SIXTH ANNUAL PROGRESS REPORT

DECEMBER 1966

SOUTHEAST SOUTH DAKOTA EXPERIMENT FARM

NEAR CENTERVILLE, SOUTH DAKOTA

Aerial view of Southeast South Dakota Experiment Farm

Agricultural Experiment Station
South Dakota State University
Brookings

SIXTH ANNUAL PROGRESS REPORT
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This sixth 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 nor conclusive. Interpretations given are tentative because additional data resulting from continuation of these experiments may result in conclusions different from those based on any one year.

South Dakota Agricultural Experiment Station
Brookings, South Dakota

Duane Acker, Director　　A. L. Musson, Ass't Director

INTRODUCTION

-- J. F. Fredrikson

It is customary to refer to the acreage of land on this research farm as having two parts: the south quarter and the north quarter. When the farm was started, the south quarter was platted to contain all the agronomic research plots, with the north quarter used for the production of grain and forage for use in livestock feeding trails. In the last two years, the broadening of many research areas has brought about a need for larger plots, and some agronomy sites have been moved to the north quarter. This trend is not expected to continue because of limitations on available funds, labor and supervisory personnel. However, the north quarter is still, for the most part, farmed on a full scale field basis for the production of feed. Surplus grain from all agronomy plots, as well as filier areas on the south quarter, is also used for livestock feed.

The crops grown on the north quarter in 1966 were: 30 acres of alfalfa, 9 acres of oats, 3 acres of grain sorghum and 110 acres of corn. The 9acres of oats and 3 acres of grain sorghum were used by Foundation Seed Stock Division for seed increase and the grain from these acreages is not reported as feed produced.

Production from the 1966 crop year yielded the following feed and forage: (determined by sampling and field measurements)

Corn silage	750 tons	Oats	1,000 bu.
Ground ear corn silage	5,000 bu.	Alfalfa hay	85 T
Ear corn	3,800 bu.		

The acreage of corn on the north quarter was fertilized according to recommendations made by State Universtiy soil testing lab from soil samples taken from those fields. These fertility rates were: 65 lbs. of nitrogen and 20 lbs. of phosphorus per acre plowed down in the fall on approximately one-half of the acreage and 75 lbs. of anhydrous ammonia applied as side dressing after the first cultivation on the remainder. Manure from the livestock barns and pens was spread on the corn ground as time and weather conditions permitted.

Some new cultural and cropping practices being tested in the agronomy plots, are used on the north quarter fields to demonstrate their possible advantages or disadvantages. 15 acres of corn was planted in 30 inch rows. In order to facilitate the narrow row harvesting problem, this was cut for silage. Chemical weed control was used on the entire field and pop-up starter fertilizer applied to about 1/3 of it. 5 acres of corn were planted with a Buffalo till-planter. All other corn was planted in pairs of 40 inch rows spaced 30 inches apart, with atrazine banded to replace one cultivation.

A field demonstration on the use of chemicals for the control of corn root worm was applied in cooperation with the Extension Service. The results

of this demonstration are reported elsewhere in this publication.

In addition to the 100 head of cattle on feeding trials, 116 head of calves were wintered in outside lots without shelter. These calves utilized the hay produced on the north quarter and were moved to Brookings in early June. A similar study is currently being conducted for the same purpose.

This marks the completion of the fourth year during which this station has functioned as the official weather observer for this area. Table I is a summary of the weather information recorded during 1966, and also compares the past year with the past 14 year period. It can be noted that the rainfall for this year was about one inch above the 14 year average. The distribution of this rainfall was such that the most abundant rains came during the period in which most crops demand the greatest amount of water. Therefore, the yields reported in this publication may be higher than the amount of rainfall would indicate. The above normal precipitation during the latter part of the growing season left a reserve of moisture in the subsoil which should be an asset in the coming season.

Table I. Precipitation and Temperature -- 1966

Month	Rainfall in Inches	1953-1966 14 year Average	1953-1966 Departure	Average Temperature (F)	1953-1966 14 year Average	1953-1966 Departure
Jan.	.34	.38	- .04	9.4	17.2	-7.8
Feb.	1.09	1.38	- .29	19.6	25.5	-5.9
March	.42	1.46	-1.04	38.6	29.5	+9.1
April	1.70	2.75	-1.05	43.8	49.1	-5.3
May	1.20	3.48	-2.28	57.9	61.7	-3.8
June	2.82	4.20	-1.38	70.0	70.1	-0.1
July	6.72	2.95	+3.77	76.9	69.8	+7.1
Aug.	4.20	2.91	+1.29	68.4	69.8	-1.4
Sept.	4.78	3.03	+1.75	60.6	63.5	-2.9
Oct.	2.44	1.19	+1.25	50.5	55.5	-5.0
Nov.	.13	1.02	- .89	32.5	36.7	-4.2
Dec.	.57	.61	- .04	20.5	23.4	-2.9
Total	26.41	25.36	+1.05	45.7	47.6	-1.9

Frost free days: May 13 to October 1 -- 140 days.

CORN POPULATIONS AND ROW SPACING

-- F. Shubeck, B. Lawrenson and L. Nelson

Objectives of Experiment:

1. What is the optimum spacing of corn rows at different plant populations for a short season hybrid and a full season hybrid?

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

3. Can moisture loss from evaporation be reduced by narrow rows?

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

Figure 1. Effect of Row Spacing on Yield of Short Season and Full Season Hybrid at 10,000 plants per acre

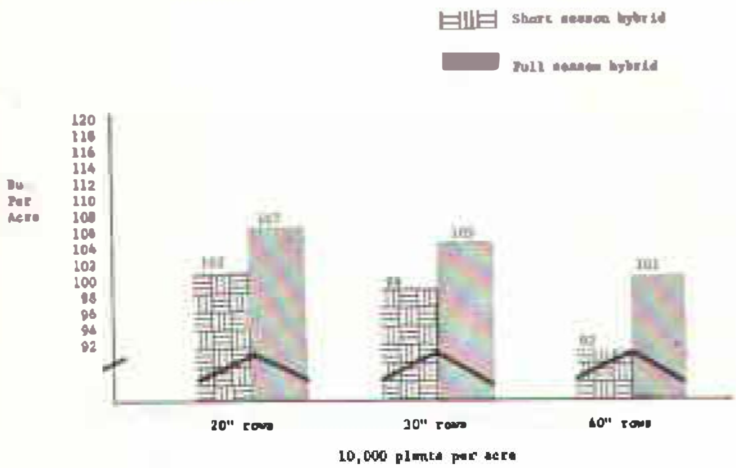


Figure 2. Effect of Row Spacing on Yield of Short Season and Full Season Hybrid at 12,000 plants per acre.

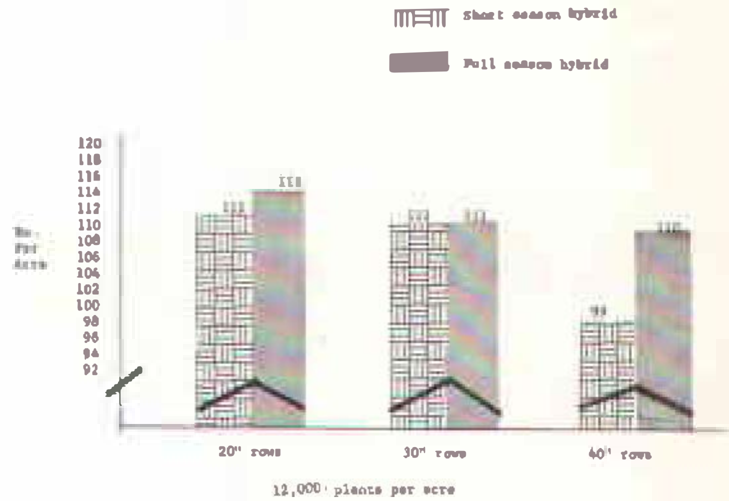


Figure 3. Effect of Row Spacing on Yield of Short Season and Full Season Hybrid at 14,000 plants per acre

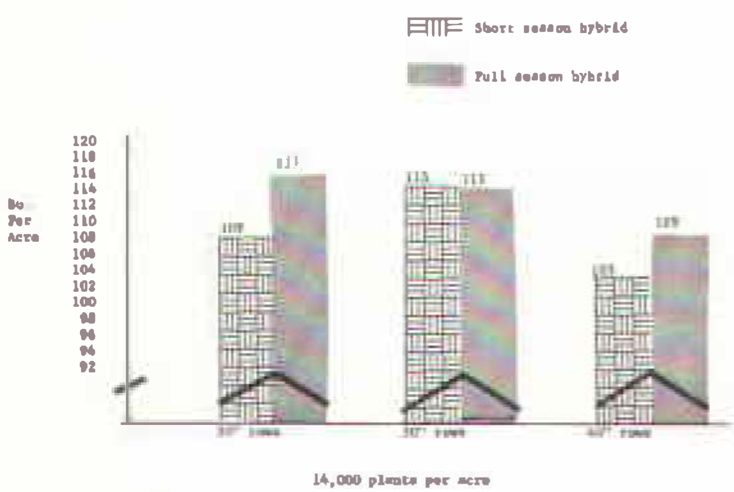


Figure 4. Effect of Row Spacing on Yield of Short Season and Full Season Hybrid at 16,000 plants per acre

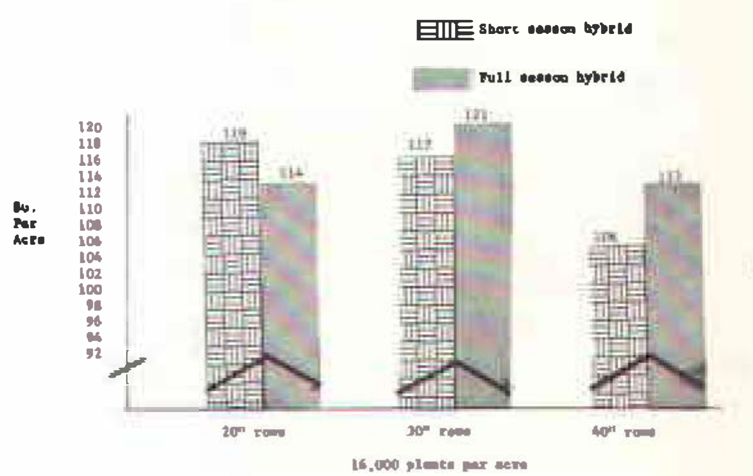


Figure 5 Effect of Row Spacing on Yield of Short Season and Full Season Hybrid at 18,000 plants per acre

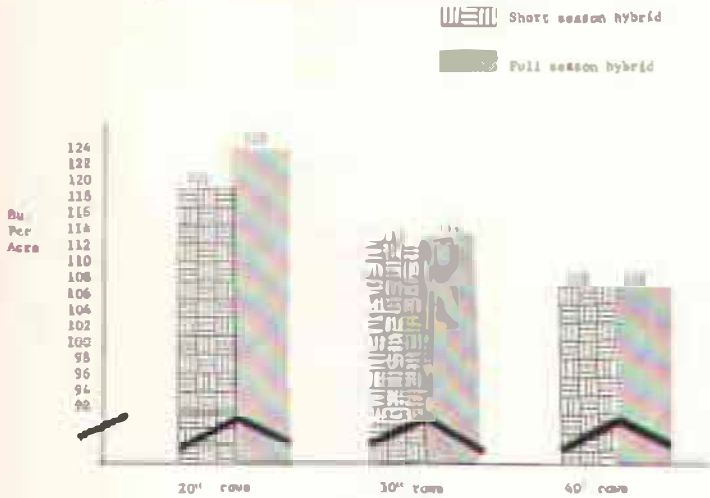
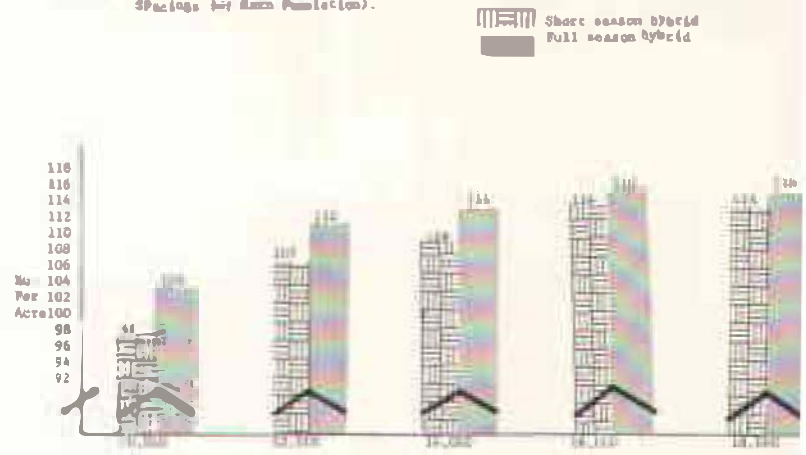


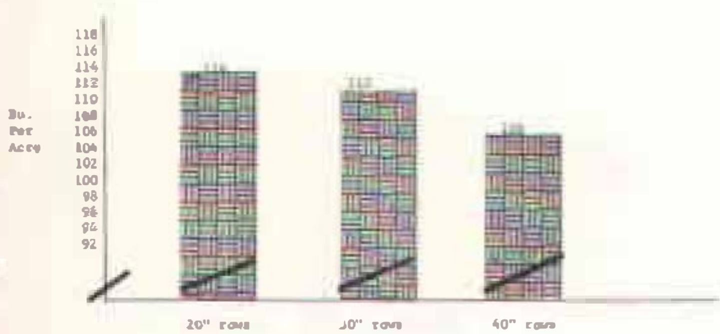
Figure 6 Effect of Plant Populations on Yield of Corn (Averaged From 3 Row Spacings for Each Population).



Discussion and Interpretation of Figure 6:

Yields from all 3 row spacings were averaged for each hybrid and each population in figure 6. Yield from the short season hybrid was more sensitive to population densities than the full season corn. The full season corn was better able to compensate for insufficient stands by increasing ear size.

Figure 7 Effect of Row Spacings on Yield of Corn (Average From 5 Populations and 2 Hybrids for Each Row Spacing).

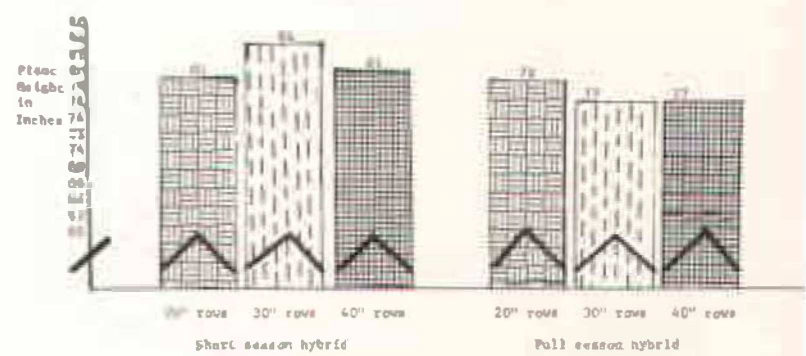


Discussion and Interpretation of Figure 7:

Yields from the different hybrids and populations were averaged for each row spacing in figure 7. This obscures effects of hybrids and populations but emphasizes row spacing. The average yield from narrow rows was higher than from 40 inch rows.

Figure 8. Effect of Row Spacing and Hybrid on Plant Height With 10,000 plants per acre.

July 20, 1966



Discussion and Interpretation of Figure 8

With 10,000 plants per acre, plant height was affected very little by row spacing by July 20.

Discussion and Interpretation of Figures 1 through 5:

The following procedures were used in this experiment:

1. Fifty pounds of nitrogen, 15 pounds of phosphorus and 33 pounds of potassium were broadcast, April 15, 1966.

2. Plowed April 16, 1966.

3. Disked twice, flextine harrowed once.

4. Planted May 4 and 5.

5. Organic phosphate insecticide applied in band at planting.

6. Four pounds of Atrazine 80 W broadcast May 17, and dragged with flextine harrow.

7. Cultivated twice with Allis Chalmers G tractor.

8. Side-dressed with 80 pounds of Nitrogen per acre June 20.

9. Sprayed for corn borer July 12, with 2 pounds per acre of 80% Sevin.

10. Hand picked on October 12.

The highest yield in 1966 was obtained with 20 inch rows at 18,000 plants per acre and a full season hybrid.

The highest yield in 1965 occurred with 20 inch rows at 16,000 plants per acre with a short season hybrid.

Rainfall in July and August of 1966 was more plentiful than in 1965. There was an increase in grain yield in favor of narrow rows with all five plant populations and with both short and full season hybrids.

Laboratory work and calculations for soil moisture data are not complete for 1966.

Table 2. Effect of Corn Plant Populations* on Barren Stalks, Ear Weight, Ear Moisture and Lodged Stalks.

Plants Per Acre	% Barren Stalks	% Ear Moisture At Harvest	Ear Weight At Harvest (lbs.)	% Broken and Lodged Stalks
10,000	13	30.4	0.70	4.1
12,000	9	30.2	0.70	3.8
14,000	8	30.1	0.63	4.8
16,000	8	29.9	0.60	5.8
18,000	8	29.9	0.57	5.8

*Average from 3 row spacings and 2 hybrids for each plant population.

Table 3. Effect of Row Spacings* on Barren Stalks, Ear Weight, Ear Moisture and Lodged Stalks.

Plants Per Acre	% Barren Stalks	% Ear Moisture At Harvest	Ear Weight At Harvest (lbs.)	% Broken and Lodged Stalks
20 inch	8	30.5	0.63	5.6
30 inch	10	30.1	0.65	4.0
40 inch	9	29.7	0.64	5.0

*Average from 5 populations and 2 hybrids for each row spacing.

Discussion and Interpretation of Table 2 and 3:

Percent of barren stalks and percent of lodged stalks were not greatly affected by either populations or row spacings. This is different from results in 1965 when number of lodged stalks increased sharply with increased plant populations.

Ear weight at harvest was influenced more by populations than by row spacings.

Maturity measured by % ear moisture at harvest was not affected very much by populations or row spacings.

EQUAL DISTANT CORN SPACING

-- F. Shubeck, B. Lawrenson and L. Nelson

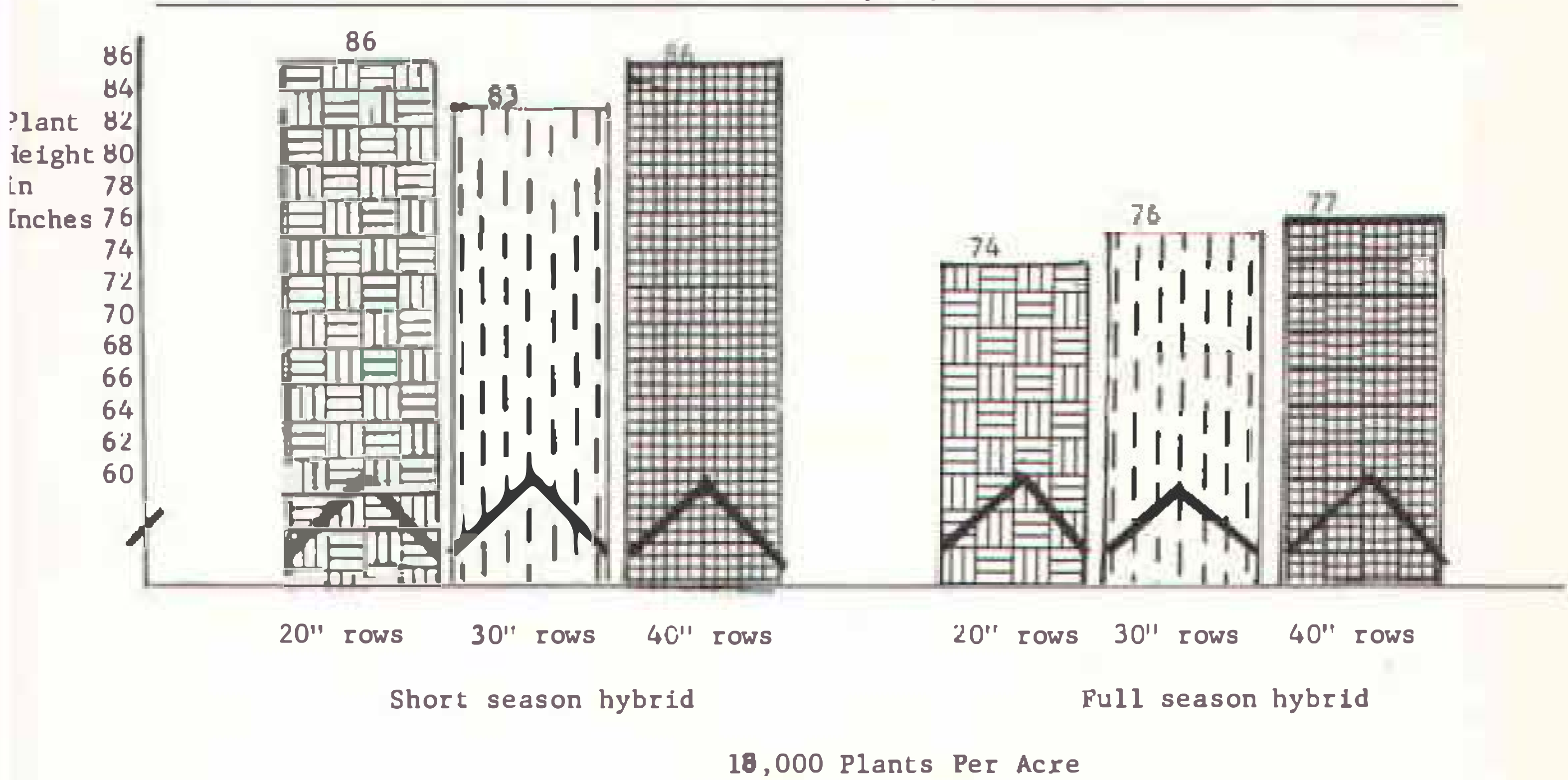
Objectives of Experiment:

1. Will highly refined space arrangements like complete equal distant planting increase yields over partial approximations of this arrangement?

2. Will leaf canopy cover, resulting from these spacial arrangements influence soil temperature or evapoartive force reaching the soil?

Figure 9. Effect of Row Spacing and Hybrid on Plant Height With 18,000 Plants Per Acre.

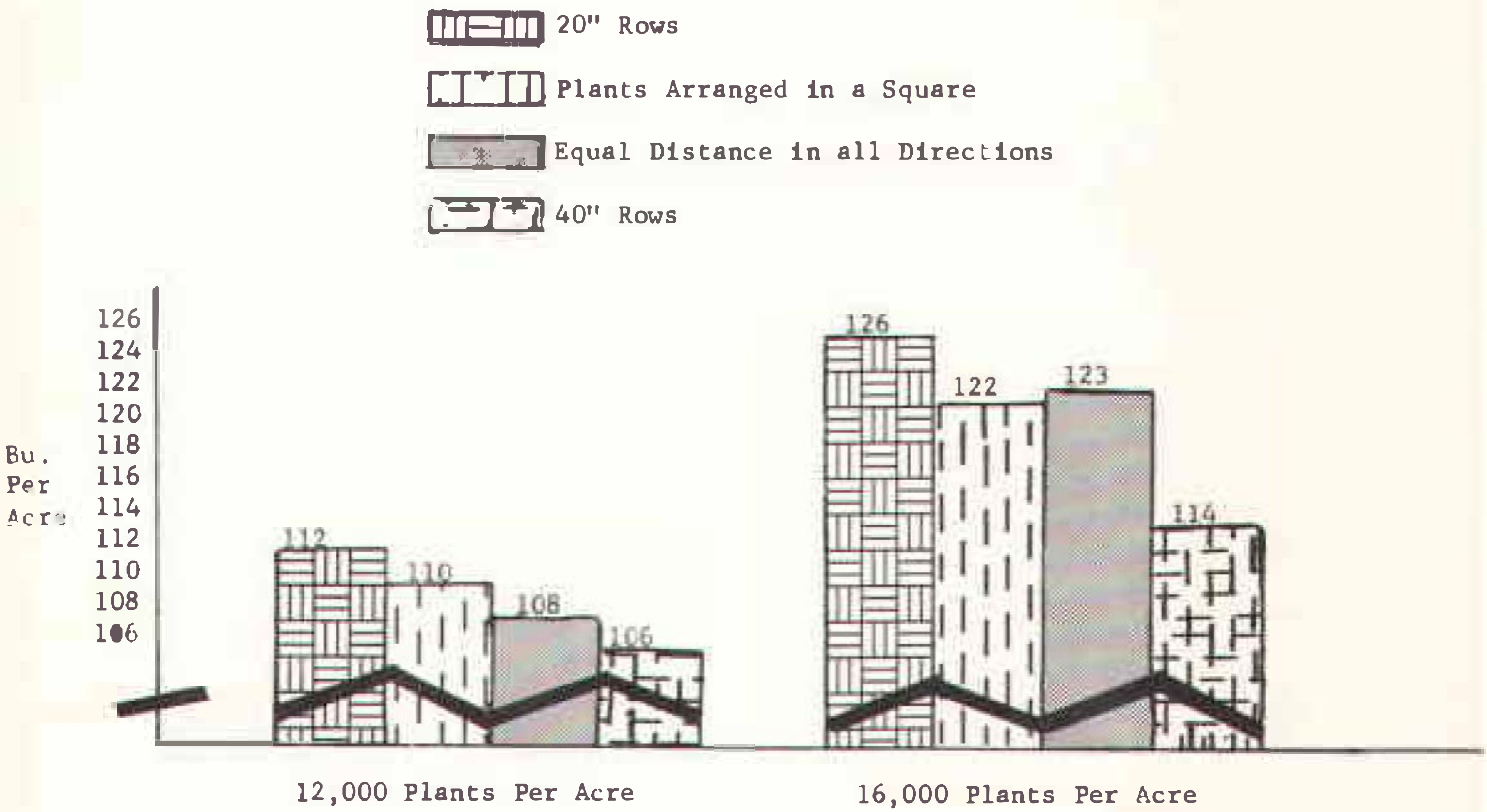
July 20, 1966



Discussion and Interpretation of Figure 9:

With 18,000 plants per acre, the short season corn plants were taller than the later maturing full season corn. Row spacing had only minor effects on plant height.

Figure 10. Effect of Corn Plant Populations and Spacial Arrangements on Grain Yield.

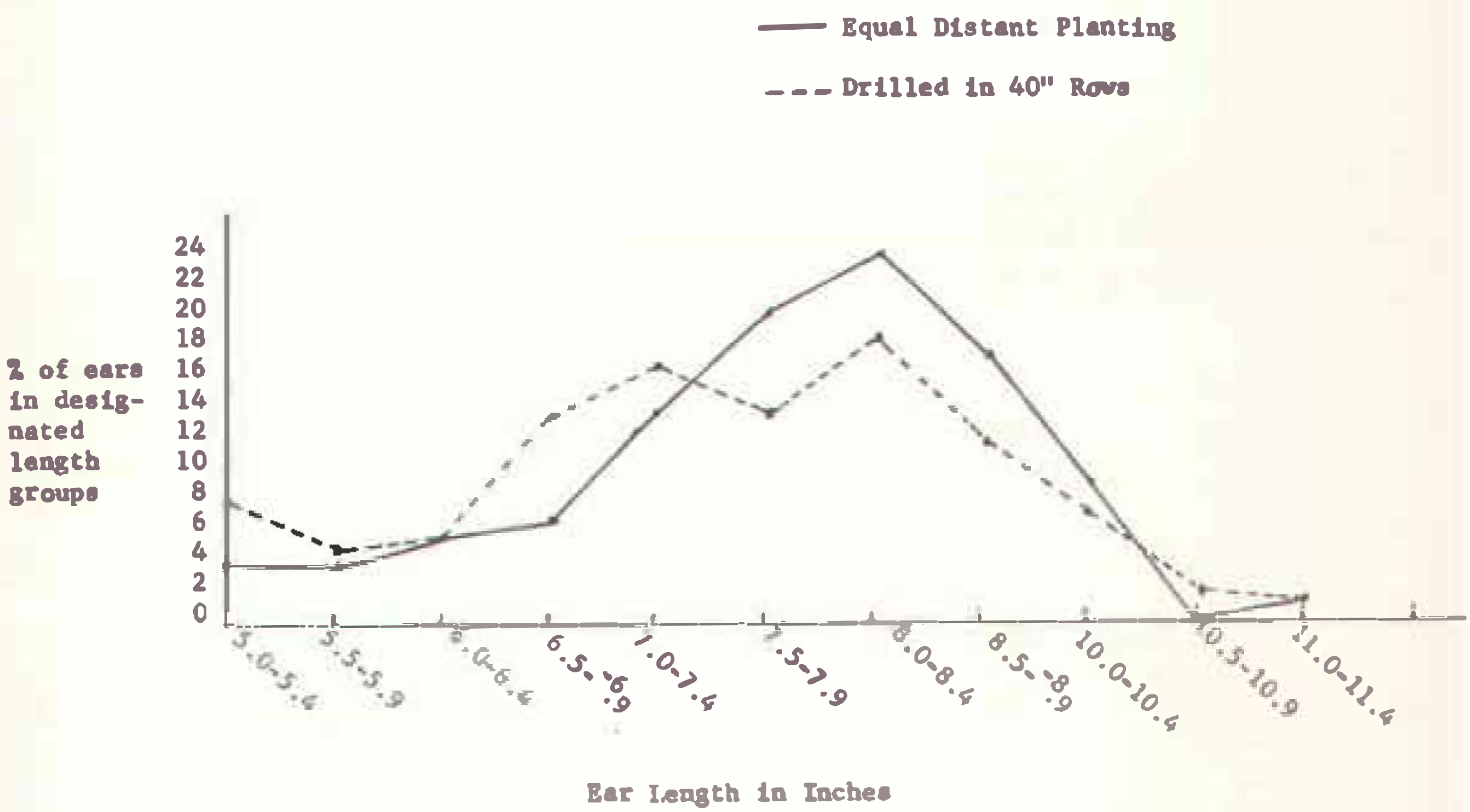


Discussion and Interpretation of Figure 10.

When corn is drilled in 20 inch rows at 16,000 plants per acre, a fairly close approximation to equal distant planting is achieved especially if plants in alternate rows are staggered in their positions relative to each other rather than at right angles. When plants occupy the corners of a square, with a population of 16,000 plants per acre, the nearest neighbors are equal distant, but the diagonal neighbors would be about 8 inches further away. With complete equal distant planting, every stalk is the same distance from every other stalk in its periphery.

From the data in figure 10 it appears that partial approximations to equal distant spacing will yield about as well as the most ideal equal distant planting arrangement. The most important lesson seems to be--plant in rows narrower than 40 inches. With a growing season not so favorable as that of 1966, the results may be different.

Figure 11. Influence of Corn Plant Spacings on Frequency Distribution of Ear Size (16,000 Plants Per Acre).



Discussion and Interpretation of Figure 11.

With complete equal distant planting, most of the ears were from 7.5 to 8.9 inches long. With 40 inch rows, the most frequent ear sizes extended over a broader range, from 6.5 to 8.9 inches. This would indicate that equal distant spacing resulted in a higher percentage of ears of uniform size.

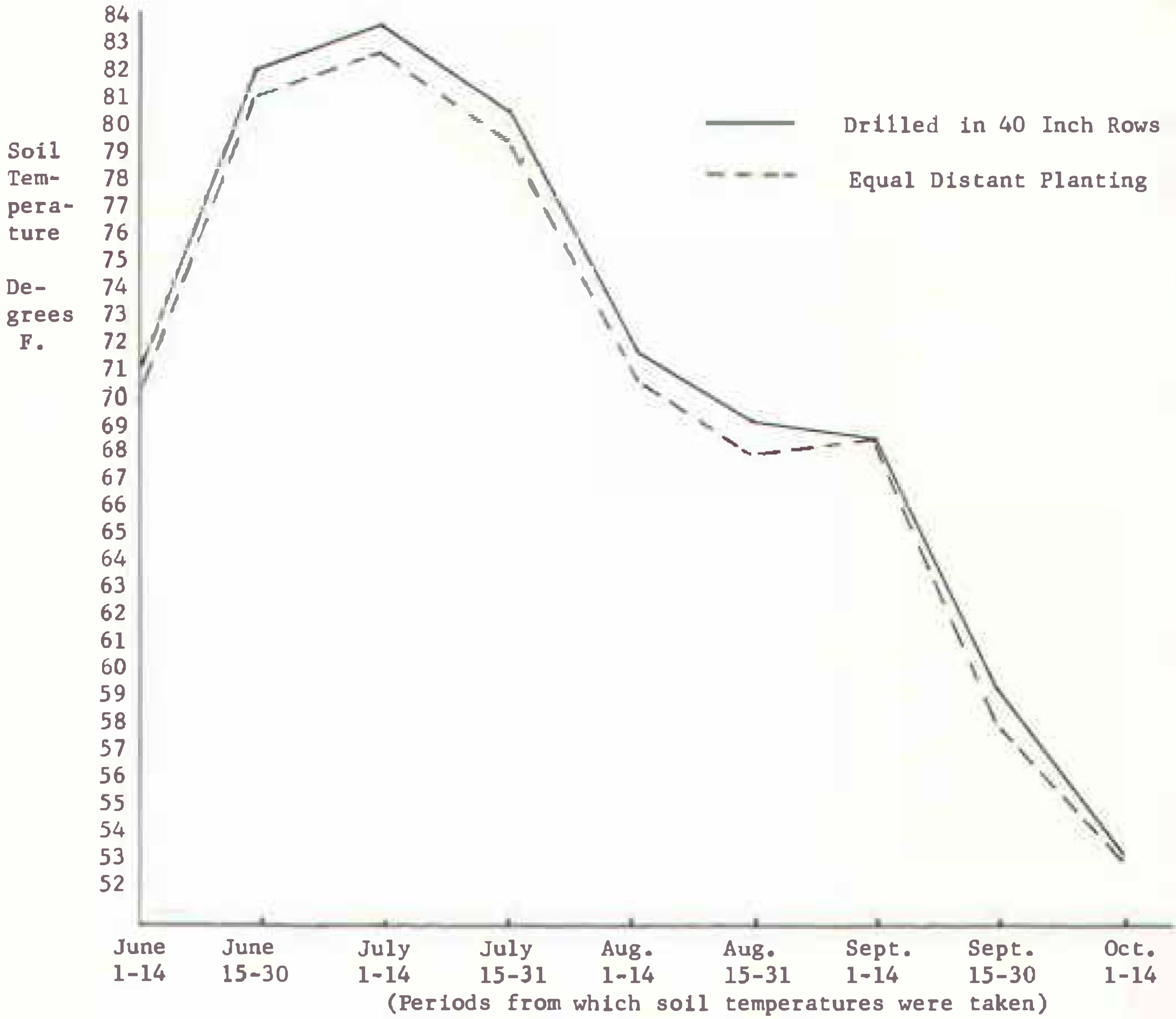
Table 4. Effect of Corn Planting Space Arrangements on Lodged Stalks, Silking Per Cent and Ear Moisture Per Cent at Harvest (16,000 Plants/Acre)

Space Arrangement	% Lodged Stalks	Silking % July 21	% Ear Moisture
Drilled in 20" Rows	10.8	50	25.5
Drilled in 40" Rows	8.8	42	25.1
Equal Distant Planting	11.0	49	25.2
Plants Arranged in a Square	12.6	54	26.5

Discussion and Interpretation of Table 4:

Ear moisture, silking per cent on July 21, and per cent lodged stalks were not influenced very much by the geometric space arrangements in which the corn was planted.

Figure 12. Effect of Equal Distant Planting and 40 Inch Row Spacing on Soil Temperature



Discussion and Interpretation of Figure 12.

There was a small but consistent difference in soil temperature in June, July and August due to the different plant spacial arrangements.

Equal distant planting resulted in cooler soil temperatures. There was also a small but consistant yield of advantage in favor of equal distant planting over that obtained from 40 inch rows. (See figure 10)

Thermocouples used to measure temperatures were buried three inches from the soil surface in the row. Four parallel thermocouples were located at four different points in 10 linear feet of one row in each plot and united to a common lead. This gave average temperature over approximately 10 linear feet per plot. Temperatures were read once each day at 1:00 p.m.

ORIENTED CORN PLANTING

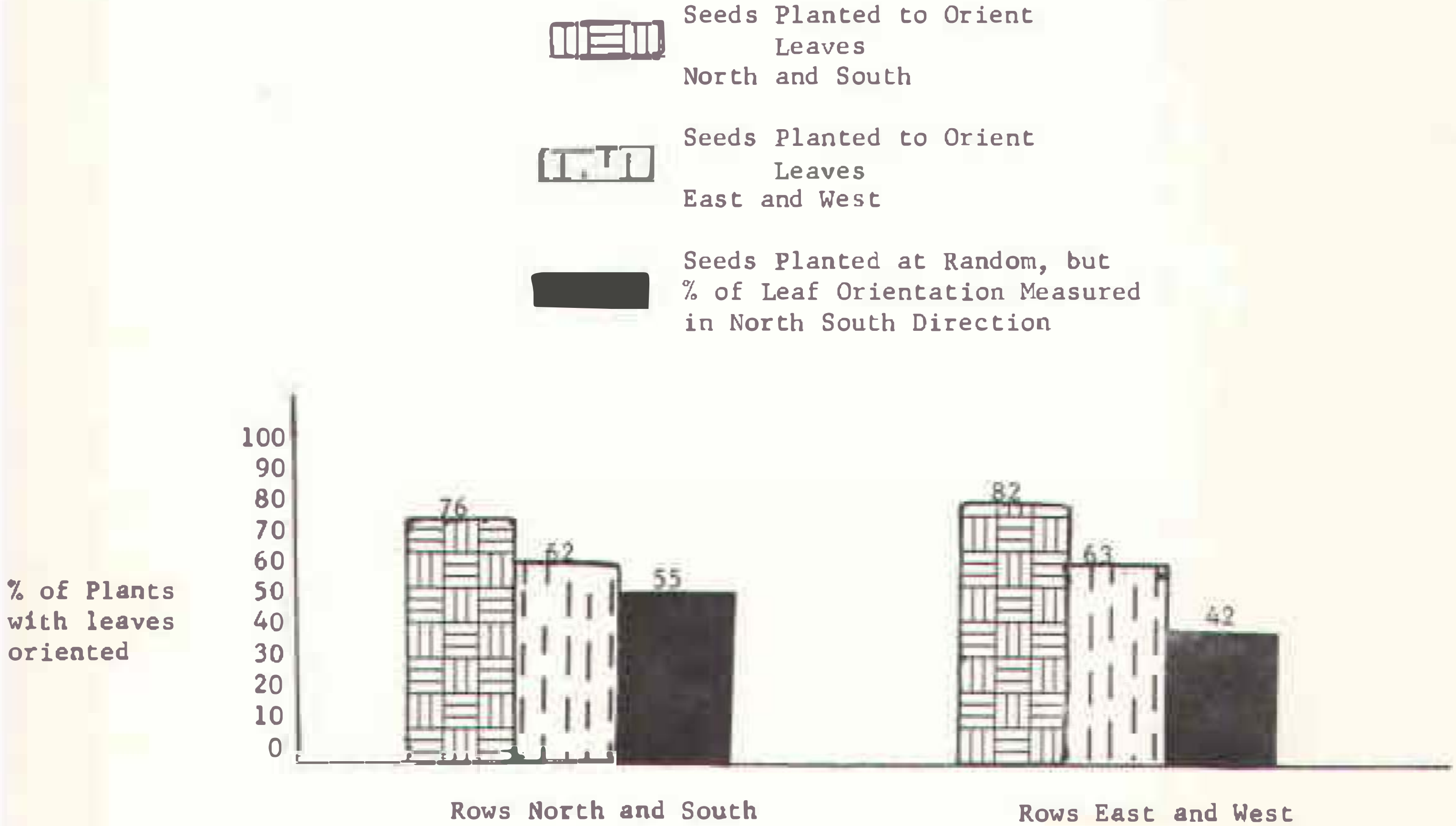
--F. Shubeck, B. Lawrenson and L. Nelson

Objectives of Experiment:

1. How effective is orientation of kernels at planting time for controlling direction of leaf growth?

2. Can orientation of leaves give a more complete leaf canopy than random planting, and in this way influence soil temperature and moisture loss?

Figure 13. Influence of Corn Kernel Orientation at Planting on Direction of Leaf Growth



Discussion and Interpretation of Figure 13:

This preliminary investigation represents an attempt to control direction in which the two ranks of leaves extend from the main stalk by orienting the kernel at planting. Orientation of the kernel involved direction in which the tip or point of kernel was placed, direction in which germ faced and the edge on which the kernel rested.

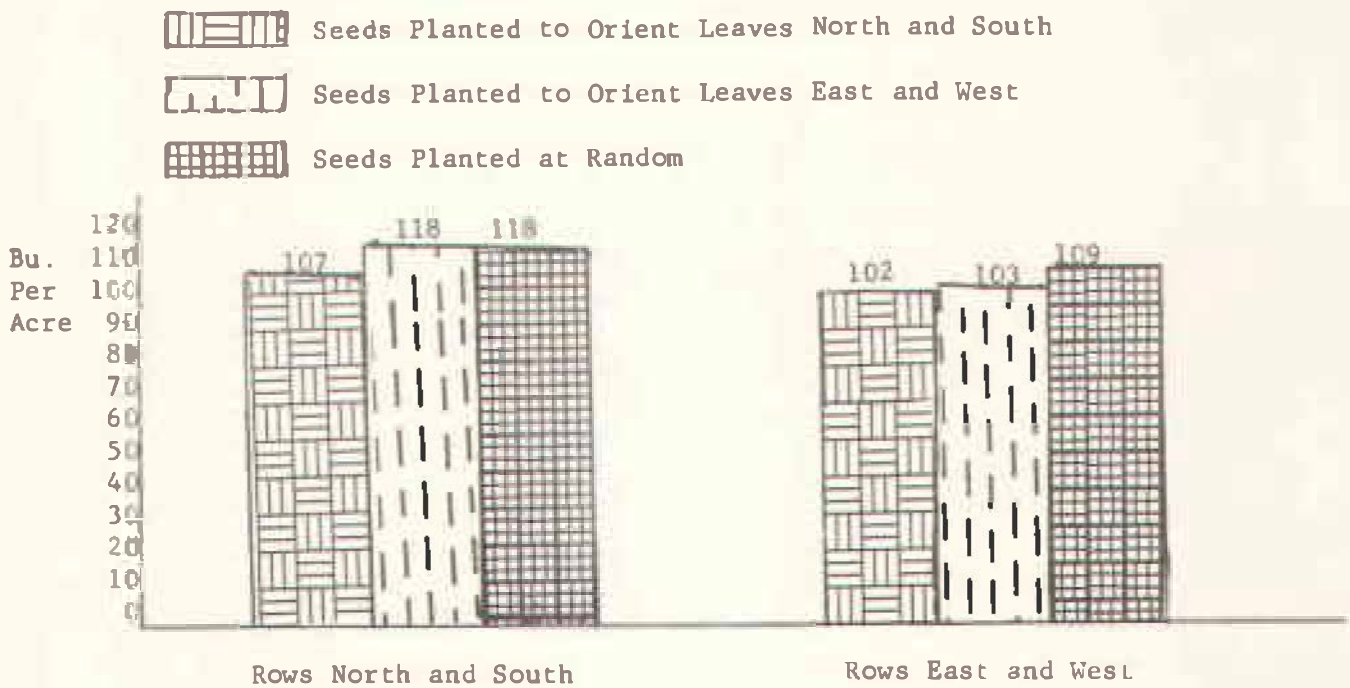
Before an extensive randomized replicated experiment is set up to measure effect of leaf orientation on yield, an accurate measurement must be made to measure how well seed orientation controls direction of leaf growth. Table 13 shows results of attempted north-south and east-west leaf orientation and also of random placement of kernels. In those plots where seed was planted at random, the degree of leaf orientation was measured in a north-south direction. A reading of 50 per cent in the random plots would mean 50 per cent of leaves are oriented north and south.

There was considerable variation in degree of leaf orientation between adjacent rows which received the same treatment. For example, in the plot where four rows averaged 82% oriented, one row had 90% of plants with leaves oriented. The success in attempted leaf orientation was better in 1966 than in 1965. This may be due to more careful seed orientation procedure in 1966.

The direction of leaf orientation was measured in rows running north-south and also in an east-west direction. There were no outstanding differences in success of leaf orientation due to row direction.

Direction of leaf growth was measured on each plant with a metal T square that had a built-in marker for 45°. Where an attempt was made to orient leaves north and south, the plant was considered oriented if direction of leaf growth at the ear was less than 45° left or less than 45° right of true north. Final stand count was 14,000 plants per acre. Each plot consisted of four rows spaced 30 inches apart. Rows were 35 feet long. Each column in Figure 13 represents an average from four rows.

Figure 14. Influence of Kernel Orientation at Planting Time, and Row Direction on Yield of Corn.



Discussion and Interpretation of Figure 14:

These plots were neither randomized or replicated so no detailed interpretation will be attempted. These data were presented in order to show what appears to be a consistent trend for lower yield with a north-south leaf orientation.

CORN TILLERING

--F. Shubeck, B. Lawrenson and L. Nelson

Objectives of Experiment:

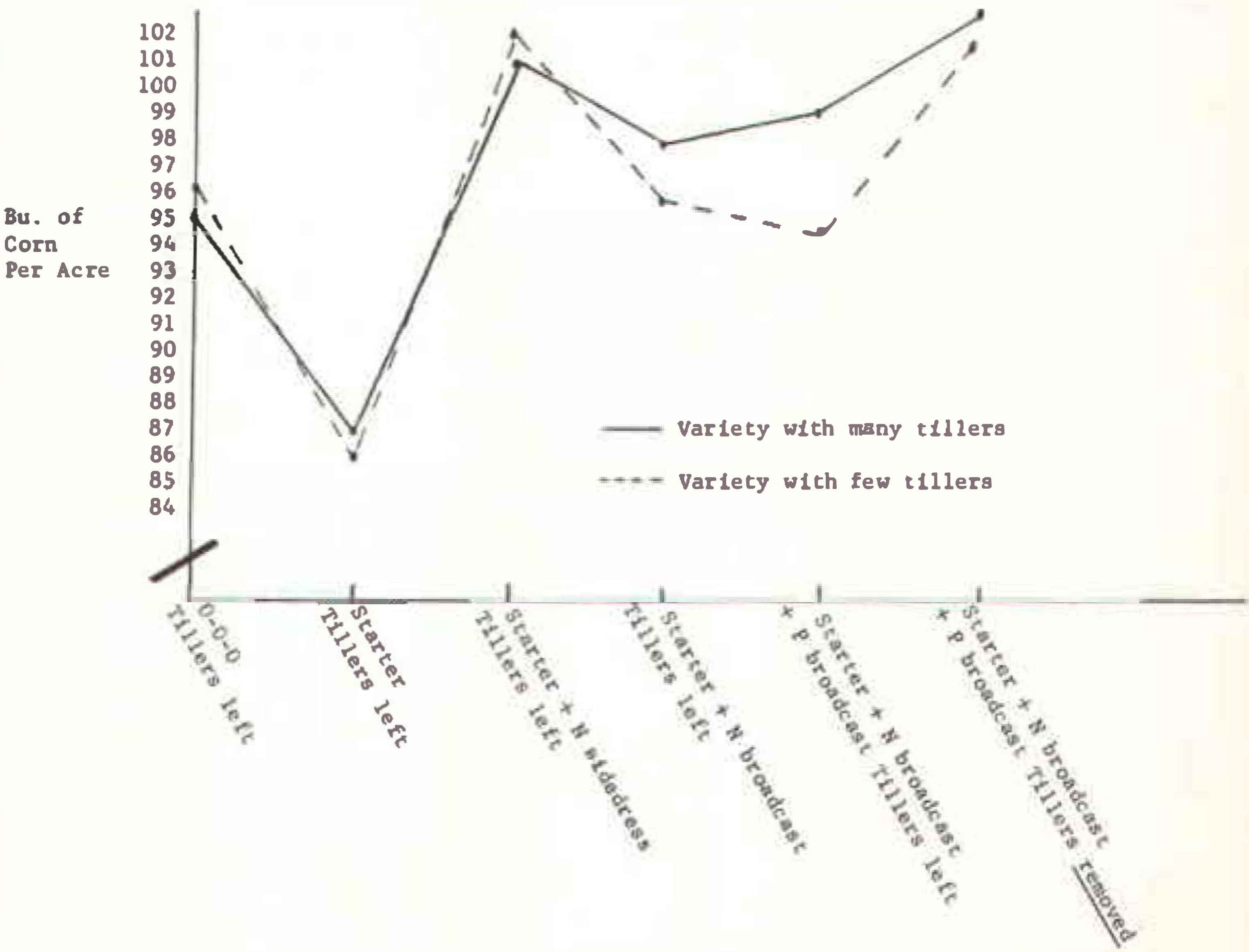
1. Does fertilizer cause or stimulate formation of tillers?

2. Do tillers depress yield?

3. Is tillering a function of total nitrogen and phosphorus applied or of method by which it was applied?

4. Will effects on yield from induced tillering be the same for a high tillering and non-tillering type of corn?

Figure 15. Effect of Fertilizers and Tiller Removal on Corn Yield



Discussion and Interpretation of Figure 15:

Starter fertilizer consisted of 112 lbs/acre of 8-32-16 + 2% zn. This would amount to 9 lbs. of N, 16 lbs. P, 15 lbs. of K and 2.2 lbs. of zinc per acre. Starter fertilizer was placed 2 inches to the side and 2 inches below the seed. In plots receiving broadcast phosphate, 18 lbs. of P was broadcast per acre in addition to the P applied in the starter. Supplemental nitrogen was applied at the rate of 80 lbs. of N per acre.

Sidedressed nitrogen was applied with a belt applicator in the form of ammonium nitrate. In plots calling for broadcast applications, the fertilizer was broadcast by hand and disked in.

Soil test values for this location were:

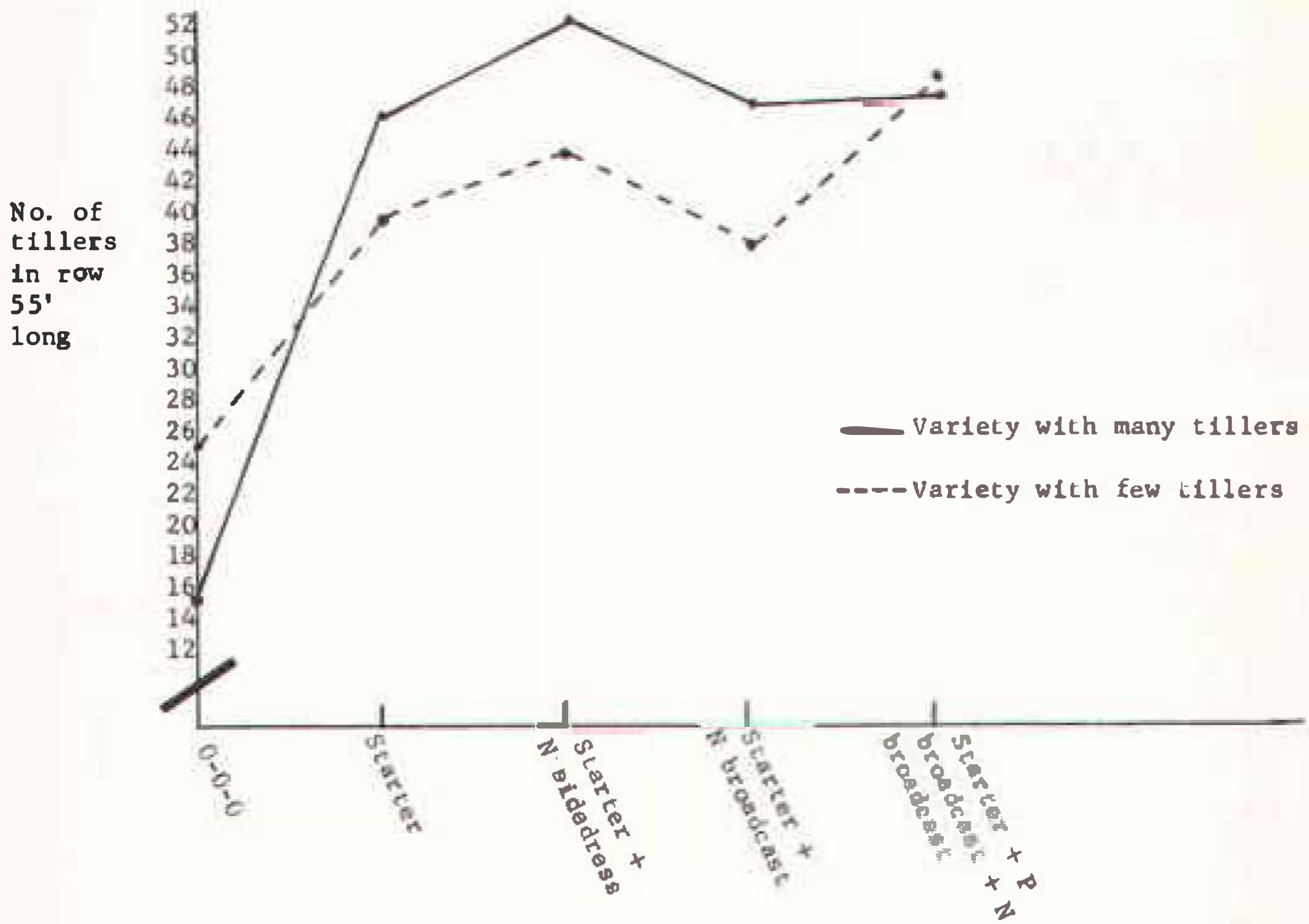
organic matter %	3.0	(medium)
P lbs/acre	21	(medium)
K lbs/acre	399	(high)
pH	6.5	
soluble salts, mmho/cm	0.35	(low)

There were six replications of each treatment. Tillers were allowed to remain on the stalks in all but one treatment where they were pulled off by hand. Final stand count was 14,000 plants per acre. The tillering characteristics of the two varieties were characterized previously in other experiments.

Yield of both varieties decreased when starter fertilizer was used alone without supplemental nitrogen. When tillers were removed, yields appeared to go up slightly with both varieties. In 1965 yields also increased when tillers were removed. No definite conclusions can be drawn at present, but it appears that tillers may not be as efficient for corn grain production as the main stalk.

The objective now is to find a way to fertilize and grow corn that takes full advantage of the extra yield potential of some of the high tillering corn varieties without over stimulating the formation of tillers.

Figure 16. Effect of Fertilizers and Their Method of Application on Number of Tillers



Discussion and Interpretation of Figure 16:

Note the large increase in number of tillers due to starter fertilizer for both varieties of corn compared to the unfertilized plot. Now look at Figure 15 showing effect of starter fertilizer high in phosphate on yield of corn. When starter was applied alone, there appeared to be an inverse relationship between number of tillers and yield of corn.

These plots were drilled in rows spaced 40 inches apart. In the commercial yield trials where fertilizer was broadcast instead of banded and check planted rather than drilled, there were practically no tillers with the same varieties as those used in this experiment. This evidence is purely circumstantial, but it does indicate some possible avenues for further investigation.

STARTER FERTILIZER FOR CORN

-- F. Shubeck, B. Lawrenson and L. Nelson

Objectives of Experiment

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

2. Is the practice of including a small amount of potassium in the starter fertilizer "for insurance" against possible potassium deficiencies in borderline response areas worthwhile?

3. Is it best to forget about the starter fertilizer and broadcast all the fertilizer before planting and disking it in?

Table 5. Effect of Starter Fertilizer and Supplemental Nitrogen on Yield of Corn

Starter Fertilizer Treatments per acre N	P	K	Lbs. of Supplemental N/Acre	% Water in ears at harvest	Tons of Stover at harvest (70% moisture)	Bu. of #2 Corn/Acre
0	0	0	None	39.5	5.9	91
12	23	0 in band	None	39.9	6.3	92
12	23	17 in band	None	40.1	5.9	95
0	0	0	80# sidedressed	39.6	7.9	124
12	23	0 in band	80# sidedressed	39.9	7.9	123
12	23	17 in band	80# sidedressed	39.9	6.8	122
12	23	17 in band + zinc	80# sidedressed	39.6	6.3	120
12	23	17 broadcast	80# all broadcast and disked in	40.4	7.1	125
L.S.D. at 5% level					1.1	5.8

Discussion and Interpretation of Table 5

The land for this experiment was fall plowed. Broadcast fertilizer was applied May 16. Pioneer 3414 was planted May 18 and 19. Selection of variety was made from Commercial Yield trial data of previous years. Four pounds of Atrazine 80W per/acre was broadcast May 19. All plots were hand picked September 28.

Eighty pounds of supplemental nitrogen increased yield of #2 corn a little over 30 bushels per acre. This is one of the largest yield increases obtained from fertilizer applications since the experiment was started.

Starter fertilizer, either with or without potash, did not increase yield very much and zinc did not increase yield either. There was little or no difference in yield due to the method of application. Sidedress nitrogen alone did very well for increasing stover also.

Soil test values for this location were:

organic matter %	2.7	(medium)
P lbs/acre	22	(medium)
K lbs/acre	389	(high)
pH	6.7	
Soluble salts, mmho/cm	0.33	(low)

Table 6. Effect of Starter Fertilizer For Corn On Dry Matter Production

Treatments Per Acre N P K	Tons of Dry Matter Per Acre July 16 (Knee High)	July 29 (1 Week After Silking)	Sept. 28 (At Harvest)
0 0 0	0.6	2.0	4.5
12 23 17	0.8	2.3	4.6

Discussion and Interpretation of Table 6

Response to starter fertilizer has been variable in previous years. Some of the theories advanced to explain this are; phosphate induced zinc deficiency, increased number of tillers, stimulation of early plant growth by fertilizer which makes excessive demands on available moisture.

Table 6 is presented to show that early growth was stimulated by the starter fertilizer. An increase of 0.3 ton of dry matter due to starter on July 29 sampling date would be 1 ton of 70% moisture silage. The difference in dry matter at harvest between check plot and starter fertilizer was not as much as on July 29. This information indicates that early growth stimulation by starter fertilizer alone without supplemental nitrogen is not always associated with comparable increases in yield of ear corn at harvest.

MINUMUM TILLAGE FOR CORN

-- F. Shubeck, B. Lawrenson & L. Nelson

Objectives of Experiment:

1. How much tillage is really necessary for corn production?

2. Can yields from minimum tillage methods be maintained or improved over yields from conventional methods?

3. Evaluate various methods of seedbed preparation, planting and cultivation.

Table 7. Effect of Minimum Tillage Methods on Yield of Corn and Ear Moisture at Harvest.

Treat-ment No.	Treatment	Fertility* N P K	Bu. of #2 Corn/Acre	% Water in Ears at Harvest
1	Spring List, Fall Subsoil	90.8 + 12 + 0	106	39
2	Stubble Mulch, Noble Blade	90.8 + 12 + 0	116	42
3	Loose-Ground List, Fall Plow	90.8 + 12 + 0	107	39
4	Roto-Tiller, Conventional Plant	90.8 + 12 + 0	106	39
5	Hard-Ground List	90.8 + 12 + 0	105	40
6	Conventional Plant, Fall Plow	90.8 + 12 + 0	106	37
7	Conventional Plant, Spring Plow	90.8 + 12 + 0	111	36
8	Plow Plant	90.8 + 12 + 0	112	40
9	Conventional Plant, Spring Plow	0-0-0	84	38
10	Wheel Track	90.8 + 12 + 0	116	38

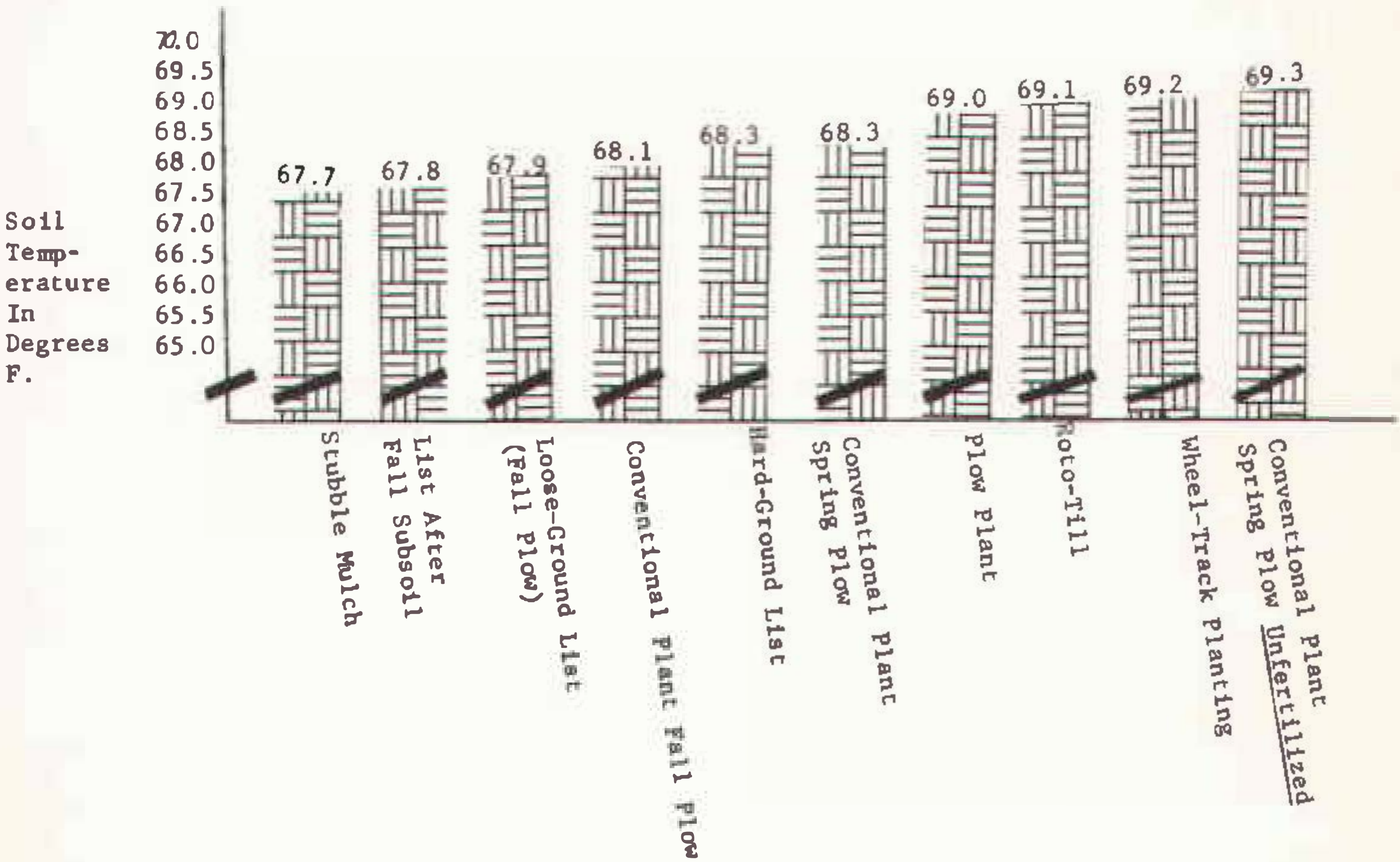
* Fertility included 60# of 18-46-0 starter. This amounts to 10.8 pounds of N and 12 pounds of P (elemental) per acre. In addition, 80 pounds of N per acre were sidedressed when the corn was 18 inches high.

Discussion and Interpretation of Table 7

Wheel-track planting was quite successful again this year. The stubble-mulch and plow-plant treatments also showed promise. Note again the substantial increase in yield due to fertilizer. To eliminate fertility as a variable, all plots were fertilized except the one marked unfertilized. The cooler temperatures in the stubble-mulch treatment appeared to slow maturity, measured by per cent moisture in ears at harvest.

A Buffalo-Till Planter was used in an area adjacent to that used by the 10 treatments listed in Table 7. Yields were comparable to other minimum tillage methods.

Figure 17 Effect of Corn Planting Method on Soil Temperature (Averaged from June 1 through October 14.)



Discussion and Interpretation of Figure 17

Soil temperatures were measured with a potentiometer. Four thermocouples were buried three inches deep at four different points in 10 linear feet of row in each plot and coupled to a common lead. An average temperature could then be taken from 10 linear feet of row. The temperature was recorded at 1:00 P.M. each day. The thermocouple area was hand weeded rather than cultivated to prevent digging up the wires or covering them more deeply with soil.

In Figure 17, treatments were arranged in order of increasing soil temperature. Notice that the highest average temperature occurred with unfertilized corn. When corn was fertilized, it had a greater leaf area and denser canopy of vegetation which intercepted more of the suns rays. Results in 1965 were very similar.

Soil temperature in stubble mulch plots was cooler because the bright straw reflected some of the suns rays and the organic matter on the soil surface acted like a blanket of insulation. In mulch plots at Highmore, (South Dakota Farm and Home Research Volume XVII 1966), the insulating effect was so great that early corn growth was retarded in some years. The mulch appeared to increase yield at SE Research Farm in 1966 (Table 7).

SOYBEAN POPULATIONS AND ROW SPACINGS

--B. Lawrensen, F. Shubeck and L. Nelson

Objectives of Experiment

1. Study effect of row spacing and plant populations on yield.
2. Will row spacings influence yield at both high and low populations?
3. Study effect of row spacings on weed control and water utilization.

Figure 18. Effect of Soybean Populations and Row Spacings on Yield

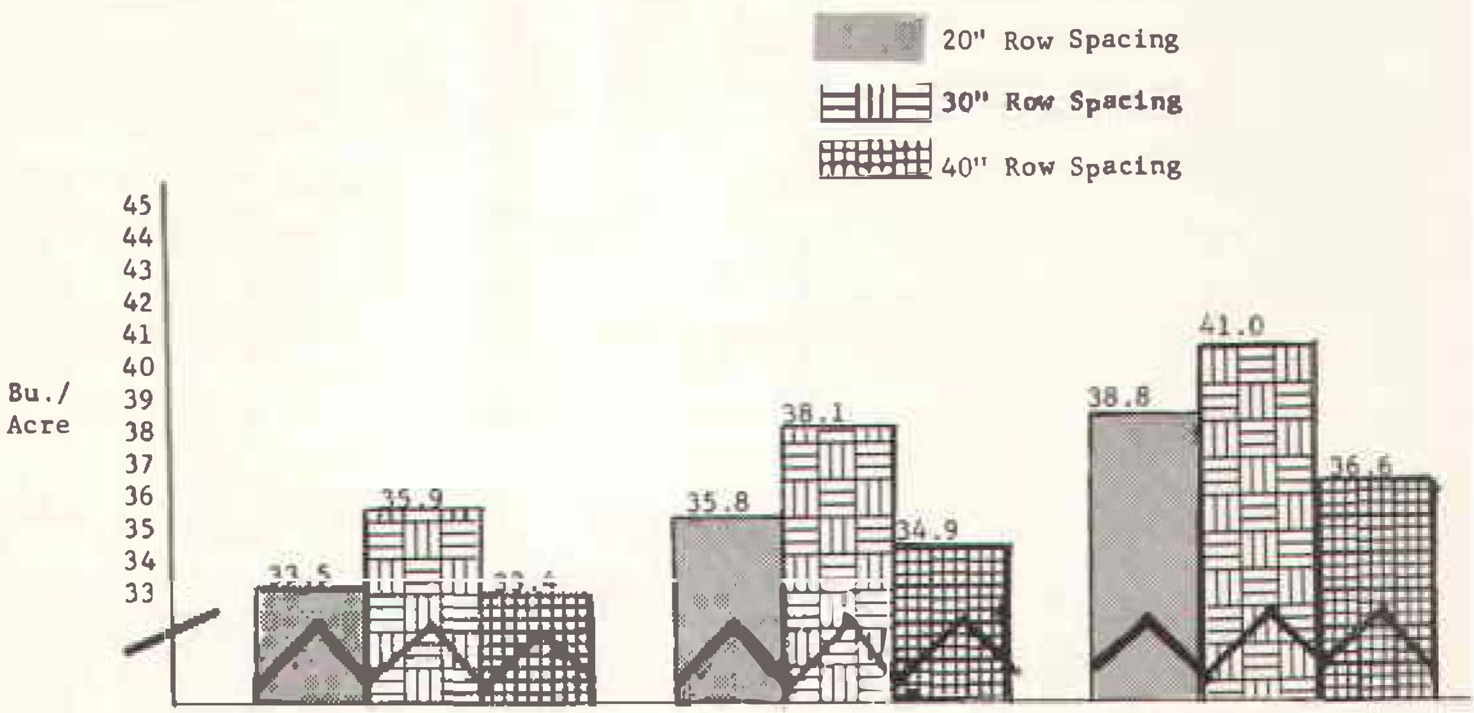
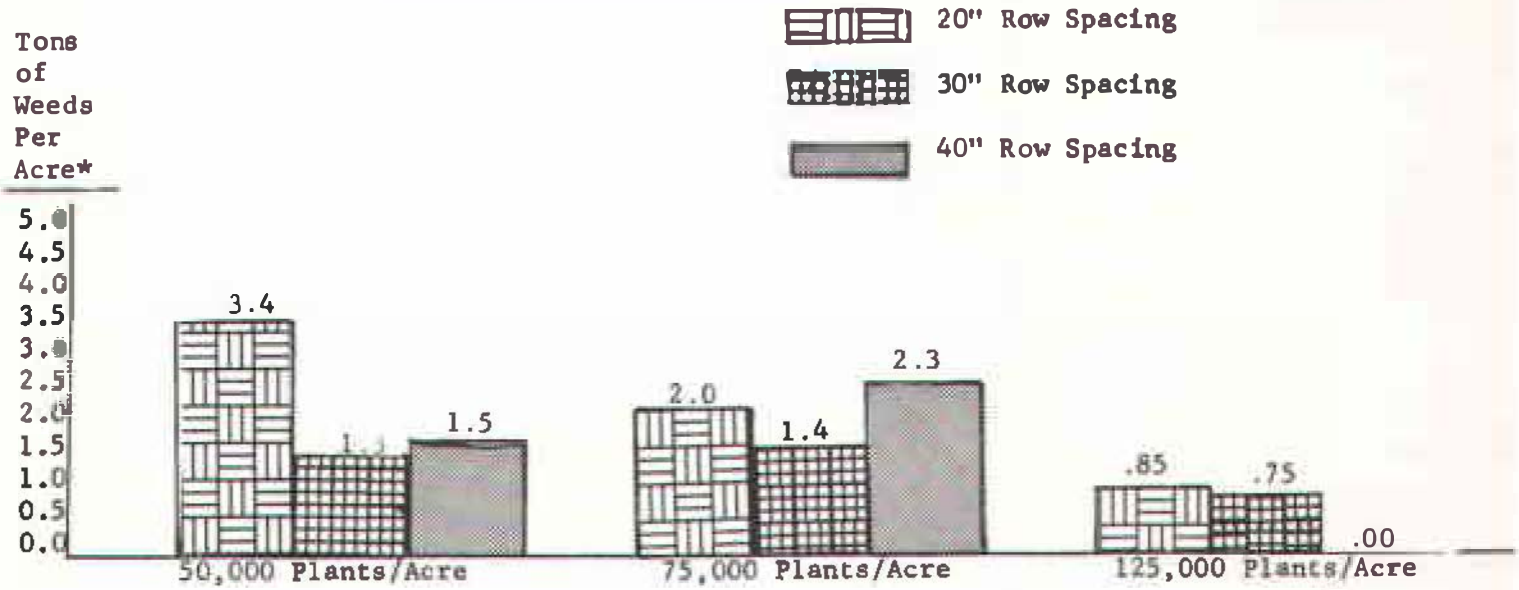


Table 8. Relation of Distance Between Plants in the Row and Row Spacings to Plants Per Acre

Plants/Acre	Row Spacing	Plants/Ft. of Row	Linear Inches Between Plants
50,000	20"	1.91	6.3
50,000	30"	2.87	4.2
50,000	40"	3.83	3.1
75,000	20"	2.87	4.2
75,000	30"	4.30	2.8
75,000	40"	5.74	2.1
125,000	20"	4.78	2.5
125,000	30"	7.17	1.7
125,000	40"	9.57	1.25

20" Rows/12" = 1.666' 30" Rows/12" = 2.50' 40" Rows/12" = 3.333'

Figure 19. Effect of Soybean Populations and Row Spacing on Weed Control



* Tons of weeds per acre were calculated at 70% water.

Discussion and Interpretation of Table 8, Figures 18 and 19.

Variety used was Lindarin 63. It was planted June 3 to 6 with a tool bar planter. One hundred pounds of 8-32-16 (8-14-13 elemental) was applied broadcast and disked in. The soybean row spacing area was fall plowed and disked once early in the spring. Treflan for weed control was broadcast at the rate of 1-1/2 pints per acre and disked. All plots were cultivated twice with an Allis Chalmers "G" tractor. There were 835 seeds per 100 grams or 3340 seeds per pound. With this variety there were 125,000 potential plants in 37.4 pounds of seed.

$$\frac{125,000 \text{ plants/acre}}{3,340 \text{ seeds/lb.}} = 37.4 \text{ lbs./acre}$$

One extra population was added this year upon the suggestion of the Advisory Committee. This gave a broader population base to make recommendations from. With three populations, a yield curve could be constructed. This could not be done with two populations. Table 8 was included to show the number of plants per foot of row necessary to obtain the populations listed at the respective row spacings.

Soybean yields increased as plant populations increased (Figure 18). This trend was much more definite than in 1965. Above average rainfall in July and August of 1966 was probably one of the major reasons. Present plans are to increase populations to 150,000 plants per acre next year.

Thirty-inch row spacings yielded the most beans in 1966 which was similar to results of 1965. Weeds were more of a problem in 20" rows (Figure 19). If weed control was equally effective in all row spacings, perhaps the yield from 20" rows would look more favorable.

Figure 20. Effect of Soybean Populations and Row Spacings on Plant Height

Figure 22. Effect of Soybean Populations and Row Spacings on Percent of Lodged Stalks.

Discussion and Interpretation of Figures 20, 21 and 22.

Row spacings and populations had little or no effect on plant height (Figure 20).

[illegible]

There was a little more lodging in 20-inch rows compared to 40-inch rows in 1966 (Figure 22). This was similar to results in 1965.

Figure 21. Effect of Soybean Populations and Row Spacings on Number of Pods Per Plant Below 5 Inches.

Figure 23. Effect of Row Spacing on Seeds Per Pod.

Table 9. Effect of Row Spacing and Plant Populations on Branches Per Plant and Pods Per Plant

Plants Per Acre	Row Spacing	Branches Per Plant	Pods Per Plant
50,000	20"	2.0	37
50,000	30"	2.3	43
50,000	40"	2.3	41
75,000	20"	1.9	31
75,000	30"	2.0	35
75,000	40"	2.1	34
125,000	20"	1.7	26
125,000	30"	1.9	25
125,000	40"	1.4	23

Discussion and Interpretation of Table 9 and Figure 23.

[illegible] of yield trials.

[illegible] ulations.

Figure 23 shows that number of seeds per pod was not altered appreciably by the different row spacings.

SORGHUM POPULATIONS AND ROW SPACING

-- B. Lawrensen, F. Shubeck and L. Nelson

Objectives of Experiment:

1. Study effect of row spacings and plant populations on yield and other plant characteristics.

2. Study Relationship of row spacings and weed control.

Figure 24 Effect of Sorghum Populations and Row Spacings on Grain Yield.

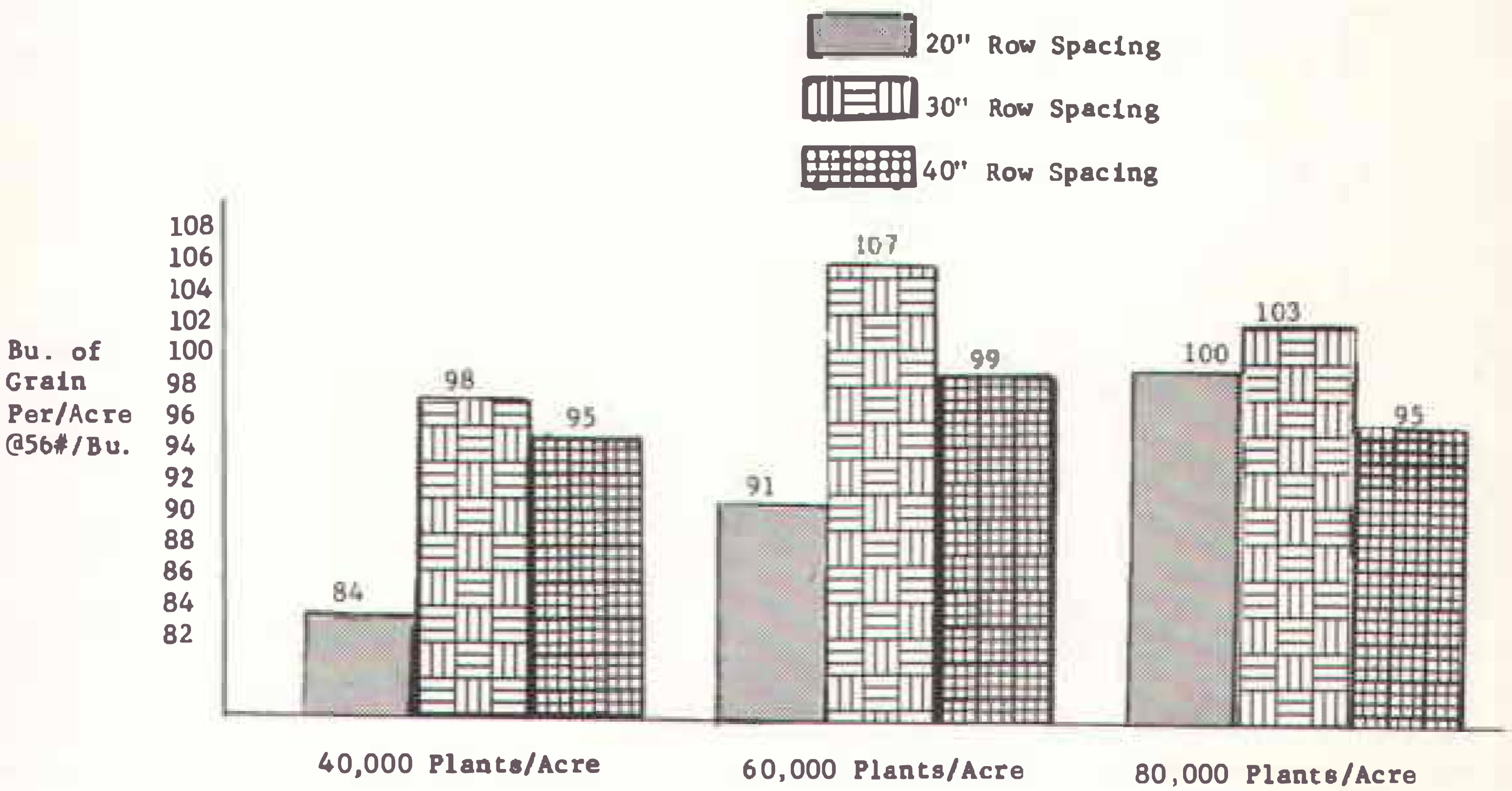


Table 10. Effect of Grain Sorghum Plant Populations and Row Spacing on Weed Control.

Plants Per Acre	Row Spacings	Tons of Weeds Per Acre at 70% Water
40,000	20"*	3.3
40,000	30"	2.1
40,000	40"	1.0
60,000	20"*	2.9
60,000	30"	0.5
60,000	40"	0.6
80,000	20"*	2.9
80,000	30"	0.9
80,000	40"	0.7

* One cultivation only, other row spacings had two cultivations.

Discussion and Interpretation of Figure 24 and Table 10.

Variety used was Northrup King 227. Seedbed preparation consisted of fall plowing and two diskings. One hundred pounds of N and 13 pounds of P were broadcast and disked in May 20. Sorghum was planted on June 1. Three pounds of Atrazine 80W per acre was broadcast after germination, but before seedling emergence. The purpose of applying Atrazine at this time was to avoid germination injury. The 40 inch and 30 inch rows were cultivated twice with an Allis Chalmers G tractor. Twenty inch rows were cultivated only once because the leaf canopy was closing the area between rows when the second cultivation normally would have been made. There were 3,120 seeds per 100 grams or 14,165 seeds per pound.

At all three populations levels, 30 inch rows yielded more grain than other row spacings. With 30 inch rows, 60,000 plants per acre were sufficient. With 20 inch rows, yields increased with populations through 80,000 plants per acre.

There were more weeds at low population densities (Table 10). If weeds could have been controlled equally in all populations, yields with 20 inch rows probably would have been more favorable. It is better to grow sorghum in weed free 30 inch rows than in weedy 20 inch rows.

Table II. Effect of Sorghum Populations and Row Spacings on Lodging, Plant Height and Diameter of Stalks.

Plant Populations	Row Spacings	% Broken and Lodged Stalks/Acre	Plant Height In Inches	Diameter of Stalk 2" above ground (in inches)
40,000	20"	16	48.8	0.7
40,000	30"	26	49.6	0.7
40,000	40"	31	50.5	0.7
60,000	20"	34	48.2	0.6
60,000	30"	22	47.6	0.6
60,000	40"	36	49.9	0.6
80,000	20"	48	47.4	0.5
80,000	30"	57	47.9	0.5
80,000	40"	59	49.0	0.6

Discussion and Interpretation of Table II

There were more broken and lodged stalks with higher plant populations. Several frosts occured before grain was harvested. The delay was caused by wet soil. If these plots could have been harvested earlier, there would have been fewer broken and lodged stalks.

There was very little difference in plant height, due to row spacings or plant populations.

Stalk diameter was less in heavy populations. As populations were reduced, stalk diameter increased and lodging decreased.

Table 12. Effect of Sorghum Populations and Row Spacings on Tiller Formation and Weight per Head.

Plant Populations	Row Spacings	% of Stalks With Tillers	Weight Per Head In Grams
40,000	20"	11	64
40,000	30"	5	73
40,000	40"	9	73
60,000	20"	9	51
60,000	30"	4	67
60,000	40"	7	60
80,000	20"	3	39
80,000	30"	5	50
80,000	40"	5	51

<u>Discussion and Interpretation of Table 12.</u>

A few more tillers were formed as plant populations decreased. There are differences of opinion regarding the value of tillers in grain sorghum. If stands are inadequate for the available nutrients and moisture, tillering may help to correct this deficiency. On the other hand, tillers may use moisture and nutrients later in the season when the main stalk is under stress. If tillers are able to develop a head, they are sometimes immature when the main head is ready to combine. With the climate, variety, fertility and populations of this experiment, tillering was not an important factor this year.

When populations were increased, weight per head decreased. A head weight of 67 grams gave the highest yield in 1966. With a less favorable growing season the optimum head weight and associated plant populations will probably be different.

MOST PROFITABLE ROTATION EXPERIMENT

-- F. Shubeck, B. Lawrensen and L. Nelson

Objectives of Experiment:

1. How much will fertilizer increase net profits?

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

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

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

Discussion and interpretation of results:

1966 was a very profitable year for fertilizer use. Every fertilized cropping sequence gave an increase in cash returns over its unfertilized counterpart except continuous grain sorghum. In this experiment, both the total yield of grain sorghum and its response to fertilizer were small. (Table 14)

It should be remembered that these returns above cash costs do not include cost of land use. For highest net returns, continuous corn was again in first place.

In Table 13 note the increase in corn yields due to inclusion of legumes in rotations where no commercial fertilizer was applied. Fertilized soybeans again appeared to give a small yield increase over the check plots.

Table 15 gives the custom rates used in computing the returns per acre.

Table 13. Crop Yields from Rotation Experiment

Cropping Sequence	Crop Receiving N-P-K 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 CWT/A	Hay Tons
1 Cont. Corn		0 + 0 + 0	-	-	71	-	-	-	-
1 Cont. Corn	Corn	6 + 11 + 10	70	-	97	-	-	-	-
2 Corn-Oats		0 + 0 + 0	-	37	70	-	-	-	-
2 Corn-Oats	Corn	6 + 11 + 10	70	-	104	-	-	-	-
	Oats	30 + 7 + 0	-	62	-	-	-	-	-
3 Corn-Corn - Oats + Alfalfa-Alfalfa Hay		0 + 0 + 0	-	48	80	77	-	-	3.0
3 Corn-Corn - Oats +	Corn	6 + 11 + 10		-	90	-	-	-	-
Alfalfa-Alfalfa Hay	Corn	6 + 11 + 10	70	-	-	95	-	-	-
	Oats	15 + 26 + 0	-	66	-	-	-	-	3.2
4 Oats + Sw. Clover-Corn		0 + 0 + 0	-	36	87	-	-	-	-
4 Oats + Sw. Clover-	Oats	30 + 7 + 0	-	58	-	-	-	-	-
Corn	Corn	6 + 11 + 10	-	-	92	-	-	-	-
5 Corn-Oats-Soybeans		0 + 0 + 0	-	52	76	-	19	-	-
5 Corn-Oats-Soybeans	Corn	6 + 11 + 10	70	-	106	-	-	-	-
	Oats	20 + 7 + 0	-	69	-	-	-	-	-
	Beans	6 + 11 + 10	-	-	-	-	20	-	-
6 Corn-Soybeans-Oats		0 + 0 + 0	-	41	77	-	17	-	-
6 Corn-Soybeans-Oats	Corn	6 + 11 + 10	55	-	99	-	-	-	-
	Beans	6 + 11 + 10	-	-	-	-	22	-	-
	Oats	30 + 7 + 0	-	61	-	-	-	-	-
7 Cont. Grain Sorghum		0 + 0 + 0	-	-	-	-	-	26.0	-
7 Cont. Grain Sorghum		6 + 11 + 10	70	-	-	-	-	28.0	-

Table 14. Net Returns from Most Profitable Rotation Experiment

Rotation	Returns above cash costs per acre* Fertilized	Unfertilized
1. Continuous Corn	$ 89.08	$ 67.45
2. Corn-Oats	61.57	40.60
3. Corn-Corn-Oats + Alfalfa-Alfalfa Hay	63.25	58.13
4. Oats + Sweet Clover-Corn	56.39	51.09
5. Corn-Oats-Soybeans	55.53	42.88
6. Corn-Soybeans-Oats	51.63	39.36
7. Continuous Grain Sorghum	14.41	22.50

*Does not include cost of land use.

Table 15. Custom Rates, Seed and Chemical Costs, Grain and Hay Prices Used to Calculate Net Returns from Rotation Study - 1966.

Custom Rates* Operation	Average Rate Per Acre
Plowing	$ 4.00
Discing (tandem)	1.35
Cultivating (row crops)	1.20
Harrowing	.50
Swathing (inc. hay)	1.25
Baling - 12¢/bale @ 50#	4.80/ton
Corn picking	3.50
Combining-Oats Soybean, Grain Sorghum	4.00
Corn Planting W/ Fertilizer	1.25
Corn Planting W/o Fertilizer	1.00
Grain-Drill W/ Fertilizer	1.25
Grain-Drill W/o Fertilizer	1.00
Side Dress Nitrogen	1.00

Seed and Chemical Costs/Acre

Corn	$ 2.20
Oats	2.50
Soybeans	3.00
Grain Sorghum	1.20
Alfalfa	3.30
Organic Phosphate	2.00
Herbicides	
Randox T	3.50
Treflan	5.65

Mixed Fertilizer Costs

	Costs/lb.
N	11¢
P_2O_5	9¢
P	9¢
K_2O	5.5¢
K	5.5¢

$P_2O_5 \times .44 = P$
$K_2O \times .83 = K$

Sidedress Nitrogen

N 8¢/lb.

Grain and Hay Prices**

#2 Corn	$ 1.25/bu.
Soybeans	2.78/bu.
Oats	.67/bu.
Gr. Sorghum	1.70/cwt.
Alfalfa Hay	22/ton

* From Economics Fact sheet No. 188
** Prices Farmers Coop Elevator Company, Brookings, S.D., December 19, 1966

MAXIMUM FORAGE EXPERIMENT

-- B. Lawrensen, F. Shubeck, L. Nelson of Agronomy Department and George Gastler of Station Biochemistry

Objectives of Experiment:

1. Compare 5 types of forage (Hybrid Sorghum - Sudan, True Sudan Hybrid, Hybrid Sorghum, Open-pollinated Sorghum and Hybrid Corn).

2. Compare multiple cutting with full season growth using two types of forage (Hybrid Sorghum - Sudan, and True Sudan Hybrid).

3. Compare nutritive values of forages of different types and cuttings.

4. Compare results from 20 inch and 40 inch rows.

<u>Discussion and Interpretation of Results of Table 16</u>

The soil was fall plowed. A fertilizer application of 100 pounds N and 14 pounds of P was broadcast in the spring and disked in. Spring seedbed preparation consisted of duckfooting early in the spring, disking once and flextine harrowing once. Plots were planted May 27, 1966. Sorghum was planted at the rate of 6#/acre in the 40 inch rows and doubled for the 20 inch rows. Corn was planted at 12,000 plants/acre in 40 inch rows and doubled in the 20 inch rows. Plots were dragged once after planting and cultivated as needed.

On July 28, heavy rain and strong wind caused lodging in all forages. Recovery was good in all varieties.

One hybrid sorghum and one hybrid sorghum sudan yielded an amazing 24 tons per acre of 70% moisture forage. By actual measurement the Pioneer 931 hybrid sorghum towered 14 feet above the ground. Some of the tall varieties that were cut only once were either high in fiber or low in protein. Multiple cuttings resulted in a much higher per cent of protein, but less total forage. Cuttings were made 4 to 6 inch above the ground. Rate of recovery measured 10 days after cutting was somewhat slower in these plots than results reported at other experiment stations. If 2 or 3 more inches of stubble were left, perhaps recovery would be faster and yields from multiple cuttings greater.

There was no consistent yield advantage in favor of double planting these forages in 20 inch rows in 1966.

Table 16. Effect of Forage Types, Row Spacings and Number of Cuttings on Forage Yield and Plant Composition

Type	Variety	** No. of Cuttings	Row Sp.	Ton/Acre @ 70% Water	% Crude Fat*	% Crude Fiber*	% Crude Protein*	% Nitrogen Free Extract*	% Ash*
Hybrid Sorghum Sudan	Frontier	1	20"	24.4	2.17	26.54	8.53	50.79	8.34
	Hydan	1	40"	19.6	2.37	26.40	9.38	49.62	8.86
	38	3	20"	9.8	2.38	26.13	15.03	40.63	11.75
		3	40"	9.9	2.80	26.29	17.75	37.14	12.02
	DeKalb	1	20"	18.2	2.30	27.43	8.62	48.77	9.26
	SX-11	1	40"	20.7	2.77	26.85	8.97	50.02	7.92
		3	20"	9.7	2.50	26.68	16.90	37.72	11.66
		3	40"	9.3	2.63	25.03	16.66	39.01	12.87
True Sudan Hybrid	Northrup	1	20"	18.5	2.59	27.71	8.66	49.36	7.63
	King	1	40"	17.7	2.64	27.61	8.72	48.85	8.55
	Trudan	3	20"	11.1	2.43	29.64	15.32	38.34	10.36
		3	40"	9.6	2.44	26.11	16.87	39.47	10.56
Hybrid Sorghum	Frontier	1	20"	14.9	2.11	26.74	8.47	50.37	8.14
	FS 210	1	40"	17.5	1.95	27.02	8.15	51.04	7.89
	Pioneer	1	20"	24.0	1.81	34.42	7.68	46.49	7.13
	931	1	40"	24.5	1.31	37.92	7.13	43.82	6.35
Open Polli-nated Sorghum	Rox	1	20"	19.2	2.17	27.75	8.12	53.43	6.48
	Orange	1	40"	18.0	3.04	20.94	8.06	57.10	6.56
Corn	Pioneer	1	20"	16.9	2.07	20.55	8.54	57.95	6.30
	3291	1	40"	17.3	2.23	21.98	9.04	56.33	6.29

* Percentage analysis reported on basis of moisture free material

** One cutting - plants were allowed to grow until frost
Three cuttings - plants were cut each time they reached approximately 40 inches in height

SOIL POTASSIUM OF THE SOUTHEAST FARM

To help evaluate the availability of soil potassium, field plots were used on this farm each season since 1962. Results from 1962 through 1965 were reported earlier (Fifth Annual Progress Report, Southeast South Dakota Experiment Farm, South Dakota Agricultural Experiment Station, December 1965). The 1966 study was a continuation of the same plots used in 1965. The plots compared three fertilizer treatments which were repeated again in the spring of 1966. Treatments were: (a) no potassium, (b) 500 pounds of potassium broadcast per acre, and (c) 12 to 17 pounds potassium banded per acre. Nitrogen and phosphorus fertilizers were broadcast and banded uniformly over all plots. Pioneer 3414 corn was planted in 40-inch rows on May 20. A month later corn plants were thinned to a uniform density of 12 thousand per acre. Good insect and weed control was maintained throught the season. Moisture content to the five-foot depth in the soils between corn rows at each corner of the plot area was determined three times: early in the corn growing season, during corn pollination, and after harvest of the corn grain. Temperatures in the corn row at the three-inch depth of soils bordering the plot area were measured daily. Corn grain yield on the individual plots was measured October 22.

Corn yield, soil moisture, and soil temperature data are in tables 17, 18, and 19. Analysis of variance showed no significant differences among corn yield data. So, banding a small amount or even repeatedly broadcasting large quantities of potassium fertilizer has not greatly influenced corn yields on these soils.

Table 17. Average moisture content of soils bordering 1966 potassium plots.

Sample depth	Moisture content (g.water/g. dry material)*		
(in.)	June	July 28	Nov. 23
0-6	0.26	0.25	0.26
6-12	0.28	0.17	0.27
12-24	0.25	0.18	0.26
24-36	0.21	0.20	0.25
36-48	0.23	0.24	0.27
48-60	0.26	0.27	0.35

*Each value is an average of four samples (one from each corner of the plot area).

Table 18. Average 1:00 P.M. temperature in corn row at three-inch depth in soils bordering 1966 potassium plots.

Period	Temperature (^{0}F.)
June 9-15	70
June 16-30	78
July 1-15	79
July 16-30	76
August 1-15	69
August 16-31	68
September 1-15	66
September 16-30	57

Table 19. Influence of potassium fertilizer on 1966 corn grain yields on some moderately well-drained soils of the Southeast Farm

Potassium Fertilizer Treatment* (lbs.K/ac./yr. 1965 & 1966)	Corn Grain Yield (bu./ac.)**
None	110
500 broadcast	107
12-17 banded	108

* All plots received nitrogen and phosphorus fertilizers.
** Each value is the average of eight replications.

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. The various rates of P were also used to determine the influence of P fertilizer on the zinc (Zn) uptake by corn plants.

Each P rate was divided into thirds with one third receiving about 10 pounds of P per acre as a starter fertilizer, one third receiving Zn fertilizer, and one third receiving no extra P or Zn. The fertilizer applications have been applied on the same site for 3 years, except the zinc fertilizer which was not applied in 1966.

The entire experimental area received 80 pounds of nitrogen (N) per acre and 33 pounds of potassium (K) per acre before planting each year. An insecticide was applied to control western corn rootworms, and atrazine was applied to control weeds. Pioneer 3291 was planted May 18, 1966.

Soil tests at the beginning of the experiment rated the P test as medium and the Zn test as very high.

Results and Discussion:

The corn yields for the various fertilizer treatments are shown in Table 20.

Table 20. Influence of various rates of broadcast P and the additional influence of starter P, and residual Zn fertilizer on the yield of ear corn.

Pounds of P Broadcast/A	No Additional P or Zn	10 Lbs. of P as Starter/A	20 Lbs. of Residual Zn/A	Average
P	Ear Corn Yield in Bushels per Acre[1/]			
0	111.8	118.7	107.3	112.6
10	120.4	123.1	122.5	122.0
20	121.7	118.2	124.9	121.6
40	121.8	124.2	121.9	122.6
80	121.6	122.9	125.4	123.3
Average	119.5	121.4	120.4	

1/ Yields corrected to 15% moisture in the ear corn.

Ten pounds of broadcast P per acre with no additional P or Zn increased the yield 8.6 bushels per acre. When more P was broadcast there was essentially no yield increase. When no P was broadcast but 10 pounds of P as a starter fertilizer was applied the yield increased 6.9 bushels per acre. This would indicate that this year starter P was just about as effective as broadcast P. This is contrary to results obtained in 1964 and 1965.

When starter P was applied along with some broadcast P the yield was essentially the same between the "no additional P or Zn" treatment and the "starter P" treatment. This again points out that 10 pounds of P (23 pounds of P_2O_5) per acre was enough to produce near maximum yields.

There was no yield response to the "residual zinc" treatment as can be seen by comparing it with the "no additional P or Zn" treatment.

Forage yields were taken on September 21, 1966 to measure the forage production as affected by the various rates of broadcast P and the other treatments. The forage results are given in Table 21.

Table 21. Influence of various rates of broadcast P and the additional influence of starter P and residual Zn fertilizer on the forage yield of corn.

Pounds of P Broadcast/A	No Additional P or Zn	10 Lbs. of P/A as starter	20 Lbs. of Residual Zn/A	Average
		Tons of Forage per Acre at 70% moisture 1/		
0	17.0	16.4	18.9	17.4
10	17.9	19.4	21.0	19.4
20	18.6	14.8	18.7	17.4
40	17.3	18.5	19.3	18.4
80	20.2	20.6	17.1	19.3
Average	18.2	17.9	19.0	

1/ Yields are averages of 2 replications. The yields include all of the corn plant including the ear.

The yields are quite variable, consequently, it is difficult to say if there was any difference in forage yields. However, the corn did produce exjellent yields of forage.

Tiller counts were made on September 21 of this year to determine if applied P influenced the number of tillers on the corn plants. As was found in 1965, the more P applied the more tillers produced. However, not as many tillers were produced in 1966 as in 1965. The number of tillers are presented in Table 22.

Table 22. Influence of various rates of broadcast P and the additional influence of starter P and residual Zn fertilizer on the number of tillers per 100 corn plants. Tillers were counted on September 21, 1966.

Pounds of P Broadcast/A	No Additional P or Zn	10 Lbs. of P as starter	20 Lbs. of Residual Zn/A	Average
	Number of tillers per 100 corn plants. 1/			
0	6	20	19	15
10	27	32	27	29
20	25	42	45	37
40	37	33	36	35
80	30	38	42	37
Average	25	33	34	

1/ Average of 2 replications.

In the past 2 or 3 years much Interest
In the past 2 04 3 years much interest has developed in the area of plant analysis as a means of diagnosing nutrient deficiencies in crops. Since this type of Information would be of value to South Dakota farmers, plant samples were taken from this experiment and analyzed with the objectives

of determining the influence that applied P has on the nutrient uptake of corn plants, and of establishing some sufficiency or deficiency levels of the nutrients measured, if possible. The corn leaf opposite and below the ear at early silking was taken from about 20 corn plants in each treatment and sent to the Plant Analysis Laboratory at the Ohio Agricultural Research and Development Center, Wooster, Ohio for plant analysis.[1/]

Some of the average nutrient values are shown in Table 23 for the various fertilizer treatments.

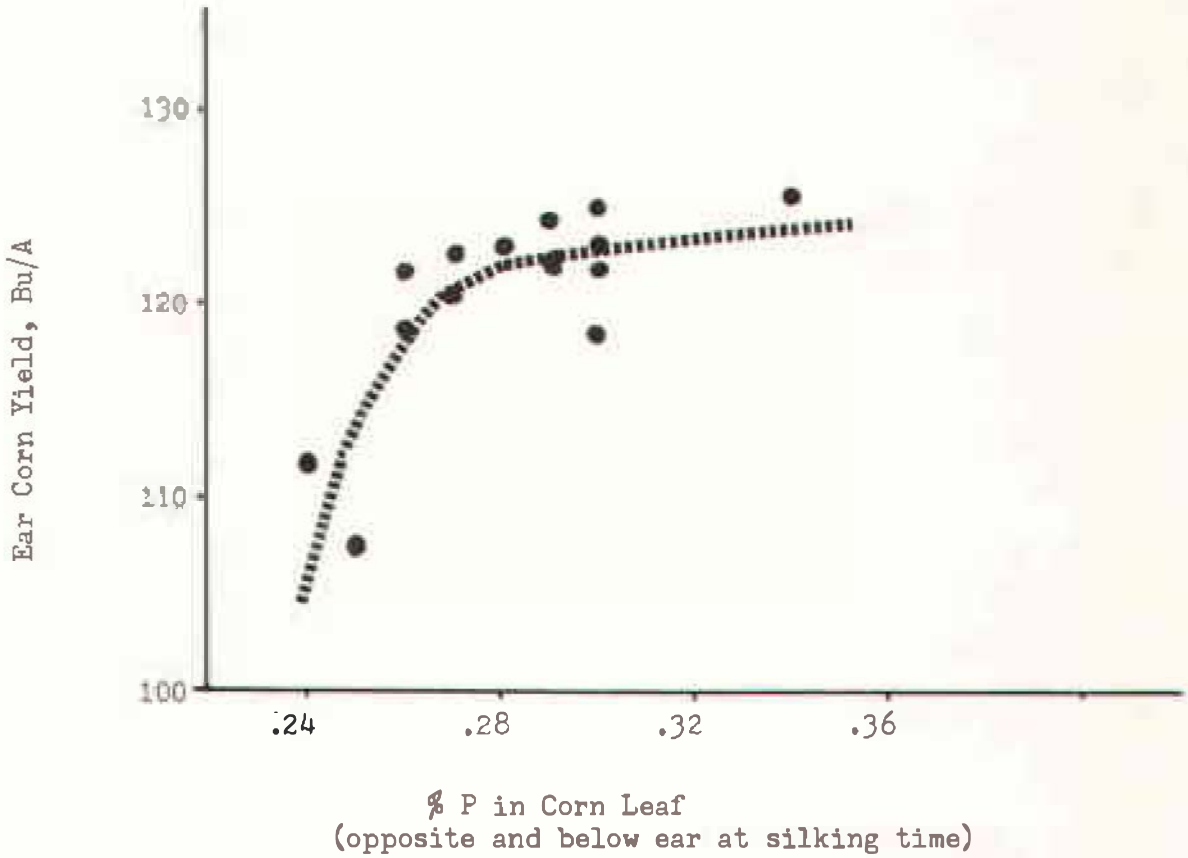
1/ Funds supplied by the South Dakota Fertilizer Association were used to support this analytical work.

Table 23. The average concentration of several nutrient elements found in corn leaves at silking time[1/] as influenced by various fertilizer treatments.

Main Plot Treatment Lbs. of Broadcast P	Sub Plot Treatment	Plant Nutrient[2/] N %	P %	K %	Ca %	Mg %	Mn ppm	Fe ppm	B ppm	Cu ppm	Zn ppm
0	No Extra P or Zn	3.08	.24	2.00	.37	.20	60	111	6	10	40
10	"	3.01	.27	2.28	.39	.17	59	112	5	8	24
20	"	3.10	.26	2.02	.41	.20	65	121	7	7	23
40	"	2.81	.29	2.05	.43	.18	67	142	6	9	20
80	"	2.97	.30	2.03	.40	.16	61	104	6	10	16
0	Starter P	2.97	.26	2.17	.36	.20	63	104	6	10	30
10	"	3.11	.28	2.10	.39	.17	59	99	6	8	25
20	"	2.98	.30	2.18	.50	.27	79	143	7	8	24
40	"	2.91	.29	2.11	.39	.19	64	117	6	7	20
80	"	2.93	.30	2.13	.42	.20	69	113	6	5	16
0	Residual Zn	3.09	.25	2.26	.37	.19	59	132	7	12	49
10	"	2.99	.27	2.18	.37	.17	55	109	6	9	35
20	"	2.84	.30	2.18	.46	.22	63	145	7	8	37
40	"	3.02	.29	2.06	.46	.20	62	116	6	6	31
80	"	3.05	.34	2.20	.47	.19	62	118	6	6	28

1/ The leaf opposite and below the ear was sampled.
2/ Average of 4 replications.

Figure 25. Relationship of corn yield and P content of the corn leaf.



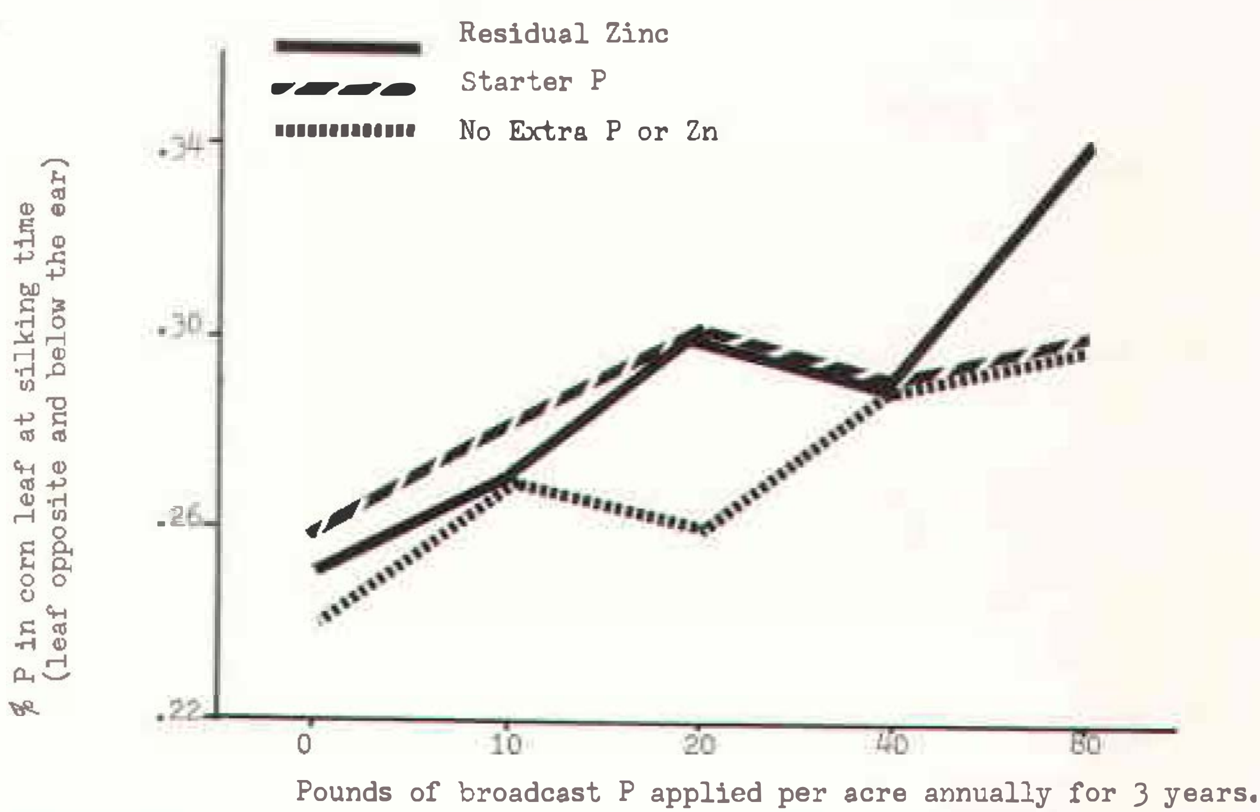


Figure 26. Influence of applied phosphorus on the phosphorus content of the corn leaf at silking time.

No attempt will be made to say if these values are adequate or inadequate because this kind of information is not yet known specifically for South Dakota. However, some of the nutrient relationships will be shown. Figure 25, for instance, shows the relations between corn yields and the P concentration in the corn leaf.

The corn yield increased as the P concentration increased and seemed to level off at about .28% P. This concentration was adequate to produce 120 bushels of corn per acre in 1966.

Another interesting relationship is between P concentration of the corn leaf and the amount of applied P as shown in Figure 26.

The general trend is for the P concentration to increase as the rate of applied P increases, although the relationship is not entirely uniform. The P concentration was expected to increase as it did because of the amount of P that had been applied the last 3 years.

Applied P is known to cause Zn deficiencies in some areas of South Dakota and in other states. The influence of applied P on the Zn concentration in the corn leaf is illustrated in Figure 27.

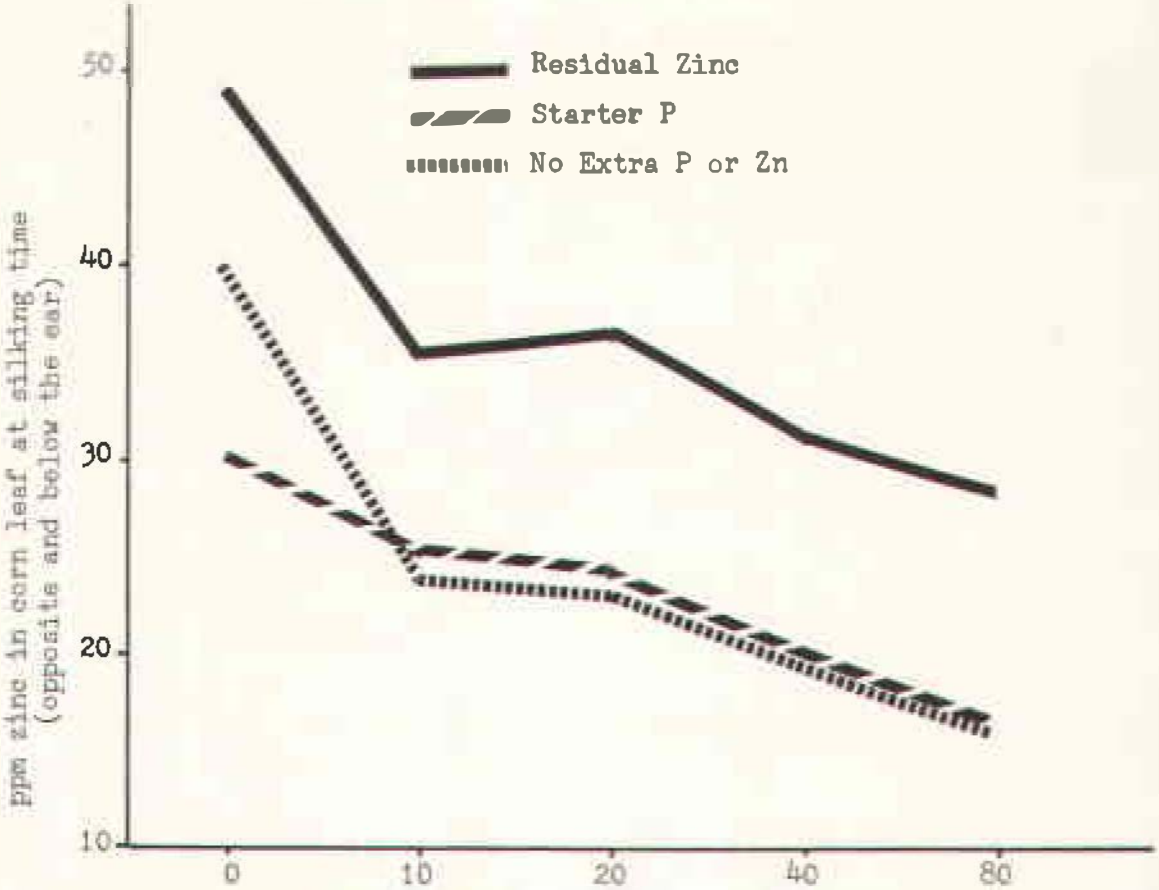
The general trend is for applied P to reduce the Zn concentration in the corn leaf. The Zn concentration in the corn leaf was 40 ppm with no broadcast P and no extra P or Zn and 16 ppm with 80 pounds of P broadcast and no extra P or Zn (16 ppm Zn would be considered as approaching the deficiency level). When broadcast P was not applied but starter fertilizer was applied the Zn concentration decreased from 40 ppm to 30 ppm. When P was broadcast the Zn concentration for the "no extra P or Zn" treatment and "starter P" treatment were very similar.

Where Zn fertilizer had been applied the Zn concentration was much higher, although, it did decrease as more P was applied.

One other trace element that appeared to be related to applied P was copper. This trace element is also known to be "tied up" with applied P. Figure 28 illustrates the influence of applied P on the copper concentration in the corn leaf.

In two out of three cases in Figure 28 as more P was applied the copper content of the corn leaf decreased. Copper deficiencies have not been observed in South Dakota, however, with large applications of P fertilizer it appears that this element may also become a problem.

There are probably other relationships that can be found by studying ratios of various nutrients or other combinations of nutrients.



Pounds of P broadcast per acre applied annually for 3 years.

Figure 27. Influence of applied phosphorus on the Zinc content of the corn leaf at silking time. S. E. Farm 1966

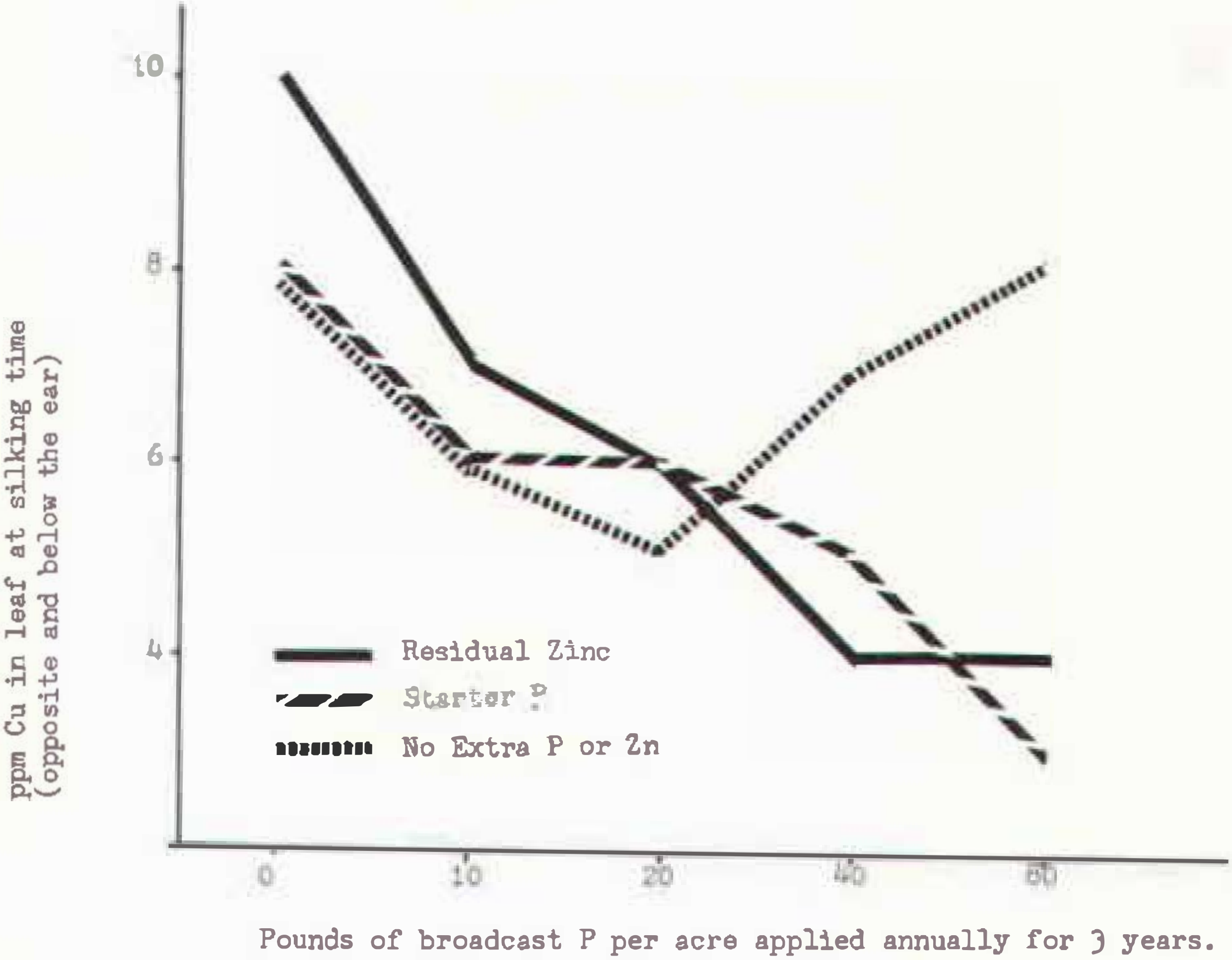


Figure 28. Influence of applied P on Cu content of the corn leaf at silking time. S. E. Farm 1966.

Western Corn Rootworm Control - 1966

B. H. Kantack, Wayne L. Berndt,
J. F. Fredrikson, P. A. Jones and Raymond Vernard

In cooperation with the South Dakota State University Extension Service a demonstration plot was established at the southeastern South Dakota experiment farm using the currently recommended insecticides for the control of western corn rootworm. Although the incidences and magnitude of infestations of western corn rootworm were higher in 1966 than for the previous year in most of South Dakota, an economic infestation of corn rootworm did not develop on the Centerville farm. Periodic worm counts by the SDSU entomologists showed that the number of larvae present in this plot was extremely low. Thus, in the absence of an economically damaging population of corn rootworms, no comparisons of treatments could be made for this plot. However, data from other plots in the southeastern area of South Dakota are available.

Results presented below show the performance data for the recommended corn rootworm insecticides in an experimental plot in Lincoln County:

Table 25. Influence of Corn Rootworm Insecticides on Lodging and Yield of Corn

Treatment	Rate/Acre Lbs. Active	Lodging Percent	Yield[1] Bu/Acre
BUX-10	0.75	0.7	111.9
Thimet 15G	1.0	6.5	110.7
Thimet 10G	1.0	4.5	109.2
Aldrex 10-10G[2]	1.0+1.0	43.2	106.7
Parahep 10-10G[3]	1.0+1.0	32.7	104.7
Diazinon 14G	1.0	4.7	104.0
Strathion 10G	1.0	48.7	103.5
Niran 10G	1.0	67.2	101.6
Untreated check	-	76.7	99.2

[1] Yields corrected to 15% moisture.
[2 & 3] Combination product of aldrin or heptachlor plus parathion.

Average of 3 replicates, corn variety planted was Sokota 619 M-1, planting rate was 16,500 plants per acre.

SOYBEAN BREEDING AND TESTING

-- A. O. Lunden

Soybean yields were above the 4 year average with good seed quality in nearly all entries. Adequate moisture and cool weather delayed ripening of all entries, favored yields of many of the early maturing strains, and caused excessive height and/or lodging of some entries.

The two new varieties, Amsoy and Hark, performed well at Centerville and have produced good yields for the last four years. Yield data from the Ford and Wayne varieties are inconclusive as they have been tested for only two years at Centerville. These years have been abnormally wet and cool and unfavorable to late maturity soybeans.

The variety picture should change markedly in the next few years from the release and utilization of these new varieties. Amsoy should be a higher yielding replacement for most of the existing acreage of Hawkeye and will encroach on both Harasoy and Lindarin while Hark will serve as an excellent replacement for Blackhawk and will blend into Chippewa in the north and into Lindarin and Harasoy on the south. The very late maturing variety, Wayne should be good in areas now planted to Ford as it has a much better yield potential than Ford in areas of similar maturity. Two experimental entries have yielded exceedingly well in the past two years but both lacked lodging resistance in 1966. These will be tested again in 1967.

Table 26. Performance of Early, Midseason, and Late Soybean Varieties

Variety	Days to Maturity*	1966 Yield	1965-66 Average	1963-66 Average	Plant Height	Lodging Index**
Group I (Early)						
Chippewa	0	39.9	40.4	----	33	2
Hark	5	43.0	42.9	----	38	2
Blackhawk	5	33.9	34.3	----	32	2.5
Group II (Midseason)						
Lindarin	6	38.5	37.7	35.3	38	2
Harasoy	7	37.6	38.4	35.5	50	3
Amsoy	9	39.9	38.5	39.4	42	2.5
Hawkeye	10	36.8	37.6	36.2	39	2
Group III (Late)						
Ford	15	40.8	36.4	----	36	2
Wayne	19	40.8	38.3	----	40	3
Experimental						
S. D. 647	4	43.9	43.4	----	33	4
AI-439	7	46.0	45.8	38.3	40	4

* Days to maturity relative to Chippewa.
** Lodging on scale of 1 for erect to 5 for severe lodging.

SORGHUM BREEDING AND TESTING

-- A. O. Lunden

Grain sorghum yields ranged to about 70 hundredweight or 125 bushels per acre in 1966. Testing of newly developed hybrids includes single replication screening or observation plantings in the first year and two or four replication yield tests in the second year. 1966 yield tests of 1965 selections revealed one hybrid which performed especially well in locations throughout the state. This hybrid is scheduled for more extensive State and Regional Testing in 1967 for probably release in 1968 as a hybrid of the 450-550 maturity range. Two other entries in this maturity and two earlier hybrids are also scheduled for advanced testing.

A single extra leafy type forage sorghum hybrid produced over 4 tons dry weight per acre and should be extremely high in protein due to its leafiness but protein tests have not been completed. This forage sorghum will be retested in 1967.

OAT BREEDING

R. S. Albrechtsen

The Uniform Early Oat Performance Nursery, Uniform Midseason Oat Performance Nursery, Rod Row Oat Nursery, and the Barley Yellow Dwarf Yield Nursery were grown at Centerville in 1966 as a part of the Oat Breeding and Testing Program of the South Dakota Agricultural Experiment Station. The Uniform Nurseries are Regional Nurseries and contain the best strains available from states throughout the North Central Region of the U. S. and Canada. These strains are in the final stages of testing and these tests will provide a basis for decision on the release of new varieties. Yield data are presented here for the Regional Nurseries only.

Data on selected high yielding experimental strains, recently released varieties and long-time check varieties in the Uniform Early Oat Performance Nursery are shown in Table 27. Entries in this nursery are primarily of the early maturity class, being equal to or earlier than the Clintland type oats. Most of these strains should be in a maturity range suitable for growing in Southeastern South Dakota.

Table 28 shows data on selected experimental strains that yielded well in 1966, with recently released varieties and long-time checks in the Uniform Midseason Oat Performance Nursery. Entries in this nursery are primarily of the midseason to late maturity class, being as late as or later than the Clintland type oats. Some strains in this nursery are too late to be adapted to the Southeast area of the state.

Table 27. Performance of Selected Experimental Oat Strains and Check Varieties in the Centerville Uniform Early Oat Performance Nursery

C. I. Number	Variety or Selection	Bushel weight 1966	Bushel weight '65-66	Yield 1966	Yield '65-66
		lbs/bushel		bushels/acre	
7805	04935	35.9	36.0	89.9	86.8
7698	Ab-60-1079	32.4	33.2	88.2	90.2
7971	Jaycee (new)	33.3	33.8	87.9	89.8
8168	62-3834	32.8	33.4	86.8	91.0
7970	C237-89	34.2	34.6	83.1	86.9
7697	Ab-60-1074	32.5	33.4	81.6	86.9
4170	Andrew	31.0	32.4	65.7	72.2
7463	Clintford	34.3	36.3	79.8	83.0
7639	Clintland 64	32.8	34.2	72.4	84.9
4988	Mo. 0-205	33.2	33.6	84.9	90.7
7272	Nodaway	34.1	34.2	78.5	78.8
7679	Tyler	32.9	34.1	74.6	83.2

Table 28. Performance of Selected Experimental Oat Strains and Check Varieties in the Centerville Uniform Midseason Oat Performance Nursery

C. I. Number	Variety or Selection	Bushel weight 1966	Bushel weight '65-66	Yield 1966	Yield '65-66
		lbs/bushel		bushels/acre	
8151	0-64-17	30.5	32.8	81.6	88.8
8168	62-3834	32.4	33.0	81.0	34.5
----	C-2-1-60	30.4	----	79.9	----
7981	Jaycee (new)	32.0	32.8	78.2	85.9
8028	0-64-16	32.1	33.2	77.4	81.0
8174	C177-45-1	32.0	34.0	76.2	84.3
7978	Holden (new)	32.8	34.2	74.5	91.4
8040	Portal (new)	31.5	33.9	73.2	84.6
8048	0-64-11	29.5	29.9	72.4	85.4
4170	Andrew	31.5	32.6	78.6	88.7
7463	Clintford	33.8	35.8	72.0	78.8
7639	Clintland 64	31.9	33.7	71.4	79.4
4988	Mo. 0-205	31.5	32.5	79.7	80.8
7679	Tyler	30.0	32.2	72.8	81.6

STANDARD VARIETY SMALL GRAIN TRIALS

-- J. J. Bonnemann

Standard variety trials of spring wheat, oats, barley, winter wheat and rye were harvested at the SE Farm in 1966. Data included in the report are bushel yields and test weights for 1966 and several year averages, where available.

The fall seeded trials made excellent growth after planting, even though they were not seeded until October 4, 1965. Winterkill was negligible and survival was 90 percent or better.

The spring grains were seeded on April 7. Soil moisture was favorable for good germination but temperatures were low and precipitation limited early in the season. Lodging was not a serious problem.

Further discussion on the small grain trials will be found in Circular 179, 1966 Small Grain Variety Trials, South Dakota Agricultural Experiment Station.

CORN PERFORMANCE TRIALS

-- J. J. Bonnemann

Corn performance trials have been conducted at the SESD Farm since 1961. Entries in the trial were those selected by commercial seed producers and control varieties developed by experiment stations in the area. Sixty-four entries were included in the 1966 trials.

The corn was seeded on May 10 and harvested October 26. It was hand planted as checked corn, 4 kernels per hill, in 40-inch rows. The plots were 2 x 7 hills in size. The seeding rate was 15,700 kernels per acre. Recommended chemicals were used for grassy weed control and corn rootworm control.

Excellent row-crop yields were attained in the area. The corn performance trials were very good and yields ranged from 158.3 to 101.0 bushels per acre. The moisture in the shelled corn at harvest time varied from 18.0 to 30.6 percent. The 1966 results are recorded in Table 34.

Additional agronomic data and several year averages can be found in Circular 180, 1966 Corn Performance Trials, South Dakota Agricultural Experiment Station.

GRAIN SORGHUM PERFORMANCE TRIALS

-- J. J. Bonnemann

Grain Sorghum Performance Trials have been conducted at the SESD Farm since 1962. The entries included in the trial were selected by the entering seed producers who pay a nominal testing fee. Check entries are included by the Agricultural Experiment Station.

Thirty-seven entries were included in the 1966 trial. The seeding was done on May 25 and harvesting on October 7. The grain sorghum trial produced excellent yields as was the case for all row crops. Conditions were favorable throughout most of the season and the absence of a killing frost until early October favored varieties of later maturity.

Yields are reported in terms of 100 pounds per acre and range from 70.9 to 43.6. The grain produced was of excellent quality, the lowest test weight being 57 lb/bu.

Results of the Grain Sorghum Performance Trial appear in Table 35. Complete results and further discussion will appear in Circular 181, 1966 Grain Sorghum Performance Trials, South Dakota Agricultural Experiment Station.

Table 29. Standard Variety Barley Trial, SESD Experiment Farm, 1966

Variety	Test wt. lb/bu	Average yields, B/A 1966	1962-66
Liberty	44.8	53.4	46.8
Plains	47.3	51.3	38.7
Dickson	43.7	50.3	
Traill	46.2	49.7	43.4
CI 11863	44.7	48.9	
Primus	46.7	47.2	
Galt	41.0	46.8	
Conquest	44.2	46.6	
Trophy	42.2	46.3	38.5
Larker	46.2	46.3	42.5
CI 11864	40.7	45.4	
CI 13110	40.7	45.0	
Spartan	47.2	43.3	31.9
Betzes	42.0	36.0	33.7
	Mean yield	46.9	
	LSD (.05)	N.S.	

Table 30. Standard Variety Spring Wheat and Durum Trials, SESD Experiment Farm, 1966

Variety	Test wt. lb/bu	Average yields, B/A 1966	Average yields, B/A 1962-66
CI 13949	58.0	35.7	
CI 13773	60.5	35.1	
Wells	58.5	34.0	
Lakota	60.0	33.9	
Stewart 63	62.5	33.8	
CI 13826	55.0	33.0	
Chris	59.0	32.8	
Fortuna	60.0	32.6	
Crim	57.5	32.6	21.1
Manitou	57.0	31.9	
Leeds	61.5	31.8	
Rushmore	59.0	30.5	19.4
Pembina	55.5	30.2	20.0
Sheridan	60.0	30.1	
Justin	57.5	29.9	16.2
CI 13947	57.5	29.7	
Selkirk	53.0	28.6	17.3
Thatcher	58.0	26.4	16.8
	Mean yield	31.8	
	LSD (.05)	4.0	

Table 31. Standard Variety Oat Trial, SESD Experiment Farm, 1966

Variety	Test wt. lb/bu	Average yields, B/A 1966	1964-66
Andrew	32.0	78.0	68.2
Dupree	31.1	77.9	72.9
Wyndmere	31.0	77.1	
Orbit	28.6	75.9	
Brave	30.7	74.1	68.4
CI 8178	31.0	72.7	
Dawn	31.1	72.0	
Jaycee	31.7	71.4	
Coachman	31.5	70.8	67.4
Mo. 0-205	32.8	69.2	69.8
CI 8072	31.7	69.2	
Burnett	32.7	69.1	70.4
CI 8174	31.2	68.7	
Sioux (8172)	29.5	68.3	
Holden	30.0	67.8	72.2
Tyler	30.4	67.5	66.9
Stormont	29.1	67.1	
Tippecanoe	31.5	67.0	65.6
Lodi	29.2	67.0	68.5
Santee	32.1	66.4	65.8
Portal	31.7	66.2	
Peterson 100	32.2	64.8	
CI 8273	30.8	63.6	
Clintland 64	32.2	62.7	66.6
Dodge	32.4	62.5	68.9
Portage	29.7	62.4	63.1
Clintford	33.0	61.8	65.6
Garland	31.7	60.1	69.7
Minhafer	30.6	59.9	65.6
Garry	27.2	58.7	68.2
Ortley	31.6	56.2	63.5
Harmon	28.5	54.9	
Rodney	27.0	51.8	59.3
	Mean yield	66.7	
	LSD (.05)	10.8	

Table 32. Standard Variety Winter Wheat Trial, SESD Experiment Farm, 1966

Variety	Test wt Lb/bu	Average yields, B/A 1966	1964-66*
Scout	59.0	48.8	40.7
Warrior	59.5	48.3	36.3
Lancer	60.5	46.1	37.1
CI 13884	61.5	45.6	
Omaha	61.0	44.5	35.0
Nebred	60.0	44.4	30.7
Ottawa	58.0	42.8	33.5
Gage	59.0	42.6	39.2
Winalta	59.5	41.8	35.6
Winalta Sel.	60.5	41.7	
Shoshoni	59.5	40.8	37.8
Bison	59.0	39.4	30.4
Hume	58.0	39.1	34.0
CI 13864	58.5	36.1	
CI 13862	58.5	36.1	
Minter	56.0	29.5	34.6
	Mean yield	41.7	
	LSD (.05)	11.2	

* - 1965 lost to winterkill

Table 33. Standard Variety Rye Trial, SESO Experiment Farm, 1966

Variety	Test wt. lb/bu	Average yields, B/A 1966	1962-66
Von Lochow	56.0	73.8	
Elk	54.7	65.6	27.0
Caribou	55.5	59.1	38.2
Antelope	55.5	57.0	38.5
Pierre	56.0	55.0	36.1
	Mean yield	62.1	
	LSD (.05)		N.S.

Table 34 1966 Corn Performance Trial, Area E, Southeast Research Farm

Variety	Performance Score	% H20 shelled corn	Yield B/A
DeKalb XL 361 (3x)	1	25.1	158.3
Pioneer 3510 (2x)	2	24.1	155.3
Northrup-King PX 610 (3x)	3	21.4	147.8
DeKalb XL 362 (3x)	5	24.7	147.6
United-Hagie SX 152A (2x)	6	23.6	146.4
Haapala SX 621 (2x)	4	19.6	145.8
United-Hagie 146A (2x)	10	25.8	142.6
Pioneer 3558 (2x)	7	20.7	142.2
McCurdy 3 X 6 (2x)	8	22.2	141.7
SD Exp 45 (4x)	11	24.9	140.4
Curry SC-160 (2x)	9	22.7	140.0
Pfister PAG SX 29 (2x)	15	26.1	138.3
Pioneer 3567 (2x)	14	23.7	135.9
Nebr. 501D (4x)	21	24.4	134.4
DeKalb XL 342 (3x)	16	22.9	134.3
Pfister PAG 348 (4x)	17	23.1	134.0
Curry SC-165 (2x)	22	24.5	133.9
Pioneer 3414 (4x)	19	23.2	133.6
Minn. 417 (4x)	12	19.7	133.0
Pioneer 3715 (3x)	13	20.0	132.7
McCurdy 112M (4x)	23	23.1	131.9
Curry C-624 (4x)	26	23.9	131.9
Pioneer 3206 (4x)	34	26.9	131.6
Curry C-558 (4x)	25	22.8	131.0
Haapala SX 626 (2x)	18	20.4	130.6
Haapala SX 475 (2x)	20	20.3	130.3
DeKalb 441A (4x)	30	24.2	130.0
United-Hagie 146C (2x)	28	22.1	128.3
Funk's G-4401 (2x)	29	22.2	128.1
Pfister PAG SX 66 (2x)	24	19.1	127.3
Funk's G-38 (4x)	35	22.9	126.9
Green Acres 623 (4x)	41	24.9	126.6
Minn. 4301 (3x)	27	19.6	126.5
Sokota 623 (4x)	33	22.1	126.4
United-Hagie 1500 (2x)	52	30.6	126.4
Northrup-King PX 52 (2x)	31	21.0	125.8
Funk's G-4582 (2x)	44	24.8	125.7
DeKalb XL-45 (2x)	32	21.0	125.4
Curry TC-358 (3x)	40	23.5	125.1
Pfister PAG 343 (4x)	45	24.2	124.9
T-E Harvestmaker (4x)	39	23.1	124.8
DeKalb XL 346 (3x)	43	23.5	124.6
T-E Bonusmaker (2x)	37	21.6	123.9
McCurdy SP3 (3x)	38	21.2	123.0
United-Hagie IXL 8 (2x)	49	24.8	122.9
Pfister PAG 272 (3x)	36	20.5	122.8
McCurdy 3 X 9 (2x)	42	20.7	121.6
SD Exp 46 (4x)	46	20.6	120.8
Pfister PAG 70 (4x)	47	21.4	120.4
Pioneer 3291 (4x)	53	26.3	119.5
Sokota SK 70 (2x)	51	22.7	118.8
Green Acres 616 (4x)	57	27.2	118.8
Iowa 5063 (4x)	50	19.8	117.0
Minn. 519 (4x)	48	18.3	116.1
Northrup-King KT 623A (4x)	56	23.9	115.7
T-E Gromaster (4x)	54	22.1	114.2
SD 622 (4x)	59	24.1	113.5
McCurdy 2 X 5 (2x)	58	20.4	111.1
Sokota MS 75 (2x)	60	21.6	110.6
Minn. 515 (4x)	55	18.0	109.5
DeKalb XT 218 (4x)	61	23.2	108.1
Sokota 625 (4x)	62	22.2	104.8
United-Hagie IXL 6 (2x)	63	20.4	102.0
T-E Moneymaker (3x)	64	25.0	101.0
Mean		22.7	127.5
LSD (.05)			11.5

C.V. - 6.4%

Table 35. 1966 Grain Sorghum Performance Trial, Area E, SESD Experiment Farm, 1966

Variety	Height, inches	Percent moisture 9/21/66	Test wt lb/bu	Yield, 100#/A 1966	Yield, 100#/A 1965-66
Frontier 400B	48	33.2	58.5	70.9	56.9
RS 610	47	30.0	59.0	70.0	57.5
Pioneer 846	49	35.1+	60.0	69.4	55.5
DeKalb DD-50	47	34.6	58.0	69.2	
T-E Grainmaster A	47	25.3	59.0	68.9	
Asgrow Rico	50	35.1+	57.0	68.0	50.5
Frontier S 400	44	24.6	59.0	67.0	
PAG 430	45	21.6	59.0	66.5	55.1
NK 227	48	29.3	59.0	66.1	55.9
T-E 44	42	22.4	59.0	65.9	56.2
Frontier 401	45	24.5	59.0	65.4	
Sokota 510	46	28.7	59.0	65.1	
Colo. 606	54	32.3	60.0	65.1	49.6
Paymaster Ute	44	25.0	61.0	64.9	48.5
NK 222	45	29.0	60.0	63.9	52.7
Paymaster Kiowa	50	30.7	59.5	63.7	53.3
NK 212	45	29.4	59.5	63.6	54.9
Pioneer 872	46	28.2	59.0	63.4	
Frontier 388	42	29.7	59.5	63.0	
Pioneer 885	45	25.1	59.5	62.5	
Asgrow Tasco	50	27.7	57.5	62.3	47.9
DeKalb C-44b	50	32.0	57.0	62.1	54.9
Frontier 375	45	23.6	59.0	62.1	
SD 451	51	19.2	57.0	60.4	52.3
Paymaster Comanche	45	20.7	59.0	59.9	50.5
Excel 202	50	24.5	58.5	59.5	53.1
Excel 303	43	25.4	58.5	59.3	
PAG 304	39	23.4	59.0	58.6	47.2
Paymaster Pawnee	51	24.3	60.0	58.4	47.4
Nebr. 504	49	21.4	60.0	57.9	51.8
NK 133	44	27.3	60.0	56.8	50.9
Curry M520	47	20.7	60.0	52.9	
Excel 202A	43	22.4	57.0	52.5	
Colo. 604	50	22.5	60.0	51.1	44.4
T-E 44C	46	24.6	59.5	51.0	
SD 503	56	27.4	59.0	49.4	45.4
Colo. 585	50	20.7	60.0	43.6	38.0
			Mean yield	61.6	
			LSD (.05)	5.7	

+ - Electronic meter calibrated to only 35 percent. Sign indicates moisture was above 35 at time of sampling.

FOUNDATION SEED STOCK DIVISION INCREASES

-- G. W. Erion

The Southeast South Dakota Experiment Farm has cooperated with the Foundation Seed Stock Division of South Datkoa State University in the increase of Foundation seed. In 1966, these were as follows:

1. Summer Switchgrass (warm season) — One acre

Summer switchgrass is a warm season native grass; it produces forage during the hot summer months. It was developed at the South Dakota Agricultural Experiment Station from a collection of Panicum Virgatum (P.I. 214759). Mass selection for earliness, leafiness, and rust resistance was made in each of two succeeding generations. Summer switchgrass is tall, upright, with abundant and somewhat coarse leaves that start growth after June 1.

2. Holden Oats — 9 acres

Holden oat was developed at the Wisconsin Experiment Station in cooperation with the United States Department of Agriculture. Holden oat is from a cross of (Hawkeye x Victoria) x Gary) x Clintland. It is closely related to Garland. It is somewhat taller and higher yielding than Garland. It has yellow kernels and is similar to Garland in disease reaction.

3. Lindarin Soybeans — 10 acres

We wanted a small increase of Foundation seed of Lindarin soybean in the adapted area. Therefore we chose the Southeast Research Farm.

Lindarin was developed cooperatively by the Midwestern Agricultural Experiment Stations and the United States Regional Soybean Laboratory. It is from a cross of (Ottawa Mandarin x Lincoln) made at Indiana Experiment Station. Lindarin matures about 4 days earlier than Hawkeye and a few days later than Blackhawk.

4. A1-439 Soybeans — 2 acres

This was an early increase of this experimental number out of Iowa.

5. Martin ms Sorghum isolation — One acre

This sorghum isolation was an increase of the Martin ms (male sterile). This ms seed is used as the seed parent in SD 451, SD 502 and SD 252 hybrid sorghums.

GRASS VARIETIES TRIALS

-- J. G. Ross and S. S. Bullis

Test of varieties of smooth brome grass and intermediate wheat grass were established in 1962. Forage yields from these varieties are shown in tables 36 and 37.

The significant part to be noted from table 37 is that the two northern varieties Manchar and Canadian are significantly lower in yield, for three successive years, than the southern strains.

No significant difference in yield has been found between the intermediate wheat grass varieties. The better brome grass varieties have consistently yielded higher than the intermediate wheat grass varieties. After three years, the intermediate wheat grass stands are being invaded by brome grass showing that brome grass has more aggressiveness than intermediate wheat grass.

This test has been fertilized with 60# of nitrogen in the early spring each year before the grasses start to grow.

Table 36. Wheatgrass Variety Test

		Tons Per Acre				
Variety	Species	1963	1964	1964	1966	Average
Amur	Int.	1.69	1.90	2.75	1.94	2.07
Greenar	Int.	1.76	1.80	2.73	1.87	2.04
Neb. 50	Int.	----	1.65	2.72	1.76	2.04
Oahe	Int.	1.88	2.14	2.61	1.71	2.09
Mandan 75-9	Pub.	1.54	1.82	2.44	1.86	1.93
Topar	Pub.	----	1.58	2.42	Bu.	----

Table 37. Smooth Bluegrass Variety Test

		Tons Per Acre		
Variety	1964	1965	1966	Average
Bromegrass	----	----	----	----
Lancaster	2.11	3.09	2.33	2.51
Saratoga	2.06	3.04	2.16	2.42
Lincoln	2.05	3.10	2.14	2.42
Lyon	1.85	3.10	2.09	2.35
Wisconsin 55	1.95	2.81	2.06	2.27
Homesteader	1.99	2.74	2.03	2.25
Soc	2.12	3.18	1.98	2.43
Southland	2.13	3.17	1.97	2.42
Manchar	1.77	2.65	1.82	2.08
Canadian	1.85	2.38	1.72	1.98
Least Significant Diff.	0.47	0.23	0.37	----

WEED CONTROL IN CORN

-- W. G. Wright

Objectives:

To determine the potential of several new herbicides for weed control in corn.

To maintain weed control but minimize atrazine carryover by using atrazine at lower rates in combination with other shorter residual herbicides.

To determine the number of cultivations needed with the various herbicides to give season-long weed control.

Description of Experiment:

SD 625 corn was planted May 9 and treated preemergence May 14, 1966. Each treatment was tested with 0, 1, and 2 cultivations. The first cultivation was omitted in the treated plots. Check plots received 0, 2, and 3 cultivations.

Predominant weeds were green and yellow foxtail. Rainfall received in 3 week period after application was as follows: May 17 (.35), 23 (.31), June 2 (.22), 4 (.52), and 5 (.77).

Table 38. Effect of Herbicides and Cultivation on Grass Control and Yield of Corn

Treatment	Rate lb/A	6-14-66	9-8-66			Yield bu/A		
		No cult.	No cult	1 cult	2 cult	No cult	1 cult	2 cult
BV-201	4	0	0	0	0	--	--	--
BH-584	4	0	0	0	0	--	--	--
Atrazine	2.5	58	40	68	90	68	100	104
Ramrod wp	4	95	62	80	88	95	103	101
Ramrod granule	4	92	77	75	88	75	90	103
CDAA-T granule	3.1	95	72	77	82	56	77	85
Atrazine + Linuron	1+1	27	27	57	70	76	91	102
Atrazine + Ramrod	1+2	85	47	70	90	101	120	120
Atrazine + Promotryne	1+1	33	43	68	80	74	91	108
GS-13529	2.5	28	33	65	70	92	107	118
GS-14260	2.5	33	30	63	78	70	93	99
Patoran	5	47	42	68	77	88	103	107
EPTC + 2,4-D(EC)*	2+1	70	40	72	80	87	119	112
EPTC + 2,4-D(gran)	2+1	73	35	58	72	67	78	102
Fenaben	.7+.3	0	7	57	65	--	--	--
Fenaben	1.3+.7	0	0	53	70	--	--	--
CP-50144	1½	13	32	52	72	75	107	114
CP-50144	3	72	58	70	82	87	97	118
Dicamba	1	82	47	70	83	97	120	122
Check	-	0	0	43	58	52	72	81
Dinoben ester	1	0	0	0	0	--	--	--
ACD-10614	4	7	0	0	20	--	--	--
ACD-10614	6	17	50	0	0	--	--	--
Daxtron	½	52	25	70	60	111	112	114
C-6313	4	13	20	0	20	--	--	--
C08250	2½	0	0	0	0	--	--	--

*Incorporated - double drag

WEED CONTROL IN SOYBEANS

-- W. G. Wright

Objective:

To determine the effect of serveral pre-emergence herbicides on injury, yield and weed control in soybeans.

Description of Experiment:

Ford soybeans were planted May 25 and treated pre-emergence May 27, 1966. Each treatment was tested with 0, 1 and 2 cultivations. The first cultivation was omitted in the treated plots. Check plots received 0, 2 and 3 cultivations.

Predominant weeds were green and yellow foxtail. Rainfall received in 3 week period after application was as follows: June 2 (.22), 4 (.52), 5 (.77), 9 (.28), and 10 (.23). Yields were taken on plots showing good weed control.

Table 39. Effect of Herbicides and Cultivations on Grass Control and Yield of Soybeans.

Treatment	Rate lb/A	6-28-66 no cult	9-8-66 no cult	9-8-66 1 cult	9-8-66 2 cult	Yield bu/A 1 cult	Yield bu/A 2 cult
Trifluralin(ppi)*	3/4	91	67	83	93	28.4	20.4
SD 11831(ppi)*	1	41	23	47	53	--	--
SD 11831(ppi)*	2	51	43	57	77	--	--
Vernam(inc)**	3	67	20	48	68	--	--
Ramrod	4	96	77	96	98	25.6	26.8
Ramrod + Linuron	2+1	96	77	90	95	30.1	25.9
GS-16065	2½	71	23	55	75	--	--
GS-17891	2½	13	13	40	57	--	--
Dyanop	2+1	30	13	50	65	--	--
Amiben	3	89	67	83	88	30.2	27.4
Patoran	4	84	17	70	90	21.3	17.0
Patoran	6	86	33	62	78	19.1	16.6
DCPA+CIPC	3+1	57	27	65	73	--	--
CP-50144	1½	85	63	85	93	22.2	22.5
CP-50144	3	97	75	94	98	31.1	21.7
CDAA	4	91	70	88	93	23.2	19.1
OCS-21799	2	0	0	23	30	--	--
DCPA	4	58	0	40	55	--	--
Check 2 & 3 cult.	--	0	20	33	47	16.7	19.6

* ppi - preplant incorporation, double drag
** post application and incorpoation with drag

Summary:

An uneven stand due to shallow planting was encountered. Consequently yield results may not be of much value. Moisture conditions were more favorable for activation after application in soybeans and many of the herbicides that failed in the corn trials performed quite well here. Trifluralin, ramrod, ramrod-linuron, amiben, CP-50144 and CDAA all showed excellent early control and season long control with 2 cultivations. Ramrod and CP-50144, at the 3 pound rate, gave excellent season long control with one cultivation. Patoran showed severe leaf burn at the 6 pound rate shortly after the soybeans emerged. At 4 pounds moderate leaf burn was evident. The soybeans recovered in both cases but maturity was delayed. Vernam showed slight early leaf burn and stunting of the soybeans.

WEED CONTROL IN SORGHUM

-- W. G. Wright

Objective:

To determine the potential of several new herbicides for weed control in sorghum.

To maintain weed control but minimize atrazine carryover by using lower rates of atrazine in combination with other shorter residual herbicides.

To determine the number of cultivations needed with the various herbicides to give season long weed control.

Description of Experiment:

SD 451 sorghum was planted May 26, treated pre May 27 and treated post June 14, 1966. Each treatment was tested with 0, 1, and 2 cultivations. The first cultivation was omitted in treated plots. Check plots received 0, 2, and 3 cultivations. Predominant weeds were green and yellow foxtail. Rainfall received after application was: June 2 (.22), 4 (.52), 5 (.77), 9 (.28) and 10 (.23).

Table 40. Effect of Herbicides and Cultivations on Grass Control and Yield of Grain Sorghum

Treatment	Rate lb/A	6-28-66	9-8-66			Yield lb/A		
		no cult	no cult	1 cult	2 cult	no cult	1 cult	2 cult
CDAA	4	92	58	85	92	3563	4787	4993
ACD-10614	5	20	0	35	57	783	2980	2847
Norea	2½	57	47	80	87	2960	4010	4380
Norea + Atrazine	1+1	71	50	80	90	3800	4720	4353
Norea + Ramrod	1=2	92	73	93	96	4253	4860	4373
Norea + Linuron	1+1	55	20	68	78	3156	4217	4387
Atrazine	2½	88	60	93	96	4236	5153	4830
Atrazine+Ramrod	1+2	92	63	92	96	4446	4823	4420
Propazine	2	81	65	90	93	4537	5317	4820
GS-14260	2½	85	50	78	87	4160	5393	4567
GS-13529	2½	73	40	77	91	3600	5067	4830
Ramrod	4	98	85	93	97	5047	5160	4840
SV-201	4	8	13	47	63	2220	3483	3723
CP-50144	2	86	43	87	92	4340	5313	4727
Atrazine+oil (STd)*	1+1	90	57	92	95	4453	4903	4483
Daxtron	¼	43	27	47	63	3040	3383	4077
Daxtron	½	70	53	82	90	3567	5247	4233
C-8250	2½	48	32	67	83	3007	3710	4300
Patoran	5	77	50	86	92	3383	4763	4113
Check	--	0	0	0	43	1210	2370	2743

* Applied post emergence when grassy weeds were 3/4 - 1 inch tall.

WATER STORAGE CAPACITIES OF VARIOUS SURFACE CONDITIONS AND GEOMETRIC SHAPES1/

-- C. W. Doty and P. E. Stegenga

Objectives of Experiment:

1. To determine the geometric shapes of bedding, conventional tillage, listing and listing superimposed on bedding.
2. To determine the surface water storage capacities for these types of tillage operations.
3. To determine the effects of these tillage operations on soil moisture, crop yield and terrace spacing.

1/ Project No: SWC 8-C4. Conducted by: Soil and Water Conservation Research Division, Agricultural Research Service at Southeast South Dakota Experiment Farm.

Table 41. Effect of Tillage Practices of Different Geometric Shapes on Corn Yield.

Treatment	Grain Bu./Acre
Conventional Contouring	135
Contour Listing	124
Contoured four-row bedding with lister planting	129
Contoured eight-row bedding with lister planting	114
Contoured four-row bedding with conventional planting	125
Contoured eight-row bedding with conventional planting	129

Table 42. Effect of Listing and Conventional Tillage Operations on Grass and Weeds at Harvest.

Treatment	*Grass & weed dry matter lbs./Acre
Conventional Tillage and Cultivation Operation	1640
Listing and Cultivation with Lister Cultivator	1420

*Average of six plots

Discussion and Interpretations of Results:

Fertility was applied to all treatments at the same rate and time. The rate was 110 pounds N and 29 pounds of P. Plants were thinned to 14,000 plants per acre.

Contouring is a recommended practice for conserving both soil and water. The treatments in this experiment were designed as an improvement on conventional contouring for erosion control and moisture conservation practices. These treatments are:

1. Contour listing - This treatment was ridged in the spring with a middle-buster, the ridges disked down and a lister planter used to form a new ridge and plant in one operation.

2. Contoured four-row bedding with lister planting - The beds were formed in the spring. The beds were 13.3 feet wide to provide

for four 40-inch rows on each bed. A contour line was run and additional lines parallel to this contour line and 13.3 feet apart were staked on either side of the contour. Plowing consisted of backfurrowing at each of these staked lines, throwing the first two furrows together and continuing throwing the furrows toward the backfurrow until the 13.3-foot width was obtained. A seedbed was prepared by disking and harrowing. Planting was done with the lister planter as, so called, soft listing.

3. Contoured eight-row bedding with lister planting - same as 2 except beds were 26.7 feet wide with eight rows on each bed.

4. Contoured four-row bedding with conventional planting - same as 2 except planting was done with a conventional planter.

5. Contoured eight-row bedding with conventional planting - same as 2 except beds were 26.7 feet wide with eight rows on each and planting was done with a conventional planter.

There were no significant differences in grain yield. This is probably due to the fact that there was ample moisture for all treatments. The yield data is shown on Table 41.

Soil moisture was increased by the use of the listing and bedding tillage operations. Figure 29 shows the soil moisture for the three most practical treatments. It should be pointed out that in July and August that the contour listing and contoured 8-row bedding had 3/4 to 1 1/2 inches more moisture in the top four feet of the soil than the Conventional Contouring. The largest portion of this was in the top two feet where it was readily available to the plants.

The effectiveness of the tillage and cultivation operations is shown in Table 42. The ability of the listing operation to keep the field clean was more apparent throughout the growing season.

Potential surface water storage capacities of each treatment was measured but time did not permit completion of the calculations.

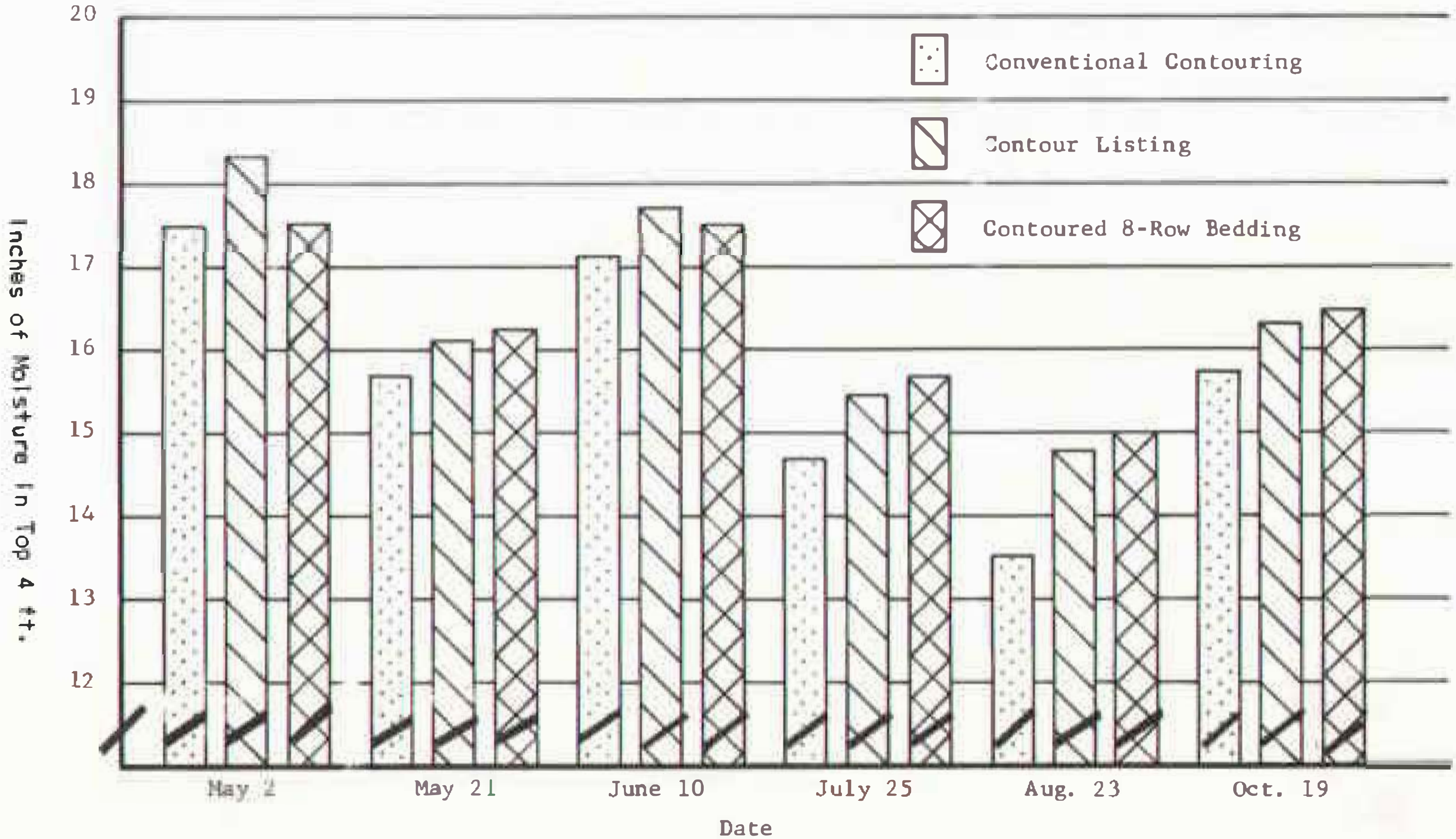


Figure 29-Inches of Moisture in the Top 4 ft. of Soil for 3 Treatments at S. E. South Dakota Experiment Farm.

CORN BREEDING

-- D. B. Shank and D. W. Beatty

Three yield tests of experimental hybrids were conducted on the Southeast Experiment Farm in 1966 as part of the corn breeding work in the Agronomy Department. Each test contained many experimental hybrids along with several check entries, the latter being some of the best performers in the 1965 corn performance trial of hybrids currently sold in the area.

The tests were hand planted on May 10, in hills checked at 40 inches. Harvesting was done on October 24 and 25. Chemicals were applied for insect and weed control while fertility levels were maintained at a fairly high level by the use of commercial fertilizer. In an attempt to obtain information on population, half of the replications in each trial were planted at the rate of 3 kernels per hill, while 4 kernels per hill were used in the rest of the plots. Yields were good in 1966, but some entries had considerable stalk lodging.

One trial consisted of 13 inbred lines crossed in all possible combinations to make 78 different single cross hybrids. From information obtained, the performance of all of the 3-way and double crosses possible from these 13 lines were predicted. Since several hundred combinations are possible from 13 inbreds, this helps to select the best new hybrids for future testing. The top predicted yield was 149 bushels per acre with 28.1% moisture at the time of harvest.

A second test was of experimental 3-way and 4-way hybrids, some of which had been made up in 1965 from predicted results obtained from a single cross test conducted in 1964. Other entries had been tested for one or more years prior to 1966. The best performer was a 3-way hybrid which yielded 141 bushels per acre with 24% moisture at the time of harvest. The top yielding entry produced two bushels more of grain than the above hybrid, but it had 56% of the plants stalk lodged which would severely lower its desirability.

The third trial was of 3-way hybrids which were being tested on a regional basis. Similar tests were conducted in several North Central States as part of cooperative work. The entries were new inbreds from various experiment stations crossed to two different single cross hybrids. Fourteen different inbreds were included. Yields in this test ranged from 53 to 138 bushels per acre. Results from South Dakota will be averaged with those from other states in the search for new, improved inbred lines with a wide area of adaptation.

RESTRICTED-FEEDING VERSUS SELF-FEEDING SOWS DURING PREGNANCY

R. W. Seerley[1] and J. F. Fredrikson[2]
Southeast Experimental Farm

An experiment was designed to compare the performance of sows during pregnancy when self-fed a bulky ration or limit-fed a higher energy ration. In the fall of 1964, second litter sows were self-fed and housed together during the breeding period. After the breeding period, the sows were divided and one group was self-fed and the other group was limit-fed 5 lb. per head daily. Limit-fed sows were given their feed once daily in open troughs. Self-fed sows had access to a round metal feeder at all times. Water was fed ad libitum and pasture was available to both groups. The two rations are shown in table I.

In the spring of 1965, gilts were self-fed a bulky ration prior to and during breeding, then they were divided into the self-fed group and limit-fed group. They farrowed their second litter on the same study, also.

Table 1. Composition of Rations

Ingredients	Self-fed	Limit-fed
	lb.	lb.
Shelled corn	535	1310
Oats	600	200
Alfalfa hay	700	200
Soybean meal (44%)	130	240
Dicalcium phosphate	20	36
T.M. salt	10	10
Vitamin-antibiotic premix[a]	10	10
	2005	2006

[a] Premix provided 6 million U.S.P. units of vitamin A, 600,000 U.S.P. units of vitamin D_2, 4 gm. of riboflavin, 10 gm. of pantothenic acid, 30 gm. of niacin, 200 gm. of choline, 20 mg. of vitamin B_{12}, 6 gm. of penicillin and 30 gm. of streptomycin per ton of ration.

[1] Department of Animal Science, South Dakota State University.
[2] Southeast Experiment Farm, Beresford, South Dakota.

Results

A summary is shown in table 2. Self-fed sows ate nearly 9 lb. of feed per day during gestation for the three periods. In the first and third periods (winter) sows ate 9.6 and 10.0 lb. per day, whereas first litter gilts ate only 7.4 lb. per day during the summer when pasture was plentiful. The average daily feed consumption of self-fed sows in all periods was nearly 4 lb. more than the quantity fed to limit-fed sows. The difference in feed cost was approximately 11 cents per day or $8.80 per sow for each 80-day period.

There was some variation in the number of pigs farrowed and weaned between treatments within each farrowing-lactation period, but the difference in the number of pigs farrowed and weaned was small when the three periods were combined.

Birth weight of pigs in the limit-fed group was slightly heavier than those in the self-fed group in all three periods. This difference is not important and, in fact, it is surprising because limit-feeding usually decreases the birth weight of pigs. The level of feeding was relatively high and permitted optimum fetal development.

Self-fed sows averaged 18 lb. more weight gain than the limit-fed sows during the 80-day period. The gilts in the second farrowing were not weighed. The limit-fed sows were in good condition at farrowing and they were in good condition at weaning time, so the excess condition of the self-fed sows was not beneficial.

The results of this experiment illustrate that self-fed sows consume more nutrients than necessary for good reproduction. A considerable quantity of feed can be saved and the cost of producing pigs can be decreased by limit-feeding sows. The 5 lb. per head daily level of feeding was adequate for good reproductive performance. There is adequate evidence at several experiment stations to show that lower levels of feeding will support good reproduction.

Table 2. Results of Three Gestation-Lactation Periods

Farrowing period	Method of feeding	No. of sows	Av. daily feed, lb.	Av. live pigs per litter	Av. birth wt., lb.	Av. no. pigs weaned	Beginning wt., lb.	Farrowing wt., lb.	Wt. gain, lb.
Spring 1965	Limit-fed	7	5.00	12.57	3.11	9.43	408	485	77
(Second litter sows)	Self-fed	7	9.62	11.14	2.93	7.43	416	511	95
Fall 1965	Limit-fed	10	5.00	9.40	3.16	7.30	--	--	--
(First litter gilts)	Self-fed	11	7.39	9.64	2.92	7.73	--	--	--
Spring 1966	Limit-fed	11	5.00	9.45	3.13	8.82	408	480	72
(Second litter sows)	Self-fed	10	10.00	11.10	3.03	9.10	431	522	91
Average of three gestation-lactation periods									
	Limit-fed	28	5.00	10.21	3.13	8.43	408	482	74
	Self-fed	28	8.92	10.54	2.97	8.14	425	517	92

A PROGRESS REPORT ON THE PERFORMANCE OF GROWING-FINISHING SWINE UNDER DIFFERENT ENVIRONMENTAL CONDITIONS

R. W. Seerley[1], H. G. Young[2] and J. F. Fredrikson[3]
Southeast Experimental Farm

Another series of trials have been completed on the effects of various floor types, number of pigs per pen and open versus insulated, ventilated housing on the performance of growing-finishing pigs. The floor types were: 100% slotted, 50% slotted, 25% slotted, and concrete with a narrow, deep gutter across the end of the pen. The slats were 5 inch wide reinforced concrete. Pits under the floor accumulated the manure. Pen sizes were either 5 x 15 feet or 10 x 15 feet. Eight or 9 pigs were placed in the smaller pens and the number of pigs was doubled in the larger pens. The pigs used in these trials were SPF Hampshire, Yorkshire, and Duroc crossbred pigs.

A 22 x 22 foot house with an adjoining outside concrete pen was used to compare the performance of pigs reared in this environment with the pigs in the insulated, ventilated house. Bedding was used in this house during both trials and the pigs were watered outside. One of two groups in this house was fed inside and the other was fed outside.

The rations used in these trials are shown in table 1. The high protein ration was fed up to 75 lb. body weight, then the 14% crude protein ration was fed to 125 lb. and then the 12% crude protein ration was fed to the end of the trials.

Table 1. Swine Rations Used at the Southeast Experimental Farm[a]

	Lb.	Lb.	Lb.
Shelled corn	766	820	872
Soybean meal (44%)	200	150	100
Dicalcium phosphate	15	10	10
Limestone	7	8	8
Trace mineral salt	5	5	5
Premix[b]	2.5	2.5	2.5
Calculated analysis:			
Crude protein, %	16	14	12
Calcium, %	0.72	0.61	0.58
Phosphorus, %	0.59	0.48	0.51

[a] The 16% crude protein ration is fed from weaning to 75 lb., the 14% ration from 75 lb. to 125 lb. and the 12% ration is fed to market weight.

[b] Each pound of premix provided 2 gm. oxytetracycline, 600,000 U.S.P. units of vitamin A, 60,000 I.C. units of vitamin D_3, 400 mg. of riboflavin, 1,000 mg. of pantothenic acid, 3,000 mg. of niacin, 20,000 mg. of choline and 2 mg. of vitamin B_{12}.

[1] Department of Animal Science, South Dakota State University.
[2] Department of Agricultural Engineering, South Dakota State University.
[3] Southeast Experiment Farm, Beresford, South Dakota.

Table 2. Results of Winter Trial (1965-66) and Summer Trial (1966)

	Floor type									
	Completely slotted		50% slotted		25% slotted		Narrow gutter		Uninsulated house	
Winter Trial										
No. of pigs	8	16	8	16	8	16	8	16	16	15
Av. initial wt., lb.	69	68	68	70	70	69	67	71	71	70
Av. final wt., lb.	195	191	194	192	197	199	198	201	198	203
Av. daily gain, lb.	1.55	1.51	1.56	1.51	1.56	1.60	1.61	1.60	1.57	1.64
Av., lb.	1.52		1.52		1.59		1.61		1.60	
Av. daily feed, lb.	5.93	5.63	5.53	5.68	6.10	5.93	5.92	6.20	6.17	6.48
Feed per lb. gain, lb.	3.82	3.73	3.55	3.77	3.90	3.71	3.67	3.87	3.94	3.94
Av., lb.	3.76		3.69		3.78		3.80		3.94	
Summer Trial										
No. of pigs	9	18	9	18	9	18	9	18	9	9
Av. initial wt., lb.	37	37	37	37	38	37	38	38	37	38
Av. final wt., lb.	218	217	215	217	219	221	211	225	205	216
Av. daily gain, lb.	1.47	1.46	1.54	1.55	1.56	1.59	1.53	1.65	1.61	1.71
Av., lb.	1.47		1.55		1.58		1.61		1.66	
Av. daily feed, lb.	4.83	4.63	4.66	4.73	4.83	4.96	4.77	5.12	5.22	5.20
Feed per lb. gain, lb.	3.28	3.17	3.03	3.05	3.09	3.12	3.12	3.10	3.24	3.04
Av., lb.	3.21		3.04		3.11		3.11		3.13	

Results and Discussion

Results of the two trials are shown in tables 2 and 3. The type of flooring did not significantly affect the daily gain of the pigs in the winter or summer trials. Pigs on the concrete floors did gain slightly faster than pigs on slotted floors in both trials. However, differences in daily gain between types of floors were small and supported the previous results (A.S. Series 65-19) that pigs gained about the same on the various types of floors.

Feed efficiency was rather consistent between pigs on the various floor types These same results were reported in the previous trials.

Pigs housed in uninsulated open housing gained as rapidly as pigs in the insulated house in both the winter and summer trials. They required approximately 4% more feed per pound of gain in the winter, but their utilization of feed was equally as good in the summer trial.

The size of pen (and number of pigs per pen) did not affect the performance of the pigs in either trial (table 3). The larger pens with twice as many pigs as the smaller pens appeared to be less crowded and provided more freedom of movement than the smaller pens, but this did not apparently influence the performance of the pigs. There was some tail biting in all pens, yet the biting appeared to occur earlier and more often in the smaller pens. Tail biting did not occur in the uninsulated house.

The labor requirement was essentially the same for the three floors with slotted area. Feeders were moved to the middle of the pen and used as partitions to control the pen area when the pigs were smaller. Feeders were moved toward the end of the pen as more space was needed by the pigs. This was an effective way of keeping the pen clean. The concrete pens with the narrow gutter were usually dirty and had to be scraped two to three times a week, which increased the labor and cost of production on this type of flooring.

This is a progress report. The data in all trials will be combined and reported as a complete summary in the future.

Table 3. Effect of Pen Size

	5 x 15 ft. pens	10 x 15 ft. pens
Winter Trial		
No. of pigs per pen	8	16
Av. daily gain, lb.	1.57	1.56
Feed per lb. gain, lb.	3.73	3.77
Summer Trial		
No. of pigs per pen	9	18
Av. daily gain, lb.	1.52	1.56
Feed per lb. gain, lb.	3.13	3.11

Corn Silage and High-Moisture Ear Corn Rations for Growing-Finishing Beef Cattle

L. B. Embry, F. W. Whetzal and J. F. Fredrikson

Another experiment has been completed in a series to measure rate of gain, feed requirements and beef gains from corn fed in various combinations as silage and high-moisture ear corn.

Procedure

One hundred Hereford steer calves were allotted into 4 lots of 25 each for a two-phase experiment. Ration treatments during phase 1 were as follows:

Lot 1 - High-moisture ear corn--full-fed
Lot 2 - Corn silage--full-fed
Lot 3 - Corn silage, 20 lb.; high-moisture ear corn--full-fed
Lot 4 - High-moisture ear corn, 20 lb.; corn silage--full-fed

The corn silage contained about 62% moisture and was stored in a concrete stave silo. The ear corn was ground with a grinder-blower and stored at about 30% moisture in a concrete stave silo.

All lots were fed 2 lb. per head daily of a protein supplement composed of dehydrated alfalfa meal, 50.0%; soybean meal, 45.1%; urea, 4.1% and diethylstilbestrol-antibiotic-vitamin A supplements, 0.8% (5 mg., 35 mg. and 5,000 I.U./lb., respectively). The feeds were offered twice daily with the full-fed portion of the rations being fed in amounts that would be nearly consumed by the next feeding.

In the original design of the experiment, the cattle full-fed high-moisture ear corn during phase 1 (lot 1) were to be finished on a full feed of corn silage (phase 2). Those in lot 2 full-fed corn silage during phase 1 were to be finished on a full feed of high-moisture ear corn during phase 2. Rations for lots 3 and 4 were to remain the same for both phases of the experiment. However, the supply of corn silage was not adequate to carry out the experiment as planned, and the cattle were continued on phase 1 rations until the supply of silage was fed up after 211 days. At this time, the rations for all lots were changed to 5 lb. of low-moisture alfalfa silage (haylage), 1 lb. of protein supplement and a full feed of high-moisture ear corn. The protein supplement was of the same ingredient composition as for phase 1 except the levels of diethylstilbestrol, aureomycin and vitamin A were increased to furnish the same amounts per head daily in 1 lb. of the supplement.

The cattle were fed for another 69 or 70 days after the change in rations before being marketed.

Results

Results of the experiment are presented in tables 1, 2 and 3. During phase 1, the fastest rate of gain was obtained from the full feed of ear corn (2.55 lb.) and the lowest from the full feed of corn silage (1.93 lb.). However, on the basis of feed required per 100 lb. of gain, 100 lb. of the high-moisture

ear corn was equal to about 276 lb. of corn silage. Such a ratio would offer an advantage for silage in gain per acre of corn. Also, the silage ration produced gains at a lower cost at the feed prices used (table 1).

The ration with 20 lb. of corn silage and a full feed of ear corn or with 20 lb. of the ear corn and a full feed of silage resulted in about the same rate of gain and slightly lower than for ear corn without silage. The one with the limited feed of 20 lb. of silage would have a distinct advantage in gain per acre of corn and cost of gain since the steers consumed only 8.1 lb. more corn silage but 5.9 lb. less ear corn. In this comparison, 100 lb. of the ear corn saved only 148 lb. of corn silage on the basis of feed required per 100 lb. of gain.

When the rations were changed to a full feed of the ear corn and 5 lb. of haylage, rate of gain was slightly lower for lots 1 and 4 than for the preceding 211 days (table 2).

The steers fed corn silage without added ear corn (lot 2) during phase 1 of the experiment, showed a marked improvement in rate of gain when changed to the more concentrated ration. It is interesting to note that the steers in lot 3 fed 20 lb. of corn silage during phase 1 and gaining as well as those in lot 4 gained at a faster rate following the ration change. Their intake of the ear corn was increased to a greater extent than for lot 4 following this ration change.

Summary of Phases 1 and 2

There were only small differences in rate of gain between steers in lots 1, 3 and 4. The steers in lot 3 had a slightly lower dressing percent and carcass grade. However, the steers in lot 3 consumed only 4,056 lb. more corn silage but 1,878 lb. less ear corn than those in lot 1 and made only 12 lb. less total gain. Since total consumption of haylage and protein supplement was nearly the same, 1 lb. of ear corn was equal to about 2.2 lb. of silage on the basis of feed required per unit of gain in this comparison.

The ration fed to the steers in lot 3 appeared to have a decided advantage over the one fed to lot 4. They consumed only 1,710 lb. more silage but 1,277 lb. less ear corn and gained 12 lb. more per steer. Haylage and protein supplement consumption was about the same resulting in the ear corn having a replacement value per pound of only 1.34 lb. of silage in this comparison.

While the gain of steers fed corn silage without added ear corn (lot 1) was improved considerably following changing to the more concentrated ration, they averaged 66 to 80 lb. less at time of marketing than for steers in the other lots. This no doubt is a major factor in the lower dressing percent and carcass grade. Other trials have shown that cattle fed this ration grade about as well as those fed rations similar to those fed to the other lots when fed to the same final weight. The main advantage of this high-silage ration has been in gain per acre of corn, but a longer time in the feedlot is required.

Table 1. Performance of Beef Cattle When Fed Corn Silage and High-Moisture Ear Corn at Different Levels
Phase 1 - Dec. 20, 1965 to July 19, 1966 - 211 days

Treatments	High-moisture ear corn	Corn silage	20 lb. corn silage + high-moisture ear corn F.F.	20 lb. high-moisture ear corn + corn silage F.F.
	2 lb. protein supplement			
Lot number	1	2	3	4
No. steers[a]	24	25	25	25
Initial filled wt., lb.	469	468	467	467
Final filled wt., lb.	1006	874	977	986
Av. daily gain, lb.	2.55	1.93	2.42	2.46
Av. daily ration, lb.				
Corn silage	0.23	44.2	19.5	11.4
High-moisture ear corn	22.1	0.79	13.5	19.4
Protein suppl.	1.97	1.97	1.97	1.97
Feed req./cwt. gain, lb.				
Corn silage	9.2	2296	805	462
High-moisture ear corn	869	41	557	788
Protein suppl.	78	102	81	80
Feed cost/cwt. gain, $[b]				
Corn silage	0.37	9.18	3.22	1.85
High-moisture ear corn	13.04	0.62	8.36	11.82
Protein suppl.	3.12	4.08	3.24	3.20
Total	16.53	13.88	14.82	16.87

[a] One steer removed from pen 1 because of an injury.
[b] Feed prices used: corn silage, $8/ton; high-moisture ear corn, $30 per ton (equivalent to $1.26/70 lb. bu. for 15% moisture corn) and protein supplement, $80 per ton.

Table 2. Final Finishing Phase With High-Moisture Ear Corn and Alfalfa Haylage
Phase 2 - July 20 to Sept. 26 or 27 - 69 or 70 days

	Phase 1 Rations[a]			
	HMEC FF	C. sil. FF	C. sil., 20 lb. HMEC, FF	HMEC, 20 lb. C. sil., FF
Lot	1	2	3	4
Days	70	70	69	69
Final filled wt., lb.	1174	1100	1165	1151
Av. daily gain, lb.	2.40	3.22	2.73	2.39
Av. daily ration, lb.				
H.M. ear corn	25.2	27.0	24.9	25.2
Alf. haylage	5.0	5.0	5.0	5.0
Protein suppl.	1.0	1.0	1.0	1.0
Feed/100 lb. gain, lb.				
H.M. ear corn	1049	837	911	1054
Alf. haylage	208	155	184	209
Protein suppl.	42	31	37	42

[a] HMEC = high-moisture ear corn, C. sil. = corn silage, FF = full-fed.

Table 3. Summary of Phases 1 and 2
(280 or 281 days)

	HMEC[a] FF	C. sil.[a] FF	C. sil., 20 lb. HMEC, FF	HMEC, 20 lb. C. sil., FF
Lot	1	2	3	4
Av. init. shrunk wt., lb.	445	443	442	442
Av. final shrunk wt., lb.	1143	1061	1128	1116
Av. gain per head, lb.	698	618	686	674
Av. daily gain, lb.	2.48	2.20	2.45	2.41
Av. feed per head, lb.				
Corn silage	50	9333	4106	2396
High-moisture ear corn	6432	2056	4554	5831
Alfalfa haylage	350	351	346	346
Protein supplement	486	486	483	484
Dressing percent	61.8	60.2	61.3	62.4
Marbling score[b]	6.1	4.9	5.8	6.2
Carcass grade[c]	19.5	18.1	19.3	19.6

[a] HMEC = high-moisture ear corn, C. sil. = corn silage, FF = full-fed.
[b] Marbling scores: 5 = small, 6 = modest, 7 = moderate.
[c] Carcass grades: 18 = Good +, 19 = Choice -, 20 = Choice.

Cattle Grub Studies - 1965-66

Paul H. Kohler

Tiguvon at a 1% concentration was fed in soybean oil meal for 6 days. An average consumption of 1 pound of the mixture per day approximates a dosage of 1 mg./kg./day body weight of each calf or a total of 6 mg./kg. for the 6 day feeding period. Grub reduction was 90 and 97 percent at the two grub counts when compared to the untreated calves.

Centerville Station 1965-66

	No. of calves	Dosage per calf	Grubs/calf (av.)		No. calves infested		Grub reduction (%)	
Grub count dates			2/15	3/28	2/15	3/28	2/15	3/28
Treatment								
Tiguvon 1% fed in 1 lb. soybean meal Dec. 14-19, 1965 (1 mg./kg./day)	113	6 mg./kg. body wt.	0.03	0.4	1	11	90	97
Untreated	113	---	0.30	14.6	15	105	--	--

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PLANT PATHOLOGY SECTION

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PLANT DISEASE CONTROL - CORN DISEASES

-- C. M. Nagel

New Corn Virus Disease Still Spreading in Corn Belt:

The new virus disease of corn which orginated in Ohio in 1963 and spread quite rapidly during 1964-65 into Indiana, Illinois, and Iowa continued to spread in 1966. The disease so far has not been found on corn in South Dakota, however, in Iowa the disease has spread into several new locations throughout the state during 1966. In the meantime, additional virus diseases of corn have also started to appear and spread in the corn belt. To date, little is known about these newest diseases or their identity and potential damage to the crop. Research is rapidly proceeding to learn more about these problems.

The Influence of Close Row Spacing and High Corn Plant Populations in Relation to Disease Development:

By increasing the plant density per acre in the growing of corn, through closer rows and/or closer planting in the row, could create some important disease problems which might nulify possible benefits to be derived from this practice. The yield losses caused in corn from stalk and root is known to be influenced by stress factors such as drought, kernel set, etc. Both root rot and stalk rot can cause severe lodging in corn, they also can be the cause of premature dying of plants in the field. It is a common observation to find dying plants in the field in mid to late August from these two diseases. These two diseases have been responsible for decreased yields in corn in southeast South Dakota. Therefore, in cooperation with Dr. Fred Shubeck of the Agronomy Department, stalk rot disease records were obtained in corn experiments grown at the station. This experiment contained 3 different row spacings, 20, 30 and 40 inches apart, 5 population rates, 10,000, 12,000, 14,000, 16,000 and 18,000 plants per acre. With two different hybrids. The data obtained in 1966 are preliminary involving only a single season, therefore no conclusions can be drawn from the results, at this time. However, with a second year's data to be obtained in 1967 it may be possible to discern what effects increased populations per acre in corn may have on such diseases as root and stalk rot which can cause reduced yield and lodging. The 1966 season was not a suitable year in which to expect these weaknesses to be expressed, because of the very adequate supply of rainfall in the area. Under conditions of high populations and reduced rainfall, under South Dakota conditions it might be expected to impose severe stress on the corn plant which could increase susceptibility or disease damage to the crop. These are important considerations to be determined with regard to increased corn plant populations under South Dakota conditions with its variable rainfall.

ROOT AND STALK ROT DISEASE CONTROL IN HYBRID CORN

-- C. M. Nagel

Approximately 300 experimental three-way corn hybrids involving one root and stalk rot resistant parent in each of the three-way hybrids were grown at the Research Farm in 1965. All hybrid entries were replicated three times. Results were obtained on the over-all performance including resistance to disease, lodging, moisture and yields. Results from the 1966 experiments have not been completely analyzed and were not available for this report.

Research in progress is directed at developing a strain of corn which is resistant to disease. Over the past years, strains of corn have been developed by the Plant Pathology Department at the main Experiment Station at Brookings; and although it appears that many of these lines are adapted more to the north, it was thought desirable to evaluate these in hybrid combinations at the Research Farm to determine if certain of these lines might also be adapted to the southeast area.

The approximately 300 experimental hybrids that were grown at the S.E.S.D. Research Farm in 1965 were divided into five different test groups and were grown on a six-acre piece of land. Although these experimental three-way hybrids were developed and are adapted for the east-central part of South Dakota (Brookings area), nevertheless, a number of the hybrids performed as well or better than the commercial hybrids used as checks in the experiments. The commercial checks used are some of the better adapted hybrids for the area.

In view of the good performance of these rather early hybrids at the station, plans are under way to try and develop later maturing inbred lines that are similarly resistant to root and stalk rot. Such adapted lines might well be expected to perform considerably better based on the results so far obtained on the yielding ability of the three-way experimental hybrids now under test. Results of seventy of the 300, three-way hybrids grown at the station in 1965 are presented in table 43.

The plots were planted on May 13 and harvested on October 15, 1965.

Table 43. Yield, performance rating, and moisture content of the 70 top yielding 3-way experimental hybrids possessing varying degrees of root and stalk rot resistance. Centerville, 1965.

Exp'tl 3-way hybrid no.	Adapted com'l hybrid no. (checks)	Yield Bu/A	Performance rating	Moisture at harvest
1		114.1	114.60	33.3
2		113.2	116.97	27.9
3		112.7	117.75	25.8
4	P352	112.5	113.57	30.2
5		112.4	119.02	25.7
6	SD622	111.9	114.06	31.9
7		109.4	115.69	22.8
8		108.5	113.27	26.2
9		107.4	114.22	32.0
10	Dek410	106.9	112.75	26.7
11		106.8	113.40	26.4
12		106.7	111.94	26.4
13		106.1	112.66	26.9
14		105.0	111.74	24.6
15		104.9	117.65	29.8
16		104.8	111.22	30.3
17		104.4	111.62	24.1
18		104.1	109.90	25.5
19		103.8	111.62	23.3
20		103.2	111.68	27.5
21		102.6	109.83	30.0
22		102.4	109.37	28.3
23		102.3	109.70	29.9
24		101.8	114.88	27.0
25		101.4	108.35	26.4
26		101.3	108.36	26.3
27		101.3	110.11	23.0
28		101.2	108.52	25.8
29		101.2	108.68	25.5
30		100.9	107.95	31.3
31		100.6	108.29	25.5
32		100.5	116.28	26.2
33		100.4	106.88	32.6
34		100.3	106.50	33.2
35		100.1	111.18	19.5
36		100.0	108.56	29.1
37		99.7	109.28	19.2
38		99.5	108.76	23.3
39		99.2	104.14	27.2
40		98.6	107.23	29.8
41	SD420	98.6	107.17	28.9
42		98.2	106.27	26.2
43		97.7	107.40	26.4
44		97.4	109.32	24.7
45		97.4	109.61	21.7
46	SD240	97.1	108.88	23.1
47		97.1	105.06	27.1
48		97.0	104.18	28.6
49		96.9	107.26	25.3
50		96.9	106.84	26.1
51		96.5	107.19	25.3
52		96.5	10[illegible].17	29.1
53		96.5	105.55	28.0
54		96.4	104.35	27.5
55		96.3	105.96	27.3
56		96.3	104.50	27.1
57		96.3	106.85	25.4
58		96.1	103.69	33.0
59		96.0	105.96	24.0
60		96.0	106.28	26.0
61		95.9	108.40	22.3
62		95.9	107.48	26.1
63		95.6	105.74	25.0
64		95.5	110.46	29.9
65		95.4	104.23	26.5
66		95.4	103.39	30.5
67		95.2	105.68	26.1
68		95.1	105.11	27.4
69		95.1	106.96	26.0
70		95.0	104.94	27.5

NEW EFFECTIVE CHEMICAL CONTROL FOR LOOSE SMUT OF BARLEY

V. D. Pederson

A new systemic seed treatment chemical called Vitavax* was tested for its effectiveness for loose smut control in barley. Two seed lots of Larker barley were treated with 75% wettable powder formulation of Vitavax at rates of 1 and 2 oz/bu. One of the seed lots contained 24%, the other less than 1% loose smut infected seed. The results of the test appear in Table 44.

Table 44. Percent smutted heads present in Larker barley treated with Vitavax seed treatment at two dosages.

Percent smut infected seed based on embryo test.	Check	Vitavax 1 oz/bu	Vitavax 2 oz/bu
	percent	smutted	heads
24	24.8	tr	0

The new chemical is unique in that it controls smut infection without harming the seed. Other chemical seed treatments have not been effective because the loose smut fungus is present in the embryo rather than on the seed coat. Preliminary results indicate the chemical is compativle with organic mercury fungicides. This is important because Vitavax is not effective against certain seed rotting organisms. Thus a combination of Vitavax and organic mercury fungicides can be used to control both loose smut, seed rot and seedling blight of barley.

*United States Rubber Company registered trademark.

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