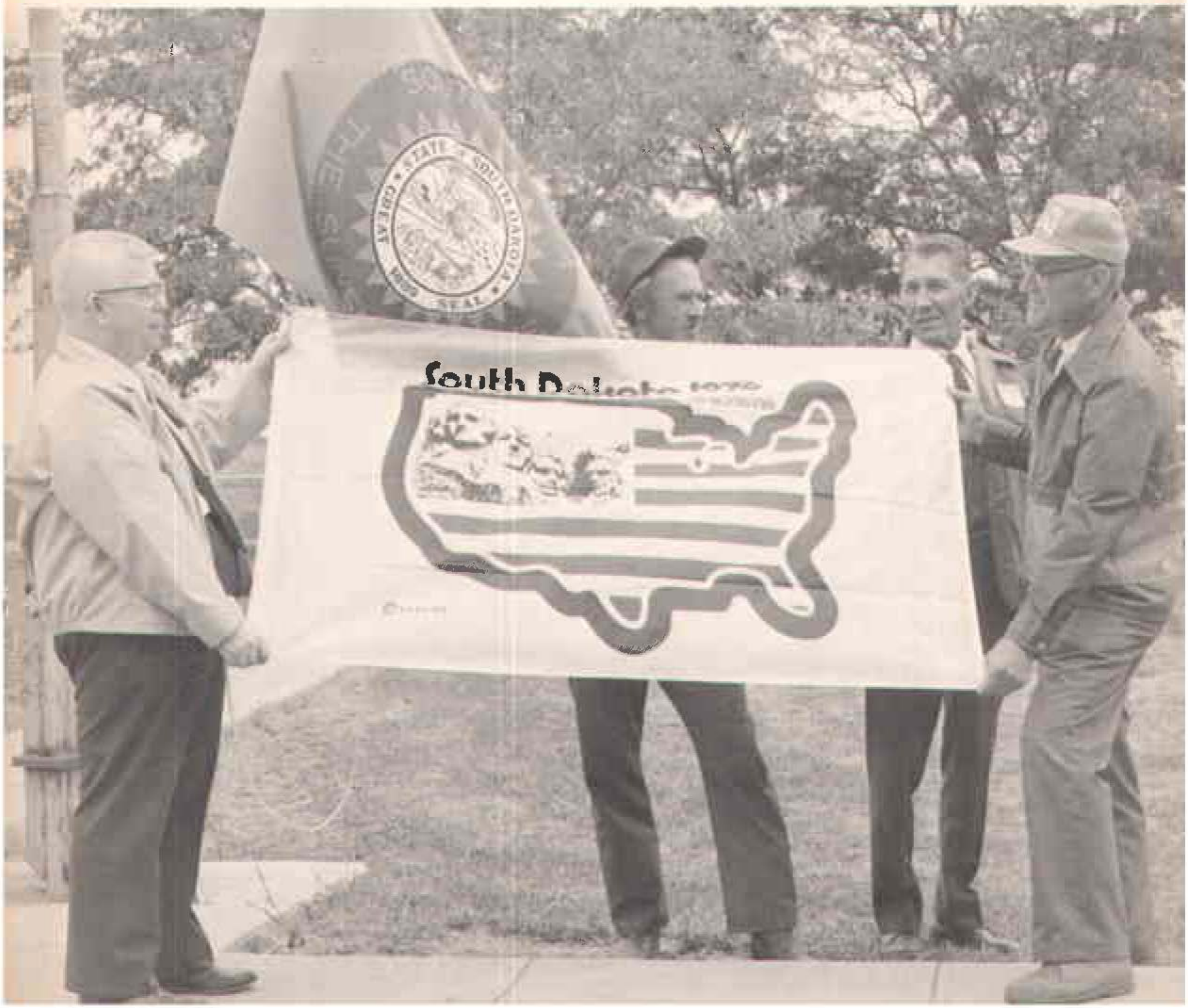
Southeast South Dakota Experiment Farm

14th Annual Progress Report 1974

Agricultural Experiment Station   South Dakota State University   Brookings



FOURTEENTH ANNUAL PROGRESS REPORT
SOUTHEAST SOUTH DAKOTA EXPERIMENT FARM

Table of Contents

SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION
BROOKINGS, SOUTH DAKOTA 57006

Delwyn Dearborn, Dean

R. A. Moore, Director

COVER PHOTO. The South Dakota Bicentennial flag flies at the Southeast South Dakota Experiment Farm. The flag was presented during 1974 Field Day at the Experiment Farm by Les Helgeland, Yankton, chairman of the South Dakota Bicentennial Commission. Ready to run up the Bicentennial flag beneath the U.S. flag and State flag are (left to right): Helgeland; Howard Livingston, in charge of operation and maintenance at the Farm; Sidney Abild, Wakonda, president of the Board of Directors at the Farm; and Fred E. Shubeck, Farm research manager and professor of plant science at South Dakota State University. The South Dakota Bicentennial Commission accepted an invitation of the Southeast Farm Board of Directors to conduct its regular September 1975 meeting at the research facility.

INTRODUCTION . . . . Alan Vogel

The fourteenth year of research at the Southeast South Dakota Experiment Farm was marked by changes in both personnel and facilitiee.

On March 1, 1974 Dr. Fred Shubeck assumed the duties of research manager following Dr. Richard Luther's assignment of new duties at Brookings.

The addition of a 20x100 ft. concrete bunker silo erected midway between the hay storage shed and the road highlighted improvements on the cattle feeding facilities. An improved ventilation system featuring adjustable sidewall vents in combination with an open ridge was installed in the barn. New water lines were buried beneath the barn floor to alleviate the pipe freezing problems of last year. Temporary manure storage bins were constructed to provide for frequent cleaning of cattle pens during cold weather.

The expansion of agronomic research brought about the need for more experimental sites to be located on the north quarter. Initiation of a new study on nitrification inhibitors generated interest which prompted a grant in aid from Dow Chemical. The grant will be a great asset to provide for care of the plots for the coming crop year. Also, a specifically designed liquid fertilizer applicator was placed at the Farm for our use by the Nutro Flow Fertilizer Company, Sioux City, Iowa.

More than 1,100 tons of corn and oat silage were harvested from the north quarter as well as the grain from the agronomy plots and filler areas. These crops were used as feed for the livestock on experiment at the Farm.

A cistern and water pressure system was installed for the office building from funds provided by the Board of Directors. Water from the farm well is frequently too high in nitrates for human consumption. Water for the cistern is hauled in from Beresford.

A Bicentennial corn plot was established at the Farm illustrating some old and new methods of growing corn. A new modern variety was compared to Reids Yellow Dent, an open pollinated corn popular about 40 years ago.

The South Dakota Bicentennial Commission awarded the Research Farm a bicentennial flag. This flag will be flown on special occasions from the Research Farm's flag pole along with the national and state flags.

The Bicentennial Commission is planning to have their September 1975 meeting at the Research Farm at approximately the time of the fall field day.

The Experiment Farm was host for a number of activities during 1974. Many Extension functions were held at the Farm throughout the year. Record crowds attended the evening crops tour and field day as personnel from South Dakota State University and the Experiment Farm presented information on current research. In June approximately 160 4-Har'e and their parents gathered at the Experiment Farm for a judging school. Personnel from Brookings gave instructions to familiarize those attending with new concepts in livestock judging and start them on the judging season.

Tables 1 and 2 show a summary of temperature and precipitation data for 1974. This information is compiled at the farmstead site by research personnel who are official volunteer weather observers for this area. Because rainfall and temperature are the two climatic factors which most heavily influence the expression of various treatments applied by the researcher, careful attention should be paid to the effects of these conditions.

Table 1. Temperatures at the Southeast Experiment Farm

Month	1974 Av. Temperature (F)[1] Maximum	Minimum	22 Year Average Maximum	Minimum	Departure from 22 Year Average Maximum	Minimum
January	25.3	-0.1	26.4	5.4	-1.1	-5.3
February	36.9	12.3	33.4	11.6	+3.5	+0.7
March	47.3	19.5	43.9	22.6	+3.4	-3.1
April	61.5	33.8	61.8	35.4	-0.3	-1.6
May	69.6	42.5	73.8	47.6	-4.2	-5.1
June	79.7	52.5	83.2	57.8	-3.5	-5.3
July	91.8	61.7	87.8	62.5	+4.0	-0.8
August	80.2	52.7	86.6	60.2	-6.4	-7.5
September	75.3	38.8	75.8	39.4	-0.5	-10.6
October	66.1	32.5	66.5	42.3	-0.4	-9.8
November	45.4	21.7	47.0	25.1	-1.6	-3.4
December	33.1	9.2	32.1	11.8	+1.0	-2.6

[1] Computed from daily observations.

Table 2. Precipitation at the Southeast Experiment Farm

Month	Precipitation 1974 (inches)	22-Year Average (inches)	Departure From 22-Yr. Av. (inches)
January	0.20	0.44	-0.24
February	0.04	1.26	-1.22
March	0.96	1.34	-0.38
April	0.65	2.39	-1.74
May	3.87	3.34	+0.53
June	3.10	4.26	-1.16
July	1.76	3.18	-1.42
August	2.46	2.69	-0.23
September	0.94	2.79	-1.85
October	1.04	1.66	-0.62
November	0.18	0.98	-0.80
December	0.04	0.77	-0.73
Total	15.24	25.10	-9.86

CORN ROW SPACING AND PLANT POPULATIONS

F. Shubeck and B. Lawrensen

Objectives of Experiment

1. Should we keep corn planters that will plant conventional 36", 38", 40" rows or sell them and buy planters that will plant narrower rows?
2. Is there a greater need for narrow rows with high plant populations?
3. Do optimum row spacings and plant populations differ for a short season hybrid and a full season hybrid?
4. Will narrow rows reduce moisture loss by evaporation from the soil surface?
5. Will subsoil moisture at the beginning of the season, when added to expected rainfall in July and August, serve as a dependable guide to determine optimum number of plants per acre?

Methods and Procedures Used in the Experiment

Nov. 30, 1973 - Plowed plot.
April 22, 1974 - Fertilized total plot area with approximately 158-67-48 (oxide).
April 25, 1974 - Sprayed total plot area with 3.4 lbs. Aatrex 4L per acre and tandem disked to incorporate.
May 6, 1974 - Tandem disked and spike tooth harrowed in readiness for planting.
May 17, 1974 - Planted plot.
Varieties - Pioneer 3388 - 115 day maturity
Pioneer 3780 - 102 day maturity
Insecticide - Furadan 10G
Herbicide - Ramrod 20G in 14" band
May 31, 1974 - Rotary hoed total plot area.
June 7, 1974 - Cultivated in the 30" rows.
June 11-12, 1974 - Finished cultivating in all 3 row spacings and plant populations.
June 13-18, 1974 - Finished thinning to desired plant populations.
June 20, 1974 - Cultivated all row spacings and plant populations.
Oct. 22, 1974 - Harvested plots (hand picked).

Table 3. Effects of Corn Plant Populations on Percent Ear Moisture. (Results from all 3 row spacings were averaged for each population.)

Hybrid	Final Stand	% Ear Moisture at Harvest
Pioneer 3780	12,000*	13.1
Pioneer 3780	14,000*	13.4
Pioneer 3780	16,000*	13.4
Pioneer 3780	18,000*	13.8
Pioneer 3780	20,000*	12.9
Pioneer 3388	12,000*	26.1
Pioneer 3388	14,000*	28.3
Pioneer 3388	16,000*	26.6
Pioneer 3388	18,000*	26.2
Pioneer 3388	20,000*	25.3

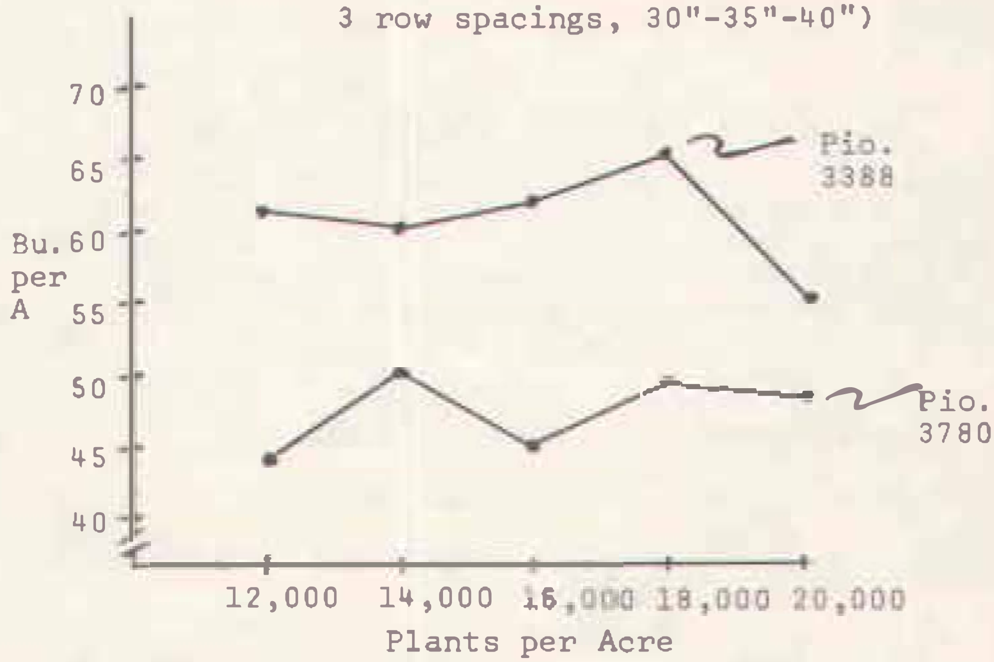
*Average from 3 row spacings (30", 35", 40")

Discussion and Interpretation of Table 3

Notice the low ear moisture percentages of the early hybrid.

There were no large differences in ear moisture due to populations.

Figure 1. Effect of Plant Populations on Yield of No. 2 Ear Corn (av. of 3 row spacings, 30"-35"-40")



Discussion and Interpretation of Figure 1

Pioneer 3780 is listed as a 102 day maturity hybrid and Pioneer 3388 is 117 day maturity. This experiment has been in operation for 10 years measuring response of row spacings and plant populations to different climatic conditions.

For the full season hybrid, populations of 20,000 plants per acre were about 2000 too many.

With the earlier hybrid there was no sharp downward break in yield as populations were increased.

The full season hybrid yielded more corn than the early hybrid at all populations. In some years when moisture was more adequate the early hybrid was able to approach but not surpass the yield of the full season numbers as populations were increased.

Table 4. Effect of Row Spacing on Percent Ear Moisture and Bushels per Acre. (Results from all 5 populations were averaged for each row spacing.)

Hybrid	Row Spacing in Inches	% Ear Moisture at Harvest	Bushels per Acre
Pioneer 3780	30	14.3	50
Pioneer 3780	35	13.1	43
Pioneer 3780	40	12.8	49
Pioneer 3388	30	26.1	62
Pioneer 3388	35	26.7	61
Pioneer 3388	40	26.3	60

Discussion and Interpretation of Table 4

There appeared to be a slight yield advantage in favor of 30 inch row spacings. Results due to row spacings were neither consistent nor very spectacular in 1974 when insufficient moisture restricted yields to the 50-60 bushel per acre range. Percent moisture in ears varied little in the full season hybrid. With the early hybrid, Pioneer 3780, there appeared to be a little more ear moisture when rows were narrowed.

RATES OF NITROGEN AND DATES OF PLANTING CORN

F. Shubeck and B. Lawrensen

Objectives of Experiment

1. Will planting dates influence response to fertilizer?
2. What should the rate of nitrogen fertilizer be for a soil that contains a medium amount of organic matter?

3. With the present shortages and high prices for fertilizer, what lower rates of nitrogen will be the most profitable?
4. Will very high rates of nitrogen influence disease or insect damage?
5. Will soil temperature serve as a dependable guide to determine the optimum time to plant corn?

Methods and Procedures Used in Rate of Nitrogen Study

Nov. 7, 1973 - Rotary chopped stalks.
Nov. 12, 1973 - Plowed plot area.
April 25, 1974 - Broadcast sprayed plot area with Aatrex 4 L at the rate of 3.4 lbs. per acre and incorporated immediately with a disk.
April 29, 1974 - Fertilized both the high and low rates of nitrogen for the lat planting date.
April 30, 1974 - Planted all first planting date plots.
Variety - Pioneer 3388
Herbicide - Ramrod 20G - banded
Insecticide - Furadan 10G
May 2-3, 1974 - Fertilized both high and low rates of nitrogen for remaining 3 planting dates and disked in.
May 7, 1974 - Planted second planting date plots.
May 16, 1974 - Planted third planting date plots.
May 23, 1974 - Planted fourth planting date plots.
May 31, 1974 - Rotary hoed plots of first 3 planting dates.
June 5, 1974 - Rotary hoed plots of fourth planting date.
June 11, 1974 - Cultivated first 3 planting dates.
June 14, 1974 - Cultivated fourth planting date.
Oct. 17, 1974 - Finished hand picking plots.

Table 5. Effect of Fertilizer and Planting Dates on Yield of #2 Corn (high rates of N)

Broadcast Treatment N + P + K	Planting Dates April 30	May 7	May 16	May 23	Average
0 + 0 + 0	47	38	35	38	40
0 + 25 - 70*	33	36	37	41	37
80 + 25 + 70*	60	51	65	57	58
160 + 25 + 70*	62	71	67	70	68
240 + 25 + 70*	56	57	74	62	62
Average	52	51	56	52	

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

Discussion and Interpretation of Table 5

In 1974, yields from this experiment were relatively high compared to some of those from other experiments at the research farm. This was not true in 1973.

One of the reasons may be due to fall plowing and less soil compaction for the 1974 crop.

Note the increase in yield from nitrogen fertilizer in a dry year.

There was no great increase in yield from very early planting (April 30).

Table 6. Effect of Fertilizer and Planting Dates on Yield of #2 Corn (low rates of N)

Broadcast Treatment	Planting Datee				
N + P + K	April 30	May 7	May 16	May 23	Average
0 + 0 + 0	39	42	36	37	39
20 + 25 + 70*	49	46	47	51	48
40 + 25 + 70*	52	58	59	63	58
60 + 25 + 70*	67	57	52	52	57
80 + 25 + 70*	63	52	54	57	57
Average	54	51	50	52	

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

Discussion and Interpretation of Table 6

A new feature was added in 1974. The north half of each block was fertilized with the lower rates of nitrogen listed above. No fertilizer had been applied to these plots for at least 8 years so there was little or no residual carry over.

It is interesting to note that 40 lbs. of nitrogen per acre was adequate in this year of below average moisture for all but the very early planting date.

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

Paul Carson, Ray Ward, Fred Shubeck, Ron Gelderman, and Burt Lawrensen

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

Objectives

1. Study and record the effects of rates of nitrogen addition on the accumulation and movement of NO_3-N in the soil profile.

2. Determine the effect of large amounts of nitrogen fertilizer on the pH of the soil.

Methods and Materials

1. Soil samples. Samples have been taken to a depth of 4 feet from 1969 until 1973 when the soils were sampled to a depth of 72 inches.
2. The samples were dried as soon as possible in a forced air oven at a temperature not to exceed 115^{o}F.
3. Nitrate-Nitrogen was determined by the n-phenol-di-sulphonic acid method until 1973 when the nitrate electrode method was used.
4. The pH was determined in a slurry made by adding 1 part of distilled water to 1 part of soil.
5. This experiment is in its sixth year. This means that the 160 pounds per acre rate of nitrogen addition has had 960 pounds per acre of nitrogen added during this time. The nitrogen fertilizer used has been ammonium nitrate. The additions P_2O_5 and K_2O have remained constant.

Results and Discussion

The effect of six years of nitrogen fertilizer additions on the amount of nitrate-nitrogen in the soil profile, its location in the profile and its effect on the pH of the soil are shown in Table 7. As the rate of applied nitrogen increases, the total amount of NO_3-N found in the soil profile increases (see totals in Table 7). The concentration of NO_3-N in the profile has remained above the 48 inch level except in the 240 lb. rate, where an increase in concentration is noted to a depth of 72 inches. Even at this rate of addition, the higher concentrations are located above the 48 inch level.

The added fertilizer has had very little effect on pH to date. It has lowered the pH approximately 0.4 of a unit at the highest (240 lbs./A) rate of addition.

Table 7. The Effects of Added Nitrogen on the Nitrate-Nitrogen and pH of Soils Growing Corn, Southeast Experiment Farm, 1974.[1]

Treatments[2]	0 + 0 + 0		80 + 0 + 0		160 + 0 + 0		240 + 0 + 0	
Depth in inches	NO_3-N lbs/A	pH	NO_3-N lbs/A	pH	NO_3-N lbs/A	pH	NO_3-N lbs/A	pH
0- 6	13.1	6.8	11.2	6.6	24.5	6.7	50.6	6.4
6-12	11.5	6.9	14.0	6.6	56.0	6.9	143.5	6.5
12-18	7.4	7.1	13.0	7.0	82.6	7.1	144.5	7.0
18-24	7.9	7.5	11.3	7.4	99.0	7.3	182.3	7.5
24-30	8.1	7.8	13.0	7.7	61.2	7.8	135.5	7.7
30-36	9.5	7.9	13.7	7.9	35.6	8.0	77.9	8.0
36-42	9.2	7.9	11.5	8.0	24.7	8.0	44.6	8.0
42-48	10.3	7.9	12.2	7.9	18.9	8.1	33.3	7.9
48-54	10.6	7.9	15.3	7.9	13.5	8.0	22.3	8.0
54-60	10.1	7.9	9.9	7.9	14.2	8.1	16.0	8.0
60-66	10.1	7.9	12.1	7.9	12.1	8.0	13.5	7.9
66-72	9.5	7.6	9.9	7.9	13.5	8.0	11.7	8.0
Total	117.3		147.1		455.8		875.7	

[1] The samples used in these analysis were taken in the fall of 1973.

[2] The treatments have been repeated on the same plots for the past 6 years. During that 6 years the plots receiving 80 lbs. per year have received a total of 480 lbs. of nitrogen per acre, etc.

Figure 2. The effect of rates of added nitrogen on the amount of nitrate-nitrogen in the four-foot profile over a five-year period. Southeast Experimental Farm.

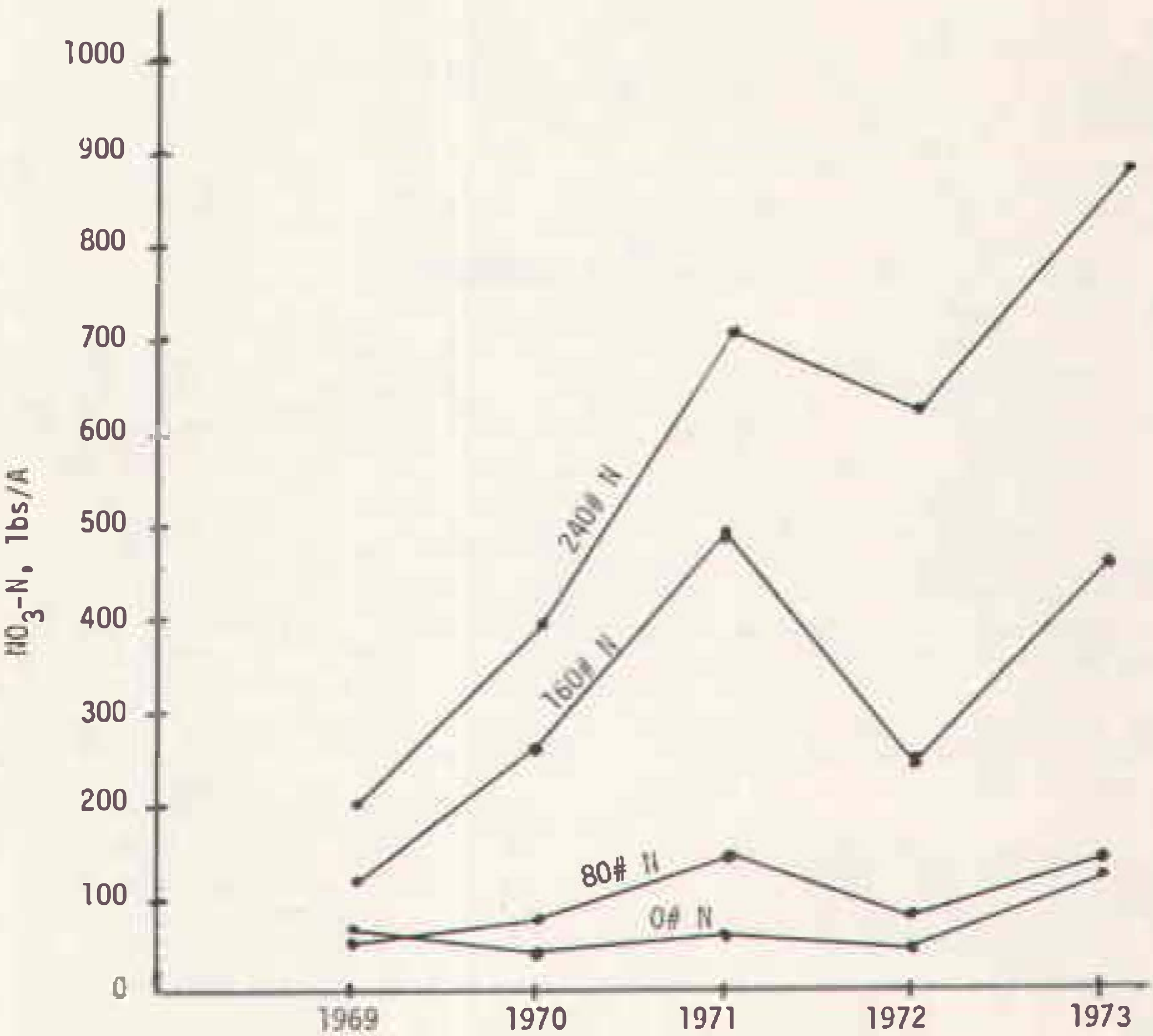


Figure 2 shows the year by year accumulation of nitrate-nitrogen in the soil profiles under the different treatments. No explanations for the lower values in 1972 is offered at the present time. Very little accumulation of NO_3-N has occurred at the 80 lbs/A rate of addition. This rate of application apparently meets the need of the crop being produced with very little being left over for accumulation. Higher rates of application have caused accumulations of nitrates in the soil profile.

If you relate this data to the yield part of this experiment (see report referred to earlier), you will note that the yields in 1972 and 1973 were very poor. 1972 was a year marked by above average moisture which made soil having a somewhat poor drainage, quite wet. It was impossible to fall plow this land in 1972. Because the experimental design calls for early planting, the seed bed in 1973 was prepared when the soil was too wet. This resulted in the soil being compacted early in the 1973 growing season. What effect the wet year and soil compaction had on the nitrates is not clearly understood at this time and needs further study.

NITROGEN SIDEDRESS STUDY

E. Adams

Objectives

Compare effectiveness of placing sidedress nitrogen between each row to that of every other row.

Methods and Procedures

Previous work has identified some of the nutrient feeding characteristics and efficiency of corn. As an example, some work shows that only a very limited portion of the total plant root mass is needed to adequately provide the phosphorus requirements of a growing plant.

With this in mind, a simple study was initiated to evaluate and demonstrate the effect of changing sidedress nitrogen placement on corn from every row to every other row. This relationship was created for both 50 and 100 lbs. of actual N per acre. The plots received uniform rates of P_2O_5 and K_2O per acre as a banded starter at planting time. The nitrogen applications were disc injected as pelleted ammonium nitrate in the respective placement positions just described. The other study inputs such as variety, planting rate, row spacing are as follows: planting date May 24, variety Pioneer 3780, soil insecticide Dyphonate 20G banded 1 lb. actual per acre, herbicide Lasso II 15G banded to deliver 25 lbs. per acre, all treatments received uniform rates of phosphorus and potash band applied at planting time.

Results

Data in Table 8 shows the comparative yields resulting from nitrogen placed between each 30 inch corn row to that placed between every other row on July 1. It appears there was no yield difference whether the nitrogen was placed between each row or every other row, both at the 50 and 100 lb/A nitrogen rates. This suggests that nitrogen sidedressing equipment need only have injection points spaced between every other row thereby requiring less power or allowing greater coverage per pass. The fact that very low corn yields were obtained in 1974 does leave unanswered the question of what affect would sidedress spacing have on yield in those years when corn yields were normal or above. Hopefully, the demonstration study can be continued to make such evaluations.

Plant analysis information in Table 8 shows the affect of the above described nitrogen placement methods and rates. Again, there appears to be little difference in nitrogen content between treatments except that the check treatment is noticeably lower than any of the nitrogen treatments. Interestingly enough, all values are well below 2.75% N, the minimum level considered by many agronomists necessary for normal growth. Again, such unusual low values may be attributable in part to low rainfall and high stress growing season.

Table 8 also shows the affect of nitrogen placement on moisture content of the grain at harvest. There appears to be little or no consistent difference in grain moisture at harvest regardless if sidedress nitrogen was placed between each row or every other row at either the 50 or 100 lb. N rate.

Table 8. Effect of Nitrogen Placement on Bushels per Acre, % Moisture in Grain and N Content in Leaves

N Treatment lbs/A-spacing	Bushels per acre	% Moisture in grain	% N Content in leaves
0	42	13.7	1.72
50 each row	47	12.9	2.14
50 every other	46	13.5	1.97
100 each row	41	14.1	2.08
100 every other	41	13.1	2.15

FOLIAR P_2O_5 STUDY

E. Adams

Objectives

Evaluate crop response to different forms of foliar applied liquid phosphate fertilizer.

Methods and Procedures

Recent midwest research results have led some investigators to believe modest corn yield increases could be obtained by foliar applying liquid phosphorus fertilizer. A field study was initiated in 1974 to evaluate the beneficial results of foliar applied phosphorus on corn. Each of three liquid phosphorus fertilizers ortho, pyro, and poly were foliar applied at 5 and 10 lb. per acre rates. The 5 lb. foliar rate was uniformly applied to all plots designated as foliar treatment. The 10 lb. treatment was accomplished by applying an additional 5 lbs. of the same phosphorus fertilizer to those plots identified as 10 lb. rate at the later date mentioned above. All plots with the exception of the check received a combined soil and foliar P_2O_5 rate of 46 lbs. per acre. The 46 lb. plowdown broadcast rate was decreased by 5 and 10 lbs. P_2O_5 per acre respectively where those foliar rates were applied. Nitrogen was uniformly applied to all treatments including the check, at 80 lbs. per acre respectively. The foliar treatments were applied with a hand sprayer, operated in a 30 to 40 psi pressure range. The other pertinent study factors are as follows: planting date May 16, variety-Pioneer 3780, soil

insecticide-Thimet 15G (1# Act. per acre), herbicide-banded Ramrod 20G (5.5# per acre). All treatments received uniform nitrogen application of 80# actual N per acre.

Results

Data in Table 9 shows the affect of various phosphorus treatments on corn yields. There were widely differing yield results between phosphorus treatments. Equally wide yield variations, however, were observed between replications of the same phosphorus treatments. Analysis of variance shows that no statistical significant yield difference could be attributed to foliar phosphorus treatment. Unexpected variability within the overall site was very eivdent throughout the growing season and perhaps accounts for the variability in yield data. Continuing the study at another site with more uniform soils is planned.

Data in Table 9 shows the moisture content of the grain at harvest. There appears to be little or no difference in grain moisture content due to the various treatments, however, harvesting was done well after time of normal maturation. Thia means possible differences, if any, could have been masked by harvest time due to normal seasonal moisture drawn down.

The leaf phosphorus concentrations are also shown in Table 9. There appears to be little difference in phosphorus levels between treatments. All of the values appear to be somewhat below 0.25%, the level considered by SDSU and other laboratories minimal for normal growth. Low corn leaf phosphorus levels in years of high moisture stress similar to 1974 have been observed before; thus, the failure to measure plant phosphorus level differences due to treatments may have been masked by the stress growing conditions.

Nitrogen leaf analysis data is shown in Table 9. There appears to be little difference due to foliar phosphorus rates or sources.

Zinc leaf analysis information is shown in Table 10. The average values by treatment indicate slightly lower leaf zinc levels occurred regardless of how or in what form phosphorus was applied. The lower values would still be considered sufficient for normal corn growth.

These data should not be considered conclusive since only one year's results are available. It is planned to continue this experiment and to measure the response of foliar phosphorus applications under different environmental conditions.

Table 9. Effect of Phosphorus Forms on Bushels of Corn per Acre, % Moisture, Leaf P and N

P_2O_5 Treatment, lbs/A* Soil + Foliar	Bu/A	% Moisture in grain	% Leaf P	% Leaf N
0+0	106	12.0	0.18	2.62
46+0	96	13.3	0.19	2.74
41+5 Ortho	104	12.0	0.19	2.66
36+10 Ortho	100	12.6	0.20	2.71
41+5 Pyro	100	12.5	0.19	2.74
36+10 Pyro	99	12.9	0.18	2.67
41+5 Poly	94	12.9	0.20	2.61
36+10 Poly	91	13.2	0.20	2.72

* All treatments received 80 lbs. N. Yield differences not statistically significant at the 5% level.

Table 10. Effect of Phosphorus Applications on Zinc Content in Leaves

Treatment Lbs. of P_2O_5 per Acre	Leaf Zn ppm
No phosphorus	32
46 (S)	24
41 (S) + 5 (F)[1]	22
36 (S) + 10 (F)[1]	24
41 (S) + 5 (F)[2]	19
36 (S) + 10 (F)[2]	23
41 (S) + 5 (F)[3]	25
36 (S) + 10 (F)[3]	21

(S) = Soil applied
(F) = Foliar applied
[1] Ortho P_2O_5
[2] Pyro
[3] Poly

STARTER FERTILIZER WITH CORN

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

Objectives of Experiment

1. To establish the value of starter fertilizer on the growth and yield of corn.
2. To determine what effects, rates of P and/or K applied as a starter have on the yield of corn.

Method

1. The experiment was located along the eastern border of the north quarter on a Badus silty clay loam. Badus soils are glacial till soils that occupy flats and shallow basins that are somewhat poorly drained. They may be saline in some places. This site was a flat area rather than a shallow basin. The soil samples taken when the experiment was established had no salts present but soils from experiments not far away did have salts present at depth of 12 to 24 inches below the surface. Tests on the soil samples taken at planting time are shown in Table 11. These tests show phosphorus to be medium, potassium to be high, and nitrogen to be in the high range.
2. Experimental design - completely randomized factorial. Plot size was 10 x 60 feet. Each plot contained four rows of corn.
3. Nitrogen was applied before planting at the rate of 100 lbs. of nitrogen per acre.
4. Variety used was Pioneer 3388.
5. Weeds were controlled with Ramrod at 25#/A applied in a band at planting time and by cultivation.
6. Soil insects were controlled with Furadan in a band at 1 lb/A of active material at planting time.
7. The land was in soybeans in 1973. The seed bed was prepared by disking once. The ground was a little too wet at planting time.
8. Corn was planted May 22nd with a John Deere tool-bar planter. The planters were equipped with belt fertilizer applicators to apply fertilizer as a starter, beside and below the seed. The rate of planting was intended to be 18,000 plants per acre. However, this rate of planting was exceeded. The row width was 30 inches.
9. Corn was harvested by hand October 10th. Sixty feet of row was harvested from each plot.
10. Fertilizer treatments:

$N + P_2O_5 + K_2O$, lbs/A
12 + 0 + 0
12 + 14 + 0
12 + 27 + 0
12 + 52 + 0
12 + 0 + 11
12 + 14 + 11
12 + 27 + 11
12 + 52 + 11
12 + 0 + 20
12 + 14 + 20
12 + 27 + 20
12 + 52 + 20

11. The weather was dry during the last part of the growing season and during this portion of the season the plots did show some effects of the dry weather. The crop showed variations in the effect of the dry weather on its growth and yield. These effects showed up as small areas within the experiment where the dry weather more seriously affected the plant growth and yield than in others.

12. Leaf samples were taken for analysis at silking time. Yield samples and ear moisture samples were taken at harvest time. Lodging and breakage notes were not taken at harvest time because little or no lodging or breakage was noted in the plots.

Results

The yield in bushels per acre of 15% moisture corn, percent moisture in the ear at harvest time, the number of ears per stalk at harvest time, and the final population are reported in Table 12. Some treatments have been listed in this table more than once to make comparisons easier. The yield results range from 93 to 109 bushels per acre. The yield without any added P or K was 99.

The yield changes due to added phosphorus were small and could not be considered significant. The addition of a constant amount of potassium with the rates of phosphorus did not cause the phosphorus to become more effective.

The addition of potassium caused a small yield increase with or without constant rates of phosphorus.

Fertilizer treatments had no consistent effect on the moisture content of the ears at harvest time.

The effect of the treatments on number of ears per 100 stalks was very small if any.

Plant population at harvest time was higher than past data indicated necessary for high yields at this location. It was also higher than was intended. The fertilizer treatments had no consistent effect on the final plant population.

This data leads one to conclude that the use of phosphorus in the starter fertilizer when the soil tests 25# of P/A or greater, does not increase the yield. The use of potassium in the starter fertilizer is not as clear as that of phosphorus. Added potassium did give small yield increases in 1974.

Table 11. Soil Test Results from the Experimental Site, 1974[1]

Depth in inches	Nitrate-Nitrogen ppm	Nitrate Nitrogen lbs/A	Organic Matter %	Phosphorus lbs/A P	Potassium lbs/A K	pH 1:1	Soluble Salts mmhos/cm	Texture
0 - 6	33.0	59	4.1	25	920	6.8	0.70	Silty clay loam
6 - 12	30.0	54	3.1	8	620	6.8	0.60	Silty clay loam
12 - 24	26.0	94	2.0	3	600	7.0	0.75	Silty clay loam
24 - 36	16.6	60	1.5	2	670	7.5	0.72	Silty clay loam

[1] The tests are made on a composite of four soil samples except for the 0-6" sample which was a composite of many samples.

Table 12. Effect of Rates of Phosphorus and Potassium in a Starter Fertilizer on Yield, Ear Moisture at Harvest, the Number of Ears per Stalk and Final Population of Corn Grown at the Southeast Experiment Farm, 1974.

Treatment Number	Treatment $N + P_2O_5 + K_2O$ lbs/A	Yield[1] bu/A	Moisture[2] %	Having Ears %	Final Population[3]
1	12 + 0 + 0	99	36.2	97.4	18,560
2	12 + 14 + 0	102	37.1	96.5	18,488
3	12 + 27 + 0	94	34.8	97.7	18,850
4	12 + 52 + 0	98	36.2	98.0	19,068
1	12 + 0 + 0	99	36.2	97.4	18,560
8	12 + 0 + 11	93	36.0	98.4	18,198
12	12 + 0 + 20	107	36.1	97.6	18,850
8	12 + 0 + 11	93	36.0	98.4	18,198
5	12 + 14 + 11	98	38.0	94.4	19,285
6	12 + 27 + 11	104	36.0	98.9	19,575
7	12 + 52 + 11	101	34.4	100.5	19,793
12	12 + 0 + 20	107	36.1	97.6	18,850
9	12 + 14 + 20	108	35.4	98.8	18,850
10	12 + 27 + 20	102	35.3	97.4	18,995
11	12 + 52 + 20	109	34.3	98.5	19,285
2	12 + 14 + 0	102	37.1	96.5	18,488
5	12 + 14 + 11	98	38.0	94.4	19,285
9	12 + 14 + 20	108	35.4	98.8	18.850
3	12 + 27 + 0	94	34.8	97.7	18,850
6	12 + 27 + 11	104	36.0	98.9	19,575
10	12 + 27 + 20	102	35.3	97.4	18,995
4	12 + 52 + 0	98	36.2	98.0	19,068
7	12 + 52 + 11	104	34.4	100.5	19,793
11	12 + 52 + 20	109	34.3	98.5	19,285

[1] Calculated at 15% moisture.

[2] Moisture sample was taken by cutting a section out of the center of 8 ears of corn, this includes a section of the cob.

[3] Approximately 20,000 seeds were planted per acre.

NITRIFICATION INHIBITION

Paul Fixen

Objectives of Experiment

1. Determine effectiveness of nitrification inhibitors in South Dakota soils.
2. Determine effects of nitrification inhibitors on corn yield, stalk rot, moisture content and nitrogen content of leaf tissue.
3. Compare two types of nitrification inhibitors (N-Serve and sulfur coated urea) for effect on yield, stalk rot, etc.

Methods and Materials

The experimental site was located on a Badus silty clay loam. This is somewhat poorly drained glacial till soil occupying nearly level topography.

Experimental design was a randomized block with four replications. Each plot was 10 feet wide by 60 feet long with four rows of corn spaced 30 inches.

The hybrid used was Pioneer 3780. It was planted May 16 at a population of 17,700 plants per acre. In the early part of the season, soil samples were taken every three weeks and analyzed for nitrates. Later on in the season, samples were taken every four weeks. Eight probes were taken in each plot and composites made for each of the following depths--0-6", 6-12" and 12-18".

Leaf samples were taken at early silking on November 18.

Two center rows 40 feet long were harvested for yield determination. Corn stalks were pulled for evaluating incidence of stalk rot.

The following fertilizer and inhibitor treatments were applied per acre:

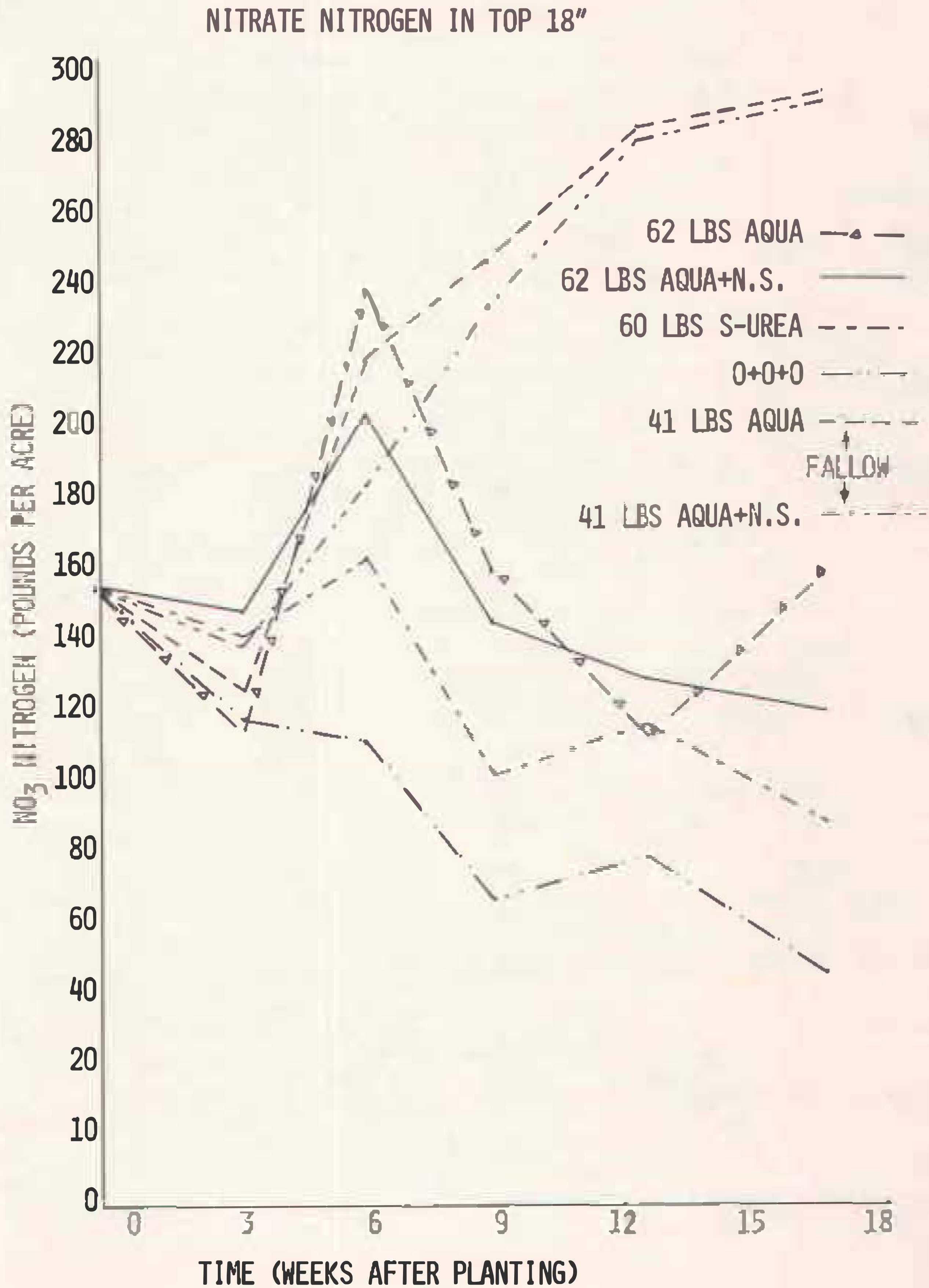
- No nitrogen
- 62, 41, and 32 lbs. of actual N as aqua ammonia
- 62, 41, and 32 lbs. of actual N as aqua ammonia plus 0.29 lbs. of N-Serve
- 100, 80 and 60 lbs. of actual N as sulfur coated urea
- 41 lbs. of N as aqua ammonia on fallowed plot
- 41 lbs. of N as aqua ammonia plus N-Serve on fallowed plot.

Discussion and Interpretation of Figure 3

Nitrification inhibitors slow down the transformation of ammonia and urea fertilizers to nitrates in the soil. The major form of nitrogen that plants use is nitrate.

Nitrates are soluble in water and will leach down through the soil disolved in rain water. The amount of nitrate nitrogen that may be leached down below the root zone is not known. If the transformation to soluble nitrates can be slowed down and leaching losses reduced because of nitrification inhibitors then inhibitors may find a place in modern day corn farming.

Figure 3. Effects of nitrogen fertilizer treatments and inhibitors on pounds of nitrate nitrogen in soil.



On imperfectly drained soils in wet years there is a deficiency of oxygen in soil air. This stimulates activity of microorganisms that can live without oxygen. Some of these are harmful as they reduce nitrogen compounds to gaseous forms which escape into the atmosphere. The role of chemical inhibitors in this imperfectly drained environment is not known. For these reasons an imperfectly drained, heavy texturized soil was selected for this experiment.

Figure 3 shows amount of nitrate nitrogen in the upper 18 inches of soil for various rates of nitrogen fertilizer application.

Fallowed plots had more nitrate nitrogen than plots with growing corn beginning about the sixth week from planting date. In fallowed plots the conversion of aqua ammonia to nitrate nitrogen was slowed down by N-Serve, especially between the third and eighth week. After the corn began removing soil nitrogen unfertilized plots had nitrate nitrogen levels below those that received N fertilizer.

Plots receiving 62 lbs. of aqua ammonia had more nitrate nitrogen than where 60 lbs. of sulfur coated urea were added. When 62 lbs. of aqua ammonia were applied, N-Serve appeared to delay conversion to nitrates but only in the third to eighth week after planting.

Table 13. Effect of Nitrogen Applications and Nitrification Inhibitors on Yield of Corn and Percent Moisture in Ears at Harvest.

Treatment			
Source of N	Rate of N (lbs/A)	% Water in ears	Bushels per acre
Aqua ammonia	62	12.3	81
Aqua ammonia	61+N-Serve	13.0	82
Aqua ammonia	41	12.0	90
Aqua ammonia	41+N-Serve	14.0	79
Aqua ammonia	32	11.8	86
Aqua ammonia	32+N-Serve	10.9	95
Sulfur coated urea	100	11.5	85
Sulfur coated urea	80	12.1	99
Sulfur coated urea	60	12.2	83
None	None	10.8	95

Discussion and Interpretation of Table 13

Nutrification inhibitors had no positive effect on bushels per acre or percent moisture in ears at harvest. Where no nitrogen fertilizer was added, the yield was 95 bu. per acre. Nitrogen applications did not increase yield. Evidently nitrogen was not the factor limiting yield in this relatively dry year. Note the high concentration of nitrate nitrogen at planting time in Figure 3.

In this experiment nitrification inhibitors had no positive effect on concentration of nitrate nitrogen in leaves or on incidence of stalk rot. These factors could be masked by the growth conditions and initial content of nitrates in the soil.

LIME EXPERIMENT

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

The use of lime on soils having pH's greater than 6.0 is considered uneconomical in most states. However interest in its use remains high in some areas of South Dakota. Past experiments have not shown yield increases large enough to justify its use. Because of the interest an experiment was established in 1974.

Objective

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

Methods

1. Lime in the form of Niobrara chalk was applied in the spring of 1974 to an Egan silty clay loam east of the office building at the Southeast Experiment Farm. Egan soils are deep, friable, well drained, silty clay loams developed in a silty cap over glacial till. To obtain a well drained site, the ends of two ranges were used. One half of the experiment being in each range. The test on the soil samples from each of these halves are shown in Table 14. A considerable difference in the fertility exists between the soils from these two ranges. This can be noted in the tests for available phosphorus, and for exchangeable potassium.
2. The fertilizer treatments used in the experiment are as follows:

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

   The fertilizer and lime were broadcast on the surface and plowed under just before planting. The lime application will not be repeated but the phosphorus application will be repeated each year. Nitrogen was not applied in 1974, but will be applied each suceeding year to make sure it is not a limiting factor.
3. Experimental design used was a randomized block.
4. Weeds were controlled with Ramrod at 25#/A applied in a band at planting time and cultivation. Tanweeds were present in the west one-half of the experiment and may have reduced yields in that area.
5. Soil insects were controlled with Furadan in a band at 1 lb/A of active material at planting time.
6. Variety was Pioneer 3780.

7. The seed bed was prepared in the conventional manner, that is, spring plowing, disking, and dragging.
8. The corn was planted May 15 with John Deere tool-bar planters. The row width was 30 inches.
9. Corn was harvested by hand October 18. Sixty feet of row was harvested from each plot.
10. The weather was dry during the last part of the growing season. During this portion of the season these plots showed severe moisture stress. The west one-half of the experiment was more affected by the dry weather than the east one-half.
11. Leaf samples were taken for analysis at silking time. Yield samples and ear moisture samples were taken at harvest time.

Results

The yield in bushels per acre of 15% moisture corn and the percent moisture in the ear at harvest time are reported in Table 15. These data show no large differences in yield except that the 120 lbs. of phosphorus per acre reduced yields 16 bushels per acre. It will be interesting to see if this yield depression remains in effect in 1975. The addition of lime just before planting should have very little effect on yield the year of application. This is because the lime requires time to react with the soil. If lime is going to have an effect on yield it should be in 1975.

This experiment is one that should be carried on for several years. The effects of the treatments, if any, should become more evident as time progresses.

Table 14. Soil Tests on Samples Taken from the Experiment Site at Seeding Time, Southeast Experiment Farm, 1974.

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

Table 15. The Effects of Added Lime and Phosphorus on the Yield and Moisture Content of the Ears at Harvest for Corn Grown at the Southeast Experiment Farm, 1974.

Fertilizer $N + P_2O_5 + K_2O$ lbs/A	Lime Tons/A	Yield[1] bu/A	Moisture[2] %
0 + 0 + 0	-	43	15.8
0 + 0 + 0	2	46	15.9
0 + 0 + 0	4	44	14.5
0 + 30 + 0	-	43	14.4
0 + 120 + 0	-	27	16.3
0 + 30 + 0	2	45	15.0
0 + 30 + 0	4	34	15.0
0 + 120 + 0	2	42	16.0
0 + 120 + 0	4	39	14.8

[1] Yields calculated at 15% moisture.
[2] Moisture sample was taken by cutting a section out of the center of 8 ears of corn. This includes a section of the cob.

NEMATODE STUDIES ON CORN

J. D. Smolik

Studies were initiated this year to determine the effects of plant parasitic nematodes on corn production. Nematodes are tiny (1/25 inch) roundworms that live in the soil and feed in or on plant roots (see Fig. 4 and 5). Feeding damage caused by a single nematode is difficult to detect, however, when millions of these worms congregate in and around a root system they effectively hinder the plants ability to pick up water and nutrients and thus reduce yield.

The preliminary experiment conducted this year at the Southeast Farm was superimposed on a portion of a date of planting-nitrogen fertilizer experiment. Furadan 10G was applied in a 7 inch band at 4 lbs. active ingredient per acre at planting. This was an experimental rate and is not currently labeled for use on corn. The number of replications was not sufficient to permit a statistical analysis, however, it did appear that nematicide treatment increased yield in most of the fertilizer treatments (Table 16). Nematode numbers were substantially less than those encountered in several producers fields in Brookings and Moody Counties and these lower numbers may account for the somewhat erratic response to the treatment.

Most nematicides are also insecticides and, even though insects did not appear to be a severe problem in this study, it is probable that a proportion of the yield increase was due to insect control. However, not all insecticides are nematocides and it is hoped that in future studies it will be possible to use a combination of chemicals that will allow the separation of effects of these two groups of organisms.

On the basis of this study and several others it appears that nematodes are a factor in corn production in South Dakota. A single year's study does not allow

the establishment of recommendations, however, experiments planned for next season should enable us to predict when nematodes are liable to be a problem and what can be done to control them.

Table 16. Effect of Nematicide Treatment on Corn Yield and Nematode Numbers, S.E. Farm, 1974.

	N - P - K	Yield[a] (Bu/A) Check	Treated[b]		Nematode Numbers Check	Treated
	0- 0- 0	40.8[c]	35.2[d]	April 30	318	436
Light	20-25-70	35.7	59.9	Aug. 15	1232	376
Fertilizer	40-25-70	56.9	59.9	Oct. 16	543	218
	60-25-70	62.8	73.5			
	80-25-70	63.7	62.4			
	Avg.	52.0	58.2			
	% increase	12%				
	0- 0- 0	44.1	42.5	April 30	481	435
	0-25-70	28.0	42.0	Aug. 15	1454	248
Heavy	80-25-70	56.0	75.6	Oct. 16	1163	156
Fertilizer	160-25-70	56.9	95.1			
	240-25-70	56.0	91.7			
	Avg.	48.2	69.4			
	% increase	44%				

[a] Yield of No. 2 ear corn at 15.5% moisture.
[b] Furadan applied in 7 in. band at 4 lb. A.I./A.
[c] Average of 1 replication.
[d] Average of 2 replications.

Signs of the (Field Day) times.

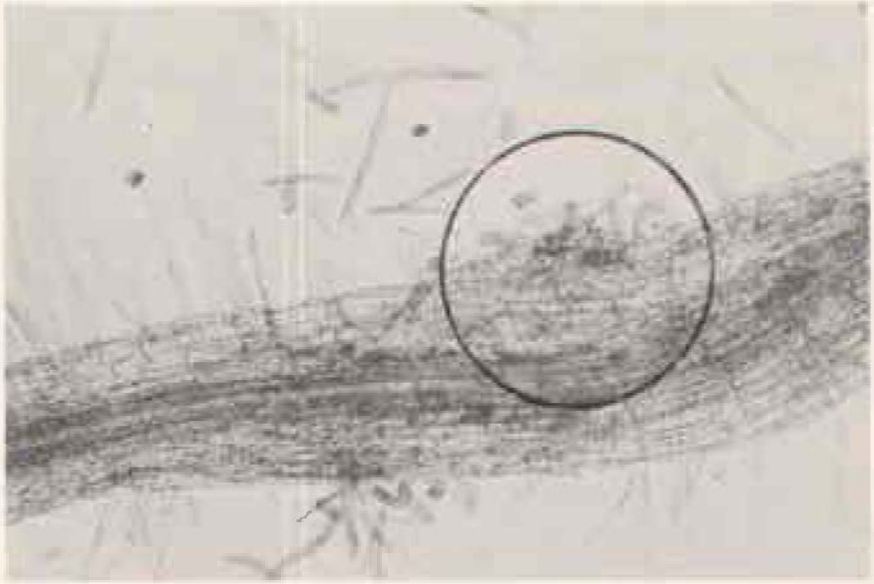
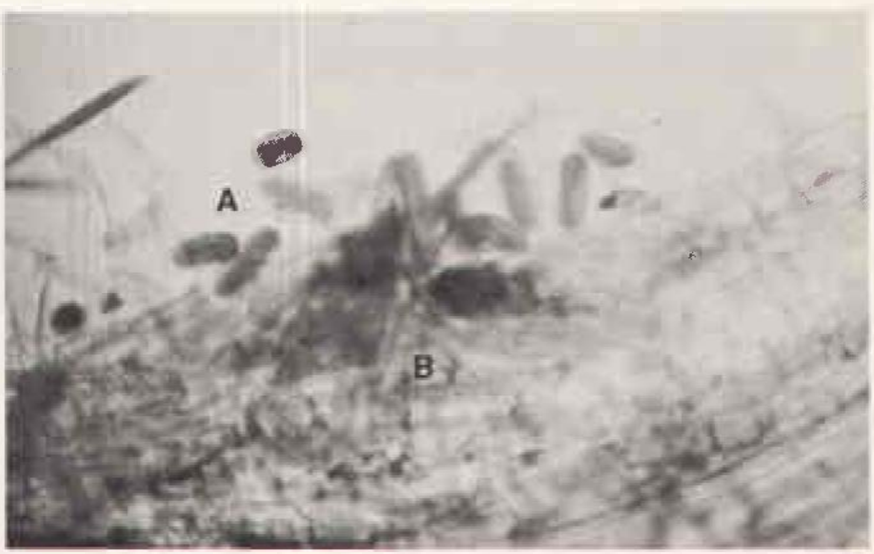


Figure 4. Photomicrograph of a section of infested corn root showing lesion nematodes and eggs forced from root during specimen preparation (250X).

Figure 5. Enlargement of area circled in Fig. 1. Note eggs (A) and mass of nematodes (B) being forced from root (750X).



INSECTICIDAL EVALUATIONS FOR LARVAL CORN ROOTWORM CONTROL

D. D. Walgenbach

Objectives

To determine efficacy of registered and experimental insecticides for control of western corn rootworm larvae, *Diabrotica virgifera* LeConte. The results of these tests are utilized in making additions and revisions to the insecticide recommendations for South Dakota farmers. The series of tests at the Southeast Experiment Station were more extensive than at the other five evaluation sites in eastern South Dakota.

To obtain information on the effects of planting date, placement, and cultivation applications of several compounds.

To obtain data on rootworm resistance through topical application of insecticides to field collected larvae.

Methods and Procedures

Field Histories

Southeast Experiment Station, Beresford

Location:	6 miles west; 3 miles south, Beresford; Clay County.
Plot History:	
Crops:	Trap Crop (corn) in 1973
Soil Type:	Silty-Clay 8% sand and 42% silt
Tillage:	Fall plowed 3 spring diskings
Fertilizer:	70-40-20/A
Herbicide:	Sutan 4.75 pt/A incorporated
Corn Variety:	DeKalb XL 45A
Row Width:	30 inches
Planter:	John Deere Flexi-Planter, 4 row, equipped with Noble Metering Units
Planting Dates:	See data
Cultivated:	Weed control, June 17
Cultivation Treatments:	See data

Schultz Farm, Madison

Plot History:	Corn, 1973, BUX failure site
Tillage:	Spring plowed
Herbicide:	Ramrod, 7 lbs. banded over row
Crop Variety:	DeKalb XL 45A
Row Width:	38 inches
Planter:	John Deere Flexi-Planter equipped with Noble Metering Units

Wink Farm, Lake Preston

Plot History:	Corn 5 years, 4 year use of Furadan
Tillage:	Spring chiseled
Herbicide:	Ramrod, banded over row
Crop Variety:	DeKalb XL 45A
Row Width:	38 inches
Planter:	John Deere Flexi-Planter equipped with Noble Metering Units

Neilson Farm, Lake Preston

Plot History:	Corn 3 years, Thimet failure 1973
Tillage:	Spring plowed
Herbicide:	Ramrod 7 lbs. banded over row
Crop Variety:	DeKalb XL 45A
Row Width:	38 inches
Planter:	John Deere Flexi-Planter equipped with Noble Metering Units

The recommended rootworm insecticides were demonstrated at three additional locations. Fields were selected with known insecticidal histories. The Schultz Farm west of Madison had a BUX failure in 1973, the Neilson Farm south of Lake Preston a Thimet failure and the Wink Farm north of Lake Preston had 4 years of Furadan application.

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

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

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

* ISU damage scale

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

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

Corn yields were scheduled from the demonstration plots, however drought and frost curtailed this operation.

Percent Root Protection (% R.P.). The percent root protection was calculated as follows:

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

Subtract 1 from the root rating of the treatment because a root rating of 1 equals negligible damage.

These calculations, although somewhat skewed allow easier comparison of treatments between plots.

Larval topical applications were made to field collected larvae from an untreated area at the Southeast Experiment Station. Adult topicals were made to beetles collected from the Southeast Experiment Station and Tofte Farm (Brookings). The western corn rootworm comprised 90% of the adult population at all plot locations. We assumed a comparable species mix with the larvae. Few southern adults were observed.

Results and Discussion

Registered Insecticides - Date of Planting Test X. Furadan and Mocap were the only compounds providing acceptable performance on the May 2 application. A levelling of rootworm control was obtained by all compounds after the May 2 date as shown by the percentage root protection (% R.P.). All compounds have shown a decline in rootworm control during the past several years. Application of the insecticides at 0.50 lb. A/A resulted in poor control (Test 1), even at a late planting date and emphasizes the need for accurate calibration at the recommended 1 lb. A/A rate for all rootworm insecticides.

Rootworm control at Madison and the two Lake Preston test sites showed acceptable performance of the registered materials. Control with BUX showed variation that could be associated with a resistant population since failure to control rootworms occurred for two years in a row at the Madison site.

Band vs. In-furrow Applications. Several compounds were evaluated as both 7" band and in-furrow applications for rootworm control. There was a general tendency for poorer rootworm control with in-furrow placement.

Band vs. Cultivation Treatments. As has been discussed many times, the vagaries associated with cultivation treatments cause the preponderance of rootworm insecticides to be applied in a band at planting. Better incorporation equipment could provide a performance edge to cultivation treatments.

Topical Insecticide Applications-Larvae. Field collected third instar larvae were evaluated at 2 hr. and 24 hr. periods after treatment with BUX, Dyfonate and Furadan. LD_{50} and LD_{90} points were determined by probit analysis. Since we do not have a topical quantitation for determining resistance, resistance has been

defined loosely in terms of plot failure. The wide separation between LD_{50} and LD_{90} points indicates a degree of larval tolerance with Dyfonate and Furadan. We would expect comparable relationships to other chemicals. Based upon rootworm reaction to BUX in field A, and numerous other observations and measurements, resistance to BUX is indicated. Further work remains to clarify the position of the other chemicals.

Adult Topicals. Field collected beetles treated topically show similar patterns on a 2 hr. basis to previous data. The 2 hr. and 24 hr. data show differences between chemicals. Based on 1974 data, we have not established correlations between adult topicals and anticipated field performance.

Table 17. Chemagro and Mobil Evaluations, Test I

Treatment	Rate lb. A/A		Root Rating Means		% R.P.	Stand counts Avg. 4 reps.
Furadan band	1.0	10G	2.55	a	71	16.8
Counter band	1.0	15G	2.65	a	69	16.3
Dyfonate band	1.0	20G	2.80	a	67	16.0
Furadan band	0.50	10G	2.95	a	64	18.3
Counter band	0.50	15G	3.0	a b	63	16.8
Dasanit band	1.0	15G	3.15	a b	60	16.8
Mocap band	1.0	10G	3.45	a b	55	17.0
Thimet band	1.0	15G	3.50	a b	54	17.3
Dyfonate band	0.50	20G	3.65	b c	51	17.0
BUX band	1.0	10G	3.75	b c	49	17.5
Thimet band	0.50	15G	4.05	b c d	44	17.0
Dasanit band	0.50	15G	4.05	b c d	44	16.8
BUX band	0.50	10G	4.20	c d	41	17.0
Mocap band	0.50	10G	4.50	c d	35	17.5
UTC			5.40	d		17.4
Planted 5/29/74						

Underline = 0.50 lb. A/A rate.

Table 18. Chemagro and Mobil Evaluations, Test II

Treatment	Rate lb. A/A		Root Rating Means		% R.P.	Stand counts Avg. 4 reps.
Furadan band	1.0	10G	2.25	a	73	16.8
Bay 92114 cult.	1.0	10G	2.75	a	68	16.8
Bay 92114 band	1.0	10G	3.00	a	64	17.0
Bay 92114 4EC cult.	1.0	4EC	3.2	a	60	17.6
Bay 92114 4EC band	1.0	4EC	3.4	a	56	16.8
Mocap band	1.0	10G	3.5	a	55	16.8
Thimet band	1.0	15G	3.6	a	53	17.8
Bay 92114 furrow	1.0	10G	3.9	a	47	16.8
Dasanit band	1.0	15G	4.0	a b	45	17.0
UTC			5.5	b		17.3
Planted 5/8/74						

Table 19. Chevron Evaluations, Test III

Treatment	Rate lb. A/A	Root Rating	Means	% R.P.	Stand counts Avg. 4 reps.
RE17033 band	1.0 10G	1.95	a	81	17.0
Furadan band	1.0 10G	2.05	a	79	18.0
RE17116 band	1.0 10G	2.30	a	75	16.8
RE17033 furrow	1.0 10G	2.45	a	72	17.8
SN316 band	1.0 10G	2.45	a	72	17.0
RE17116 furrow	1.0 10G	2.55	a	70	18.5
Furadan furrow	1.0 10G	2.75	a b	66	18.5
RE11237 band	1.0 10G	2.75	a b	66	19.3
RE11237 furrow	1.0 10G	2.75	a b	66	8.5
Thimet band	1.0 15G	2.90	a b	63	17.3
Landrin band	1.0 15G	3.05	a b	60	17.0
BUX band	1.0 10G	3.95	b c	42	16.3
UTC		5.1	c		18.5
Planted 5/8/75					

Table 20. FMC Evaluations, Test IV

Treatment	Rate lb. A/A	Root Rating	Means	% R.P.	Stand counts Avg. 4 reps.
Furadan band	1.0 10G	1.95	a	83	17.3
Furadan band	0.75 10G	2.30	a	77	17.8
Furadan furrow	2.0 10G	2.70	a	69	18.5
Thimet band	1.0 15G	2.95	a	65	19.0
Furadan furrow	1.0 10G	3.25	a	59	17.0
UTC		5.55	b		17.0
Planted 5/8/74					

Table 21. Ciba-Geigy Evaluations, Test V

Treatment	Rate lb. A/A	Root Rating	Means	% R.P.	Stand counts Avg. 4 reps.
CGA-12223 band	1.0 10G	2.4	a	72	17.3
Furadan band	1.0 10G	2.55	a	69	16.3
CGA-12223 furrow	1.0 10G	2.65	a	67	10.8
CGA-12223 band	0.8 10G	2.80	a	64	16.8
Thimet band	1.0 15G	3.1	a	58	17.5
UTC		5.05	b		16.3
Planted 5/8/74					

Table 22. Stauffer Evaluations, Test VI

Treatment	Rate lb. A/A	Root Rating	Means	% R.P.	Stand counts Avg. 4 reps.
Furadan band	1.0 10G	2.4	a	75	16.8
Dyfonate 20G band	1.0 20G	3.3	a	58	18.5
Dyfonate 10GK band	1.0 10G	3.3	a	58	18.0
N2596 10G band	1.0 10G	3.35	a	57	17.0
Dyfonate 10G band	1.0 10G	3.4	a	56	17.0
Dyfonate 15GK band	1.0 15G	3.5	a	55	18.0
N2596 10GK band	1.0 10G	3.55	a	54	17.3
N2596 20G band	1.0 20G	3.6	a	53	17.8
N2596 20GK band	1.0 20G	3.6	a	53	17.8
Thimet 15G band	1.0 15G	3.75	a	50	17.3
UTC		5.50	b		16.5
Planted 5/8/74					

Table 23. American Cyanamid Evaluations, Test VII

Treatment	Rate lb. A/A	Root Rating	Means	% R.P.	Stand counts Avg. 4 reps.
Furadan band	1.0 10G	2.25	a	75	17.5
Counter band	1.0 15G	2.30	a	76	18.3
Counter band	0.75 15G	2.30	a	76	17.5
Counter furrow	1.50 15G	2.60	a	68	16.3
Counter furrow	1.00 15G	2.65	a	67	14.8
Counter furrow	0.75 15G	2.80	a	64	15.5
Thimet band	1.00 15G	2.90	a	62	15.5
UTC		5.00	b		16.8
Planted 5/8/74					

Table 24. Dow Evaluations, Test VIII

Treatment	Rate lb. A/A	Root Rating	Means	% R.P.	Stand counts Avg. 4 reps.
Furadan band	1.0 10G	2.1	a	79	17.3
M 3961 band	1.0 10G	2.9	a b	63	17.8
M 3983 band	1.0 10G	3.15	b	58	17.8
Thimet band	1.0 15G	3.20	b	57	17.8
M 3916 band	1.0 15G	3.35	b	54	16.8
M 3916 cult.*	1.0 15G	3.35	b	54	16.8
M 3983 cult.*	1.0 10G	3.40	b	53	17.5
UTC		5.15	c		17.5
Planted 5/8/74					

* Cultivated 6/17/74.

Table 25. Test IX

Treatment	Rate lb. A/A	Root Rating Means	
Furadan band	1.0	1.55	a
Bay 92114 band	1.0	2.20	a
Furadan furrow	2.0	2.25	a
SH 316 band	1.0	2.35	a
CGA 12223 band	1.0	2.45	a
Mocap Encap band	1.0	2.45	a
Bay 92114 4EC band	1.0	2.50	a
Dyfonate band	1.0	2.50	a
Landrin band	1.0	2.60	a
Dasanit band	1.0	2.65	a
Mocap band	1.0	2.90	a b
Thimet band	1.0	2.95	a b
BUX band	1.0	3.0	a b
Mocap 6E band	1.0	3.2	a b
UTC		5.0	c
Planted 5/29/74			

Table 26. Date of Planting - Insecticide Application, Test X (Root Ratings - 7" Band)

Treatment	Rate lb. A/A	Planting and Application Dates 5/2	5/8	5/20	5/28	6/7
		Root Ratings (1-6 scale)				
Furadan	1	2.85a[1]	2.45a	2.10a	1.70a	1.60a
Mocap	1	3.35a	2.75a	3.35ab	2.85b	2.05a
Dyfonate	1	3.55ab	3.50a	3.10ab	2.90b	2.60ab
Thimet	1	3.75ab	3.0a	3.05ab	2.75b	2.35ab
Dasanit	1	3.90ab	3.4a	3.45ab	2.95b	2.85ab
BUX	1	4.25b	3.7a	3.85b	3.0b	2.4ab
Counter	1	---	---	3.0a	2.55b	2.2a
UTC		4.45b	5.3b	5.4c	4.90c	3.6b
		% Root Protection				
Furadan		58	72	80	84	83
Mocap		47	67	56	62	71
Dyfonate		43	53	61	61	56
Thimet		38	62	62	64	62
Dasanit		35	55	55	60	49
BUX		27	49	47	59	61
Counter		--	--	63	68	67

[1] Means sharing a common letter do not differ significantly at the 5% level.

Table 27. Root Ratings, Registered Compounds

Treatments	Root Rating Means			% R. P.
	Wink Farm, Lake Preston, Text XI			
Furadan	2.1	a		74
BUX	2.3	a		70
Dyfonate	2.55	a		64
Mocap	2.60	a		63
Counter	2.80	a		58
Dasanit	2.85	a		57
Thimet	3.05	a		52
UTC	4.30		b	
Planted 5/23/74				
	Neilson Farm, Lake Preston, Test XII			
Counter	2.45	a		70
Furadan	2.50	a		69
BUX	2.75	a		64
Dasanit	2.95	a	b	59
Thimet	3.05	a	b	57
Mocap	3.05	a	b	57
Dyfonate	3.60	a	b	46
UTC	4.80		b	
Planted 5/23/74				
	Schultz Farm, Madison, Test XIII			
Furadan	2.13	a		80
Counter	2.30	a		77
Dyfonate	2.80	a		68
Dasanit	2.80	a		68
Mocap	2.80	a		68
Thimet	3.0	a		65
BUX	5.0		b	30
UTC	5.7		b	
Planted 5/22/74				

CORN ROOTWORM RECOMMENDATIONS FOR 1975

B. H. Kantack and D. D. Walgenbach

Recommendations for control of western corn rootworm will remain basically the same as they were for 1974, with Mocap, Dyfonate, Furadan, Thimet and Dasanit recommended at 1 lb. actual per acre based on 40 inch rows (condensed from Corn Rootworm F.S. 491). We are continuing to emphasize that farmers should rotate to break the corn on corn sequence and not plant corn following corn. Adult beetle

populations were extremely high this past year of 1974 and we anticipate heavy rootworm populations again in 1975. Thus, we cannot over emphasize the importance of rotation of your crops to reduce the rootworm numbers. We are also strongly recommending that you rotate your rootworm chemicals and not use the same chemical two years in a row on the same field. Many of our problems of lack of field performance by some of the recommended insecticides have occurred where the same chemical has been used on the same field year after year.

Table 28. Insecticides Recommended for Control of Corn Rootworm Larvae. All insecticides are recommended at 1 lb. actual per 13,080 ft. of row.

Insecticide/ Formulations	Amount formulation 1,000 ft. row (ounces)	Formulation and Amount/ Acre of row (pounds)
Mocap 10G	12	10
Dyfonate 10G	12	10
Dyfonate 20G	6	5
Furadan 10G	12	10
Thimet 15G	8	6½
Dasanit 15G	8	6½

Two newcomers in the rootworm insecticide field will be available in limited supply this year. Counter 15G soil insecticide produced by the American Cyanamid Company is now registered by EPA for the control of corn rootworm in field corn. Counter 15G may be used at planting time when applied in a 7 inch band over the row before the planter press wheel or directly into the seed furrow behind the planter shoe. (South Dakota does not recommend the in-furrow treatment as performance will not be as good as when applied in the band.) Our recommended rate will be 6½ lbs. of Counter per acre based on 40 inch rows or 8 oz. of Counter 15G per 1,000 ft. of row for any row spacing.

Corn and soybeans are the only two crops that may be planted in rotation the year following Counter treated corn. However, cover crops may be planted in a treated area if they are plowed under and not grazed. There are additional restrictions if the in-furrow treatment is used, however we do not feel that the in-furrow or seed furrow treatment should be used under South Dakota conditions in 1975.

Another chemical that will be available in very limited supply in 1975 will be Lorsban, an organophoaphate insecticide produced by the Dow Chemical Company. This will also be recommended at the 1 lb. per acre rate to be used in a 7 inch band over the row based on 40 inch row spacings.

ROOT PULLING RESISTANCE OF CORN INBRED LINES

L. H. Penny and J. R. Jenison

Root pulling resistance is sometimes used by corn breeders as a measure of root development, lodging resistance, and possibly rootworm tolerance. We initiated a study in 1974 on root pulling resistance in a group of 49 inbred lines of corn. Purposes of the study are to determine (1) the range of root pulling resistance that exists among lines, (2) the repeatability of root pulling measurements in different environmental conditions and at different stages of plant growth, (3) the relationship between root pulling resistance and other root characteristics such as root spread, root dry weight, and root rot resistance, and (4) the ability of inbred lines to transmit differences in pulling resistance to hybrids. The 49 lines chosen for the study included lines from the state corn breeding programs in South Dakota and Minnesota, the USDA Northern Grain Insect Research Laboratory at Brookings, and a few lines from other sources. They were grown in 1974 at the Southwest Minnesota Agricultural Experiment Station at Lamberton, Minnesota, at the Northern Grain Insect Research Laboratory at Brookings, South Dakota, and at the Southeast South Dakota Experiment Farm. The same material will be grown at these same locations for at least two and possibly three years.

Root pulling resistance was measured as the pounds of force required to lift a plant vertically from the soil. We planned to pull 5 plants per plot at the boot stage of plant growth, another 5 plants at the milk stage (approximately 3 weeks after silking), and another 5 plants at a later stage after root rots had become established. However, we had to abandon plans for the last date of pulling in 1974 because of damage from the severe drought and the early freeze. The roots pulled at the milk stage were washed free of soil and the root span and dry weight determined. No attempt will be made to summarize or interpret the results until all data are complete. However, the 1974 data will be used to plan crosses for the hybrid study indicated as purpose (4) above.

Data obtained at the Southeast South Dakota Experiment Farm in 1974 for a few representative lines are shown in Table 29 to indicate the range of values with which we are working. The values shown are on an individual plant basis and are means of 20 plants (5 plants in each of 4 replications). The root dry weight and root span represent that portion of the root system that remained with the stalk as it was pulled from the soil. Pulling values remained rather constant for most lines between the two pulling dates, probably because of the dry weather. Considerably higher values would have been expected at the later stage if soil moisture had been available for normal growth. The roots of some lines did grow during this period, but there was actually a deterioration for others.

Table 29. Root Pulling Measurements, Root Span, and Root Dry Weight Obtained on a Selected Group of Corn Inbred Lines in 1974.

Inbred line	Pounds pull		Dry weight (grams)	Root span (inches)
	Boot stage	Milk stage		
NG 72227	273	321	23.2	8.6
NG 72335	280	374	19.5	8.4
NG 72336	323	356	17.8	8.8
A 619	194	206	7.8	6.6
A 632	215	200	10.5	7.0
A 634	274	298	12.6	8.2
A 660	134	135	7.3	4.9
SD 10	272	255	15.9	6.7
SD 23	207	195	7.7	5.6
SD P2A	192	211	9.4	7.3
SDSU P3558-26B	296	334	19.6	9.1
SDSU OP1 R4-4 E-4	290	319	14.2	7.8
W 202	272	288	17.3	6.2
W 64 A	244	246	11.6	7.5
W 182 E	160	133	4.8	5.3
C 123	218	211	7.5	5.1
Mean (all 49 lines)	234	244	12.6	6.6
L.S.D. (.05)	38	38	2.8	0.8
C.V.	10.7%	10.5%	15.5%	8.5%

ROOTWORM RESISTANCE IN CORN

L. H. Penny

Nine corn inbred lines and the 36 possible single crosses among those lines were grown under rootworm infested conditions in an attempt to identify and measure differences in rootworm resistance. The lines and their crosses were planted in separate but adjacent 3-replicate experiments. They were planted on land that had grown a late planted corn trap crop to attract adult rootworms for egg laying in 1973. The relative ability of a line or a hybrid to withstand the rootworm attack was measured by rating each plot on a 1 to 9 scale for plant anchorage in the soil at approximately the time of peak rootworm larval feeding on the corn roots. The 1 to 9 scale (1-best, 9-poorest) for root anchorage used for this type of evaluation provides relative ratings, and a particular numerical rating may represent vastly different amounts of root damage in different experiments according to the general level of rootworm infestation. Both the experiments in 1974 had high levels of infestation.

Root anchorage ratings of the 9 lines and 36 single crosses were made on July 23. Ratings for the lines themselves and for the mean of the 8 crosses in which each line was a parent are summarized in Table 30. Wide and significant differences were found both among lines and among crosses. Pa405, R168, and SD10 were most resistant as lines, as indicated by the low anchorage ratings of 2.7,

3.7, and 3.7, respectively. Their resistance was expressed to some extent in their crosses also. The three best single crosses were the three crosses among those lines, rating 4.3, 4.7, and 5.3 for Pa405 X R168, Pa405 X SD10, and R168 X SD10, respectively.

As stated previously, this method of rating plant material provides information on relative resistance but not on actual damage. The general level of infestation was high in both experiments in 1974, and considerable root damage occurred even in the plots with the lowest root anchorage ratings. No corn lines or hybrids have yet been found that will effectively prevent rootworm damage under conditions favorable for a heavy rootworm infestation.

Table 30. Summary of Root Anchorage Ratings of 9 Corn Inbred Lines and All Possible Single Crosses Among Those Lines When Grown Under Heavy Rootworm Infestation.

Inbred line	Inbred line rating	Mean rating in crosses
SD10	3.7	6.5
Oh545	8.7	7.8
Oh43	8.0	7.5
MS107	9.0	7.6
R168	3.7	6.5
Pa405	2.7	6.3
Oh05	8.7	7.6
WF9	7.7	8.5
M14	7.7	7.9

CORN BREEDING

D. B. Shank and John R. Jenison

Five yield trials, each containing experimental corn hybrids were planted in 1974. One test was of three and four-way hybrids made up primarily from standard released inbreds crossed with superior lines developed in the pathology project on root and stalk rot studies in corn. Another trial was a uniform cooperative test conducted by several north central states and contained three-way hybrids of the 400-600 maturity level made by crossing some of the newest, most promising inbreds from several north central states to two different single cross testers. The other three trials were of single cross hybrids made up of new, promising lines developed in both the Agronomy and Plant Pathology projects with the objective of seeking good, adapted new single crosses. Also obtained from the data were the predictions of the performances of modified single and three-way hybrids which could have been made from the same inbreds and could have been included in the same tests, had seed been available. This aids in deciding which of many possible hybrids the breeder should be evaluating in future years.

Adverse weather, primarily low rainfall and high temperatures accompanied by wind, during the critical development periods of the corn damaged all of the tests. Not only were yields reduced drastically from values which are usually expected for the Southeast Research Farm but also field variability increased to the extent that large differences in mean yields were necessary before two entries could be considered really different in performance. Since the entries were experimentals the detailed performance records are not listed but from Table 31 it may be seen that average yields over the five trials ranged from 31.8 to 57.0 bushels per acre. Yields of 31.8 bushels per acre were low, even for 1974. The entries in that test were single crosses made up of related inbreds, thereby being hybrids with less vigor and yield potentials than those possible for entries in some of the other trials.

Stalk lodging in 1974 actually was lower than usual. For some reason, in spite of rather poor stalk development and adverse weather during the growing season, stalk rot diseases and stalk lodging were below averages obtained from other years.

Table 31. Summary of Mean Performance Records from Five Corn Tests of Experimental Hybrids Conducted at the Southeast South Dakota Research Farm in 1974.

Test	Yield Bu/A	Moisture %	Broken Stalks %	Number Hybrids Tested
Regional Uniform 400-600 Maturity 3-Ways	57.0	22.9	4.2	49
Early 600 Single Crosses	54.6	24.2	16.6	72
Plant Pathology 3- and 4-Way Hybrids	49.6	27.6	1.7	42
600 Maturity Single Crosses	55.8	29.0	0.5	81
Plant Pathology Late Inbred Single Crosses	31.8	28.9	3.4	36

CORN PERFORMANCE TRIALS

J. J. Bonnemann

A total of 72 corn hybrids, proprietary and experimental, were included in the 1974 trial at the Southeast Experiment Farm.

The corn was drilled in single rows, 32 feet long, 30 inches apart on May 22. Harvest was with picker-sheller October 16. The trials were seeded to achieve populations of 16,- and 20,000 plants per acre. Actual counts in mid-August were 16,000 and 19,300 for the two populations. The yield reported is the mean of the two populations. A statistical difference was found for the lower population in 1974. This might be expected considering the adverse weather throughout much of the 1974 growing season.

The yields of some hybrids were quite acceptable while others either too early or too late did not produce a decent yield. The mean yield for the entire trial

was 56.1 bushels per acre. Stalk lodging was very limited for most entries. Moisture in the shelled corn averaged 25.7 percent at harvest.

The results are presented in Table 32. Additional information will be found in an upcoming circular, 1974 Corn Performance Trials.

Table 32. Corn Performance Trial, Southeast Experiment Farm, Beresford, 1974.

Brand & Variety	Type and Cross	Yield B/A	Percent Stalk Lodged	Percent Moisture
P-A-G SX 397	N 2X	75.6	28	20.2
P-A-G SX 69	N M2X	74.9	2	25.0
Funk's G-4444	N 2X	72.5	2	23.8
Wilson 1500	N 2X	72.0	1	22.5
McCurdy MSX 44A	N 2X	71.9	3	23.7
Pioneer 3388	N M2X	71.6	1	26.8
Funk's G-4445	N 2X	71.5	4	23.1
Cargill 930	N M2X	71.3	17	27.1
ACCO UC 3301	N 2X	71.2	6	24.0
Pride R-522	N 2X	70.8	2	21.7
Curry's SX-144	N 2X	70.6	2	23.4
Funk's G-4366	N 3X	68.6	6	20.6
Payco SX 865	N 2X	68.6	2	24.8
Green Acres S 66	N M2X	67.8	1	28.0
Asgrow RX 58	N 2X	67.2	1	24.1
Wilson 1017	N 2X	66.5	7	20.5
Asgrow RX 64	N 2X	65.3	2	23.7
Renk RK 66	N 2X	65.1	1	20.6
Funk's G-4465	N M2X	64.8	4	26.1
Cargill 890	N M2X	64.7	6	22.4
Green Acres 630	N 3X	64.4	2	26.2
Pride 8824	N 2X	64.4	6	29.4
Disco SX 1104	N 2X	64.2	1	23.4
Funk's G-4321	N 2X	64.2	1	22.2
Disco SX 17	N 2X	63.7	4	23.0
Horizon MYT 544	N 3X	62.7	0	29.2
Cargill 449	N 3X	62.3	1	22.8
Curry's SC-145	N 2X	61.6	0	21.9
ACCO UC 3601	N 2X	61.2	0	28.8
ACCO UC 6601	N 2X	60.8	2	24.5
Todd MX 69	N M2X	60.7	0	28.3
Pioneer 3535	N 2X	60.3	4	21.4
Wilson 1016	N 2X	60.2	2	23.7
Trojan TXS 111	N 3X	59.8	6	23.4
Trojan TXS 113	N 2X	59.0	3	29.5

Table 32 continued on next page.

Table 32. Continued

Brand & Variety	Type and Cross	Yield B/A	Percent Stalk Lodged	Percent Moisture
Todd M30	N 2X	58.6	4	25.8
ACCO U 378	N 3X	58.5	3	30.2
Horizon KR 103	N 2X	58.5	2	18.2
Sokota MS-88	N M2X	57.2	0	28.4
Funk's G-H0562	N M2X	56.9	5	29.1
Funk's G-WX520	N 2X	56.2	1	22.8
Pride R-803	N 2X	55.4	1	27.4
Pioneer 3543	N 3X	55.4	1	21.1
Payco SX 1093	N 2X	54.5	1	34.3
Pioneer 3366	N 2X	54.2	2	30.5
McCurdy MSP 733	N 3X	54.0	2	27.5
Horizon KR 105	N 3X	53.6	0	24.0
ACCO U 348	N 3X	53.5	0	21.8
Pride 6694	N 2X	52.2	3	29.2
Pride R-793	N 3X	51.8	1	26.7
McCurdy MSX 46	N 2X	51.7	1	20.8
McCurdy MSX 55A	N 2X	50.3	3	29.5
ACCO UC 4201	N 2X	50.3	0	25.0
ACCO U 370	N 3X	49.2	14	23.0
McCurdy MSX 60	N 2X	48.0	0	29.8
Todd M58	N 2X	46.0	2	25.0
Pride R-728	N 3X	43.9	9	20.5
Sokota SK-90	N 3X	43.5	1	29.6
McCurdy MSX 84	N 2X	41.3	0	29.8
Trojan TXS 108A	N 2X	41.0	1	26.4
SDAES PP 197	N 3X	40.6	1	29.4
O'sGold SX 2200A	N 2X	39.2	0	24.2
McCurdy MSX 67	N 2X	38.7	0	28.3
P-A-G 344	N 3X	38.6	0	28.4
Green Acres L 19	N 4X	37.4	1	27.8
Wilson 2317	N M2X	37.3	1	24.7
Curtis 426	N 2X	35.7	0	31.0
Curry's SC-150	N 2X	34.7	1	31.8
Sokota TS-82	N 2X	32.2	2	30.0
Renk RK 77	N 2X	30.8	0	29.8
O's Gold SX 5500A	N 2X	29.2	0	30.5
Horizon KR 870	N 2X	25.8	1	30.0
Mean		56.1	3	25.7

Standard error 4.7

PERFORMANCE OF HERBICIDES IN CORN AND SOYBEANS

W. E. Arnold and L. J. Wrage

Herbicide screening experiments are conducted at the Southeast Experiment Farm to give area farmers a chance to compare the performance of several herbicides which may be used in their area. The performance of herbicides used on corn and soybeans this year as compared to previous years is presented in the following tables.

Corsoy soybeans were planted in 30-inch rows. Preplant incorporated treatments were applied and incorporated with a tandem disking at a 4-inch depth followed by two flextinings. Post-emergence applications were made when the soybeans were in the first and second trifoliate stage and the weeds were 1 to 3 inches tall. The predominant weeds were: Foxtail sp., Common Lambsquarters, prostrate, smooth and redroot pigweed. The rainfall within four days was 1.32 inches.

Pioneer 3388 seed corn was planted in 30-inch rows. Preplant incorporated treatments were applied and incorporated with tandem disking at the 4-inch depth followed by two flextinings. Post-emergence treatments were applied when the corn was 5 inches tall and the weeds, foxtail sp., and pigweed sp., were 2 to 3 inches tall. The predominant weeds were green and yellow foxtail. The rainfall within six days was 0.84 inches.

All herbicide treatments were applied in a 20 gpa water spray at 40 psi. The planting and spraying information for previous years are reported in the Southeast South Dakota Experiment Farm Progress Report for the year in question.

Table 33. Corn Herbicide Plots

		Estimated % Early Season Weed Control			
	Rate	1974		5-Yr. Avg. (70-74)	4-Yr. Avg. (70-73)
Herbicide	lb/A	Gr	Bdlf	Gr	Bdlf
PREPLANT INCORPORATED					
atrazine (AAtrex)	2½	70	*	86	97
butylate + atrazine (Sutan + AAtrex)	3+1	80		89	96
butylate (Sutan)	4	85		84	63
butylate + cyanazine (Sutan + Bladex)	3+1½	95		--	--
EPTC+R-25788 (Eradicane)	3	95		--	--
EPTC+R-25788 (Eradicane)	4	95		--	--
ethiolate + cyprazine (Prefox)	3+3/4	90		--	--
alachlor (Lasso)	3	80		--	--

Table 33 continued on next page.

Table 33. Continued

Herbicide	Rate lb/A	Estimated % Early Season Weed Control: 1974 Gr	1974 Bdlf	5-Yr. Avg. (70-74) Gr	4-Yr. Avg. (70-73) Bdlf
PREEMERGENCE					
atrazine (AAtrex)	2½	30		76	99
alachlor (Lasso)	2½	90		87	62
propachlor (Ramrod)	5	95		93	52
cyanazine (Bladex)	2½	65		78	55
alachlor + atrazine (Lasso + AAtrex)	2+1	88		89	85
alachlor + cyanazine (Lasso + Bladex)	2+1½	88		92[2]	90[3]
alachlor + dicamba (Lasso + Banvel)	2+½	90		---	---
propachlor + atrazine (Ramrod + AAtrex)	3+1	---		93	89
POST-EMERGENCE					
atrazine + oil (AAtrex + oil)	1½[1]	75		70	92
cyprazine (Outfox)	3/4	50		60[2]	82[3]
cyanazine (Bladex)	2	95		63[2]	20[3]
Check	---	0		0	0

* No broadleaf weeds present.
1 Previous rate 2+1 gal.
2 Average of 2 years.
3 1973 data.
Gr = annual grasses
Bdlf = annual broadleaved weeds

Table 34. Soybean Herbicide Screening

Herbicide	Rate lb/A	Est. % Early Season Weed Control 1974 Gr	Bdlf	5-Yr. Avg. (70-74) Gr	Bdlf
PREPLANT INCORPORATED					
vernolate (Vernam)	2½	88	85	88	85
trifluralin (Treflan)	3/4	99	98	90	90
dinitralin (Cobex)	1/2	99	98	99*	91*
tolban	3/4	90	92	--	--
SPLIT APPLICATION (ppi & pre)					
trifluralin and linuron (Treflan & Lorox)	3/4+1	99	99	99*	97*
trifluralin and metribuzin (Treflan & Sencor, Lexone)	3/4+3/8[1]	99	99	99	97*
SPLIT APPLICATION (ppi & post)					
trifluralin + chlorobromuron (Treflan + Maloran)	3/4+1½	99	99	--	--
trifluralin + bentazon (Treflan + Basagran)	3/4+3/4	99	96	--	--
PREEMERGENCE (pre)					
chloramben (Amiben)	3[2]	94	90	80	81
alachlor (Lasso)	2½	95	80	91	72
alachlor + linuron (Lasso + Lorox)	2+1	95	85	91	85
fluorodifen (Preforan, Soyex)	4	40	60	69	74
alachlor + metribuzin (Lasso + Sencor, Lexone)	2+3/8	95	92	85*	89*
alachlor + chlorbromuron (Lasso + Maloran, Bromex)	2+1½	95	75	88*	82*
metribuzin (Sencor, Lexone)	½	80	88	73*	84*
alachlor + bifenox (Lasso + Modown)	2+1½	92	90	--	--
Check	----	0	0	0	0

* Average of two years.
[1] Previous rate 3/4 + ½.
[2] Previous rate 2½.
Gr = annual grasses
Bdlf = annual broadleaved weeds

CHISEL PLOW SOYBEANS AND CORN

F. Shubeck and B. Lawrensen

Objectives

1. How much tillage is necessary for optimum yields?
2. Will fall tillage increase moisture storage?
3. Without a serious weed problem, which is the best to use in the fall, sweeps or twists?
4. Can yields be maintained with chisel plowing rather than moldboard plowing in the fall and subjecting soil to a greater erosion hazard?
5. Can disking stalks in the fall be eliminated by chopping and using chisel points with twists?
6. Is the system of fertilizing adequate, using a sideband starter and side-dressing nitrogen?

Procedure (Soybeans)

Nov. 9, 1973 - Rotary chopped cornstalks in specified treatments.
Nov. 30, 1973 - Specified chisel plow (twists performed in the plots).
April 19, 1974 - Rotary chopped cornstalks in the specified treatment for follow-up tillage.
May 28, 1974 - All specified tillage treatments in (1973 Corn plow corn area) were carried out.
May 28, 1974 - Spike tooth harrowed all plots. All soybean plots planted.
Variety - Corsoy
Herbicide - Lasso Il 15G banded
June 12, 1974 - Cultivated all soybean plots.
July 8, 1974 - Cultivated all soybean plots (second time).
Oct. 2, 1974 - Combined all plots.

Procedure (Corn)

Nov. 30, 1973 - Chiseled (sweeps and twists) in the itemized plots.
May 20, 1974 - Completed all the spring tillage treatments.
May 23, 1974 - Planted all corn plots.
Variety - Pioneer 3780
Herbicide - Ramrod 20G banded
Insecticide - Dyphonate 20G banded
June 5, 1974 - Rotary hoed all corn plots.
June 13, 1974 - Cultivated all corn plots.
June 21, 1974 - Side-dressed with 100 nitrogen (act.) per acre.
July 8, 1974 - Cultivated all corn plots (second time).
Oct. 15, 1974 - Hand picked all plots.

Table 35. Effect of Tillage Treatments on Yield of Soybeans

	Tillage Treatment		Soybeans
	In Fall	In Spring	Bu/A
1	---	Disk-disk-drag	24
2	---	Chop-sweeps-disk-drag	22
3	---	Disk-moldboard plow-disk-drag	28
4	Disk-moldboard plow	Disk-drag	24
5	Disk-twists	Disk-drag	22
6	Chop-twists	Disk-drag	25
7	Chop-twists	Sweeps-drag	20
8	Chop-sweeps	Sweeps-drag	21
9	Disk	Disk-drag	23
10	Chop-twists*	Sweeps-drag	21

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

Discussion and Interpretation of Table 35

This is the second year for the chisel plow experiment. In 1974, yields with conventional tillage in the spring with moldboard plow appeared to be a little higher than with some of the reduced tillage systems.

Table 36. Effect of Tillage Treatments on Yield of Corn

	Tillage Treatment		Soybeans
	In Fall	In Spring	Bu/A
1	---	Disk-drag	68
2	---	Sweeps-drag	57
3	---	Plow (moldboard)-disk-drag	70
4	Plow (moldboard)	Disk-drag	60
5	Twists	Disk-drag	64
6	Twists	Disk-drag	64
7	Twists	Sweeps-drag	68
8	Sweeps	Sweeps-drag	54
9	---	Disk-drag	63
10	Twists*	Sweeps-drag	83

*Treatment 10 was unfertilized. All other corn plots received 100 lbs. of 8-32-16 (oxide) as a sideband starter. In addition, 100 lbs. of nitrogen per acre were applied as a side-dressing when corn was about 18 inches high.

Discussion and Interpretation of Table 36

Tillage treatments 5 and 6 were identical for corn but different for the preceding soybean crop. Soil tests show accumulations of salts 1.5 feet below the surface in some plots. This experiment will be moved to a better drained site in 1975. Variations in yield due to soil variation were as large as those due to some of the tillage treatments.

Fertility levels were adequate for the amount of rainfall received in 1974.

Table 37. Effect of Fall Tillage Treatments on Soybean Yield (2 yr. average, 1973-74)

Fall Tillage Treatment	Beans Bu/A
Disk-moldboard plow	26
Chisel plow (average of 5 treatments)	30

Table 38. Effect of Spring Tillage Treatments on Soybean Yield (2 yr. average, 1973-74)

Spring Tillage Treatment	Beans Bu/A
Disk-moldboard plow-disk-drag	28
Chisel plow (average of 5 treatments)	26

Discussion and Interpretation of Tables 37 and 38

When yields of the last two years were averaged, chisel plowing in the fall appeared to yield a little more than moldboard plowing in the fall. However, with tillage in the spring only, the moldboard plow gave a slightly higher average yield than the chisel plow treatments.

SOYBEAN ROW SPACING (30" VS 7")

B. Lawrensen and F. Shubeck

Objectives

1. Is there a yield advantage in narrowing rows from 30" to 7"?
2. Will planting soybeans with a grain drill (7") and not cultivating be a profitable venture?

Methods and Procedures

Dec. 3, 1973 - Moldboard plowed.
April 23, 1974 - Sprayed plot area with Treflan at the rate of 1.5 pints per acre and tandem disked immediately to incorporate.
May 28, 1974 - Prepared soil for planting. Planted 30" row with tool bar planter and 7" rows with grain drill.
June 13, 1974 - Cultivated 30" rows.
Oct. 3, 1974 - Combined all plots.

Table 39. Comparison of 30" Rows and 7" Rows for Soybeans

Row Spacing	Bu/A
30" rows (planted with tool bar planter)	28.0
7" rows (seeded with press drill)	28.0

Discussion and Interpretation of Table 39

Narrowing rows to 7 inches did not increase yields over the 30 inch row spacing in 1974. These results were the same for the last 4 years.

Weed control was very good in both 7 inch and 30 inch rows. Broadleaf weeds were not a problem at this experimental site.

Plant populations were 190,000 to 220,000 which is more than adequate for a dry year.

DATE OF PLANTING SOYBEANS

F. Shubeck and B. Lawrensen

Objectives of Experiment

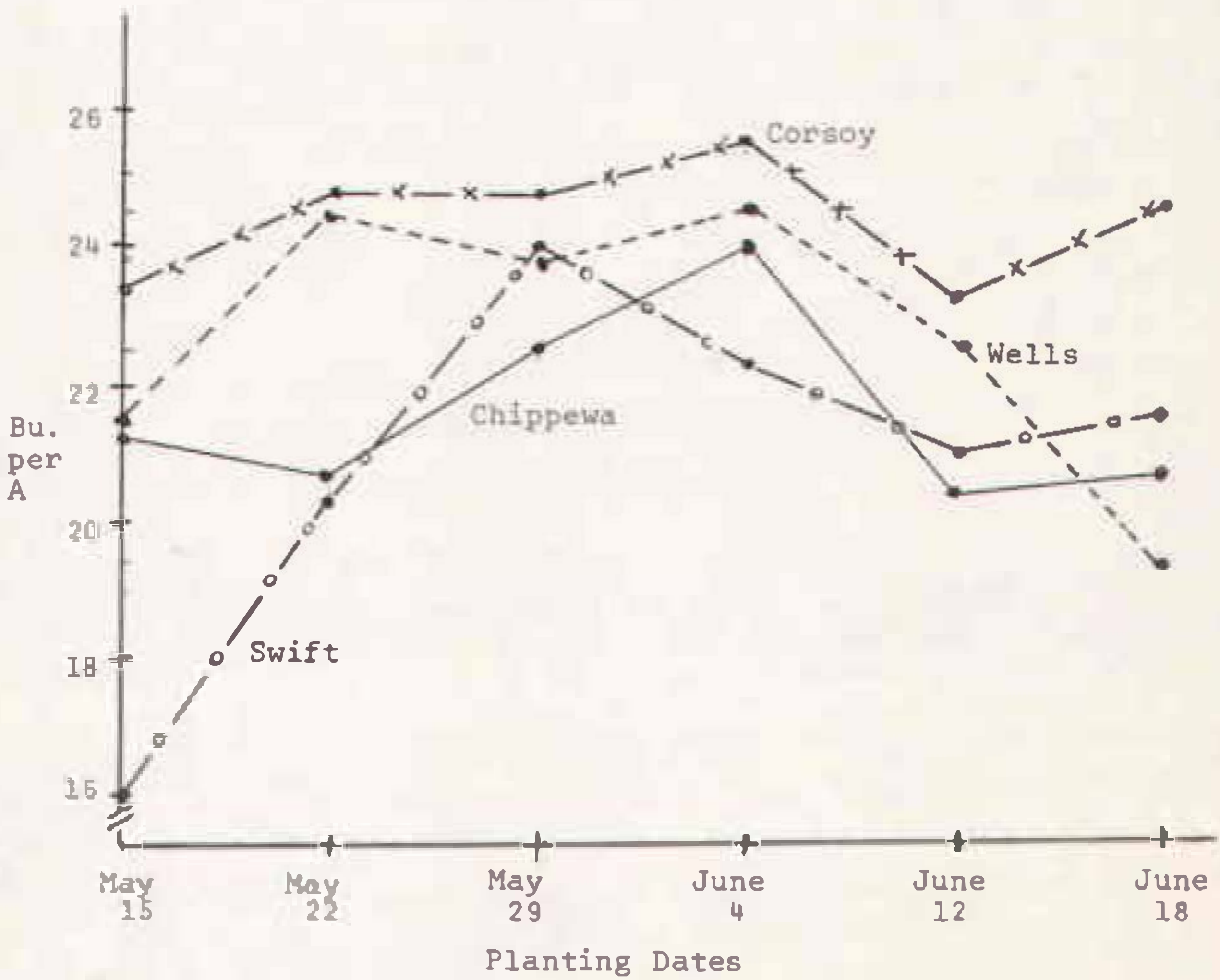
1. Will early planting dates decrease yields of early maturing soybean varieties?
2. Does day length and time of planting seriously affect soybean yield?
3. Can a planting date be selected for early maturing varieties that will prevent improper day length from triggering premature flowering?

Methods and Procedures Used in Soybean Study

Nov. 14, 1973 - Plowed 1974 plot area--no fertility added.
April 19, 1974 - Fertilized rotation corn area with 13-36-25 and disked in. Additional N was added later.
April 23, 1974 - Broadcast sprayed experimental area with 1½ pts of Treflan and tandem disked to incorporate herbicide.

May 6, 1974 - Tandem disked and spike-tooth harrowed total plot area
May 15, 1974 - First planting date
Varieties - Corsoy, Wells, Swift, Chippewa 64
Herbicide - Lasso II 15G banded
NOTE: This planting information will be the same for the next succeeding planting dates.
May 22, 1974 - 2nd planting date. Area tandem disked and spike-tooth harrowed and planted.
May 29, 1974 - Tandem disked and spike-tooth harrowed and planted 3rd planting data area.
June 4, 1974 - Prepared plots for the 4th planting date by tandem disking, harrowing and then planting.
June 12, 1974 - Planted all 5th planting date plots. Soil preparation the same as in previous planting dates.
June 18, 1974 - Planted the 6th planting date plots. Soil preparation the same as in the previous planting dates.
June 25, 1974 - Cultivated in the 1st five planting dates.
July 8, 1974 - Finished cultivating in all plots.
Oct. 1, 1974 - Combined all experimental plots.

Figure 6. Effect of Planting Date on Soybean Yield

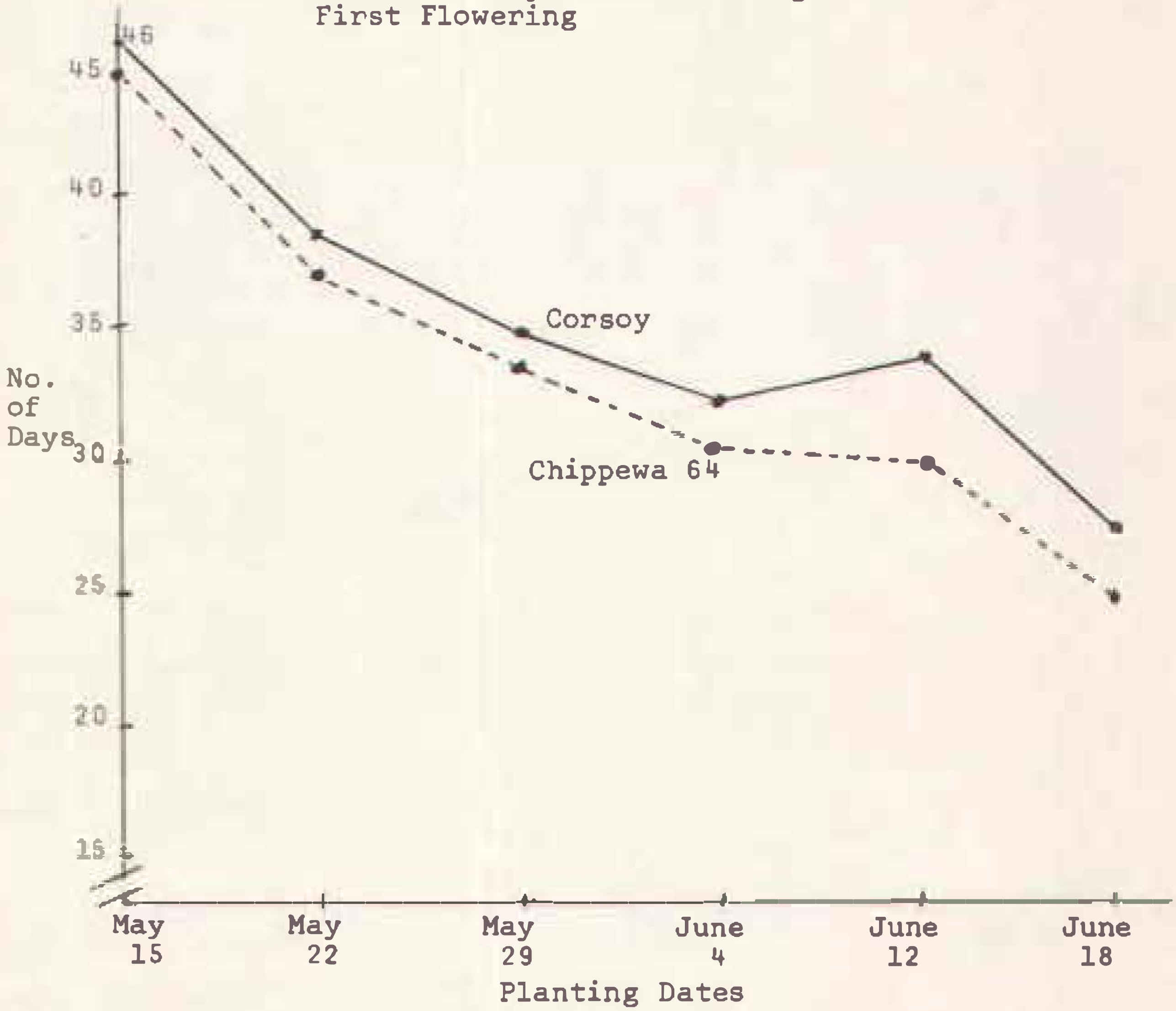


Discussion and Interpretation of Figure 6

The May 15 planting date appeared to be just a little too early for the two full season varieties, Corsoy and Wells in 1974. In 1973, the May 18 planting date yielded the most beans with full season varieties.

The two early varieties, Swift and Chippewa, did not do very well when planted early in 1974. When planting was delayed until the last of May or the first week in June, yields approached those of the full season varieties.

Figure 7. Effect of Soybean Planting Dates on Number of Days Between Emergence and First Flowering

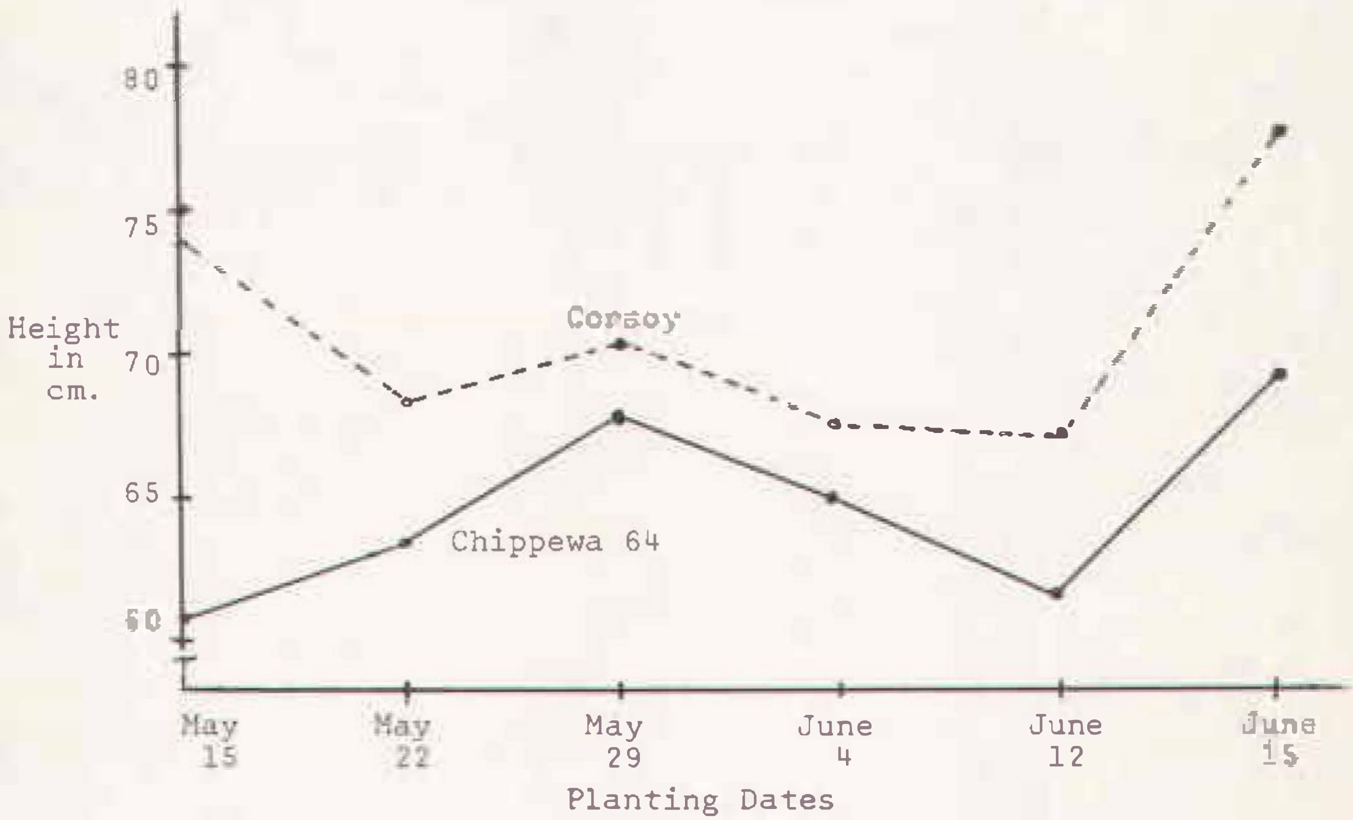


Discussion and Interpretation of Figure 7

Figure 7 shows the influence of planting dates on number of days between emergence and first flowering for two varieties: early Chippewa and full season Corsoy. Previous work suggests that planting dates should be selected to give a maximum number of days for growth in this period for each variety to obtain maximum yield. Date of flowering is controlled primarily by length of day so the only way to maximize this period is to adjust planting dates.

The greatest number of days between emergence and first flowering occurred with the earliest planting dates for both varieties but the earliest planting dates did not always result in the highest yield in 1974. With adequate moisture, results will probably be different.

Figure 8. Effect of Soybean Planting Dates on Plant Height at Maturity



Discussion and Interpretation of Figure 8

Figure 8 shows relationship of planting dates to plant height at maturity. Note how the tallest variety gave the greatest yield for most of the planting dates (Fig. 6).

If taller plants have a greater yield potential than short plants then it would be helpful to adjust planting dates to obtain the maximum growth.

In 1973, the moderately early plantings had the tallest plants and usually yielded the most beans. This relationship was not apparent in 1974 results.

SOYBEAN RESEARCH

A. O. Lunden

Soybean planting at the Research Farm included 38 Group II Regional Test entries, 18 commercial entries, 12 standard varieties and 6 advanced breeding lines. 1974 yields were about 20-25% below average and seed quality was poor for some entries because of immaturity at frost. Standard variety yields ranged only from 22 to 27 bushels per acre in spite of the fact that they included early Group I entries, median maturity Group II lines and late Group III soybeans for an overall maturity differential of nearly 3 weeks. This factor and the similarity between relative 1974 yields and long time average yield rank suggests that yield differences reflect true potential of the different entries and that the only important limiting factor was moisture. Corsoy is the best standard variety in this area, Amsoy is a high yielder but has poor seedling hypocotyl elongation and Wells and Provar are competitive while having more lodging resistance. Woodworth and Wayne were the top yielders in 1973 but were not as good in 1974 due to late maturity. Both must be considered to be very late at Beresford but Woodworth has excellent yield potential in favorable seasons. Yield summaries of all commercial entries will be distributed to all County Extension Agents by mid February.

Table 40. Soybean Yields, Southeast Farm, 1968-1974

Entry	Days to Mat.	3 Yr. Avg. Bu/A	3 Yr. Avg. Rank	6 Yr. Avg. Bu/A	6 Yr. Avg. Rank	1973	1974
Hodgson	+ 3	--	--	--	--	--	22.5
Chip-64	+ 3	27.1	10	28.7	9	26.5	22.5
Steele	+ 4	31.5	7	--	--	35.3	22.8
Rampage	+ 9	30.5	9	30.9	6	30.4	23.5
Corsoy	+10	35.5	2	35.1	1	37.6	26.9
Wells	+10	34.1	4	32.0	5	37.0	25.2
Hark	+11	30.6	8	30.5	8	31.9	23.9
Provar	+11	32.5	6	32.8	3	37.3	22.1
Amsoy	+13	34.8	3	32.8	3	39.3	25.2
Beeson	+15	33.4	5	30.9	6	41.3	21.9
Woodworth	+21	--	--	--	--	49.2	21.9
Wayne	+22	36.7	1	35.1	1	42.3	26.4
LSD		4.2		3.6		7.6	4.3

Soybean yield test plots were also planted in the Elk Point area where the test included 50 Regional Group III entries, 14 commercial entries, 11 standard varieties and 2 advanced breeding lines. 1974 yields at Elk Point were only slightly below average due to a more favorable moisture supply but full season varieties were considerably below average because of poor growing conditions in September. Woodworth is an excellent new full season variety for the Elk Point area and is more resistant to lodging than Wayne. Corsoy and Amsoy are also quite competitive in spite of their relative earliness but are also more subject to lodging and Calland is too late for any part of South Dakota.

Table 41. Soybean Yields, Elk Point, 1969-1974

Entry	Days to Mat.	3 Yr. Avg. Bu/A	3 Yr. Avg. Rank	5 Yr. Avg. Bu/A	5 Yr. Avg. Rank	1973	1974
Rampage	+ 9	37.3	11	36.0	9	37.7	35.9
Corsoy	+10	42.2	2	40.6	2	41.6	39.7
Wells	+10	40.1	7	--	-	40.8	35.8
Hark	+11	39.0	9	38.4	4	39.8	35.6
Provar	+11	38.6	10	36.7	8	43.2	30.4
Amsoy	+13	42.1	4	40.2	3	44.9	35.3
Beeson	+15	40.5	6	38.0	6	46.2	35.9
Woodworth	+21	44.4	1	--	-	45.4	37.4
Wayne	+22	42.2	2	41.1	1	44.8	36.9
Calland	+24	41.3	5	38.2	5	49.4	36.3
Williams	+25	39.8	8	37.8	7	40.0	38.2
LSD		4.4		4.0		5.9	4.5

BEANS

Paul Prashar

One of the goals of the South Dakota Agricultural Experiment Station is to seek out new crops which can be grown in the state or in a given region to increase the income of our farmers. Beans have shown a great potential in the last three years in the southeast part of the state. In 1972 and 1973, only pea beans were planted at the Southeast South Dakota Experimental Farm, and the yield obtained was very promising. In 1974, eleven varieties of beans were planted on May 23. Nine varieties were pea beans and two varieties were pinto beans. Pea beans yield less but the price per pound is higher; pinto beans yield more but the price per pound is lower.

The middle two rows of four rows were harvested on September 4. The yield data are listed in Table 42. It is difficult to draw any conclusive results from these data due to two factors. One, the weather was extremely dry and rainfall much below normal. As a result bean rows did not fill and plant size was very small. Secondly, the seed provided to us by one of our main cooperators was not

certified seed. The variety, Snowflake, spread bacterial blight to the other varieties early in the growing season and reduced their yield capabilities. Extra care should be taken in obtaining seed. It is essential that the grower should obtain only Idaho Certified Seed for beans, or yield will be tremendously reduced.

There was no insect problem on the beans, but bacterial blight was severe. None of the varieties were sprayed for disease or insects during the growing season.

Table 42. Dry Beans Variety Trial (under dry land), Centerville, South Dakota.

	Entry Name	Yield/acre lbs.
1.	Sanilac	283.7
2.	Bonus	344.6
3.	Aurora	337.8
4.	Kentwood	154.8
5.	W-5 (6R-395)	316.1
6.	W-15 (W-34)	262.2
7.	W-95-4	257.4
8.	W-122-23-7	368.2
*9.	Pinto 114	464.6
*10.	Tara (Great Northern)	549.7
11.	Snowflake	229.0

*Pinto beans

Length of rows harvested - 20 ft.
Row width - 3 ft.
Area harvested per plant - 120 ft.

RESIDUAL PHOSPHORUS - ALFALFA RESPONSE

P. L. Carson, R. C. Ward, B. Lawrensen and R. Gelderman

Objectives

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

Methods and Procedures

This experiment was established in 1964 to study the effects of various rates of phosphorus (P) fertilizer on the yield of corn. From 1964 through 1967 four rates of P (10, 20, 40, and 80 lbs. per acre of P) were broadcast and plowed down annually. No phosphorus has been broadcast on these plots since 1968. Each of

the phosphorus treatments was divided into thirds with one-third receiving about 10 lbs. of P as a starter fertilizer from 1964 through 1968, one-third receiving 10 lbs. of zinc per acre in 1964 and 1965, and one-third receiving no additional fertilizer.

This land has been cropped to various crops since 1967, such as soybeans, sorghum and oats. It is presently seeded to alfalfa. The experimental area was soil sampled in the spring of 1973. The tests for available phosphorus are reported in Table 43. These tests show the effect of the past fertilizer treatments on available phosphorus. The past fertilizer treatments result in soil tests ranging from 11.8 to 139.3 lbs. of available P/A in the surface 0-4" layer. These tests show that the added fertilizer not only influenced the 0-4" layer but also had an effect on the 4-8" and the 8-12" layers. The fact that the added fertilizer had an effect on the 8-12" layer is an indication that this land has been plowed relatively deep during seed bed preparation in the past.

Table 43. The Effect of Past Fertilizer Treatments on the Soil Test[1] for Available Phosphorus, Southeast Experiment Farm, 1974.

Averages	Sampled April 1973 Treatments, lbs. of P applied[3]				
Depth	0	40	80	160	320
	Soil test values lbs. of P per acre				
0-4"					
A[2]	11.8	26.5	40.0	59.8	121.8
B[2]	15.0	36.25	45.0	71.3	139.3
C[2]	9.8	25.3	38.0	59.3	125.5
4-8"					
A	9.0	22.0	34.8	56.8	122.5
B	12.3	36.0	41.5	77.0	134.0
C	8.5	22.3	36.8	57.3	126.5
8-12"					
A	4.3	12.5	13.0	31.8	38.8
B	6.8	18.0	13.8	26.0	43.5
C	4.8	13.3	15.5	23.3	36.8

1 Soil test used was Brays weak acid test.
2 A = No starter P.
B = 10 lbs. of P_2O_5 per year for 4 years (1964-1967).
C = Zn added at the rate of 10# of Zn per acre in 1964 and in 1965.
3 Fertilizer applied over a 4 year period at the rates of 0, 10, 20, 40 and 80 lbs. of P per year.

This portion of the experiment was started in 1973 when the experimental area was seeded with Iroquois alfalfa. It was hoped that one or more cuttings could be harvested in 1973. Dry weather made it impossible to follow through with this idea. The north two alleys were seeded with Vernal. The south two replications were seeded at a higher rate of seeding than the north two replications. Balan

was applied at the rate of 1.38# of actual material per acre to control early weeds. The Balan did not control the weeds. This was probably due to the dry weather encountered right after seeding. By June 28th the plants present varied all the way from just emerging to plants 12" high and blooming. Sweet clover, dandelions, wild oats, tan weed, lambs quarter, and pigeon grass were present. Tan weed and sweet clover were the only ones considered serious. The field was clipped to help control the weeds and to give the smaller seedlings a chance to become established.

Two crops were harvested in 1974. The samples for yield were taken by mowing a 30" x 15' area with a small sickle type mower. The hay was collected and weighed in the field. A sample was taken from each plot to determine moisture content at harvest time and to supply a plant sample for future analysis.

The first cutting was seriously infested with downy brome grass. Moisture was not overly abundant but a reasonably good supply was present. The weather turned very dry during the growth period for the second cutting. As a result, the yield was low and very few yield differences existed between treatments. The alfalfa did not make sufficient growth during the remainder of the summer to justify sampling. The growth that was present in early September was clipped and the field sprayed with Simazine to help control the downy brome grass. The alfalfa made little or no growth after this date.

Results

The yields in pounds of dry hay per acre for the two cuttings made in 1974 are shown in Table 44. These data show that the higher yields are related to a higher soil test value for available phosphorus when other growth factors are not limiting. This is illustrated by the yields for the first cutting. Moisture was a serious limiting factor during the growth of the second crop. As a result the yield variations due to the differences in available phosphorus are not as noticeable and are not great enough to be considered significant. It should be interesting to see what variations in yield would exist when a year of average to above average moisture is encountered.

Southeast Farm photo display during special Bicentennial workshop at University of South Dakota, Vermillion.

Table 44. The Effect of Levels of Available Soil Phosphorus[1] on the Yield[2] of Alfalfa Hay, Southeast Experiment Farm, 1974.

Sub-plot Treatments[4]		Soil Test Value lbs. of P/A	1st Cutting lbs. hay/A	2nd Cutting lbs. hay/A	Total
			Phosphorus added, lbs/A 0 + 0 + 0[3]		
A	Starter P	11.8	3020	1751	4772
B	Zinc	15.0	3166	1546	4712
C	0 + 0 + 0	9.8	3165	1864	5029
			0 + 40 + 0		
A	Starter P	26.5	3717	1826	5543
B	Zinc	26.3	3659	1872	5481
C	0 + 0 + 0	25.3	3514	1702	5216
			0 + 80 + 0		
A	Starter P	40.0	3862	1812	5674
B	Zinc	45.0	4211	1916	6127
C	0 + 0 + 0	38.0	4037	1628	5665
			0 + 160 + 0		
A	Starter P	59.8	4297	1886	6183
B	Zinc	71.3	4036	1832	5864
C	0 + 0 + 0	59.9	4269	1984	6253
			0 + 320 + 0		
A	Starter P	121.8	4792	1733	6525
B	Zinc	139.3	4240	1702	5942
C	0 + 0 + 0	125.5	4676	2037	6713

1 Available phosphorus as measured by the Bray #1 (weak acid) method.
2 Yield measured as lbs. of dry hay.
3 Total amount of phosphorus applied during a 4 year period.
4 A = No starter fertilizer.
B = 10 lbs. of P_2O_5 per year for 4 years (1964-1967).
C = Zinc added at the rate of 10 lbs. of Zn per acre in 1964 and 1965.

MOST PROFITABLE ROTATION

B. Lawrensen and F. Shubeck

Objectives of Experiment

1. How much will commercial fertilizer increase net profits?
2. Is it more profitable to add nitrogen from a commercial source or grow a legume in rotation?
3. Which rotation or cropping sequence will bring the greatest net cash return?
4. Will the previous crop affect the available moisture during the cropping season?

Method and Procedures

April 9, 1974 - Rotary chopped cornstalks before tillage preparations started.
April 16, 1974 - All plots for corn, soybeans, grain sorghum have been plowed.
April 18, 1974 - Oats plots seeded with John Deere press drill with the suggested fertility.
May 17, 1974 - Prepared corn plots for planting and planted same day.
May 24, 1974 - Prepared soil and planted all soybean and grain sorghum plots.

Varieties: Corn - Pioneer 3780
Oats - Froker
Alfalfa - Vernal
Soybeans - Coreoy
Grain sorghum - NK-222
Sweet clover - Madrid

May 31-July 1 - Cultivating was done as needed for grass and broadleaf weed control.
June 20 - Sidedressed with nitrogen all specified corn and grain sorghum plots.

NOTE: All crops, oats, corn, soybeans, grain sorghum harvested when mature.

Table 45. Effect of Cropping Sequence and Fertilizer on Crop Yield, 1974

Cropping Sequence	Crop Receiving Fertilizer	Fertilizer lbs/A N + P + K	N Side Dress lbs/A	Oats Bu/A	1st Year Corn Bu/A	2nd Year Corn Bu/A	Soy-beans Bu/A	Sor-ghum Bu/A	Hay Tons/A
1 Continuous corn	--	0 + 0 + 0			13.0				
1 Continuous corn	Corn	6 + 11 + 10	70		9.0				
2 Corn-oats	--	0 + 0 + 0		29.0	18.0				
2 Corn-oats	Corn	6 + 11 + 10	70		23.0				
	Oats	30 + 7 + 0		62.0					
3 Corn-corn-oats+alf-alf hay	--	0 + 0 + 0		58.0	22.0	13.0			1.1
3 Corn-corn-oats+alf-alf hay	Corn	6 + 11 + 10			22.0				
	Corn	6 + 11 + 10	70			8.0			
	Oats	15 + 26 + 0		66.0					
	Alf residual	0 + 0 + 0							1.4
4 Oats+sweet clover-corn	--	0 + 0 + 0		39.0	13.0				
4 Oats+sweet clover-corn	Oats	30 + 7 + 0		65.0					
	Corn	6 + 11 + 10			8.0				
5 Corn-soybean-oats	--	0 + 0 + 0		71.0	21.0		20.0		
5 Corn-soybean-oats	Corn	6 + 11 + 10	70		19.0				
	Soybeans	6 + 11 + 10					21.0		
	Oats	30 + 7 + 0		77.0					
6 Corn-oats-soybeans	--	0 + 0 + 0		42.0	51.0		24.0		
6 Corn-oats-soybeans	Corn	6 + 11 + 10	55		32.0				
	Oats	20 + 7 + 0		68.0					
	Soybeans	6 + 11 + 10					24.0		
7 Continuous grain sorghum	--	0 + 0 + 0						35.0	
7 Continuous grain sorghum	Sorghum	6 + 11 + 10	70					34.0	

Discussion and Interpretation of Table 45

Yields of corn in rotation were unusually low this year except for the corn that followed beans (rotation 6).

Where oats followed beans (rotation 5) yields were more favorable than in other rotations.

Sorghum yields with continuous sorghum were higher than corn in the continuous corn sequence.

GRAIN SORGHUM

A. O. Lunden

Grain sorghum plantings at the Research Farm included 14 entries from the Regional Uniform Test and 47 experimental hybrids and also included two early varieties at three dates of planting. Yields ranged to about 95 bushels per acre but bird loss was so severe in some plots that yield comparisons are meaningless. The results reveal, however, that overall yield potential was very good in spite of severe moisture stress. The date of planting test was damaged only slightly by birds and suggests that early varieties can be planted as late as June 1 to June 15 with no loss in yield. SD 104 yielded 60 bushels per acre when planted on May 20 and 65 on June 15 but only 7 bushels for planting on July 1. SD 106 yielded 55, 58 and 10, respectively, for the same dates. Greenbugs were not effectively controlled with Di-Syston at planting time in 1974 so we plan to use about 1#/acre of Thimet in 1975.

GRAIN SORGHUM PERFORMANCE TRIALS

J. J. Bonnemann

The 1974 Grain Sorghum Performance Trial included 26 proprietary and Experiment Station hybrids. The trials were seeded on May 22 and harvested on September 26. The row spacing was 30 inches. Di-Syston and Ramrod were banded at the time of seeding for insect and weed control, respectively. Grain quality was good and yields quite acceptable for the growing season of 1974. The trial mean yield was 4360 pounds per acre.

The 1974 trial results appear in Table 46. This and additional data will appear in an upcoming circular, 1974 Grain Sorghum Trials.

Table 46. 1974 Grain Sorghum Performance Trial, Area E, Southeast Experiment Farm, Beresford

Brand & Variety	Yield, lb/A	Test Wt. lb/B	Height, inches	Date Headed	Percent Moisture 9/20/74
NC+ 55X	5110	61	39	7/24	23.0
Warner W-561	4975	57	35	7/28	22.0
ACCO R 1019	4965	57	39	7/31	35.+
SDAES RS 506	4850	58	43	7/26	20.3
SDAES RS 610	4840	58	38	7/26	23.4
Northrup-King NK 180	4665	59	37	7/23	23.5
DeKalb B-35R	4575	59	37	7/27	30.5
Northrup-King NK 265	4570	60	36	7/28	34.4
DeKalb C-42A	4570	58	36	7/29	31.8
Frontier Super 400A	4515	57	35	7/27	25.6
NC+ 54X	4435	60	37	7/25	21.3
ACCO R 1014	4420	57	37	7/26	31.3
Funk's G-393	4380	60	38	7/26	28.1
Funk's G-251	4370	60	32	7/22	14.6
Pioneer 8681	4305	55	38	8/1	35.+
Warner W-55	4255	57	32	7/28	24.9
ACCO R 1029	4245	56	37	8/1	35.+
SDAES SD 451	4215	57	41	7/21	14.7
Pioneer 8600	4175	55	35	8/2	35.+
Northrup-King NK 222	4150	59	34	7/27	27.3
SDAES SD 503	4140	58	42	7/23	19.3
Funk's G-490	4065	55	36	8/1	35.+
SDAES SD 106	3855	55	35	7/21	15.5
Funk's G-399	3805	59	36	7/29	24.5
Funk's HW 3075 Ex	3790	59	35	7/31	35.+
Northrup-King NK 272	3120	53	39	8/6	35.+
Mean	4360				
CV = 8.8% LSD (.05)	625				

OATS SILAGE TONNAGE
From Observation Drill Strips

B. Lawrensen

Procedure and Discussion

During the annual field tour in June, several farmers requested that we measure silage production by the different oats varieties in the observation drill strips. It should be noted that these are not replicated plots.

All varieties were seeded April 16 with a press drill on disked soybean stubble. No fertilizer was applied because this field was already high in fertility. A sample of forage was taken at time of cutting and oven dried to determine moisture percent. Tons of silage were calculated at 65% water.

Most of the varieties had from 60 to 72 percent moisture at time of cutting. In general, silage yields were excellent. There was quite a difference in yield between oat varieties. Because of the late season drought, oats silage yields were as good or better than yields of corn silage from other fields at the Research Farm.

Table 47. Oats Silage Yields from Observation Drill Strips

Variety	% H_2O at harvest	Tons/acre at 65% H_2O
Portal	67.4	7.4
Burnett	68.2	8.4
Garland	71.9	7.0
Diana	60.4	9.1
Astro	69.6	7.5
Cayuse	67.7	7.1
Noble	69.4	7.0
Trio	62.9	8.1
MF-73	67.1	9.7
Chief	68.0	6.7
Otee	65.9	7.7
Nodaway-70	64.0	9.1
Kelsey	72.6	7.4
E-74	63.2	7.8
Holden	65.0	9.9
Dal	71.4	7.7
Grundy	61.6	7.9
SD-955	68.2	8.2
Froker	67.3	8.2

EFFECT OF FERTILIZERS ON YIELDS OF FIVE SPRING WHEAT VARIETIES

Robert Pylman, Ray Ward, Paul Carson,
Fred Shubeck and Ron Gelderman

Objectives of Experiment

1. Determine the effect of rates of nitrogen, phosphorus and potassium fertilizers on the yield of five varieties of Spring Wheat.
2. Determine any relationship one of the elements may have to another in influencing the yield of the wheat.
3. Determine optimum rates of fertilizer addition in relation to soil tests.

Procedure

1. This experiment was one of a series of six located throughout northern and eastern South Dakota in 1974.
2. Soil. The experiment was located on a Badus silty clay loam. Badus soils are glacial till soils that occupy flats and shallow basins that are somewhat poorly drained. This site was a flat rather than a shallow basin. The tests on the soil samples taken when the experiment was established are shown in Table 48. These tests indicate that the nitrate-nitrogen was present in relatively large amounts, the available phosphorus is considered low, exchangeable potassium is high, pH (7.3) is slightly alkaline and that the soluble salt content is higher than normally found in a well drained soil. The sodium content does not place this soil in a high sodium risk category.
3. The field had been in soybeans in 1973 and the seed bed was prepared by disking.
4. The field was seeded on April 26th with a pony press drill equipped with a divider that evenly distributed the seed and fertilizer for each row.
5. The experimental designs used was a composite having five rates of nitrogen, five rates of P_2O_5 and five rates of K_2O. Through the use of statistical comparisons the number of fertilizer treatments was reduced to 23 per variety.
6. The fertilizer treatments used are listed in Table 49.
7. The varieties used and some of their characteristics are designated in Table 50.
8. The plots were sprayed with 2,4-D to control broadleaf weeds. Some chemical damage occurred on a few wheat plots due to spray drift from an adjacent experiment.
9. The plots were harvested on August 6th with a small self-propelled plot combine.
10. Soil samples from two treatments were taken at harvest time to a depth of 4 feet to determine the amount of moisture and the nitrate-nitrogen in the soil after producing a crop.

Table 48. Tests on Soil Samples from the Wheat Experiment, Southeast Experiment Farm, 1974[1]

Depth in inches	NO_3-N ppm	NO_3-N lbs/A	O.M. %	Phosphorus lbs/A	Potassium lbs/A	pH 1:1	Salts mmhos/cm	Soluble Na me/L
0 - 6	42.3	76.1	3.9	11.8	833	7.3	6.70	21.3
6 - 12	29.3	52.7	2.9	4.5	703	7.4	5.25	13.6
12 - 24	11.2	40.3	1.7	1.5	543	7.6	5.60	14.2
24 - 36	10.6	38.0	1.0	1.0	468	7.9	4.80	10.0
36 - 48	7.6	27.4	0.5	1.0	415	8.0	4.47	8.3

[1] Average of 4 holes for the 6-48 inch depths, a composite of not less than 20 small samples were used for the 0-6 inch layer.

Table 49. Fertilizer Treatments Applied on Wheat

Treatment No.	Identification	N	P_2O_5	K_2O
		lbs/A		
1	$N_2P_2K_2$	40	17	6
2	$N_2P_2K_4$	40	17	18
3	$N_2P_4K_2$	40	52	6
4	$N_2P_4K_4$	40	52	18
5	$N_4P_2K_2$	120	17	6
6	$N_4P_2K_4$	120	17	18
7	$N_4P_4K_2$	120	52	6
8	$N_4P_4K_4$	120	52	18
9	$N_3P_3K_3$	80	35	12
10	$N_1P_3K_3$	0	35	12
11	$N_5P_3K_3$	160	35	12
12	$N_3P_1K_3$	80	0	12
13	$N_3P_5K_3$	80	69	12
14	$N_3P_3K_1$	80	35	0
15	$N_3P_3K_5$	80	35	24
16	$N_1P_1K_5$	0	0	24
17	$N_1P_5K_1$	0	69	0
18	$N_1P_5K_5$	0	69	24
19	$N_5P_1K_1$	160	0	0
20	$N_5P_1K_5$	160	0	24
21	$N_5P_5K_1$	160	69	0
22	$N_5P_5K_5$	160	69	24
23	$N_1P_1K_1$	0	0	0

Table 50. Wheat Varieties Used in Fertilizer Study and Their Characteristics

Variety	Name	Awns	Strength of Straw	Light Sensitivity	Maturity*
A	Era	Yes	Short	Intermediate	4
B	WS 1809	No	Short	Not sensitive	1
C	Bounty 208	Yes	Short	Not sensitive**	1
D	Waldron	No	Tall but stiff	Intermediate	2
E	Chris	No	Tall	Sensitive	3

* Number 1 is earliest, a year of high moisture (long season) 7-9 days between; extreme hot and dry year 2-4 days between extremes.

** Cloudy weather insensitive will keep growing.

Results

Yield results are presented in Tables 51, 52 and 53. Treatments have been combined to show the response to each element. Table 51 shows yield response of five varities of wheat to five levels of added nitrogen. The effects of the rates of added nitrogen on the yield can be partially evaluated by looking at the average of each rate for all varieties. This shows that increasing the rate of added nitrogen caused a small decrease in yield at this site. A yield increase from added nitrogen was not expected because of the large amount of nitrate-nitrogen found in the soil profile at planting time and the fact that the wheat was planted on soybean ground. The yields of WS 1809 and Bounty 208 appear to have been increased a small amount from the added nitrogen. The other varieties show either no consistent advantage to the added nitrogen or a small reduction in yield.

The effects of added phosphorus are shown in Table 52. The effect of rates of added P_2O_5 on the yield can be partially evaluated by averaging each rate for all varieties. These results show a yield increase from the addition of phosphorus, but that the lower rates of phosphorus application were just as effective as the higher rates. Bounty 208 and Waldron show greater yield increases from added phosphorus than the other varieties. WS 1809 and Era show no consistent response to added phosphorus. A yield increase from added phosphorus was expected because of the low soil test for available phosphorus.

Table 53 shows the effects of added K_2O on the yields of the wheat. The averages of the treatments show that added potassium did not increase the yield. Individual varieties show no consistent advantage to added potassium.

Table 51. Effects of Applied Nitrogen on Yields of Five Spring Wheat Varieties Grown at the Southeast Experiment Farm, Beresford, 1974.

Nitrogen lbs/A	Era	WS1809	Bounty 208	Waldron	Chris	Average
0	45.1	44.4	42.9	47.0	46.1	45.1
40	44.5	47.2	45.2	41.8	41.7	44.1
80	47.9	47.5	44.5	45.4	40.5	45.1
120	45.5	45.1	40.8	45.6	41.1	43.7
160	45.2	45.5	43.2	45.7	38.9	43.7
Average	45.6	45.9	43.3	45.1	41.7	

Table 52. Effects of Applied Phosphorus on the Yields of Five Spring Wheat Varieties Grown at the Southeast Experiment Farm, Beresford, 1974.

P_2O_5 lbs/A	Era	WS1809	Bounty 208	Waldron	Chris	Average
0	46.3	46.1	41.8	45.7	39.7	43.9
17	44.6	45.3	43.8	43.8	43.8	44.3
35	47.4	45.0	44.3	46.7	42.2	45.1
52	45.4	47.0	42.1	48.6	39.1	44.4
69	49.4	46.4	44.5	46.5	39.5	45.3
Average	46.6	46.0	43.3	46.3	40.9	

Table 53. Effects of Applied Potassium on Yields of Five Spring Wheat Varieties Grown at the Southeast Experiment Farm, Beresford, 1974.

K_2O lbs/A	Era	WS1809	Bounty 208	Waldron	Chris	Average
0	46.5	45.8	43.7	46.7	40.3	44.6
6	43.6	46.7	40.5	47.9	41.4	44.0
12	49.2	46.5	43.2	47.7	40.9	45.5
18	46.5	45.6	45.4	44.5	41.5	44.7
24	47.5	45.3	43.7	43.6	41.0	44.0
Average	46.7	46.0	46.0	45.3	40.8	45.0

The effect of the fertilizer on the growth of the crop and utilization of moisture present was determined by taking moisture samples at the beginning and at the end of the growing season. The check plot and the 160+69+24 treatments on the variety WS1809 were sampled. These results show no practical difference (0.11 of an inch less) in the amount of water used by the fertilized as compared to the non-fertilized wheat. The check yield was 45 bu/A while that produced by the 160+69+24 was 41 bu/A.

The lack of yield increase from added nitrogen further emphasizes that when an adequate supply of nitrate-nitrogen is already in the soil that added nitrogen fertilizer does not increase the yield and does increase the cost of production. The phosphorus soil tests were low. These treatments further show that the major yield increase occurred with the lowest rate of application in 1974. The addition of potassium had very little, if any, effect on the yield of the wheats. The yields of the semi-dwarf wheats were a little higher than the conventional varieties.

STANDARD VARIETY SMALL GRAIN TRIALS

J. J. Bonnemann

With increasing prices, especially for wheat, interest was expressed for having additional small grain rod-row trials at the farm again in 1974. Spring wheat and barley were again seeded and the oat trials were continued as in prior years.

The trials were seeded on April 18. Yields were not as poor as might be anticipated with the growing season of 1974. The maturity of the entry was a major factor in the performance of a variety. If the plants were flowering at the time when several days of extremely warm temperatures occurred accompanied by high velocity winds, fertilization and seed set were seriously affected.

The data included in this report are bushel weight, test weight and available three-year averages. The results appear in Tables 54, 55 and 56.

Table 54. 1974 Standard Variety Oat Trial Yields, Southeast Experiment Farm, Beresford

Variety	1972	1973	1974	3 Yr. Av.	T.W.
Dupree	76.5	83.2	81.3	80.3	32
Burnett	69.4	97.9	69.4	78.6	31
Garland		87.5	85.6		31
Lodi	69.2	86.7	61.2	72.4	26
Trio	88.9	91.9	68.4	83.1	32
Diana	84.2	83.9	89.4	85.8	31
Holden	60.6	84.7	82.4	75.9	29
Portal	72.2	87.6	72.7	77.5	32
Kelsey	75.9	103.8	68.5	82.7	30
Cayuse	66.4	104.0	71.8	80.7	24
Otter	60.9	89.3	82.1	77.4	30
Nodaway 70	83.1	89.5	80.0	84.2	34
Froker	86.8	91.8	72.9	83.8	29
Grundy	83.9	77.0	90.2	83.7	32
Chief	81.9	85.6	81.1	82.9	30
Random	60.1	94.2	72.2	75.5	24
Otee	80.3	83.6	84.7	82.9	32
Dal	79.6	81.2	68.2	76.3	29
Astro		96.6	75.2		28
Noble		90.7	88.2		29
Stout		88.2	89.2		31
Goodland			56.0		30
M-73		82.1	64.2		31
Hudson			59.2		23
SD 955 (Spear)	90.9	90.3	87.4	89.5	31
Mean, B/A			75.5		
CV-%			9.9		
LSD (.05)			10.5		

Table 55. 1974 Standard Variety Spring Wheat Trial, Southeast Experiment Farm, Beresford

Variety	1974	T.W.
Standard Height		
Thatcher	22.0	52
Sheridan	32.6	56
Fortuna	32.7	57
Chris	34.1	56
Polk	33.4	58
Waldron	36.2	54
Tioga	28.0	55
Ellar	34.4	53
Nowesta	34.2	53
Nordek	29.0	56
BW 25	33.0	58
Semi-dwarf		
Era	36.3	54
Bonanza	39.9	56
WS 1809	45.0	58
Bounty 208	38.5	57
Lark	36.1	56
Olaf	39.6	55
WS 3	38.7	57
WS 6	32.2	49
MP 19	42.1	57
Protor	40.2	57
Prodax	32.8	50
Cargill 309	34.5	51
Funk's W-433	39.1	57
Durum		
Wells	37.6	57
Leeds	40.2	61
Hercules	34.8	57
Wascana	32.5	56
Rolette	35.3	59
Ward	40.3	57
Crosby	32.2	56
Botno	45.6	58
Rugby	37.0	57
Mean, B/A	34.3	
CV-%	11.1	
LSD (.05)	6.1	

Table 56. 1974 Standard Variety Barley Trial, Southeast Experiment Farm, Beresford

Variety	1974	T.W.
Liberty	58.1	42
Firlbecks III	42.4	42
Larker	68.9	45
Cree	51.7	40
Conquest	63.7	42
Primus II	63.7	45
Bonanza	52.5	39
Burk	63.0	43
Prilar	62.0	44
Beacon	53.0	40
Manker	56.5	42
Mean, B/A	56.7	
CV-%	9.9	
LSD (.05)	8.0	

THE EFFECTS OF FEED ADDITIVES IN SWINE DIETS

Richard C. Wahlstrom, George W. Libal and Alan Vogel

In a previous experiment reported in the SESD Experiment Farm Thirteenth Annual Progress Report (1973) we found that several different feed additives were effective in increasing gains and improving feed/gain ratio when fed for 35 days during early growth. Withdrawal of these compounds during the subsequent finishing period of 84 days resulted in performance similar to that of pigs fed the control (unsupplemented) diet throughout the trial. Antibiotic supplementation during the finishing period resulted in slightly increased gains and significantly improved feed conversion.

This experiment was conducted exactly as the previous one to obtain further data on the effectiveness of feed additives fed for a 5-week period, the effect of withdrawal of feed additives after 5 weeks on future performance and the effect of the antibiotic tylosin when fed during the finishing period.

Experimental Procedure

Ninety pigs were allotted to three replications of five treatments for the initial 5-week study. Each of the 15 lots consisted of three barrows and three gilts. Initial weights varied among replicates and were approximately 40, 31 and 25 lb. for replicates 1, 2 and 3, respectively. The pigs were housed in a total confinement building in pens 5 feet by 16 feet in which self-feeders and automatic waterers were located.

The composition of the basal diets is shown in Table 57. The feed additives included in the basal diet for the five treatments were as follows:

1. No additive (control)
2. 50 g Mecadox per ton
3. 100 g furazolidone (Furox) per ton
4. 100 g furazolidone, 100 g oxytetracycline and 90 g arsanilic (FOA) per ton
5. 100 g chlortetracycline, 100 g sulfamethazine and 50 g penicillin (ASP-250) per ton

After 5 weeks on the above diets, the pigs were reallotted from the three replicate lots of six pigs within treatments to two replicate lots of six to eight pigs each. Because of a loss of some pigs and poor performance of others, several pigs were removed from the original 18 per treatment group and it was not possible to equalize numbers during the finishing phase. One lot of pigs from each of the five previous treatments was fed the basal diet and the other lot received the basal diet supplemented with 20 g of tylosin per ton of diet. This part of the experiment was conducted for 70 days. The pigs averaged 79 lb. at the beginning of this phase and 185 lb. at termination.

Results

The growth performance during the initial 5-week period is summarized in Table 58. The data are presented for each replicate to show differences observed due to differences in initial weights. There were significant (P<.025) differences in average daily gain, with pigs fed Furox, FOA or ASP-250 gaining from 14 to 20% faster than pigs fed Mecadox or the unsupplemented control diet. Significant (P<.01) differences were also observed in rate of gain between replicates, as the heavier pigs grew at the fastest rate. Rates of gain for the 5-week period were 1.41, 1.32 and 1.00 lb. per day for pigs having initial weights of 40, 31 and 25 lb., respectively. The gains obtained in this trial were similar to those of the previous trial except that in 1973 pigs fed Mecadox also gained at a faster rate than the control pigs.

Feed required per unit of gain was significantly (P<.05) different among treatments. Pigs receiving Furox, FOA and ASP-250 required 2.15, 2.13 and 2.11 lb. of feed per lb. of gain, respectively, compared to 2.36 and 2.43 lb. for pigs fed Mecadox and the control diet. Initial weight had no effect on feed/gain ratio. There were significant (P<.01) differences among replicates for daily feed consumption. Heavier pigs consumed more feed than lighter pigs.

Table 59 summarizes the results of the second phase of this experiment involving feeding tylosin to pigs that had previously been fed the feed additives as discussed above. Differences in daily gains were not significant, although pigs fed tylosin gained 0.08 lb. per day more than pigs fed the basal diet. Pigs fed the control diet during the initial 5-week period showed a greater response to tylosin in the finishing period than did pigs fed the various additives in the early growth period. In this trial there did appear to be a carry-over effect from feed additives during early growth. Pigs fed the basal finishing diet gained from 11 to 20% faster during this period if they had been fed one of the feed additives previously when compared to pigs previously fed the control diet.

Feed/gain ratios were quite variable during the finishing period but did not differ significantly among treatments. It is difficult to explain the reason for the poor feed efficiency of pigs fed tylosin that had previously been fed FOA. It is possible that this difference may be due, at least in part, to greater feed wastage in this lot.

Summary

Ninety weanling pigs were used in an experiment to study the effects of feeding Mecadox, furazolidone, a furazolidone-oxytetracycline-arsanilic acid mixture and a chlortetracycline-sulfamethazine-penicillin mixture for 5 weeks. After the 5-week study the pigs were reallotted to study the effect of the previous treatment on the response of pigs to tylosin. The experiment was terminated when pigs averaged 185 lb. 70 days after the end of the initial 5-week study.

Significant improvements in gain and feed/gain ratio were observed during the 5-week period when diets contained furazolidone and the two feed additive combinations. There were no significant effects due to feeding tylosin during the finishing phase. A greater response to tylosin was obtained if the pigs had not been fed a feed additive during the early growth period. There appeared to be a carry-over effect from feed additives during the withdrawal period.

Table 57. Composition of Basal Diets (Percent)

	First 5 weeks	5 wk. to 125 lb.	125 to 185 lb.
Ground yellow corn	76.5	82.5	88.7
Soybean meal (44%)	20.7	14.8	8.9
Dicalcium phosphate	1.6	1.5	1.2
Ground limestone	0.5	0.5	0.5
Trace mineral salt (0.8% zinc)	0.5	0.5	0.5
Vitamin premix[a]	0.2	0.2	0.2

[a] Provided per lb. of diet: vitamin A, 1500 IU; vitamin D, 200 IU; riboflavin, 1.25 mg; pantothenic acid, 5 mg; niacin, 10 mg; choline, 50 mg and vitamin B_{12}, 7.5 micrograms.

Table 58. Growth Performance of Pigs Fed Feed Additives For a Five-Week Period[a]

	Control	Mecadox	Furox	FOA	ASP-250	Replicate average
			Average Daily Gain, Lb.[b]			
Rep 1	1.33	1.39	1.39	1.50	1.45	1.41
Rep 2	1.15	1.20	1.40	1.46	1.43	1.32
Rep 3	0.93	0.76	1.09	1.01	1.21	1.00
Avg.	1.14	1.12	1.30	1.32	1.36	
			Avg. Daily Feed Consumed, Lb.[c]			
Rep 1	3.30	3.13	3.11	3.35	3.11	3.20
Rep 2	2.69	2.72	2.83	2.85	3.08	2.83
Rep 3	2.31	1.94	2.30	2.21	2.45	2.24
Avg.	2.77	2.60	2.74	2.79	2.88	
			Feed/Gain[d]			
Rep 1	2.48	2.25	2.10	2.24	2.15	2.24
Rep 2	2.34	2.28	2.25	1.96	2.15	2.20
Rep 3	2.47	2.54	2.11	2.18	2.03	2.27
Avg.	2.43	2.36	2.15	2.13	2.11	

[a] Six pigs per lot; avg. initial weight, 40, 31 and 25 lb. for replicates 1, 2 and 3, respectively.
[b] Significant treatment (P<.025) and replicate (P<.005) differences.
[c] Significant replicate (P<.005) differences.
[d] Significant treatment (P<.05) differences.

Table 59. Effect of Tylosin on Growth Performance of Pigs[a]

	Control	Mecadox	Furox	FOA	ASP-250	Replicate average
			Average Daily Gain, Lb.			
Basal	1.30	1.44	1.50	1.57	1.57	1.47
Tylosin	1.63	1.55	1.64	1.47	1.48	1.55
Average	1.46	1.49	1.57	1.52	1.52	
			Average Daily Feed Consumed, Lb.			
Basal	4.66	5.71	5.23	5.17	5.16	5.19
Tylosin	5.14	5.86	5.29	6.01	4.86	5.43
Average	4.90	5.78	5.26	5.60	5.01	
			Feed/Gain			
Basal	3.59	3.79	3.43	3.32	3.29	3.50
Tylosin	3.17	3.80	3.22	4.06	3.28	3.51
Average	3.38	3.80	3.33	3.69	3.29	

[a] Six to eight pigs per lot; avg. initial wt., 79 lb.; avg. final wt., 185 pounds.

ANIMAL WASTE MANAGEMENT

Maurice L. Horton, Fred Shubeck, John L. Wiersma, Alan Vogel,
Albert Dittman, James L. Halbeisen and Ron Beyer

The animal waste management experiment involving salt levels in beef rations, waste disposal rates, crop yields, and runoff was continued during 1974. Considerable interest has been expressed by livestock feeders and farmers in the crop yields and application rates.

The feedlot consisted of 16 concrete surfaced pens with 10-11 beef steers per pen. Eight of the pens were located in a cold confinement shelter and eight of the pens were located in the open environment. The test animals were fed a ration which included four levels of added salt (NaCl), 0.0%, 0.25%, 0.50%, and 0.75% of the ration on a dry-weight basis.

The wastes (solids plus liquids) produced by the steers were collected and applied to field plots at rates up to 80 tons per acre on a dry-weight basis. Applied wastes were incorporated by chisel plow at or near time of application. All disposal plots were plowed and disced prior to planting.

The field plots were planted to Funks G-4252 corn at a population of approximately 19,000 plants per acre on May 24, 1974. Leaf samples were taken from the growing plants on July 30, 1974, for chemical analyses. A portion of each plot was harvested for silage on September 9, 1974, and a portion harvested for grain on September 18.

Soil samples were taken by power probe from each plot in May and October. Chemical analyses have been performed by the Soil Testing Lab and the Water Quality Lab on the SDSU campus.

Half of the field plots were instrumented with recorders and samplers to collect runoff data. Both quantity and quality of the water from each runoff plot can be determined. The runoff equipment was installed in mid-April and kept serviced and functional until mid-November.

Partial results are reported below under the following headings:

I. Waste Amount, Characteristics, and Field Application Rate
II. Plant Analyses
III. Silage and Grain Yields
IV. Soil Effects
V. Runoff

I. Waste Amount, Characteristics, and Field Application Rates.

The amount of manure produced by the test animals was low in comparison with values given in waste management literature. The daily waste production per animal was estimated at 6 to 10 lbs. of dry matter. The actual wastes produced were approximately 4 to 6 lbs. per head per day. Since the wastes produced were approximately 80 to 85% water content, the daily amounts of wet wastes produced were 20 to 40 lbs. per head. As anticipated, the amount of wastes produced increases as the roughage content of the ration is increased.

The nitrogen content of wastes removed from the feedlot was generally 3 to 4% with the higher nitrogen content associated with a higher concentrate ration.

The sodium content of the wastes increased from approximately 0.5% with no salt added to the ration to approximately 1.5% where the ration contained 0.75% added salt (NaCl).

Table 60 gives a brief summary of the actual rates of wastes applied to field plots. Application of wastes began in October 1973 and continued until May 1974. The wastes were applied by conventional tailgate spreaders, except when the wastes became too liquid to handle in this manner a tank spreader for slurry wastes was used.

Table 60. Final Waste Application Rates (dry weight).

Proposed Rate	Salt Level	Range	Average
		tons/acre	
20	Low	15.15 - 19.98	17.25
20	High	8.15 - 19.81	12.02
40	Low	43.07 - 50.65	45.30
40	High	32.23 - 44.59	37.95
60	Low	55.80 - 65.66	60.38
60	High	50.92 - 55.72	53.44
80	Low	73.97 - 78.69	75.70
80	High	69.63 - 88.72	77.10

II. Plant Analyses.

Animal wastes when applied at high rates to cropland may cause an imbalance of nutrients. Corn grown on soil where greater than 8 tons per acre of wastes were applied has been reported in the literature to contain a large potassium to magnesium ratio. Silage from such corn may cause a condition called "grass tetany" when fed to beef cattle.

Leaf samples were collected from all plots by removing the leaf opposite and below ears which showed white silks. The leaf samples were analyzed by spark-emission spectroscopy for a number of elements. The chemical analyses could indicate plant uptake and nutrient imbalances.

The leaf sample analyses showed no increase in potassium content as waste application rates increased; however, the magnesium content did decrease with increasing waste application rates. Further examination of silage samples from waste disposal plots will be necessary to determine if a "grass tetany" hazard exists.

III. Silage and Grain Yields.

Silage and ear corn yields were taken in September 1974 and the results are given in Table 61.

Although the yields are quite variable, two important points emerge from the data. It appears that waste application influences silage yield and ear corn differently. Silage yield dropped distinctly at most applications greater than 45 tons per acre, while the ear corn yield remained fairly constant as the application rate increased. Also, the time of waste application in relation to planting date has a direct influence on the silage yield and may affect ear corn yield. Plots receiving large quantities of waste just prior to planting yielded less than plots receiving waste earlier in the season.

Table 61. Silage and Ear Corn Yields.

Average Rate t/a	Salt Level	Ear corn at 15.5% moisture bu/a		Silage at 70.0% moisture t/a	
		Range	Average	Range	Average
Check		23.44-52.73	45.01	5.92-12.62	8.14
17.25	Low	44.26-82.68	63.43	11.56-13.63	12.61
12.02	High	21.36-69.03	40.54	9.03-11.44	10.08
45.30	Low	63.22-81.56	71.64	5.86-16.91	11.21
37.95	High	55.96-77.83	62.64	9.74-12.75	11.70
60.38	Low	51.11-70.69	60.65	5.12-12.04	8.90
53.44	High	53.31-95.04	70.11	9.21-11.53	9.94
75.70	Low	64.51-79.78	71.48	10.50-12.59	11.42
77.10	High	26.96-81.15	61.94	8.58-10.63	9.48

IV. Soil Effects.

Due to the less than normal rainfall, the nutrients applied in the animal wastes have remained in the surface foot of soil except for nutrients removed in the crop. Soil samples show little or no change in the chemical nature of the soil below one foot during the first year.

Concern for the dispersion effect of the wastes on the soil will necessitate additional tests on the soil which are not yet complete. A change over time in the dispersion ratio computed from cation analyses should indicate the effect of the applied wastes.

V. Runoff

No runoff was recorded from the field plots during the period April-November 1974. The runoff instruments were removed from the field in November due to cold weather. The runoff equipment will be installed again in the spring as soon as weather permits.

Animal Waste Management Research. (Top, left) Checking runoff instrumentation in the laboratory. (Top, right) Runoff instruments installed in the field. (Center, right) Differences appearing during season. (Center, left) Discussing the research during Field Day. (Bottom, right) Newly designed cattle pens used in the animal waste research.

THE SOUTHEAST SOUTH DAKOTA EXPERIMENT FARM CORPORATION

BOARD OF DIRECTORS

Members	County	Address
Sidney Abild, President	Clay	Wakonda
Lloyd Overgaard, Vice President	Turner	Centerville
Vane Miller, Secretary	Yankton	Yankton
Ercil Bowles, Treasurer	Lincoln	Centerville
Leon Jorgenson	Turner	Freeman
Leonard Dailey	Union	Jefferson
Earl Rames	Hutchinson	Menno
Ervin Cleland	Clay	Vermillion
William DeJong	Yankton	Volin
Allan Rasmussen	Charles Mix	Platte
Wesley Larsen	Union	Beresford
Eric Thormodsgaard	Lincoln	Hudson
Stanley Jensen	Lincoln	Beresford

THE COOPERATIVE EXTENSION SERVICE

Delwyn Dearborn, Dean

Hollis D. Hall, Director

COUNTY EXTENSION AGENTS OF THE SOUTHEAST AREA

County	Agent	Address
Bonne Homme	Donald Boone	Tyndall
Charles Mix	Arnold Rieckman	Lake Andes
Clay	Bob Schurrer	Vermillion
Douglas	Norman Telkamp	Armour
Hutchinson	Leroy Johnke	Olivet
Lincoln	Larry Tidemann, John Hansen	Canton
Turner	Merlin Pietz	Parker
Union	Louie DeSmet	Elk Point
Yankton	Vane Miller	Yankton

District III Supervisor

Kenneth Ostroot, Cooperative Extension Service

Brookings, South Dakota