CORN PLANTING METHODS IN VIRGINIA'S RESIDUE MULCH

by

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TABLE OF CONTENTS

LIST OF ILLUSTRATIONS, TABLES AND CHARTS

Illustrations

Tables

Charts

INTRODUCTION

Terracing, contour strip cropping and contour cultivation are among the more important practices recommended in Virginia for erosion control. Although they reduce the movement of the soil down the slope, they do not eliminate it. Under present agricultural methods these practices only postpone the time when the top soil will be lost.

A great stride toward the solution of the problem of eliminating soil losses will be made when a practical method is devised whereby tilled crops can be grown on a slope without appreciable erosion resulting therefrom. A mulch cover over the soil appears to offer the best practical approach to this problem. In many respects, it duplicates nature's method of producing a protective vegetative cover. Mulch provides a partial shield against the violent impact of raindrops and, because of increased friction, reduces the velocity of surface runoff (Fig. 1). At the same time it is much more desirable than normal vegetation as a cover where crops are growing because it does not compete with plants for nutrients, light and moisture.

The most practical mulch on a cultivated field is one composed of residues from the previous season's growth. Recently this method of providing a protective mulch has proved very successful in many parts of the United States, practically eliminating soil losses on moderate slopes (1,3,4,5,6,8,11,12,13,14,16). Studies dealing with vegetative residues as a mulch for corn fields have been conducted by the Virginia Agricultural Experiment Station since 1944.

Fig. 1. This picture was taken immediately after a heavy rain. Notice the effect of the mulch in preventing run-off.

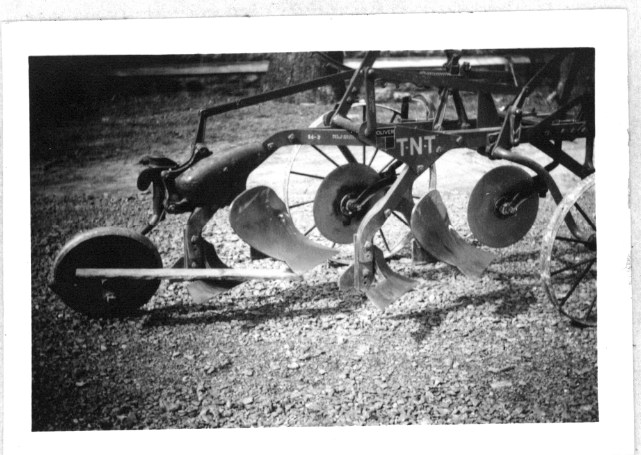


Fig. 2. The "double-cut plow" used in preparing the mulch seedbed. Each bottom is composed of two parts, the moldboard plow which is set to invert the top 3 inches of soil and the sub-tiller which is set to sub-till an additional 4 inches.

Fig. 3. The "double-cut plow" in action. The top 3 inches of soil are being inverted and the next 4 inches sub-tilled.

The first experiments in Virginia were made using sweeps, moldboardless plows and disks as the tools to provide effective mulch in corn occurring in a three year rotation of corn, wheat, and clover. Conventional tools and methods were used during the wheat and clover years of the rotation. While these implements had proven successful elsewhere (4,5,6,11) in establishing mulch, they did not prove satisfactory for Virginia conditions because they did not provide a kill of the perennial grasses and legumes which were present (7,9). The result was overwhelming weed and regrowth competition and consequently poor yields.

In 1947 experiments were begun using the "double-cut plow", a commercially available implement in the preparation of the mulch seedbed (Fig.2). When used as a mulching tool, it is adjusted so that it completely inverts the top three inches of soil and at the same time subtills an additional four inches, thereby preparing a seven inch seedbed (Fig. 3). The roots of the perennials and legumes remain exposed for 30 to 45 days and are thoroughly killed (Fig. 4). The initial plowing is done as early as weather will permit, usually in March. A few days before planting, a standard spring tooth harrowing is performed with about 50 percent of the sod being pulled to the surface (Fig.5). This is followed by one disk harrowing. This system, using the "double-cut plow", proved superior to the methods tried prior to 1947, yet the yields and stands were less satisfactory than where the conventional moldboard plow method was used. The "double-cut plow" method was used in experiments conducted in 1948 and 1949 and results were again deficient. Not only were stands and yields inferior as in prior experiments, but laboratory studies showed that plants grown on mulch plots contained less of certain

Fig. 4. A mulch plot after being plowed with the "double-cut plow". The upturned roots of the perennials and legumes remain exposed in this manner for 30 to 45 days resulting in a thorough kill.

Fig. 5. This picture shows a spring tooth harrow being used a few days before planting. The mulch is harrowed once which results in about 50% of the sod being pulled to the surface.

Fig. 6. A view of the mulch seedbed after disk harrowing. The seedbed is now ready for planting. Note that the surface is in very good condition for preventing run-off.

plant nutrients during specific periods of the growing season (7,9).

It is difficult to say whether or not yields would be the same on both types of plots having equal stands, but it seems logical to assume that one of the prerequisities for equal yields would be equal stands. In view of this supposition this study was devoted to developing a method of planting corn in a mulch seedbed which would result in stands equal to those obtained in a seedbed prepared in the conventional manner. The Agricultural Engineering Department at Blacksburg made a similar study with emphasis on fertilizer placement and its effect on plant assimilation of nutrients during the same period this study was conducted.

OBJECTIVE

The objective of this study was to devise a method of planting corn in a residue mulch seedbed which would result in stands and yields as good as those obtained in planting in a conventionally prepared seedbed.

FACILITIES

Records were available of the residue mulch studies carried out since 1944 by the Agricultural Engineering Department of the Virginia Agricultural Experiment Station, cooperating with the Soil Conservation Service Research.

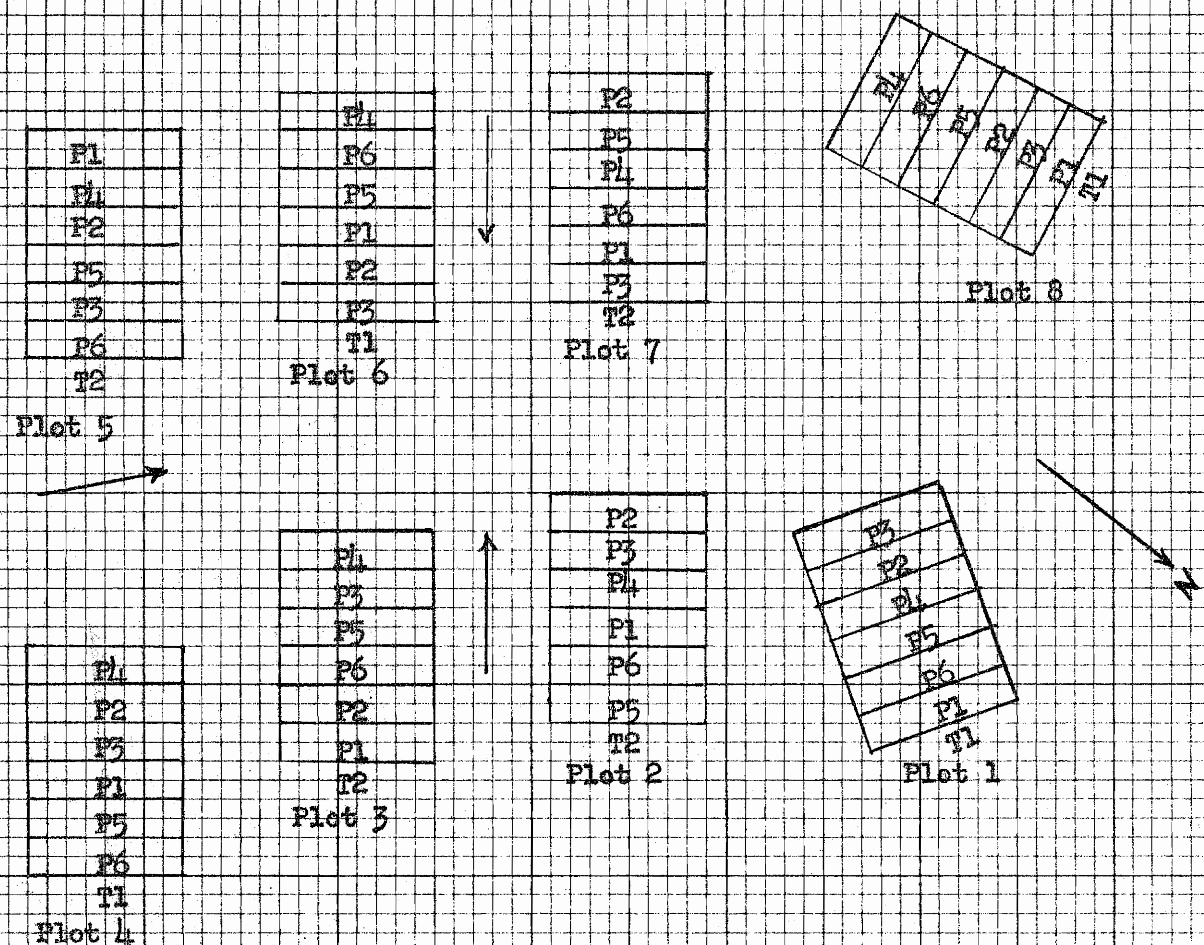
Office equipment and land for the plot areas were furnished by the Agricultural Engineering Department. The plots were located on the Kipps' Farm, approximately four miles west of Blacksburg, just off the Price's Fork Road.

Seed, fertilizer, and planting and fertilizing equipment were furnished by the Agricultural Engineering Department.

Mr. J. H. Lillard, Project Leader for Soil and Water Research in the Virginia Agricultural Experiment Station, Blacksburg, Virginia, and Mr. T. W. Edminster, Project Supervisor for the Soil Conservation Service, Research Division, U. S. Department of Agriculture, Blacksburg, Virginia, and other members of the Agricultural Engineering Department were available for consultation.

The facilities of the library of the Virginia Polytechnic Institute were utilized. Members of the faculty of the College of Agriculture were consulted when needed.

TILLAGE EXPERIMENT PLOT ARRANGEMENT



Tillage Treatments

T1-Seedbed prepared by the conventional turn plow method.
T2-Crop residue mulch seedbed prepared by the "double-cut plow" method.

Planting Treatments

P1-Standard planter with runner opener and fertilization F1. (Fig.10)
P2-Standard planter with runner opener and fertilization F2. (Fig.10)
P3-Standard planter with double-disk opener, fertilization F2 and disk hiller attachment. (Figs.11, 12, 13, 15)
P4-Standard planter with double-disk opener and fertilization F2. (Figs.8, 9, 10)
P5-Standard planter with runner opener, fertilization F2 and disk hiller attachment. (Fig. 14)
P6-Standard planter with double-disk opener, compaction weight attached and fertilization F2. (Fig. 17)

Fertilization Methods

F1-300 pounds/acre of 4-12-4 broadcast at seeding time.
200 pounds/acre of 4-12-4 in band 2" to side and at same depth of seed.
F2-500 pounds/acre of 4-12-4 in band 2 inches to side and 2 inches below seed.

Figure 7

PROCEDURE

Eight plots, with dimensions of 80 x 55 feet, were laid out on the contour in the field designated for this study. Four plots were placed on each side of a draw which runs diagonally through the field (Fig. 7). Four of the plots were mulch and four were used as check plots. The location of the plots were randomized but paired so that there was always a check plot adjacent to a mulch plot. The paired plots were spaced sufficiently close to be considered as a split-plot for the purpose of statistical analysis.

Each of the eight plots was divided into six sub-plots numbered in ascending order from the uphill side of the plot. The sub-plots, each receiving a different planting treatment, consisted of 4 rows of corn spaced 42 inches between rows and 42 inches between sub-plots.

The seedbed on the check plots was prepared by the conventional moldboard plow method which consisted of inverting the soil to a depth of approximately seven inches with a moldboard plow during the latter part of March. This was followed about one month later with one disking. The mulch plots were prepared by the "double-cut plow" method following the procedure described in the introduction to this paper. Corresponding operations in preparing the seedbed were performed at the same time for both methods.

This experiment was conducted under field conditions using commercially available equipment. Six planting treatments were devised using a conventional, two-row, tractor-mounted planter with fertilizer attachment as the basic implement. The only construction done on the planter was the bracing of the fertilizer shoe. This was done only as a precaution against breakage.

The corn was planted May 10, with a different treatment to each of the six sub-plots within each plot (Fig. 7). This resulted in four replicas of each treatment in both the check and mulch plots. The planter assemblies used in each of the six treatments are described in Fig. 7 and illustrated in Figs. 8-17.

Three soil samples for moisture determination were taken from each plot immediately after completion of the planting operation. For sampling purposes the plots were divided into three approximately equal portions. Each sample was taken from a composite of nine core samples mixed thoroughly in a container. The oven drying method was used in determing the moisture content. The average moisture content of the samples taken from all plots was 21.68 percent; the average from the mulch plots 21.70 percent; and from the check plots, 21.66 percent.

Stand counts were made during the growing season to determine the following:

1. The relative degree of germination of the seed under the various treatments in each of the plots.
2. The apparent vigor of plants by treatments in mulch and check plots.
3. The mortality rate comparison of corn planted by the six planting treatments in mulch and conventional seedbeds.

The initial stand count was taken on June 4, just before the first plowing. In the interest of accuracy in sampling, counts were made on every row in the experiment. The plants were classified according to apparent vigor using the two categories of "healthy" and "unhealthy". Those obviously below normal in health as judged by appearance, were classified "unhealthy"

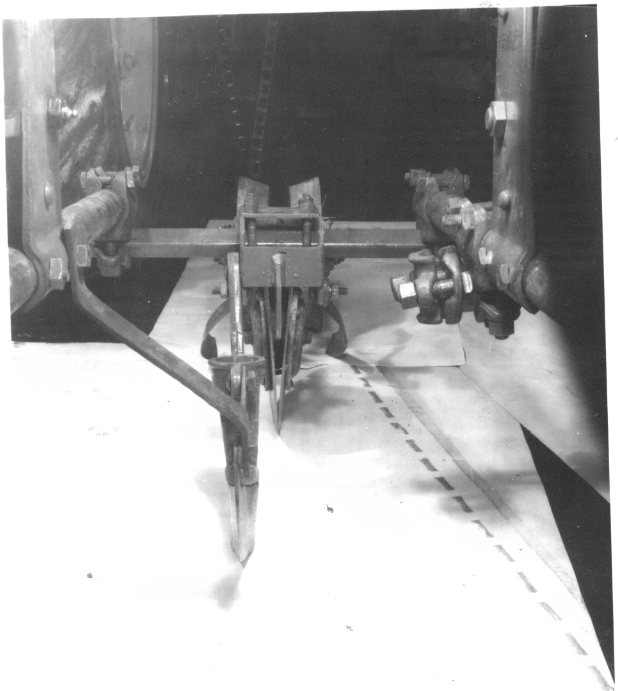


Fig. 8. Front view of the planter arrangement for treatment P4. This is the same arrangement which was used in treatments P1 and P2 except in these treatments a curved runner furrow opener was used. In the foreground is the fertilizer shoe. (The steel strap tying the shoe to the frame of the planter was the only construction done on the planter for the experiment.) Behind the fertilizer shoe is the double-disk furrow opener followed by the covering devices and the press wheel.

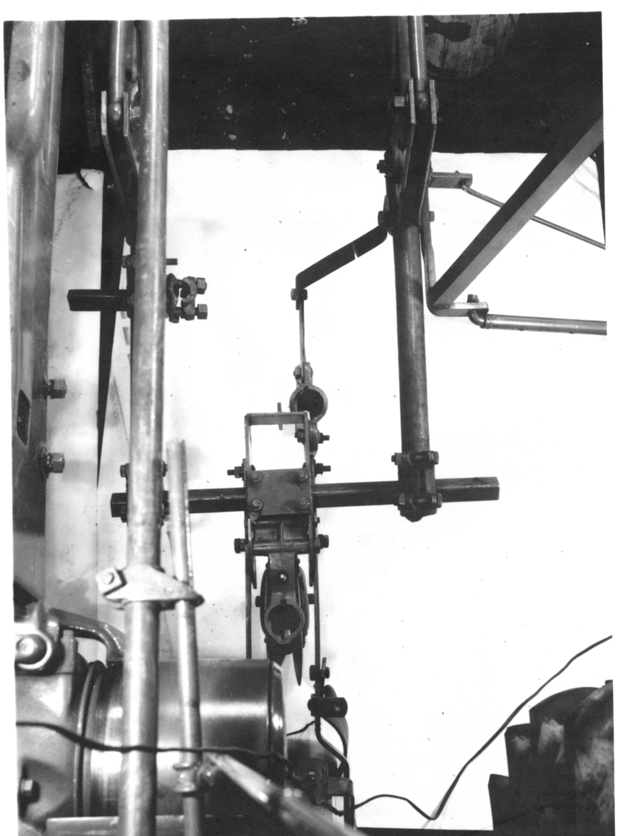


Fig. 9. A top view of the planting arrangement shown in Fig. 8. The planter and fertilizer attachment were removed for the picture. Note that the fertilizer shoe is located 2 inches to the right of the planter shoe.

Fig. 10

A side view of the double-disk furrow opener mounted on the planter. This type of furrow opener was used in treatments P3, P4, and P6. To the right of the double-disk opener is the fertilizer shoe set to place the fertilizer 2 inches to the right of and 2 inches below the seed. To the left of the double-disk opener are the spoon coverers and the press wheel. In the foreground is the curved runner furrow opener used in treatments P1, P2, and P5. The double-disk furrow opener was better adapted for use in the mulch seedbed. It was less subject to clogging and pushing trash in front of it.

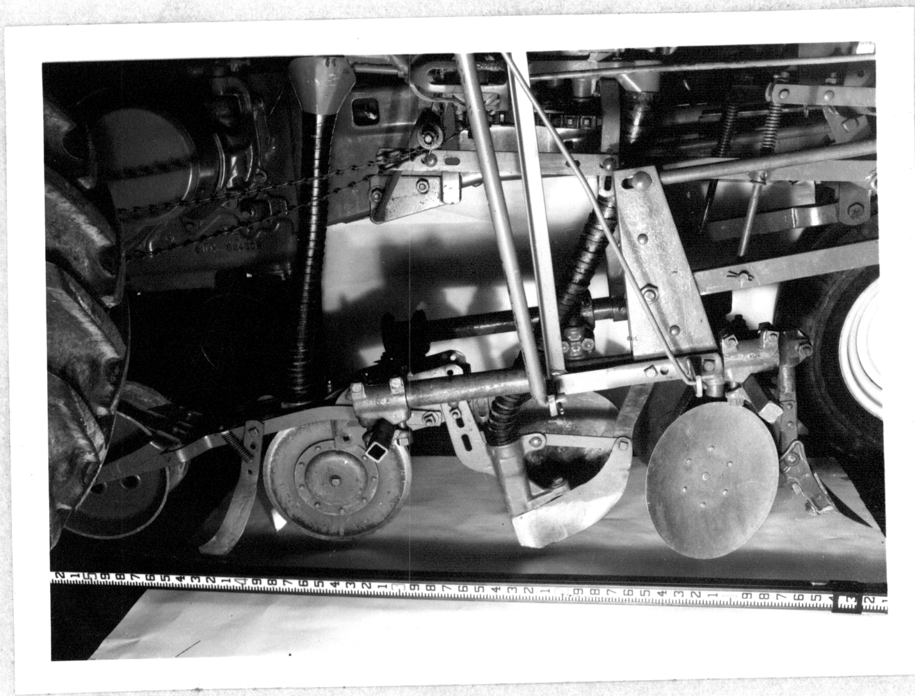


Fig. 11

Side view of the planting arrangement for treatment F3. From right to left is shown the shovel opener, pair of disk hillers set to throw the mulch to the side, and single disk hiller set to throw clean soil back into the furrow made by the shovel opener and pair of disk hillers. Beside the single disk hiller in the foreground is the fertilizer shoe, followed by the double-disk furrow opener, the spoon coverers and the press wheel. This is the same arrangement used in treatment F5 except in that treatment the curved runner furrow opener was utilized.

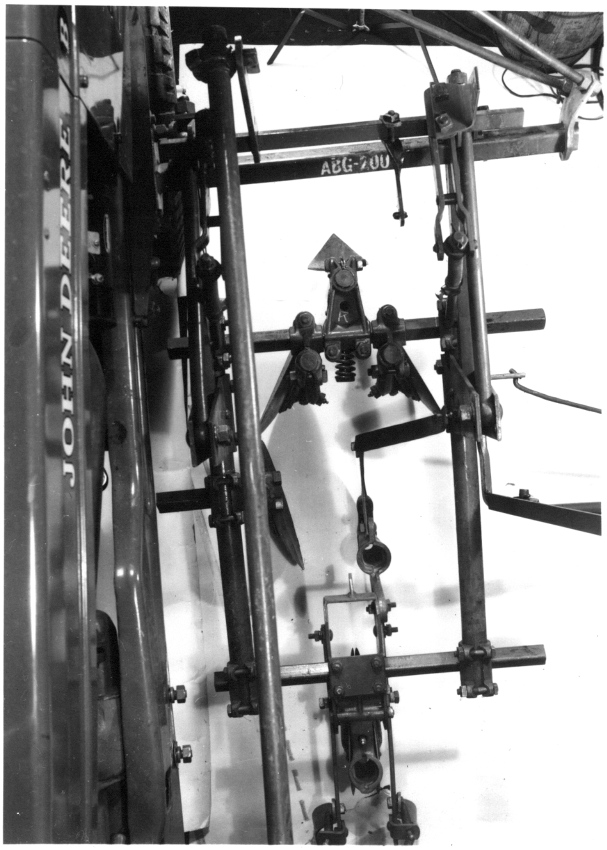


Fig. 12. Top view of the planting arrangement for treatment P3 with the planter and fertilizer distributor removed. From top to bottom are shown the shovel opener, pair of disk hillers set to throw the mulch out, single disk hiller throwing clean soil back into the furrow, fertilizer shoe, and spoon coverers. The press wheel is not shown.

Fig. 13. A view of the same planting arrangement as shown in Fig. 11 operating in the field. Notice the position of the single disk hiller throwing clean soil into the path of the planter. This action resulted in more efficient coverage of the seed.

Fig. 14. Views of the planter arrangement for treatment P5 in operation. The top picture is a side view of this planting arrangement. The bottom picture is a front view showing the action of the shovel opener and the pair of disk hillers in opening a furrow. Note the space between each of the disk hillers and the shank of the shovel opener. These clearances were important because they allowed loose soil to sift back down into the furrow opened, thereby aiding the single disk hiller in collecting clean dirt in the path of planter shoe.

Fig. 15. A top view showing in detail the action of the single disk hiller in throwing clean soil into the path of the planter shoe. The double-disk furrow opener is seen following the single disk hiller and fertilizer shoe. The pair of disk hillers extend out of the bottom of the picture.

Fig. 16. A view of the details of the corn row just after being planted by planter assemblies used in treatment P5 or treatment P3. The mulch has been pushed to the side and the corn planted in clean soil. The center of the furrow into which the corn has been planted is slightly higher than the edges, due to the action of the single disk hiller and soil sifting back into the center of the furrow in the clearance between each of the pair disk hillers and the shank of the shovel opener. In case of a heavy rain just after planting the water will first settle to the sides of the planted corn instead of on top of it.

Fig. 17

Planter assembly used in treatment P6. An extra weight has been placed on the frame of the press wheel to gain greater compaction on the seed.

Fig. 18

Two rows planted with the assembly used in treatment P5 are shown in the center of the picture. The rows to the left have been planted without pushing the mulch to the side.

Fig. 19. Cultivator used for the first cultivation at work in mulch.

Fig. 20. The man on the left is standing in corn planted with treatment P1 in which 200 pounds of fertilizer were placed by the planter and 300 pounds broadcast at the time of planting. The stalks are slender and do not reach to his waist. The man on the right is standing in corn planted by one of the other treatments.

Fig. 21. The man is standing in corn planted by treatment P1 shortly before it was hoed. Note the bushy, vigorous type of weeds in this corn. The corn in the upper left corner of the picture was planted by one of the other methods.

and those remaining as "healthy". The total of these two categories was used as the stand count. Three such counts were taken, each made the day before cultivation, except the second which was taken one week in advance of the second plowing. A fourth stand count, omitting the health classification aspect, was taken one week before silking began.

When conducting the first stand count an effort was made to determine the cause of skips in the corn rows. Ten skips were chosen at random in each sub-plot for examination. The area was dug into by hand in an attempt to locate the kernel that had failed to produce a plant. When the kernel was found, it was examined and the reason for its failure to come up determined. Where no kernel could be found, failure of the planter was assumed.

The first cultivation was made June 6, the second on June 26 with a side dressing of 500 pounds per acre of nitrate of soda, and the third and last cultivation on July 3.

Counts to determine the silking dates of the corn planted by the different methods were begun on July 27, and continued until August 8. The counts were made each day with the exception of July 30 and August 5. The method used by Meyers (10) was employed for determining the corn silking on the days no data were taken. Counts were made on each row of stalks that had at least one ear showing silk until 50 percent of the total row population, as determined in the fourth stand count, had reached this state. The row was then recorded as "in silk" and was not counted further.

Regular inspections of the plots were made at intervals of approximately one week.

The corn samples for yields were gathered early in October. The two inside rows of the sub-plots were divided into three equal sampling areas and a sample taken from each. The samples were placed in bags and the number of ears harvested and the stalks in the sampling area recorded. They were then placed in an artificial grain drier and dried to an average moisture content of 14 percent. On October 19 the samples were shelled. Each sample was divided into good and defective ears, and the weight of the grain from each category recorded separately.

At the time the corn was shelled, samples were taken for the purpose of determining the moisture content. The samples were placed in a drying oven and dried according to the standard practice of leaving the grain in the oven at a temperature of 65 degrees Centigrade until a constant moisture content was reached.

The length of row used for all counts and sampling was 41 feet. This allowed approximately four and one-half feet extra on each end of the rows to eliminate end effect.

DISCUSSION OF PROCEDURE

Planting was begun with treatment P3. Plots 1, 2 and 3 were planted in this treatment before the planter was adjusted properly.

The first cultivation was made with a tractor-mounted spring shank cultivator (Fig. 19). This cultivation was not satisfactory because on many occasions coverage or damage to young plants occurred when clumps would roll into the corn row ahead of or behind the shield.

The second and third cultivations were done with standard tractor cultivating equipment. These cultivations were quite satisfactory because the corn had reached sufficient height not to be in danger of being covered. The second cultivation was delayed from a week to 10 days because the soil was too wet for tilth. When the cultivation was performed, some of the weeds in the corn row had grown too tall to cover. These weeds were hoed out later so that differences between treatments would be confined, as nearly as possible, to treatment effects.

It was noted at the time of hoeing, on July 19, that the weeds in corn that had been planted by treatment P1, where a portion of the fertilizer was broadcast at seeding time, were larger and more vigorous in appearance while the corn plants were more slender and about one foot shorter than where the other planting treatments were used (Figs. 20, 21).

RESULTS

Statistical analyses of variance on the initial stand count and yield data were made because they were of primary interest. The details of these analyses are given in Appendix I. No significant differences were found at the 5 percent level among blocks, seedbed preparation methods, planting treatments, or interaction between seedbed preparation and planting methods. However, the data indicated trends, which warranted further consideration. This is done in the following paragraphs.

Germination Study-- Table I shows the initial stand count made on June 4. It can be seen from this table that treatments P3 and P5, in which the mulch was pushed to the side, not only show a larger initial stand in both mulch and check than the other treatments but the initial stand in mulch was actually larger than in check where treatment P5 was used in planting. All other treatments showed less initial stand in mulch. However, in treatment P6, in which extra compaction was placed on the seed, the initial stand in mulch was 639 compared to 640 in check.

Stand Losses Study-- The stand losses during the period June 4 through July 3 were greater in mulch for all treatments except treatments P2 and P3 (Table I). However, in treatment P3 the percent loss in check was 2.80 percent while in mulch it was 2.76 percent, a difference of only .04 percent. In all mulch plots the stand loss was 4.02 percent compared to 2.96 percent in check.

Apparent Vigor Study-- The apparent vigor data, given in Table I, show that in the early part of the season most treatments had higher percentages of healthy plants in the check plots. However, at the time of

TABLE I

STAND COUNT AND APPARENT VIGOR DATA

	Date count was taken												
	June 4				June 18				July 5				
Treatment*	Healthy plants	Unhealthy plants	Total	Percent healthy plants	Healthy plants	Unhealthy plants	Total	Percent healthy plants	Healthy plants	Unhealthy plants	Total	Percent healthy plants	Percent stand loss
T1	3868	300	4168	91.36	3796	321	4117	92.24	3848	236	4084	94.22	2.02
T2	3592	341	3735	90.86	3314	321	3635	91.17	3384	199	3583	94.45	4.02
P1	1094	82	1176	93.03	1061	97	1158	91.62	1074	69	1143	93.96	2.81
P2	1176	104	1280	91.87	1162	82	1244	93.41	1165	60	1225	95.10	4.30
P3	1246	158	1404	88.75	1233	130	1363	90.46	1288	77	1365	94.35	2.78
P4	1233	104	1337	92.22	1177	110	1287	91.45	1209	84	1293	93.50	3.30
P5	1288	137	1425	90.38	1269	118	1387	91.49	1315	68	1383	95.08	2.95
P6	1163	116	1279	90.93	1170	100	1270	92.13	1181	77	1258	93.88	1.64
P1 x T1	592	43	635	93.23	589	42	631	93.34	592	37	629	94.12	.95
P2 x T1	649	55	704	92.19	640	43	683	93.70	637	29	666	95.64	5.40
P3 x T1	664	87	751	88.42	653	83	736	88.72	684	46	730	93.70	2.80
P4 x T1	678	55	733	92.50	676	51	727	92.98	674	52	726	92.83	.96
P5 x T1	645	60	705	91.49	644	54	698	92.26	663	32	695	95.40	1.42
P6 x T1	580	60	640	90.46	594	48	642	92.52	598	40	638	92.16	.32
P1 x T2	502	39	541	92.99	472	55	527	89.56	482	32	514	93.77	5.00
P2 x T2	527	49	576	91.49	522	39	561	93.05	528	31	559	94.45	5.40
P3 x T2	582	71	653	89.12	592	49	641	92.35	604	31	635	95.27	2.76
P4 x T2	555	49	604	91.88	517	61	578	89.44	535	32	567	94.35	6.13
P5 x T2	643	77	720	89.30	635	65	700	90.71	652	36	688	94.76	4.45
P6 x T2	583	56	639	91.23	576	52	628	91.72	583	37	620	94.00	4.54

* See Fig. 7 for description of treatments

the count on July 3, the percentages had gradually changed to the extent that the mulch plots actually had a slightly higher percentage of healthy plants than did the check plots.

Study of Corn Skips -- Failure of the planter was the largest single cause for skips in the corn rows (Table II). This type of failure occurred approximately the same number of times in all treatments except in treatments P4 and P6.

The next category was "sprouted and came to surface only". There were 39 such failures in check and 25 in mulch. The data under "obstructed by clod" shows 28 in mulch and 12 in check.

The remaining categories have so few samples that the data collected under them is considered inadequate for comment.

Date of Silking Study -- All planting treatments resulted in the same silking date except P1 and P2 (Table III). Treatment P1, in which 300 pounds of fertilizer was broadcast at planting caused silking to be three days later and P2 one day earlier than the other treatments. The seedbed preparation methods did not affect the date of silking.

Yields -- Table IV gives a summary of the yield data. The total yield in check plots was higher than in mulch. Treatment P5 resulted in the greatest yield of all planting treatments, loading in both mulch and check plots. The ears were the same size in both mulch and check, but there was a greater percentage of defective corn on check plots than in mulch. The plant yield factors, which were obtained by dividing the number of plants per acre by the number of bushels produced per acre, show that the lowest yield per plant was where treatment P3 was used with treatment P5 second lowest.

TABLE II

DATA ON CAUSES OF SKIPS IN CORN ROWS

Treatment*	Total Skips Examined	Failure of Planter	Sprouted and Came to Surface Only	Obstructed by Clod	Root Worm	Only Sprouted	Did Not Sprout	Cut Off at Surface	Mole
T1	240	164	39	12	8	14	2	1	0
T2	240	165	25	28	10	11	1	0	2
P1	80	61	5	6	3	3	1	0	1
P2	80	59	9	8	2	1	0	1	0
P3	80	52	18	3	2	4	1	0	0
P4	80	46	12	11	5	5	1	0	0
P5	80	55	9	3	5	8	0	0	0
P6	80	54	11	9	1	4	0	0	1
P1 x T1	40	29	4	2	2	3	0	0	0
P2 x T1	40	30	7	1	1	0	0	1	0
P3 x T1	40	28	10	1	0	0	1	0	0
P4 x T1	40	18	7	7	3	4	1	0	0
P5 x T1	40	28	4	1	2	5	0	0	0
P6 x T1	40	31	7	0	0	2	0	0	0
P1 x T2	40	32	1	4	1	0	1	0	1
P2 x T2	40	29	2	7	1	1	0	0	0
P3 x T2	40	24	8	2	2	4	0	0	0
P4 x T2	40	28	5	4	2	1	0	0	0
P5 x T2	40	27	5	2	3	3	0	0	0
P6 x T2	40	25	4	9	1	2	0	0	1

* See Fig. 7 for description of treatments

TABLE III

DATE OF SILKING DATA

Treatment*	Date of Silking
T1	August 1
T2	August 1
P1	August 4
P2	July 31
P3	August 1
P4	August 1
P5	August 1
P6	August 1
P1 x T1	August 3
P2 x T1	July 30
P3 x T1	August 1
P4 x T1	August 1
P5 x T1	July 31
P6 x T1	August 1
P1 x T2	August 4
P2 x T2	July 31
P3 x T2	August 1
P4 x T2	August 1
P5 x T2	August 1
P6 x T2	August 1

* See Fig. 7 for description of treatments

TABLE IV

SUMMARY OF YIELD DATA

No Samples	Treatment*	Yield in Bushels per Acre	Plants per Acre	No Ears per Acre	Ear Size Factor (Bushels per Ear)	Plant Yield Factor (Bushels per Plant)	Percentage Defective Grain
72	T1	70.50	14,497	14,570	.00484	.00488	1.74
72	T2	66.80	13,105	13,792	.00484	.00510	1.49
24	P1	62.73	12,259	13,302	.00472	.00512	.46
24	P2	68.36	13,378	13,700	.00499	.00511	1.27
24	P3	70.64	15,370	14,972	.00468	.00457	2.60
24	P4	72.09	14,080	14,459	.00499	.00512	1.94
24	P5	74.12	14,955	15,009	.00494	.00496	1.55
24	P6	64.59	12,600	13,662	.00473	.00515	2.30
12	P1 x T1	68.89	13,472	14,307	.00482	.00511	.27
12	P2 x T1	69.25	14,459	14,194	.00488	.00479	1.10
12	P3 x T1	75.82	17,078	16,167	.00457	.00432	2.74
12	P4 x T1	74.80	14,953	15,256	.00490	.00500	2.45
12	P5 x T1	75.41	14,573	14,839	.00508	.00517	1.44
12	P6 x T1	61.08	12,106	12,676	.00482	.00504	3.62
12	P1 x T2	56.57	11,044	12,296	.00460	.00512	.70
12	P2 x T2	67.48	12,296	13,207	.00511	.00548	1.46
12	P3 x T2	66.27	13,662	13,776	.00481	.00485	2.45
12	P4 x T2	69.55	13,207	13,662	.00509	.00527	1.40
12	P5 x T2	72.02	15,352	15,180	.00474	.00470	1.67
12	P6 x T2	64.08	13,095	14,049	.00465	.00520	1.13

* See Fig. 7 for description of treatments

DISCUSSION OF RESULTS

The analysis of variance of the initial stand count and the yield data was that for a randomized split-plot design. It will be noted that there were two types of treatments involved. One type was the tillage treatment used in preparing the seedbed and the other was the planting variations used. The split-plot design analysis is especially well suited to this case because in this design the effects of the sub-units and the interaction of the sub-units with the whole units are estimated more precisely than the whole unit effects (2). In the case of this experiment there was more concern over the effects of the various planting treatments and how they reacted in mulch and in check than over the effects of mulch and check. The complete analyses of variance are given in Appendix I.

Since the difference among planter treatments in mulch was of primary concern, it was decided to run an analysis of variance on the yield data of these treatments in mulch only. This was done by the use of a simple randomized block design. This analysis is given in Appendix I. It also failed to show significant differences among the planting treatments at the 5 percent level. In a further attempt to determine if there was a statistically significant difference among treatments in mulch, Tuckey's method of comparing individual means in an analysis of variance was employed (15). This method also failed to show one treatment significantly different from another.

In reviewing the summary of the analyses given in Appendix I it will be seen that the sampling error is small relative to the experimental error. This indicates that the sampling procedure was adequate for the experimental material. On the other hand the experimental error term is large relatively, meaning that the refinements should be made in the experiment and not in sampling methods.

Germination Study — The results of the study on germination indicate that treatments P3 and P5, where the mulch was pushed aside, are superior in obtaining an initial stand in mulch (Table I). It will be noted that treatment P3, in which the disc type furrow opener was used, produced the best initial stand in check plots but was second best in mulch plots, actually producing considerably less stand in mulch than treatment P5, which was identical except that a runner type furrow opener was used. It was expected, from observations made at the time of planting, that the disc furrow opener would give better results in mulch than the runner type because it appeared to be doing a better job, not clogging or pushing trash before it.

In reviewing the experiment for some explanation of the relatively poor showing of treatment P3 in mulch, it was found that its failure to do as well as treatment P5 was confined mainly to plot 2. On plot 2 the stand count for treatment P5 was 172 while that for treatment P3 was only 96. The difference between treatment P5 and P3 in this plot more than made up for their total differences. If they had had the same stand count in plot 2, treatment P3 would have been superior to treatment P5 in mulch as well as on the check plots.

There are two factors which probably contributed to the poor stand of treatment P3 in plot 2. Treatment P3 was the first treatment planted. Planting was begun with plot 1, each plot following in numerical order. Plot 2 was the first mulch plot reached. Difficulty was being encountered in getting the planters to stay in the ground, especially the one on the down-hill side of the plot. This trouble was apparent in plot 1, a check plot in which treatment P3 had the lowest stand of all treatments. It was not completely remedied until plot 4 was reached. This means that the planter was not functioning properly when treatment P3 was used in plot 2. Another contributing factor was the physical condition of plot 2. The up-hill side of the plot, where treatment P5 was used, was in good condition for a mulch plot but the lower side, in which treatment P3 was used was by far the roughest spot on any of the plots. Treatment P3 resulted in a better stand than any other treatment in plots 3 (mulch), 6 (check). 7 (mulch) and 8 (check). It was third in plot 5 (mulch), second in plot 4 (check) and sixth in plots 1 (check) and 2 (mulch). The above factors indicate that treatment P3 may be just as good treatment as P5, if not better.

It will be noted that treatment P4 gave the third best total results with treatment P2 placing fourth. Treatment P4 was second to treatment P3 in check and was the third ranking treatment in mulch. Treatments P2 and P4 were identical except that in treatment P4 a double disk opener was used and in P2 a curved runner opener was used. A comparison of the results of treatments P4 and P2 indicate that the double disk opener is superior over the runner type opener, both in and out of mulch. This comparison gives further weight to the assumption made above that treatment P3 may be as good a treatment as P5.

Treatment P6, which was conventional except for an extra weight secured to the frame of the press wheel to gain more compaction, gave the third best results in mulch but was fifth in check plots. This indicates that extra compaction of the seed in mulch is desirable if the mulch is not pushed aside for planting. However, the results of this experiment indicate that pushing the mulch to the side is the better approach to obtaining the maximum stand.

Treatments P1 and P2 were identical except that in P1 300 pounds of fertilizer were broadcast at the time of planting and 200 pounds placed by the planter. The 300 pounds of fertilizer were broadcast with a fertilizer grain drill. It is believed that, in placing the fertilizer with the drill, trash and extra soil were placed on top of the planted rows causing interference with the plants coming to the surface. This would account for treatment P2 showing superiority over P1 in initial stand count.

Stand Losses Study -- The percent stand losses shown in Table I indicate that a problem exists in the cultivation of corn in mulch. The apparent vigor data does not consistently indicate mulch plots grow less healthy corn than check plots. Therefore, while no attempt was made to determine the cause of the stand losses during the cultivating season, it is believed that this excessive loss in the mulch plots was due entirely to cultivation damage. The percent stand loss in every planting treatment except P2 and P3 shows that corn on mulch plots had higher stand losses during the cultivating season. Using treatment P5 as an example, an initial stand of 15 more plants were obtained in mulch plots than check plots but during the cultivation period this numerical superiority was lost and in the end there were even fewer plants in mulch.

The percent stand loss of treatment P2 in the check plots was 5.40 percent which is considerably higher than for other planting treatments in check plots. Since there seemed to be no apparent reason for this, the data were investigated for a possible explanation. It was found that 24 of the 38 plants lost occurred on only three rows out of 32, a fact which indicates that some type of accident happened on these rows. By eliminating the abnormal losses on these rows the percent loss is 1.99 percent which is more consistent with other results in check plots.

Data taken on the fourth stand count has not been presented because it was exactly the same as the third count on check plots and only 6 plants less on the mulch plots.

Apparent Vigor Study — The results of this study indicate that corn plants are slightly less healthy when grown on a residue mulch seedbed (Table I). It will be noted that there was a greater difference in health during the early part of the growing season and that at the end of the season very little difference was observed.

Study of Corn Skips — Much difficulty was encountered in finding the kernels when examining the skips. For this reason skips classified as caused by "failure of planter" may have been due to failure to find the kernal.

Date of Silking Study — The results of this study show that corn grown in mulch will not mature appreciable later than that planted in a conventionally prepared seedbed (Table III). Treatment P1 had more delaying effect on the maturing of corn than did planting in mulch.

Yields — The season was good for corn. The distribution of rainfall by months, during the time the corn was affected, is shown in Chart I. It will be noted that in the months of April, June, August, September and October there was less rainfall than normal while May and July had more than normal.

Grain produced in the experiment was of good quality but the cobs were a little soft. The quality of the grain harvested on mulch plots proved to be as good as that from check plots.

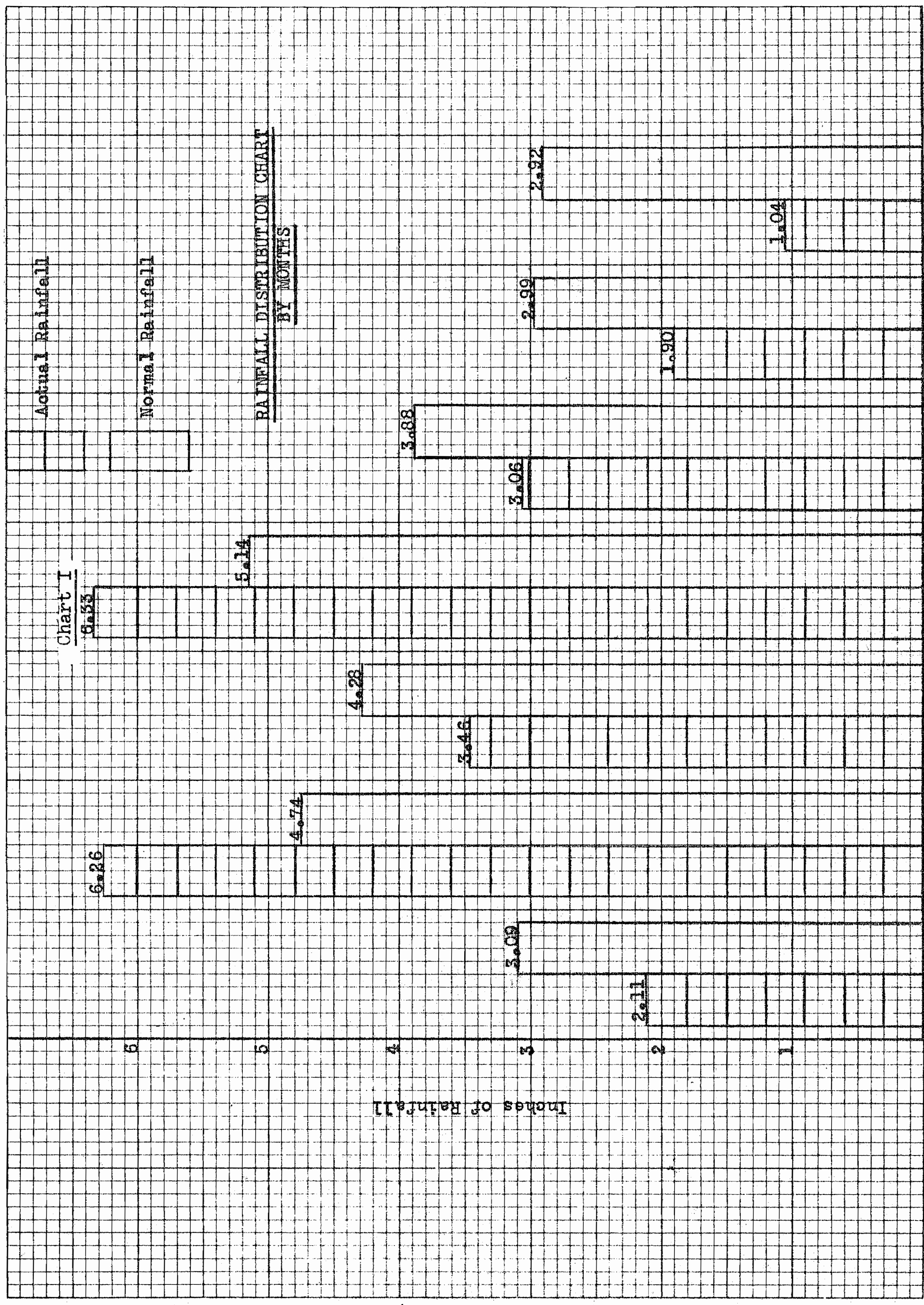


Chart I
RAINFALL DISTRIBUTION CHART
BY MONTHS
Actual Rainfall
Normal Rainfall
Inches of Rainfall
1
2
3
4
5
6
April
May
June
July
August
September
October
2.11
3.09
6.26
4.74
3.46
4.28
6.33
5.14
3.06
3.88
1.90
2.99
1.04
2.92

The area sampled for yield in treatment P5 contained more plants on mulch than on the check plots but the yield was actually a little less. This is consistent with results of previous experiments which showed plant nutrient deficiencies to be a problem in addition to obtaining a stand (7,9). In this case it is possible that the plants in mulch were too thick for maximum total production of grain. This possibility is strengthened by noting that treatment P3 on check plots had the highest number of stalks in the sampled area of any treatment in the experiment and the lowest yield per stalk (Table IV). The plant yield factor increases with the reduction of plants per acre but it does not follow this pattern consistently.

CONCLUSIONS

It is realized that, before definite conclusions can be made, the results obtained in this type of experiment, where climatic conditions have a great influence, should be verified by repetition over a period of several years. However, on the basis of information gained in this study the following conclusions appear to be warranted:

1. In planting corn in a vegatative residue mulch seedbed, mechanical devices should be employed to push aside the mulch layer in the path of the planter, thereby providing trash-free soil into which the seed may be deposited.
2. There is very little variation in the apparent vigor of corn plants growing in a vegetative residue mulch seedbed and those growing in a conventionally prepared seedbed.
3. By using the silking dates as an index of maturity, the ripening of corn grown in a vegetative residue mulch seedbed will not be appreciably delayed.
4. Corn grown in a vegetative residue mulch seedbed is subject to greater stand losses during the cultivating season than that grown on a conventionally prepared seedbed.

SUMMARY

This study was undertaken as a part of the research program of the Agricultural Engineering Department of the Virginia Agricultural Experiment Station to determine a method of planting corn in a vegetative residue mulch seedbed which would result in stand and yields as good as obtained in planting in a conventionally prepared seedbed.

Yields obtained in the first experiments in Virginia were very low because methods used in peeparing the mulch seedbed, which had proven successful in other locations in the United States, proved unsuited in that they did not kill the perennials and legumes in the vegetative residue. This factor was overcome in 1947 when the "double-cut plow" was introduced for preparing the residue mulch seedbed. However, the initial stands and yields were still not as good as for corn grown on a mulch seedbed in experiments conducted since that time.

This experiment was conducted on eight main plots. Mulch seedbeds were prepared on four of the plots using the "double-cut plow" method, and on the other four the seedbeds were prepared by the conventional turn-plow method. The plots were arranged to conform to a randomized split-plot design.

Six planting methods were devised by modifying a conventional two-row, tractor-mounted corn planter with fertilizer attachment. The plots were planted, using these six treatments randomized in each of the eight plots, on May 10, under fair conditions. The performance of the planting equipment was good except in the planting of the first three plots in treatment P3, the first treatment planted.

Stand counts and apparent vigor data were taken before each of the three cultivations. A stand count, without apparent vigor observations, was taken just prior to silking.

A study was made at the time of the initial stand count in an effort to determine the causes of germination failures of seed planted.

An application of 500 pounds of nitrate of soda as a side dressing was made at the time of the second cultivation. Commercial 4-12-4 fertilizer was applied to the corn at planting at the rate of 500 pounds per acre. The second plowing was delayed because of rain and resulted in weed growth in the rows. These weeds were hoed out just prior to the silking period.

Silking dates of the corn, as an index of maturity, were determined for each planting and seedbed preparation treatment.

The samples for yield were gathered in early October and placed in an artificial drier. They were shelled and weighed, and yield data were recorded in mid-October. The general condition of the harvested grain was good. There was almost a total absence of lodging when the harvest was made.

The most successful, in providing initial stands and yields of grain, were those planting treatments in which mechanical means were used for pushing the mulch aside in the path of the planter.

Clods, in the mulch plots where mechanical means were not employed to push the vegetative residue mulch layer away from the path of the planter, were found to interfere with young plants coming to the surface.

Results of this study indicate that corn grown in a residue mulch seedbed was at a slight disadvantage in apparent vigor during the early part of the growing season, but at no appreciable disadvantage in maturing. The data did show that there was a larger loss in stand in mulch plots than in check.

While the statistical analysis of variance of the initial stand count and yield data showed no significant differences, the variations did indicate definite trends.

RECOMMENDATIONS FOR FUTURE STUDY

The following recommendations for future study are made:

1. It is recommended that a more closely controlled experiment be conducted, in addition to field experiments of the type conducted in this study, in which every effort is made to have only two variable factors. These factors should be the two methods of preparing the seedbed used in this experiment. This would require hand methods, but would definitely establish the difference in yields in mulch and check due to these two methods of seedbed preparation where an equal number of plants per unit area reached maturity.
2. Further studies should be made on the effect of cultivation on stand losses in mulch as compared to check.
3. There is a need for areas where equipment modifications can be tested under field conditions to a greater extent to insure the maximum efficiency of operation in the experiment area.
4. Experiments should be continued with planter modifications used in treatments P3 and P5 in which the mulch was pushed away from the path of the planter. It is believed that these two treatments could be combined into one by using only the double-disk furrow opener.

   A suggested variation of this modification would be to vary the distance the mulch is pushed to the sides of the path of the planter. If the mulch were pushed a sufficient distance to the side to permit the inside cultivators to work in mulch-free soil, next to the young corn in the first cultivation, it is believed that less cultivation damage would result.

Another suggested modification of this treatment would be to use an assembly on which two disc hillers could be utilized to throw the soil back into the middle of the furrow. This modification could be varied by replacing the two disc hillers for throwing the soil into the middle of the furrow with two cultivator shanks equipped with a small tongue type plow. It is believed that the tongue type shovels would have the advantage of suction and would leave the corn in a better defined mound in the middle of the furrow. This would result in better protection to the seed in case of a rain heavy enough to cause water to stand in the rows before the corn came up.

APPENDICES

APPENDIX I

ANALYSIS OF VARIANCE OF INITIAL STAND COUNT DATA

TABLE V

INITIAL STAND COUNT DATA

	Block I								Block II							
	Plot No 1				Plot No 2				Plot No 3				Plot No 4			
Treatment	T1				T2				T2				T1			
	No. Plants in Each Sample				No. Plants in Each Sample				No. Plants in Each Sample				No. Plants in Each Sample			
P1	39	42	51	36	31	41	41	22	17	31	15	18	32	41	45	21
P2	40	45	42	43	27	27	31	16	39	34	39	29	36	49	56	42
P3	29	45	55	30	32	25	16	23	37	50	43	46	38	43	56	47
P4	45	56	46	33	37	33	37	19	43	47	55	24	45	52	53	49
P5	49	53	47	41	44	51	37	40	40	55	40	37	26	42	51	38
P6	42	49	51	45	37	34	38	28	29	44	36	39	20	11	21	27

	Block III								Block IV							
	Plot No 5				Plot No 6				Plot No 7				Plot No 8			
Treatment	T2				T1				T2				T1			
	No. Plants in Each Sample				No. Plants in Each Sample				No. Plants in Each Sample				No. Plants in Each Sample			
P1	32	45	47	40	38	37	44	35	40	45	40	36	39	48	50	39
P2	45	46	41	37	43	45	47	46	30	45	46	44	37	41	54	38
P3	40	47	49	48	48	61	56	42	44	55	54	44	53	50	51	47
P4	44	47	45	34	45	54	41	39	38	40	42	39	47	40	47	41
P5	49	54	46	39	41	47	56	42	44	48	56	42	50	30	46	46
P6	50	51	41	47	42	39	42	50	42	47	40	36	46	47	54	46

TABLE VI

INITIAL STAND COUNT BY BLOCKS

IN MULCH AND CHECK

Treatment	Block I Number of Plants	Block II Number of Plants	Block III Number of Plants	Block IV Number of Plants	Total Number of Plants
P1 x T1	168	139	152	176	635
P2 x T1	170	183	181	170	704
P3 x T1	159	184	207	201	751
P4 x T1	180	199	179	175	733
P5 x T1	190	157	186	172	705
P6 x T1	187	87	173	193	640
Total	1054	949	1078	1087	4168
P1 x T2	135	81	164	161	541
P2 x T2	101	141	169	165	576
P3 x T2	96	176	184	197	653
P4 x T2	126	149	170	159	604
P5 x T2	172	170	188	190	720
P6 x T2	137	148	189	165	639
Total	767	865	1064	1037	3733
Grand Total	1821	1814	2142	2124	7901

CALCULATION OF SUMS OF SQUARES

SS Grand Total $= S(x)^2 - \frac{(Sx)^2}{N} = (39)^2 + \ldots\ldots + (46)^2 - (7901)^2 = 16{,}095$

$C = \frac{(Sx)^2}{N} = \frac{(7901)^2}{192} = 325{,}134$

SS Blocks $= \frac{(18211)^2 + \ldots\ldots + (2124)^2}{48} - C = 2{,}070$

SS Seedbed Treatment $= \frac{(3733)^2 + (4168)^2}{96} - C = 986$

SS Total $= \frac{(767)^2 + \ldots\ldots + (1087)^2}{24} - C = 3997$

SS Planting Treatments $= (1176)^2 + \ldots\ldots + (1379)^2 - C = 1{,}325$

SS Planting Treatments x Seedbed Treatments $= \left(\frac{(541)^2 + \ldots\ldots + (640)^2}{12} - C \right) -$ $(986 + 1{,}323) = 629$

SS Error $= (3{,}997 + 1{,}325 + 629) - 5{,}949 = 3{,}794$

SS Total $= \frac{(135)^2 + \ldots\ldots + (193)^2}{4} - C = 9{,}743$

SS Sampling Error $= 16{,}095 - 9{,}743 = 6{,}352$

TABLE VII

Summary of Analysis

Source	d/f	SS	MS	F
Blocks	3	2,078	692.66	2.23
Seedbed Treatment	1	986	986.00	3.17
Error	3	933	311.00	
Total	(7)	3,997		
Planting Treatment	5	1,323	264.4	2.09
Planting Treatment x Seedbed Treatment	5	629	125.8	.99
Error	30	3,794	126.47	
Total	47	9,743		
Sampling Error	144	6,352		
Grand Total	191	16,095		

ANALYSIS OF VARIANCE OF YIELD DATA

TABLE VIII

YIELDS OF HARVEST SAMPLES IN POUNDS

	Block I						Block II					
	Plot No 1			Plot No 2			Plot No 3			Plot No 4		
	T1			T2			T2			T1		
Treatment	Yield of Each Sample in Pounds			Yield of Each Sample in Pounds			Yield of Each Sample in Pounds			Yield of Each Sample in Pounds		
P1	9.35	10.20	8.57	7.34	5.72	6.96	7.88	4.85	4.09	10.24	9.33	9.82
P2	8.70	9.06	9.35	10.82	4.50	9.05	9.69	8.75	7.67	10.13	10.68	11.23
P3	8.78	9.15	9.51	5.66	7.88	3.34	10.64	10.52	9.05	11.18	9.20	11.14
P4	8.79	7.55	8.20	7.36	6.28	8.41	10.96	10.92	10.18	10.58	12.07	12.96
P5	9.23	8.15	9.74	11.61	11.48	11.96	9.34	9.36	8.57	12.10	9.99	14.11
P6	9.86	10.39	10.05	9.92	6.15	9.80	8.35	8.88	8.14	5.75	8.34	2.40

	Block III						Block IV					
	Plot No 5			Plot No 6			Plot No 7			Plot No 8		
	T2			T1			T2			T1		
Treatment	Yield of Each Sample in Pounds			Yield of Each Sample in Pounds			Yield of Each Sample in Pounds			Yield of Each Sample in Pounds		
P1	11.10	8.90	6.59	6.21	6.78	3.56	6.50	6.86	5.69	8.70	8.92	9.98
P2	6.64	7.27	7.26	5.58	7.40	4.91	10.79	8.51	8.62	9.20	8.01	7.93
P3	7.03	8.48	7.86	7.44	6.99	8.44	10.50	7.70	9.33	7.95	8.58	10.79
P4	8.36	8.20	8.15	8.79	8.81	8.74	8.08	7.11	8.62	6.59	9.23	7.81
P5	6.52	6.88	8.32	7.92	7.36	9.17	7.80	7.19	8.54	8.02	8.98	6.51
P6	9.12	9.58	7.24	5.26	4.81	7.31	8.20	9.10	5.88	8.00	9.04	8.94

TABLE IX

YIELDS OF PLANTER TREATMENTS BY BLOCKS

IN MULCH AND CHECK

Treatment	Block 1 Yield in Pounds	Block II Yield in Pounds	Block III Yield in Pounds	Block IV Yield in Pounds	Total Yield in Pounds
P1 x T1	28.12	29.39	16.55	27.60	101.66
P2 x T1	27.11	32.04	17.89	25.14	102.18
P3 x T1	27.24	31.52	22.87	27.30	108.93
P4 x T1	24.54	35.61	26.54	23.63	110.12
P5 x T1	27.12	36.20	24.45	23.51	111.28
P6 x T1	30.30	16.49	17.38	25.98	90.15
Total	164.43	181.25	125.48	153.16	624.32
P1 x T2	19.02	16.82	28.59	19.05	83.48
P2 x T2	24.37	26.11	21.17	27.92	99.57
P3 x T2	16.88	30.01	23.37	27.53	97.79
P4 x T2	22.05	32.06	24.71	23.81	102.63
P5 x T2	35.05	27.27	21.72	23.53	107.53
P6 x T2	25.87	25.37	26.04	23.18	100.46
Total	143.24	157.64	145.60	145.02	591.50
Grand Total	307.67	338.89	271.08	298.18	1215.82

CALCULATION OF SUMS OF SQUARES

$$\text{SS Grand Total} = Sx^2 - \frac{(Sx)^2}{N} = (9.35)^2 + \ldots\ldots + (8.94)^2 - \frac{(1215.82)^2}{144} = 525.26$$

$$C = \frac{(Sx)^2}{N} = \frac{(1215.82)^2}{144} = 10,265.40$$

$$\text{SS Blocks} = \frac{(307.67)^2 + \ldots\ldots + (298.18)^2}{36} - C = 65.24$$

$$\text{SS Seedbed Treatment} = \frac{(591.50)^2 + (624.32)^2}{72} - C = 7.48$$

$$\text{SS Total} = \frac{(143.24)^2 + \ldots\ldots + (153.16)^2}{18} - C = 106.28$$

$$\text{SS Planting Treatments} = \frac{(185.14)^2 + \ldots\ldots + (190.81)^2}{24} - C = 34.72$$

$$\text{SS Planting Treatments x Seedbed Treatments} = \left(\frac{(83.48)^2 + \ldots\ldots + (90.15)^2}{12} - C\right) - (7.48 + 34.72) = 18.38$$

$$\text{SS Total} = \frac{(19.02)^2 + \ldots\ldots + (25.98)^2}{3} - C = 377.55$$

$$\text{SS Error} = (377.55) - (106.28 + 34.72 + 18.38) = 218.17$$

$$\text{SS Sampling Error} = (525.26) - (34.72 + 18.38 + 218.17 + 377.55 + 147.71) = 147.77$$

TABLE X

Summary of Analysis

Source	d/f	SS	MS	F
Blocks	3	65.24	21.75	1.94
Seedbed Treatment	1	7.48	7.48	.67
Error	3	33.56	11.19	
Total	(7)	106.28		
Planting Treatment	5	34.72	6.94	.954
Planting Treatment x Seedbed Treatment	5	18.38	3.67	.505
Error	30	218.17	7.27	
Total	40	377.55		
Sampling Error	96	147.71	1.53	
Grand Total	143	525.26		

ANALYSIS OF VARIANCE OF YIELD DATA IN MULCH ONLY

CALCULATIONS OF SUMS OF SQUARES

$$SS\ Total = S(x)^2 - \frac{(Sx)^2}{N} = (7.34)^2 + \ldots\ldots + (5.88)^2 - \frac{(591.50)^2}{72} = 1,219.85$$

$$C = (Sx)^2 = \frac{(591.50)^2}{72} = 4,720.45$$

$$SS\ Blocks = \frac{(143.24)^2 + \ldots\ldots + (145.02)^2}{18} - C = 146.12$$

$$SS\ Planter\ Treatments = \frac{(85.48)^2 + \ldots\ldots + (100.46)^2}{12} - C = 165.70$$

$$SS\ Sampling\ Error = (19.02)^2 + \ldots\ldots + (25.16)^2 - C = 291.51$$

$$SS\ Error = (1,219.85) - (146.12 + 165.70 + 291.51) = 616.13$$

TABLE XI

Summary of Analysis

Source	d/f	SS	MS	F
Blocks	3	146.12	48.71	1.82
Planter Treatments	5	165.70	33.14	1.24
Error	23	616.13	26.79	
Sampling Error	4	291.51		
Total	71	1,219.85		

APPENDIX II

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APPENDIX III

BIOGRAPHICAL SKETCH

PROFESSION: Agriculture Engineer

BIRTH: August 22, 1915, Springfield, Effingham County, Georgia

PARENTS: Frank B. and Gertrude A. (Exley) Seckinger

NATIONALITY: American

HEIGHT: 5' 10" WEIGHT: 175 lbs. HEALTH: Excellent

MARRIAGE: Margaret Dohoheva, January 11, 1947

CHILDREN: Boris A. Seckinger, Born November 23, 1947

EDUCATION: Springfield High School, Springfield, Georgia, 1929-33
University of Georgia, Athens, Georgia, 1938-42

DEGREE: B. S. in Agricultural Engineering, April 1942. Expect to complete work for M. S. Degree from Virginia Polytechnic Institute, Blacksburg, Virginia, by June 1941.

SOCIETIES, ORGANIZATIONS, AND HONORS: (In College)

Secretary of Agricultural Engineering Club; Honor Key Agricultural Engineering Club; Editor of Georgia "Ag. Engineer"; wrote several articles on agricultural engineering subjects for the "Georgia Agriculturist" and Georgia "Ag. Engineer"; Debating Team of the Agricultural Club; member of the AGHON, local honorary agricultural society; Chancellor of the Georgia Chapter of Alpha Zeta, delegate to the national biennial Alpha Zeta Conclave; delegate to the Industrial Seminar, sponsored by several of the large farm machinery manufacturers; vice-president of the Ag. Hill Council; completed CAA Flight Course; NYA job with the Georgia Egg Laying Contest; won a letter in baseball; Captain in ROTC; member of Scabbard and Blade, an honorary military society; member of the Wesley Foundation Council, and an Affiliate Steward, First Methodist Church, Athens, Georgia.

CHURCH: Methodist

EXPERIENCE:

<u>National Service (Military)</u> — National Guard from March 1934 to October 1934; U. S. Marines, October 1934 to October 1938; four years Infantry ROTC in College. Commissioned 2nd. Lt. in Signal Corps and called to active duty May 26, 1942; month later transferred to the Ordnance Department and sent to Depot and Supply School at Aberdeen, Md.; departed for overseas duty September 21, 1942. Arrived overseas October 30, 1942, and was assigned to the Asmara Arsenal, Asmara, Eritrea as Adjutant and Security Officer. In April 1943 was transferred to Hq., Eritrea Service Command and served as Adjutant, Ordnance Officer and Motor Transportation Officer; transferred to Hq., USAFIME, Cario, Egypt, in January 1944, for duty with the Ordnance Section; served as assistant Ordnance Officer until May 1944, when placed in the AC of S, G-1 Section as Assistant G-1.

<u>National Service (Agricultural Field)</u> - In December 1944 was made Agricultural Officer of Greece for the Military Liaison Headquarters of the U. S. Forces in the Middle East. Served in Greece in this capacity until May 1945. Duties consisted chiefly of conducting surveys of agricultural needs in Greece. After the completion of this mission in Greece in May 1945, proceeded to Salzburg, Austria, and was appointed the Agriculture and Forestry Officer for Military Government of Land Salzburg. On March 11, 1946, was also made the Chief of the Food Section. Relieved from active duty as a Major on April 1, 1946, to accept Civilian employment with the U. S. War Department. Retained the position as the Chief

of the Food, Agriculture and Forestry Division of Land Salzburg as a U. S. War Department civilian employee with a CAF-12 rating. At first duties consisted of direct supervision over the Land Government agencies responsible for food rationing, and the various phases of agriculture and forestry. The duties gradually changed to that of advising, observing and reporting on the activities of these agencies. In addition to these duties, was the advisor to the Commanding General Zone Command Austria, on food, agriculture, and forestry matters for the American Zone of Austria. Was also a lecturer to the Officers and Enlisted Men on the subject of Military Government in the School of Standards, Zone Command Austria. Severed contract on May 12, 1948, and returned to the United States although could have continued in this capacity indefinitely. Desired to become more thoroughly qualified for permanent work in Agricultural Engineering.

MISCELLANEOUS

In addition to the experience outlined above, was a Field Reporter for the AAA Farm Program during two summer vacations while in college. Farmed with father for one year after graduating from high school. While growing up, worked on father's farm in the afternoons after school and during summer vacations. After returning to the United States in May 1948, designed and built a three-bedroom dwelling house on father's farm near Springfield, Georgia. On January 1, 1949, entered Virginia Polytechnic Institute, Blacksburg, Virginia, with a teaching fellowship and began work on a Master's Degree in Agricultural Engineering. Teaching experience has been mainly in Farm Machinery with some instructing in Farm Motors and Farm Surveying. Thesis problem was the development of a successful method of planting corn in a crop residue mulch. Accepted employment with Dearborn Motors Corporation in their Product Engineering Section on January 8, 1951. Learned to speak German while with Military Government in Austria. Member of the American Society of Agricultural Engineers

Charles B. Siesinger