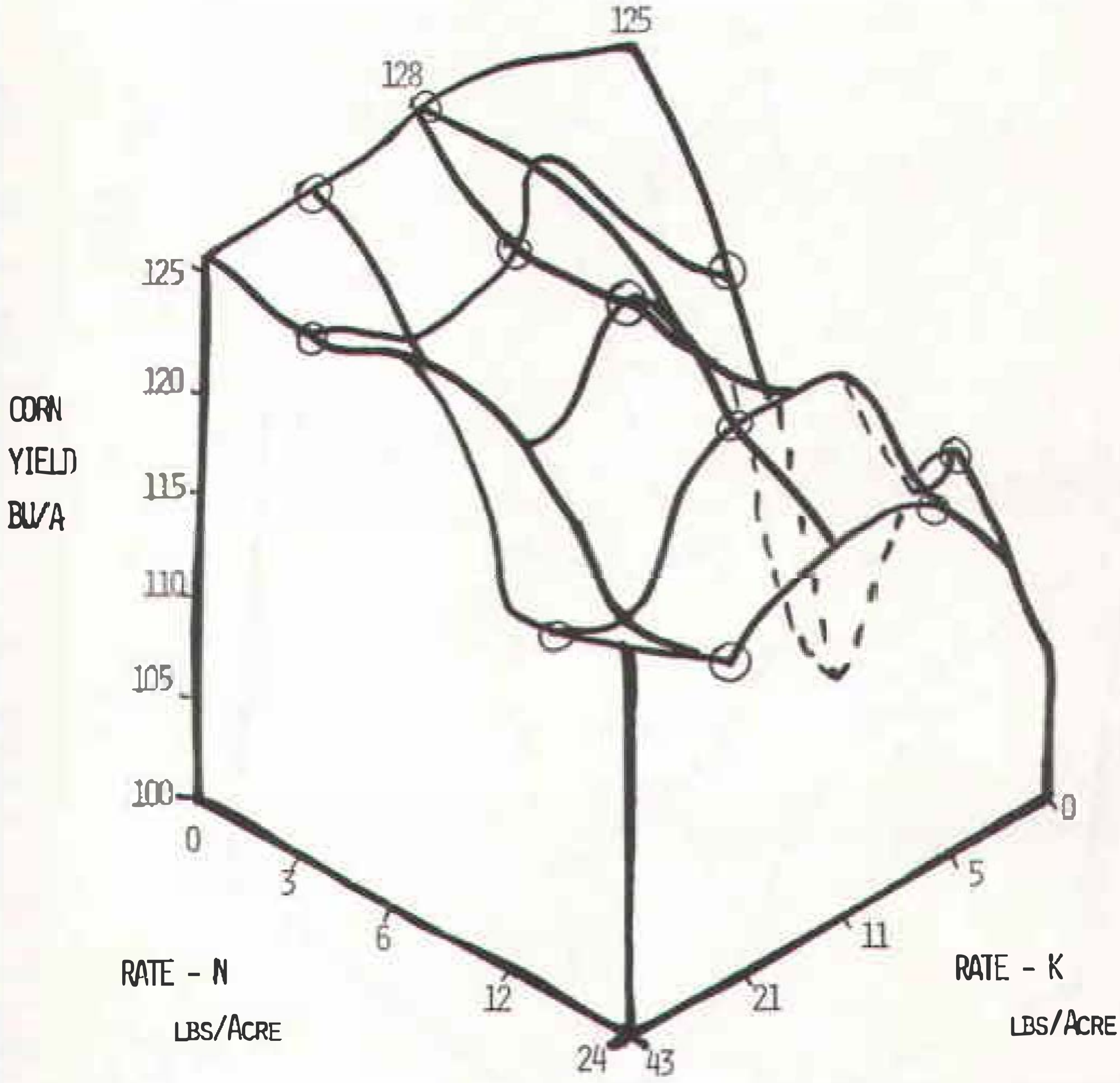


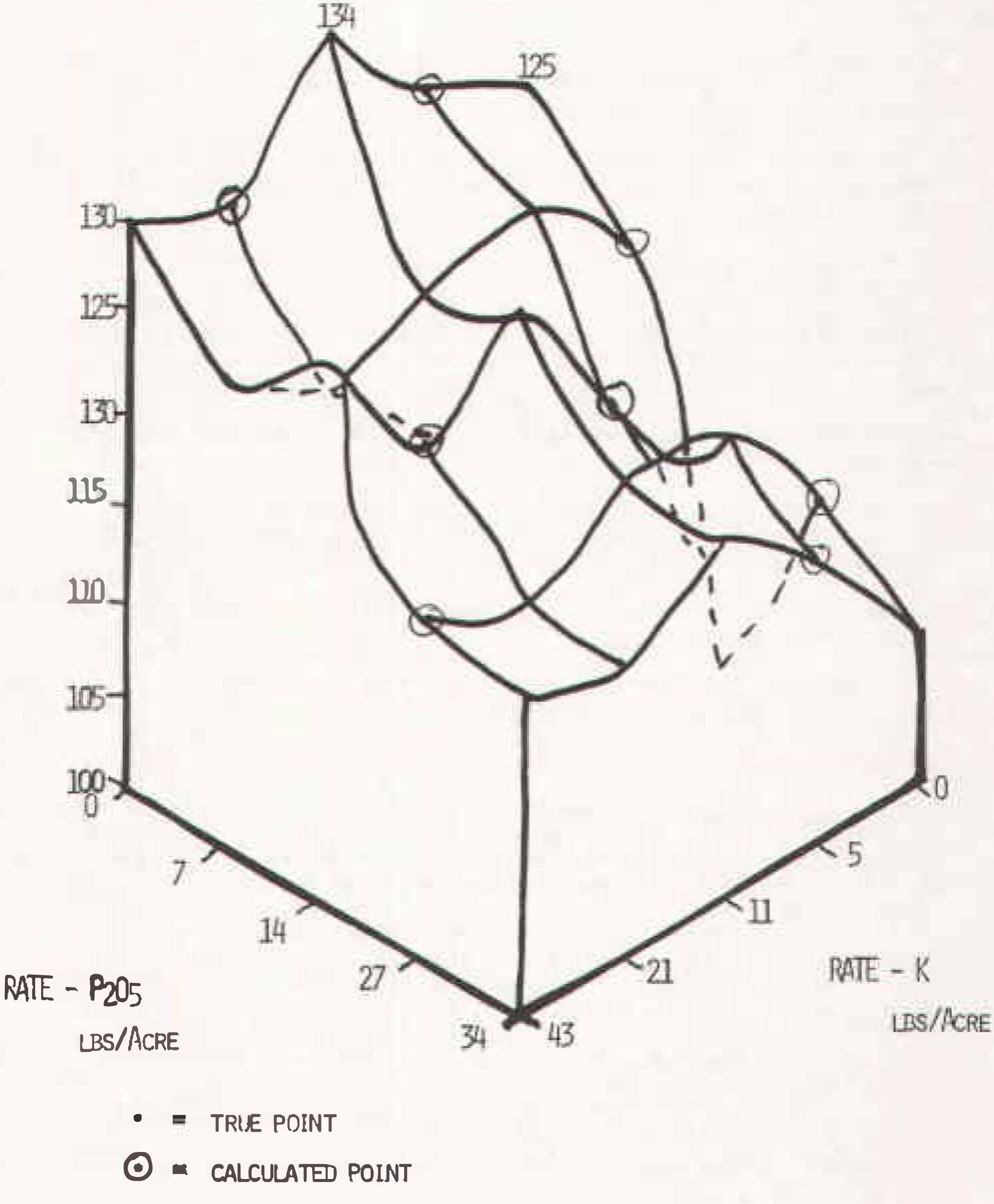
FIGURE 7. THE EFFECTS OF N & K APPLIED AS A STARTER FERTILIZER ON THE YIELD OF CORN GROWN AT THE SOUTHEAST EXPERIMENTAL FARM, 1977.



• = TRUE POINT

⊙ = CALCULATED POINT

FIGURE 8. THE EFFECTS OF P & K APPLIED AS A STARTER FERTILIZER ON THE YIELD OF CORN GROWN AT THE SOUTHEAST EXPERIMENTAL FARM, 1977.



CORN ROOTWORM - INSECTICIDE INTERACTION RESEARCH PROJECT

D. D. Walgenbach

Objectives

To provide the basis for South Dakota State University soil insecticide recommendations. Experiments and evaluations were conducted at five locations in addition to the Southeast Experiment Station.

To obtain information on insecticide performance as influenced by planting date sequences, insecticide placement and post-emergence applications of rootworm insecticides.

To evaluate experimental insecticides for improved performance and reduction in hazard.

To monitor corn rootworm insecticidal resistance through topical applications of technical insecticides to field collected and laboratory reared larvae.

To evaluate the factors associated with first year corn rootworm damage following small grains and flax.

A. Attractiveness of volunteer small grain and several weed species in replicated plots to corn rootworm adults as determined by egg counts and following year root damage to corn.

B. Rootworm egg count survey in harvested small grain fields at 2 week intervals.

To evaluate the feasibility of corn rootworm sex attractants in determining adult population levels for pest management programs.

Methods and Procedures

At-Planting Evaluations. Insecticides were applied at planting in single-row plots 100 ft. in length with 4 replications. Granular treatments were applied with modified Noble metering units mounted on a specially adapted John Deere 4-row Flexiplanter. The metering units were ground driven. The granules were applied in a 7 inch band in front of the press wheel. Covering knives were utilized for incorporation. Insecticides placed in the seed furrow were metered through plastic tubing directly behind the double disk seed furrow openers. Liquid formulations were applied in a 7 inch spray over the seed furrow in 10 gpa insecticidal solution.

Five roots were dug from each replication, washed under pressure and rated for rootworm feeding damage. The 1-6 rating system adopted for use in the North Central States was utilized as the measure of insecticidal effectiveness. The damage rating criteria are as follows:

*Damage Rating	Description of Root System
1	No noticeable feeding damage
2	Feeding scars, no root pruning
3	At least one root pruned but less than an entire node of roots pruned
4	One node of roots destroyed
5	Two nodes of roots destroyed
6	Three or more nodes of roots destroyed

*ISU Damage Rating

To qualify as a pruned root, the root must be eaten to within 1½ inches of the plant. It is not necessary for all pruned roots to originate from the same node to qualify as a root system with a full node pruned. The number of roots pruned must be equivalent to that of a full node.

The cultivation treatments were applied with a specially adapted 2 row John Deere rear mounted cultivator, equipped with Noble metering units driven by 12 volt electric motors.

Percent Root Protection (% R.P.)

The percent root protection was calculated as follows:

$$\% \text{ R.P.} = \frac{\text{100-(root rating of treatment-1)}}{\text{root rating of UTC}}$$

These calculations, although somewhat skewed at the low performance range allow comparison of treatments between plots.

Results and Discussion

The performance of soil insecticides for corn rootworm control was not stressed in 1977 because of the unprecidented decline of the western corn rootworm. No rootworm insecticide complaints were reported. Significant damage was again observed in untreated first year corn fields caused by the northern corn rootworm. In 1978, damage potential to first year corn following small grains and flax will equal that of continuous corn.

In 1976, western beetles averaged 3 to 5 per plant in the major corn production counties. All 1977 plot locations had beetle numbers exceeding 10 per plant with trap crop locations having western populations in the range of 50 per plant. Rootworm egg counts in April and May, 1977 were in the moderate to high range although viability was very low. Western eggs were not separated from northern eggs in these studies.

Extensive corn rootworm adult surveys in 1977 showed very low to trace numbers of western beetles per plant; only four fields were found in a random survey that had greater than 2 western beetles per plant. Approximately 60 percent of these same fields had northern populations greater than 1 adult per plant. Several fields had northern populations of 8 to 10 beetles per plant.

The diminution of the western population and at least a stable if not increased northern population emphasizes the biological differences between the species. Reasons for the unprecidented western corn rootworm decline are difficult to quantitate on a statewide basis.

The reasons for the apparent high egg mortality of the western corn rootworm are probably associated with both the severe summer drought and colder than normal soil temperatures. Soil temperatures at the Southeast Experiment Station at the 8" depth showed an extended period in the 15° F range. The nutritional status of the females must also have been limited due to continued plant stress, limited silking and ear set and greater than normal acreage harvested for silage.

Plots were established at the Tofte Farm, Furadan history, Brookings; NGIRL lab, Trap Crop, Brookings; SDSU Ag. Engineering Farm, Furadan history, Brookings; Van Liere Farm, Thimet history, Colton; USDA, ASCS Farm, Trap Crop, Madison; and the Southeast Experiment Station, Trap Crop, Beresford.

Root damage was sufficient for evaluation at only the Beresford and Madison plots, the remaining plots had no damage. The rootworm pressure was not sufficient for clear separation of the compounds. All roots were dug, washed and rated on July 25, 26 and 27.

Separate wireworm and cutworm plots were established, however, no significant differences were noted.

Table 48. Rootworm Soil Insecticide Performance in South Dakota Research Experiments During 1974 Through 1976.

Treatment & Formulation	% Root Protection				
1 lb./A, 7" Band					
	1977	1976	1975	1974	4 yr. Ave.
Furadan 10G	(12) 75	(18) 60	(20) 73	(32) 76	(82) 74
Counter 15G	(14) 83	(21) 55	(25) 65	(14) 71	(74) 69
Dyfonate 20G	(10) 76	(10) 51	(13) 60	(14) 60	(47) 62
Dasanit 15G	(5) 80	(15) 48	(15) 52	(14) 56	(49) 59
Thimet 15G	(10) 81	(17) 49	(12) 49	(32) 56	(71) 59
Mocap 10G	(9) 79	(19) 44	(13) 48	(14) 58	(55) 57
Lorsban 15G	(9) 80	(21) 44	(13) 42	(3) 62	(46) 57
Bux 10G	(10) 73	(15) 53	(11) 38	(14) 49	(50) 53

All insecticides tested at recommended rate of 1 lb. actual per acre at planting time in 7 inch band.
Number of test indicated in ( ) parenthesis.

Experimental Insecticides

SRA 12869 (OFTANOL) will be marketed on a limited basis in 1978. The insecticide has shown good to excellent performance the past 4 years in South Dakota.

Resistance Monitoring

Bob Hooten, Graduate Assistant

The corn rootworm larval resistance monitoring program has continued to show the need for rotation of carbamate and phosphate insecticides. These studies have shown that carbamate resistance has developed on fields with continuous Furadan use. The data on organophosphate insecticides has not been as dramatic and no clear evidence exists showing phosphate resistance by rootworms.

The work has shown that rootworms collected from a given field can show considerable differences in tolerance depending on their time of hatch. This provides a handle in separating rootworm populations and provides a focal point on the segment of the population that is most damaging in the field. It is probable that the dominant underlying selection pressure for early hatching rootworms involved the gradual shift to earlier corn planting dates over the past decade. This shift in corn planting has provided root mass for larvae that hatch early, and it is this early developing larval population that is showing the most resistance to carbamates, but still susceptible to good control by phosphates. The continued use of carbamates has been shown to be a second selection pressure. The early hatching larvae are exposed to greater concentrations of insecticides than later hatching larvae. This situation usually will accelerate the development of insecticide resistance. The proportion of early developing larvae may vary from field to field and result in varying levels of rootworm control, ranging from noticeable damage (lodging) to root feeding damage comparable to untreated areas.

The extremely dry weather and a substantially colder winter in 1977 has practically decimated the western corn rootworm population. In the past, westerns accounted for nearly 90 percent of the rootworm problem. We do not know how the western will respond to insecticides as it makes a comeback in 1978. It is still the safest measure to continue following the recommendations for insecticide rotation.

First Year Corn Rootworm Damage

Tom Hedrick, Graduate Assistant

The sporadic corn rootworm damage in first year corn following small grains and flax was apparent again in 1977. These infestations and damage are primarily by the northern corn rootworms. The following crops and weeds were seeded in small plots to simulate weed and volunteer grain growth after harvest. The stands were kept to a single species to measure ovipositional attractiveness. The following (Table 49) lists the average number of rootworm eggs per square foot of soil. The average was derived from six soil samples and the eggs were washed and filtered from the soil. Volunteer oats and wheat

were more attractive than corn at the Southeast Experiment Station and equal to corn at the Madison site. The corn was at the normal maturation range, planted on May 9.

Table 49. Average Number of Eggs/Square Foot.

	Southeast Experiment Farm	Madison
Fallow	0.5	3
Combination Weeds	3.5	4
Pigweed	4.5	2
Smartweed	12.0	4
Lambsquarter	8.0	8
Yellow Foxtail	8.5	6
Green Foxtail	4.0	9
Soybeans	2.5	7
Flax	5.5	17
Oats	34.5	12
Wheat	67.0	13
Corn	11.5	12

Several small grain fields were surveyed for adult numbers and later sampled from rootworm egg density. The Table 50 shows adult numbers and rootworm eggs per square foot decreased as the distance from adjoining corn fields increased. These surveys also indicated a potential first year corn rootworm problem in the east central portion of the state.

Table 50. Oat Stubble.

Distance from Corn (ft.)	# Adults/100 Sweeps*	# Eggs/sq. ft.
300	40	3.8
135	37	5.3
90	47	4.5
45	117	8.3
Border Rows	62	4.5
45	5/plant	17.3
90	4/plant	10.5
135	4/plant	12.8

* 100% Northerns

Sex Pheromone Trapping Studies

Mike Lockwood, Graduate Assistant

The sex pheromone trapping studies were initiated in 1976 and continued during 1977. The pheromone was collected and provided by Dr. Paul Guss, Northern Grain Insects Research Laboratory, Brookings. Conclusions from the two year study were that environmental factors affected adult rootworm catches almost as much as population density and that use of sex pheromones for estimating rootworm populations was not practical.

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