May 18, 1962

To the Graduate Council:

I am submitting herewith a thesis written by Paulus P. Shelby entitled "Some Effects of Seedbed Preparation, Tillage and Herbicides on Corn Yields and Soil Compaction." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agronomy.

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Major Professor

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SOME EFFECTS OF SEEDBED PREPARATION, TILLAGE AND HERBICIDES ON CORN YIELDS AND SOIL COMPACTION

A Thesis

Presented to

the Graduate Council of

The University of Tennessee

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

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by

Paulus P. Shelby

June 1962

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ACKNOWLEDGEMENTS

The author wishes to express his gratitude and appreciation to:

Professor Henry Andrews, not only for advice during the planning and performance of this study, but also for his continued interest and encouragement through the period of graduate work.

Professor H. C. Smith for guidance and preparation of the manuscript.

Dr. H. A. Fribourg for guidance in the preparation and analysis of data.

Dr. Royal Shanks for serving on the author's graduate committee, and other members of the Agronomy Department for their cooperation and helpful suggestions.

My wife and children for their sacrifices during the different phases of the graduate program.

525584

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CHAPTER I

INTRODUCTION

Because of the need for efficiency in production, the problem of how much seedbed preparation and tillage is necessary for corn (Zea mays L.) production is becoming increasingly important. Most of the experimental work that has been done to determine how much preparation and tillage is necessary for corn production has been confined largely to the corn belt area. This information is of comparatively little value to farmers in Tennessee because of the difference in climate and edaphic conditions.

The objective of this study was to determine the relationships between two types of seedbed preparations for corn production. These two types of seedbeds were: conventional seedbed where the soil was plowed, disced, harrowed, and cultipacked; and minimum seedbed where the soil was plowed and corn was planted in the tractor wheel tracks. Each type of seedbed was subdivided to include two practices; weed control by using a herbicide and by cultivation. This study was conducted to determine the effect of the above on yield, control of weeds, stand, lodging and soil compaction.

CHAPTER II

LITERATURE REVIEW

Corn needs a good seedbed. Soil must be fine enough to pack around seed, keep it moist, and insure good germination. The newer ideas are pointed at doing the job with fewer trips across the field. Decreasing the number of operations will not help if seed is dropped in dry cloddy earth. Miller, Clarke County Iowa, has found that a good seedbed can be had without repeating disking and harrowing (6). Repeated tillage as done in seedbed preparation for corn under conventional systems often cause excess compaction and poor water and soil conservation (24).

The previous crop will influence the amount of seedbed preparation needed. For instance, soybeans stubble or sod will usually break up easily (19).

Schaller listed four considerations in preparing a good seedbed: lossen the soil, kill all growing plants (weeds or sod crop), prepare an even seedbed for planting at uniform depth and be sure the seedbed will give firm contact between seed and soil (19).

The number of trips needed to produce a good seedbed will vary with the soil type. A medium textured soil is the easiest to work into a good seedbed (19).

Plowing and planting must be done close together for best results when wheel-track-planting (6). If the soil dries out tractor wheels will not crush clods, and you will not get firm seedbed in the row. Only

the immediate area where seed is to be placed needs to be worked and carefully firmed to create good soil-seed contact. A poor seedbed of loose soil between the rows is desirable to retard weed seed germination, particularly of the annual grasses (3, 16). This type seedbed can be prepared by tractor-track-planting.

Wheel track planting means planting corn in tractor wheel tracks on freshly plowed ground. The usual disking and harrowing after plowing are omitted (18).

Another term used when minimum tillage is discussed is plow-plant. Plow-plant can mean many things. Usually it means plowing and planting in a single operation by mounting the planter behind the plow. To others it means plowing and planting the same day in separate operations whether in the wheel-track or not, but with no other tillage. In either case it involves spring plowing (17).

Minimum tillage is defined as the least amount of tillage needed for quick germination, a good stand and profitable yields. This term may be used when referring to either wheel-track-planting or plow-planting (25).

Field trials in 23 counties in Minnesota showed that corn yields averaged as much or slightly more from wheel track planting than from plantings on land prepared in the regular way (16). In these tests it was found that weeds grew poorly in the loose soil between the rows.

Experimental work of the Agricultural Research Service, USDA at Coshocton, Ohio, illustrated some of the conservation merits of plow-planting. In 1957, two test areas were compared. One test area was

plow-planted to corn across the general slope (as close to the contour as practical) and the other area was disked, dragged, and planted on the true contour. A record breaking 3.5 inch rain fell during the cropping season. Where the seedbed was disked, dragged, and planted on the true contour, there was a maximum rate of runoff of 5.97 inches of water per hour. Where the crop was plow-planted across the general slope, the maximum rate of runoff was 3.12 inches per hour, a savings of 2.85 inches. Soil losses paralleled runoff rates with a loss of 6.7 tons per acre where disked, and 2.2 tons per acre where plow-planted. Where disked, the corn yield was 109 bushels per acre, where plow-planted the yield was 124 bushels per acre, an increase of 15 bushels. Increased corn yield is thought to be primarily due to the moisture conserved by plow-planting (9). Other researchers have reported similar findings on erosion and water infiltration (1, 8, 26).

When a soil is loosened with a tillage implement, the total porosity and the thickness of the tilled soil layer are increased. Increasing the porosity of a soil affects moisture conservation and surface drainage. Increased porosity is an additional reason why wheel-track and plow-plant tillage have been effective in reducing runoff and infiltration (2, 10).

Mumm said that tillage with heavy machinery plugs soils pores, breaks down desirable structure, slows drainage and aeration and makes soil difficult for roots to penetrate (21). Extra trips over the field causes the soil to be pulverized and compacted, and increase the rate of water runoff.

Hagen (7) said there is little doubt that over compaction reduces crop yields. The University of Minnesota field trial tested the effects of compaction on corn yields. It was found that with no special compaction, the yield was 84.1 bushels per acre, with surface compaction the yield was 77.0 bushels per acre, and with surface and furrow bottom compaction the yield was 72.0 bushels per acre.

Bourget et al. (4) reported that an analysis of variance showed that oat yields obtained on uncompacted plots were highly significantly greater than on the compacted plots. These plots were compacted by passing a tractor over each plot until the wheels had covered the entire plot. This procedure of passing a tractor over the plots was repeated for the desired number of tractor passes.

About one-third of the cost necessary to produce a crop is in seedbed preparation. So, fewer trips mean more profit (19).

The conventional method used by most farmers in preparing a seedbed includes about five or six operations or trips across the field--chopping or disking stalks, plowing, disking, harrowing, and planting.

Paul (17) reported the following cultural cost per acre for growing corn in Illinois to add up to $10.20 for conventional method which includes plowing, three diskings, harrowing, planting, rotary hoe and two cultivations. Wheel-track planting cost $5.10 per acre for plowing, planting and one cultivation while plow-plant cost $4.60 per acre plowing and planting in one operation and one cultivation. Others have also reported a savings of $5 to $7 for each acre of corn (18, 24, 25).

Larson (10), Iowa State Agronomist, and others found that tractor track planting will:

1. Loosen the soil. Fewer trips over the field reduce compaction.

2. Give better weed control. Seedbed is firm only in tractor track.

3. Seed germinates quickly due to the firm seedbed. Pre-emergence spray may be used in this area. Fewer weed seed germinate in the loose soil between rows and may be controlled with one cultivation.

4. Save soil and water because the loose, rough soil soaks up water fast and there is less runoff and erosion (14).

5. Fewer tillage operations reduce both time and production cost.

6. Yields are as good as where soils are tilled more intensively (15).

7. Wheel track planting works well on either fall-plowed or early-spring plowed land if a cultivator or similar implement is mounted on front of the tractor at the time of planting (2).

The following are disadvantages found when using the tractor track planting method:

1. Rear wheels of most tractors will not set in to the normal width for corn rows (8, 10).

2. Planting speed is limited by how fast land can be plowed. Planting should be done before the soil dries after plowing (3, 18).

3. The biggest problem associated with minimum tillage production is the lack of commercially developed equipment (27).

4. May have too low a plant population if the soil is worked

too wet. This is usually because the seed is poorly covered. This is no problem when the soil is mellow (10, 18).

Brower's et al. (5) found that minimum tillage corn would grow slower than conventional corn early in the season. At the same time, the minimum tillage corn had a larger and more vigorous root system. This may have turned into an advantage near tasseling time, since minimum tilled corn usually overcomes the early lag in growth. Most researchers and farmers using the wheel-track planting method usually makes three trips over the field; chopping or disking stalks, plowing and planting. Many farmers apply a pre-emergence chemical with the planting operation, usually only to the wheel track area.

Meggitt (11, 12) reported that a pre-emergence application of 2-chloro-4 ethylamino-6, isopropylamino-S-triazine (atrazine) at 2 and 4 pounds per acre has provided excellent weed control throughout the season without injury or reduction in yield of field corn in New Jersey.

Springer (20) has found in Delaware that excellent control of broadleaves and grasses was obtained with atrazine at 2 and 4 pounds per acre. 2-chloro-4, 6 bis (ethylamino) -S-triazine (simazine) was satisfactory at 2 pounds per acre on broadleaf weeds but not as effective on grasses. At 4 pounds per acre simazine gave good control of broadleaves but poor control of grasses.

Atrazine appeared to be much more effective on both broadleaf weeds and grasses than simazine when moisture was limited.

Meggitt (13) reported that simazine, atrazine and 2, 4-dichlorophenoxyacetic acid (2,4-D) provided excellent weed control

throughout the entire growing season even if no cultivation is performed. He also found that a 12-inch weed free band over the row plus one cultivation was not sufficient to eliminate weed competition.

The number of times a crop should or can be cultivated depends on the preparation before planting, the weather, the fertility and structure of the soil, and the growth of weeds. The main object of cultivation in most cases is to control or kill weeds. If weeds can be controlled by chemicals or some other means, we do not need to worry about cultivating many crops on most soils. The motto should be: "Plow as little as necessary to control weeds, and keep the soil ready for absorbing as much rain water as possible (23)."

In 1912 two USDA workers (21) concluded from a series of tests that cultivation is not beneficial to the corn plant except insofar as removing weeds is concerned.

CHAPTER III

METHODS AND MATERIALS

This study was conducted to compare minimum and conventional seedbed practices in corn production under Tennessee conditions. Each type of seedbed was subdivided to include two practices: weed control by using a herbicide and by cultivation. Experiments were initiated in 1960 and continued through 1961, at the University of Tennessee Main Agricultural Experiment Station, near Knoxville and five of the branch stations as shown in table 1.

Experimental Design

A split-plot design was used. The main treatments were conventional seedbed preparation and minimum seedbed preparation. Each main treatment was subdivided to include two practices; weed control by use of a herbicide and by cultivation. The four treatments may be designated as follows: plow-plant-spray, plow-plant-cultivate, conventional-spray and conventional-cultivate.

The main treatments were replicated six times. The sub-treatments were replicated twelve times. Each experimental plot consisted of six rows 40 feet long. Thirty feet of the two middle rows were harvested for yield.

Data were recorded on IBM cards and the analysis of variance was computed on an IBM 1620 Electronic Digital Computer. The program used was Analysis of Variance and Analysis of Covariance by Lew D. Harkins

Table 1.--Experiment station, location, soil type and previous crop where tests were conducted in 1960 and 1961.

Experiment station	Location	Soil type	Previous crop
Main	Knoxville	Cumberland loam	Corn
Tobacco	Greeneville	Cumberland silt loam	Fescue sod
Plateau	Crossville	Hartsells loam	Corn
Highland Rim	Springfield	Greendale cherty silt loam	Corn
Middle Tennessee	Spring Hill	Maury silt loam	Alfalfa
West Tennessee	Jackson	Richland silt loam	Cotton

of the Louisiana State University Computer Research Center.

Fertilizer Rates and Application

It was requested of each station superintendent that adequate fertilizer be applied to support yields of 100 bushels per acre if other conditions were favorable. The fertilizer including nitrogen was broadcast before plowing. A starter fertilizer was applied in a band at the time of planting. No additional fertilizer was applied after planting.

Variety and Plant Population

In 1960, Dixie 29 was planted at all locations except at the Highland Rim Experiment Station where Tennessee 501 was planted. In 1961, Dixie 29 was planted at all locations. The experiments were planted using two row tractor-drawn corn planters.

In 1960, the planters were calibrated to plant to a population of approximately 12,000 plants per acre. In 1961, the planters were calibrated to plant more than the desired population of 12,000 plants per acre. After the first cultivation, the corn was thinned to approximately 12,000 plants per acre.

Preparation of the Seedbed

The entire area was plowed, prepared and planted the same day. An area about 130 feet wide by 160 feet long was disked before plowing so the previous crop would be plowed under, and then plowed. Alternate

strips 40 feet wide were disked across the area (see figure 1) and a conventional seedbed prepared by disking twice, and harrowing or cultipacking. The remaining strips were planted after plowing only. The rows were planted across the conventional seedbed and plow-plant strips in continuous rows.

Weed Control

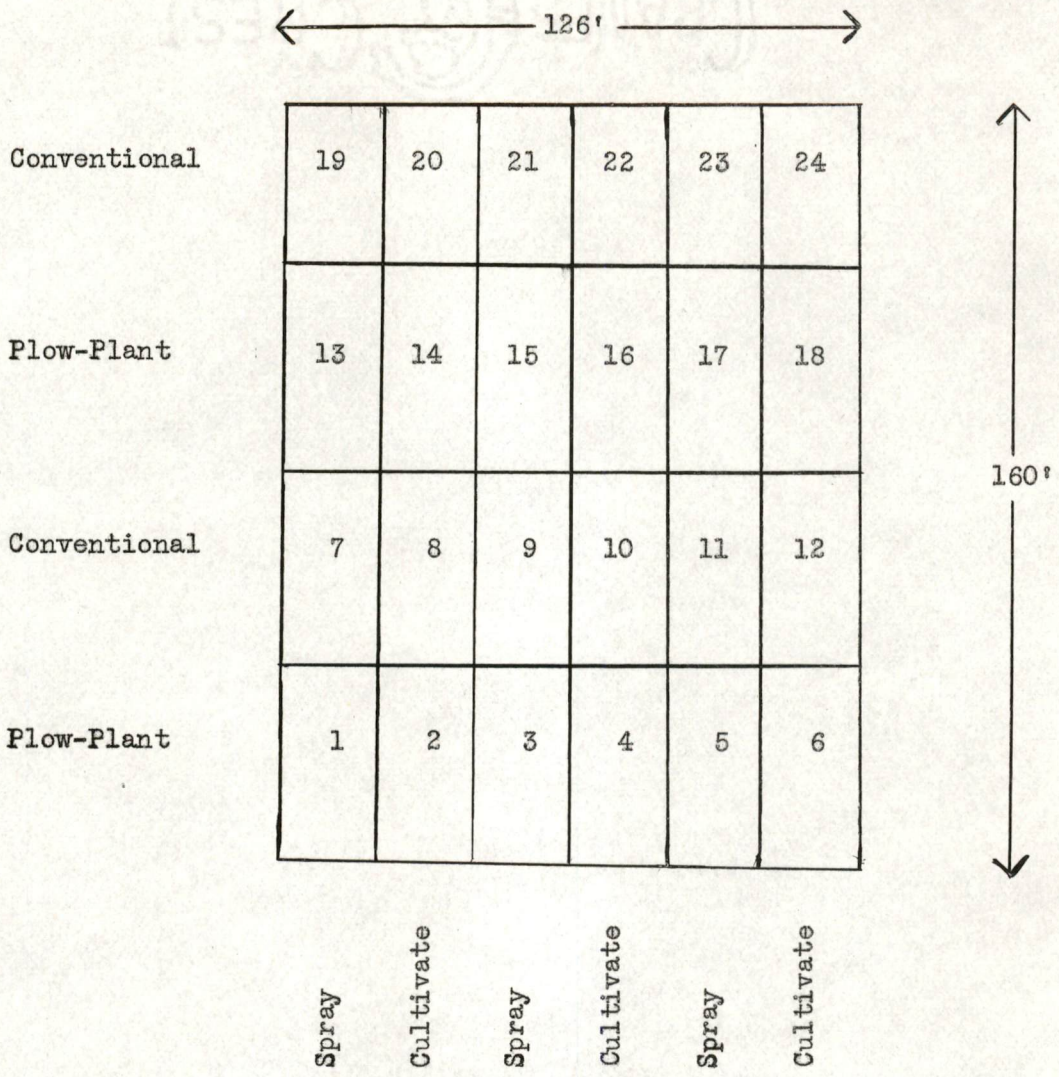
Weeds were controlled either by cultivation, or by a pre-emergence broadcast application of atrazine at the rate of two pounds active ingredient per acre. At harvest time a rating of weed control was made. A scale from 0 to 10 was used. No weed control was indicated by 0 and 10 indicated complete weed control.

Planting Dates

The planting dates were arranged as early as weather conditions and labor would permit. These dates are shown in table 2.

Harvesting

The corn plots were hand harvested, shucked and placed in a bag and weighed in the field. A sample of grain was collected from the harvested sample. Each sample was placed in an air tight plastic bag for moisture determination. Percent moisture was determined by the use of a "Steinlite Moisture Tester" and yields were corrected to 15.5 percent moisture.



Replications

Treatment	I	II	III	IV	V	VI
Plow-Plant-Spray	1	3	5	13	15	17
Plow-Plant-Cultivate	2	4	6	14	16	18
Conventional-Spray	7	9	11	19	21	23
Conventional-Cultivate	8	10	12	20	22	24

Figure 1.--Experimental design and plot layouts used in 1960 and 1961 at all locations.

Plant Characteristic

Notes were taken on lodging for the rows harvested. Where there seemed to be excessive lodging without evidence of damage from wind and rain storms, the stalks were examined for insect damage. Stand counts were made on the rows harvested.

Soil Bulk Density

Soil samples were collected for bulk density measurements by using a three by three inch cyclinder as described by Upland (22). Samples were taken at 1-4, 4-7 and 9-12 inch depths at the Tobacco, West Tennessee and Middle Tennessee Experiment Stations. Samples were taken at 1-4 and 4-7 inch depths at the Main, Plateau and Highland Rim Experiment Stations. Soil samples were taken in three replications and each sample depth from each plot taken twice.

The samples were dried in oven at 105° C for 24 hours, then weighed. The bulk density was calculated by the following formula:

$$\text{Bulk density} = \frac{\text{oven dry weight - weight of cyclinder}}{\text{volume of cyclinder}}$$

Table 2.--Planting dates for 1960 and 1961 at the six experiment stations.

Experiment station	Dates planted	
	1960	1961
Main	May 14	May 29
Tobacco	April 25	May 19
Plateau	May 17	May 17
Highland Rim	April 18	May 23
Middle Tennessee	April 15	May 4
West Tennessee	May 24	April 4

CHAPTER IV

RESULTS AND DISCUSSION

Results are discussed by individual factor studied. Analysis of variance shown in table 3 was made to determine the variation due to years, location, seedbed preparation, weed control and interactions of these factors. The average corn yields for years, locations, seedbed preparation, and weed control are shown in table 4.

Yields as Effected by Seedbed Preparation and Weed Control

There was no differences in yield between the methods of seedbed preparation at the 10 percent level of probability. The average yields for two years for minimum seedbed preparation was 115.1 bushels per acre as compared to 113.4 bushels per acre for the conventional seedbed preparation.

Weed control with atrazine was significantly better than weed control by cultivation at the one percent level of probability. The average yield for weed control with atrazine was 116.5 bushels per acre and 112.0 bushels per acre for the cultivated plots.

There was no significant difference in yields between seedbed x years and weed control x years at the 10 percent level of probability. There was a significant difference between seedbed x locations, and weed control x locations at the 0.01 level of probability. This would be expected when the seedbed and weed control are combined with locations because of the differences in climatic and edaphic conditions that exist

Table 3.--Analysis of variance of corn yields.

Source of variance	Degrees of freedom	Mean squares	F value	F test[1]
Years	1	8,738.42	100.15	**
Locations	5	11,050.72	126.66	**
Years x locations	5	13,191.07	151.19	**
Replications within locations	30	366.47	4.20	
Replications within locations x years	30	87.25		
Seedbed	1	202.00	2.650	NS
Seedbed x years	1	19.64	0.258	NS
Seedbed x locations	5	600.16	7.874	**
Seedbed x locations x years	5	870.31	10.418	**
Seedbed x replications within locations	30	115.41	1.514	NS
Seedbed x years x replications within locations	30	72.22		
Weed control	1	1,440.06	15.690	**
Weed control x years	1	35.00	0.381	NS
Weed control x locations	5	3,475.38	7.563	**
Weed control x years x locations	5	315.15	0.686	NS
Weed control x seedbed	1	344.09	3.744	10
Weed control x seedbed x years	1	35.84	0.390	NS
Weed control x seedbed x locations	5	687.70	1.497	NS
Weed control x seedbed x years x locations	5	293.41	0.638	NS
Weed control x replications within locations	30	5,483.69	1.989	*
Weed control x years x replications within locations	30	4,800.06	1.741	NS
Weed control x seedbed x replications within locations	30	2,224.08	0.807	NS
Weed control x seedbed x years x replications within locations	30	2,756.84		

[1]F test

** significant at one percent level of probability.
* significant at five percent level of probability.
10 significant at ten percent level of probability.
NS not significant at ten percent level of probability.

Table 4.--Average corn yields in bushels per acre corrected to 15.5 percent moisture for years, location, seedbed preparation and weed control.

Experiment station	Seedbed	Weed control	Year		2 year average
			1960	1961	
Main	Plow-plant	Spray	74.6	102.5	88.5
	Plow-plant	Cultivate	68.6	103.8	86.2
	Conventional	Spray	59.2	108.6	83.9
	Conventional	Cultivate	57.5	111.6	84.6
Tobacco	Plow-plant	Spray	104.4	149.4	126.9
	Plow-plant	Cultivate	95.8	138.1	117.0
	Conventional	Spray	96.4	137.7	117.1
	Conventional	Cultivate	95.4	138.7	117.0
Middle Tennessee	Plow-plant	Spray	141.1	115.9	128.5
	Plow-plant	Cultivate	124.4	104.2	114.3
	Conventional	Spray	160.5	111.2	135.9
	Conventional	Cultivate	155.6	107.5	131.6
West Tennessee	Plow-plant	Spray	99.7	142.2	121.0
	Plow-plant	Cultivate	101.1	138.2	119.6
	Conventional	Spray	97.0	119.3	108.2
	Conventional	Cultivate	100.3	134.3	117.3
Plateau	Plow-plant	Spray	122.4	118.1	120.3
	Plow-plant	Cultivate	103.6	106.0	104.8
	Conventional	Spray	120.0	116.4	118.2
	Conventional	Cultivate	101.7	98.4	100.1
Highland Rim	Plow-plant	Spray	133.5	116.9	125.2
	Plow-plant	Cultivate	142.4	114.8	128.6
	Conventional	Spray	126.9	121.3	124.1
	Conventional	Cultivate	127.3	118.6	123.0

between the extremes of the Tobacco Experiment Station near Greeneville and the West Tennessee Experiment Station near Jackson, Tennessee.

There was no significant difference in yields due to weed control x years x locations interactions at the 10 percent level of probability which points out that herbicides gave excellent weed control at each location for the two years studied.

There was a significant difference between seedbed x years x locations effects at the one percent level of probability. This indicates that the seedbed preparations did differ for locations during the two years studied. The weed control x seedbed interaction was significantly different at the one percent level of probability. This indicates a difference between the type of weed control and the seedbed preparations. The minimum seedbed preparation sprayed with atrazine had an average yield of 118.4 bushels per acre, while the minimum seedbed that was cultivated had an average yield of 111.7 bushels per acre. Here there was a significant difference of 6.7 bushels per acre. The conventional seedbed preparation sprayed with atrazine had an average yield of 114.5 bushels per acre and the conventional seedbed preparation that was cultivated had an average yield of 112.2 bushels per acre, a difference in yield of only 2.2 bushels per acre.

These data show that the minimum seedbed preparation combined chemical weed control produced significantly higher yields than the other treatments.

Weed Control

Weeds were controlled either by cultivation or by a pre-emergence broadcast application of atrazine at the rate of two pounds active ingredient per acre. Mechanical cultivation gave adequate weed control with two cultivations but annual weeds germinated and matured after the last cultivation. Atrazine gave excellent control of all annual weeds on both seedbed preparations with no mechanical cultivation. Table 5 shows the weed ratings for 1960 and 1961. The average for the sprayed plots was 7.9 and the average for the plots cultivated was 5.6.

Lodging

Lodging was not a serious problem on any of the treatments. This may be accounted for by early harvesting after maturity. In 1960, there was more lodging at West Tennessee Experiment Station than at the other locations. This set of plots was harvested in late November and was subject to more rain and wind than the other locations. A local wind and rain storm caused excessive bending and lodging at the Highland Rim Experiment Station during the growing season in 1961. The average number of plants lodged are shown in table 6.

General Observations

It was observed that corn on the seedbed with minimum preparation grew faster during seeding stage than corn on the conventionally prepared seedbed. When the corn was waist high there was no observable difference in growth between treatments. Excessive moisture and lack of

Table 5.--Average rating of weed control for each treatment at each location. (0 = no weed control 10 = complete weed control)

Experiment station	Seedbed	Weed control	Years		2 year average
			1960	1961	
Main	Plow-plant	Spray	9.5	7.7	8.6
	Plow-plant	Cultivate	4.0	8.2	6.2
	Conventional	Spray	6.0	8.7	7.4
	Conventional	Cultivate	3.8	8.5	6.2
Tobacco	Plow-plant	Spray	8.0	10.0	9.0
	Plow-plant	Cultivate	7.0	7.3	7.2
	Conventional	Spray	9.0	10.0	9.5
	Conventional	Cultivate	8.0	7.2	7.6
Middle Tennessee	Plow-plant	Spray	5.2	5.2	5.2
	Plow-plant	Cultivate	2.2	2.2	2.2
	Conventional	Spray	4.7	5.3	5.0
	Conventional	Cultivate	2.0	2.7	2.4
West Tennessee	Plow-plant	Spray	8.7	9.0	8.8
	Plow-plant	Cultivate	8.7	3.5	6.1
	Conventional	Spray	7.6	9.3	8.4
	Conventional	Cultivate	8.2	3.8	6.0
Plateau	Plow-plant	Spray	8.8	7.3	8.0
	Plow-plant	Cultivate	5.7	7.8	6.8
	Conventional	Spray	7.2	7.0	7.1
	Conventional	Cultivate	4.8	7.0	5.9
Highland Rim	Plow-plant	Spray	8.8	8.3	8.6
	Plow-plant	Cultivate	5.5	5.8	5.6
	Conventional	Spray	8.7	9.5	9.1
	Conventional	Cultivate	4.8	6.8	5.8

Table 6.--Average number of plants per plot lodged for each treatment at each location.

Experiment station	Seedbed	Weed control	Years		2 year average
			1960	1961	
Main	Plow-plant	Spray	10.2	11.2	10.7
	Plow-plant	Cultivate	8.8	8.7	8.8
	Conventional	Spray	7.8	20.7	14.2
	Conventional	Cultivate	10.2	20.7	15.4
Tobacco	Plow-plant	Spray	13.5	6.7	10.1
	Plow-plant	Cultivate	14.2	10.0	12.1
	Conventional	Spray	16.5	5.5	11.0
	Conventional	Cultivate	19.7	8.0	13.8
Middle Tennessee	Plow-plant	Spray	5.0	4.7	4.8
	Plow-plant	Cultivate	2.5	2.8	2.6
	Conventional	Spray	7.3	7.3	7.3
	Conventional	Cultivate	6.0	7.0	6.5
West Tennessee	Plow-plant	Spray	28.6	15.0	21.8
	Plow-plant	Cultivate	26.4	16.0	21.2
	Conventional	Spray	23.6	18.0	20.8
	Conventional	Cultivate	22.2	15.0	18.6
Plateau	Plow-plant	Spray	4.3	9.5	6.9
	Plow-plant	Cultivate	1.8	4.7	3.2
	Conventional	Spray	5.7	10.5	8.1
	Conventional	Cultivate	2.7	3.7	3.2
Highland Rim	Plow-plant	Spray	4.0	14.5	9.2
	Plow-plant	Cultivate	3.2	13.3	8.2
	Conventional	Spray	5.5	8.7	7.1
	Conventional	Cultivate	4.3	9.7	7.0

aeration on the conventionally prepared seedbed may have caused this early difference in growth.

Stand counts in 1960 shown in table 7 indicated that one could expect as good a stand with tractor wheel track planting on the minimum seedbed as on the conventional seedbed. The only exception was at the Middle Tennessee Experiment Station where there was a higher plant population on the conventional seedbed preparation. This may have been due to the use of a large tractor to pull the planter. The rear wheels could not be set in close enough for the planter to follow in the tractor wheel tracks, resulting in poor seedbed.

In 1961, the planters were calibrated to plant well over the desired population and then thinned back to a stand of about 12,000 plants per acre. This is shown in table 7.

Soil Bulk Density

The results from these data did not confirm that reported by Overdohl and others (16) who found that measurements of soil density showed the soil to be less packed under minimum tillage than under conventional practices. As shown in table 8, there is little difference between treatments. Samples were difficult to take on the minimum seedbed preparation--spray plots due to the looseness of the soil which tended to fall out of the sample cylinder. In adjoining plots where there had been mechanical cultivation, the soil sample would remain intack with no special care.

It is the opinion of the author that it will take several years

Table 7.--Average number of plants per acre for each location and treatment.

Experiment station	Seedbed	Weed control	Years		2 year average
			1960	1961	
Main	Plow-plant	Spray	8,942	13,280	11,111
	Plow-plant	Cultivate	9,091	13,170	11,130
	Conventional	Spray	9,155	13,240	11,198
	Conventional	Cultivate	8,154	13,280	10,717
Tobacco	Plow-plant	Spray	9,510	11,980	10,745
	Plow-plant	Cultivate	9,275	13,810	11,542
	Conventional	Spray	10,920	12,210	11,565
	Conventional	Cultivate	10,255	14,040	12,148
Middle Tennessee	Plow-plant	Spray	12,331	11,970	12,150
	Plow-plant	Cultivate	10,193	10,670	10,432
	Conventional	Spray	17,029	12,030	14,529
	Conventional	Cultivate	15,413	12,550	13,986
West Tennessee	Plow-plant	Spray	11,885	12,300	12,092
	Plow-plant	Cultivate	11,989	12,260	12,124
	Conventional	Spray	11,902	12,440	12,171
	Conventional	Cultivate	12,248	12,600	12,424
Plateau	Plow-plant	Spray	12,935	17,020	14,978
	Plow-plant	Cultivate	11,518	16,260	13,889
	Conventional	Spray	13,044	17,400	15,222
	Conventional	Cultivate	12,172	16,740	14,476
Highland Rim	Plow-plant	Spray	10,827	11,460	11,144
	Plow-plant	Cultivate	12,072	12,060	12,066
	Conventional	Spray	11,616	12,260	11,938
	Conventional	Cultivate	12,030	12,220	12,125

Table 8.--Average bulk density value for various depths, treatments and locations.

Experiment station	Seedbed	Weed control	Inch depths		
			1 to 4	4 to 7	9 to 12
Main	Plow-plant	Spray	1.150	1.239	-----
	Plow-plant	Cultivate	1.201	1.270	-----
	Conventional	Spray	1.174	1.242	-----
	Conventional	Cultivate	1.203	1.343	-----
Tobacco	Plow-plant	Spray	1.335	1.412	1.595
	Plow-plant	Cultivate	1.403	1.411	1.582
	Conventional	Spray	1.331	1.374	1.520
	Conventional	Cultivate	1.381	1.447	1.582
Middle Tennessee	Plow-plant	Spray	1.335	1.374	-----
	Plow-plant	Cultivate	1.362	1.445	-----
	Conventional	Spray	1.341	1.368	-----
	Conventional	Cultivate	1.328	1.426	-----
West Tennessee	Plow-plant	Spray	1.396	1.390	1.535
	Plow-plant	Cultivate	1.406	1.426	1.508
	Conventional	Spray	1.418	1.424	1.470
	Conventional	Cultivate	1.406	1.418	1.481
Plateau	Plow-plant	Spray	1.055	1.146	-----
	Plow-plant	Cultivate	1.197	1.347	-----
	Conventional	Spray	1.125	1.322	-----
	Conventional	Cultivate	1.248	1.256	-----
Highland Rim	Plow-plant	Spray	1.348	1.378	-----
	Plow-plant	Cultivate	1.422	1.605	-----
	Conventional	Spray	1.326	1.397	-----
	Conventional	Cultivate	1.323	1.422	-----

to detect noticeable changes in bulk density between minimum seedbed and conventional seedbed preparation on soils that have been under continuous cultivation for several years, due to the fact that the soil is plowed every spring before corn is planted. If the plots are seeded to a cover crop in the fall after corn is harvested, the plow layer will be disturbed again.

CHAPTER V

SUMMARY AND CONCLUSIONS

The objective of this study was to determine the relationships between two types of seedbed preparation combined with two types of weed control for corn production. These two types of seedbeds were: conventional and minimum seedbed preparation. Each seedbed preparation was subdivided to include weed control by the use of a pre-emergence application of atrazine and by mechanical cultivation. This study was conducted to determine the effect of these treatments on yield, control of weeds, stand, lodging, and soil compaction.

The effects of these treatments were measured in terms of grain yield in bushels per acre, number of plants, plants lodged, weed control ratings, and bulk density at harvest time. From this study the following conclusions may be drawn:

There was no difference in yields between conventional seedbed and minimum seedbed preparation at the 10 percent probability level. Not only did minimum seedbed preparation yield the same as conventional seedbed preparation, it required fewer trips over the field which resulted in a savings in the cost of labor and machinery.

Corn yields of plots sprayed with atrazine were significantly higher than the cultivated plots at the one percent level of probability regardless of which type of seedbed preparation was used.

Stand counts in 1960 indicated that one could expect about equal stands of corn with the two types of seedbed preparation when the corn

was planted in the tractor wheel tracks.

Most annual weeds can be controlled easier and more successfully with the use of atrazine than by cultivation with little difference in initial cost.

Soil bulk density indicated little difference in compaction at harvest time due to the seedbed preparations and tillage practices.

It is the opinion of the author that corn can be grown in Tennessee with fewer operations in seedbed preparation and cultivation than are commonly used by the practice of minimum seedbed preparation with wheel track planting and weed control by the use of atrazine on soils that are recommended for corn production.

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