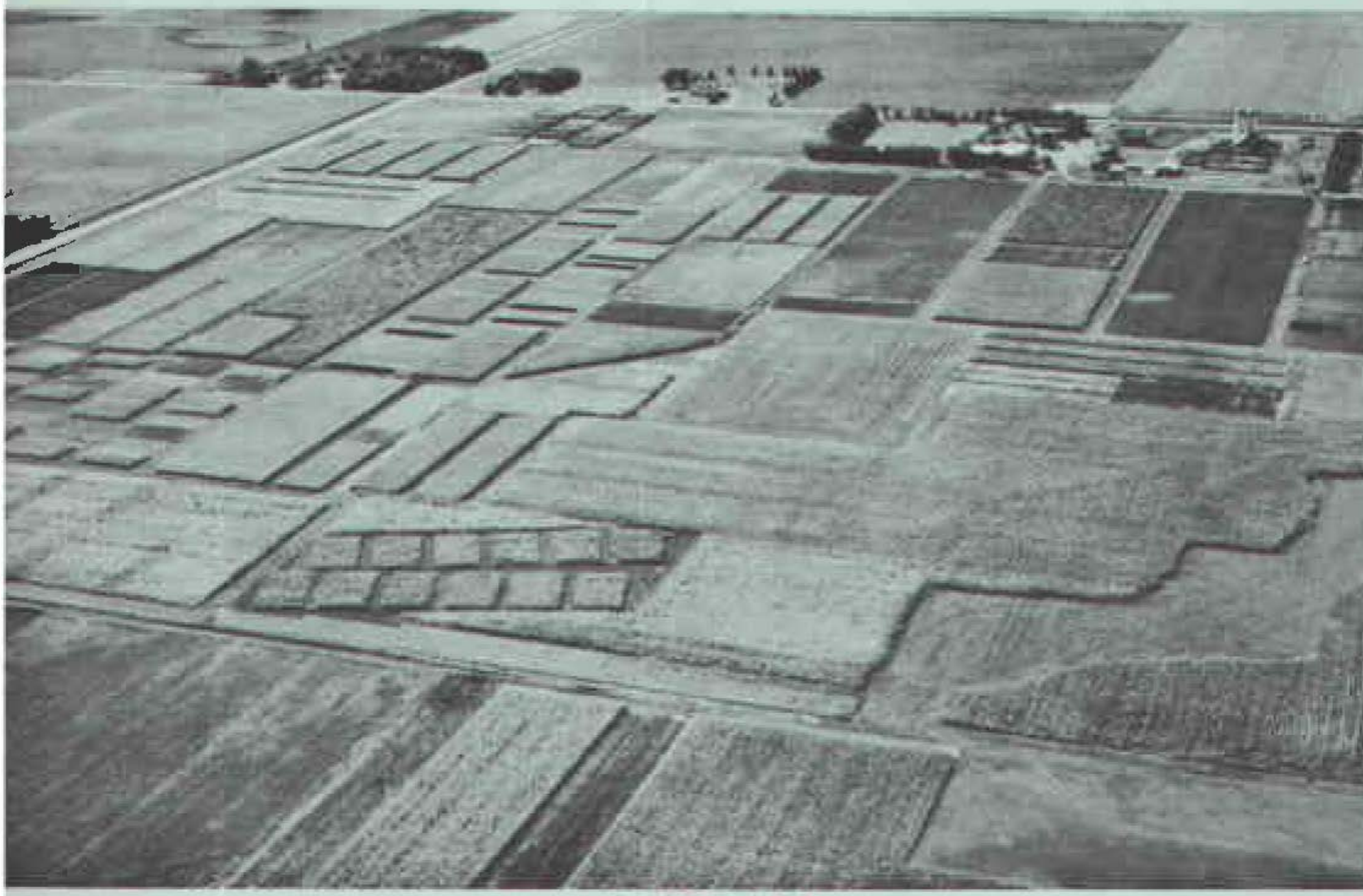
NINTH ANNUAL PROGRESS REPORT

DECEMBER 1969

SOUTHEAST SOUTH DAKOTA EXPERIMENT FARM

NEAR CENTERVILLE, SOUTH DAKOTA



Agricultural Experiment Station
South Dakota State University
Brookings

NINTH ANNUAL PROGRESS REPORT
SOUTHEAST SOUTH DAKOTA EXPERIMENT FARM

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This ninth annual report of the research program at the Southeast South Dakota Experiment Farm has special significance for those engaged in agriculture and the agriculturally related businesses in the nine county area of southeast South Dakota. The results shown are not necessarily complete or conclusive. Interpretations given are tenative because additional data resulting from continuation of these experiments may result in conclusions different from those based on any one year. Trade names are used in this publication merely to provide specific information. A trade name quoted here does not constitute a guarantee or warranty and does not signify that the product is approved to the exclusion of other comparable products.

SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION
BROOKINGS, SOUTH DAKOTA 57006

Duane Acker, Director | A. L. Musson, Assoc. Director

INTRODUCTION -- J. F. Fredrikson

This publication is a summary of the ninth year of research at S.E.S.D. Experiment Farm.

Some physical changes have taken place in the farmstead this year: Three buildings, that had become obsolete and beyond repair, were removed. All remaining buildings and fences were painted. The farm home retains the traditional white, while all other buildings and fences are McCrory green. A pole type hay shed, measuring 36 ft. by 84 ft. was built and financed by the S.E.S.D. Experiment Farm Association. This is located north of the cattle barn, midway between the barn and shelter belt.

When research was started on this farm in 1961, the south quarter was plotted to contain all agronomic plots. In the past 5 years expansion of research has brought about a need for larger experiment sites, and some agronomic studies have been moved to the north quarter. Grain and hay raised on the north quarter, as well as surplus grain from the agronomy plots and filler areas, were used for feed in the livestock research program.

Production of grain and forage in 1969 was: (determined by weighing at time of harvest)

Corn Silage: 317 T	Alfalfa Hay: 60 T
Alfalfa Haylage: 115 T	Ear Corn: 11,700 bu.

All corn on the north quarter was fertilized as recommended by S.D.S.U. soils testing laboratory. Seventy-two acres of the corn were side dressed soon after emergence; anhydrous ammonia was used at the rate of 100 lbs. N per acre. The other 52 acres of corn were fertilized with ammonium nitrate and superphosphate at the rate of 100 lbs. N and 46 lbs. P_2O_5 per acre plowed down in the spring.

Table 1 is a summary of precipitation and temperature data for 1969. This information is compiled at the research farm by the official weather observer for this area.

Distinctive environmental factors during the 1969 growing season had direct influences upon yields and performance of crops in some research trials. On June 21, a hail storm passed through this area. The combination of hail damage and subsequent army worm infestation required that most of the small grain plots be abandoned. Soybeans were damaged by hail enough that replanting became necessary in some trials. The hail damage to corn and sorghum resulted in shredding of leaves and breaking over of some stalks. However, regrowth and recovery of corn and sorghum after the hail was excellent. This is reflected in yields reported in this publication.

On June 25, State University staff members called an emergency meeting for the benefit of area farmers, to discuss the problems related to hail damage. About 20 farmers attended this meeting.

On July 19, army worms were found and identified on the farm and on neighboring farms. This outbreak coincided with the appearance of army worms over a wide area in eastern South Dakota. Because hail damaged small grain fields and resulting regrowth became ideal hatching areas, they were sprayed

as a method of control. Also sprayed were roadways, drive-ways and edges of corn fields adjacent to the hatching areas. Sevin was sprayed at the recommended rate and gave excellent control. Except for a small area of corn left unsprayed as a demonstration, no yield reduction was experienced from army worm damage.

TABLE 1. PRECIPITATION AND TEMPERATURE AT SOUTHEAST FARM, 1969

Month	Rainfall in inches	17 yr. Ave.	Departure	Ave. Temp. (F)	17 yr. Ave.	Departure
Dec. 68	1.61	0.68	+0.93	17.9	23.2	-5.3
Jan. 69	1.56	0.45	+1.11	10.5	17.1	-6.6
Feb.	5.52	1.46	+4.06	21.7	24.7	-3.0
March	1.94	1.35	+0.59	22.1	29.9	-7.8
April	0.24	2.57	-2.33	50.1	46.4	+3.7
May	3.13	3.21	-0.08	62.5	51.0	+1.5
June	4.11	4.17	-0.06	64.6	65.9	-1.3
July	4.64	3.23	+1.41	74.5	75.3	-0.8
Aug.	3.94	2.95	+0.99	72.5	70.7	+1.8
Sept.	1.26	2.85	-1.59	64.2	53.4	+0.8
Oct.	3.01	1.52	+1.49	45.3	54.4	-9.1
Nov.	0.48	0.88	-0.40	33.6	36.4	-2.8
Total	31.44	25.32	+6.12	Ave. 44.9	47.4	-2.5

Frost free days: May 20 to Oct. 8 - 141 days.

CORN POPULATIONS AND ROW SPACING

-- F. Shubeck and B. Lawrensen

Objectives of Experiment

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

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

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

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

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

6. Will an erect leaf hybrid perform better than an arched leaf hybrid at higher populations and narrow rows?

Methods and Procedures Used in Corn Row Spacing Experiment

Oct. 8 - Fertiliized plot with 154 lbs. of N; 28 lbs. of P and 33 lbs. of K per acre.

Nov. 14 - Applied approximately 15 tons manure per acre.
Nov. 17 - Fall plowed plot.
May 10 - Tandem disked and dragged.
May 14 - Finished planting. Bux Ten was used as the insecticide, Ramrod 20G (granules) was banded in the row for weed control.
June 2 - Thinned to intended populations.
June 3 - Cultivated.
June 17 - Cultivated.
June 21 - Hail storm.
July 11 - Cultivated - mositure from rains and hail stimulated grass growth so corn was cultivated even though it was quite tall.
Oct. 8 - Hand picked.

Discussion and Interpretation of Figures 1 and 2

There was a difference in yield due to row spacing with both the early and full season corn.

Yield results for this year indicate that the early corn may be more sensitive to row spacings than the bigger, full season, erect leaf variety. The difference in yield between extremes in row spacings was 14 bushels per acre with the early corn and only 7 bushels with the bigger full season corn. Each yield figure represents an average taken from five plant populations all having that particular row spacing.

A change was made in the experiment this year. Thirty-five inch rows were used to replace the narrow 20 inch rows. The reason for this change was that much of the corn machinery on farms today can be narrowed down to plant 35 or 36 inch rows. The question is, "should I narrow my machinery down to 36 inch rows or trade it in for new 30 or 20 inch row equipment?" It will take more than one year to answer this question but from this year's data the yields from 35 inch rows seem to be reasonably close to the midpoint between the two extremes in row spacing.

Figure 1. Effect of Row Spacing on Yield of Short Season Corn
(Yields from five populations were averaged for each row spacing)

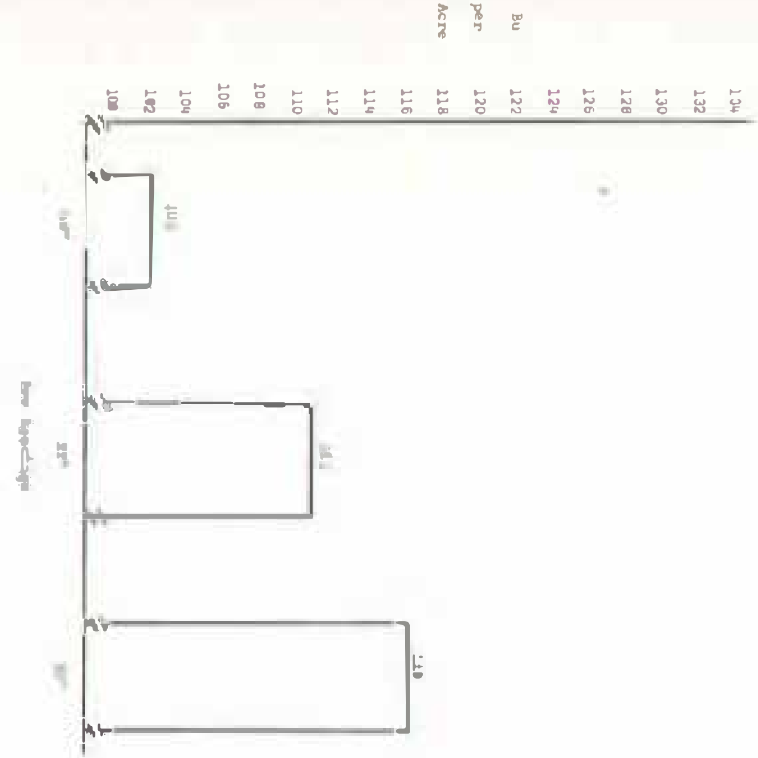


Figure 2. Effect of Row Spacing on Yield of Full Season Corn
(Yields from five populations were averaged for each row spacing)

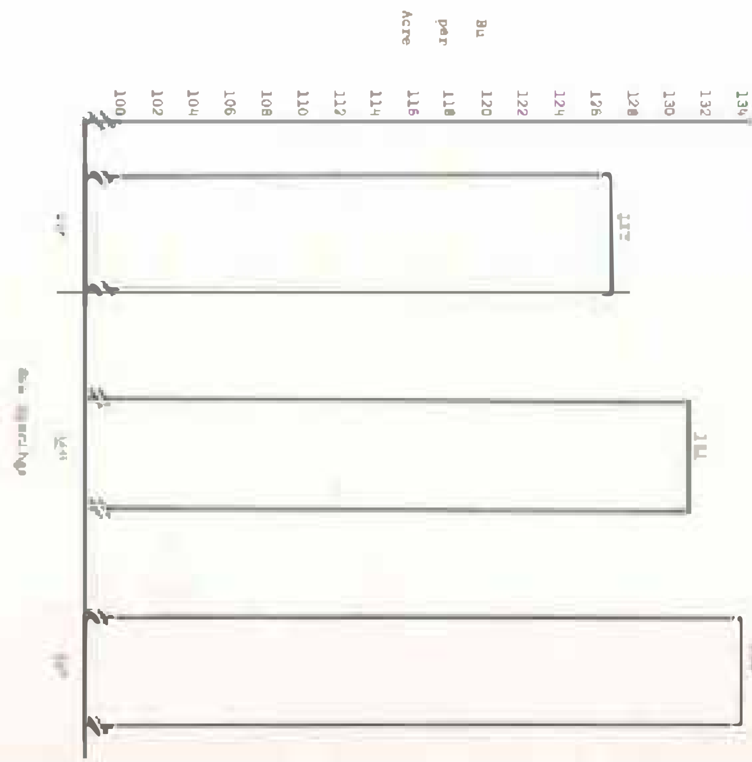
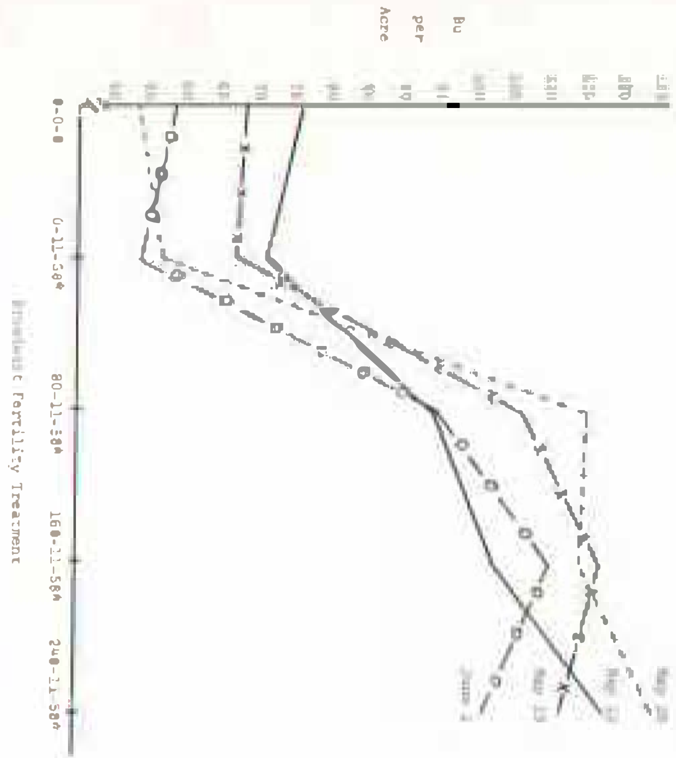


Figure 3. Effect of Fertilizer and Planting Dates on Yield of Corn



*Received 50 lbs. per acre of 8-14-3 (N-P-K) starter placed 2 x 2 in addition to broadcast treatment.

TABLE 2. EFFECT OF PLANT POPULATIONS ON YIELD OF CORN (YIELDS FROM 3 ROW SPACINGS WERE AVERAGED FOR EACH POPULATION)

Hybrid	Desired Stand in plants per acre	Final Stand in plants per acre*	Bushels per acre
NK - Px 556	10,000	9,400	98
NK - Px 556	12,000	11,200	108
NK - Px 556	14,000	12,500	109
NK - Px 556	16,000	12,700	119
NK - Px 556	18,000	15,100	115
Pioneer 3505	10,000	10,000	123
Pioneer 3505	12,000	11,800	127
Pioneer 3505	14,000	13,800	130
Pioneer 3505	16,000	13,800	134
Pioneer 3505	18,000	17,100	139

*Rounded off to the nearest 100.

Discussion and Interpretation of Table 2

Populations were presented as final counted stands because of the rather wide variations from populations desired. Increments of 2,000 plants per acre beginning at 10,000 and ending at 18,000 were planned. The hail storm on June 21 had an influence on final stand counts. It was difficult to do any thinning after the hail storm to standardize populations because there was no positive way to determine which plants would live and produce an ear and which plants would die or remain in a horizontal position with leaves and stem unable to break through the outer sheath and grow.

The final yields were much better than anticipated after inspecting the cornfield on June 23. However, only generalizations should be made regarding influences of plant populations for this year.

There appeared to be a general trend for increased yields with increasing populations.

TABLE 3. EFFECT OF ROW SPACINGS ON WEIGHT PER EAR AT HARVEST, % EAR MOISTURE AND % OF STALKS WITH TILLERS*

Row spacing	Wet Weight per ear at harvest	% ear moisture at harvest	% stalks with tillers
30 inches	0.71	34.6	20.8
35 inches	0.74	34.7	23.3
40 inches	0.76	34.8	12.8

*Yields from all 5 populations were averaged for each row spacing.

Discussion and Interpretation of Table 3

Row spacings had little affect on ear weight at harvest. Maximum effect was less than 1/10 pound per ear.

Row spacings had only minor affects on percent ear moisture at harvest. Using this as an indication of maturity, it appears that row spacing had only minor affects on rate of growth and development.

Forty inch rows probably had fewer tillers than narrow row spacings. In narrow rows, plants were spaced more equidistantly and crowding was minimized. Damage from the hail storm may have influenced these results.

TABLE 4. EFFECT OF PLANT POPULATIONS AND HYBRID ON WET WEIGHT PER EAR AT HARVEST, PERCENT EAR MOISTURE AT HARVEST AND PERCENT OF STALKS WITH TILLERS*

	Desired populations	Final populations	Wet Weight per ear in pounds	% Ear moisture at harvest	% of stalks with tillers
NK - Px 556	10,000	9,400	0.61	31.9	19
NK - Px 556	12,000	11,200	0.65	31.0	18
NK - Px 556	14,000	12,500	0.62	31.0	19
NK - Px 556	16,000	12,700	0.63	31.3	15
NK - Px 556	18,000	15,100	0.58	30.6	14
Pioneer 3505	10,000	10,000	0.96	38.8	27
Pioneer 3505	12,000	11,800	0.92	38.2	30
Pioneer 3505	14,000	13,800	0.80	37.3	24
Pioneer 3505	16,000	13,800	0.85	38.1	12
Pioneer 3505	18,000	17,100	0.77	37.6	12

*Results from all 3 row spacings were averaged for each population.

Discussion and Interpretation of Table 4

The bigger, later maturing, full season Pioneer 3505 had ears that weighed 0.2 to 0.3 pounds more than the smaller, early season hybrid. The early corn was a little more advanced on June 21 when the hail fell and stand reductions were greater than with the bigger hybrid. Judging from ear size (Table 4) and yield (Table 2) optimum stands may have been higher than actual stands for the conditions in 1969. The full season corn had about 6-7% more moisture at harvest than the earlier variety. Plant densities had only minor effects on percent ear moisture at harvest.

Percent of tillering was not influenced very much by populations in the early corn. The full season corn may have had a few more tillers with lower populations than with higher populations.

TABLE 5. EFFECTS OF PLANT POPULATIONS AND ROW SPACINGS ON YIELD OF 70 PERCENT MOISTURE SILAGE IN TONS PER ACRE

Desired plants per acre	Actual final stand replicates 1 & 2 only for 30" rows	Tons/acre 30" row spacings	Actual final stand replicates 1 & 2 only for 40" rows	Tons/acre 40" row spacings
10,000	10,500	22	9,600	19
12,000	12,800	22	12,600	22
14,000	14,600	21	13,500	22
16,000	17,500	29	14,400	23
18,000	19,200	26	18,800	23
Average	--	24	--	21.8

Discussion and Interpretation of Table 5

Final stands were rounded off to the nearest 100 stalks per acre. There were four replicates in the experiment but replicates one and two only were used for silage determinations. Silage yields in Table 5 are from the large full season corn. No silage determinations were made for the smaller early season corn because early maturity is not such an important factor for silage and its smaller size governs its yield potential. Final stands reported in Table 5 are different from those in Tables 2 and 4 because only 2 of the 4 replicates were used for silage determinations.

Thirty inch rows averaged a little more silage per acre than 40 inch rows but this apparent difference was partially due to variance between desired and actual stands. There appeared to be a general trend upward in silage yields with increased populations but there were some exceptions. Hail damage and variations in stands reduced precision in this experiment and additional work will be necessary to confirm these results.

TABLE 6. EFFECT OF ROW SPACINGS ON SILKING DATES*

Row Spacings in inches	% of plants silked July 25		% of plants silked August 5	
	Short season hybrid	Full season hybrid	Short season hybrid	Full season hybrid
30"	10	0	80	87
35"	14	0	77	91
40"	11	0	77	81

*Results from all 5 populations were averaged for each row spacing.

Discussion and Interpretation of Table 6

This table gives an indication of the relative maturities of the two hybrids. On July 25, the early hybrid had 10% to 14% of the ears with silks showing while the full season hybrid had no silks showing.

By August 5 this relationship was reversed. The later maturing hybrid had a few more silks showing than the earlier hybrid. This is probably due to the greater uniformity in the bigger hybrid. Silking proceeded rapidly as soon as it started, instead of taking place over a longer period of time as the data suggest for the less uniform early hybrid.

TABLE 7. EFFECT OF ROW SPACING ON PLANT HEIGHT*

Row spacing in inches	Height in feet July 30		Height in feet August 6	
	Short season hybrid	Full season hybrid	Short season hybrid	Full season hybrid
30	6.6	6.4	6.9	6.8
35	6.6	6.4	6.8	6.8
40	6.6	6.2	6.9	6.7

*Results from all 5 populations were averaged for each row spacing.

Discussion and Interpretation of Table 7

In previous years there appeared to be some differences in plant height due to row spacings. There were no appreciable differences in plant height due to row spacings in 1969.

Leaf area indexes were determined in 1968 but after the hail storm in 1969 the decision was made not to take these measurements because of variability in stands and growth characteristics caused by the hail. In 1968 the total leaf area, governed by size of plant (width, length and number of leaves) appeared to be related to yield of ear corn.

TABLE 8. EFFECT OF ROW SPACINGS ON BARREN AND LODGED STALKS

Row spacing in inches	% barren stalks	% broken and lodged stalks
30	0.1	0.3
35	0.2	0.4
40	0.3	0.2

Discussion and Interpretation of Table 8

There were practically no barren stalks and less than 1% broken and lodged stalks for all row spacings and all populations in 1969.

In one of the earlier years of this experiment, the amount of lodging increased greatly with increased populations. This was related to the presence of more stalk and root rot in higher plant populations.

HIGH PHOSPHORUS EXPERIMENT

-- Raymond C. Ward

An experiment was established in 1964 to study the effects of various rates of phosphorus (P) fertilizer on the yield of corn. From 1964 through 1967 four rates of P (10, 20, 40, and 80 pounds P/acre) were broadcast and plowed down annually. No phosphorus has been broadcast the last two years. Each of the P treatments was divided into thirds with one-third receiving about 10 pounds of P as a starter fertilizer from 1964 through 1968, one-third receiving 10 pounds of zinc per acre in 1964 and 1965, and one-third remaining only as the broadcast phosphorus treatment.

In 1968 grain sorghum was planted on the experimental area. Sokota 513 was planted May 28, 1969, in 30 inch rows. Seeding rate was about 6 pounds of seed per acre. Ramrod was sprayed to control weeds.

Results and Discussion

Previous reports have shown that corn yields were increased about 10 bushels per acre for the first increment of phosphorus. Additional broadcast P did not increase corn yields and at high rates tended to decrease yields. Zinc tended to overcome the depressing effects of the high P applications.

In 1969 grain sorghum was grown to determine the effects of the residual phosphorus on the yield of that row crop. The yields are shown in Table 9. Grain sorghum yields were very good. Large yield increases were obtained from residual phosphorus plots (either broadcast and/or starter). Residual starter alone increased grain sorghum yields about 15 cwt/acre. The first increment of broadcast phosphorus increased the yield about 22 cwt/acre. This first increment of P appeared to produce near maximum yields although the highest rate of broadcast P tended to produce the highest yield at 75 cwt/acre.

The moisture content of the grain sorghum was reduced from 25.7% to 21.6% by the higher residual P rates (Table 10). The effects of phosphorus on the maturity of the grain sorghum could be observed from the boot stage until harvest.

Comparing the yield increases of grain sorghum with responses obtained from corn in previous years it appears that grain sorghum is more responsive to phosphorus fertilization than corn.

TABLE 9. INFLUENCE OF VARIOUS RATES OF RESIDUAL BROADCAST P AND THE ADDITIONAL INFLUENCE OF RESIDUAL STARTER P AND RESIDUAL ZINC ON YIELD OF GRAIN SORGHUM

Total lbs of P Broadcast/A (1964-67)	No Additional P or Zn	Residual Starter	Residual Zinc	Average
	Grain Sorghum Yield, cwt/acre[1]			
0	44	62	49	52
40	69	71	71	70
80	72	71	73	72
160	70	72	72	71
320	74	76	74	75
Average	66	71	68	

[1]Yields corrected to 12.5% moisture in the grain.

TABLE 10. INFLUENCE OF VARIOUS RATES OF RESIDUAL BROADCAST P, RESIDUAL STARTER, AND RESIDUAL ZINC ON MOISTURE CONTENT OF GRAIN SORGHUM

Total lbs. of P Broadcast/A (1964-67)	No additional P or Zn	Residual Starter	Residual Zinc	Average
	Moisture content, percent			
0	25.3	25.3	26.4	25.7
40	25.1	23.4	25.3	24.6
80	24.1	22.8	23.4	23.4
160	23.9	23.3	22.9	23.4
320	21.7	21.7	21.4	21.6
Average	24.0	23.3	23.9	

LIME EXPERIMENT

-- Raymond C. Ward

A lime experiment was started in 1968. The objectives and methods were reported in the 1968 Annual Report.

Results and Discussion

Ear Corn yields and moisture content from the lime experiment are shown in Table 11. There was no response to lime this year. The moisture percentage was quite similar for all treatments.

TABLE 11. THE EFFECTS OF ADDED LIME AND PHOSPHORUS ON THE YIELD AND MOISTURE CONTENT OF EAR CORN

Treatment	Ear Corn Yield Bu/A	Ear Corn Moisture %
Check	91.2	37.0
Lime (4 tons/A)	95.4	36.3
0+60+0	89.6	36.7
Lime and 0+60+0	85.8	37.2

Ear corn yield was corrected to 15.5% moisture.

DATES OF PLANTING AND RATES OF NITROGEN

-- F. Shubeck and B. Lawrensen

Objectives of Experiment

1. Will planting dates influence response to fertilizer?

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

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

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

Methods and Procedures

April 23 - Cut old stalks and tandem disked
April 29 - Disked plots
May 6, 7 - Broadcast fertilizer
May 8 - Plowed
May 9 - Disked, harrowed, and rotary hoed plots, attempting to break up clods

May 12 - Disked and harrowed area for first planting date and planted
May 19 - Disked and harrowed area for second planting date and planted
May 26 - Disked and harrowed area for third planting date and planted
June 2 - Disked and harrowed area for fourth planting date and planted
June 5 - Cultivated 1st and 2nd planting
June 9 - Cultivated 3rd planting
June 13 - Cultivated 1st and 2nd planting again
June 20 - Cultivated 3rd planting again
July 1 - Clipped hail damaged stalks
July 2 - Cultivated 4th planting
Oct. 9 - Hand picked
Insecticide - Bux Ten
Weedicide - Ramrod 20 G grannules in a band over the row
Variety - Northrup King Px50
Population aimed for - 16,000

Discussion and Interpretation of Figure 1 (on page 4)

Probably the most spectacular result of this experiment was the tremendous response to nitrogen fertilizer. Yield increases due to nitrogen were a little over 40 bushels per acre. When nitrogen was omitted in the broadcast treatment, yields were about the same as the unfertilized plots. As more nitrogen was included in the broadcast treatment, yields increased.

The greatest yield increase came with the first 80 lb. increment of nitrogen for most planting dates. Yield increases tended to level off at about the 160 lbs. of N rate for most planting dates.

There was one major difference between last year's results and results of 1969. In 1968 the first planting date with no fertilizer had the lowest yield of all 4 planting dates. In 1969 the first planting date with no fertilizer yielded considerably better than some of the other planting dates. It should be remembered that the first planting date in 1968 was April 26. In 1969 after the big snow and early rains, the earliest planting date was held back until May 12, which was about 2 weeks behind schedule.

Small differences in yield apparently due to planting dates should be ignored because the hail storm introduced additional variation. Corn from some planting dates was at a more vulnerable stage when the hail fell.

TABLE 12. EFFECT OF NITROGEN FERTILIZER RATES ON YIELD OF CORN STOVER*

Fertilizer Treatment		
Lbs. per acre broadcast N-P-K	Lbs. per acra starter placed 2 x 2 N-P-K	Tons of stover per acre, 70% moisture
0-0-0	0-0-0	4.5
0-11-58	4-7-7	6.2
80-11-58	4-7-7	8.5
160-11-58	4-7-7	8.0
240-11-58	4-7-7	10.2

* Average of 2 replications from first planting date only (May 12). The stover was harvested when silks first appeared.

Discussion and interpretation of Table 12

Stover yields were taken when silks first appeared, before any corn grain was set on the cob. Yields of stover were calculated at 70% moisture which would be comparable to moisture content at time of making silage. Note that the first planting date only was sampled.

Fertilizer treatments were all expressed in elemental form. A broadcast treatment of 0-11-58 (elemental) would be 0-25-70 expressed as the respective oxides.

In 1968, the very early planting (April 26) had shorter plants, less leaf area and lower yields than later plantings, but response to nitrogen appeared to be greater with the early planting. In 1969, Stover yield with 240 lbs. of N per acre was more than twice that of the check plot, but the first planting date was May 12 rather than April 26 as in 1968. There were some inconsistencies, but generally speaking yield of stover increased with increasing rate of N.

TABLE 13. EFFECT OF FERTILITY TREATMENT AND DATE OF PLANTING ON PLANT HEIGHT IN FEET

Broadcast fertilizer treatment Lbs. per acre N-P-K	Height July 18				Height Aug. 22			
	1st planting	2nd planting	3rd planting	4th planting	1st planting	2nd planting	3rd planting	4th planting
0-0-0	2.4	2.2	2.1	1.5	5.9	5.7	6.0	6.2
0-11-58*	3.1	3.4	2.5	2.0	6.2	6.4	6.3	6.8
80-11-58*	3.0	3.2	3.2	2.0	6.8	6.7	7.1	7.2
160-11-58*	3.7	3.0	2.1	1.9	7.0	7.2	6.9	7.4
240-11-58*	3.0	2.9	2.6	2.0	6.9	7.0	7.3	7.4

*Received 4 lbs. of N, 7 lbs. P and 7 lbs. K starter per acre placed 2 inches to the side and 2 inches below the seed in addition to broadcast treatments.

Discussion and Interpretation of Table 13

It was interesting to observe plant heights from the 4 different planting dates because height differences were not always proportional to the differences in planting dates. For example, note the July 18 measuring date and the 240-11-58 fertilizer treatment. There was very little difference in height among the first 3 planting dates even though they were planted at 1 week intervals.

By Aug. 22 with this same fertilizer treatment note that corn height of the last planting was taller than that of the first planting. This relationship was even more obvious in 1968 when we were able to make the first planting about two weeks earlier in the season.

A starter fertilizer was used to take full advantage of early planting by having a readily available supply of plant nutrients close to the seed. This should give the plants a quick start in cold wet conditions that often occur in the early part of the planting season.

TABLE 14. EFFECT OF PLANTING DATES AND FERTILIZER TREATMENTS ON LEAF AREA INDEX

Fertilizer broadcast treatment Lbs. per acre N-P-K	Planting Dates May 12	May 19	May 26	June 2
0-0-0	1.3	1.5	1.4	1.5
0-11-58*	1.4	1.5	1.3	2.0
80-11-58*	1.3	1.7	1.9	2.6
160-11-58*	1.5	2.4	1.8	2.3
240-11-58*	1.4	2.1	1.9	2.9

* Received 4 lbs. N, 7 lbs. P, and 7 lbs. K starter per acre placed 2x2 in addition to broadcast treatments.

Discussion and Interpretation of Table 14

Leaf area index is the ratio of total leaf area per acre divided by soil surface area per acre. It gives an indication of the quantity of leaf factories capable of manufacturing carbohydrates on an acre basis.

Plots receiving fertilizer and planted late (June 2) had the highest leaf area index. This was not always accompanied with the highest yield of ear corn, however. One theory proposed to account for this observation was that late planted corn grew taller and leafier due to different day length during period of maximum growth. The bigger leaf factory had a greater potential to make bigger yields, but it ran out of time. Frost killed the plants, and manufacture of carbohydrate ended. Another theory was that the phototropic response to different day length may influence grain to stover ratio.

These theories may or may not be correct, but the fact is that late planting has given the tallest corn and the greatest leaf area index for 2 consecutive years but not the highest yield of corn grain.

Increasing rates of nitrogen fertilizer did not increase leaf area as much in the early planting as it did in the three later plantings. Other stations have reported that ear corn yields from earlier plantings were more responsive to the heavier rates of nitrogen than later planting (see discussion in Southeast Experiment Farm Report for 1968). If a similar yield response occured here, it looks as though it would have to be done with less leaf area than the later plantings.

TABLE 15. EFFECT OF PLANTING DATES AND FERTILIZER TREATMENTS ON % OF PLANTS WITH TILLERS

Fertilizer broadcast treatment Lbs. per acre	Planting dates				
N-P-K	May 12	May 19	May 26	June 2	Av.
	Percent of plants with tillers[T]				
0-0-0	0.5	11	13	12	0.9
0-11-58*	13	7	12	12	8.8
80-11-58*	21	8	14	8	12.8
160-11-58*	18	7	14	8	11.4
240-11-58*	19	12	8	11	12.1
Average	14.1	8.9	6.0	10.0	

*Received 4 lbs. N, 7 lbs. P, and 7 lbs. K starter per acre placed 2x2 in addition to broadcast treatment.

T - Tillers were counted on September 29.

Discussion and Interpretation of Table 15

There is one experiment at the Research Farm with major objectives concerned with tillering. However the date of planting and rate of nitrogen experiment provides an opportunity to measure effect of two entirely different variables on incidence of tillering.

There were a few more tillers due to broadcast nitrogen applications on the first planting date. Results from previous years indicated that phosphorus applied in a band stimulated tiller formation more than nitrogen. The hail storm may have influenced tillering in 1969 and also identification of tillers when they were counted.

Late plantings averaged a few less tillers than earlier plantings, but here again, damage at different stages of growth may have influenced tiller formation.

TABLE 16. EFFECT OF PLANTING DATES AND FERTILITY TREATMENTS ON DATES OF SILKING

Fertility broadcast treatment Lbs. per acre	1st planting			2nd planting			3rd planting			4th planting		
N-P-K	7/28	8/5	8/13	7/28	8/5	8/13	7/28	8/5	8/13	7/28	8/5	8/13
	Percent of plants with silks showing											
0-0-0	0	80	100	0	64	95	0	20	93	0	0	75
0-11-58*	0	95	95	0	57	74	0	9	94	0	0	100
80-11-58*	0	68	90	0	77	100	0	38	100	0	0	86
160-11-58*	0	68	90	0	55	100	0	0	95	0	0	60
240-11-58*	0	79	97	0	40	93	0	0	88	0	0	59

*Received 4 lbs. N, 7 lbs. P, and 7 lbs. K starter per acre placed 2x2 in addition to broadcast treatment.

Discussion and Interpretation of Table 16

Interest has developed regarding influence of nitrogen (especially heavy application rates) on maturity of corn. Research at other stations (1) has indicated that if a severe nitrogen deficiency exists, a moderate application of nitrogen may hasten maturity. If soil nitrogen supply is sufficient or somewhat less than optimum for maximum growth, heavy applications of nitrogen may delay or have little effect on maturity.

Table 16 shows effect of high rates of nitrogen and four different planting dates on maturity, measured by dates of silking, at the Southeast South Dakota Experiment Farm.

(1) Black, C. A. Soil Plant Relations. Second Edition, page 530. John Wiley and Sons, Inc., New York.

Results were somewhat erratic due to variations in hail damage on plants at different stages of growth. There was no clear cut delay in silking dates due to nitrogen applications, although on some planting dates nitrogen may have delayed silk emergence.

Notice that on Aug. 5, the 3rd and 4th plantings were slower than the 1st and 2nd in regard to percent of ears with silks showing. But on Aug. 13, the 3rd planting had already caught up with the earlier plantings, and the latest planting was developing fast except where heavy rates of nitrogen were applied.

TABLE 17. EFFECT OF PLANTING DATES AND FERTILIZER TREATMENTS ON % EAR MOISTURE AT HARVEST

Fertilizer broadcast treatment N-P-K	1st planting May 12	2nd planting May 19	3rd planting May 26	4th planting June 2	Av.
0-0-0	36.0	40.7	42.8	46.0	41.4
0-11-58*	37.2	37.2	41.7	45.6	40.4
80-11-58*	36.0	37.0	39.3	44.7	39.3
160-11-58*	38.0	36.7	39.9	46.7	40.3
240-11-58*	35.2	37.4	39.8	45.1	39.4
Average	36.5	37.8	40.7	45.6	40.2

*Received 4 lbs. N, 7 lbs. P and 7 lbs. K starter per acre placed 2x2 in addition to broadcast treatment.

Discussion and Interpretation of Table 17

This table was included in the report to present additional evidence on relationship of maturity and heavy rates of nitrogen applications.

The averages in the right hand column show effect on ear moisture of each fertilizer treatment averaged for all four planting dates. The plots receiving the highest rate of nitrogen plus starter, had average ear moisture close to that from plots receiving no broadcast nitrogen.

Notice the high moisture content in ears from June 2 planting. This would lend support to the theory that late planting may provide a greater "leaf factory" but bigger yields are not always realized because it runs out of time.

TABLE 18. EFFECT OF FERTILIZER ON LEAF COMPOSITION AT FIRST SILKING May 12 PLANTING DATE

Broadcast fertilizer treatment N-P-K	N %	P %	K %	Ca %	Mg %	S %	Fe ppm	Mn ppm	Zn ppm
	Composition of dry leaves**								
0-0-0	2.74	0.222	2.22	0.33	0.14	0.257	200.0	37.9	15.8
0-11-58*	2.56	0.244	1.95	0.49	0.20	0.265	177.0	46.7	16.9
80-11-58*	2.85	0.253	2.08	0.43	0.17	0.186	162.0	53.4	21.5
160-11-58*	3.60	0.276	2.16	0.71	0.25	0.206	173.0	81.7	26.6
240-11-58*	3.67	0.276	2.14	0.41	0.15	0.194	230.0	99.3	30.3

*Received 4 lbs. N, 7 lbs. P and 7 lbs. K starter per acre placed 2x2 in addition to starter treatment.
**Leaf analysis made by Soil Testing Laboratory at South Dakota State University, Brookings, South Dakota.

TABLE 19. SUFFICIENCY LEVELS TO EVALUATE LEAF ANALYSIS FOR CORN AS DETERMINED BY OHIO RESEARCH AND DEVELOPMENT CENTER STANDARDS

Element	Content of element in leaves, sampled at first silk	
	Minimum	Maximum
N	2.76%	3.50%
P	0.25%	0.40%
K	1.71%	2.25%
Ca	0.21%	0.50%
Mg	0.21%	0.40%
Mn	20.0 ppm	150.0 ppm
Fe	21.0 ppm	250.0 ppm
Zn	20.0 ppm	70.0 ppm

Discussion and Interpretation of Tables 18 and 19

One of the major reasons for analysis of leaf tissue was to detect any possible nutrient deficiencies in leaves due to nutrient imbalance caused by high rates of nitrogen.

There are several known interactions between two nutrients governed by the supply of either nutrient. For example, large quantities of nitrogen sometimes reduces uptake of potassium. A surplus of phosphorus is believed to inhibit uptake of zinc. A small amount of nitrogen applied in a band with phosphorus facilitates uptake of phosphorus.

Percent of potassium in leaves (Table 18) remained fairly constant as nitrogen rates increased and all values were above the minimum sufficiency level given in Table 19. This would indicate that the rate of potash was sufficient for even the highest rate of nitrogen with environmental conditions of 1969.

Zinc percentages were below the minimum sufficiency levels for the 0-0-0 and 0-11-58 treatments. This is somewhat unusual because not many responses to zinc occured in previous years unless large quantities of phosphorus were applied.

Magnesium percentage in leaves was below the minimum sufficiency levels of the standards now used. Sufficiency levels for magnesium are somewhat arbitrary due to insufficient information relating leaf content to field response.

ORGANIC SOIL CONDITIONER FOR CORN AND OATS

-- F. Shubeck and B. Lawrenson

Objectives of Experiment

Compare effects of organic speciality fertilizer or soil conditioner to chemical fertilizer regarding bushels of grain per acre, protein in grain and moisture in grain at harvest.

Methods and Procedures Used in Soil Conditioner Study

The following methods and procedures were used for corn.

Preceeding crop - Oats
April 26 - Disked
May 7 - Broadcast fertilizer salts
May 14 - Plowed
May 15 - Planted - used Bux Ten and Ramrod, Pioneer 3715, 200 lbs. of soil conditioner/acre banded 2x2
June 5 - Cultivated
June 20 - Cultivated
July 12 - Cultivated
July 24 - Sprayed with Sevin for army worm control
Sept. 30 - Hand picked

The following methods and procedures were used for oats:

Preceeding crop - corn
April 25 - Broadcast fertilizer and soil conditioner
April 25 - Disked and harrowed
April 25 - Drilled oats - variety Kota
June 21 - Hail storm
July 3 - Forage taken for dry matter determinations

TABLE 20. SOIL TEST DATA FOR ORGANIC SOIL CONDITIONS STUDY*

Soil Test	Test Crop Corn	Test Crop Oats
Organic matter, %	2.6 (medium)	2.9 (medium)
Bray No. 1 phosphorus, lbs/acre	12 (low)	18 (low)
Exchangeable potassium, lbs/acre	353 (high)	450 (high)
pH 1:1 dilution	6.4 (good)	6.5 (good)
Soluble salts, mmho/cm	0.20 (low)	0.36 (low)

*Provided by Soil Testing Laboratory, South Dakota State University.

Discussion and Interpretation of Table 20

Soil test information indicated that nitrogen and phosphorus were the only two macronutrients that might limit yield. The percent organic matter was medium and phosphorus content was close to the border between low and medium. Exchangeable soil potassium was high and soluble salts were not a problem.

TABLE 21. EFFECT OF COMMERCIAL FERTILIZER AND SOIL CONDITIONER ON YIELD OF CORN, EAR MOISTURE AT HARVEST AND PERCENT PROTEIN IN GRAIN

Fertilizer treatment	% ear moisture at harvest	% protein in grain*	Bu/Acre No. 2 Corn
None	39.2	6.2	90
200 lb./acre soil conditioner	38.3	6.9	105
60 lbs. N + 13 lbs. P/acre	37.1	7.2	131

*Provided by Soil Testing Laboratory, South Dakota State University.

Discussion and Interpretation of Table 21

Yield differences due to fertilizer treatments were highly significant. Percent protein in grain was closely related to increases in yield due to fertilizer treatment.

Those plots with the highest yield of corn grain and the highest percent of protein had the lowest content of ear moisture at harvest.

TABLE 22. EFFECT OF COMMERCIAL FERTILIZER AND SOIL CONDITIONER ON YIELD OF OATS DRY MATTER

Fertilizer treatment	Yield of dry matter, lbs/acre
None	1,034
200 lbs./acre soil conditioner	1,327
60 lbs. N + 13 lbs. P/acre	2,626

Discussion and Interpretation of Table 22

The oats in this experiment was in the early heading stage on June 21 when the hail storm came. Damage to the crop was severe enough so that no yields of grain could be taken. The broken stems and tangled vegetation was clipped and removed June 30, then dried and weighed. Results are presented in Table 22.

STARTER AND POP-UP FERTILIZER FOR CORN

-- F. Shubeck and B. Lawrensen

Objectives of Experiment

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

2. Is it best to forget about starter fertilizer and to broadcast all

fertilizer before planting and disk it in or plow it down?

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

Methods and Procedures Used in Starter and Pop-up Experiments

Cropping history: 1968-unfertilized corn was removed for silage, 1967-starter fertilizer experiment was on this area; 1966-unfertilized corn removed for silage.

April 24 - Disked
May 8 - Plowed (plow down fertilizer was broadcast just before plowing)
May 8 - Disked (disked in fertilizer was broadcast just before disking)
May 9 - Planted corn
June 4 - Cultivated
June 10 - Sidedressed nitrogen
June 30 - Broken stalks and those with rolled leaves due to heat damage were clipped in replicates 2, 3, 5 and 6.
July 2 - Cultivated
July 12 - Cultivated
Sept. 30 - Picked

TABLE 23. EFFECT OF STARTER FERTILIZER, POP-UP, SUPPLEMENTAL NITROGEN AND METHODS OF FERTILIZER APPLICATIONS ON CORN YIELD AND PERCENT MOISTURE IN EARS

Treatment No.	Starter pop-up & broadcast fertilizer lbs. per acre N	P	K		Additional Nitrogen, lbs. per acre	% Water in ears at harvest	Bu. of #2 corn per acre
1	0	0	0		None	29.4	75
2	12	23	17	plowed down	80 plowed down	29.5	103
3	12	23	17	disked in	80 plowed down	29.3	96
4	12	23	17	starter, band	80 sidedress	30.6	99
5	12	23	17	starter, band	80 plowed down	30.6	94
6	12	23	17	starter plus	80 plowed down	30.2	101
	12	23	17	plowed down			
7	3	6	5	pop-up plus	80 plowed down	30.7	102
	9	17	12	plow down			
L.S.D. at 5%							8.5

Discussion and Interpretation of Table 23

Yields of corn were better than expected from appearance of plants after the June 21 hail storm and in early fall.

Apparent differences in yields due to methods of application were small and for the most part not significant at the 5% confidence level.

Notice in treatment 6 that 12-23-17 (N-P-K) was applied as a side band starter and in addition an equal amount was plowed down with 80 pounds of nitrogen. The purpose of this treatment was to see if the starter would increase yields if the soil was already fairly well supplied with these nutrients from a plow under treatment. Compare this treatment to number 2 to determine the value of the starter.

The pop-up plus plow down treatment yielded about the same as treatment number 2 where all the fertilizer was plowed down.

Probably one of the more important lessons gained from this experiment in 1969 was the fact that applied fertilizer was not wasted even though corn was damaged by hail of moderate intensity. This experiment was planted a little earlier than some of the others and plants were a little further advanced when the hail fell. From appearances, the leaves and stalks appeared to be damaged more than in most other experiments, but yet, there was an increase in yield of more than 25 bushels per acre due to fertilizer in some plots.

TABLE 24. EFFECT OF FERTILIZERS AND METHODS OF APPLICATION ON CORN HEIGHTS

Treatment No.	Starter pop-up & broadcast fertilizer lbs. per acre N	P	K		Additional nitrogen, lbs. per acre	Plant height in feet July 9	July 17
1	0	0	0		None	2.0	3.7
2	12	23	17	plowed down	80 plowed down	2.4	4.1
3	12	23	17	disked in	80 disked in	2.2	4.1
4	12	23	17	starter, band	80 sidedressed	2.2	3.6
5	12	23	17	starter, band	80 plowed down	2.0	4.1
6	12	23	17	starter plus	80 plowed down	2.5	4.5
	12	23	17	plowed down			
7	3	6	5	pop-up plus	80 plowed down	2.3	4.4
	9	17	12	plow down			

Discussion and Interpretation of Table 24

One of the reasons for measuring plant heights early in the growing season was to see if starter or pop-up helped the corn to a faster start and especially to see if this quick start carried on through to silking dates, ear moisture at harvest and finally to yield of corn.

By July 9, corn was taller in most of the fertilized treatments than in the check plot. Fertilized corn still maintained a height advantage by July 17. Now lets see if it was still ahead by silking time (Table 25).

TABLE 25. EFFECT OF FERTILIZERS AND METHODS OF APPLICATION ON SILKING DATES

Treat-ment No.	Starter, pop-up & broadcast fertilizer lbs per acre N	P	K		Additional nitrogen, lbs. per acre	% of ears with silks showing July 5	July 30	Aug. 1
1	0	0	0		None	2	57	91
2	12	23	17	plowed down	80 plowed down	25	85	74
3	12	23	17	disked in	80 disked in	3	77	94
4	12	23	17	starter, band	80 side dress	1	64	90
5	12	23	17	starter, band	80 plowed down	2	65	84
6	12	23	17	starter plus	80 plowed down	4	78	98
	12	23	17	plowed down				
7	3	6	5	pop-up plus	80 plowed down	5	91	100
	9	17	12	plowed down				

Discussion and Interpretation of Table 25

Corn in some fertilized plots had a few more silked ears than in unfertilized plots on July 5. This difference in rate of development was more noticeable by July 30. By August 1, differences were not so apparent. By harvest time (Table 23) there was pratically no difference in maturity due to fertilizer treatment measured by percent of moisture in ears.

Summary of results of this experiment:

1. Total yields were better than expected.
2. Different systems or methods used for applying fertilizer had only minor effects on yield.
3. Starter and pop-up fertilizer gave corn plants a faster early start indicated by plant height measurements.
4. This acceleration lasted through the silking period but was not in evidence at picking time, measured by % of ear moisture.
5. Early growth stimulus due to fertilizer treatments was associated with yield increases at harvest. (This has not always occured in the past).

CORN TILLERING

-- F. Shubeck and B. Lawrensen

Objectives of Experiment

1. Does fertilzier stimulate tiller formulation?
2. Do tillers depress yields?
3. Is tillering a function of total nitrogen and phosphorus applied or of methods by which they were applied?
4. Do number of plants per acre or methods of planting corn influence formation of tillers?

Methods and Procedures Used in Tillering Study

April 24 - cut stalks with rotary chopper
May 20 - broadcast fertilizer
May 20 - plowed
May 24 - double tandem disked and harrowed
May 25 - planted
June 10 - cultivated
July 10 - cultivated
July 22 - sprayed with "Sevin" for army worms
July 22 - cultivated
Aug. 6 - removed tillers from designated plots
Oct. 3 - hand picked
Variety - Pioneer 3558
Insecticide - Bux Ten
Weedicide - Ramrod granules 20G

TABLE 26. EFFECT OF FERTILIZER AND METHODS OF APPLICATION ON TILLERING AND YIELD OF CORN

Treatment No.	Treatment N-P-K	Method of Application	Plants per acre (planted)	Method of planting	Tillers	% stalks with tillers	Bu. per acre
1	0-0-0	none	13,275	drilled	left	4.6	43
2	6-11-11	starter	13,274	drilled	left	9.5	47
3	6-11-11	starter	13,275	checked	left	14.0	41
4	100-18-0	plowed down	13,275	drilled	left	5.0	80
5	100-18-0	plowed down	13,275	checked	left	5.0	76
6	100-18-0	plowed down	19,000	drilled	left	5.0	86
7	100-18-0	plowed down	13,275	drilled	removed	removed	83
8	6-11-11	starter + 100-18-0 plowed down	13,275	drilled	left	4.0	86
L.S.D. at 5% level							11.4

Discussion and Interpretation of Table 26

Most of the plots had very few tillers this year. This fact together with variation introduced by hail damage, minimizes conclusions to be drawn regarding tillering. Checking corn in hills spaced 40" x 40" did not reduce tillering as it did in the 2 previous years. Plots receiving starter alone appeared to have a few more tillers than plow down treatments.

Judging by the yield of corn grain, this experiment was injured more by the hail than some of the others. However, large increases in grain yield (over 40 bu/acre) were obtained by fertilizer applications. This represents nearly a 100% increase.

Comparisons of certain specific treatments are of interest. By comparing treatments 7 and 8 it looks as though addition of a starter to the plow down treatment did not increase yield of corn very much.

Yields of treatments 4 and 5 were similar indicating that checking did not decrease yields appreciably in 1969, but the trend was similar to that in 1968.

Comparison of numbers 7 and 4 shows that removal of tillers did not increase yield. Results from previous years indicated that when total number of tillers was small, their removal did not consistantly increased yield.

Comparison of numbers 6 and 4 indicate a small yield increase for increasing populations from 13,275 to 19,000. These were planted populations, not final populations.

Starter alone appeared to give a small increase over the check plot but it was not statistically significant at the 5% conficence level. Yields were increased more when 100 pounds of nitrogen per acre were applied.

SOYBEAN POPULATIONS AND ROW SPACINGS

-- F. Shubeck and B. Lawrensen

Objectives of Experiment

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

Methods and Procedures Used in Soybean Populations and Row Spacing

Oct. 7, 1968 - Broadcast and plowed down 61 lbs. of N, 20 lbs. of P and 19 lbs. of K per acre
May 24, 1969 - Tandem disked
May 29 - Disked, dragged and planted - variety Corsoy
June 3 - Sprayed all plots with Lasso for weed control
June 16-18 - Thinned 20" rows
June 19 - Cultivated
June 21 - Hail storm
June 30 - Disked and harrowed replicates 1, 2, 4, and 5. Replicates 3 and 6 were left for observation

July 2 - Planted replicates 1, 2, 4 and 5 with an earlier bean (Chippewa 64)
Ramrod was banded in row at time of planting for weed control
July 15, 16 - Cultivated
July 22-25 - Thinned replicates 1, 2, 4 and 5
Nov. 11 - Harvested

TABLE 27. EFFECT OF ROW SPACINGS AND REPLANTING ON YIELD OF BEANS

Row spacing in inches	Beans replanted after hailstorm (Chippewa 64)*	1st planting hail damaged (Corsoy)*
20	38	37
30	37	44
40	35	37

*Results from 6 populations were averaged for each row spacing.

Discussion and Interpretation of Table 27

After the hailstorm, a decision had to be made whether to disk up the hail-damaged beans and replant them or do nothing and observe how well they recovered. It was decided to replant four replications of all treatments with a shorter season variety (Chippewa 64) and leave two replications for observation. In this way perhaps more information could be gained.

Replanted beans appeared to yield a little more in narrow rows than in conventional 40 inch row spacings.

Yields with 30 and 40 inch rows were greater when the beans were left alone and not replanted, but the reverse was true for 20 inch rows. More variability would be expected in hail damaged beans but there is an additional factor that may have had an influence. Note under methods and procedures that by June 18 (before the hailstorm) the 20 inch rows had been thinned to the final stand but not the 30 and 40 inch rows. The pratice of over planting was followed to make sure that stands were adequate. Therefore, 30 and 40 inch rows had an excess of plants and could sustain a 20 to 30% stand reduction by the hail and still have fairly adequate populations in most plots. With 20 inch rows, however, stands were already hand thinned to the final count before the hail and a 30% loss from hail would make a large deficiency in plants per acre. This may be the reason why yield from the first planting in 20 inch rows appears to be inconsistent.

Another reason for relatively good yields in hail damaged beans was excellent weed control after the hail. Weed control by cultivation only was difficult because of height differences in damaged beans. Chemical weed treatment was very helpful under these circumstances.

TABLE 28. EFFECT OF SOYBEAN POPULATIONS ON YIELD*

Replanted beans (Chippewa 64)		1st planting hail damaged (Corsoy)	
Plants per acre (hand thinned)	Bushels per acre replicates 1,2,4,5	Final stand replicate 6 only	Bushels per acre average of replicates 3&6
75,000	36	62,000	36
100,000	36	76,000	38
125,000	36	72,000	39
150,000	38	110,000	41
175,000	37	115,000	40
200,000	37	95,000	41

*Results from 3 row spacings were averaged for each population.

Discussion and Interpretation of Table 28

There was very little yield response to different populations with replanted beans.

Final stand count in hail damaged beans was made in replicate six only. Note the variations between final stand in replicate six and stands from replanted, hand thinned beans. Note also the trend for higher yields with thicker population densities in hail damaged beans.

To sum up this year's data regarding whether or not to replant soybeans after a hail storm, it looks as though the final remaining stand should be a primary consideration. If the remaining plant pupulation is near 100,000 healthy live plants, the value of replanting is questionable. The difficult part, is determining quickly and accurately how many of the damaged plants will recover. Estimates of percent damage to stands were made shortly after the hailstorm. Plants were considered lost if the stems were cut off with no leaves, branches or axillary buds visable. Most of the actual plant losses were between 20 and 60 percent. Estimates of losses taken a few days after the storm were generally too small. Some of the plants that were injured but appeared to be alive may have died from disease.

In order to have 100,000 plants per acre there must be about 3.8 plants per foot in 20 inch rows, 5.7 plants per foot in 30 inch rows and 7.7 plants per foot in 40 inch rows.

TABLE 29. COMPARISON OF 7 INCH AND 30 INCH ROW SPACINGS FOR SOYBEANS

Row Spacings	Bushels per acre
7 inch	50
30 inch	48

Discussion and Interpretation of Table 29

This phase of the narrow row investigation was initiated because several requests were made for information comparing very narrow rows to 20, 30 and 40 inch spacings. A separate area was used for this experiment because there was not enough room in the area allotted for the original study.

To evaluate 7 inch spacing, comparisons were made with 30 inch rows because 30 inch spacing was one of the most successful in the past and results can be related to the original experiment.

A John Deere press drill was used to plant 7 inch spacings. Tool bar unit planters were used to plant 30 inch rows. A final population of 150,000 was aimed for because plants would be reasonably close to equidistant spacing with this population in 7 inch rows. Planting dates, fertilizer applications and weed control treatments were similar to the main experiment.

These plots were not thinned before the hail and were not replanted afterward. They were originally overplanted with the intention of thinning, but the hail storm thinned stands to the approximate populations desired, and introduced some additional variability.

With the environmental conditions of this experiment, seven inch rows appeared to yield a little more than 30 inch rows. However, before any planting decisions regarding row spacings are made, it would be well to see what happens when there is no hail storm and conditions are more precisely controlled.

MOST PROFITABLE ROTATION

-- F. Shubeck and B. Lawrensen

Objectives of Experiment

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

Methods and Procedures Used in Rotation Study

Seven different rotations or cropping sequences were investigated. The longest sequence had 2 years of corn, one year of oats and one year of alfalfa hay.

Varieties used were as follows:

Corn - Northrup King PX 556
Oats - Holden
Alfalfa - Vernal

Soybeans - Corsoy and Chippawa 64
Grain sorghum - Northrup King 222
Sweet clover - Madrid

Fertilizer applications were based on soil test recommendations.

Discussion and Interpretation of Table 30

Oats yields were very low due to hail damage and no conclusions regarding treatments can be made.

Notice the larger corn yield increases in sequences 1 and 2 when commercial fertilizer was applied (37 and 46 bu/acre).

In the unfertilized alfalfa rotation (sequence 3) second year corn after alfalfa dropped about 9 bushels compared to first year corn. In the fertilized alfalfa rotation, response to 70 lbs. of nitrogen was about 12 bushels. This was considerably less than the response to 70 lbs. of nitrogen in the continuous corn (37 bu) or corn-oats sequence (46 bu). This difference in response to nitrogen between legume rotations and continuous corn or corn-oats sequences can be attributed to the beneficial effects of alfalfa.

The value of planting sweet clover in an unfertilized corn-oats sequence amounted to about 6 bushels of corn (compare unfertilized sequence number 4 to number 2).

Soybeans were damaged by hail and most of these sequences were replanted with Chippawa 64.

Yields of sorghum were not as high as in other experiments on well-drained soils further west on the farm.

Table 30 Effect of Cropping Sequence and Fertility on Crop Yield

Cropping Sequence	Crop Receiving Fertilizer	Fertilizer lbs/acre N+P+K	N Side Dress Lb/A	Oats Bu/A	1st Yr. Corn Bu/A	2nd Yr. Corn Bu/A	Soy-beans Bu/A	Sorg-hum Bu/A	Hay Tons/Acre
1 Cont. Corn	—	0 + 0 + 0	-	-	65	-	-	-	-
1 Cont. Corn	Corn	6 + 11 + 10	70	-	102	-	-	-	-
2 Corn-Oats	—	0 + 0 + 0	-	8	62	-	-	-	-
2 Corn-Oats	Corn	6 + 11 + 10	70	-	108	-	-	-	-
	Oats	30 + 7 + 0	-	12	-	-	-	-	-
3 Corn-Corn-Oats + Alf.-Alf. hay	—	0 + 0 + 0	-	9	101	92	-	-	2.9
3 Corn-Corn-Oats + Alf.-Alf. hay	Corn	6 + 11 + 10	-	-	79	-	-	-	-
	Corn	6 + 11 + 10	70	-	-	91	-	-	-
	Oats	15 + 26 + 0	-	13	-	-	-	-	-
	Alfalfa residual		-	-	-	-	-	-	3.9
4 Oats + Sw. Clover-Corn	—	0 + 0 + 0	-	10	68	-	-	-	-
4 Oats + Sw. Clover-Corn	Oats	30 + 7 + 0	-	13	-	-	-	-	-
	Corn	6 + 11 + 10	-	-	80	-	-	-	-
5 Corn-Oats-S. beans	—	0 + 0 + 0	-	14	67	-	27*	-	-
5 Corn-Oats-S. beans	Corn	6 + 11 + 10	70	-	95	-	-	-	-
	Oats	20 + 7 + 0	-	13	-	-	-	-	-
	Beans	6 + 11 + 10	-	-	-	-	32*	-	-
6 Corn-S. beans-Oats	—	0 + 0 + 0	-	6	75	-	36*	-	-
6 Corn-S. beans-Oats	Corn	6 + 11 + 10	55	-	108	-	-	-	-
	Beans	6 + 11 + 10	-	-	-	-	36*	-	-
	Oats	30 + 7 + 10	-	9	-	-	-	-	-
7 Cont. Grain Sorghum	—	0 + 0 + 0	-	-	-	-	-	26	-
7 Cont. Grain Sorghum		6 + 11 + 10	70	-	-	-	-	45	-

* Represents yields of hail damaged Corsoy or replanted Chippewa 64 soybeans.

SOIL POTASSIUM OF THE SOUTHEAST FARM

-- Dwight Hovland and B. Lawrensen

The 1969 study was a continuation of the same plots used in 1965-68. Descriptions of the plots were included in previous annual progress reports for the southeast farm.

Three potassium fertilizer treatments were compared. The same fertilizer treatments were used on the same plots each spring 1965, 1966, 1967, and 1968. Treatments were: (a) no potassium, (b) 500 pounds of potassium per acre broadcast and disked into surface soil, and (c) 12 to 17 pounds potassium per acre banded alongside and just below the seed. No additional potassium fertilizer was used in 1969. Nitrogen and phosphorus fertilizers were broadcast uniformly over all plots. Northrup King PX 610 corn was planted in 30-inch rows on May 27. Good insect and weed control was maintained throughout the season. The major adversity of the growing season was the fairly severe hail storm the night of June 21. The corn had not advanced far enough to be seriously injured. The late planting coupled with the late fall probably accounted for the fair yields in spite of the hail.

TABLE 31. INFLUENCE OF POTASSIUM FERTILIZER ON CORN GRAIN YIELDS ON SOME MODERATELY WELL DRAINED SOILS OF THE SOUTHEAST FARM

Lb. 0-0-60.ac./yr.	Corn grain yield (bu./ac.)					
1965, 1966, 1967 & 1968	1965	1966	1967	1968	1969	1965-69 Av.
0	101	110	119	89	104	105
1000	101	107	111	70	101	98
30	100	108	112	105	105	106

Corn grain yields for each of the five years along with the average for the five year period were recorded in Table 31. It should be noted that the differences in 1968 yields were not repeated in 1969. The low corn yields associated with heavy applications of 0-0-60 in 1968 may have resulted from low soil moisture during the early growing season and high concentrations of 0-0-60 (KCl) decreased the availability of soil water for germination and plant growth. Soil moisture supply was more nearly adequate during 1969.

TABLE 32. POTASSIUM CONTENT IN CORN LEAVES AT THE TIME OF POLLINATION FOR 1966-68

Lb. 0-0-60/ac./yr.	Potassium content of dry leaves (%K)		
1965, 1966, 1967 & 1968	1966	1967	1968
0	2.9	3.0	2.5
1000	2.8	2.9	2.6
30	3.0	3.1	2.6

Chemical analysis of corn leaves in Table 32 showed no differences in potassium content associated with fertilzer treatments. The data showed that the soil potassium supply probably was sufficient. Also these results showed that plant uptake did not account for the fertilzier potassium. So the next thing to be investigated was the fate of the potassium in the soil. The soil in the plots was sampled in detail in May 1965 before the application of any fertilizer and in August 1968 after four annual applications of fertilzer. Some chemical analysis of these samples have been completed.

TABLE 33. AMMONIUM ACETATE EXTRACTABLE POTASSIUM IN TOP SIX INCHES OF SOIL BEFORE AND AFTER FERTILIZATION

Lb. 0-0-60/ac/yr. 1965,1966,1967&1968	Extractable potassium in soil (lb./ac.) May 1965	Aug. 1968
0	716	594
1000	710	1636

Ammonium acetate extractable potassium in some of the surface soil samples were included in Table 33. The difference in extractable potassium between no potassium plots and potassium plots accounts for about half of the potassium applied as fertilizer (2,000 lbs. K were added and the difference was about 1,000 lbs.).

Although laboratory studies of the soils will continue, the field studies will be completed with this report.

WESTERN CORN ROOTWORM - 1969

-- B. H. Kantack, Wayne L. Berndt, J. F. Fredrikson, Merlin Pietz and Bernard Uthe

Western corn rootworm larval populations were again prevalent in the major corn growing areas of South Dakota. Good growing conditions for corn masked much of the larval injury. However, considerable lodging was present in many fields. Chemicals recommended for corn rootworm control performed well in most instances. There were a few cases of field failures reported in 1969. Diazinon was recommended north of U. S. Highway 16 only. Performance of this chemical was unsatisfactory in the Beresford plot in 1969 (Table 34). Thus, as in 1969, we are not recommending this insecticide for southern South Dakota in 1970.

Corn rootworm control results from the Herman Paulson farm are in Table 34. The infestation on this plot was moderate to heavy with averages of 25 - 50 worms per plant. Good moisture conditions prevailed throughout the larval feeding period and good root regrowth occurred. With the exception of Diazinon all insecticides gave good rootworm control. Recommendations for corn rootworm control in 1970 are in Table 35.

TABLE 34. CORN ROOTWORM CONTROL DMONSTRATION PLOT, HERMAN PAULSON FARM, 1969

Treatment	Rate - Lbs./Acre	Lodging, Percent stalks greater than 30° from perpendicular
BUX 10G	0.75	4
BUX 15G	0.75	2
THimet 15G	1.0	6
Daeanit	1.0	11
Furadan	0.75	3
Dyfonate 10G	0.75	1
Dyfonate 20G	0.75	5
Thimet (50) - Zinophos (50)	1.0	0
Thimet (12) - Zinophos (3)	1.0	0
Thimet (10) - Zinophos (5)	1.0	1
Diazinon 14G	1.0	45
Check	-	45

TABLE 35. RECOMMENDATIONS FOR CORN ROOTWORM CONTROL IN 1970

Insecticide	Dosage Actual Per Acre
Bux Ten	0.75 lb.
Thimet	1.0 lb.
Furadan	0.75 lb.
Dyfonate	1.0 lb.
Dasanit	1.0 lb.
Landrin	1.0 lb.
Mocap	1.0 lb.
Diazinon*	1.0 lb.

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

Caution

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

GREENBUG CONTROL ON GRAIN SORGHUM WITH SYSTEMIC INSECTICIDES

-- B. H. Kantack, Fred Shubeck and Burt Lawrensen

With recent outbreaks of the greenbug, Schizophis graminum (Rondani) on sorghum it has become necessary to search for methods to control this insect on this crop. One possible method involves systemic treatments applied at planting time.

Di-syston, Thimet and Furadan were applied at planting time. The insecticides were applied as granules over the row in a 4 to 7 inch band and incorporated to a depth of one-half to one inch. Results in grain yields are shown in Table 36.

TABLE 36. YIELDS OBTAINED FROM GRAIN SORGHUM PLOTS RECEIVING PLANTING TIME TREATMENTS OF THREE SYSTEMIC INSECTICIDES

Insecticide Treatment	Rate, lbs. actual/acre	Bu/acre*
Di-syston	1.0	122.8
Thimet	1.0	121.5
Furadan	1.0	115.4
Untreated Check	-	117.7

*Averages of six replicates for each treatment.
There were no significant differences among treatment means.

Greenbug infestation started to develop on August 13, with 40-50 greenbugs per leaf on the lower four leaves in the Check plots. Observations on the treated plants showed fewer aphids than untreated Check plots with averages of 5 to 10 per leaf on the lower four leaves. Aphid counts taken on August 20 showed a decrease in greenbugs on all plots with numerous parasites and predators present on the plants. Thus, no further evaluations of the treatments were possible as an economic infestation did not develop. Preliminary observations on August 13 did indicate that the systemic treatments were preventing greenbug buildup, however the infestation did not persist long enough to make adequate evaluations.

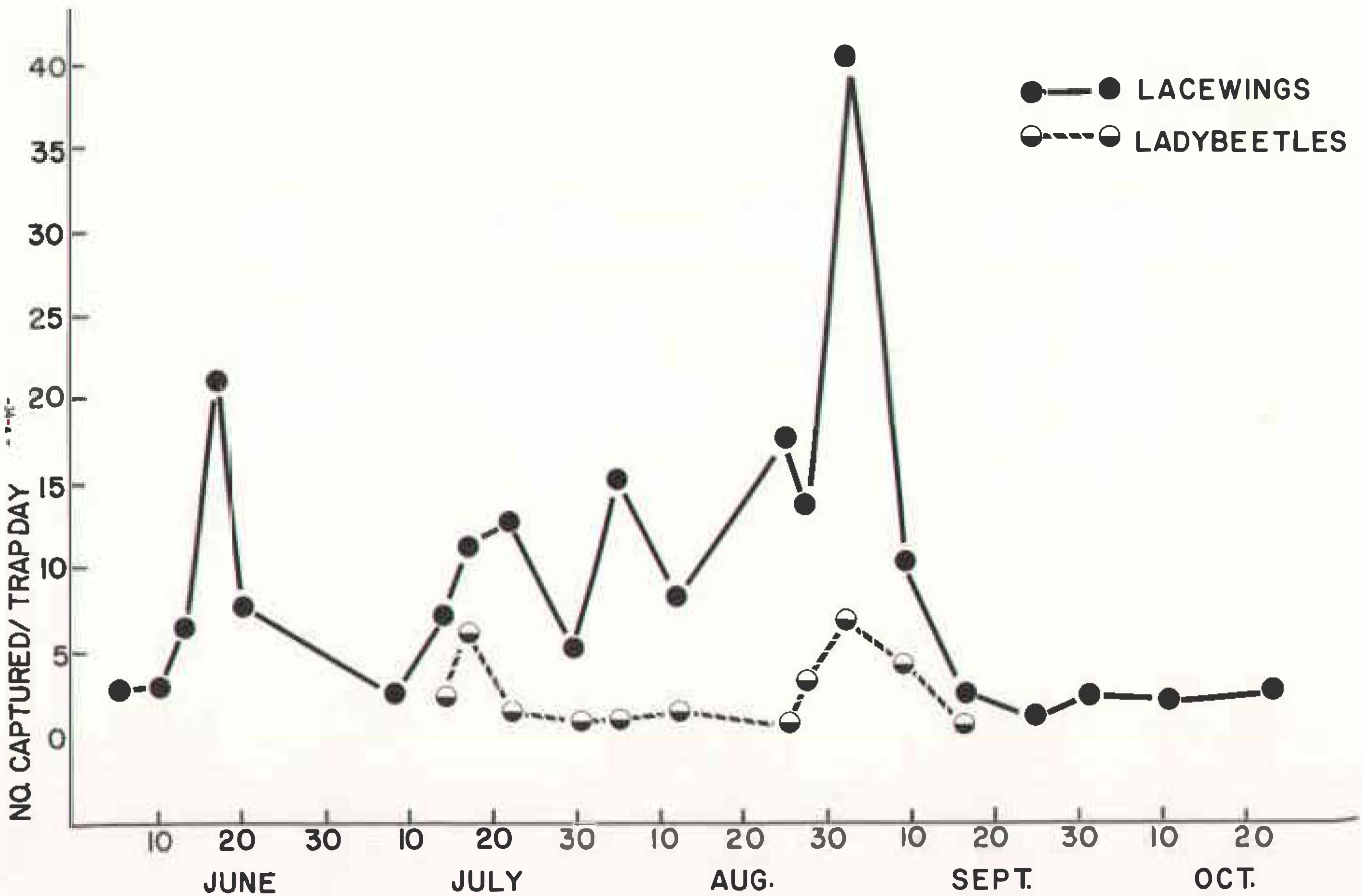
FLIGHT ACTIVITY OF INSECT PREDATORS OF CEREAL APHIDS

-- R. W. Kieckhefer

Objectives

1. To determine whether insect predators of cereal aphids move between

FIG. 4. FLIGHT ACTIVITY OF GREEN LACEWINGS AND CONVERGENT LADYBEETLES AT SE EXPERIMENT FARM 1969



small grains, corn and alfalfa in South Dakota and to describe the nature of these movements.

2. To determine which environmental factors may be associated with flight of predators from one crop to another.

Problems connected with widespread application of insecticides have renewed interest in use of insect predators as an alternative or supplementary method of regulating populations of insect pests. A detailed knowledge of the field biology of predators and pest populations is prerequisite to management of predator populations or to making predictions about their effectiveness as pest control agents. Lady beetles, lacewings, and damsel bugs are known to be the most prevalent groups of insect predators in South Dakota small grain fields.

This year's work and its objectives were a) continuation of the studies begun last year (see 8th Annual Report, SE South Dakota Experiment Farm). Flight traps, consisting of adhesive cylinders mounted on poles 12 feet in height, were again placed between principal crops at the SE Experiment Farm and checked at regular intervals throughout the growing season for presence of predators. Much of the data obtained tended to confirm our conclusions of last year, but there were some important differences. Although populations of adults of the convergent lady beetle in oats and alfalfa at the Farm in 1969 were comparable to those in 1968, flight activity of this ladybird was considerably reduced in 1969 (Fig. 4). Ladybird populations in corn were sharply reduced in 1969, probably reflecting lack of movement between oats and alfalfa and corn. Statistical analyses of data from the 2 years may help to determine which factors (condition of the crop, weather factors, availability of food) are associated with various levels of flight activity.

Flight activity of green lacewings in 1969 generally closely paralleled that of 1968 both in frequency of flight and peak numbers in flight. With accumulation of additional information in the future, we may be able to devise systematic management programs that will enable us to conserve and manipulate predator populations for very specific pest control objectives.

SMALL GRAIN VARIETY TRIALS

-- J. J. Bonnemann

Rye and winter wheat entries were seeded in September of 1968. Oat trials were seeded in April of 1969. The severe hailstorm that passed over the SE Farm on June 21 caused severe damage to the plots and they were abandoned. Rod-row trials of spring wheat and barley were discontinued as the acreage seeded in the area is very limited.

Further discussion on small grain trials will be found in Circular 197, 1969 Small Grain Performance Trials, South Dakota Agricultural Experiment Station.

GRAIN SORGHUM PERFORMANCE TRIALS

-- J. J. Bonnemann

Grain Sorghum Performance Trials have been conducted annually at the SE Farm since 1962. The entries included are the choice of the producing companies and the check entries are included by the Agricultural Experiment Station.

The grain sorghum trial was seeded on May 23 and harvested on October 9. Cooler temperatures prevailed during much of the growing season. The cool, wet period immediately after seeding was detrimental to good germination and initial stands were thin. However, the severe hailstorm that destroyed small grain caused tillering of the grain sorghum plants and the thin stands of early June were greatly augmented. Where gaps in the rows were once quite variable, stalks had filled in. Despite cooler temperatures, the sorghum did produce grain of good quality. Moisture was quite high and supplemental drying was often necessary.

Results of the Grain Sorghum Performance Trials appear in Table 37. Complete results and further discussion will appear in Circular 199, 1969 Grain Sorghum Performance Trials, Agricultural Experiment Station.

CORN PERFORMANCE TRIALS

-- J. J. Bonnemann

The entries included in the corn performance trials were those selected by the participating commercial seed producers and varieties developed by Experiment Stations in the area.

The corn was drilled in rows, 30 inches apart, on May 13. It was harvested with a picker-sheller on October 29. Prior to the hail the corn had been thinned to populations of approximately 17,000 and 21,000 plants per acre. The severe hail storm of June 21 caused damage to all plants, the degree depending upon the stage of growth. As some plants were completely destroyed, the trials were again thinned to populations of 15,000 and 19,000 plants per acre. The plots were single rows, 32 feet long. (Continued on page 39)

TABLE 37. 1969 GRAIN SORGHUM PERFORMANCE TRIAL, AREA E, SOUTHEAST EXPERIMENT FARM, BERESFORD

Variety	Height inches	Percent Moisture 9/25/69	Test Weight lb/bu	Yield lb/A
RS 633	44	32.1	61.0	7930
Frontier 388A	46	31.7	60.0	7850
Frontier 409	44	35.4	60.0	7730
ACCO Exp. 7354	44	33.4	60.5	7620
RS 610	51	32.0	58.5	7620
Coop SG 20	41	31.0	61.0	7490
ACCO R102	42	31.6	59.0	7460
Coop SG 10	45	26.9	59.5	7410
Pioneer 866	51	31.9	60.0	7370
Dekalb E-55	42	31.8	57.5	7340
ACCO R1029	44	33.1	59.5	7320
Curry's M-530	46	30.9	59.0	7320
DeKalb C-42a	40	33.5	60.0	7170
ACCO R1050	43	32.3	60.0	7120
NK 265	42	27.9	61.0	7120
Frontier Super 400	40	30.1	57.0	6960
Pioneer 875	44	32.3	58.5	6920
DeKalb DD-50	40	30.5	59.0	6900
NK 222	40	29.7	59.0	6850
Curry's M-540	43	3102	59.5	6690
Pioneer 883	42	31.2	56.0	6500
SD 503	56	28.4	59.0	6330
FMC Rapido	38	30.4	59.0	6260
SD 451	54	20.0	58.0	6250
Frontier GX410	38	32.1	57.0	6160
NK 127	38	25.4	58.0	5520
			Mean yield	52.9

C.V. = 10.0%

TABLE 38. CORN PERFORMANCE TRIAL, AREA E, SOUTHEAST EXPERIMENT FARM, 1969

Variety	Cross	Perfor-mance score	Percent Stalks Broken	Percent Moisture	Yield B/A
Pioneer 3510	2x	1	0	28.3	191.0
Pioneer 3505	M2x	2	1	28.2	169.2
Pioneer 3390	M2x	4	1	28.1	160.1
Curry's SC-142	2x	3	2	24.6	159.0
Pioneer 3291	4x	8	1	29.2	156.0
Pioneer 3571	M2x	5	2	26.4	156.0
Lincoln Mellowdent 18	2x	11	1	28.8	155.1
Northrup-King PX 50	2x	6	1	24.9	154.1
Pioneer 3365	3x	12	0	28.1	154.0
Northrup-King Px 580	3x	7	1	25.1	153.1
Nebr. 501G	4x	16	1	29.0	152.0
Curry's SC-158	2x	10	1	25.3	151.0
Northrup-King Px 147	2x	9	0	24.5	150.0
Pioneer 3567	2x	14	2	26.2	150.0
McCurdy's HP4	3x	17	1	26.7	149.1
Wilson's WXS-1016	2x	13	1	24.6	149.0
Curry's SC-162	2x	23	2	29.1	148.1
Curry's TC-345	3x	19	0	26.5	148.0
SD PP105	M3x	18	4	25.1	147.1
Wilson's WXS-1118	2x	15	1	23.8	147.0
Stull 620 Sx	2x	20	1	24.4	145.0
Northrup-King PX 545	3x	21	1	23.8	144.1
Curry's TC-342	3x	22	1	23.1	142.1
Pioneer 3387	2x	26	0	27.0	142.1
Agrow ATC 29	3x	29	1	28.2	142.1
McCurdy's 244	2x	24	1	24.6	141.1
McCurdy's 112M	4x	27	1	26.5	141.0
Barzan BxL0110-3	3x	25	1	23.7	138.0
Coop S201	2x	28	0	23.8	137.1
Coop T207	3x	32	0	25.3	137.1
Barzan BxL-105-3	3x	30	1	25.0	137.0
Pioneer 3570	2x	32	0	25.2	135.1
Northrup-King PX610	3x	34	1	26.1	135.1
Curry's TC-358	3x	41	1	27.7	135.1
Pioneer 3715	3x	31	0	22.6	134.0
Green Acres EX12	M2x	37	1	25.0	133.0
Northrup-King PX556	3x	36	2	24.0	132.1
McCurdy's 66-03	2x	40	1	24.9	132.1
Asgrow IxL 4	2x	34	1	23.0	131.1
Stull 627 TX	3x	38	0	23.6	131.0
McCurdy's 3x6	2x	42	1	25.8	130.1
McCurdy's 2x5	2x	43	1	26.9	130.0
SD Exp 76	3x	39	2	23.0	130.0
Minn. 417	3x	44	0	24.9	126.1
SD PP107	M2x	45	6	25.4	126.0
McCurdy's 66-02	2x	46	4	25.6	125.1
Coop D 209	4x	47	1	27.3	125.1
Coop D 205	2x	49	4	28.1	124.1
SD 644	4x	48	1	26.5	122.1
SD PP106	M3x	50	1	26.0	117.0
SD PP 108	M3x	52	1	24.4	113.1
STULL 608Y	4x	51	1	22.2	112.0
STULL 604 Sx	2x	53	1	22.6	107.1
SD PP 110	M3x	55	3	25.6	106.1
Barzan BxL-100.3	3x	54	1	21.9	102.0
			Mean	25.6	132.3

C.V. = 4.7%

Most corn yields in southeastern South Dakota seemed to be record breakers, 150 B/A a commonly heard figure. The cool season and wet fall prevented field drying in the fall and much of the harvested corn was from 23-25 percent moisture. The performance trials were no exception as the average for 55 entries was 25.6 percent moisture. The trial yields are exceptionally good but because no statistical difference was found for populations the yields reported are the mean for both populations or the average of six replications. The results are a matter of record as the hail storm caused severe setbacks and the various entries may have performed differently had not damage occurred. Table 38 presents the 1969 results.

Additional information will be found in Circular 198, 1968 Corn Performance Trials South Dakota Agricultural Experiment Station.

SOYBEAN BREEDING AND TESTING AND REGIONAL UNIFORM TESTS

-- A. O. Lunden

No 1969 yield test information was obtained because of severe hail injury to the plot in late June. The plot was maintained for observational purposes but yield tests were meaningless due to differential injury, weed competition and soybean recovery. Recovery was better for late entries but was generally too slow to provide satisfactory weed competition or yield potential.

Three new soybean strains are being released in 1970. Rampage has medium maturity and is slightly earlier than Corsoy. Anoka and Wirth are early varieties being, respectively, about one day later and one day earlier than Chippewa. Rampage is slightly below Corsoy in yield but has greater lodging resistance and is more resistant to shattering than Hark. Anoka is slightly superior to Chippewa in yield and is a more upright plant but lacks resistance to shattering. Anoka is susceptible to chlorosis on high lime soils and has been superior on sandy soils in Minnesota. Wirth is probably too early to be a competitor in the area south of Moody or Lake Counties.

1969 GRAIN SORGHUM BREEDING AND TESTING

-- A. O. Lunden

Yields of experimental hybrids were excellent in spite of considerable hail damage shortly after planting. Weed control was quite effective with granular Ramrod applied at time of planting. Yields ranged up to 8700 pounds or 155 bushels per acre for Regional Test entries and to over 10,000 pounds or 180 bushels per acre for experimental entries. The highest yielding entries were long season hybrids which normally would not mature in this area so these record yields were not typical. Selected 1969 yields are shown in Table 39. Two hybrids which produced exceedingly well were extra leafy forage sorghums. These hybrids are being developed and tested for sorghum silage production. They are much shorter than most forage sorghums, stand well after frost and produce a very high percentage of grain in the silage. The 1969 yield of 12 tons per acre included over 5 tons or 180 bushels of grain.

TABLE 39. YIELDS OF SELECTED EXPERIMENTAL AND OPEN PEDIGREE GRAIN SORGHUM YIELDS

	Yields in pounds per acre			1969 Agronomic data	
	67	68	69	Pl. Ht.	Test Wt.
				in.	lb./bu.
SD441	6050	5330	5420	60	56
SD451	6570	5050	5990	55	56
SD503	7150	5820	7340	59	57
NB505	6350	4410	6400	51	59
RS610	7260	6270	6940	52	56
RS633	5940	6170	6410	48	59
RS671	4920	6570	8530	52	57
RS690	--	--	7060	44	58
RS703	--	--	8700	50	57
SD25228	6680	--	5930	49	58
SD25265	7700	--	6480	56	58
SD67873*	--	--	9830	58	58
SD67882*	--	--	10330	60	56

*This hybrid is being developed and tested for its forage sorghum qualities.

Figure 5 Plant Height at Three Stages in the Growing Season as Influenced by Various Treatments.

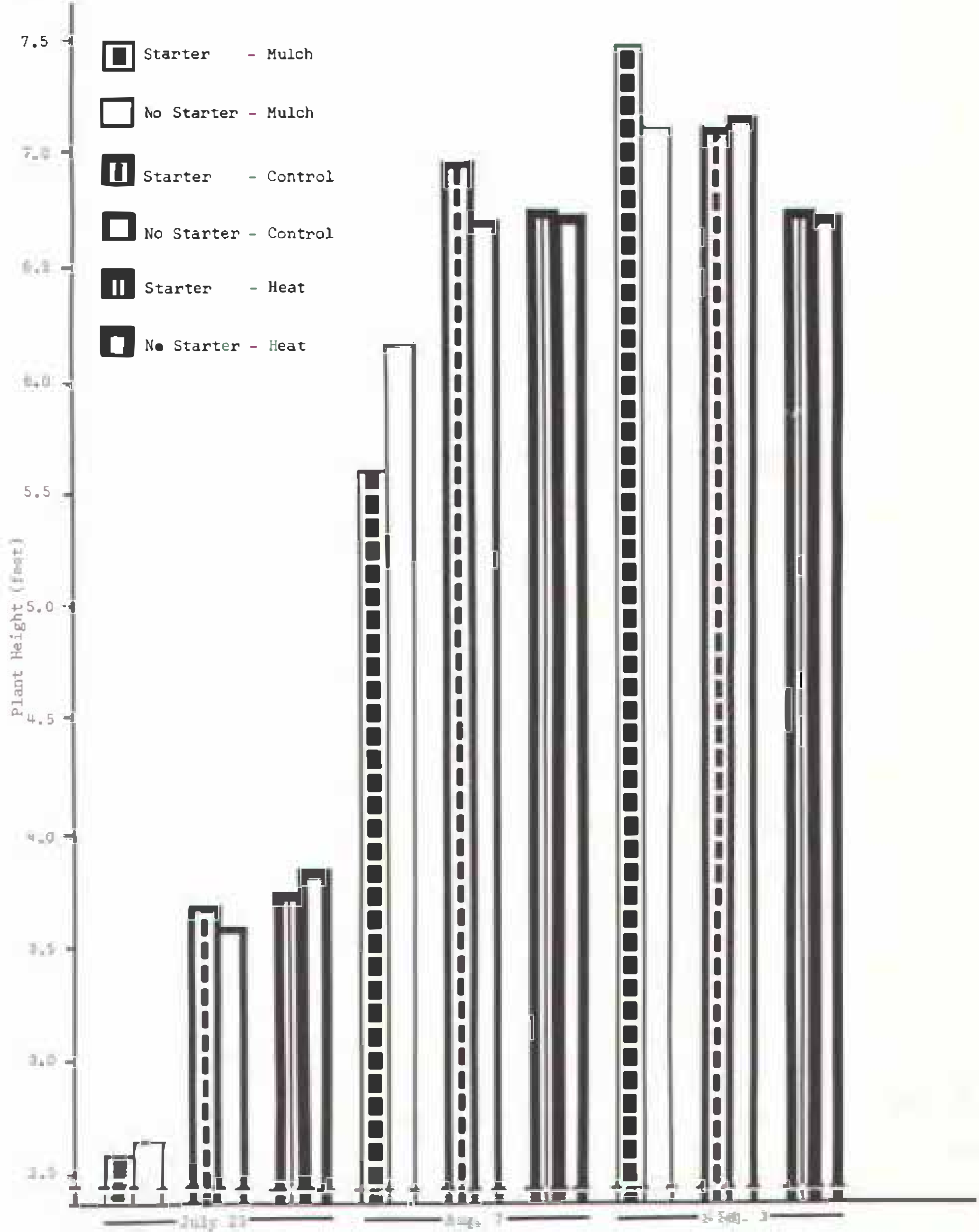
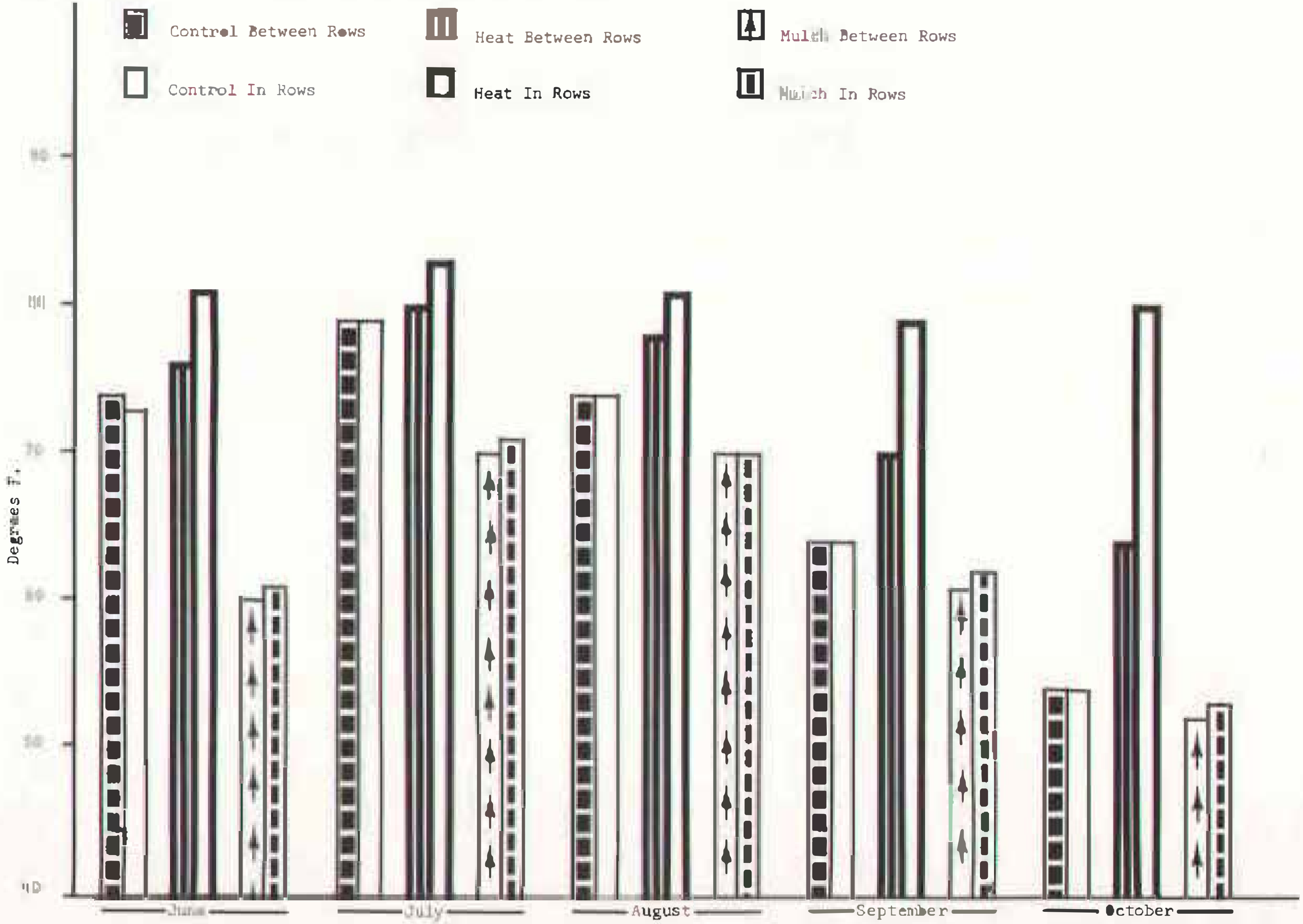


Figure 6 Average Monthly Soil Temperatures (Measured at a Depth of Three Inches with Thermo-couples) as Influenced by the Various Treatments without Starter Fertilizer.



WEED CONTROL IN CORN IN SOUTHEAST SOUTH DAKOTA

-- J. F. Stritzke and C. E. Stymiest

OBJECTIVES: To compare the effectiveness of new herbicides with some of the recommended herbicides for annual weed control.

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

SOIL TEXTURE: Silt loam, 3% organic matter.

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

PLANTING DATA: Pioneer 3715 hybrid corn was seeded at 16,000 plants per acre in 30-inch rows on May 10, 196.

SPRAYING INFORMATION: Preplant treatments were applied May 9 and incorporated by disking 4 inches deep with a tandem disk. Preemergence treatments were applied May 12 and postemergence treatments June 5. Foxtails were in the 5-leaf stage at the time of postemergence spraying.

CULTIVATION: The check plots were cultivated 3 times and the plots treated with a herbicide were cultivated twice.

DATA TAKEN: Early weed control notes on annual grasses and redroot pigweed were taken June 19, 1969.

RESULTS: Satisfactory weed control of pigweed and weedy grasses was obtained with all preplant incorporated treatments. Propachlor and alachlor gave good control of weedy grasses but control of pigweed was only fair. Several mixtures of other preemergence herbicides also gave good control of weeds (See Table 40. The postemergence treatments applied to 5-leaf grasses did not control the grasses but did control the pigweed. The hail storm on June 21 severely damaged the corn and resulted in uneven corn stands. The plants that were not killed produced good ears of corn but yields were not taken due to uneven stands. Also the weedy plots were severely damaged by army worms.

TABLE 40. WEED CONTROL IN PLOTS TREATED WITH HERBICIDES

Treatment	Rate[3] lb/A	% Early Weed Control Grasses[1]	% Early Weed Control Pigweed[2]
Preplant Inc.			
Atrazine (Aatrex)	2.5	87	93
Butylate (Sutan)	4	72	85
Butylate + atrazine	3 + 1	87	90
Preemergence			
Propachlor (Ramrod)	4	93	50
Propachlor (Ramrod)	6	93	78
Alachlor (Lasso)	2	88	70
ACD 15M	2.5	10	40
SD-15418 (Bladex)	2.5	13	13
Atrazine (Aatrex)	2.5	67	92
C-6989	4½	63	78
Atrazine + Prometryne	1½ +1½	85	90
Atrazine + Propachlor	1 + 2.4	83	83
Atrazine + GS-14260	1½ + 1½	73	93
GS-14260 + GS-13529	1½ + 1½	43	85
Propachlor + Linuron	2 ½ 1	82	50
Post emergence			
Atrazine + oil	1 + 1 gal.	62	90
ACD 15M + oil	1 + 1 gal.	60	80
S-6115	1	52	93

[1] Green and yellow foxtail and barnyardgrass
[2] Redroot and smooth pigweed
[3] Rates are expressed in pounds per acre of active material

USE OF ATRAZINE AND FERTILITY ON CORN PLOTS

-- J. F. Stritzke and C. E. Stymiest

OBJECTIVES: (1) To determine the effect of fertility and atrazine on weed control and corn yields

(2) To determine the carryover of atrazine under various fertility levels

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

SOIL TEXTURE: Silt loam, 3% organic matter

PLOT INFORMATION: Plot size was 20 feet by 30 feet. Each treatment was replicated 4 times in a randomized complete block design.

FERTILITY AND HERBICIDE TREATMENTS: A soil test showed no deficiency in potassium. Plots receiving phosphorus received 100#/A of 0-46-0. Nitrogen was applied at 100# actual per acre. Both ammonium nitrate and ammonium sulfate forms of nitrogen were used as sources of nitrogen. Atrazine plots received 3 lb/A of actual on May 12. Fertilizer and herbicide treatments are given in Table 41.

CULTIVATION: All plots were cultivated 3 times.

DATA TAKEN: Corn yields and weed yields were taken in a 30 in. by 20 ft. area. This information was then converted to an acre basis.

RESULTS: Adding nitrogen and phosphorus increased yields of both corn and weeds in the plots not treated with atrazine (Table 41). The use of atrazine alone or fertilizer alone resulted in a 25 bu/A corn yield above that of the unfertilized check plot. Using both fertilizer and atrazine increased the average corn yield by 40 bu/A. This means that under the conditions of this experiment, both weed control and proper fertility were equally important for maximum yields of corn. The effect of fertilizer rates on atrazine breakdown will be determined in 1970 when oats and soybeans will be grown on these plots.

TABLE 41. THE EFFECTS OF ATRAZINE AND FERTILIZER ON CORN GRAIN AND FORAGE YIELDS AND ON WEEDY GRASS YIELDS

Treatment	Average Corn Yields Bu/A	Average Weedy Grass Yields lbs. DM/A	Average Forage Yields lb. DM/A
No atrazine			
No fertilizer	50.7	1040	5,273
No nitrogen (P&K)	44.0	1267	4,820
NH_4SO_4(P&K)	67.0	1545	7,272
NH_4NO_3(P&K)	75.3	1988	7,719
Atrazine (3 lb/A)			
No fertilizer	75.5	0	7,401
No nitrogen (P&K)	85.0	0	7,873
NH_4SO_4(P&K)	98.6	0	10,687
NH_4NO_3(P&K)	100.0	0	8,794

USE OF PROPACHLOR AND ALACHLOR ON CORN PLOTS

-- J. F. Stritzke and C. E. Stymiest

OBJECTIVE: To compare various rates and formulations of propachlor and alachlor for annual weed control.

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

SOIL TEXTURE: Silt loam, 3% organic matter.

PLOT INFORMATION: Plot size was 10 feet by 30 feet and the treatments (see Table) replicated in a randomized complete block design.

PLANTING DATA: Pioneer 3715 hybrid corn was planted at 16,000 plants per acre in 30-inch rows on June 4, 1969.

SPRAYING INFORMATION: All herbicides were applied June 5, 1969. The back half of all plots was flextined immediately after spraying.

CULTIVATION: All plots were cultivated twice.

DATA TAKEN: Early weed control notes were taken June 30 and later observations were made on July 31 and in the fall. The primary weed problem was green and yellow foxtail.

RESULTS: A 0.68 inch rain, 5 days after application of herbicides, was sufficient to activate all of the herbicides. Flextining the treated areas immediately after spraying had no effect on performance of the herbicides. Weed control with propachlor and alachlor applied as spray was slightly better than with

granular formulations (Table 42). After 2 cultivations, all herbicide treated plots were essentially weed free. No corn yields were taken since all herbicides satisfactorily removed weeds.

TABLE 42. THE EFFECT OF PROPACHLOR (RAMROD) AND ALACHLOR (LASSO) ON FOXTAIL

Treatment Name		Rate lb/A of actual	Average control of foxtails on June 30
Common	Trade		%
Propochlor	Ramrod (gran)	4	83
Propochlor	Ramrod	4	88
Propochlor	Ramrod	6	90
Alachlor	Lasso (gran)	2	75
Alachlor	Lasso (liq)	2	82
Alachlor	Lasso (liq)	3	87
Alachlor	Lasso (liq)	4	83
	Lariat (gran)	1 1/2 + 3	75
	Lariat (gran)	2 + 4	77
	Ramrod + Atrazine (gran)	3 + 1	85
	Ramrod + Atrazine (gran)	4 + 1 1/3	82
	Ramrod + Atrazine	2.4 + 1	82
	No herbicide	—	0

SOYBEAN VARIETY RESPONSE TO TRIFLURALIN

-- J. F. Stritzke

OBJECTIVE: To evaluate the tolerance of Coraoy and Amsoy to trifluralin.

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

SOIL TEXTURE: Silt loam; 3% organic matter.

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

PLANTING DATA: Corsoy and Amsoy soybeans were drilled in plots at a plant population of 75,000 plants per acre in 30-inch rows on June 5, 1969.

SPRAYING INFORMATION: Trifluralin was applied with a tractor type sprayer applying 20 gallons spray solution per acre on June 5, 1969. The treatment was incorporated with a tandem disk.

CULTIVATION: All plots were cultivated twice.

DATA TAKEN: Stand counts and soybean yields were taken on October 10, 1969. Soybean yields were calculated from one of the two center rows (30 ft. by 30 in.).

RESULTS: All three rates of trifuluralin (3/4, 1, and 2 lb/A) gave satisfactory control of weeds. Plant populations of soybeans were variable due to a hail storm on June 21 but not the rate of trifluralin (Table 42). Under the conditions of this experiment, no yield reduction of Amsoy or Corsoy occurred with the high rates of trifluralin. All trifluralin treated plots outyielded non-treated plots which were infested with smooth pigweed.

TABLE 43. THE EFFECT OF TRIFLURALIN ON SOYBEAN STANDS AND YIELDS

Treatment	Rate[1] lb/A	Soybean Stand Counts 10-10-69	Soybean Yields Bu/A
Amsoy			
check	--	60,290	33
treflan	3/4	51,230	44
treflan	1	51,230	48
treflan	2	62,730	49
Corsoy			
check	--	54,710	32
treflan	3/4	56,800	44
treflan	1	58,200	47
treflan	2	53,320	44

[1]Rates are expressed in pounds per acre of active material.

SOYBEAN SCREENING

-- J. F. Stritzke and C. E. Stymiest

OBJECTIVE: To evaluate annual weed control of new and currently recommended herbicides at this location.

SOIL TEXTURE: Silt loam, 3.0% organic matter

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

PLANTING DATA: Corsoy soybeans were drilled in 30-inch rows at a plant population of about 75,000 plants per acre on June 5, 1969. On June 21, a hail storm reduced the stand to 60,000 plants per acre.

SPRAYING INFORMATION: The preplant and preemergence herbicides were applied on June 5 with a tractor type sprayer delivering 20 gallons spray per acre. The preplant treatments were incorporated by a tandem disk. A list of chemicals used is in Table 44.

CULTIVATION: The check plots were cultivated three times and all other plots were cultivated twice.

DATA TAKEN: Early weed control notes were taken on June 30, 1959. Weeds at that time were primarily yellow and green foxtail. Soybean yield samples ware taken October 4, 1969.

RESULTS: Early estimates indicated only fair control of grass from the various herbicides (Table). Some stunting occurred to soybeans treated with the 2 lb./A rate of RP-17623. An infestation of army worms in July fed on the grasses and essentially eliminated the weedy grass problem. The primary weed problem by fall was redroot and smooth pigweed. All herbicides when accompanied with two cultivations gave fair to good control of the pigweed and bean yields from treated plots were equal to or better than untreated plots.

TABLE 44. THE EFFECT OF HERBICIDES ON WEEDY GRASSES AND SOYBEAN YIELDS

Treatment	Rate[1] lb/A	% Grass Control	Soybean Yields Bu/A
Preplant Inc.			
Dacthal	10	73	39
Trifluralin	3/4	62	45
Vernam	3	68	42
Preemergence			
BAS2903	3	78	44
BAS2903	4	82	42
BAS2903	5	85	42
RP-17623	1	72	44
RP-17623	2	88	41
Ramrod	4	80	43
Amiben	3	82	40
Lasso	2	77	42
Lasso	3	85	42
Preforan	4	82	42
Maloran	4	57	43
Noraben	1.2 + 1.5	60	44
UNI 1000	3 + 3	62	44
Londax	2 + 1	77	42
Linuron + Lasso	0.95 + 1.9	62	43
Linuron	2.5	55	46
No Herbicide	--	0	38

[1]Rates are expressed in pounds per acre of active material.

ATRAZINE CARRYOVER AT S. E. FARM

-- J. F. Stritzke and C. E. Stymiest

OBJECTIVE: To evaluate carryover of atrazine on bioassay crops of oats and soybeans.

LOCATION: Southeast Experiment Farm near Centerville, South Dakota.

RESULTS: Visual signs of atrazine damage was noted in the oats in the atrazine treated plots. A hail storm on June 21 severely damaged the oats and no yields could be taken. No signs of atrazine damage were noted on the soybeans. The average yield of Corsoy soybeans planted as a bioassy crop across the 1968 corn herbicide screening experiment was 53.5 bu/A.

PLOT INFORMATION: This experiment was conducted on the site of the 1968 corn herbicide screening experiment. The area was fall plowed after harvest of the corn crop in 1968. During the 1969 growing season a bioassay crop of Corsoy soybeans and oats was planted across each plot. In 1968 corn screening experiment, 2.5 pounds per acre atrazine was applied preplant incorporated and preemergence. One and two pounds per acre atrazine were applied in combination with 1 gallon crop oil post emergence in the 1968 experiment. The soil texture is a silt loam with 3% organic matter.

INFLUENCE OF SOIL TEMPERATURE TREATMENTS ON STARTER FERTILIZER RESPONSE

-- Paul Evenson, Fred Shubeck and B. Lawrensen

Objective of Experiment

To determine whether corn response to starter fertilizer was influenced by soil temperature conditions.

Methods and Procedures

The experiment consisted of six treatments.

1. Heat tapes with starter fertilizer.
2. Heat tapes without starter fertilizer.
3. Control with starter fertilizer.
4. Control without starter fertilizer.
5. Straw mulch with starter fertilizer.
6. Straw mulch without starter fertilizer.

Thermostatically controlled heat tapes were placed five inches beneath corn rows on the plots receiving supplemental heat. The tapes were set to turn on when the soil temperature fell below 80° F. at a depth of four inches. Control treatments received no supplemental heat or mulch. Straw was applied on the mulch plots at the rate of 6.7 tons per acre. Plot size was three 30-inch rows x 17 feet.

All plots received a plowed-down application of 100 lbs. N + 9 lbs. P + 25 lbs. K per acre. Plots with starter fertilizer received an additional application of 12 lbs. of N + 23 lbs. of P + 17 lbs. of K per acre. The starter fertilizer was banded two inches below and two inches to the side of the seed. The experiment was planted on June 5 with Northrup King PX 556. Heat tapes were connected to a power source on June 11, and temperature records were started on June 13. The plots were harvested October 23. Continuous temperature records were taken with diodes on three plots. This data will be reported later. Temperatures also were recorded on three other plots using thermocouples. These records were taken at approximately 1 P.M. Daylight Saving Time.

Experimental Results

Table 45 gives the results of the grain harvested from this experiment and Table 46 shows the physiological maturity of the corn plants at one point in the growing season.

TABLE 45. INFLUENCE OF TREATMENTS ON YIELD, TEST WEIGHT, MOISTURE PERCENTAGE AND SHELLING PERCENTAGE OF CORN. RESULTS ARE AVERAGES OF FOUR REPLICATIONS

Treatments	Yield of No. 2 Corn bu/A	Test Weight lbs/bu	Moisture Percentage	Shelling Percentage
Heat tape with starter	125	55	36	83
Heat tape without starter	114	55	34	83
Control with starter	127	55	40	83
Control without starter	126	53	42	83
Straw mulch with starter	82	51	47	79
Straw mulch without starter	84	52	46	80

TABLE 46. INFLUENCE OF TREATMENTS ON NUMBER OF SILKS AND EARS PER PLOT ON AUGUST 12. RESULTS ARE AVERAGES OF TWO REPLICATIONS

Treatments	Number of Silks per Plot	Number of Ears per Plot
Heat tape with starter	8	18
Heat tape without starter	13	16
Control with starter	5	17
Control without starter	6	18
Straw mulch with starter	0	6
Straw mulch without starter	0	9

There was essentially no response to starter fertilizer in these tables. This was probably due to a high soil fertility level prior to the conduction of the experiment.

The heat tape and control treatments produced more corn, had higher test weights and had higher shelling percentages than the straw mulch treatments. There were no significant differences between the heat tape treatments and control treatments in the above categories. However, the moisture percentage of the corn was the lowest in the heat tape treatments and was significantly higher for the control. The corn moisture percentage for the straw mulch treatments was significantly higher than for the other treatments.

On August 12, the heat tape and control treatments had a larger number of silks and ears than the straw mulch treatments. These results, along with the results of the test weights and moisture and shelling percentages, indicated the straw mulch treatment produced corn which was slower physiologically and later in maturity than corn produced by the other treatments.

This lack of maturity was also evident in Figure 5. (see page 41)

On July 23 the straw mulch treatments were approximately a foot shorter than the other two treatments, and the mulch treatment still lagged behind them in growth on August 7. However, by September 3 the mulch treatments appeared to be taller than the heat tape treatments. This phenomenon may have been due to an imbalance of growth regulators in these treatments at different stages of the growing season. This imbalance could have been caused by differences in soil temperatures, since soil temperatures appear to regulate the production of certain growth promoting substances which are produced in the roots.

Soil temperature data on the three treatments without starter fertilizer are found in Figure 6. (see page 42)

The soil temperatures in Figure 6 were taken between June 13 and October 14. The control treatment temperatures in June averaged very close to the minimum optimal soil temperature for corn, i.e. 75 degrees. This treatment hit its maximum temperature in July and didn't fall much below the optimum temperature until September. The temperatures under the straw mulch were much lower than those under the other two treatments in June. The mulch temperatures reached a maximum at a later date than the other treatments, but the mulch temperatures never exceeded the others, and they were always below 75 degrees. There was very little difference between the in-row and between-row temperatures in both control and mulch treatments. The heat tapes maintained the temperatures in the row at approximately 80 degrees throughout the growing season. The between-row temperatures were also maintained at a higher level than the temperatures in the other treatments. However the between-row temperatures were considerably lower than the in-row temperatures later in the growing season.

The results of this experiment probably would have been different if it had been planted the first week in May before the soil temperatures became so high. Plans are to repeat this experiment using an earlier planting date.

EFFECT OF VARIOUS FERTILIZER LEVELS AND DATES OF PLANTING ON STALK-ROT DISEASE DAMAGE IN HYBRID CORN

-- C. Nagel, F. Shubeck and B. Lawrensen

Stalk rot, a fungus disease, is one of the most serious diseases of corn in the corn belt region of the United States. It causes reduced yields, stalk breakage and ear drop. The losses in yield in 1967 and 1968, based on experimental data, were 18-20%. Infection by the fungus (a parasitic mold) takes place about mid-August. The disease organism continues to develop inside the stalk until harvest time or until the stalk moisture drops to a fairly low level. Effects of the disease are usually not noticeable under field conditions until in September. If the disease is serious, lodging and ear drop usually results following ripening of the crop. Stalk breakage in bad disease years has reached 70-80 percent.

Following infection in mid-August the fungus usually continues to grow up and down inside of the stalk from the point of infection. The fungus ultimately digests the tissues inside the stalk except for the fibers. This condition weakens the stalk and lodging, stalk breakage, and ear drop usually result.

This disease is usually associated with another important disease, namely corn root rot. Frequently, the same organisms are involved in causing stalk rot and root rot. Commercial hybrids, are susceptible to some extent. Resistance to these two diseases has been most difficult to develop in corn hybrids.

In 1969, experimental data were collected from plots receiving various rates of fertilizer at four dates of planting. In this experiment approximately 600 corn stalks were split to the base of the stalks to permit the measurement and recording of the rotted tissues inside the stalks. Stalk rot was not as damaging to corn in 1969 as it was in 1967 and 1968. The data obtained are presented in Table 47.

TABLE 47. PERCENT DISEASED AND/OR ROTTED PITH IN CORN STALKS AT HARVEST TIME WHEN GROWN AT 4 FERTILITY LEVELS AND 4 DATES OF PLANTING. SOUTHEAST RESEARCH FARM. 1969.

Fertilizer broadcast N-P-K	Planting Dates May 12	May 19	May 26	June 2
	Amount of disease in percent			
0-0-0	35.5	30.2	19.7	16.3
0-25-70*	14.2	14.2	8.6	3.6
80-25-70*	21.2	26.3	29.6	10.9
160-25-70*	23.8	29.2	14.3	19.6
240-25-70*	59.2	32.5	36.7	33.6

*Received 4 lbs. N, 7 lbs. P and 7 lbs. K starter per acre placed 2 x 2 in addition to broadcast treatment.

On the May 12 planting date, when no fertilizer was applied, the percent of stalk rot was higher than when moderate amounts of nitrogen were broadcast. Plots receiving the highest rate of nitrogen had the highest amount of disease. In general, the data show these trends: a reduction in disease with delay in planting and a reduction in disease in unfertilized plots compared to plots receiving heavy rates of nitrogen.

Because these results are for a single year and therefore preliminary, no recommendations are planned at this time, the results, nevertheless, are in general agreement with experiments conducted at certain other State Experimental Stations in the heart of the United States corn belt.

Since corn borers are frequently found feeding in corn stalks, and are associated with stalk rot, they may be important in the spread of the stalk rot disease fungus, therefore borers were counted when the stalks were split for the collection of stalk rot data. Table 48, shows the average number of corn borers per stalk (in no instance did the corn borer population reach a level of 1 borer per plant).

TABLE 48. AVERAGE NUMBER OF CORN BORERS PER STALK WITH VARIOUS FERTILITY LEVELS AND DATES OF PLANTING. SOUTHEAST RESEARCH FARM. 1969.

Fertilizer broadcast N-P-K	Planting Dates May 12	May 19	May 26	June 2
		Borers per stalk*		
0-0-0	0.17	0.10	0.17	0.03
0-25-70**	0.17	0.13	0.20	0.07
80-25-70**	0.30	0.50	0.20	0.37
160-25-70**	0.50	0.60	0.63	0.67
240-25-70**	0.53	0.80	0.80	0.76

*In no case did the corn borer population exceed an average of one borer per stalk. The above averages were obtained by dividing number of borers by number of stalks per plot.

**Received 4 lbs. N, 7 lbs. P, and 7 lbs. K starter per acre placed 2 x 2 in addition to the broadcast treatment.

The data shows an increase in borer numbers per plant, when the nitrogen fertilizer level was increased. The slightly higher borer figures starting with the May 19 date of planting are probably associated with the egg laying cycle of the corn borer.

In making readings on split stalks in the field, there appeared to be little relationship between the presence of the corn borers and stalk rot damage.

Experimental design consisted of a split plot with 4 replications. Results in above tables are based on 600 split stalk readings from each of 3 replications.

CALCIUM AND PHOSPHORUS IN RATIONS FOR GROWING-FINISHING SWINE

— Richard C. Wahlstrom and
J. F. Fredrikson

Calcium and phosphorus are two mineral elements that are most often deficient in swine rations. Since they are associated with bone development, any lameness in swine is often attributed to a lack of calcium and/or phosphorus. The objective of this experiment was to study the value of increasing levels of calcium and phosphorus above the minimum recommended requirements for growing-finishing swine.

Experimental Procedure

Forty-eight weanling crossbred pigs averaging 44.5 lb. were divided into two groups and fed the rations shown in Table 1. The rations fed to the two groups of pigs were of equal protein content. Rations A and B contained approximately 16% protein and were fed to an average weight of about 115 lb. to market weight. Rations A and C fed to group I contained the minimum amount of calcium and phosphorus recommended by the National Research Council, while rations B and D fed to group II contained from 30 to 40% more calcium and approximately 100% more phosphorus (see Table 49). The higher phosphorus levels were fed to give a 1 to 1 ratio of calcium and phosphorus in rations B and D based on a 40% availability of phosphorus in corn and soybean meal since it has been shown that the phosphorus of cereal products is largely unavailable to the pig.

The pigs were housed in open-front houses with adjoining outside concrete pens where feed and water were available.

Results

Results of this experiment are summarized in Table 50. Average daily gain and feed efficiency were very good with both ration treatments. The similar results in gains of 1.87 lb. per day and feed conversions of 3.13 and 3.15 indicate that calcium and phosphorus levels had no effect on gain or feed efficiency in these rations. There were no visible differences noted in lameness or other bone abnormalities.

These results support previous research indicating that present National Research Council recommendations of 0.65% calcium and 0.50% phosphorus for growing pigs and 0.50% calcium and 0.40% phosphorus for finishing pigs are adequate for maximum rate and efficiency of gain.

TABLE 49. COMPOSITION OF RATIONS (PERCENT)

	Ration			
	A	B	C	D
	Weaning to 115 lb.		115 lb. to market	
Ground yellow corn	770	750	884	863
Soybean meal (44%)	205	210	95	100
Dicalcium phosphate	9	31	5	27
Disodium phosphate	---	4	---	3
Limestone	9	---	9	---
Trace mineral salt	5	5	5	5
Premix[a]	2.5	2.5	2.5	2.5
Calculated analysis				
Crude protein, %	15.95	15.99	12.13	12.17
Calcium, %	0.62	0.81	0.50	0.69
Phosphorus, %[b]	0.50 (0.30	1.01 (0.81)	0.40 (0.22)	0.87 (0.69)

[a] Provided 1500 I.U. vitamin A, 150 I.U. vitamin D, 1 mg. riboflavin, 2.5 mg. calcium pantothenate, 7.5 mg. niacin, 50 mg. choline, 5 mcg. vitamin B_{12} and 5 mg. oxytetracycline per pound of ration.

[b] Values in ( ) are phosphorus levels based on 40% availability of phosphorus in corn and soybean meal.

TABLE 50. CALCIUM AND PHOSPHORUS LEVELS IN SWINE RATIONS

	Group I	Group II
Calcium Level	0.62 - 0.50	0.81 - 0.69
Phosphorus Level	0.50 - 0.40	1.01 - 0.87
No of pigs	24	24
Av. initial wt., lb	44.5	44.5
Av. final wt., lb.	216.2	217.7
Av. daily gain, lb.	1.87	1.88
Av. daily feed, lb.	5.83	5.93
Av. feed per lb. gain, lb.	3.13	3.15

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

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

Previous research at the Southeast South Dakota Experiment Farm has shown that the main economical advantage of controlled environment housing for swine is an improved feed efficiency during the winter months. Some research workers have reported that gilts require a ration of higher protein content than do barrows. If this observation is true, barrows and gilts should be fed separately for maximum performance and efficiency. The purpose of the experiment reported herein was to study the performance of barrows and gilts fed separately rations

containing either 17 or 15% protein to about 110 lb. and 14 or 12% protein from 110 lb. to market when housed in a controlled environment building or an open-front building with feeders and waterers outside.

Experimental Procedure

Fifty-six barrows and 56 gilts weighing approximately 41 lb. were allotted into four groups of barrows and four of gilts with 14 pigs per group.

A 2 x 2 x 2 factorial design was used with the variables being environment, protein level and sex of pigs. The eight experimental treatments were:

1. Controlled environment, high protein ration, barrows
2. Controlled environment, high protein ration, gilts
3. Controlled environment, low protein ration, barrows
4. Controlled environment, low protein ration, gilts
5. Uncontrolled environment, high protein ration, barrows
6. Uncontrolled environment, high protein ration, gilts
7. Uncontrolled environment, low protein ration, barrows
8. Uncontrolled environment, low protein ration, gilts

The composition of the rations used is shown in Table 51. Protein was reduced in each ration when the pigs weighed approximately 110 lb. The controlled environment house was a fully insulated, ventilated, slatted floor house. The temperature was maintained between approximately 50 and 60° F. and supplemental heat was not required. The uncontrolled environment consisted of an open-front, pole type building with concrete floor and outside concrete feeding floor where self-feeders and automatic waterers were located. A partition approximately three feet high was placed across the back part of the house to form a confined and protected area for the pigs. This area was bedded with straw.

The experiment was conducted during the winter months (November 1 to February 18). Average maximum temperatures were 45, 26, 19 and 27° F. and average minimum temperatures were 27, 10, 1 and 8° F. for the months of November, December, January and February, respectively. Approximately 70 inches of snow fell during the period of this experiment. Because of the extreme amount of snow over a prolonged period of time, it was impossible to keep the pens free of snow even around the feeders and waterers. An electric wire was placed on top of the wooden fences to prevent pigs from walking over the fences.

At the termination of the 109-day trial, 40 barrows, ten from each group, were slaughtered and carcass data were obtained for carcass length, backfat, loin eye area and ham and loin percent.

Results

Table 52 shows the results of this experiment. There were no differences in rate of gain between pigs housed inside in a controlled environment building and those housed in an open-front outside building. However, significantly less feed was required per unit of gain when pigs were housed in the controlled environment building. Over 50 lb. more feed were required per pig to reach market weight when pigs were fed outside and housed in an uncontrolled building. More feed was consumed by the pigs in the uncontrolled environment. This could be due to an attempt of the pig to compensate for the extra energy required to maintain body temperature in the colder environment. There were 26 days

when the temperature dropped to zero or below with a low of 25 degrees below zero. There were also 3 days that the maximum temperature was below zero (-1, -1 and 8° F.). Although no record was kept of the amount of labor required, it should be pointed out that it did require considerable more labor to care for the pigs in the uncontrolled environment to keep the pens moderately free of snow and manure.

Neither rate of gain or feed efficiency were affected by level of protein fed. Even the 15 to 12% protein sequence appeared to be adequate for gilts. These results would differ from those of some workers in this respect. Barrows gained significantly faster than gilts, but feed conversions were very similar. Wa reported similar results in regard to sex at the 1968 Swine Field Day (A.S. Series 68-28).

Carcasses of barrows fed in the controlled enviroment house had significantly less backfat and larger loin eye areas than did the carcasses of barrows fed outside. Significantly less backfat was also noted on the carcasses of barrows fed the higher protein ration (17 to 14%) than when the lower protein ration (15 to 12%) was fed. The smaller average loin eye area of pigs fed the higher protein ration, though not significant, is contrary to the results of some other research. Although certain differences existed in backfat and loin eye area, there were no treatment differences in average ham-loin percent.

Summary

Performance of pigs from approximately 40 lb. to market weight was similar on rations containing 17 or 15% protein to 110 lb. body weight and 14 or 12% protein from 110 lb. to market weight. Pigs housed in an open-front building with outside area gained as fast as those housed in a controlled environment building, but they required significantly more feed per unit of gain. Barrows gained significantly faster than gilts. Decreased carcass backfat was found when pigs were fed the higher protein ration and also when housed in the controlled environment building.

TABLE 51. COMPOSITION OF RATIONS (PERCENT)

	High Protein		Low Protein	
	To 110 lb.	110 lb. to market	To 110 lb.	110 lb. to market
Ground yellow corn	73.7	82.7	79.2	88.2
Soybean meal (44%)	23.5	14.9	17.9	9.3
Dicalcium phosphate	1.6	1.1	1.7	1.2
Limestone	0.5	0.6	0.5	0.6
Trace mineral salt	0.5	0.5	0.5	0.5
Vitamin-antibiotic premix[a]	0.2	0.2	0.2	0.2
Calculated analysis				
Crude protein, %	17	14	15	12
Calcium, %	0.65	0.55	0.66	0.56
Phosphorus, %	0.64	0.52	0.64	0.52

[a] Provided 1500 I.U. vitam A, 150 I.U. vitamin D, 1 mg. riboflavin, 2.5 mg. calcium pantothenate, 7.5 mg. niacin, 50 mg. choline, 5 mcg. vitamin B12 and 5 mg. oxytetracycline per pound of ration.

TABLE 52. EFFECTS OF ENVIRONMENT, PROTEIN LEVEL AND SEX ON PIG PERFORMANCE

	Environmental		Protein Level		Sex	
	Con-trolled	Uncon-trolled	17-14	15-12	Barrows	Gilts
No of pigs[a]	55	54	54	55	54	55
Av. initial wt., lb.	41.3	41.1	41.2	41.2	42.0	40.4
Av. final wt., lb.	209.0	213.6	209.8	212.7	217.2	205.4
Av. daily gain, lb.	1.54	1.58	1.55	1.57	1.61[b]	1.51
Av. daily feed, lb.	5.1	5.8	5.5	5.4	5.6	5.3
Av. feed per lb. gain, lb.	3.34[c]	3.65	3.52	3.46	3.50	3.49
Carcass data						
Av. length, in.	30.5	30.5	30.5	30.5		
Av. backfat, in	1.36[c]	1.46	1.36[d]	1.46		
Av. loin eye area, sq. in.	4.39[e]	4.05	4.10	4.36		
Av. ham-loin, %	37.7	37.7	37.7	37.7		

[a] Two lots of barrows and two lots of gilts per treatment, 14 pigs per lot. Two pigs died and one removed because of prolapse.
[b] Significant ($P < .01$) difference in sex.
[c] Significant ($P < .025$) difference in environment.
[d] Significant ($P < .05$) difference in environment.
[e] Significant ($P < .05$) difference in environment.

PROTEIN AND LYSINE LEVELS IN GROWING-FINISHING SWINE RATIONS

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

Although we speak in terms of protein content of the ration, swine actually require amino acids for optimum performance, not protein. Thus, a ration containing 14 percent protein could be composed of ingredients that would give it an amino acid content equal to another ration containing 16 percent protein.

Cereal grains are particularly low in lysine, one of the essential amino acids, and a protein supplement must be fed with grains to supply additional lysine, as well as other amino acids. The purpose of the experiment reported herein was to study the performance of growing and finishing pigs when fed rations of different protein content with and without additional lysine supplementation.

Procedure

One hundred twenty weanling pigs were divided into three replicate groups on the basis of weight and sex. Each replicate was then allotted into five treatment groups of 8 pigs each with equal numbers of gilts and barrows. Thus, three lots of pigs received each of the ration treatments which were:

1. 16% protein ration (high protein)

2. 14% protein ration (medium protein)

3. 14% protein ration plus 0.15% L-lysine

4. 12% protein ration (low protein)

5. 12% protein ration plus 0.15% L-lysine

The lysine supplementation increased the lysine content of these rations to a level equivalent to that in the rations containing two percent additional protein. All rations were decreased two percent in protein content when the pigs weighed approximately 110 pounds. Composition of the rations is shown in Table 53.

Average initial weights of the three replicates varied from approximately 30 to 47 pounds with treatment averages of the three replicates being about 39 pounds. The pigs were weighed off of the experiment when they reached an average weight of from 200 to 210 pounds except for five pigs in treatment 4 and two pigs in treatment 5 that had not reached 200 pounds when the experiment was terminated.

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

Results

Growth performance data are summarized in Table 54 and carcass data in Table 55. Pigs on treatment 1 that received the high protein ration and those on treatments 2 and 3 that received the medium protein ration without and with lysine, respectively, had identical average daily gains (1.54 pounds per day). The low protein ration, treatment 4, was clearly deficient in protein as the pigs had an average daily gain of only 1.16 pounds per day.

Pigs fed the low protein ration plus lysine, treatment 5, gained 1.35 pounds per day which was 0.19 pound per day faster than those pigs fed this ration without lysine but was 0.19 pounds per day slower than those pigs fed the medium protein ration with the same lysine content (treatment 2). This would indicate that the low protein ration was deficient in lysine content and also in some other amino acid(s).

Feed required per pound of gain was somewhat variable between treatments although the low protein ration, treatment 4, required considerably more feed per unit of gain. Feed:gain ratios were 3.46, 3.56, 3.31, 4.03 and 3.57 for treatments 1,2,3,4 and 5 respectively.

Carcasses of pigs fed the high protein ration or the medium protein rations did not differ in the characteristics measured. Carcasses of pigs fed the low protein ration without supplemental lysine had slightly more backfat, almost one square inch less loin eye area and about 1 percent less ham and loin. Loin eye area and ham-loin percentage of carcasses from pigs fed the low protein ration plus lysine were somewhat greater than those fed this ration without lysine but smaller than those from pigs fed the medium or high protein rations.

Summary

Pigs fed low protein rations, 12 percent to 110 pounds and 10 percent from 110 pounds to market weight, gained slower, required more feed per unit of gain and produced carcasses with smaller loin eye areas and less percentage of ham and loin. Supplementing this low protein ration with lysine improved gain, feed:gain ratio and carcass characteristics but performance did not equal that of pigs fed higher protein rations.

TABLE 53. COMPOSITION OF RATIONS (PERCENT)

	To 110 lb.			110 lb. to market		
	16	14	12	14	12	10
Ground yellow corn	76.0	82.0	87.5	82.5	88.0	93.2
Soybean meal, 44%	21.0	15.0	9.4	15.0	9.4	4.0
Dicalcium phosphate	1.7	1.8	1.9	1.3	1.4	1.5
Ground limestone	0.5	0.5	0.5	0.5	0.5	0.5
Trace mineral salt	0.5	0.5	0.5	0.5	0.5	0.5
Vitamin-antibiotic premix[a]	0.25	0.25	0.25	0.25	0.25	0.25

[a]Provided 1500 I.U. vitamin A, 150 I.U. vitamin D, 1 mg. riboflavin, 2.5 mg. calcium pantothenate, 7.5 mg. niacin, 50 mg. choline, 5 mcg. vitamin B_{12} and 5 mg. oxytetracycline per lb. of ration.

TABLE 54. GROWTH PERFORMANCE OF PIGS FED HIGH, MEDIUM AND LOW PROTEIN RATIONS, WITH AND WITHOUT LYSINE

	High Protein (16-14%)	Medium Protein (14-12%)	Medium Protein +0.15% lysine	Low Protein (12-10%)	Low Protein +0.15% lysine
No. of pigs[a]	24	23	24	24	24
Av. initial wt., lb.[b]	38.6	39.1	38.5	38.2	38.9
Av. final wt., lb.	202.7	201.6	204.1	183.4	198.7
Av. daily gain, lb.	1.54	1.54	1.54	1.16	1.35
Av. feed cons./day, lb.	5.34	5.49	5.09	4.67	4.84
Feed:gain ratio	3.46	3.56	3.31	4.03	3.57

[a]Three replicates of 8 pigs each per treatment. One pig died on medium protein.
[b]Av. initial weights were 47.3, 39.2 and 29.3 for replicates 1, 2 and 3 respectively.

TABLE 55. CARCASS DATA OF PIGS FED HIGH, MEDIUM AND LOW PROTEIN RATIONS, WITH AND WITHOUT LYSINE

	High Protein (16-14%)	Medium Protein (14-12%)	Medium Protein +0.15% lysine	Low Protein (12-10%)	Low Protein +0.15% lysine
No. of carcasses	24	23	24	19	22
Cold carcass wt., lb.	146.7	145.8	148.0	138.3	144.8
Av. carcass length, in.	30.2	30.2	30.4	30.0	30.8
Av. carcass backfat, in.	1.35	1.37	1.34	1.42	1.37
Av. % ham and loin	38.1	38.0	38.0	37.1	37.4
Av. loin eye area, sq. in.	3.8	3.7	3.9	2.9	3.4

CHLORTETRACYCLINE AND SULFAMETHAZINE SUPPLEMENTATION OF CALVES DURING FEEDLOT ADAPTATION

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

For the past few years, calves purchased for various experiments have been subjected to feedlot adaptation studies during the first month following arrival. The two most recent experiments at the Southeast Experimental Farm were conducted to test the value of chlortetracycline at two levels and a combination of chlortetracycline with sulfamethazine.

Experiment 1

Procedures

Ninety-six steer calves were purchased from an auction sale barn for this experiment. They arrived at night and were held until the next morning without feed and water. The following morning the calves were ear tagged, weighed and allotted into 4 pens of 24 calves each. Four experimental treatments were as follows: (1) control, (2) 350 mg. chlortetracycline daily, (3) 700 mg. chlortetracycline daily and (4) 350 mg. chlortetracycline and 350 mg. sulfamethazine (Aureo S-700) daily.

The ration when on full feed consisted of 2 lb. of a 30% protein supplement, 5 lb. of alfalfa-bromegrass haylage and corn silage to appetite. The control supplement was composed of the following ingredients (%): ground corn grain, 30.0; soybean meal (44%), 62.0; trace mineral salt, 4.0; and dicalcium phosphate 4.0. Vitamin A was added to furnish 10,000 I.U. per pound of supplement. A chlortetracycline or a chlortetracycline-sulfamethazine premix was added to the supplement replacing an equal weight of soybean meal to provide the appropriate levels of these compounds.

Feeding was once daily. The calves had access to a shed with a choice between inside and outside loafing and bedding areas. Feeding was inside the shed.

Results

Results of the first experiment are presented in Table 56. Weather conditions were rather severe upon arrival of the calves and during the time of the experiment. There was freezing rain at time of arrival and considerable snow, wind and low temperatures occurred during the experiment. Gains during the 29-day experiment were at a lower rate than have generally been obtained with calves during the first month following weaning and shipping and fed rations similar as in this experiment.

Weight gains for the first 14 days were higher for the calves supplemented with 350 mg. of chlortetracycline or the combination of the antibiotic and sulfamethazine. Rate of gain improved during the second 2-week period with all treated groups gaining at a faster rate than the control calves. Weight gains after 29 days on basis of weights after an overnight stand without feed and water exceeded the control group by 0.31, 0.38 and 0.42 lb. daily for the 350 mg. chlortetracycline, 700 mg. chlortetracycline and 350 mg. each of chlortetracycline and sulfamethazine treatments.

There were only small differences in feed consumption between treatments. Therefore, calvea making the more rapid gains also made the most efficient gains.

Four calves were given individual medication for shipping fever. One received the antibiotic-sulfa drug combination, two the 350 mg. level of chlortetracycline and one the 700 mg. level of the antibiotic.

Experiment 2

Procedure

One hundred twenty steer calves were purchased from one rancher for this experiment. They were rounded up early in the morning, sorted from their dams, trucked to a central weighing point, unloaded and weighed and arrived at the station in the early evening. They were offered hay and water until late the following afternoon. Feed and water were then withheld over night prior to the initial weighing.

The calves were allotted into 4 pens of 30 each on basis of weight. Four experimental treatments were the same as for experiment 1. The ration when on full feed consisted of 2 lb. of a protein supplement, 5 lb. of alfalfa hay and corn silage to appetite. Ingredient composition of the protein supplements was the same as for experiment 1.

Feeding was once daily. The calves were fed in open pens without access to shelter. The pens had a concrete apron in front of the feed bunk and to an electric automatic waterer. A bedding mound was provided for each pen.

Results

Results of the second experiment are presented in Table 57. Weather conditions were rather moderate during the time of the experiment.

The calves were rather light in weight at the beginning of the experiment and intake of the corn silage was low along with an average of about 4.5 lb. of hay and 2 lb. of the protein supplements.

Weight gains were higher for all treated groups than for controls during the first 2 weeks of the experiment with only small differences between treated groups. Control calves gained at a lower rate during the second 2-week period while those fed 350 mg. of chlortetracycline or the combination treatment gained at about the same as during the first 2-week period. Calves fed 700 mg. of chlortetrocycline daily gained at a somewhat faster rate during the second 2-week period. Weight gains on basis of shrunk weights after 30 days exceeded the controls by 0.29, 0.66 and 0.36 lb. daily for 350 mg. chlortetracycline, 700 mg. chlortetracycline and 350 mg. each of chlortetracycline and sulfamethazine.

There were only small differences in feed consumption between treatments. Calves making the faster gains had lower feed requirements. No evident problems other than a few runny noses and mild coughs were encountered with these calves.

Summary

Two experiments with 96 and 120 calves showed a beneficial effect on rate of gain from chlortetracycline at 350 or 700 mg. per head daily or 350 mg. each of a chlortetracycline-sulfamathazine combination when administered for about 4 weeks following weaning and shipping. Improvement in rate of gain amounted to 0.29 to 0.66 lb. daily for the various treatments over control calves. Calves fed the antibiotic-sulfa drug combination gained slightly more than those fed only 350 mg. of the antibiotic in both experiments. Calves fed chlortetracycline at 700 mg. daily gained at about the same rate as those on the combination treatment in one experiment but at a faster rate (0.30 lb. daily) in the other experiment.

There were only small differences in feed consumpiton between treatment groups. However, those fed the antibacterial compounds consumed slightly more feed and had lower feed requirements.

Problems from shipping fever and other diseases were relatively minor in all treatment groups in the experiments.

TABLE 56. CHLORTETRACYCLINE AND SULFAMETHAZINE DURING FEEDLOT ADAPTATION OF CALVES. EXPERIMENT 1: SOUTHEAST FARM - DECEMBER 12, 1968 TO JANUARY 10, 1969--29 DAYS.

Item	Control	Chlor-tetracycline 350 mg.	Chlor-tetracycline 700 mg.	Chlor-tetracycline and Sulfa-methazine[1]
Number of calves	24	24	24	24
Initial wt., lb.	391	391	391	391
Final wt., lb.	411	429	426	428
Av. daily gain, lb.				
Day 1-14	0.51	0.87	0.51	0.98
Day 15-28	0.89	0.86	1.95	1.69
Over-all shrunk	0.37	0.68	0.75	0.79
Av. daily ration, lb.				
Corn silage	12.7	12.5	12.8	12.8
Alfalfa-brome	4.6	4.6	4.6	4.6
Protein supplement	2.0	2.0	2.0	2.0
Feed/100 lb. gain, lb.				
Corn silage	1824	917	1042	962
Alfalfa-brome	662	336	374	343
Protein supplement	283	144	160	148
Incidence of shipping fever	0	2	1	1

[1] 350 mg. chlortetracycline and 350 mg. sulfamethazine (Aureo S-700) daily.

TABLE 57. CHLORTETRACYCLINE AND SULFAMETHAZINE DURING FEEDLOT ADAPTATION OF CALVES. EXPERIMENT 2: SOUTHEAST FARM - NOVEMBER 5 TO DECEMBER 5, 1969 - 30 DAYS

Item	Control	Chlor-tetracycline 350 mg.	Chlor-tetracycline 700 mg.	Chlor-tetracycline and Sulfa-methazine[1]
Number of calves	30	30	30	30
Initial wt., lb.	346	346	346	346
Final wt., lb.	376	384	396	387
Av. daily gain., lb.				
Day 1-14	1.35	1.64	1.75	1.72
Day 15-29	1.09	1.65	2.04	1.69
Over-all shrunk	1.00	1.29	1.66	1.36
Av. daily ration, lb.				
Corn silage	4.41	4.75	4.75	4.75
Alfalfa hay	4.09	4.55	4.46	4.39
Protein supplement	1.97	1.97	1.97	1.97
Feed/100 lb. gain, lb.				
Corn silage	442	369	287	349
Alfalfa hay	410	354	269	322
Protein supplement	197	153	119	144

[1] 350 mg. chlortetracycline and 350 mg. sulfamethazine (Auro S-700) daily.

RATIOS OF CONCENTRATES AND ROUGHAGES IN RATIONS DURING VARIOUS STAGES OF GROWING AND FINISHING OF CATTLE

-- L. B. Embry and J. F. Fredrikson

One factor which may have a major influence on the rate and efficiency of production of growing and finishing cattle is the ratio of concentrates and roughages in the rations. The ratio of concentrates to roughages at various stages of growing and finishing can be of greater importance than the average ratio throughout the feeding period.

The objective of this experiment was to determine the effects on rate of gain, feed requirements and carcass characteristics when cattle were changed from a corn silage ration to one of corn grain with a low level of alfalfa haylage at various stages of growing and finishing.

Procedures

Four pens with 24 steer calves initially were used in the experiment. One pen of steers (control) was fed a ration consisting of 4 lb. of alfalfa haylage and 1 lb. of a 40% protein supplement with a full feed of ground corn grain. Another pen of the steers was full-fed corn silage with 2 lb. of a 40% protein supplement from the beginning of the experiment (av. wt. about

410 lb.) to an average weight of about 650 lb. They were then fed as the control group until finished for market. Two pens of steers were fed the corn silage ration to an average weight of about 900 lb. then the corn-haylage ration until finished for market. One of these pens was to be fed the corn silage ration throughout the experiment but the amount of silage available was not sufficient.

Feeding was once daily inside the shed with a choice between inside and outside bedding areas for the cattle. Dicalcium phosphate and trace mineral salt were offered free choice. The 40% protein supplements were composed of eoybeen meal, urea, corn grain, limestone and trace mineral salt. They were fortified with 10,000 I.U. of vitamin A per pound of supplement and with diethylstilbestrol and chlortetracycline to provide 10 and 70 mg. of these additives per head daily.

The cattle in each treatment group were marketed when the average pen weight at the station was about 1190 lb.

Results

Results of the experiment are shown in Table 1. Steers (pen 1) fed the corn-haylage ration throughout the experiment consumed an average of slightly over 16 lb. of corn grain daily and gained an average of 2.59 lb. They were fed for 293 days.

When steers (pen 4) were full-fed corn silage with 2 lb. of protein supplement to an average feedlot weight of 649 lb. (112 days), average rate of gain was reduced 0.18 lb. daily in comparison to those fed corn and haylage. This accounted to a 6.95% reduction in rate of gain. While non-feed costs are not shown in the table, they would be increased with the reduction in rate of gain. More protein supplement was required for these steers fed corn silage. On basis of feed efficiency, 100 lb. of corn silage and 3.5 lb. of the 40% protein supplement saved 29.4 lb. of corn grain and 9.2 lb. of alfalfa haylage.

Steers (pens 2 and 3) fed the corn silage ration to a feedlot weight of about 900 lb. (214 days) gained an average of 0.23 lb. less daily (8.88%) than steers fed the corn-haylage throughout the experiment. Nonfeed costs should ba expected to incrrease accordingly. In this comparison, 100 lb. of corn silage and 3.2 lb. of the 40% protein supplement saved 35.2 lb. of corn and 9.3 lb. of haylage per 100 lb. of gain.

Steers (pens 2 and 3) fed the corn silage ration to a feedlot weight of about 900 lb. (214 days) gained an average of 0.23 lb. less daily (8.9%) than steers fed the corn-haylage ration throughout the experiment. Nonfeed cost should be expected to increase accordingly. In this comparison 100 lb. of corn silage and 3.2 lb. of the 40% protein supplement saved 35.2 lb. of corn grain and 9.3 lb. of haylage per 100 lb. of gain.

The feeding systems resulted in only small differences in dressing percent, marbling and carcass grade when the cattle were fed to similar final weights.

Summary

Feeding a full feed of corn silage with 2 lb. of protein supplement to steers from about 400 lb. to 650 or 900 lb. reduced average rate of gain to market finish by 6.95 and 8.88% in comparison to those fed a ration of 4 lb.

alfalfa haylage, 1 lb. of protein supplement and a full feed of corn grain. On basis of feed per 100 lb. of gain, 100 lb. of corn silage with about 3.5 lb. of 40% protein supplement saved about 9 lb. of alfalfa haylage and 30-35 lb. of corn grain. The saving in corn grain was slightly greater for the longer feeding period with corn silage.

Carcass characteristics did not appear to be affected by these feeding systems when marketed at similar final weights.

Nonfeed costs would be higher for the slower gaining cattle. These could be estimated from the percentage reduction in rate of gain. Relative economy of the rations could then be estimated from the nonfeed cost and the feed requirements per unit of gain.

This and other experiments at the South Dakota Station have shown that cattle can be fed corn silage on other similar high roughage rations from weights of around 400 lb. up to about 900 lb. and then a high concentrate ration without a large reduction in overall average rate of gain to market. This system has resulted in more total gain per acre of corn than obtained with high concentrate rations initiated at lighter weights. The high-concentrate finishing phase has appeared to be beneficial in comparison to the high silage ration to market finish.

TABLE 58. HIGH SILAGE AND HIGH GRAIN RATIONS AT VARIOUS STAGES OF FINISHING (JANUARY 10 - NOVEMBER 25, 1969)

	Pen 1 Corn-alfalfa	Pen 2 Corn ailage to 900 lb. then as Pen 1	Pen 3 Corn silage to 900 lb. then as Pen 1	Pen 4 Corn silage to 650 lb. then as Pen 1
Number of eteers	24	24	23	22
Days fed	293	319	318	306
Init. shrunk wt., lb.	410	410	412	412
Final shrunk wt., lb.	1169	1172	1158	1149
Av. daily gain, lb.	2.59	2.39	2.34	2.41
Av. daily ration, lb.				
Corn silage	—	24.35	24.44	12.27
Alfalfa hay	3.94	1.32	1.32	2.55
Corn grain	16.05	6.16	5.93	11.30
Protein supplement	1.00	1.67	1.70	1.36
Total	20.99	33.50	33.39	27.48
Feed/100 lb. gain, lb.				
Corn silage	—	1020	1045	510
Alfalfa hay	152	55	57	105
Corn grain	619	258	254	469
Protein supplement	38	70	73	56
Total	809	1403	1429	1140
Dressing percent	63.8	62.6	63.0	63.6
Conformation[a]	22.7	22.3	22.7	22.3
Marbling[b]	6.7	5.8	6.3	6.0
Carcass grade[a]	20.6	19.8	20.3	20.0
Condemned livers	5	(15 head lot 2 & 3)		3

[a] Choice + = 21; Prime = 22; Prime + = 23.
[b] Small = 5; Modest = 6; Moderate = 7.

CORN DISEASE CONTROL

-- C. M. Nagel

New Corn Disease in Midwest

A new fungus (a mold) leafspot disease which kills the corn leaves in mid-season, was first observed in southern Wisconsin in 1968. Pathologists at the Wisconsin Agricultural Experiment Station were unable to determine the cause of this serious disease until last summer. The disease also occurred in south eastern Minnesota, northern Illinois and north eastern Iowa. Bushel yields were reduced by as much as 1/3 in some fields.

1969 Experiments

Although 1969, was a favorable growing season for corn, a serious hail storm struck in late June and seriously damaged corn experiments at the station. Damage consisted of broken plants, leaf shattering by hail stones and severely bent plants which could not recover their upright position.

The disease resistance performance experiments involving inbred corn lines having varying degrees of disease resistance to root-rot and stalk-rot were changed in the 1969 experiments. Because the original inbred lines selected for disease resistance at Brookings in past years were to early for this area, various types of genetic combinations have been tried to adjust to a later maturity for the south eastern section of the state. The combinations up to 1968 matured too early and thereby limited their yielding ability. New, and later maturing single crosses have been incorporated into these hybride during the past 2-3 seasons in experiments at Brookings, and over 200 hand pollinated seed lots produced under bags. This seed was planted at the Southeast Research Farm for the first time in 1969.

Five tests, each containing 40 different experimental hybrids and four commercial hybrids appeared in a particular test as checks. The 4 commercial hybrids used as checks were as follows: Pioneer 3510, DeKalb XL 361, Northrup King Px 50 and DeKalb XL 45. Each of the 40 experimental hybrids plus the checks were replicated 3 times in a particular test.

The yields obtained in 1969 suggests that these experimental hybrids are better adapted to the area than the combinations tried in past years.

Many factors are necessary to develop a good hybrid and yield is only one of the important characteristics. If a high yielding hybrid does not possess significant protection against root and stalk rot its yield may be reduced 15-20 percent in bad disease years as in 1967 and 1968.

In order to save space only the top 15 hybrids in each of the 5 experiments are presented in Table 59. This permits comparisons of the new experimental combinations to commercial hybrids grown in the area. In tests 1 through 5 the experimental number in one test is not the same experimental combination as that listed as the same experimental number in another test. These tests were planted in hills spaced 40"x40" and 4 stalks per hill. These yield results may be somewhat different from other experiments on the farm that have different row spacings, plant populations and fertility levels.

TABLE 59. DISEASE PERFORMANCE RATING OF 75 EXPERIMENTAL 4-WAY HYBRIDS VARYING IN DISEASE RESISTANCE TO ROOT AND STALK ROT (LODGING) COMPARED TO 4 ADAPTED COMMERCIAL HYBRIDS USED AS CHECKS. SOUTHEAST RESEARCH FARM. 1969.

Expt'l hybrid or commercial check	Performance score ranking	Yield Bu/A	Ear moisture at harvest %
	Test I		
Pioneer 3510 (check)	1	124.5	30.6
Expt'l. #1	3	106.3	22.5
" 2	2	102.8	14.9
" 3	5	100.6	25.9
" 4	6	100.0	26.0
" 5	4	99.2	22.1
" 6	8	98.8	26.7
DeKalb XL 361 (check)	10	98.6	29.2
Expt'l. 7	11	97.4	29.3
Northrup King Px 50 (check)	7	96.9	23.3
Expt'l. #8	9	95.4	25.1
" 9	13	94.6	27.2
" 10	24	93.6	29.2
" 11	18	93.3	27.8
" 12	23	93.0	28.0

C.V. 14.92%; Av. yield 91.1; Av. % moisture 25.5%

TABLE 59. (continued)

Expt'l hybrid or commercial check	Performance score ranking	Yield Bu/A	Ear moisture at harvest %
	Test II		
Pioneer 3510 (check)	1	120.3	31.3
Expt'l #1	2	102.4	22.9
DeKalb XL 361 (check)	12	101.6	30.8
Expt'l #2	3	99.6	21.8
" 3	9	99.5	27.1
" 4	15	99.5	31.6
" 5	10	99.0	26.6
DeKalb 409 (check)	4	98.1	22.7
Expt'l 6	7	98.0	24.4
" 7	6	97.9	24.2
" 8	5	97.7	23.8
" 9	11	97.4	25.4
" 10	14	95.4	26.0
" 11	21	95.4	29.1
" 12	18	94.8	27.1

C.V. - 17.93%; Av. yield 91.09; Av. moisture % (25.45%)

Expt'l hybrid or commercial check	Performance score ranking	Yield Bu/A	Ear moisture at harvest %
	Test III		
Pioneer 3510 (check)	1	115.3	32.9
Expt'l #1	2	100.3	26.7
" 2	4	97.5	26.5
DeKalb XL 361 (check)	8	96.1	30.7
Expt'l 3	12	95.0	31.6
Northrup King Px 50 (check)	3	94.6	22.0
Expt'l 4	5	93.4	25.6
" 5	19	92.3	32.2
" 6	9	91.9	25.3
" 7	6	90.3	22.7
" 8	10	89.5	24.1
" 9	7	89.0	21.3
DeKalb 409 (check)	13	89.0	24.1
Expt'l 10	14	89.0	25.3
" 11	16	88.8	26.7

C.V. 13,46%; Av. yield 86.8 bu/a; mean moisture % (25.2%)

TABLE 59. (continued)

Expt'l hybrid or commercial check	Performance score ranking	Yield Bu/A	Ear moisture at harvest %
	Test IV		
Pioneer 3510 (check)	1	124.5	27.7
Expt'l #1	2	104.4	27.3
DeKalb 409 (check)	3	100.1	24.4
Northrup King Px 50 (check)	4	95.8	22.5
Expt'l #2	8	94.6	28.9
DeKalb XL 361 (check)	7	94.4	28.6
Expt'l 3	6	92.2	24.4
" 4	9	91.9	25.9
" 5	5	91.4	18.8
DeKalb XL 345 (check)	13	90.2	26.4
Expt'l 6	12	89.6	25.5
" 7	18	88.9	27.8
" 8	11	88.7	23.1
" 9	10	88.5	21.7
" 10	20	87.8	27.0

C.V. 21.4%; Av. yield 85.3 bu/a; mean moisture % (25.7%)

	Test V		
Pioneer 3510 (check)	1	113.8	34.0
Expt'l #1	3	102.5	32.4
DeKalb XL 45 (check)	4	96.9	26.1
Expt'l #2	7	96.4	26.6
" 3	5	96.0	25.0
" 4	2	95.3	22.9
Northrup King Px 50 (check)	6	95.2	24.2
Expt'l 5	8	94.8	25.2
" 6	10	94.5	26.2
" 7	9	94.3	25.7
" 8	11	93.0	26.0
" 9	21	92.9	33.9
" 10	23	91.0	32.1
DeKalb XL 361 (check)	20	90.7	31.1
Expt'l 11	16	90.1	28.2

C.V. 18.81%; Av. yield bu/a (86.7); Av. moisture % (26.7)

PROPOSED LABORATORY-OFFICE-MEETING ROOM BUILDING FOR THE SESD EXPERIMENT FARM

The Experiment Station workers with research under way at the Southeast Farm have felt for some time that their work was handicapped because of inadequate laboratory facilities. Mr. Fredrikson and Mr. Lawrensen need desk space in a suitable place for keeping appropriate farm and research records. More adequate toilet facilities have been needed for some time. A suitable meeting place for area extension and research educational activities has been mentioned by a great many persons as a facility that should be included in any new construction.

The plans shown on the following pages represent two feasible alternatives, one, a completely adequate building that would satisfy all the needs envisioned but probably more expensive than can be undertaken at this time. The second alternative is a less ambitious but completely useful building that will serve the present needs. Mr. Ed. Dowding of the Agricultural Engineering staff prepared the plans and the costs estimates. These two plans are the final selections from among several preliminary sketches and are the result of many hours of study and design to obtain maximum usefulness at least cost.

General Discussion

Both plans have a minimum of hallways to provide the maximum usable floor space. However, some of the traffic patterns may be inconvient or inefficient. Window location and size are somewhat flexible.

Figure 7 is probably the most desired plan. It contains the space requested by those who will be using the facilities. The total area of the 36 x 72 foot building is 2592 square feet and will cost about $12.50 per square foot or $32,390.

The building has a concrete slab floor which means the service to all the utilities will be below the concrete or in the attic space. The plumbing pipes beneath the floor will be inconvenient should repair be necessary. A special feature of this plan is a small meeting room with a stove, refrigerator and sink which was desired by several of the persons consulted but adds to the cost. Another feature of special merit is that the shower and locker room is isolated from the public restroom area.

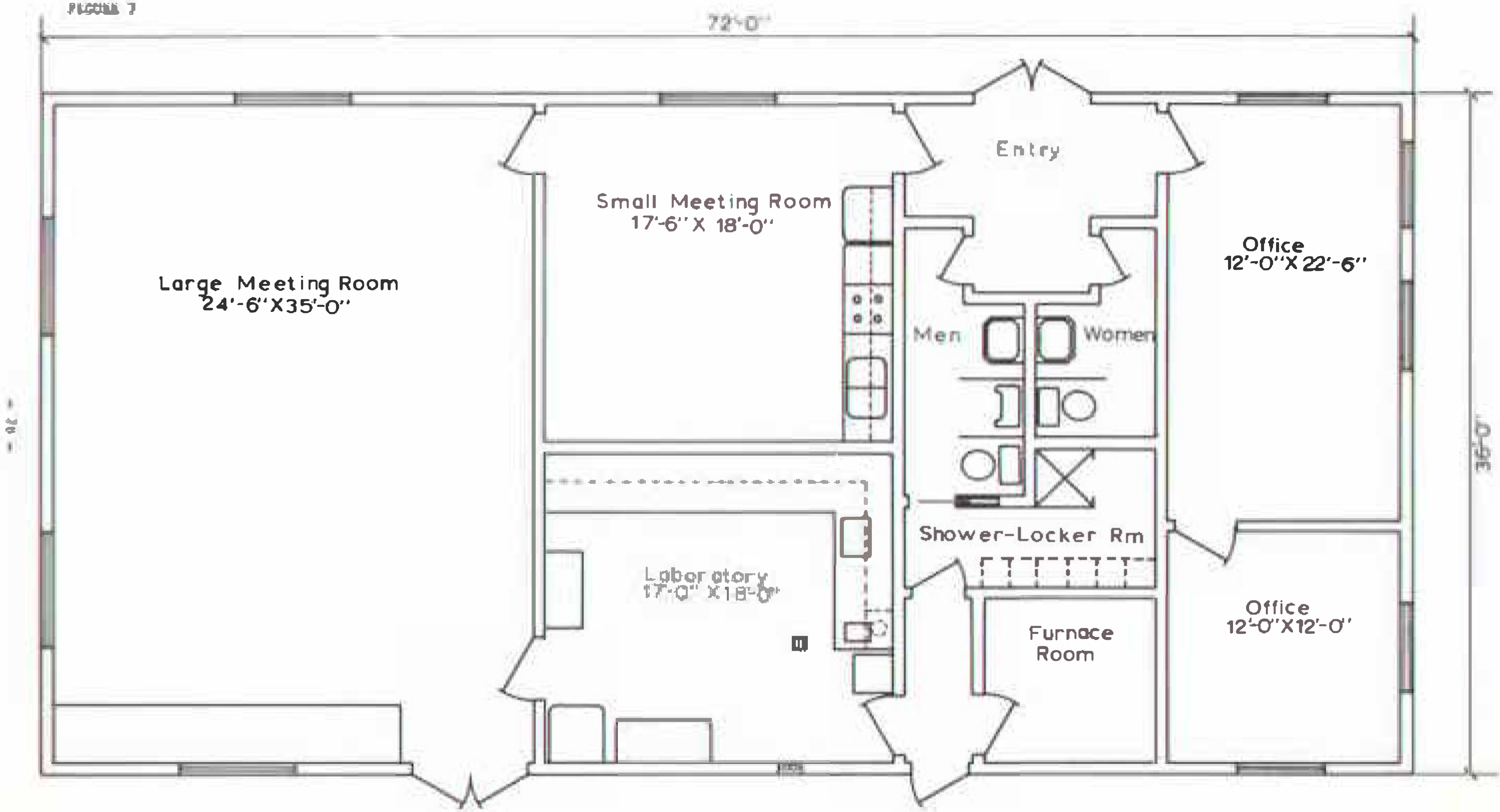
The large meeting room seats 125 people quite easily. While some storage space will be provided by the cabinets in the large meeting room, other storage space will be limited.

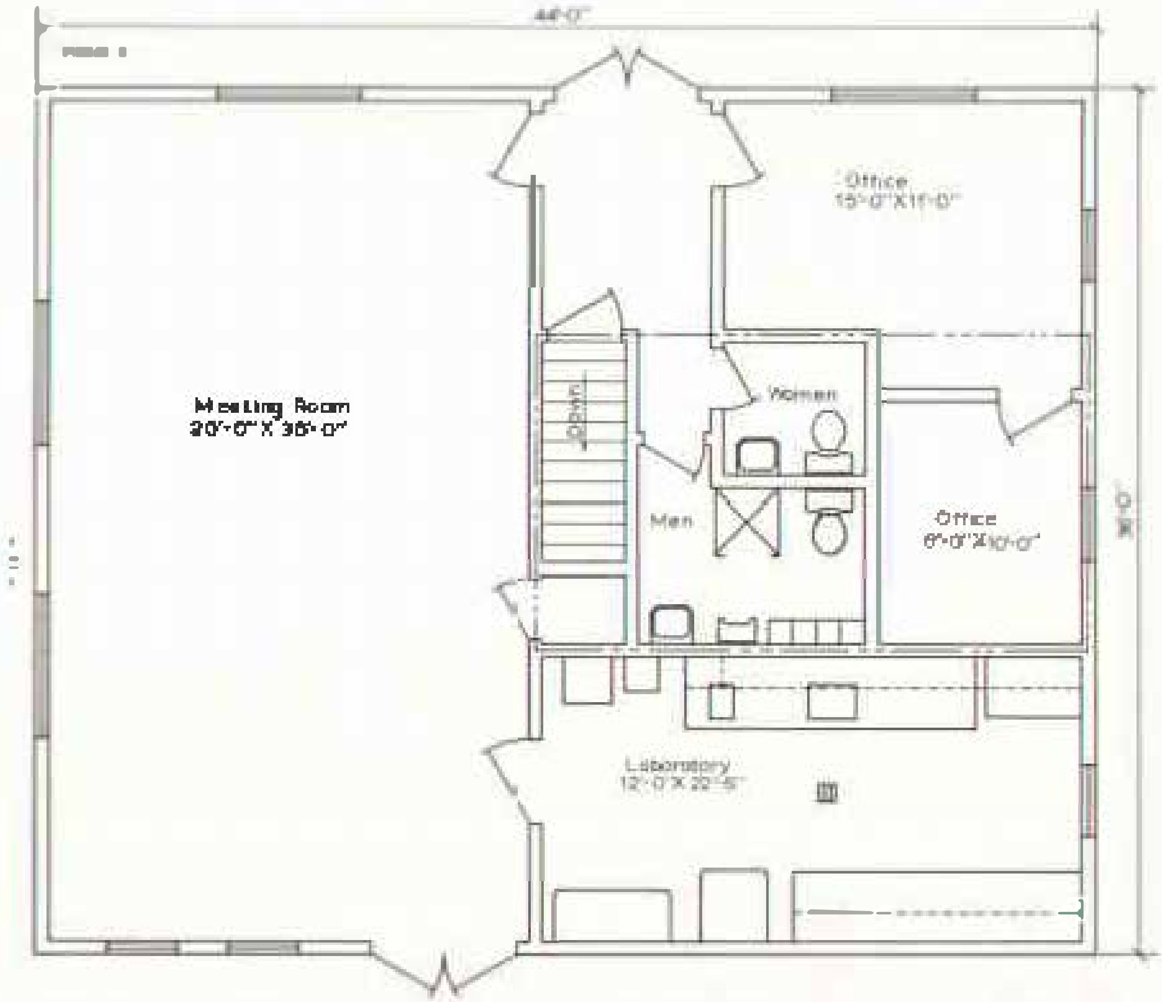
Figure 8 incorporates as much of the desired space as could be fitted into a 36 x 44 foot building. The total area is 1584 square feet on the main floor with a basement area of 327 square feet. The cost will approximate $12.80 per square foot for 1911 square feet or a total cost of about $24,460.

The basement area serves several functions, - it provides space for the heating plant, the major part of the plumbing will be exposed for better access should repair be necessary, and it provides additional storage space. The basement will provide less expensive floor space for these requirements than an equal amount of space on ground level.

The ground floor contains every thing of plan 1 except the small meeting room with the kitchen area. A small closet off the meeting room will provide some storage. The meeting room will seat 125 people with some crowding. The large meeting room could be divided by an accordion partition if smaller meeting rooms were desired.

The shower room and workmen's lockers are incorporated in the men's restroom which may be disadvantagous at certain times.


72'-0"
36'-0"
Large Meeting Room
24'-6"X35'-0"
Small Meeting Room
17'-6" X 18'-0"
Entry
Office
12'-0"X 22'-6"
Men
Women
Shower-Locker Rm
Laboratory
17'-0" X 18'-0"
Furnace
Room
Office
12'-0"X12'-0"



44'-0"
Office
15'-0" X 11'-0"
Meeting Room
20'-0" X 36'-0"
Women
Down
Men
Office
8'-0" X 10'-0"
Laboratory
12'-0" X 22'-6"
36'-0"

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