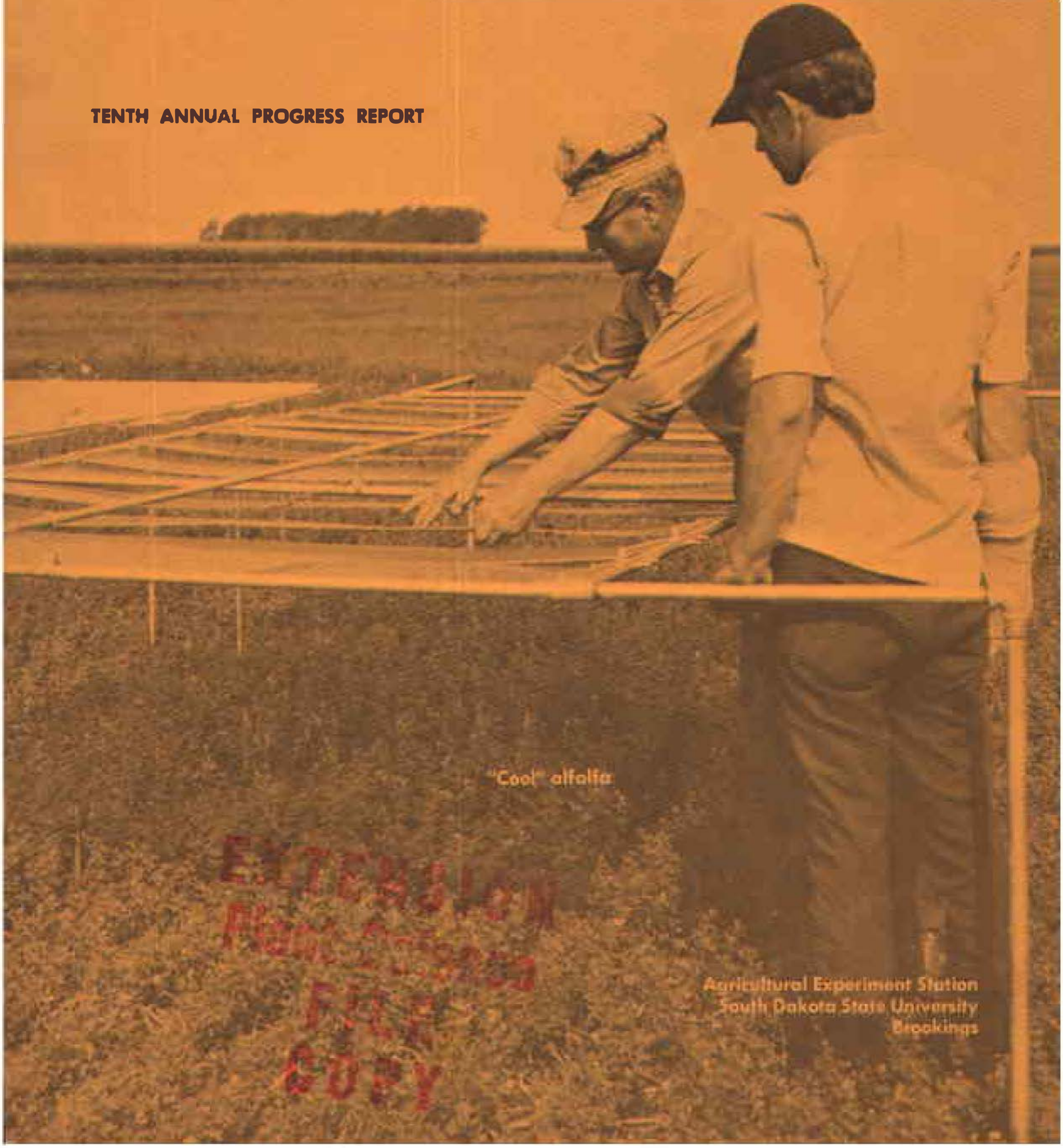
DECEMBER 1970

Southeast South Dakota Experiment Farm

TENTH ANNUAL PROGRESS REPORT



"Cool" alfalfa

Agricultural Experiment Station
South Dakota State University
Brookings

TENTH ANNUAL PROGRESS REPORT
SOUTHEAST SOUTH DAKOTA EXPERIMENT FARM

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This tenth 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 tenative because additional data resulting from continuation of these experiments may result in conclusions different from those based on any one year. Trade names are used in this publication merely to provide specific information. A trade name quoted here does not constitute a guarantee or warranty and does not signify that the product is approved to the exclusion of other comparable products.

SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION
BROOKINGS, SOUTH DAKOTA 57006

Duane Acker, Director

A. L. Musson, Assoc. Director

COVER PHOTO -- See description of experiment on page 52.

Southeast South Dakota Experiment Farm staff (right to left): Richard M. Luther, Research Manager; Jacob F. Fredrikson, Superintendent; and Burton E. Lawrensen, Assistant Superintendent.

The new Office-Laboratory building at the Farm soon after it was occupied in late 1970 (above) and as construction got underway earlier in the year (left).

FROM THE RESEARCH MANAGER

This 10th annual report of the Southeast South Dakota Experiment Farm is a means of listing for South Dakotans some of our activities and accomplishments during the year. Each year we look forward to "exhibiting our wares" (research results) in an effort to provide useful and applicable information to farmers and agribusiness people of Southeastern South Dakota.

As we review a decade of activity at the Southeast Experiment Farm we find a number of changes have occurred that are of interest. Prior to its designation as the Southeast South Dakota Experiment Farm in 1961 crops and soils research were conducted at the Mobile Unit farm at Menno, South Dakota. These activities were moved to the Experiment Farm and over the years agronomic investigations have involved fertility and cultural practices, crop diseases and corn, small grain, sorghum and soybean variety testing. These and other crop research continue to be a vital part of the Farm's research program. Livestock research was initiated in 1962 and involved housing and nutrition studies with swine. A year later a "Farrow to Finish" confinement building was constructed and a Specific Pathogen Free Swine herd established. Beef cattle nutrition studies were initiated in 1963 with the remodeling of the cattle shed with automated feeding of four pens of cattle. An additional outside feeding facility for four pens of cattle was in operation in 1968. Livestock research with both swine and cattle has centered about the environment and its relationship to the nutrition of the animal. The accomplishments of research programs initiated at the Farm is a result of untiring efforts of research people and the continued interest of members of the Experiment Farm Corporation. As we look to the future we will continue to make improvements in equipment and to evaluate research activities and facilities to provide meaningful programs to people of Southeastern South Dakota and the surrounding agricultural area.

The agronomic results this year were greatly influenced by climatic conditions. During late summer the "blast furnaces" came on and the rain "spigot" was closed resulting in one of the poorest crop yields ever known in the history of the Farm (except when hailed out). On the other hand the weather proved to be ideal for the building of the new Office-Laboratory Building. This building was financed and constructed by the Southeast South Dakota Experiment Farm Corporation. It is one of the many improvements made about the Farm by the Corporation. This facility completed and occupied in October, is a welcomed asset to the Experiment Farm activities and to agricultural education programs in this area. The building is 36 x 72 feet and provides 2,592 square feet of floor space. A large meeting room seating up to 125 people has been used for several agricultural meetings this year. A smaller meeting room with kitchen facilities has a seating capacity for 15-20 people. These rooms will be available to groups for educational purposes. A laboratory room equipped with a drying oven will be used for drying grains, forages and feed samples. Various simple chemical determinations may be made here. The building provides office space for the Research Manager, the Farm Superintendents and a secretary. We of the Experiment Farm and the College of Agriculture and Biological Sciences at South Dakota State University are most appreciative of the support the Corporation has given in providing this facility.

FROM THE SUPERINTENDENT

This progress report marks the completion of a decade of research at the Southeast South Dakota Experiment Farm

When the Farm was established, the south quarter was used for experimental plots and the north quarter for producing feed for experimental livestock. This practice continues to be followed with the exception that a Corn Population and Row Spacing experiment is located on the southwest corner of the quarter.

Grain and forage grown on the north quarter, as well as surplus grain and forage from the experimental plots and filler areas, are used for feed in the beef cattle and swine programs.

Production of grain and forage in 1970 was:

(based on weight at harvest)

Corn	3,808 bushel	Corn Silage	303 Ton
Oats	293 bushel	Alfalfa Hay	59.6 Ton
Soybeans	321 bushel	Grass Hay	7.3 Ton
Milo	121 bushel		

Corn grown for feed on the north quarter was fertilized as recommended after analysis of soil samples by SDSU soils testing laboratory. Fifty acres were side dressed, after planting and prior to emergence, with 100 lbs. of nitrogen (N) in the form of anhydrous ammonia. Seventy-two acres received 100 lbs. of N and 40 lbs. of P_2O_5 as plow down in the fall of 1969. Yields of corn from these fields reflected the effect of the stress brought on by lack of adequate moisture and above normal temperatures.

Table 1 shows a summary of precipitation and temperature data for 1970. This information is compiled at the farmstead site by the official volunteer weather observer for this area.

These data warrant careful interpretation because rainfall and temperature are the two environmental factors that most nearly determine the performance of our major crops.

While the performance of crops is not determined entirely by the total amount of rainfall, or temperature, these climatic factors influence the expression of certain treatments employed by the researcher. The distribution and intensity of rainfall and temperature is most important.

Figure 1 shows that the greatest deficiency of rainfall occurred during the critical growing season months of June, July and August. This coincided with a rise in mean temperature, as shown in Figure 2. The degree to which these stress factors affected agronomic studies at the Southeast Experiment Farm is discussed in the interpretations which accompany each report.

TABLE 1. PRECIPITATION AND TEMPERATURE AT SOUTHEAST FARM, 1970

Month	Rainfall in Inches	18 Year Ave.	Departure	Ave. Temp. (F)	18 Year Ave.	Departure
Dec. 69	1.14	0.71	+0.43	20.8	23.1	-2.3
Jan. 70	0.55	0.46	+0.09	6.8	16.5	-9.7
Feb.	0.35	1.40	-1.05	24.2	24.7	-0.5
March	1.45	1.36	+0.09	28.9	29.8	-0.9
April	2.74	2.58	+0.16	48.4	46.5	+1.9
May	3.65	3.23	+0.42	63.6	61.1	+2.5
June	2.48	4.08	-1.60	71.7	66.2	+5.5
July	1.47	3.13	-1.66	76.0	75.3	+0.7
Aug.	0.85	2.83	-1.98	75.2	70.9	+4.3
Sept.	3.18	2.87	+0.31	64.8	63.5	+1.3
Oct.	4.02	1.66	+2.36	49.0	54.1	-5.1
Nov.	2.03	0.94	+1.09	34.9	36.3	-1.4
Total	23.91	25.25	-1.34			

Days free of killing frost: May 2 to October 10 = 160 days.

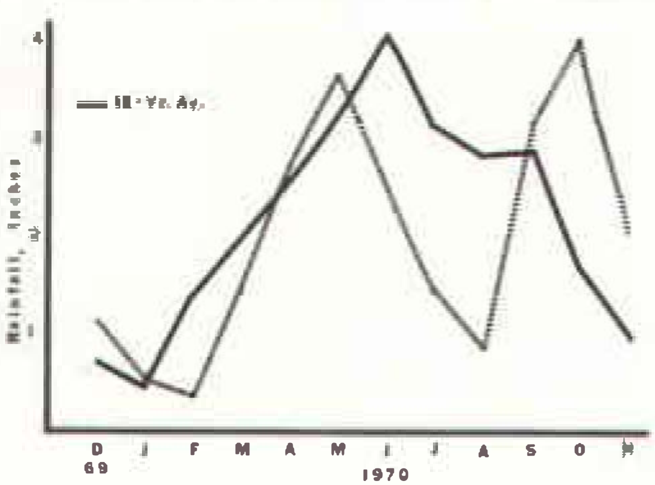

Figure 1. Precipitation - SESD Expt. Farm

Figure 2. Temperature SESD Expt. Farm

CORN POPULATIONS AND ROW SPACING

F. Shubeck and B. Lawrensen

Objectives of Experiment

1. Should we keep corn planters that can plant 35 or 36 inch rows or trade them in for machinery that can plant narrower rows?

2. Are the optimum row spacings and plant populations different for a short season hybrid and a full season hybrid?

3. Is there a greater need for narrow rows with high plant populations?

4. Can moisture loss by evaporation be reduced by narrow rows?

5. Will subsoil moisture at the beginning of the season, when added to expected rainfall in July and August, serve as a reliable guide to determine optimum number of plants per acre?

6. Will an erect leaf hybrid perform better than an arched leaf hybrid at populations and row spacings used in this experiment?

Methods and Procedures Used in Corn Row Spacing Experiment

November 19, 1969 - Plot fertilized with 118 lbs. of N, 46 lbs. P_2O_5 (20 lbs. P) and 40 lbs. K_2O (33 lbs. K) per acre broadcast.
December 23, 1969 - Plowed
April 21, 1970 - Tandem disked
May 22, 1970 - Planted both varieties, all plant populations and row spacings using Bux-ten insecticide at 8 lbs. per acre. Using Ramrod 20 G in 14" band over row at 25 lbs. per acre on area actually covered by band.
Varieties: Pioneer 3505 and Pioneer 3715
June 10, 1970 - Hand thinned to desired populations
June 19, 1970 - Cultivated
June 25, 1970 - Cultivated
October 20, 1970 - Hand picked

TABLE 2. EFFECT OF CORN PLANT POPULATIONS ON % BARREN STALKS, EAR MOISTURE, AND YIELD. (RESULTS FROM ALL 3 ROW SPACINGS WERE AVERAGED FOR EACH POPULATION)

Hybrid	Final Stand Thousands	% Barren Stalks	% Ear Moisture at Harvest	Bushels per Acre
Pioneer 3715	12	5.9	24.1	44
Pioneer 3715	14	7.7	24.3	43
Pioneer 3715	16	16.3	24.2	35
Pioneer 3715	18	13.9	24.3	34
Pioneer 3715	20	10.7	25.4	35
Pioneer 3505	12	3.0	27.8	47
Pioneer 3505	14	8.8	29.3	50
Pioneer 3505	16	12.3	30.2	42
Pioneer 3505	18	13.3	30.8	39
Pioneer 3505	20	20.7	32.2	34

Discussion and Interpretation of Table 2

Plant populations greater than 14,000 generally decreased corn grain yield in this year which was characterized by below average moisture and above average temperatures.

Populations of 12,000 through 18,000 had only minor effects on ear moisture at harvest. When populations were raised from 18,000 to 20,000, ear moisture appeared to be slightly higher with both hybrids.

With the full season hybrid, there was a definite increase in % barren stalks as populations were increased. With the earlier maturing hybrid this trend was not quite so apparent.

TABLE 3. EFFECT OF ROW SPACINGS ON YIELD, EAR MOISTURE AND % BARREN STALKS (RESULTS FROM ALL 5 POPULATIONS WERE AVERAGED FOR EACH ROW SPACING)

Hybrid	Row Spacing in Inches	% Barren Stalks	% Ear Moisture at Harvest	Bushels per Acre
Pioneer 3715	30	10	25.2	41
Pioneer 3715	35	13	24.4	34
Pioneer 3715	40	10	24.2	38
Pioneer 3595	30	9	31.0	46
Pioneer 3505	35	12	30.3	41
Pioneer 3505	40	14	28.9	41

Discussion and Interpretation of Table 3

The narrowest row spacing (30 inch) gave the highest yield of corn grain with both the early and full season hybrids. Yields from 35 and 40 inch rows were about the same with the full season hybrid. With the short season hybrid, 40 inch rows apeared to yield a little more than 35 inch rows. This is the reverse of the results obtained in 1969 and may be due to soil variation, climatic conditions, or coincidence.

There appeared to be a very small but consistant decrease in ear moisture at harvest as row spacings were widened. This also was different from results of the preceding year, but it should be remembered that the climatic conditions were also different from the preceding year.

The percent of barren stalks was not influenced very much by row spacings with the early hybrid. The full season hybrid had more stalks without ears as rows were widened.

TABLE 4. EFFECT OF HYBRID AND PLANT POPULATIONS ON YIELD OF 70% MOISTURE ENSILAGE. (YIELDS OF 3 ROW SPACINGS AVERAGED FOR EACH POPULATION)

Plant Populations	Tons per Acre	
	Pioneer 3715	Pioneer 3505
12,000	6.4	9.4
14,000	8.0	9.7
16,000	8.6	9.5
18,000	7.6	7.7
20,000	7.8	7.7

Discussion and Interpretation of Table 4

Notice that at lower plant populations, there was a wide difference in silage yields between the early and full season hybrids. As populations were increased from 12,000 to 16,000 silage yields from the early hybrid (Pioneer 3715) increased. Silage yields from the full season hybrid appeared to decrease with populations over 14,000. At 18,000 and 20,000 plants per acre silage yields from both hybrids were about the same.

TABLE 5. EFFECT OF ROW SPACINGS AND HYBRIDS ON YIELD OF 70% MOISTURE ENSILAGE (YIELDS OF 5 POPULATIONS AVERAGED FOR EACH ROW SPACING)

Hybrid	Row Spacing	Ton/Acre
Pioneer 3715	30 inches	8.0
Pioneer 3715	40 inches	7.3
Pioneer 3505	30 inches	9.5
Pioneer 3505	40 inches	8.1

Discussion and Interpretation of Table 5

Narrow rows (30 inches) gave more tons of silage per acre than conventional 40 inch rows with both early and full season hybrids.

No silage determinations were made for 35 inch row spacings. Only the widest and narrowest spacings were sampled.

AN ORGANIC SOIL CONDITIONER FOR CORN AND OATS

F. Shubeck and B. Lawrensen

Objectives of Experiment

To compare an organic speciality fertilizer or soil conditioner with a chemical fertilizer regarding their effects on bushels of grain per acre, protein in grain and moisture in grain at harvest.

Methods and Procedures Used in Soil Conditioner Study

The following methods and procedures were used for corn:

Preceding crop - oats
- May 7 - Fertilizer broadcast on those plots receiving 60 lbs. N, 13 lbs. P per acre
- May 7 - Plowed, disked and harrowed
- May 7 - Planted Pioneer 3715. Plots receiving organic conditioner were fertilized at planting with 200 lbs/acre placed in a band two inches to the side, and two inches below the seed
- May 27 - Rotary hoed
- June 2 - Cultivated
- June 12 - Cultivated
- July 20 - Ear leaf sampled for chemical analysis
- Sept. 30 - Hand picked

Final stand - 18,000 plants per acre

The following methods and procedures were used for oats:

Preceding crop - corn
- April 8 - Corn stalks shredded
- April 9 - Tandem disked
- April 17 - Broadcast fertilizer
- April 17 - Tandem disked and harrowed
- April 17 - Drilled Kota oats at 2½ bushel per acre
- July 15 - Windrowed
- July 17 - Combined

TABLE 6. EFFECT OF COMMERCIAL FERTILIZER SALTS AND A SOIL CONDITIONER ON YIELD OF CORN, EAR MOISTURE AT HARVEST, AND PERCENT PROTEIN IN GRAIN

Fertility Treatment	% Ear Moisture at Harvest	% Protein in Grain*	Bu/Acre No. 2 Corn
None	22.4	8.1	54
200 lbs/acre soil conditioner	22.6	8.3	59
60 lbs N + 13 lbs P/acre	20.6	10.2	64
L.S.D. at 5%			6.7

* Provided by Soil Testing Laboratory, South Dakota State University

Discussion and Interpretation of Table 6

Application of 60 lbs. N + 13 lbs. P/acre in the form of fertilizer salts increased corn yields more than the other treatments. This experiment was located in a low lying area of the farm. Consequently, in years with below average rainfall, corn yields were not reduced as much as would be expected from the limited rainfall. There were five replications of every treatment. Locations of treatments were randomized in the entire area.

Corn in the highest yielding plots had the least ear moisture at harvest but the highest protein content in grain.

TABLE 7. EFFECT OF COMMERCIAL FERTILIZER SALTS AND A SOIL CONDITIONER ON CORN LEAF COMPOSITION*

	Composition of Dry Leaves**								
Fertility Treatment	N %	P %	K %	Ca %	Mg %	S %	Fe ppm	Mn ppm	Zn ppm
None	1.73	0.169	2.14	0.54	0.22	0.099	60.0	41.0	24.8
200 lbs/A Soil Conditioner	1.55	0.141	2.14	0.47	0.22	0.116	47.0	48.7	23.2
60 lbs N + 13 lbs P/A	1.94	0.210	2.31	0.49	0.29	0.122	61.0	52.6	26.9

* Leaf analysis made by Soil Testing Laboratory at South Dakota State University, Brookings, South Dakota

** Leaf opposite and below the ear was taken for analysis and dried at 60-65° C.

TABLE 8. SUFFICIENCY LEVELS TO EVALUATE LEAF ANALYSES FOR CORN

Element	Content of Element in Ear Leaf Sampled at First Silk	
	Minimum	Maximum
N (Nitrogen)	2.75%	3.50%
P (Phosphorus)	0.25%	0.40%
K (Potassium	1.71%	2.25%
Ca (Calcium)	0.21%	0.50%
Mg (Magnesium	0.21%	0.40%
S* (Sulfur)	0.10%	0.40%
Fe (Iron)	21.0 ppm	250.0 ppm
Mn (Manganese)	20.0 ppm	150.0 ppm
Zn (Zinc)	20.0 ppm	70.0 ppm

* Levels for sulfur from South Dakota State University Soil Testing Labatory. Other levels established by Plant Analyses Laboratory, Wooster, Ohio.

Discussion and Interpretation of Tables 7 and 8

The purpose of leaf analysis was to determine if any nutrient deficiencies existed. The optimum levels of the different nutrients in corn leaf tissue would fall between the minimum and maximum quantities listed in Table 8.

Nitrogen levels in leaf tissue for all treatments (Table 7) were below the minimum levels given in Table 8. This suggests that higher rates of nitrogen fertilizer application may have given more bushels per acre. However, the dry surface soils at sampling time may have interfered with nitrogen uptake by the plants.

When 60 lbs. N and 13 lbs. P per acre were applied, leaf content of P was almost sufficient for optimum corn yields. Leaf tissue taken from plots of other treatments was deficient in P.

Quantities of K, Ca, Mg, S, Fe, Mn, and Zn were sufficient.

TABLE 9. EFFECT OF COMMERCIAL FERTILIZER AND A SOIL CONDITIONER ON YIELD OF OATS

Fertility Treatment	Oats Bu per Acre
None	42
200 lbs/acre soil conditioner	45
60 lbs N + 13 lbs P per acre	64
L.S.D. at 5% level	3.8

Discussion and Interpretation of Table 9

Yield of oats was very responsive to fertilizer salts. Yields from the fertility treatment consisting of 60 lbs N + 13 lbs P per acre were significantly greater than the other treatments.

(Right) Experimental 3-way hybrids with stalk and root rot resistance (very little stalk breakage).

(Below) Stalk breakage and lodging due to stalk and root rot diseases.

STARTER AND POP-UP FERTILIZER FOR CORN

F. Shubeck and B. Lawrensen

Objectives of Experiment

1. Will a starter fertilizer high in phosphorus increase corn yields in a soil with medium to low phosphorus supplying ability?

2. Is it best to forget about starter fertilizer and broadcast all fertilizer before planting, then disk it in or plow it down?

3. What can we expect from "pop-up" fertilizer in regard to yield, maturity, and early growth?

Methods and Procedures Used in Starter and Pop-up Experiment

Cropping history:

1969 - Corn was grown in this area. It was unfertilized and removed for silage.
1968 - Starter fertilizer experiment was in this area with several rates of fertilizer and methods of application. Plants were removed for silage.
April 10 - Tandem disked
May 8 - Fertilizer was broadcast in plots calling for plow down applications, then plowed. After plowing, fertilizer was broadcast in plots calling for disked in fertilizer, then these plots were tandem disked.
May 19 - Tandem disked, spike tooth harrowed. Then planted Pioneer 3570.
Insecticide - Bux-ten
Herbicide - Ramrod 20G banded in 14 inch band over row
Pop-up was applied with seed
Side-band starter was placed approximately 2 inches to the side and 2 inches below the seed.
June 3 - Cultivated
June 8 - Sidedressed 80# N/acre in form of ammonium nitrate in designated plots
June 19 - Cultivated
October 23 - Hand picked

TABLE 10. EFFECT OF STARTER FERTILIZER, POP-UP, SUPPLEMENTAL NITROGEN AND METHODS OF APPLICATION ON CORN YIELDS AND PERCENT MOISTURE IN EARS

Treat-ment No.	Starter, Pop-up & Broadcast Fertilizer lbs. per Acre N + P + K	Method	Additional Nitrogen lbs. per Acre	Tons of 70% Moisture Ensilage	% Water in Ears at Harvest	Bu. of #2 Corn per Acre
1	0 + 0 + 0		none	7.9	18.2	12.0
2	0 + 0 + 0		80 plow	8.0	26.3	11.0
3	12 + 23 + 17	starter band	none	7.4	26.2	10.0
4	12 + 23 + 17	starter band	80 plow	7.9	27.9	6.0
5	3 + 6 + 5	pop-up	80 plow	8.5	22.6	10.0
6	3 + 6 + 5	pop-up plus				
	9 + 17 + 12	starter	80 plow	7.5	33.4	4.0
7	12 + 23 + 17	plow down	80 plow	8.1	30.8	7.0
8	12 + 23 + 17	disk in	80 plow	7.8	30.9	7.0
9	12 + 0 + 17	starter band	80 plow	8.1	26.5	10.0
10	12 + 23 + 0	starter band	80 plow	7.7	29.9	7.0
11	12 + 23 + 17	starter band	80 sidedress	7.5	30.3	5.0
12	3 + 6 + 5	pop-up plus				
	9 + 17 + 12	plow down	80 plow	7.4	28.1	8.0
13	3 + 6 + 5	starter band				
	9 + 17 + 12	plow down	80 plow	6.8	34.5	3.0

Discussion and Interpretation of Table 10

The highest yield of ear corn was obtained in the unfertilized check plots. When drought was so severe that corn yields were in the 6 to 12 bushel range, fertilizer did not increase yields.

Unfertilized plots had less ear mosisture at harvest than fertilized plots. There were very few total ears and the ratio of grain to cobs varied considerably which probably influenced total ear moisture.

Yields of silage were low generally and were not influenced very much by fertility levels.

TABLE 11. EFFECT OF FERTILIZERS AND METHODS OF APPLICATION ON CORN HEIGHTS

Treat-ment No.	Starter, Pop-up & Broadcast Fertilizer lbs. per Acre N + P + K	Method	Additional Nitrogen, lbs/Acre	Plant Height in Feet and Tenths June 22	July 3	July 16
1	0 + 0 + 0		none	1.4	2.6	4.6
3	12 + 23 + 17	starter band	none	1.7	3.0	4.7
4	12 + 23 + 17	starter band	80 plow	1.7	3.1	4.6
5	3 + 6 + 5	pop-up	80 plow	1.5	3.0	4.8
6	3 + 6 + 5	pop-up	80 plow	1.6	3.0	4.6
	9 + 17 + 12	starter				
9	12 + 0 + 17	starter band	80 plow	1.4	2.8	4.7
10	12 + 23 + 0	starter band	80 plow	1.5	3.1	4.7
11	12 + 23 + 17	starter band	80 sidedress	1.5	3.0	4.6
12	3 + 6 + 5	pop-up	80 plow	1.6	2.9	4.8
	9 + 17 + 12					
13	3 + 6 + 5	starter band	80 plow	1.5	3.0	4.7
	9 + 17 + 12	plow down				

Discussion and Interpretation of Table 11

Note that treatments 2, 7, and 8 were not measured for corn height.

Early in the growing season (June 22), corn that received fertilizer got off to a faster start than corn in unfertilized check plots. At this stage some of the sideband starter treatments had a growth rate equal to that of the pop-up treatments.

Notice, in treatment number 9, where phosphorus was omitted from the side-band starter, plant height on June 22 was just about the same as that in the unfertilized check plots.

By June 3, the maximum differences in growth rate were attained between plots receiving starter and those receiving no starter.

On July 16, height differences between fertilized and unfertilized corn were less. This sequence has occurred before. The starter and pop-up treatments stimulate early growth but later in the season, growth in plow down and other treatments began to catch up to the sideband and pop-up treatments. This rapid early growth response is frequently but not always associated with a yield response.

TABLE 12. EFFECT OF FERTILIZER AND INTERNODE NUMBER ON NITRATE NITROGEN ACCUMULATION IN CORN STALKS*

Sideband Starter lbs. per Acre N P K	Additional Nitrogen lbs per Acre	Internode Number (First Internode Above Ground Is Number 1)	Nitrate Nitrogen In Stalks Parts Per Million**
0 + 0 + 0	none	1	115
0 + 0 + 0	none	2	53
0 + 0 + 0	none	3	49
0 + 0 + 0	none	4	78
0 + 0 + 0	none	5	96
0 + 0 + 0	none	6	103
0 + 0 + 0	80 plow down	1	3266
0 + 0 + 0	80 plow down	2	3267
0 + 0 + 0	80 plow down	3	2021
0 + 0 + 0	80 plow down	4	1425
0 + 0 + 0	80 plow down	5	901
0 + 0 + 0	80 plow down	6	592
12 + 23 + 17	80 plow down	1	4550
12 + 23 + 17	80 plow down	2	3270
12 + 23 + 17	80 plow down	3	1741
12 + 23 + 17	80 plow down	4	1935
12 + 23 + 17	80 plow down	5	1080
12 + 23 + 17	80 plow down	6	1235
12 + 23 + 17	80 sidedress	1	3072
12 + 23 + 17	80 sidedress	2	2592
12 + 23 + 17	80 sidedress	3	1731
12 + 23 + 17	80 sidedress	4	1200
12 + 23 + 17	80 sidedress	5	591
12 + 23 + 17	80 sidedress	6	620

* Analyses made by Soil Testing Laboratory, South Dakota State University, Brookings, South Dakota

** To convert ppm to %, divide ppm by 10,000

Discussion and Interpretation of Table 12

In a dry growing season such as 1970, the question of nitrate poisoning frequently arises. Consequently samples were taken and analyzed from several treatments in different experiments to see what influence these treatments would have on nitrate content of forage.

On a dry basis, forage with less than 1,500 parts of nitrate nitrogen per million (0.15%) is usually considered safe to feed under all conditions (1). Forage with 1,500 to 4,500 ppm of NO_3-N is in the danger zone, and forages with more than 4,500 ppm are all potentially toxic (1).

In Table 12, notice the low content of nitrate nitrogen in corn stalks when no plow down or sidedress nitrogen applications were made.

When 80 lbs. N/acre were plowed down, nitrate nitrogen content in stalks increased to the point where the lower part of the stalks were in the danger zone for feeding.

Use of starter fertilizer had no beneficial affect on reducing nitrate nitrogen accumulation in corn stalks.

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(1) Extension Service Fact Sheet 420. South Dakota State University, Brookings,

INSECTS AFFECTING CORN

B. H. Kantack, W. L. Berndt and J. Fredrikson

Seed Treatments

Use of planter box seed treatments have long been recommended for use at planting time. These treatments are designed to protect the germinating seeds against insects such as wireworm, seed corn maggot, seed corn beetles and some disease organisms. This experiment was designed to measure the effect of a Captan-Diazion 37.5 - 25 seed treatment. Results of this test are shown in Table 13.

TABLE 13. THE EFFECT OF A CAPTAN-DIAZINON SEED TREATMENT ON CORN PLANT STAND ON FIRST YEAR CORN FOLLOWING ALFALFA CROP

Replicate	Treated	Untreated	Increase
1	36	28	+ 8
2	36	30	+ 6
3	32	35	- 3
4	26	28	- 2
5	31	25	+ 6
6	39	33	+ 6
	200	179	+ 20

Stand counts taken on 30 feet of linear row for each replicate.

No significant difference was found between treatment and check (t = 1.45)

Although the stand counts indicated an 11.7 percent increase in favor of the treatment, statistical analysis showed no significant difference between the treated and the untreated check.

WESTERN CORN ROOTWORM

B. H. Kantack, J. Fredrikson and W. L. Berndt

Corn rootworm populations were extremely high in South Dakota during the 1970 growing season. Both the incidence of infested fields as well as the numbers of rootworm were high. Although some treated fields suffered severe injury because of overwhelming rootworm populations, poor calibration of planter equipment or unknown factors, most growers were satisfied with the results obtained from recommended treatments. Some of the fields where partial control was reported were investigated by the Extension entomologist. In these cases the problems resulted from too light a dosage of the insecticide such as using 0.5 pounds actual instead of 0.75 etc. We cannot over emphasize that recommended dosages are the minimum amounts that are required to give satisfactory performance in most instances.

Results of a rootworm control demonstration are shown in Table 14. Rootworm populations were very light at the Southeast Farm (5 to 10 worms per plant) with essentially no lodging in the untreated check or any of the treatments. Field results are shown in Table 14.

TABLE 14. YIELDS OBTAINED IN CORN ROOTWORM DEMONSTRATION PLOTS - FARM RESEARCH

Treatment	Dosage Actual/Acre	Yield[1] Bu/Acre
Furadan	0.75 lb.	41.2
Bux	1.0 lb.	37.4
Thimet	1.0 lb.	36.4
Dyfonate	1.0 lb.	37.4
Dasanit	1.0 lb.	38.6
Mocap	1.0 lb.	37.3
CHECK		35.6

[1] Average 2 replicates based on ear corn at 16% moisture. Statistical analysis shows no difference between treatment means.

The infestation was not sufficient in this plot to show differences between insecticide treatments on yield performance.

Corn rootworm recommendations for 1971 are: (1) Rotate to another crop whenever possible to break the corn on corn sequence. (2) Use a recommended insecticide treatment on all corn following corn.

TABLE 15. RECOMMENDED INSECTICIDES FOR CORN ROOTWORM CONTROL IN 1971

Insecticide	Dosage Actual per Acre
Furadan	0.75
Bux	1.0
Thimet	1.0
Dyfonate	1.0
Dasanit	1.0
Mocap	1.0
Diazinon*	1.0

*Diazinon is recommended for use only NORTH of US Highway 16 in South Dakota.

Caution

Insecticides are poisonous - handle and store them with care. Be sure to read the label and follow directions to the letter. Keep children and pets out of the area where chemicals are stored, mixed, or used. Do not contaminate feed, feed containers, or water troughs. Clean all contaminated planting equipment carefully. Destroy all emptied containers so they cannot be reused for any purpose.

An untreated corn field in Moody County destroyed by western corn rootworm. (August 1970)

GREENBUG CONTROL WITH SYSTEMIC INSECTICIDES ON GRAIN SORGHUM

P. A. Jones, B. H. Kantack,
F. Shubeck and B. Lawrensen

Infestations of greenbugs, Schizaphis graminum (Rondani), have been a limiting factor in sorghum production since 1968 in South Dakota. Economic infestations of this insect have been encountered in South Dakota during the 1968, 1969 and 1970 growing season in both grain and forage sorghums.

This study was conducted to evaluate various systemic insecticides for control of greenbugs on sorghum. Systemic insecticides have several advantages: (1) They can be applied at planting time as granules, thus eliminating a spray treatment. (2) The treatment allows persistence of non-economic greenbug populations to support insect predator and parasitic populations which are a factor in holding other past species in check.

Results are reported from a plot consisting of seven replicates for each of three systemic insecticide treatments. The variety planted was DeKalb A-25 with yield results taken from two thirty inch rows, each row 80.4 feet in length.

Greenbug populations were found developing during early July and were approaching economic numbers by mid-July and persisted during the entire growing season until September 1. The severity of infestations is shown in Table 16.

TABLE 16. GREENBUG CONTROL USING THREE SYSTEMIC INSECTICIDES AS PLANTING TIME TREATMENTS

Treatment	Dosage Actual/Acre	Ave. Aphids per Leaf[1]	Yield Bu/Acre[2,3]
Di-Syston	1.0 lb.	27	69.4
Furadan	1.0 lb.	40	71.2
Thimet	1.0 lb.	156	56.1
Check		158	55.4

[1] Average numbers greenbug per leaf of whole plant on August 10, 1970.
[2] Yield of No. 2 grain sorghum based on 14% moisture.
[3] Both Di-Syston and Furadan means are significantly different from the Thimet treatment and the untreated check.

The sorghum was planted June 2 and field observations were made bi-weekly for greenbug infestations. All three treatments showed good greenbug suppression until July 20, at which time the Thimet treatment started to break down and greenbug populations were increasing rapidly. Final greenbug counts were taken August 10, 1970. Both the Di-Syston and Furadan treatments were still giving good control.

Results of this experiment show that control of greenbug is both profitable and possible for sorghum growers, and that control can be obtained using systemic insecticides applied at planting time.

HERBICIDE SCREENING TESTS ON CORN

SOUTHEAST EXPERIMENT FARM - 1970

W. E. Arnold, C. E. Stymiest and W. B. O'Neal

OBJECTIVE: To compare the effectiveness of new herbicides and herbicide combinations with some recommended herbicides for the control of annual weeds in corn.

LOCATION: Southeast Experiment Farm, 6 miles west and 3 miles south of Beresford, South Dakota.

PLOT SIZE AND DESIGN: Plots were 10 feet by 30 feet replicated 3 times in a randomized complete block design.

PLANTING INFORMATION: Pioneer 3505 was planted at the rate of 20,900 seeds/A on May 7, 1970.

SPRAYING INFORMATION: All treatments were applied with a tractor type sprayer applying 20 gallons per acre of spray solution. Preplant incorporated treatments were applied on May 7, 1970 and were incorporated with a tandem disk. Preemergence treatments were also applied on May 7, 1970. Post treatment was applied on May 27, 1970 when foxtail was in 2-3 leaf stage of growth.

CULTIVATION: The cultivated check plot was cultivated twice. All treated plots and the weedy check were not cultivated during the growing season.

DATA TAKEN: Estimations of percent grass (primarily green and yellow foxtail) control were taken on June 2 and again on July 6. Broadleaf weed control notes were taken on July 6. Broadleaf weed infestations were not heavy enough for analysis on a percentage basis. An indicator system was used where 'x' denotes the presence of a specified broadleaf species in one plot out of a possible three. The column headings shown in Table 17 for the various broadleaf weeds are: K = kochia; PW = pigweed (smooth or redroot); LQ = lambsquarter; CB = cocklebur; and WM = wild mustard. Corn yields were taken on September 19. Thirty feet of one row in each plot was harvested. Yields were calculated on the basis of 15.5 percent moisture. Rates of application, weed control and corn yields are shown in Table 17.

RESULTS: Satisfactory weed control of annual broadleaf weeds and weedy grasses was obtained with several treatments. Preemergence herbicide combinations of Bladex + Lasso and Lasso + AAtrex showed the best overall performance for full season weed control of both grasses and broadleaf weeds. These results point out that if adequate rainfall occurs within 2 weeks after treatment, preemergence treatments are as effective as preplant incorporated treatments. The only postemergence treatment to give satisfactory control was AAtrex + oil.

TABLE 17. HERBICIDE SCREENING TESTS ON CORN — SOUTHEAST EXPERIMENT FARM

Treatment	Rate lbs./A	% Grass Control Early	% Grass Control Late	Broadleaf Weed Control[1] K	PW	LQ	CB	WM	Corn Yield (Bu/A)
Preplant Incorporated									
AAtrex	2½	88	82		x				61.5
AAtrex + Sudan	1 + 3	86	75		x				48.4
Bladex	3	87	75		xxx		x		74.7
Bladex + Lasso	1½ + 1½	83	63		x				62.1
Bladex + Sutan	1 + 3	83	80		x		x	x	51.4
Lasso	2½	78	68		xx	xx		x	61.5
Lasso + AAtrex	2 + 1	90	72						81.9
Sutan	4	73	78	x	xx	x	x	xxx	94.8
Sutan + S-6115	3 + 3/4	67	68		x			x	68.0
S-6115	3/4	70	50		x			x	66.8
AAtrex 4L	2½	79	82						86.9
Preemergence									
AAtrex	2½	92	78				x		95.8
AAtrex 4L	2½	88	83		xx		x		66.0
Bladex	3	92	88		xx				83.6
Bladex + Lasso	1½ + 1½	87	83		x				73.0
Bladex + Lasso	3 + 1	94	93				x		74.2
Lasso	2½	87	82			xx	xx		64.2
Lasso + Lorox	2 + 1	87	77						67.1
Lasso + AAtrex	2 + 1	92	93						108.2
Ramrod	5	89	88		x		x	xx	91.1
Ramrod + Atrazine	3 + 1½	90	78				x		74.1
S-6115	3/4	72	40				x		82.2
Ramrod + Lorox	3 + 1½	87	73						83.5
Post emergence									
AAtrex + oil	1 + 1	85	78				x		68.5
AAtrex 4L	1	70	57		xx		x		121.5
Dowpon + oil	3/8 + 1	7	13	xxx		xxx	x	x	37.2
AAtrex + Dowpon + oil	1 + 3/8 + 1	77	63						84.5
Dowpow + Preemerge	½ + 4	0	27		xxx			xxx	24.0
Control									
Weedy check		0	0		xxx	x	xx	xx	62.4
Cultivated check					x				69.9

x - Indicates weed was present in 1 of a possible 3 replications.

[1] K = kochia; PW = pigweed; LQ = lambsquarter; CB = cocklebur; WM = wild mustard.

HERBICIDE SCREENING TESTS ON SOYBEANS

SOUTHEAST EXPERIMENT FARM - 1970

W. E. Arnold, C. E. Stymiest and W. B. O'Neal

OBJECTIVE: To evaluate the effectiveness of new and currently recommended herbicides for the control of annual weeds in soybeans.

LOCATION: Southeast Experiment Farm, 6 miles west and 3 miles south of Beresford, South Dakota.

SOIL TEXTURE: Silt loam, 3% organic matter.

PLOT SIZE AND DESIGN: The plots were 10 feet by 30 feet, replicated 3 times in a randomized complete block design.

PLANTING INFORMATION: Soybeans were planted on June 1, 1970.

SPRAYING INFORMATION: Preplant incorporated and preemergence treatments were applied with a tractor type sprayer applying 20 gallons of spray solution per acre. Preplant incorporated treatments were applied on May 7, 1970, and were incorporated with a tandem disk. Preemergence treatments were applied June 2, 1970. Post emergence treatments were applied with a bicycle sprayer applying 20 gallons of spray solution per acre. The post-emergence treatments were applied on June 23, 1970, when foxtail was in the 1-2 leaf stage and soybeans were in the second trifoliate stage of growth.

CULTIVATION: The control plots were cultivated once and the treated plots were not cultivated.

DATA TAKEN: Estimations of percent grassy weed control were taken on July 6, 1970 and soybean yields were taken on October 3, 1970. Results of this study are shown in Table 18.

RESULTS: Several herbicides and herbicide combinations showed good control of annual grasses (primarily yellow and green foxtail). Enough moisture was received within two weeks after application of the preemergence herbicides to move them into the soil where they could be effective for weed control. The preemergence herbicides Lasso, Ramrod, Amiben and their combinations, gave the best overall grass control. The best preplant incorporated treatments were Treflan, Vernam, and Planavin. The experimental herbicide that most effectively controlled the foxtail and resulted in higher yields of soybeans was a pre-emergence treatment of Ryzelan at 3 lbs./acre.

TABLE 18. SCREENING TESTS ON SOYBEANS - SOUTHEAST EXPERIMENT FARM

Treatments	Rate (lbs./A)	% Grass Control	Soybean Yield (Bu/A)
Preplant Incorporated			
SD-25279	3/4	10	16.1
SD-25279	1/2	6	9.7
Lasso	2 1/2	43	19.6
Vernam	3	83	27.8
Treflan	3/4	75	29.0
SD-25644	3/4	30	8.0
SD-25644	1 1/2	27	17.6
Planavin	1 1/2	68	26.0
Preemergence			
Lasso	2 1/2	90	27.2
Lasso + Lorox	2 + 1	95	29.5
Lasso + Amiben	2 + 1 1/2	93	29.9
Ramrod	5	90	26.2
Ramrod + Lorox	3 + 1 1/2	94	28.6
Lorox	2 1/2	87	19.7
Amiben	3	83	27.5
Solo	1 + 1	67	28.7
Preforan	4	83	27.4
Ryzelan	1 1/2	77	26.1
Ryzelan	2	79	26.1
Ryzelan	3	75	30.2
Preemergence 21	8 qt/A	62	23.9
SD-25279	3/4	17	22.7
SD-25279	1 1/2	17	24.2
SD-25644	3/4	37	18.0
SD-30187	1/2	43	18.9
SD-30187	3/4	50	21.0
SD-30187	1 1/2	57	20.6
SD-35644	3/4	3	9.8
Post Emergence			
Lasso + oil	2 + 1	10	17.9
GS-16068	1 1/2	20	15.1
Tenoran + oil	1 + 1	34	17.5
No Herbicide (1 cult.)	--	0*	23.7
No Herbicide (no cult.)	—	0	18.2

* Notes taken before cultivation.

EFFECT OF FERTILIZER ON ATRAZINE BREAKDOWN
SOUTHEAST EXPERIMENT FARM - 1970

W. E. Arnold, C. E. Stymiest and W. B. O'Neal

OBJECTIVE: To determine the carryover effects of atrazine under various fertility levels on oats and soybeans.

SOIL TEXTURE: Silt loam, 3% organic matter.

PLOT SIZE AND DESIGN: The plot size was 20 feet by 30 feet, replicated 4 times in a randomized complete block design.

PLANTING INFORMATION:

1969: Pioneer 3715 corn was planted on May 10.

1970: Strips of Kota oats and Corsoy soybeans were planted across plots with various levels of fertility and with and without atrazine treatment applied in the 1969 crop season.

SPRAYING INFORMATION: Atrazine (3 lb/A) was applied with a tractor type sprayer applying 20 gallons per acre of spray solution. The atrazine was applied preemergence to the corn on May 12.

FERTILIZER INFORMATION: Both ammonium nitrate and ammonium sulfate forms of nitrogen were applied at a rate of 100 pounds actual nitrogen per acre. The rate of phosphorus applied was 100 lbs/A of 0 - 46 - 0. A soil test showed no deficiency in potassium.

DATA TAKEN:

1969: Corn forage, corn and weed yields were taken in a 30 inch by 20 foot area on October 4.

1970: Oat yields were taken in a 3 foot by 12 foot area on July 20. Soybean yields were taken in a 30 inch by 12 foot area on October 3.

RESULTS:

1969: Adding nitrogen and phosphorus increased yields of both corn and weeds in the plots not treated with atrazine. The use of atrazine alone or fertilizer alone resulted in a 25 bu/A corn yield above that of the unfertilized check plot. Using both fertilizer and atrazine increased the average corn yield by 50 bu/A over the no atrazine-no fertilizer treatment (check). Therefore for the conditions of this experiment, both weed control and fertility were equally important for maximum corn yields.

1970: Oat yields on the atrazine-no fertility plots decreased as compared to the oat yields of the check. Oat yields on plots where atrazine and fertility were applied were about the same as the no atrazine-fertilized treatments. According to this data, sufficient residues of atrazine may be present the year after treatment to reduce oat yields. However, this effect appears to be overcome by (1) the growth response of oats to the increased fertility of

the fertilized plots; e.g. increased tillering or (2) the increased dissipation of atrazine during the year of application; e.g. increased plant uptake or increased microbial decomposition.

TABLE 19. EFFECT OF FERTILIZER ON ATRAZINE BREAKDOWN

Treatment in 1969	Corn Yields (Bu/A)	Corn Forage Yield lbs. DM[1]/A	Weedy Grasses Yield lbs. DM[1]/A	Oat Yields (Bu/A)	Soy-bean Yields (Bu/A)
	1969			1970	
No Atrazine					
No Fertilizer	50.7	5,273	1,040	35.3	19.8
No Nitrogen (Rec. P + K)*	44.0	4,820	1,267	37.2	19.1
NH_4SO_4 (Rec. P + K)	67.0	7,272	1,585	43.6	18.7
NH_4NO_3 (Rec. P + K)	75.3	7,719	1,988	49.8	19.9
Atrazine (3 lb. active/A)					
No fertilizer	75.5	7,401	0	26.6	19.0
No Nitrogen (Rec. P + K)	85.0	7,873	0	40.0	20.4
NH_4SO_4 (Rec. P + K)	98.6	10,687	0	48.5	19.0
NH_4NO_3 (Rec. P + K)	100.0	9,794	0	47.7	18.4

* (Rec. P + K) - Recommended Phosphorus and Potassium
[1] DM = Dry Matter

Weed control research.

HERBICIDE CARRYOVER FROM 1969 CORN SCREENING TESTS

SOUTHEAST EXPERIMENT FARM 1969-1970

W. E. Arnold, C. E. Stymiest and W. B. O'Neal

OBJECTIVE: To evaluate the persistance and injury to succeeding crops of oats and soybeans after the use of corn herbicides.

LOCATION: Southeast Experiment Farm, Beresford, South Dakota.

SOIL TEXTURE: Silt loam, 3% organic matter.

PLOT SIZE AND DESIGN: The plots were 10 feet by 30 feet, replicated 3 times in a randomized complete block design.

PLANTING INFORMATION:

1959: Pioneer 3715 hybrid corn was seeded at 16,000 plants per acre in 30 inch rows on May 10, 1969.

1970: Oats and soybeans were planted in strips across the plots of the previous years experiment.

SPRAYING INFORMATION: All plots were sprayed with a tractor type sprayer applying 20 gallons of spray solution per acre. The preplant incorporated herbicides were applied on May 9, 1969, and were incorporated with a tandem disk. Preemergence herbicides were applied on May 12, 1969 and post emergence treatments were applied on June 5, 1969.

DATA TAKEN: Yield samples were harvested on both oats and soybeans in 1970. A area of 3 feet by 12 feet of oats was harvested from each plot on July 20, 1970. An area of 2.5 feet by 15 feet of soybeans was harvested on October 3, 1970. The results are shown in Table 20.

RESULTS: Broadleaf weed infestations resulted in inconsistant yield data by replications, especially in the soybeans. Oat yields were decreased by Sutan, Londax, and triazine herbicides; Aatrex, ACD-ISM, Bladex, Primaze and S-6115, but the only treatments that consistently lowered yields of oats were the preplant, preemergence, and post treatments of AAtrex and also the preemergence and post emergence applications of ACD-15M. Since Sutan and Londax both have rapid dissipation in the soil (within 2 months) late season weed growth may have used up soil moisture which resulted in reduced yield of oats the following year.

TABLE 20. CARRYOVER FROM 1969 HERBICIDE CORN SCREENING TESTS, SOUTHEAST EXPERIMENT FARM - 1970

Treatment in 1969	Rate (lbs/A)	Oat Yields (Bu/A)-1970	Soybean Yields (Bu/A)-1970
Preplant Inc.			
AAtrex	2 1/2	61.8	15.9
Sutan	4	63.6	10.8
Sutan & AAtrex	3 + 1	66.6	13.5
Preemergence			
Ramrod	4	72.2	13.7
Ramrod	6	69.7	11.5
BASF 2903	3	66.8	11.6
BASF 2903	4	72.0	12.2
BASF 2903	5	66.3	9.5
Lasso	2	71.3	9.0
ACD-15M	2.5	61.8	14.8
Bladex	2.5	64.4	10.2
AAtrex	2.5	64.5	8.4
Preforan	3	71.6	12.9
Preforan	4.5	71.5	9.5
Primaze	2.5	67.6	11.7
Ramrod & Atrazine	2.4 + 1	68.4	12.0
Atrazine & GS-14260	1 1/4 + 1 1/4	72.0	14.6
GS-14260 & GS-13529	1 1/4 + 1 1/4	67.9	12.8
Londax	2 + 1	59.3	11.3
S-6115	2.5	64.8	14.5
Post emergence			
Aatrex + oil	1 + 1	62.9	11.9
ACD - 15M + oil	1 + 1	63.8	11.2
S-6115	1	60.1	11.9
No Herbicide	-	69.3	10.0

FLIGHT ACTIVITY OF LADY BEETLES AT THE SOUTHEAST EXPERIMENT FARM

Robert W. Kieckhefer and Gene A. Olson -
Northern Grain Insects Research Lab.

Objectives

1. To study flight of lady beetles between small grains, corn and alfalfa in South Dakota and to describe how numbers of lady beetles in these crops and environmental factors may be related to flight activity.

Methods and Procedures

Six, 12-foot, cylindrical, traps, coated with adhesive were used at the Southeast Experiment Farm May 18 through December 3, 1970 to study flight activity of lady beetles. Traps were re-coated periodically to insure adhesion of flying insects and were checked at approximatley 7 to 10 day intervals for lady beetles. Lady beetles caught were removed from traps and taken to the laboratory for detailed examination. Data recorded for each specimen caught included height of flight, direction of flight, identification of species, size measurements, sex, and variations in patterns of spotting. Information associated with these statistics included detailed weather data and numbers of immature and adult lady beetles in crops adjacent to traps.

Discussion

Problems connected with widespread application of insecticides have renewed interest in use of insect predators as an alternative or supplementary method of regulating populations of insect pests. Mass release of lady beetles collected in California is already being practiced in the Southern Plains to control greenbug in sorghum. But a detailed knowledge of the field biology of lady beetles, and pest populations, is prerequisite to effective management of natural populations of lady beetles. An important characteristic of native lady beetles in South Dakota is their great mobility due to constant, roving, flight activity. An understanding of this roving flight underlies effective application of native lady beetles as pest control agents.

Thirteen species of lady beetles were trapped during the 1970 season at the Southeast Experiment Farm. Six of the 13 species occurred commonly (Table 21). The 13-spotted lady beetle was active early in the season and was an important predator of aphids in small grains. Convergent lady beetles reached peak numbers later in the season and were important in diminishing corn leaf aphid populations in corn. These 2 species and the parenthesis-marked lady beetle were active in alfalfa throughout the growing season. The 2-spotted and immaculate lady beetles increased on aphids in shade trees and occurred in small numbers in corn. Pink lady beetle populations peaked in October and this species was predominant in winter grains.

TABLE 21. NUMBERS OF LADYBEETLES TRAPPED AT SOUTHEAST SOUTH DAKOTA EXPERIMENT FARM - 1970

Date	Convergent	13-spotted	Parenthesis	Pink	2-spotted	Immaculate
May 25	19	48	11	16	1	0
June 2	15	38	5	4	0	4
June 19	42	96	12	19	5	9
June 26	12	24	6	4	4	0
July 10	4	13	3	2	1	1
July 20	4	9	3	1	0	0
July 30	83	23	2	1	0	1
Aug. 10	19	8	3	10	2	2
Aug. 25	101	69	18	18	0	10
Sept. 4	23	20	13	8	0	3
Sept. 11	6	12	4	2	0	1
Oct. 2	20	60	7	46	0	0
Oct. 16	5	2	0	2	0	0
Nov. 6	3	0	0	0	0	0
Dec. 4	0	0	0	0	0	0

Inspecting traps used in research to study flight activity of lady beetles.

STANDARD VARIETY SMALL GRAIN TRIALS

J. J. Bonnemann

Variety trials of small grains were limited to oats, rye and winter wheat in 1970. Spring wheat and barley were discontinued because acreages of these crops are very limited in the southeast area.

The data included in this report are bushel yield, test weight and five-year averages, where available.

The winter grains were seeded on September 17, 1969. Soil moisture was adequate and good cover was obtained before freezing temperatures stopped fall growth. Stands were good in the winter wheat. Stands were good in all but three rye varieties. The viability of the seed was found to be low. Increased seeding rates were made but this did not compensate for the low germination. Yields and quality of both were good.

The oat trail was seeded on April 10. Cool, wet weather slowed early growth but stands were uniform. The earlier varieties escaped the hot, dry weather and were most satisfactory in 1970.

Further discussion on the small grain trails will be found in the 1970 Small Grain Variety Trials, Circular 200.

TABLE 22. STANDARD VARIETY WINTER WHEAT TRIALS, SOUTHEAST EXPERIMENT FARM, BERESFORD 1964-70*

Variety	Test Wt. lb/Bu	Average Yields, Bu/A 1970	1967-70	1964-70
Scout 66	60.5	47.9		
Lancer	61.0	46.3	38.5	39.7
Sturdy	59.5	44.1		
Scout	60.0	43.3	37.1	40.3
Winoka	62.2	43.1	37.0	
Gage	60.0	43.0	40.5	40.6
Trader	60.5	42.8	36.5	
Trapper	60.5	42.7	39.7	
Guide	60.0	41.6		
Hume	61.5	38.8	34.2	35.1
Nebred	61.0	36.5	31.1	33.7
Minter	60.0	32.3	32.6	32.4
Froid	59.3	32.0		

*1965 - Winter killed
1969 - Hailed out

TABLE 23. STANDARD VARIETY RYE TRIALS, SOUTHEAST EXPERIMENT FARM, BERESFORD, 1965-1970*

Variety	Test Wt. lb/Bu	Average Yields, Bu/A 1970	1969-70	1965-70
Von Lochow	55.5	55.8	56.1	52.6
Petkus	56.0	52.6	51.2	
Pearl	54.5	51.6		
Cougar	53.5	50.1		
Dakold	57.0	45.2	42.8	
SD 1	56.5	42.3		
Adams	56.0	42.2	39.0	
Antelope[a]	56.0	40.3	50.7	49.7
Elk	54.5	40.3	47.7	45.3
Caribou	55.0	33.2	39.9	45.7
Zelder	54.5	32.0	49.9	
Dominant	53.5	28.6	45.6	
Frontier[a]	55.0	27.8	43.0	
Sangaste[a]	52.5	21.2	38.4	

* - 1969 hailed out

[a] Seeding rates were adjusted to compensate for low germination but this failed to give satisfactory yields.

TABLE 24. STANDARD VARIETY OAT TRIALS, SOUTHEAST EXPERIMENT FARM, 1965-1970*

Variety	Test Wt. lb/Bu	Average Yields, Bu/A 1970	1965-70	1967-70
Pettis	40.0	82.5		
Nodaway 70	36.0	79.2		
Burnett	35.5	79.2	53.9	63.7
Wyndmere	35.0	79.0	60.5	
Garland	35.5	76.9	54.6	65.0
Portal	36.0	76.5	56.6	
Multi M 70	38.0	75.6		
Kota	37.5	74.9	58.3	66.3
Clintland 64	35.5	72.9	66.1	70.3
Holden	35.0	72.2	58.5	67.2
Lodi	32.5	72.2	58.8	65.1
Jaycee	36.5	71.1	58.4	
Froker	34.5	70.3		
Santee	36.0	70.1	54.0	62.8
Dupree	36.0	69.3	54.7	64.9
O'Brien	38.0	69.0	51.2	
Clintford	37.5	66.8	56.3	64.7
Kelsey	34.5	65.6	58.1	
Multi E 70	37.5	65.3		
Otter	35.0	65.1		
Sioux	33.5	62.7	52.0	
Orbit	34.0	61.2	48.9	
Dawn	36.0	60.4	50.7	
Brave	35.0	58.3	49.7	61.7

* The 1969 trials were hailed out.

GRAIN SORGHUM PERFORMANCE TRIALS

J. J. Bonnemann

The entries included in the trial are the choice of the producing companies. Check entries labeled SD or RS, are included by the Agricultural Experiment Station.

The grain sorghum trial was seeded on May 18 and harvested September 30. The row spacing was 30 inches. Ramrod was applied at time of seeding. Stands were uniform and growth rapid early in the crop year. Cool wet weather slowed growth in June but the sorghums performed much than corn throughout the crop season. Yields, test weight and overall quality were good. Lodging was not a serious problem.

Results of the Grain Sorghum Performance Trial appear in Table 25. Complete results and further discussion will be found in the 1970 Grain Sorghum Performance Trials, Circular 202.

TABLE 25. 1970 GRAIN SORGHUM PERFORMANCE TRIAL, AREA E, SOUTHEAST EXPERIMENT FARM, BERESFORD

Brand and Variety	Height Inches	Percent Moisture	Test Wt. lb/Bu	Yield, lb/A 1970	Yield, lb/A 1968-70
Northrup-King 265	39	16.5	60.0	6080	6475
RS 633	41	16.0	60.0	5750	
DeKalb C-42a	38	19.3	59.0	5440	
ACCO R 1029	42	18.9	59.0	5400	
ACCO R 1019	38	19.1	59.0	5360	
Northrup-King X 3016	42	15.6	58.0	5220	
Pioneer 866	42	17.9	58.0	5160	6565
ACCO R 1010	44	15.2	61.0	5120	
SD 503	46	15.7	58.0	5100	5730
DeKalb B-36	39	15.0	59.0	5040	
Curry's XM-536	37	16.3	58.0	5000	
Coop SG-20	39	15.4	60.0	4990	
Curry's M-530	41	15.9	60.0	4930	6195
SD 25265	46	16.5	57.5	4810	
Northrup-King 222	40	15.0	60.0	4660	5760
RS 610	39	16.4	57.0	4630	6255
ACCO R 1050	40	16.4	60.0	4410	5720
Barzan GS 43	42	14.6	59.0	4400	
Northrup-King 133 A	38	16.0	59.0	4390	
Pioneer 883	40	15.6	57.0	4210	5610
SD 451	44	16.5	56.0	4210	5200
Curry's XM-534	39	15.0	58.0	3960	

DATE OF PLANTING CORN AND RATES OF NITROGEN 1970

F. Shubeck and B. Lawrensen

Objective of Experiment

1. Will planting dates influence response to fertilizer?

2. How high should rates of nitrogen be with a soil containing a medium amount of organic matter?

3. Will exceptionally high rates of nitrogen influence disease or insect damage?

4. Will soil temperatures serve as a dependable guide as to the optimum time to plant corn?

Methods and Procedures Used in Date of Planting and Rates of Nitrogen Study

December 1, 1969 - Rotary chopped stalks and tandem disked plot area
December 4, 1969 - Plowed all of the plots
April 25, 1970 - Tandem disked plots
April 27, 1970 - Fertilized soil for first planting
April 28, 1970 - First planting date
May 4, 1970 - Fertilized for second planting. Tandem disked and spike tooth harrowed
May 5, 1970 - Second planting date
May 18, 1970 - Fertilized for third planting
May 19, 1970 - Third planting date
May 21, 1970 - Rotary hoed first and second plantings to break crust and lumps from a driving rain May 11
May 25, 1970 - Fertilized, tandem disked and spike tooth harrowed plot for fourth planting
May 26, 1970 - Fourth planting date
June 2, 1970 - Broadcast sprayed postemergence first and third plantings with 1.25# Atrazine 80W + 1 gal. oil
June 15, 1970 - Cultivated
June 19, 1970 - Cultivated
July 31, 1970 - Implanted corn borer egg masses in the fourth planting only in all four replicates and fertilized treatments.
August 5, 1970 - Sprayed fourth planting only with Cythion at the rate of 1.5 pts./A for control of corn rootworm beetle
October 28, 1970 - Hand picked

Insecticide - Bux ten
Herbicide - Ramrod 20G in 14 inch band at planting
Variety - Pioneer 3570
Planted population - 18,000 plants/A

TABLE 26. EFFECT OF FERTILIZER AND PLANTING DATES ON YIELD OF CORN IN BUSHELS PER ACRE

Broadcast Treatment N + P + K	Planting Dates April 28	May 5	May 19	May 26	Average
0 - 0 - 0	33	25	14	12	21
0 - 11 - 58*	30	26	18	11	21
80 - 11 - 58*	40	35	40	15	33
160 - 11 - 58*	29	41	40	19	32
240 - 11 - 58*	31	37	36	19	31
Average	33	33	30	15	

* Received 4 lbs. N, 7 lbs. P and 7 lbs. K starter per acre placed two inches to the side and two inches below the seed in addition to broadcast treatment.

Discussion and Interpretation of Table 26

When yields from each of the four planting dates were averaged, the two earliest planting dates produced the most corn per acre.

Plots receiving broadcast nitrogen averaged more corn per acre than those receiving no broadcast nitrogen.

Influence of planting dates on response to nitrogen was not clear because yield potential was restricted so severely by lack of moisture.

TABLE 27. EFFECT OF FERTILIZER ON LEAF COMPOSITION AT FIRST SILKING, APRIL 28 PLANTING DATE

Broadcast Fertilizer Treatment	Composition of Dry Leaves**								
N-P-K	N	P	K	Ca	Mg	S	Fe	Mn	Zn
	%	%	%	%	%	%	ppm	ppm	ppm
0-0-0*	1.53	0.133	1.88	0.56	0.48	0.106	104	38.4	28.5
0-11-58*	1.60	0.133	1.85	0.46	0.38	0.078	40	39.2	18.5
80-11-58*	2.35	0.150	2.19	0.56	0.44	0.093	45	53.7	24.5
160-11-58*	2.47	0.210	2.02	0.63	0.40	0.122	53	85.6	33.2
240-11-58*	--	--	2.11	0.55	0.42	0.099	46	103.4	28.0

*Received 4 lbs. N, 7 lbs. P and 7 lbs. K starter per acre placed two inches to the side and two inches below the row in addition to broadcast treatment.
**Leaf analysis made by Soil Testing Laboratory at South Dakota State University, Brookings, South Dakota.

Discussion and Interpretation of Table 27

Leaves opposite and below ears were taken for analysis. Replicates one and two were sampled from the first planting date, April 28.

For sufficiency levels refer to Table 8.

It was interesting that percent nitrogen in leaves at the time silks first appeared did not surpass the minimum desired level for any of the nitrogen treatments in this dry year. Phosphorus percentages in leaves were also low even though seven lbs. P were applied in the starter and 11 lbs. P were broadcast. Other nutrients in leaves were adequate.

TABLE 27A. EFFECT OF BROADCAST NITROGEN FERTILIZER ON NITRATE NITROGEN IN CORN STALKS**

Broadcast Fertilizer Treatment, lbs./Acre N-P-K	Nitrate Nitrogen in Parts Per Million
0-0-0	94
0-11-58*	59
80-11-58*	356
160-11-58*	1501
240-11-58*	1936

*Received 4 lbs. N, 7 lbs. P and 7 lbs. K starter per acre in addition to broadcast treatments.

**Analyses made by Soil Testing Laboratory, South Dakota State University, Brookings, South Dakota.

Discussion and Interpretation of Table 27A

To convert parts per million to percent, divide ppm by 10,000. On a dry basis, forage with less than 1,500 parts of nitrate nitrogen per million (0.15%) is usually considered safe to feed (see explanation and reference following Table 12).

The quantities shown in Table 27A are for stalks only. Stalks from soil surface to ear height were taken and thoroughly mixed before analyzing. Stalks in this test had more nitrates than leaves so only the largest source of nitrates was reported--that in the stalks.

As the quantity of fertilizer nitrogen increased, the nitrate nitrogen in stalks also increased. However, only at the highest rate of nitrogen application (240 lbs. N/acre broadcast) did nitrates in stalks exceed the level usually considered to be safe.

Therefore, in a dry year when normal plant growth was restricted and nitrate accumulations were expected, rates as high as 160 lbs. of nitrogen per acre could have been safely used.

INCIDENCE OF EUROPEAN CORN BORER WITH RATES OF NITROGEN ON CORN

P. A. Jones

The relationship between high rates of Nitrogen on corn and establishement and development of European corn borer, Ostrinia nubilalis (Hubner) were investigated in this study.

The third year of a five year study on this project has now been completed. A preliminary report was presented in the 1968 annual report of the Southeast South Dakota Experiment Farm. This second report which follows presents data for 1968-1970, inclusive. (See Table 28).

Methods used each year were similar to those outlined in the 1968 report. Procedures used in the rates of nitrogen study are presented in the preceeding report by Shubeck and Lawrensen. Minimal corn borer populations were assured each season by artificially infesting the corn with egg masses obtained through the courtesy of the USDA Corn Borer Laboratory at Ankeny, Iowa. This superimposed an artificial infestation over any natural infestation which may have been present. Each year larval counts were made approximatley three weeks after infesting the plots.

Statistical analysis of the data showed that for both numbers of larvae and plants infested the data were significant, and in most cases highly significant; although comparisons between years were non-significant for both categories.

Data for 1968 indicated that under growing conditions for that year, the higher rates of Nitrogen (N) did not increase or decrease corn borer establishment. In 1969 and 1970, data did indicate a definite trend upwards in numbers of corn borers which became established on the corn that had been treated with higher rates of N; also the percentage of plants infested increased as the rates of N increased. The data obtained in 1969 and 1970 tends to parallel results from other states.

Although this study will continue for two more years, it can be tentatively concluded that with higher rates of N, establishment of corn borers is more likely to occur; and hence, with higher rates of N additional measures should be taken by the grower to protect a corn crop from possible depredation by European corn borer.

The project will probably be expanded in the next two years to attempt to determine yields associated with the different levels of corn borer infestation.

TABLE 28. ESTABLISHMENT OF EUROPEAN CORN BORER ON CORN TREATED WITH VARIOUS RATES OF NITROGEN AT THE SOUTHEAST EXPERIMENT FARM, BERESFORD, SOUTH DAKOTA. 1968, 1969, 1970

Broadcast Fertilizer N + P + K	Average No. Larvae/Yr			Average % Plants Infested/Rep/Yr		
	1968	1969	1970	1968	1969	1970
0-0-0	34.25	14.75	23	80	45	25
0-11-70	34	19	18	71.25	46.25	50
80-11-58*	37.75	26.5	34	75	65	72.5
160-11-58*	34.25	24	63	76.25	61.25	85
240-11-58*	35	30.75	59.25	76.25	70	86.25

* Received 4 lbs. N, 7 lbs. P and 7 lbs. K per acre as sideband starter in addition to broadcast treatment.
20 plants per replicate artificially infested 7-28-68, 7-28-69, 7-31-70 with 1 egg mass per plant.

Date of Larvae Counts - 1968-1970

Replicate	1968	1968	1970
1	8-22, 25	8-22	8-17
2	"	"	"
3	"	8-23	8-18
4	8-26	8-24	8-20

CORN VARIETY - ROW SPACING - POPULATION STUDY

P. Carson, F. Shubeck and R. Ward

Objectives of Experiment

1. Determine if yields are equal when leaf area of "small" very early maturing corn is increased by increasing populations so that it equals the leaf area of "big" late maturing corn.

2. Determine if the highest yields are produced by the biggest, late maturing varieties and if earlier varieties can be made to produce equal yields by increasing populations.

3. Determine the effect of widely varying populations and row widths on the growth and yield of corn varieties with a wide range of maturity.

Methods

Populations: 20,000, 40,000 and 80,000 plants per acre

Row Spacing: 10, 20 and 40 inches

Hybrids

1. Pioneer 3510 - Late maturing
2. Renks NR-1 - 75 day - Early maturing
3. Agsco 3 x AAA - Very early maturing

The harvesting of the corn at such an early date resulted in high moisture contents of the harvested grain. The maturity of the hybrids used is clearly indicated in the moisture content of the grain as shown in Table 29. Increasing the population caused an increase in grain moisture content as shown by the average of the 3 populations and 3 row widths of each hybrid.

Experiment Design: Completely randomized factorial

Fertilizer:

N = 120 pounds per acre

P_2O_5 = 66 pounds per acre

K_2O = 100 pounds per acre

Fertilizer was broadcast and worked into the soil before planting.

Weed Control:

Ramrod - applied in a band.

Atrazine - Broadcast prior to planting.

Insect Control: Bux-ten at planting time.

The corn was planted with John Deere tool-bar planters on May 21st. The corn was selectively thinned to desired populations after emergence and received no other treatments or attention until harvest. Corn forage (ensilage) was harvested August 26, 1970 and the grain yields were harvested on September 4, 1970.

The corn was under severe moisture stress during July. The leaves, as high as the 5th from the bottom, showed potassium-like deficiency symptoms at this time.

This experiment was designed for the average moisture conditions normally encountered at the Southeast Experiment Farm. Thus, the prolonged dry period encountered in 1970 caused an exaggeration of the effects of population, hybrid and row spacing expected in this area. Since these conditions existed it was decided to take forage yields in addition to grain yields. No attempt was made to measure leaf area indices.

The corn forage yields (Table 29) indicate that a lack of moisture was the dominant feature affecting the yields. Plant population, row spacing and hybrid become secondary factors and therefore did not affect forage yields.

The grain yields (Table 29b) provide an entirely different picture. Plant population had a very great influence. More grain was produced under drought conditions at lower plant populations of all 3 hybrids. The very early hybrid produced the highest yield at all populations followed by the early and finally by the late hybrid. Yields were higher at the 40 inch row spacing for all 3 hybrids. Yields were the same for the 10 and 20 inch row spacings and were lower than at the 40 inch rows. The greatest practical effect of row spacing occurred at the lower population except on the early hybrid.

Crop rotation research.

TABLE 29. THE EFFECT OF VARIETY, ROW SPACING AND PLANT POPULATION ON THE YIELD OF CORN FORAGE, GRAIN AND THE PERCENT MOISTURE CONTENT OF THE GRAIN AT HARVEST TIME AT THE SOUTHEAST EXPERIMENT FARM 1970

Corn Maturity	Population in Plants per Acre	Row Spacing, Inches 10	20	40	Average
		Forage Tons at 70% Moisture/Acre			
Very Early	20,000	9.2	9.3	8.5	9.3
	40,000	8.3	9.4	9.5	9.1
	80,000	9.5	9.5	10.0	9.7
		9.0	9.4	9.3	
Early	20,000	7.7	9.5	8.8	8.7
	40,000	8.7	9.2	9.4	9.2
	80,000	9.5	10.0	8.9	9.5
		8.5	9.6	9.0	
Late	20,000	9.5	9.7	10.5	9.9
	40,000	9.5	9.3	9.4	9.4
	80,000	11.4	9.4	10.3	10.4
		9.8	9.5	10.1	
Average		9.3	9.5	9.5	
(b)					
		Grain Bushel/Acre			
Very early	20,000	37.0	42.0	42.2	40.4
	40,000	20.0	17.4	27.5	21.6
	80,000	7.0	7.4	18.2	10.9
		21.3	22.3	29.3	
Early	20,000	23.4	25.8	19.5	22.9
	40,000	8.9	4.3	12.6	8.6
	80,000	2.1	3.5	9.6	5.1
		11.5	11.2	13.9	
Late	20,000	5.4	12.6	15.3	11.1
	40,000	3.6	0.8	2.4	2.3
	80,000	0.0	0.0	1.4	0.5
		3.0	4.5	6.4	
Average			11.9	12.6	16.5
(c)					
		Percent Moisture in Grain			
Very Early	20,000	18.0	20.5	22.0	20.2
	40,000	32.6	32.4	26.3	30.4
	80,000	48.1	40.0	26.4	37.8
		32.9	31.0	24.8	
Early	20,000	44.8	31.5	32.9	36.4
	40,000	50.6	56.7	40.0	49.1
	80,000	50.6	57.6	46.3	55.7
		51.9	48.6	39.7	
Late	20,000	74.3	64.8	61.7	66.9
	40,000	72.0	77.4	68.2	72.5
	80,000	—	—	73.9	73.9
		73.1	70.7	67.9	

SOYBEAN ROW SPACING

F. Shubeck and B. Lawrensen

Objectives of Experiment

1. Study the effect of soybean row spacings and populations on yield.

Methods and Procedures Used

Sept. 26, 1969 - Broadcast and plowed down 60 lbs. N, 17 lbs. P, 32 lbs. K per acre and tandem disked immediately.
Nov. 15, 1969 - Plowed plot area
May 26, 1970 - Tanden disked and spike tooth harrowed
June 2 - Tandem disked and spike tooth harrowed
June 3 - Planted Corsoy soybeans in all row spacings and plant populations
June 4 - Finished thinning to desired stands in all replications
July 3 - Cultivated all plots

TABLE 30. EFFECT OF PLANT POPULATIONS ON SOYBEAN YIELDS (YIELDS FROM 3 ROW SPACINGS AVERAGES FOR EACH POPULATION)

Plant Populations	Bu./A
75,000	28
100,000	29
125,000	32
150,000	30
175,000	31
200,000	29

Discussion and Interpretation of Table 30

Highest yields were obtained with 125,000 plants per acre this year. Yield differences were small between plots with 125,000, 150,000 and 175,000 plants per acre. With 200,000 plants per acre, yields diminished, indicating that the top of the yield curve had been reached with lower plant densities.

A stand of 125,000 plants is approximately 4.8 plants per foot of row in 20" rows; 7.2 plants per foot in 30 inch rows and 9.6 plants per foot in 40 inch rows.

TABLE 31. EFFECT OF ROW SPACING ON SOYBEAN YIELDS (YIELDS FROM 6 POPULATIONS AVERAGED FOR EACH ROW SPACING)

Row Spacing	Bu./A
20 inches	30
30 inches	32
40 inches	28

Narrow row beans yielded more than the wide row 40 inch spacing.

Methods and Procedures for Very Narrow (7-Inch) Row Beans

Spring plowed
May 20 - Sprayed 1½ pints of Treflan per acre and disked
June 3 - Tandem disked and flextined (Melroe)
June 4 - Planted Corsoy beans. Used John Deere press drill for 7 inch rows and tool bar planters for 30 inch rows
June 19 - Sprayed 2/3 quart Cythion for potato leaf hopper
June 22 - Cultivated 30" rows

TABLE 32. COMPARISON OF 7 INCH ROW SPACING AND 30 INCH ROW SPACINGS FOR SOYBEANS

Row Spacings	Bu./A
7 inch	30.0
30 inch	25.0
L.S.D. at 5%	1.5

Discussion and Interpretation of Table 32

This experiment was conducted independently of the preceding study to evaluate 7 inch row spacings planted with a press drill. A final population of approximately 150,000 was achieved.

In this experiment, 7 inch rows yielded more beans than 30 inch rows in side by side comparisons replicated six times within the plot area.

SOYBEAN FERTILITY*
(IN A CORN-SOYBEAN SEQUENCE)

F. Shubeck and B. Lawrensen

Objectives

1. Will soybeans respond to broadcast commercial fertilizers if the preceding corn crop is also adequately fertilized?

2. Will applications of manure in addition to commercial fertilizer influence yield?

Methods and Procedures Used for Soybeans

April 9 - Tandem disked area. Previous corn had been removed for silage.
May 14 - Spread manure on designated plots
May 15 - Broadcast fertilizer on each of the plots
May 25 - Tandem disked and spike-tooth harrowed
May 25 - Planted Corsoy soybeans with tool-bar planters in 30-inch rows. Beans were inoculated.
June 9 - Rotary hoed all plots
June 11 - Cultivated
June 22 - Cultivated

Methods and Procedures Used for Corn

April 9 - Tandem disked
May 6 - Broadcast 113 lbs. N and 20 lbs. P per acre over entire area
May 6 - Tandem disked, spike tooth harrowed and planted Pioneer 3510
June 2 - Cultivated
June 17 - Cultivated

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* This experiment was originally planned and started by Dr. D. Hovland. Present address: College, Alaska

TABLE 33. EFFECT OF BROADCAST FERTILIZER ON YIELD OF SOYBEANS AND CORN

Broadcast Fertilizer Treatment For Soybeans Only, Not Corn* N + P + K	Bu./A	
	Beans	Corn
134 + 13 + 25	19	25
0 + 13 + 0	19	35
0 + 13 + 0 (12 ton manure per acre)	18	20
30 + 13 + 0	18	34
30 + 26 + 25	18	25
30 + 13 + 25	18	31
30 + 13 + 100	17	26
30 + 0 + 0	17	35
12 ton manure per acre	17	31
0 + 0 + 0	17	28
0 + 0 + 25	16	32
0 + 0 + 25	15	34
L.S.D. at 5%	4.5	11.4

*Fertility applied for corn was 113 lbs. N and 20 lbs. P per acre broadcast on all plots. Therefore, any yield differences in corn yields appearing in Table 33 are due to residual carryover of the different fertilizers applied for the previous soybean crop.

Discussion and Interpretation of Table 33

There were no significant yield differences in soybean yields due to fertilizer treatments.

Residual fertility, left in the soil from that applied for the previous corn crop, was evidently sufficient for the soybeans.

Fertilizers applied for beans would have residual carry over for the corn. Apparent differences in corn yield were not statistically significant at the 5% level. Therefore, residual carry over of fertilizers applied for beans had only minor affects on corn yields in a year when heat and drought restricted corn yields to 25-35 bushels per acre.

ALFALFA MANAGEMENT RESEARCH

P. Evenson, M. D. Rumbaugh, D. Hovland and B. Lawrensen

Experiment I

TITLE: Soil Fertility Treatments to Maintain Alfalfa Stands and Productivity

OBJECTIVE: To determine the influence of improved soil fertility management in maintaining alfalfa stands and forage yields and in increasing economic return from this crop.

JUSTIFICATION: There are some advantages in not rapidly rotating alfalfa from location on the farm. Cost of alfalfa seed and seeding, costs of plowing alfalfa sod and the occasional lowered yields of subsequent crops in dry years are definite disadvantages in moving alfalfa from field to field. Reasons for rotating alfalfa include reduced stands and yield production sometimes associated with longevity. If methods for maintaining alfalfa stands and forage production can be demonstrated, then rotating alfalfa will not be necessary, some of the expenses listed above will be reduced, net returns will will be increased, and alfalfa could then be more competitive with other crop species.

EXPERIMENTAL PLAN: The test area was prepared for seeding in 1969. Inoculated seed of 'Vernal' alfalfa was drilled following preplant application of an herbicide (Benefin) over the entire plot area. A ten-foot wide alfalfa buffer strip surrounding the test and each plot was sufficiently large (10' x 15') to avoid border effects. Fertilizers were applied in accordance with the treatment schedule as follows.

Symbol	Treatment
A	Check: no fertilizer applied
B	15 lbs. P/A/year (75 lb. 0-46-0/A once before seeding and once each subsequent year)
C	30 lb. P/A/year (150 lb. 0-46-0/A once before seeding and once each subsequent year)
D	60 lb. P/A/year (300 lb. 0-46-0/A once before seeding and once each subsequent year)
E	300 lb. P split (750 lb. 0-46-0/A before seeding and 75 lb. 0-46-0/A each subsequent year)
F	300 lb. P (1,500 lb. 0-46-0/A before seeding)
G	200 lb. K/A/year (400 lb. 0-0-60/A once before seeding and once each subsequent year)
H	F + G

The experimental design is a randomized complete block with five replications. Weather permitting, a four harvest schedule will be followed.

RESULTS: Excellent stands were uniformly obtained in all plots. Weeds and alfalfa top growth were removed from the plots after the first killing frost in the autumn of 1969. Oven dry forage determinations were made for three cuttings in 1970. Drought precluded a planned fourth harvest. Forage yield data for this season have not yet been fully analyzed or interpreted.

Experiment II

TITLE: Field Temperature Control and Growth Response of Alfalfa

OBJECTIVE: To develop methods of altering temperatures of alfalfa crowns, shoots and foliage during critical periods of plant growth in order to enhance plant dry matter production.

JUSTIFICATION: Temperature is known to be a critical environmental factor affecting all stages of plant growth. Both direct and indirect mechanisms are recognized. Marked elevations in temperatures of alfalfa crowns, shoots and the surrounding soil have been detected following hay harvests. Preliminary research at Brookings, South Dakota, has shown that a straw mulch significantly lowered soil temperatures following alfalfa cutting and increased annual forage yield as much as 17 percent. These investigations need to be extended to more fully explore similar techniques for increasing yield potential of alfalfa.

EXPERIMENTAL PLAN: A five replicate randomized complete block design experiment was initiated at the same time and site as Experiment I. 'Vernal' alfalfa was seeded in each plot. Treatments imposed in 1970 were as listed below. Treatment "N" was not applied in 1970.

Symbol	Treatment
I	300 lb. P (1,500 lb. 0-46-0/A before seeding)
J	I + 15 lb. N/A (45 lb. 33.5-0-0 + 15,000 lb. 0-46-0/A once before seeding)
K	I + straw mulch + overhead shade (louver material for transmittance of solar energy in wavelengths of 420-675 nanometers)
L	I + straw mulch + overhead shade (cheese cloth about 40" above the soil surface)
M	I + styrofoam mulch (1/2' particles to a depth of 1" thick over the soil)
N	I + white sand mulch (ca 20 mesh 1" thick over the soil, freshen white surface yearly after first cut)

O I + straw mulch (add fresh straw once each year after the first cut)

P I + 280 lb./A sulfur + 180 lb./A Magnesium + 3 lb./A iron + 3 lb./A maganese + 2 lb./A zinc + 2 lb./A boron + 1 lb./A copper + 0.2 lb./A molybdenum (1,500 lb. $CaSO_4 \cdot 2HOH$ + 5 lb. Sequestrene Na_2Mn and 7 lb. $MnSO_4 \cdot HOH$ + 5 lb. Sequestrene Na_2Zn and 5 lb. $ZnSO_4 \cdot 7HOH$ + 17 lb. $Na_2B_4O_7 \cdot 10HOH$ + 4 lb. Sequestrene Na_2Cu and 1 lb. $CuSO_4$ + 0.5 lb. $Na_2MoO_4 \cdot 2HOH$ + 1,500 lb. 0-46-0/A once before seeding)

Air temperature and soil temperatures at various depths are to be logged continuously throughout the growing season. A four cut harvest schedule will be followed whenever possible.

RESULTS: Forage yield from three harvests and environmental data were obtained in 1970. This information has not been fully analysed and interpreted.

Photo on cover of this report shows plastic louver shades over alfalfa. Cheese cloth shade material is shown above.

(Right) See any difference in shaded and unshaded alfalfa?

(Top right) Styrofoam and straw mulches.

SIMULATED HAIL DAMAGE IN SOYBEANS

B. Lawrensen and F. Shubeck

Objectives of Experiment

1. Inflict damage to the soybean plant simulating that caused by hail.

2. Evaluate extent of simulated hail damage by actual measurements which would determine whether to replant soybeans after a hail storm.

3. Determine yield loss (% of check) where damage was inflicted.

Methods and Procedures

April 25 - Plowed
April 29 - Tandem disked
May 25 - Tandem disked and spike tooth harrowed. Planted Corsoy soybeans
June 9 - Rotary hoed all plots
June 18 - Inflicted damage to specified plots at Stage 1 of growth to simulate medium and heavy hail damage. Soybean plants at Stage 1 have the first trifoliate leaves unrolled and second trifoliates beginning to unroll and are 4" to 6" in height
June 18 - Evaluation of the soybean plant made immediately after the inflicted damage
June 29 - Inflicted medium and heavy simulated hail damage at Stage 2 Soybean plants at this stage have four trifoliate leaves unrolled and the fifth trifoliate set of leaves beginning to unroll
June 29 - Evaluation of inflicted damages made immediately after the damage
June 18-August 3 - Plant heights and canopy widths recorded at weekly intervals
July 8 - Cultivated
July 20 - Cultivated
Nov. 6 - Combined all plots

Variety - Corsoy
Herbicide - None
Plant population - 125,000 per acre

Simulated hail damage (left), undamaged plants (right).

TABLE 34. EFFECT OF SIMULATED HAIL DAMAGE ON SOYBEANS AT TWO DIFFERENT STAGES OF GROWTH

Stimulated Hail Damage	Stage of Growth	Bushels/A	Pods/Ft. of Row
Medium damage	1	16.0	335
Medium damage	2	22.0	415
Heavy damage	1	10.0	425
Heavy damage	2	13.0	495
Check (no damage)	-	23.0	515
Actual hail damage*	3	3.0	---

* Hail storm occurred July 1. Approximately 8 miles north and 1 mile east of the Experiment Farm.

Discussion and Interpretation of Table 34

This study represents our first attempt to learn more about the effects of hail damage on soybeans. Instruments used this year to inflict damage were a heavy-tine garden rake and a 5 tine pitch fork. Damaged soybeans looked suprisingly like actúal hail damage despite the simple tools used for this purpose. Techniques and procedures will be improved as more experience is gained.

Simulated medium damage to soybeans at Stages 1 and 2 yielded 60-70% more than heavily damaged beans at corresponding stages (Table 34). Soybeans subjected to medium damage in Stage 2 of growth yielded about the same as undamaged (check) beans. These simulated damages were compared to severe actual hail damaged beans located approximately eight miles north and one mile east of the Experiment Farm. Soil and moisture conditions at the two locations were reasonably similar, but the actual hail damage occurred at a latter stage of plant growth than the simulated hail. The purpose of the comparison was to see if the mechanically inflicted damage was really severe enough to be called "heavy" damage. Yields from actual hail damage were considerably less than those of plots receiving "heavy" simulated damage. It is recognized that ice and temperature changes from hail may have other affects on soybean growth in addition to the mechanical damage. These conditions are very difficult to reproduce experimentally. However, as a result of this comparison, the damage inflicted mechanically next year should be a little more severe.

Measurements of canopy width and plant height made at weekly intervals to study plant recovery from simulated hail damage are presented in Table 34a.

TABLE 34a. EFFECT OF SIMULATED HAIL DAMAGE ON SOYBEAN CANOPY WIDTH AND PLANT HEIGHT.

Simulated Hail Damage	Stage of Growth	Canopy Width Inches	Plant Height Inches
None	-	19.2	28.8
Medium	1	21.6	28.8
Heavy	1	24.0	27.6
Medium	2	22.8	27.6
Heavy	2	25.2	25.2
Actual Hail (7-1-70)*	3	25.2	26.4

* 8 miles north and 1 mile east of Experiment Farm.

(Above) Simulating hail damage to soybeans with garden rake.

(Left, top and bottom) Two stages of growth of "hail damaged" soybeans (right) and undamaged soybeans (left).

MOST PROFITABLE ROTATIONS

F. Shubeck and B. Lawrensen

Objectives of Experiment

1. How much will commercial fertilizer increase net profits?

2. Which rotation or cropping sequence will bring the greatest net cash return?

3. Is it more profitable to add nitrogen from a commercial source or to grow a legume in the rotation?

4. Will the previous crop affect the available moisture during the growing season?

Methods and Procedures

Seven different rotations or cropping sequences were studied. The longest sequences had two years of corn, one year of oats and one year of alfalfa.

Varieties used:

Corn - Northrup-King PX 580
Oats - Kota
Alfalfa - Vernal
Soybeans - Corsoy
Grain Sorghum - Northrup-King 222
Sweet Clover - Madrid

Fertilizer applicatons were based on soil test recommendations.

Discussion and Interpretation of Table 35

Notice the large increases in yields of oats when fertilizer was used. Rotations including soybeans, corn and oats gave the highest oats yields, especially when oats followed beans rather than corn.

Corn yields from continuous corn were not as high as those in other rotations. The implication of this is that it is more difficult to maintain continuous corn yields at a level equal to that of rotated corn, particularly in a dry year. In years with more rainfall, continuous corn yields compared more favorably with rotation corn yields. Nitrogen applications on second year corn after alfalfa gave a favorable yield increase.

Soybeans did not consistently respond to fertilizer in the rotation experiment this year.

Fertilized sorghum gave yields that were superior to corn yields this dry year. Fertilized sorghum yielded 18 bushels more than unfertilized sorghum.

Alfalfa hay yields were low but increases were obtained from residual fertility applied on the preceding oats crop.

TABLE 35. EFFECT OF CROPPING SEQUENCE AND FERTILIZER ON CROP YIELD

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	Soybeans Bu/A	Sorghum Bu/A	Hay Tons/A
1 Cont. corn	--	0+0+0	--	--	38	--	--	--	--
1 Cont. corn	Corn	6+11+10	70	--	44	--	--	--	--
2 Corn-oats	--	0+0+0	--	34	51	--	--	--	--
2 Corn-oats	Corn	6+11+10	70	--	60	--	--	--	--
	Oats	30+7+10	--	64	--	--	--	--	--
3 Corn-corn-oats+alf-alf hay	--	0+0+0	--	43	49	34	--	--	0.83
3 Corn-corn-oats-alf-alf hay	Corn	6+11+10	--	--	47	--	--	--	--
	Corn	6+11+10	70	--	--	53	--	--	--
	Oats	15+26+0	--	51	--	--	--	--	--
	Alf residual	--	--	--	--	--	--	--	1.30
4 Oats+sw. clover-corn	--	--	--	30	48	--	--	--	--
4 Oats+sw. clover-corn	Oats	30+7+0	--	55	--	--	--	--	--
	Corn	6+11+10	--	--	41	--	--	--	--
5 Corn-soybean oats	--	0+0+0	--	61	47	--	29	--	--
5 Corn-soybeans-oats	Corn	6+11+10	55	--	56	--	--	--	--
	Soybeans	6+11+10	--	--	--	--	29	--	--
	Oats	30+7+10	--	84	--	--	--	--	--
6 Corn-oats-S. beans	--	--	--	--	--	--	--	--	--
6 Corn-oats-S. beans	Corn	6+11+10	70	--	68	--	--	--	--
	Oats	20+7+0	--	70	--	--	--	--	--
	Soybeans	6+11+10	00	--	--	--	28	--	--
7 Cont. Gr. Sorghum	--	0+0+0	--	--	--	--	--	58	--
7 Cont. Gr. Sorghum	--	6+11+10	70	--	--	--	--	76	--

SORGHUM RESEARCH AND TESTING - 1970

A. O. Lunden

Sorghum test plantings included nearly 100 state and regional grain sorghums, experimental forage sorghums and experimental grain sorghum hybrids. Grain yields were considerably below average in 1970 because of the severe late summer drought stress and ranged from 70 to 90 bushels per acre but were very competitive with the 1970 area yields of corn. All hybrids matured satisfactorily in spite of this drought stress, lodging was evident in only a few enteries and seed quality was good. Yields are reported in Table 36.

The new South Dakota experimental hybrid SD 25265, did not perform as well as expected in this test but was excellent at other locations in the state and in other states. This hybrid will probably be released as RS 506 and is expected to have a wide area of adaptation in the state and region. It is earlier than RS 610, superior in yield to SD 451, SD 503 and NB 505 and is more resistant to lodging than SD 441 and SD 451. Foundation Seeds Division has a good supply of hybrid seed which was produced in Nebraska from Combine Kafir-60 male sterile and restorer line SD 331. The pollinator line which is also available is a good yielding early sorghum line and is about three weeks earlier than the male sterile.

Two experimental forage sorghums, SD 67873 and SD 67882, again produced good grain and forage yields in spite of the drought conditions and seed is available to farmers and seedsmen for testing in 1971. These hybrids have short, thick stalks, many long, wide, thick leaves and large seed heads. They are designed for late fall silage harvest as they stand well and hold their leaves after frost. Submit seed requests to the University at Brookings.

TABLE 36. EXPERIMENTAL AND OPEN-PEDIGREE HYBRID SORGHUM YIELDS - SOUTHEAST EXPERIMENT FARM - 1970

Entry	Days to Heading	Plant Height Inches	Yields in Pounds per Acre				Bu/A Av.
			1967	1969	1970	Ave.	
RS 610	68	38	7260	6940	5180	6463	115
SD 503	62	47	7150	7340	4720	6403	114
SD 25265*	60	46	7700	6480	4610	6263	112
RS 671	72	40	4920	8530	4760	6070	108
SD 451	56	46	6570	5990	4560	5707	102
RS 633	66	41	5940	6410	4480	5610	100
NB 505	62	51	6350	6500	3830	5527	99
SD 441	56	50	6050	5420	3850	5097	91
SD 67873**	75	50	--	9830	3940	6385	114
SD 67882**	73	41	--	10330	4640	7485	134

* This entry will probably obtain the open pedigree hybrid #RS 515.
** These entries are being developed and tested for forage sorghum qualities.

SOYBEAN RESEARCH AND TESTING - 1970

A. O. Lunden

Soybean yields were considerably below average because of severe midsummer drought injury and seed quality was well below average because of presence of many immature underdeveloped seeds. Yields and averages listed in Table 37 include no data from 1969 because of severe hail injury in that year. Yield tests included the Group II Regional Test and a standard variety test and consisted of about 65 replicated entries. Corsoy continues to have the best yield record in the Centerville area and Wayne was the best entry south of Elk Point.

The new varieties Provar, Rampage, Dunn and Wirth, have acceptable yield records but average yields are well below Corsoy and the new phytophthora resistant Amsoy 71 is similar to Amsoy. Protana is also acceptable but slightly late. The recent releases are generally adapted to either wide or narrow rows except for Dunn which has a less erect growth habit similar to Chippewa.

TABLE 37. SOYBEAN YIELDS - SOUTHEAST EXPERIMENT FARM - 1970

Variety	Days to Maturity	Plant Height Inches	Yield in Bushel/Acre 1968	1970	5 Yr. Av.**	Seed Quality
Corsoy	+10	35	43.0	28.2	40.0	2
Rampage	+ 8	30	38.0	26.7	37.3	3
Provar	+11	33	34.2	29.6	37.1	3
Hark	+11	35	38.8	24.3	36.7	2
Dunn	+ 2	32	36.1	28.7	36.1	2
Wayne	+22	40	40.2	25.9	35.9	3
Chippewa	+ 3	32	36.5	25.4	35.3	3
Amsoy	+13	37	34.8	27.4	35.1	3
Wirth	+ 2	30	34.9	26.8	35.0	4
Protana	+15	35	36.5	26.6	34.9	2
Hawkeye	+13	39	36.5	27.2	34.7	3
Beeson	+15	37	32.7	23.8	33.6	3
Ford	+18	40	35.2	22.5	32.6	3

* 1968 - CV = 14.2%, NS; 1970 - CV = 12.6%, LSD = 7.8 Bu.
** 5 year average excludes 1969 and includes weighted values for missing entries.

INFLUENCE OF SOIL TEMPERATURE ON STARTER FERTILIZER RESPONSE

P. D. Evenson, F. Shubeck and B. Lawrensen

Starter fertilizer response was evaluated under three soil temperature conditions. The cool temperatures were created by applying straw or polystyrene mulches to the soil. Warm soil temperatures were achieved by burying heat tapes 5 inches below the soil surface under the corn rows. The tapes were thermostatically controlled to turn on when the soil temperatures dropped below 80° F. A heat treatment with the mulch on the soil surface was used to reduce evaporation of soil moisture due to elevated temperatures. Medium soil temperature conditions were those which normally occurred during the season.

Starter fertilizer was applied in a 2" x 2" band at the rate of 90 lbs. per acre of 8-32-16 (7-13-12 elemental) and an overall application of 80 lbs. of nitrogen per acre was made on the whole experiment. The experiment was planted on May 7 and harvested on October 14.

Corn yields and ear moisture percentages are shown in Figure 3. Those treatments which had the greatest early season growth (Figure 4) also matured first and produced the largest yields. The mulched plots produced the lowest yields, had the slowest early growth and had the highest ear moisture percentage at harvest. High ear moisture percentage is an indication of delayed maturity. In contrast, the heated plots produced the highest yields, had the greatest early growth and had the lowest moisture percentage. The check plots were between the mulched and heated plots with respect to these factors.

The mulch tends to reduce evaporation of soil moisture while the heat increases evaporation of soil moisture. Therefore, the response to soil temperature would actually be greater than is shown by the first six bars in Figure 3. This is brought out by the seventh bar which represents the yield from the heated plots covered with mulch. The mulch increased the yield in the heated plots by 20 bushels (86 bushels - 66 bushels). The increase over the check plots was 23 bushels, and the increase over the mulched plots was 29 bushels.

The starter fertilizer increased yields from 9 to 12 bushels per acre depending upon the temperature treatment. Therefore, temperature appeared to have little influence on starter fertilizer response. However, the yields from this experiment were generally quite low as a result of inadequate rainfall. Results from previous experiments indicate that temperature treatments would have a greater influence on yields at higher soil moisture levels. Temperature might have more of an influence on starter fertilizer response at these higher moisture levels.

This experiment shows that corn yields can be maximized when adequate amounts of heat and fertilizer are applied. It also demonstrates the value of mulch in retaining soil moisture for plant growth. If the Corn Belt is to be moved to the north and west the lack of soil heat will have to be overcome. This may be accomplished through plant breeding by selection of varieties which will grow under cool temperature conditions. It might be attained by studying the biochemistry of the plant and determining the imbalance of growth regulating substances during these cool periods. In the future, the farmer might spray synthetic growth regulators on his corn to make it grow under cool conditions. He might use inexpensive sources of heat such as hot water from industrial wastes to increase soil temperatures in the spring.

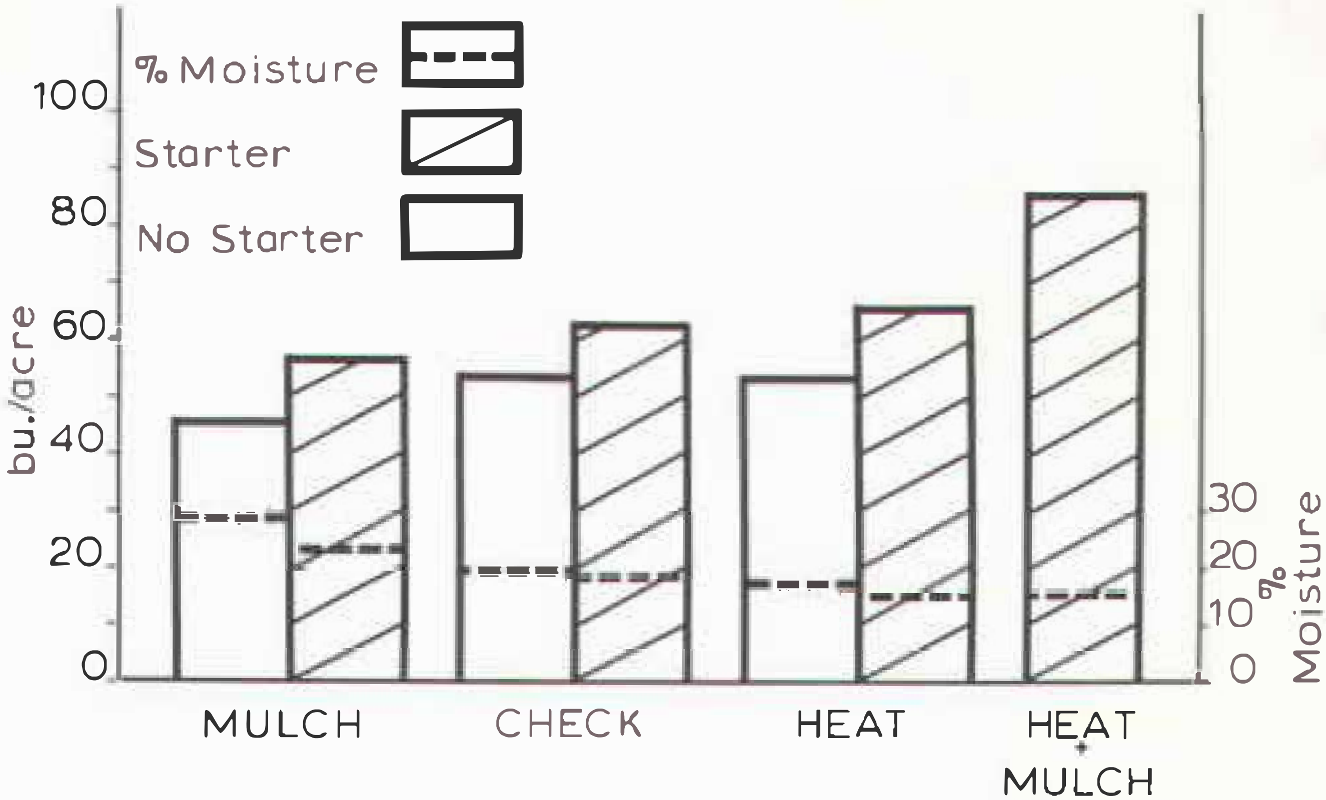
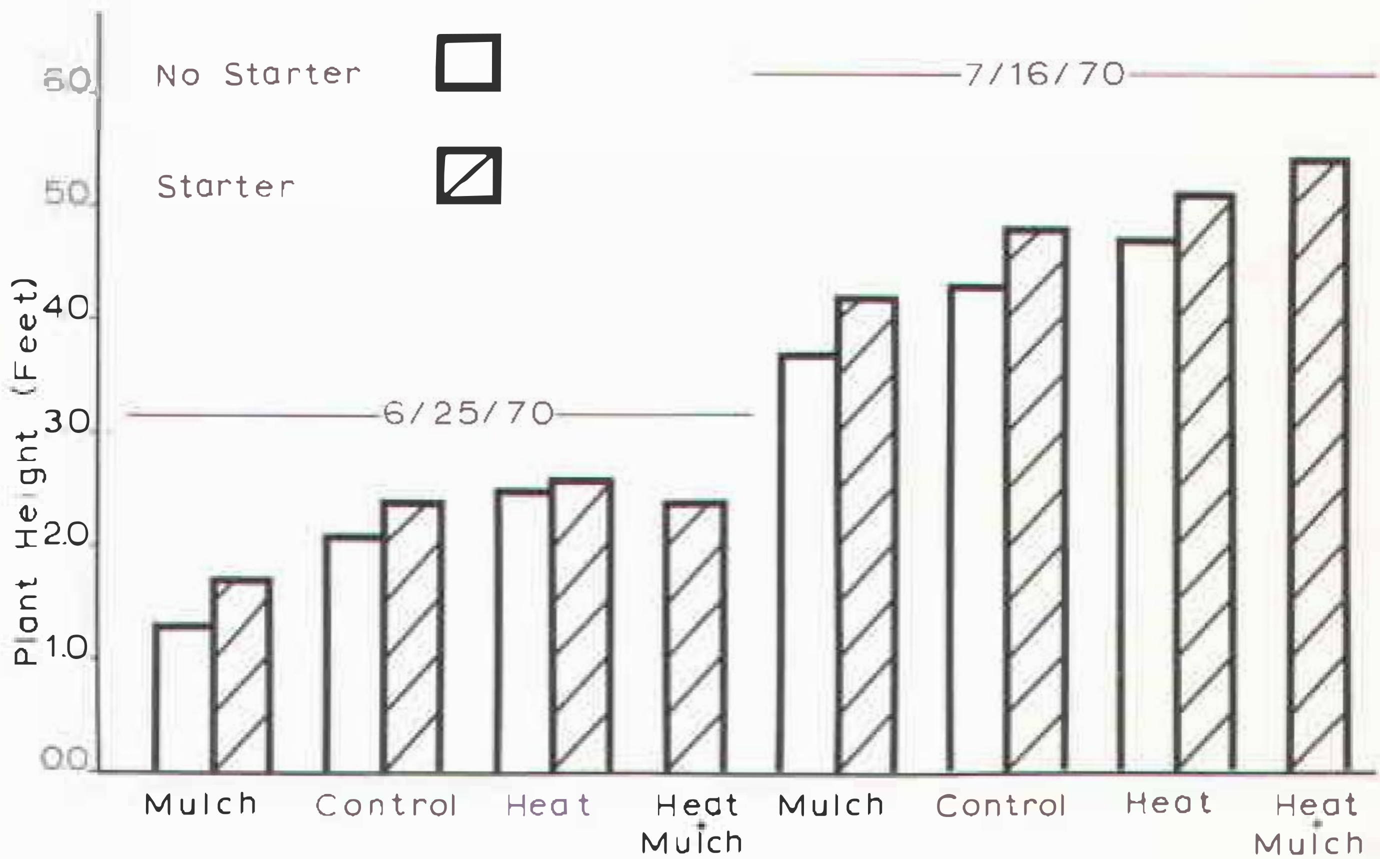


Figure 3. Corn yields and ear moisture percentage as influenced by starter fertilizer (90 lbs. per acre of 8-32-16) and various soil temperature treatments.

Figure 4. Plant height at two times during the growing season as influenced by starter fertilizer (90 lbs. 8-32-16 per acre) and soil temperature treatments.



CORN BORER POPULATIONS AND DAMAGE IN CORN SUBJECTED TO VARYING INPUTS OF HEAT, STARTER, AND MULCH - 1970

P. A. Jones and P. D. Evenson

The relationship between soil heat, starter fertilizer, and mulch applied to corn and their effect on European corn borer establishment was studied. Extremely high populations of borers resulted in a natural infestation of 100% so that effect of the treatments had to be judged by damage to the corn rather than by infestation level. Data were collected October 1, 1970 from 25 plants in each of four replicates in each treatment. Numbers of borers were established by dissecting two of the 25 plants. Stalk breakage was attributed primarily to first brood borers, whereas ear droppage due to cob shank breakage was probably the result of second brood borers. The data, summarized in the following Table 38 indicated a negative association between starter fertilizer and ear shank breakage; where no starter was applied, ear droppage was lower. When soil heat and starter were both used, there was an apparent increase in stalk breakage.

Treatments which tended to hold growth of the corn plant back were associated with a lower amount of stalk breakage: e.g. where soil heat and starter were not used, and where soil temperatures were held back to a slower rate of increase from insolation by use of mulch, the lowest amount of stalk damage from borers resulted.

It becomes apparent, therefore, that when treatments are used to enhance corn growth, at least in south eastern South Dakota, then the treatment for European corn borer becomes more desirable and probably more necessary, dependant of course, on the level of infestation of the first and second brood of borers.

Two early-season views of soil temperature plots used in several experiments.

TABLE 38. CORN BORER POPULATIONS[a] AND DAMAGE IN CORN SUBJECTED TO VARYING INPUTS OF HEAT, STARTER, AND MULCH - 1970

Treatments					Damage					Borer Population
	Input				Broken Stalks (%)					
No.	Heat	Starter	Mulch	Yield[d] (Bu/A)	Above Ear	Below Ear	Unbroken Stalks (%)	Ears on Ground (%)[b]	Ears With Broken Shank (%)	Ave. No. Larvae Per Plant
1	+	+	-	66	74	21	9	19	2	6.5
2	+	-	-	54	79	7	14	9	2	2.75
3	-	+	-	63	76	11	13	16	5	7.625
4[c]	-	-	-	52	74	11.5	14.5	13	1.5	4.3
5	-	+	+	57	75	7	18	12	5	5.0
6	-	-	+	46	61	8	31	9	1	6.25
7	+	+	+	86	77	12	11	19	7	6.25

[a] Corn borer infestation level was 100% in all treatments and replicates.
[b] Ears on ground include those from stalk breakage plus shank breakage.
[c] Average of two untreated checks.
[d] Yields based on Bu/A at 0% moisture.

CORN PERFORMANCE TRIALS

J. J. Bonnemann

The entries included in the 1970 corn performance trials were those brands and varieties submitted by the participating companies and hybrids developed by Experiment Station breeders.

The corn was drilled in single-row plots, 20 inches apart, 37 feet long, on May 18. It was harvested with a picker-sheller on October 23 and 26. The corn was thinned to approximately 15- and 19,000 plants per acre. Actual stand counts in late August averaged 14,900 and 18,600 plants per acre. The severe drought greatly retarded growth, especially of the higher population. Corn borer infestations were very heavy and the weakened, drought restricted plants were more subject to lodging and ear dropping. This caused much greater variability than was desired for adequate evaluations.

The mean yield for the trial was 61.2 bushels per acre. Because the drought and severe corn borer infestations caused such wide variability there was no statistical difference between populations and therefore only the mean yield for both populations (eight replications) is reported. The average moisture percentage for all entries was 20.5 percent. The results are presented in Table 39.

Additional information will be found in Circular 201, 1970 Corn Performance Trials, Agricultural Experiment Station.

TABLE 39. CORN PERFORMANCE TRIAL, SOUTHEAST EXPERIMENT FARM, 1970

Brand & Variety	Cross	Performance Score	Mean Yield B/A	Average Moisture %	Stalk Lodged %	Ear Drop %
Pioneer 3387	2X	1	82.9	20.9	3.4	2.7
Western KX-55	2X	2	82.0	19.7	11.2	20.0
Burt's A239	2X	3	79.3	20.1	5.8	20.6
McCurdy 3 X 3	2X	4	77.4	18.8	7.3	15.0
McCurdy 69-109	2X	5	76.0	19.7	6.4	13.2
Coop S-201	2X	6	74.3	19.6	8.1	15.8
Northrup, King PX 50	2X	7	71.7	19.3	9.9	19.9
Curry SC-142	2X	8	71.1	20.7	9.7	18.3
Burt's A201	2X	11	69.7	20.4	12.1	19.3
O's Gold SX-110	2X	10	69.6	21.2	7.8	18.1
McCurdy MSP 777	3X	13	69.4	18.6	16.0	16.3
McCurdy MSX 44	2X	14	68.8	20.4	12.3	17.3
Trojan TXS108	M2X	9	68.2	17.9	7.8	23.8
Trojan TXS107	2X	12	67.9	19.1	7.5	5.1
SDAES EX 70	3X	15	66.9	18.7	11.8	11.0
Curry SC-158	2X	16	66.8	20.0	8.4	17.2
Trojan TXS115	M2X	20	66.4	23.1	8.8	10.6
McCurdy 2 X 4	2X	18	66.2	21.1	7.7	16.0
Pride R-540	3X	17	66.1	19.2	9.7	21.2
Pioneer 3390	M2X	27	65.5	21.5	15.3	4.7
Trojan TXS102	2X	19	65.2	20.1	7.6	19.6

TABLE 39 continued at the top of next page.

TABLE 39. (Cont.)

Brand & Variety	Cross	Performance Score	Mean Yield B/A	Average Moisture %	Stalk Lodged %	Ear Drop %
Curry TC-344	3X	22	64.9	21.4	8.2	13.7
Green Acres 473	4X	29	64.8	22.8	9.3	7.9
Sokota TS-67	2X	21	64.6	20.4	8.1	18.6
Curry SC-160	2X	31	64.3	23.4	6.0	10.3
Coop S-205	2X	35	64.3	22.8	9.9	8.1
Pioneer 3715	2X	23	63.9	18.9	10.9	22.2
Lincoln Mellowdent HQ16	2X	30	63.8	20.9	9.7	20.8
Maygold 2095	3X	28	63.7	19.1	13.7	14.4
Northrup, King PX 610	3X	24	63.5	20.1	7.9	12.3
SD AES PP119	4X	26	63.4	19.9	9.4	11.6
Lincoln Mellowdent HQ18	2X	36	63.2	21.8	7.7	10.5
Wilson's WXS-1118	2X	25	63.2	19.4	9.2	14.6
Pride R-450	2X	33	63.0	19.1	11.4	19.0
Sokota MS-84	M2X	39	62.5	21.4	10.9	12.7
Wilson's WXS-1016	2X	37	62.3	19.9	10.5	17.9
Renk RK 44	2X	32	62.3	20.5	3.9	11.3
Pioneer 3571	M2X	38	62.2	21.3	6.5	11.6
McCurdy MSX 66	2X	46	62.2	23.9	11.8	7.6
Northrup, King PX 545	3X	41	61.6	19.4	13.7	17.5
Coop T-207	3X	40	61.4	21.3	7.3	13.5
SDAES EX 77	4X	44	61.2	18.7	18.7	8.5
Pioneer 3505	M2X	45	61.1	21.3	13.2	9.8
SDAES PP105	4X	43	60.5	18.7	14.5	13.1
Trojan TXS 95	M2X	33	60.4	17.4	4.6	7.8
Pride R-728	3X	48	60.3	19.7	8.9	12.1
Lincoln Melowdent HQ14A	2X	47	59.5	21.1	7.1	11.8
McCurdy HP4	3X	48	59.3	20.5	10.8	15.4
Pioneer 3369 A	2X	51	58.9	23.9	17.3	10.2
Sokota 69-1	2X	49	58.7	20.4	10.3	7.5
O's Gold SX-550	2X	52	58.0	26.1	7.8	7.4
McCurdy MSP 333	3X	50	56.6	20.0	8.2	16.1
Trojan TXS99	3X	54	55.4	18.1	17.1	16.7
O's Gold SX-21	2X	53	55.4	19.8	12.4	8.3
Curry TC-356	3X	55	54.7	20.9	8.9	9.6
SDAES PP104	4X	57	54.2	19.0	26.6	10.5
Pioneer 3431	4X	56	53.9	21.5	7.1	10.0
SDAES PP115	4X	59	53.6	19.8	22.6	8.8
SDAES PP116	4X	61	52.6	18.5	26.5	11.8
Curry C-560	4X	63	51.2	20.4	16.4	8.9
Maygold F25	2X	60	51.2	22.0	8.3	13.4
Lincoln Melowdent HQ35B	3X	58	50.7	20.7	6.3	8.2
Maygold 2068	3X	62	50.6	21.9	8.0	10.5
Pioneer 3291	4X	65	50.3	22.8	14.8	11.0
McCurdy MSP 999	3X	64	49.8	23.7	8.1	12.9
Maygold 988	4X	66	47.4	20.2	8.8	12.6
Barzan BSL-115-SP	2X	67	47.4	21.5	12.6	14.4
Pride R-750	3X	68	46.4	20.9	14.3	6.3
Burt's 649A	3X	69	41.0	19.3	12.4	13.8
SDAES PP131	4X	70	37.1	21.4	19.2	6.8
SDAES SD 604	4X	71	33.2	20.7	18.0	9.7
		Mean	61.2	20.5	10.8	13.0
C.V. = 21.2%		LSD (0.05)	12.7			

OFF STATION - CORN STARTER FERTILIZER EXPERIMENT

P. Carson, F. Shubeck, R. Ward and B. Lawrensen

This experiment was included because the experimental design and most of the treatments were identical to the starter experiment at the Experiment Farm. However, all the supplemental nitrogen was sidedressed and a zinc treatment was added. It is hoped that closely related outlying experiments such as this one will strengthen results and interpretations for the area.

Objectives of Experiment

1. Will a starter fertilizer increase corn yields on a soil testing low in available phosphorus?

2. How valuable is pop-up fertilizer?

3. Is zinc important under these conditions?

Methods and Procedures Used in Starter Fertilizer Experiment

Location: Clay County, Sec. 11, Twp. 95, Rn. 53 on the Kermit Holm farm.

1. The site was selected through the aid of the Turner County Extension Agent.

2. Row spacing: 30 inches

3. Plant Population: 16,000 per acre

4. Hybrid used: Pioneer 3570 (approximatley 110 day corn)

5. Replicated 4 times

6. Weed control:

   (a) Ramrod at planting
   (b) 2-4D when the corn was 10 inches high
   (c) cultivated once

7. Insect Control: Bux 10 at planting time

8. Planted: May 18, 1970
   Sidedressed: June 9, 1970
   Leaf Sampled: July 28, 1970
   Harvested: October 1, 1970

9. Corn was planted with a John Deere tool-bar plater equipped with belts to apply fertilizer to individual rows and with attachments to apply the insecticide and herbicide. The yield was estimated by picking 50 feet of row by hand.

Results

TABLE 39a. SOIL TEST VALUES ON A COMPOSITE SOIL SAMPLE FROM THE EXPERIMENTAL SITE

Depth Inches	Organic Matter %	NO_3 N ppm	Phosphorous P Lbs/A	Potassium K Lbs/A	pH 1:1 Dil.	Soluble Salt mmhos/cm	0.1N HCl Mn ppm	0.1N HCl Zn ppm
0-6	3.0	11.8	8	340	6.9	0.34	218	5.6
6-12	2.8	11.5	4	228	7.6	0.49	210	5.2
12-18	1.8	6.7	4	103	7.8	0.82	89	1.6
18-24	1.2	1.8	3	60	8.0	0.98	9	0.2
24-30	0.4	1.7	2	112	7.9	2.30	62	0.7
30-36	0.4	1.7	3	107	8.0	2.50	50	0.2
36-42	0.4	1.4	3	85	8.0	2.60	99	2.4
42-48	0.8	1.2	4	59	8.0	2.30	10	T

Weather was abnormally dry in July and August and corn was severly affected.

Yield results and percent moisture in grain at harvest are shown in Table 39b.

TABLE 39b. THE EFFECT OF STARTER FERTILIZERS ON THE YIELD AND MATURITY OF CORN GROWN ON A SOIL TESTING LOW IN AVAILABLE PHOSPHORUS, CLAY COUNTY 1970

Treatments: Starter N+P+K, Lbs/A	Treatments: Sidedressed Nitrogen N+P+K, Lbs/A	Yield** Bu/A	Moisture in Grain at Harvest Time %
0+0+0	0+0+0	24.2	30.8
0+0+0	80+0+0	39.5	28.4
12+23+17	0+0+0	24.1	31.7
12+23+17	80+0+0	35.5	31.2
3+6+5 pop-up	80+0+0	34.4	30.7
3+6+5 pop-up + 9+17+12 starter	80+0+0	32.7	32.2
12+0+17	80+0+0	34.9	29.9
12+23+0	80+0+0	32.4	29.4
12+23+17+Zn*	80+0+0	32.9	30.1

* Zn at 10# per acre of sequestrian Zn.
** Yields calculated at 15 percent moisture.

Discussion and Interpretation of Table 39b

The yield of corn was seriously depressed by the dry weather encountered. The highest yield was obtained from the addition of nitrogen. Any starter, or pop-up fertilizer applied in addition to the nitrogen depressed the yield. Starter fertilizer without added nitrogen had no affect on yield.

The driest corn was found in the plots treated with nitrogen only.

The effect of the starter fertilizers can be determined only after conducting this type of experiment on a soil testing low in phosphorus for several years. A year of unusually dry weather provides very little information useful in determining the value of these starters.

RESIDUAL PHOSPHORUS - SOYBEAN RESPONSE

Raymond Ward and Burton Lawrensen

An 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 pounds P/acre) were broadcast and plowed down annually. No phosphorus has been broadcast during the past three years. Each of the P treatments was divided into thirds with one-third receiving about 10 pounds of P as a starter fertilizer from 1964 through 1968, one-third receiving 10 pounds of zinc per acre in 1964 and 1965, and one-third remaining only as the broadcast phosphorus treatment.

Grain sorghum was grown in 1969 and residual phosphorus increased yields about one-third by the broadcast application rate of 10 lbs. of P/A (23 lbs. of P_2O_5/A) for four years (1964-67). In 1968 and previous years corn yields were increased about 10 bushels per acre for the first increment of applied phosphorus. Additional broadcast P did not increase corn yields and at high rates yields tended to decrease. Grain sorghum yields did not decrease where higher rates of P had been applied.

Many times the question comes up as to the value of fertilizing soybeans. The purpose of planting soybeans on the residual phosphorus plots was to determine if soybeans respond to high soil phosphorus. If higher yields are obtained at higher P soil tests then the possibility of getting a soybean yield increase from a direct application of P_2O_5 will be greater.

Corsoy soybeans were planted June 1, 1970 in 30" rows at a planting rate of approximately one bushel/A. Lasso was sprayed at a rate of two lbs/A on June 4 to control weeds.

Results and Discussion

Soybean yields were low because of the 1970 weather conditions. Drought was severe enough that a "complete canopy" was not obtained with 30" rows. However, a visual response to residual phosphorus could be observed through most of the growing season. By the first of September the plots never receiving phosphorus fertilizer were about two thirds the height of the plots with residual phosphorus (visual observation).

Actual yields were harvested November 6, 1970 and are shown in Table 39c. Soybean yields were relatively good considering the rainfall received. The apparent soybean yield response was 3 to 4 bushels per acre when comparing the yield of the no broadcast-no additional P or Zn treatment (upper left hand corner of Table 40) to the yield of treatments that received P_2O_5. The yield difference between the no broadcast-no additional P or Zn treatment and no broadcast-residual zinc treatment is probably not due to residual zinc but due to variability within the experimental area.

Phosphorus soil tests taken in 1968 showed the check plot to be low and the 40 lb. P plot (23 lbs. P_2O_5 for 4 years) to be medium-high in phosphorus availability. This indicates that soybeans respond to residual P_2O_5 fertilizer when initial phosphorus soil tests are low. It may also be concluded that soybeans will respond to direct applications of phosphorus fertilizer. Other research at the Station has shown this to be true (see most profitable rotation exeriment).

TABLE 39c. INFLUENCE OF VARIOUS RATES OF RESIDUAL BROADCAST P AND THE ADDITIONAL INFLUENCE OF RESIDUAL STARTER P AND RESIDUAL ZINC ON YIELD OF SOYBEANS IN 1970

	No Additional P or Zn	Residual Starter	Residual Zinc
Total lbs. of P Broadcast/A (1964-67)		Soybean Yield, Bu/A	
0	16.4	20.5	18.4
40	20.8	21.0	19.4
80	19.9	19.9	20.6
160	19.7	20.4	20.6
320	19.5	18.6	19.9

Plant samples were taken the first week of August by sampling the top-most mature trifoliate leaves. The analysis are shown in Table 39d. In general the P level was lower for the no broadcast treatments and P level reached its highest level with the 80 lb. P treatment (45 lbs. P_2O_5 per year for 4 years). The other nutrients were fairly similar for all treatments. Residual zinc increased zinc slightly in the soybean leaves. Unlike corn, zinc levels in soybeans did not decrease as the P rates increased. The plant nutrient levels are shown so that future plant tests (either for research or for growers) can be compared with these results for interpretation.

TABLE 39d. PLANT ANALYSIS OF THE MOST RECENTLY MATURE TRIFOLIATE LEAVES OF CORSOY SOYBEANS FROM THE RESIDUAL PHOSPHORUS EXPERIMENT, 1970

Treatment lbs. of P Broadcast/A (1964-1967)	Nutrient Concentration							
	P %	K %	Ca %	Mg %	S %	Fe ppm	MN ppm	Zn ppm
				No Additional P or Zn				
0	0.24	2.2	1.8	0.63	0.21	83	56	46
40	0.26	2.3	1.6	0.53	0.19	84	47	41
80	0.35	2.2	1.5	0.51	0.21	78	49	44
160	0.32	2.1	1.7	0.54	0.20	83	49	40
320	0.34	2.2	1.4	0.53	0.23	78	46	41
				Residual Starter				
0	0.26	2.3	1.5	0.53	0.20	74	46	41
40	0.31	2.2	1.4	0.51	0.21	81	51	42
80	0.33	2.1	1.5	0.55	0.20	84	47	40
160	0.32	2.2	1.5	0.54	0.22	84	46	40
320	0.31	2.3	1.5	0.51	0.19	78	46	36
				Residual Zinc				
0	0.27	2.1	1.4	0.52	0.22	78	50	55
40	0.30	2.1	1.5	0.52	0.22	82	51	48
80	0.33	2.2	1.2	0.49	0.22	84	51	48
160	0.30	2.2	1.5	0.50	0.20	82	44	41
320	0.33	2.2	1.5	0.54	0.22	85	47	47

LIME EXPERIMENT

Raymond Ward and Burton Lawrensen

A lime experiment was established in 1968. The purpose was to determine if lime is needed on some of our soils in Southeastern South Dakota. Lime recommendations are not made by the Soil Testing Lab at South Dakota State University because no yield increases have been measured from research plots and because almost all our soils contain free lime within the root zone. However, many questions have been asked about the use of lime so new experiments were established at four locations to determine if lime will produce yield increases. A four year cropping plan was set up so that residual lime could be measured. Next year a final report will be made on these experiments.

Results and Discussion

Ear corn yields and moisture content from the lime experiment are shown in Table 39e. Corn yields were low this year because of the low rainfall. Both treatments receiving an application of lime produced higher corn yields which indicates a lime response this year.

The lime treatments (4 tons/A) also had a slightly lower ear corn moisture content. Lime response, as shown in Table 39e has not been found at this experimental site in the two previous years so it will be interesting to see if the response is changing with time.

TABLE 39e. THE EFFECTS OF ADDED LIME AND PHOSPHORUS ON THE YIELD AND MOISTURE CONTENT OF EAR CORN, 1970

	Ear Corn	
Treatment	Yield Bu/A	Moisture %
Check	40.8	18.2
Lime (4 tons/A)	48.0	16.9
Phosphorus (60 lb. P_2O_5/A)	40.9	19.1
Lime and Phosphorus	44.7	18.7

Ear corn yield was corrected to 15.5% moisture

SOUTHERN CORN LEAF BLIGHT

C. M. Nagel

In 1970, southern corn blight hit all major news headlines nationwide and began a scare that corn, and therefore, beef and pork might be in short supply this winter. In spite of the losses estimated now at 15 percent nationwide, there should be no severe shortage because this year's harvest, estimated at 4.1 billion bushels, will be the third largest in our history because of the favorable growing conditions in the corn belt. However, if blight continues to be a major disease on corn, shortages could occur rapidly, and the economy could be severely jolted.

Southern corn leaf blight (SCLB) was present in light amounts on corn in South Dakota from the Nebraska to the North Dakota borders envolving the two tiers of counties along the eastern border of South Dakota. The yield loss for the state would amount to less than 1 percent.

The symptoms of this disease consist of tan colored spots on the leaves, leaf sheaths, and one inch circular black spots on husks; rotted ear shanks and ears. If the disease becomes severe and defoliation occurs, other diseases affecting the plants, namely, stalk and root rot, may become more destructive.

What was cause and what steps are being taken to guard against similar damage in the future?

The cause was the southern leaf corn blight fungus, a new strain of an old fungus which has been present in the southern states for 25 years, scientifically called Helminthosporium maydis. Blighted corn looks spotted and scorched as though killed by an early frost. The diseased lesions produce spores or "seed" abundantly on the surface and are spread by wind, rain, and seed. It cannot be stated with accuracy at this time whether or not the SCLB fungus will survive the winter conditions in South Dakota or in much of the rest of the corn belt. The reason, the current new strain of the fungus which was created recently in nature and only recently isolated by plant pathologists in the laboratories of the corn belt Agricultural Experiment Stations during the past year, has not afforded enough time to obtain all the necessary information concerning the new strain of this serious plant disease organism to answer many of the questions pertinent to its effective control. Experiments are under way in many state Agricultural Experiment Stations to this end.

Present knowledge regarding the control of this disease may be listed as follows:

1. Growers should try to obtain seed produced from seed fields which have been detasseled by hand. Hybrid seed produced with male sterile or with T. cytoplasm is highly susceptible. Normal cytoplasm produced seed is highly resistant although not immune to the T strain of the southern corn blight fungus.

2. Carefully chop and plow down harvested corn fields so as to cover up as much of the leaves, stalks, and other refuse from the crop as possible. This will help to reduce the source of fungus inoculum in the spring which, if the organism survives the winter, can spread to the new corn crop.

3. Barley, oats and wheat as eroneously reported in the news media is not susceptible to southern corn leaf blight.

4. Hybrid seed corn blends are on the market, consist of mechanical mixtures of male sterile and male fertile produced seed. Blends will have limited value in controlling the disease and may create problems at harvest especially if blight becomes serious in 1971. Most hybrid seed corn producers will have "Blend" information printed on the seed corn bags.

5. Conditions of minimum tillage would tend to increase the amount of damage from southern corn leaf blight.

6. Seed treatment with the fungicide Captan will benefit by reducing the amount of inoculum produced.

7. For the future hybrids based on S and other resistant but male sterile cytoplasms are being prepared and tested.

Two other fungi also cause leaf blight and, may be confused with southern corn leaf blight in the field. Northern corn leaf blight is caused by Helminthosporium turcicum, a major problem readily controlled with resistant hybrids, and yellow leaf blight (a new disease threat in 1968) caused by still a different fungus, Phyllosticta spp, which first began to damage corn in the northern states in 1968. The symptoms of the three diseases are similar and therefore difficult to tell apart in the field. Laboratory diagnosis is necessary. All three fungi have been isolated from disease lesions from corn in South Dakota.

The weather conditions for spread and development of leaf blight in 1970 were at times favorable. However, we do know that the genetic make-up of the corn itself grown in the Corn Belt including South Dakota was a major factor. It was largely T cytoplasm or male sterile, which is highly susceptible. This arises from current practice in hybrid seed production, in using male sterile cytoplasm to avoid the expense of hand detasseling.

Until the last 15-20 years virtually all hybrid seed corn was produced by hand detasselling--removing the male elements or tassel, in a seed field, i.e., the pollen, so that the seed parent was not self-pollinated. At the peak of the detasseling season the job occupied an estimated 135,000 people nationwide. It was the most expensive part in the production of raising hybrid seed corn. A search for the genetic substitute for detasselling began. The late Donald F. Jones of the Connecticut Experiment Station and Dr. Paul Mangelsdorf, formerly of the Texas Experiment Station, were the first to show how to use a corn strain with naturally sterile pollen. This is called cytoplasmic male sterility. A cytoplasmic character is transmitted by the mother plant to all its progeny. The cytoplasmic male sterility character was introduced by crossing an inbred to the sterile source, crossing the hybrid back to the inbred and repeating the backcross in each successive generation. A hybrid, made up with "sterile cytoplasm", was fertile because of the action of the restorer genes from the male parent.

About 15 years ago, this system was introduced into the hybrid seed corn production program and has become widely adopted. In recent years, including 1970, about 80% of commercial hybrids were made up with the T cytoplasmic male

sterility. The wide use of T rather than other sources of sterile cytoplasm came about because it worked better under varying environmental conditions in the field.

The first indications that a problem was in the offing, resulted from research published in 1961 at the Central Experiment Station in the Philippines. It was found that T cytoplasmic male sterile corn inbreds and hybrids were much more susceptible to the southern corn leaf blight disease than those with normal cytoplasm. In fact, the Philippine publication and another confirming it published in 1965, are the first descriptions of the cytoplasmic inheritance of disease susceptibility in a crop plant.

A check in 1963 showed no difference in disease reaction between the male sterile and normal corn lines used in the Philippines which had been made by inoculating with strains of Helminthosporium maydis from Illinois. The same was true of similar tests made later in Pennsylvania. However, in 1969 heavy infection was observed on corn with T cytoplasm in southern Iowa, Indiana, Ohio, Illinois and other states. In 1970, corn grown in Florida became infected with H. maydis and rapidly spread north into the corn belt and Onterio, Canada. A new race of the fungus had developed specifically adapted to corn carrying the T cytoplasm. In 1969 it was reported that high susceptibility to yellow leaf spot was also associated with T male sterile cytoplasm. Although plant scientists had produced a wide spectrum of different corn hybrids with considerable genetic diversity they had overlooked the fact that these hybrids were nearly uniform with respect to their cytoplasms. Thus, with favorable weather conditions there was rapid spread of a new strain of a virulent pathogen readily adapted to its host, the corn plant.

The short term cure might be considered simple--not to use hybrids made up with T cytoplasm. Normal cytoplasm is highly resistant to the T race. Available for the 1971 corn planting season is about 3 million bushels of hybrid seed produced by the fertile male method made by hand detasselling--this amount will plant only about 15-20% of the total national requirement. Much of this will go to major corn states where the risks are considered greater. Most farmers will have to grow T cytoplasm corn next year because only this is available in large quantities. Also, some hybrids are being put out as blends with up to 50% seed with normal cytoplasm for pollination. Most seed producers have labeled their hybrid seed blends on the bags stating its percentage of T cytoplasm (the susceptible type).

Foliage fungicides for the control of blight on fields used for seed production will perhaps be available for 1971. However, the effectiveness is not as good as desired, hence the control may not be economically feasible. Applications will need to be made several times during the growing season.

EFFECT OF LYSINE AND METHIONINE SUPPLEMENTATION ON PERFORMANCE AND CARCASS CHARACTERISTICS OF GROWING-FINISHING SWINE

R. C. Wahlstrom, G. W. Libal and J. F. Fredrikson

Lysine and methionine are two of the essential amino acids for swine that are thought to be most limiting in corn-soybean meal diets. Previous research at the Southeast South Dakota Experiment Farm indicated that lysine improved diets that were low in protein but pigs fed low protein diets plus lysine did not gain as rapidly as did those receiving high protein diets.

The objective of the experiment reported herein was to study the effect of lysine and methionine supplementation when added to diets at levels equal to that present in a similar diet containing 2 or 4 percent more protein.

Procedure

Seventy-two weanling pigs averaging approximately 47 pounds were divided into 12 lots of six pigs each. Each lot contained three barrows and three gilts. Four replicate lots received each of the following dietary treatments:

1. 16% protein diet reduced to 14% protein at 110 lbs.

2. 14% protein diet reduced to 12% at 110 lbs. plus 0.16% L-lysine and 0.03% methionine.

3. 12% protein diet reduced to 10% at 110 lbs. plus 0.31% L-lysine and 0.05% methionine.

All diets contained the same amount of lysine and methionine. Composition of the diets is shown in Table 40.

Individual pigs were removed from the experiment when they weighed over 205 pounds on the weekly weigh day when carcass data were obtained. Several pigs in treatment 3 did not reach this final weight figure by the time the experiment was terminated. These pigs were marketed at John Morrell and Co., Sioux Falls, South Dakota.

Carcass data were obtained after the carcasses had been cooled for approximately 24 hours. Data collected were carcass length, backfat, percent ham and loin and area of the longissimus dorsi muscle (loin eye).

Results

Growth performance data are summarized in Table 41 and carcass data in Table 42. During the growing phase pigs fed the 16% protein diet gained 8 percent faster than those pigs fed the 14% diet and 31% faster than those fed the 12% protein diet even though all diets contained equal amounts of lysine and methionine. These results would indicate that either other amino acid is deficient in these low protein diets or that the balance of amino acids is not correct for maximum growth when lysine and methionine are supplemented to low protein diets. During the growing phase pigs gained at similar rates 1.66 pounds per day, fed 14 or 12% protein diets but those fed the 10% protein diet gained considerably slower, 1.25 pounds per day. For the entire experimental

period gains were 1.64, 1.59 and 1.25 pounds per day for pigs fed the 16, 14 and 12% protein diets, respectively.

Feed/gain increased as the protein level of the diet decreased. During the growing phase pigs required 2.84, 2.90 and 2.99 pounds of feed per pound of gain when fed the 16, 14 or 12% protein diets, respectively. Feed/gain for the finishing period was 3.51, 3.69 and 4.06 pounds of feed per pound of gain. For the entire trial, approximately 4 and 10 percent more feed was required by the pigs fed the 14 and 12% protein diets, respectively compared to those pigs fed the 16% protein diet.

Carcass from pigs fed the low protein diet had slightly more backfat, less percent ham and loin and smaller loin eye areas. The data are similar to that obtained in previous experiments, however the magnitude of the differences are not as great. There are two possible explanations of why low protein diets did not cause as severe an effect on carcass characteristics in this trial. Only 14 of 23 pigs are represented in the data. These are the fastest gaining pigs in this treatment and thus may not be a true representative average of all pigs fed the low protein diets. Another reason that may account for somewhat less effect on carcass quality is that the low protein diet was supplemental with lysine and methionine. Other work at the South Dakota Experiment Station has indicated an improvement on carcass quality due to supplemental lysine.

Summary

Pigs fed low protein diets, 10 percent to 110 pounds and 10 percent from 110 pounds to market weight, supplemented with lysine and methionine to a level equal to that in 16-14% protein diets, gained slower, required more feed per unit of gain and produced carcasses with more backfat, less percent ham and loin and smaller loin eye areas than pigs fed 16-14% protein diets or 14-12% protein diets plus supplemental lysine and methionine.

Main building for swine research at the Farm.

TABLE 40. COMPOSITION OF RATIONS (PERCENT)

Treatment No.	Weaning to 110 lbs. 1	2	3	110 lbs. to Market Wt. 1	2	3
Ground yellow corn	763	817	871	823	877	932
Soybean meal (44%)	208	143	87	150	86	29
Dicalcium phosphate	16.5	17.5	18.5	14.5	14.5	15.5
Limestone	5	5	5	5	5	5
Trace mineral salt	5	5	5	5	5	5
Vitamin-antibiotic premix[a]	2.5	2.5	2.5	2.5	2.5	2.5
Lysine-methionine premix	—	10	11	—	10	11
Calculated analysis:						
Crude protein, %	16.0	14.0	12.0	14.0	12.0	10.0
Lysine, %	0.81	0.81	0.81	0.66	0.66	0.66
Methionine, %	0.29	0.29	0.29	0.27	0.27	0.27
Calcium, %	0.65	0.66	0.67	0.59	0.58	0.59
Phosphorus, %	0.65	0.65	0.65	0.60	0.58	0.57

[a] Provided 1,500 I.U. vitamin A, 150 I.U. vitamin D, 1 mg. riboflavin, 2.5 mg. calcium pantothenate, 7.5 mg. niacin, 50 mg. choline, 5 mcg. vitamin B_{12} and 5 mg. oxytetracycline per lb. of ration.

TABLE 41. GROWTH PERFORMANCE OF PIGS FED HIGH, MEDIUM AND LOW PROTEIN DIETS OF EQUAL LYSINE AND METHIONINE CONTENT

	High Protein (16-14%)	Medium Protein & Lysine & Methionine (14-12%)	Low Protein & Lysine & Methionine (12-10%)
No. of pigs[a]	24	24	23
Av. initial wt., lb.[b]	46.7	27.0	46.9
Av. final wt., lb.	210.3	210.5	184.3
Av. daily gain, lb.	1.64	1.59	1.25
Av. feed cons./day, lb.	5.30	5.35	4.45
Feed/gain, lb.	3.23	3.36	3.55

[a] Four replicates of 6 pigs each per treatment. One pig died on low protein diet.
[b] Av. initial weights were 53.3, 41.8, 46.2 and 46.2 for replicates 1, 2, 3 and 4, respectively.

TABLE 42. CARCASS DATA

	High Protein (16-14%)	Medium Protein & Lysine & Methionine (14-12%)	Low Protein & Lysine & Methionine (12-10%)
No. of carcasses	24	24	14
Cold carcass wt., lbs.	153.5	155.0	153.4
Av. length, in.	30.3	30.4	30.6
Av. backfat, in	1.48	1.46	1.58
Av. % ham and loin	37.25	37.95	37.01
Av. loin eye area, sq. in.	3.70	3.82	3.39

EFFECT OF ENVIRONMENT, SEX AND PROTEIN LEVEL OF RATION ON PERFORMANCE AND CARCASS CHARACTERISTICS OF GROWING-FINISHING SWINE

R. C. Wahlstrom, G. W. Libal and J. F. Fredrikson

Research conducted at the Southeast Souh Dakota Experiment Farm during the winter of 1968-69 indicated that the performance of pigs fed rations containing 15% protein to about 115 lbs. and 12% protein to market weight was equal to that of pigs fed a ration of 17% protein to 115 lbs. and reduced to 14% protein from 110 lbs. to market weight. In the previous trial about 9% more feed was required for those pigs fed in the uncontrolled environment; however, rate of gain was not affected by the type of housing. The present experiment was conducted to obtain further information on the protein needs of barrows and gilts and their performance when fed in a controlled environment building or an open-front building with feeders and waterers outside.

Experimental Procedure

One hundred twelve crossbred pigs were allotted into four groups of barrows and four groups of gilts with 14 pigs per group. The barrows averaged approximately 35 lbs. and the gilts 33 lbs. One group of barrows and one group of gilts were assigned to each of the following treatments:

1. Controlled environment, high protein diet
2. Controlled environment, low protein diet
3. Uncontrolled environment, high protein diet
4. Uncontrolled environment, low protein diet

The high protein diet was calculated to contain 16% protein until the pigs averaged approximately 115 lbs. when it was reduced to 13% and the low protein diets were calcalculated to contain 14 and 11% protein during the same two periods. However, chemical analyses indicated these diets contained slightly less protein than the calculated levels. These values and the composition of the diets used are shown in Table 43.

The controlled environment house was a fully insulated, ventilated, slotted floor house. The temperature was maintained between approximatley 50 and 60° F. with concrete floor and outside concrete feeding floor where self-feeders and automatic waterers were located. A partition, approximately three feet high, confined the pigs to a sleeping area at the rear of the house. This area was bedded with straw. The experiment was conducted during the winter months from November 14 to late February. Average maximum temperatures were 41, 30, 18 and 36° F. for the months of November, December, January and February, respectively. Approximately 24 inches of snow fell during the period of this experiment.

Forty-three barrows were slaughtered at the termination of the experiment and carcass data were obtained for carcass length, backfat, loin eye area and ham-loin percent.

Results

A summary of the results of this experiment is shown in Table 44. The average daily gains of all eight treatments are shown in Table 45. During the first phase of the experiment the only significant difference in rate of gain was due to protein level of the diet. Pigs fed the 15.4% protein diet gained

significantly faster than those fed the 13.7% protein diet. For the entire trial, pigs fed the high protein diets gained significantly faster than those fed the low protein diets (1.69 vs. 1.49 lb. per day), barrows gained faster than gilts and slightly faster gains were observed for pigs fed in the controlled environment than those in the open housing. However, the data in Table 45 indicate that these differences in gain due to environment are due to the poor performance of the barrows fed the high protein diet in the uncontrolled environment as the gilts and the other group of barrows gained equally as well in the uncontrolled environment. This one lot of pigs gained 1.65 lb. per day up to a weight of 135 lbs. and then gained only 1.37 lbs. per day the remainder of the trial for an average of 1.55 lb. per day for the entire trial. The reason for the poor growth during the latter period is not known. One might expect a low order infection as a possibility although the pigs appeared normal at all times.

Feed efficiency was improved 8.7% when pigs were fed in the controlled environment. The difference of 31 lb. of feed required per 100 lb. of gain is similar to that reported in 1969 when pigs were fed under similar environmental conditons. Barrows required about 6% more feed than gilts and pigs fed the low protein diets required about 6% more feed than those fed the high protein diets.

Carcass data of the barrows did not reveal any significant treatment differences. However, there did appear to be a trend for slightly leaner carcasses when pigs were fed the high protein diet.

Summary

This experiment indicated that from 35 lb. to market weight pigs gained at a similar rate but much more efficiently if housed in a controlled environment building rather than an open-front building during the winter period. Barrows gained faster than gilts but also required slightly more feed per unit of gain. A diet containing 13.7% protein fed to pigs from 35 to 115 lbs. followed by a 10.9% protein diet to market weight was not adequate for either barrows or gilts. Significantly faster gains and also more efficient gains were obtained when the diet contained 15.4% and 12.8% protein during the growing and finishing phases, respectively.

Research with swine included studies of floor types and controlled environment. This is an experimental pen with 50% slotted floor area.

TABLE 43. COMPOSITION OF DIETS (PERCENT)

	High Protein		Low Protein	
	To 115 lb.	115 lb. to Market	To 115 lb.	115 lb. to Market
Ground yellow corn	77.1	85.1	83.0	90.0
Soybean meal (44%)	20.0	12.5	14.0	7.5
Dicalcium phosphate	1.7	1.2	1.8	1.3
Limestone	0.5	0.5	0.5	0.5
Trace mineral salt	0.5	0.5	0.5	0.5
Vitamin-antibiotic premix[a]	0.2	0.2	0.2	0.2
Calculated analysis				
Crude protein, %	16	13	14	11
Calcium, %	0.65	0.55	0.66	0.56
Phosphorus, %	0.64	0.52	0.64	0.52
Chemical analysis				
Crude protein, %	15.4	12.8	13.7	10.9

[a] Provided 1,500 I.U. vitamin A, 150 I.U. vitamin D, 1 mg. riboflavin, 2.5 mg. calcium pantothenate, 7.5 mg. niacin, 50 mg. choline, 5 mcg. vitamin B_{12} and 5 mg. oxytetracycline per pound of ration.

TABLE 44. EFFECTS OF ENVIRONMENT, SEX AND PROTEIN LEVEL ON PERFORMANCE OF GROWING-FINISHING SWINE

	Environment		Sex		Protein Level	
	Con-trolled	Uncon-trolled	Barrows	Gilts	16-13	14-11
No. of pigs[a]	54	53	53	54	54	53
Avg. initial wt., lb.	34.0	34.4	35.0	33.3	34.3	34.1
Avg. final wt., lb.	191.8	199.4	199.4	191.8	203.2	188.0
Avg. daily gain, lb.						
To 115 lbs.	1.56	1.56	1.58	1.54	1.70[c]	1.42
Total exp.	1.63[b]	1.55	1.63[b]	1.54	1.69[c]	1.49
Avg. feed/gain, lb.	3.27[b]	3.58	3.52	3.33	3.32	3.53
Carcass data						
Avg. length, in	29.9	29.5			29.8	29.6
Avg. backfat, in.	1.64	1.56			1.56	1.63
Avg. loin eye area, sq. in.	3.87	3.96			4.05	3.79
Avg. ham-loin, %	36.6	37.8			37.6	36.8

[a] Two lots of barrows and two lots of gilts per treatment, 14 pigs per lot. Five pigs removed and data not included.
[b] Significant difference ($P < .05$).
[c] Significant difference ($P < .01$).

TABLE 45. AVERAGE DAILY GAIN BY TREATMENTS

	Controlled Environment	Uncontrolled Environment
Barrows, high protein	1.85	1.55
Barrows, low protein	1.55	1.52
Gilts, high protein	1.65	1.69
Gilts, low protein	1.40	1.41

SULFUR SUPPLEMENTATION WITH UREA AS THE SUPPLEMENTAL PROTEIN WITH CORN SILAGE OR EAR CORN RATIONS FOR BEEF STEERS

L. B. Embry, R. M. Luther and J. F. Fredrikson

This experiment was conducted to determine the need for a sulfur supplement with urea used as the primary supplemental protein in corn silage or ear corn rations for growing and finishing steers. Supplements which contained one part of sulfur to 10 or 20 parts nitrogen from the urea were compared to a urea supplement without added sulfur and to a low-protein corn supplement fed at the same level. The experiment consisted of a corn silage feeding phase of about 4 months and a ground ear corn phase of about 6 months.

Procedure

Corn Silage Phase

Eight pens each with 15 steers were used in the experiment. Four ration treatments were replicated with inside and outside feeding which will be combined in presenting results of the ration treatments.

The cattle were full-fed corn silage once daily and 2 lbs. of a supplement. The four experimental treatments were as follows:

1. Corn supplement (control)
2. Urea supplement (40% protein)
3. Urea supplement with 1 part sulfur to 20 parts nitrogen in the urea
4. Urea supplement with 1 part sulfur to 10 parts nitrogen in the urea

The corn (control) supplement was composed of 87.65% ground corn grain, 6.0% dicalcium phosphate, 6.0% trace mineral salt and 0.35% aureomycin premix to furnish 35 mg. aureomycin per pound of supplement. Vitamin A was added to furnish 10,000 I.U. per pound of supplement and the cattle were implanted with diethylstilbestrol. Urea was used to replace an equal weight of corn in this supplement (11.80, 11.85 or 11.90%) to obtain 40% protein supplements with no added sulfur and at 1 part sulfur to 20 or 10 parts of nitrogen in the urea.

Ground Ear Corn Phase

The corn silage phase of the experiment was terminated after 124 days. Rations were then changed to ground ear corn with the corn silage being eliminated over a 5-day period. Ground ear corn was increased to a full feed at a rate of 2 lbs. per head daily. This rate of increase apparently was too rapid and some death losses resulted as indicated from numbers of cattle per treatment group in table 47. Results presented are for animals completing the experiment with an average feed being deducted per animal up to time each loss occurred.

Experimental treatments for the supplements were the same as during the corn silage phase except diethylstilbestrol was added at 5 mg. per pound of supplement. The cattle remained in the same pens for this phase of the

experiment as during the previous phase. The experiment was terminated after 189 days on this ground ear corn phase. The cattle were marketed at a central stockyards and carcass data were not obtained.

Results

Corn Silage Phase

Results of this phase of the experiment are shown in table 46. It is evident that corn silage and the 2 lbs. of corn supplement with added minerals, vitamin A and aureomycin did not supply adequate protein and that supplementing with urea resulted in marked improvement in rate of gain. The average improvement in rate of gain for all the urea supplemented groups amounted to 43% in comparison to the corn control. The cattle fed urea also consumed more feed but required 15.1% less feed per 100 lb. of gain than did the low-protein groups.

Rate of gain was lower and feed requirements higher when feeding supplements with added sulfur. However, these differences were quite small and more likely indicate no effect from sulfur supplementation rather than a reduction in feedlot performance.

Water analysis showed a sulfate (SO_4) content of 1,865 ppm. Sulfur requirements of cattle appear to be about 0.1% of the air-dry ration. On this basis, the maximum daily sulfur requirement would be about 7 to 8 gm. during this phase of the experiment. Each gallon of the water contained about 2.3 gm. of sulfur. Normal intakes of the water by the cattle should supply total sulfur needs from the water without a need from other ration sources.

Ground Ear Corn Phase

Results of this phase of the experiment are shown in table 47. Rate of gain and feed efficiency for cattle fed the corn (control) supplement were improved somewhat more than for those fed the high urea supplement over the corn silage phase. This would be in support of a lower protein requirement of cattle with advancing age and finish.

Gains and feed requirements also favored the cattle fed the urea supplement without added sulfur during this phase of the experiment. The difference in gain between urea supplements with and without added sulfur was greater during this phase of the experiment than during the corn silage phase, especially in case of the higher level of sulfur supplementation (1 part sulfur to 10 parts nitrogen from urea). However, data from this one experiment are not enough to conclude these levels of added sulfur were detrimental to cattle feedlot performance.

Summary

Rations composed of corn silage or ground ear corn were improved by urea supplementation with the improvement in gain and feed efficiency being more pronounced during early stages of growing and finishing when fed corn silage than during later stages of finishing when fed ground ear corn.

Adding sulfur at 1 part to 20 or 10 parts of nitrogen from the urea did not show any beneficial effect during either phase. Sulfur content of the water was quite high and would furnish in excess of sulfur requirements at normal water consumption.

TABLE 46. SULFUR LEVELS IN UREA SUPPLEMENTS FED WITH CORN SILAGE TO GROWING AND FINISHING BEEF STEERS (JANUARY 22 TO MAY 26, 1970 - 124 DAYS)

	Type of Supplement			
	Corn	Corn-Urea	Corn-Urea 1 pt. S to 20 pt. N[a]	Corn-Urea 1 pt. S to 10 pt. N[a]
Number of steers	30	30	30	30
Av. init. wt., lb.	416	416	416	416
Av. final wt., lb.	592	671	663	687
Av. daily gain, lb.	1.41	2.07	1.99	1.99
Av. daily ration, lb.				
Corn silage	30.28	37.35	36.70	36.84
Supplement	1.98	1.98	1.98	1.95
Feed per 100 lb. gain, lb.				
Corn silage	2148	1804	1844	1851
Supplement	140	96	99	98
Total	2288	1900	1943	1949

[a] 1 part of sulfur to 20 or 10 parts nitrogen from urea in the supplement.

TABLE 47. SULFUR LEVELS IN UREA SUPPLEMENTS FED WITH GROUND EAR CORN TO GROWING AND FINISHING BEEF STEERS (MAY 26 to DECEMBER 1, 1970 - 189 DAYS)

	Type of Supplement			
	Corn	Corn-Urea	Corn-Urea 1 pt. S to 20 pt. N[a]	Corn-Urea 1 pt. S to 10 pt. N[a]
Number of steers	26	30	28	30
Av. init. wt., lb.	590	671	664	687
Av. final wt., lb.	959	1106	1080	1067
Av. daily gain, lb.	1.95	2.30	2.20	2.13
Av. daily ration, lb.				
Ground ear corn	14.69	16.50	16.59	16.16
Supplement	1.95	1.95	1.96	1.97
Feed per 100 lb. gain, lb.				
Ground ear corn	753	717	754	759
Supplement	100	85	89	92

[a] 1 part sulfur to 20 or 10 parts nitrogen from urea in the supplements.

A vo-ag class learns about beef cattle research during the annual Field Day.

VALUE OF SHELTER FOR GROWING AND FINISHING CATTLE

L. B. Embry, R. M. Luther and J. F. Fredrikson

In an experiment which involved a study of sulfur additions to supplements with high levels of urea fed with corn silage and with ground ear corn, four ration treatments were replicated with inside or outside feeding. Results for this aspect of the experiment are summarized for this report.

Procedures

Eight pens each with 15 head initially were used in this experiment. There were four outside pens which measured 56 feet x 64 feet. The pens were equipped with fence-line feed bunks and an automatic electrically heated waterer. Each pen had a 10-foot concrete apron adjacent to the feed bunk and a concrete runway from this apron to the waterer. A bedding mound was provided with corn cobs and straw used for bedding as necessary.

Another four pens of cattle were fed inside on east-west oriented shed. The shed measured 38 feet x 100 feet and was divided into equal size pens with 25 feet x 50 feet outside pens for each to the north or south. Both inside and outside areas were paved with concrete, and the cattle were allowed free choice to inside and outside loafing and bedding areas. Only the inside area was bedded with straw as necessary.

The experiment consisted of a corn silage feeding phase of 124 days and a ground ear corn feeding phase of 189 days.

Results

Results of the corn silage phase from January 22 to May 26 are shown in Table 48. Rate of gain was only sightly less for the outside cattle. They consumed more feed and had higher feed requirements (6%) than the inside cattle. For each 100 lb. of gain this amounted to 113 lb. of corn silage and 4 lb. protein supplement. At prices of $8 per ton for corn silage and $80 per ton for protein supplement, feed cost per 100 lb. of gain would have been increased by 61 cents during this phase of the experiment.

During the ground ear corn feeding phase (Table 49) from May 26 to December 1, steers in the outside pens gained faster than those fed inside the shed. They also consumed more feed and had slightly higher feed requirements (2.8%). This amounted to 28 lb. of ground ear corn but 5 lb. less protein supplement per 100 lb. of gain. At feed prices of $24 per ton of ear corn and $80 per ton for protein supplement this would amount to about 24 cents more cost per 100 lb. of gain for the cattle fed outside.

Summary

Steers fed for 124 days (January 22 to May 26) on a corn silage ration gained only slightly less when fed in outside pens in comparison to steers fed inside a shed with access to an outside paved area. The steers fed outside consumed more feed and required 6.0% more feed per pound of gain. This

would have resulted in about 61 cents more feed cost per 100 lb. of gain using typical prices for the feeds.

When fed ground ear corn rations for 189 days (May 26 to December 1), steers fed outside gained at a slightly faster rate than the inside cattle. They consumed more feed and required about 2.8% more feed per pound of gain. Increased cost of the gains under conditions of this phase of the experiment would amount to about 24 cents per 100 lb. of gain at typical prices for the feeds.

Differences in rate of gain and feed requirements would not justify any lare expenditure for type of housing involved under conditions of this experiment. Labor, bedding, conditon of the cattle, manure disposal and problems likely to be encountered with winter storms and spring mud under the two systems should be taken into consideration.

TABLE 48. INSIDE OR OUTSIDE FEEDING FOR BEEF STEERS FED CORN SILAGE RATIONS (JANUARY 22 TO MAY 26, 1970 - 124 DAYS)

	Inside	Outside
Number of steers	60	60
Av. init. wt., lb.	416	416
Av. final wt., lb.	663	643
Av. daily gain, lb.	1.90	1.83
Corn silage	34.89	35.66
Supplement	1.97	1.97
Feed per 100 lb. gain, lb.		
Corn silage	1836	1949
Supplement	104	108

TABLE 49. INSIDE OR OUTSIDE FEEDING FOR BEEF STEERS FED GROUND EAR CORN RATIONS (MAY 26 to DECEMBER 1, 1970 - 189 DAYS)

	Inside	Outside
Number of steers	58	56
Av. init. wt., lb.	661	645
Av. final wt., lb.	1044	1063
Av. daily gain, lb.	2.08	2.21
Av. daily ration, lb.		
Ground ear corn	15.21	16.77
Supplement	1.95	1.97
Feed per 100 lb. gain, lb.		
Ground ear corn	731	759
Supplement	94	89

One of the groups at the feedlot stop during Field Day.

CORN DISEASE CONTROL

C. M. Nagel

In addition to the information on the Southern Corn Leaf Blight disease the experimental results which follow involve experimental hybrids with resistance to two other diseases, namely, stalk and root rot.

The 1970 growing season at the station was lacking in moisture, particularly the later half of the season. Yields were markedly reduced (about 50 percent) in comparison to the previous two years. However, over a period of years in South Dakota just such seasons with low rainfall can be expected. Therefore, it is especially important to know how various hybrids perform not only under favorable but adverse growing conditions as well.

Most of the experimental hybrids developed and included in these five experiments are resistant to Southern Corn Leaf Blight. The commercial hybrids included as checks are susceptible, they contain the Texas male sterile cytoplasm and therefore, are susceptible to Southern Corn Leaf Blight, *Helminthosporium maydis,* race T. The experimental hybrids contain normal cytoplasm and are therefore resistant to this serious disease.

Southern Corn Leaf Blight infection in 1970 was present in light amounts in the southeastern part of the state. The overall loss in yield was about one percent. Drought was the principle cause of the low yields and not blight.

To save space only the top 3/4 of the hybrids are listed in each of the tables. The significant difference (sign. diff.) shown at the bottom of each table, indicates the number of bushels required in yield between any two hybrids for the difference to be significant. For example, in table 1, the difference required is 8.7 bushels.

TABLE 50. DISEASE PERFORMANCE RATING OF 43 EXPERIMENTAL HYBRIDS VARYING IN RESISTANCE TO ROOT AND STALK ROT DISEASES, COMPARED TO 4 ADAPTED COMMERCIAL HYBRIDS USED AS CHECKS. SOUTHEAST RESEARCH FARM. 1970 PLANTED MAY 18, HARVESTED OCTOBER 20.

Exp'l Hybrid or Commercial Check	Performance Score Ranking	Yield Bu/A	Ear Moisture at Harvest %
	Experiment #1		
Expt'l. #1	1	74.9	11.4
Northrup King PX50 (check)	2	73.1	19.1
Sokota TS 67 (ck)	9	70.6	23.3
Expt'l. #2	5	69.9	17.3
" #3	12	69.8	25.3
" #4	3	69.7	12.3
" #5	4	69.5	12.2
" #6	15	69.3	25.8
" #7	6	68.5	14.7
" #8	10	68.5	19.5
" #9	7	67.3	14.2
" #10	18	67.3	22.9
Pioneer 3505 (ck)	21	66.0	22.5
Expt'l. #11	8	65.6	12.7
" #12	16	65.4	18.7
" #13	11	65.0	14.5
" #14	24	65.0	23.1
" #15	19	64.1	16.6
" #16	17	64.1	16.3
" #17	13	63.7	13.7
Pioneer 3510 (ck)	27	63.1	21.7
Expt'l. #18	14	62.7	12.1
" #19	28	62.3	21.4
" #20	22	62.2	17.1
" #21	20	62.1	13.3
" #22	25	61.4	15.9
" #23	26	61.0	16.5
" #24	23	60.8	14.4
" #25	29	58.1	15.5
" #26	31	55.9	16.2
" #27	30	55.6	12.9
" #28	32	54.4	17.6
" #29	38	53.6	26.7
" #30	33	52.5	17.2
Dekalb XL361 (ck)	44	48.0	27.9

Sign. diff. (Tukey's) 8.7 bu/A

TABLE 51. Experiment #2

Expt'l Hybrid or Commercial Check	Performance Score Ranking	Yield Bu/A	Ear Moisture at Harvest %
Pioneer 3510 (check	2	80.3	22.6
Sokota TS 67 (ck)	1	78.2	17.5
Northrup King PX50 (ck)	3	76.9	18.7
Expt'l. #1	4	70.2	14.7
" #2	5	69.3	15.6
" #3	6	68.1	21.0
" #4	7	68.0	21.2
" #5	15	66.8	24.5
" #6	10	66.7	20.3
" #7	11	66.1	19.2
" #8	8	65.4	16.2
" #9	14	65.3	20.5
" #10	18	65.2	22.1
" #11	9	65.2	15.8
" #12	16	63.7	18.4
" #13	12	63.7	15.1
" #14	13	63.4	15.7
" #15	17	63.3	17.5
" #16	21	62.0	18.5
" #17	25	61.9	22.6
" #18	29	61.8	25.2
" #19	19	61.4	15.7
" #20	20	60.3	13.7
" #21	30	59.8	22.4
" #22	23	58.9	15.6
" #23	22	58.8	13.2
" #24	31	58.8	22.1
" #25	27	58.0	15.9
" #26	24	57.7	13.7
" #27	28	57.3	15.3
" #28	33	57.3	22.3
Pioneer 3505 (ck)	26	57.2	13.8
Expt'l. #29	36	56.9	24.7

Sign. diff. (Tukey's) 4.4 bu/A

TABLE 52. Experiment #3

Expt'l Hybrid or Commercial Check	Performance Score Ranking	Yield Bu/A	Ear Moisture at Harvest %
Pioneer 3505 (check)	1	67.7	21.6
Expt'l. #1	4	62.2	15.2
" #2	2	61.6	12.7
" #3	3	61.3	12.5
Sokota TS 67 (ck)	9	61.0	20.1
Expt'l. #4	7	60.6	17.8
" #5	13	59.9	23.6
" #6	8	59.4	16.3
" #7	10	59.4	19.4
Pioneer 3510 (ck)	11	59.4	21.3
Expt'l. #8	6	59.1	14.1
" #9	5	58.3	11.4
" #10	15	58.1	21.3
" #11	16	57.4	19.8
" #12	12	56.4	15.1
" #13	14	56.1	16.0
Dekalb XL 361 (ck)	25	56.1	27.4
Northrup King PX 50 (ck)	18	55.8	19.0
Expt'l. #14	17	54.4	14.4
" #15	20	54.0	16.7
" #16	19	53.8	14.3
" #17	23	53.7	18.5
" #18	32	53.7	26.8
" #19	24	53.4	18.6
" #20	27	53.4	16.5
" #21	22	52.7	15.8
" #22	29	52.4	21.5
" #23	26	51.3	17.1
" #24	28	50.9	16.2
" #25	33	50.5	20.9
" #26	31	50.4	18.0
" #27	30	49.9	16.3
" #28	35	48.0	19.7

Sign. diff. (Tukey's) 4.3 bu/A

TABLE 53. Experiment #4

Expt'1 Hybrid or Commercial Check	Performance Score Ranking	Yield Bu/A	Ear Moisture at Harvest %
Northrup King PX 50	1	63.0	17.0
Expt'l. #1	6	59.6	23.6
" #2	2	58.5	14.5
Pioneer 3510 (check)	7	58.0	22.0
Expt'l. #3	10	57.0	21.2
" #4	5	56.8	16.4
Sokota TS 67 (ck)	8	56.5	19.4
Expt'l. #5	3	56.2	10.3
" #6	4	55.7	10.9
" #7	9	55.7	17.6
" #8	16	54.2	11.4
Pioneer 3505 (ck)	17	53.9	24.3
Expt'l. #9	11	53.0	14.0
" #10	22	52.2	24.9
" #11	12	52.1	13.0
" #12	14	52.1	17.2
" #13	15	51.6	16.0
" #14	21	51.0	21.6
" #15	20	51.0	21.4
" #16	19	50.0	16.5
" #17	30	49.9	28.8
" #18	13	49.8	9.5
" #19	25	49.5	21.0
" #20	18	49.3	13.9
" #21	23	49.1	18.1
" #22	27	48.9	22.8
" #23	24	48.3	16.5
" #24	26	47.7	19.7
" #25	41	47.7	21.1
" #26	28	46.5	17.4
" #27	29	45.9	16.6
" #28	32	45.3	19.7

Sign. diff. (Tukey's) 3.8 bu/A

TABLE 54. Experiment #5

Expt'l. Hybrid or Commercial Check	Performance Score Ranking	Yield Bu/A	Ear Moisture at Harvest
Pioneer 3510 (check)	1	65.3	17.5
Sokota TS 67 (ck)	3	60.3	18.0
Northrup King PX 50 (ck)	2	59.6	15.6
Expt'l. #1	5	57.0	13.8
" #2	4	56.9	12.1
" #3	8	55.2	19.0
" #4	6	53.8	13.4
" #5	7	53.7	13.7
" #6	9	53.0	18.6
" #7	10	51.2	13.9
Pioneer 3505 (ck)	15	50.8	20.5
Expt'l. #8	14	50.4	17.6
" #9	11	50.1	12.7
" #10	17	50.1	20.3
" #11	19	49.8	20.2
" #12	22	49.3	24.3
" #13	13	49.1	12.3
" #14	12	48.9	10.2
" #15	18	48.8	17.0
" #16	21	48.8	21.7
" #17	16	48.6	15.5
" #18	26	48.0	25.0
" #19	23	46.7	18.2
" #20	20	46.6	14.8
" #21	28	45.7	20.3
" #22	27	45.4	19.4
" #23	25	45.0	16.8
" #24	29	44.9	18.2
" #25	30	44.3	16.9
" #26	33	44.2	22.4
" #27	31	43.7	16.1
" #28	24	43.6	11.5
Dekalb XL 361 (ck)	40	43.4	28.4

Sign. diff. (Tukey's) 3.8 bu/A

THE SOUTHEAST SOUTH DAKOTA EXPERIMENT FARM CORPORATION

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Brookings, South Dakota