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LONG-TERM EFFECTS OF NO-TILL CROPPING SYSTEMS ON EROSION AND RUNOFF FROM WEST TENNESSEE LOESS SOILS

A Thesis

Presented for the

Master of Science

Degree

The University of Tennessee, Knoxville

Swannie Jett

AUGUST 1995

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DEDICATION

This thesis is dedicated to my parents, William Joseph Jett and Diane Jett, and my extended family Donya and Quadir Jett. I deeply regret my father couldn't see this moment. I truly appreciate the support of my entire family and without the birth of my son, I would not have extended my educational opportunities beyond the Bacculerate level.

ACKNOWLEGEMENTS

My sincere thanks are directed to my major professor, Dr. Daniel C. Yoder, for sharing his best judgements throughout this project. His support as a friend and advisor was greatly appreciated. I extend my thanks to my other committee members, Dr. Ronald E. Yoder, Dr. Donald D. Tyler, for their advice in aiding the thesis project and related academic decisions. I would like to thank Dr. Fred D. Tompkins and Dr. McDow for their support and introduction into the department.

My gratitude also includes John Bradley and the entire staff at the Agricultural Extension Station in Jackson, TN. I would like to thank all the staff in the Agricultural Engineering Department.

ABSTRACT

This study focused on comparing the hydrologic responses of a West Tennessee loess soil to identical simulated rainfall events in the early 1980's and 1994. The goal is to see whether long-term no-till (in place longer than 10 years) causes a significant change in that hydrologic response. For these treatments, the amount of runoff and the peak rate of runoff were measured. Two quantitative parameters (the total amount of rainfall, the total amount of runoff) were used to determine the final runoff amount. The runoff values from the 1980's were significantly higher than runoff values for the 1994 study, though it is not understood to what these differences should be attributed. The runoff amounts for the 1994 study were greatest for tillage double crop, followed by no-till and tillage single crop, respectively.

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CHAPTER 1

INTRODUCTION

Soil erosion began in the New World centuries ago, and removes valuable topsoil and nutrients. Man has contributed to much of the soil erosion that has taken place. This is perhaps best summarized in the following quote:

> " Fleas are parasite upon men: if they are few they cause him minor discomfort, but no serious harm, so that his vitality and power to continue functioning are not impaired. If the fleas become excessively numerous, they may so weaken their host by their depredations as finally to destroy him and, in the absence of any other host, themselves. A few men can live parasitically upon a soil, without destroying it, but should destroy it unless they find means to enhance its annual increment of fertility. For, as fleas suck men's blood, so men suck the fertility of soils" (Hyams, 1952).

In 1982, studies showed that 44 percent of U.S. cropland was losing topsoil above soil loss tolerance levels. This annual loss of soil was estimated as 1.7 billion tons from 422 million acres of cropland (Brown and

Wolf, 1984). The total soil loss that year for the world was 25,400 million tons (Brown and Wolf, 1984). Soil loss has long been recognized as a problem, because in 1936 depending on the cropping system the average annual soil loss was 2.7 tons/acre for a corn, wheat, and clover rotation (Miller, 1936). Controlling erosion is vital to our survival as a human race for our food supply is linked very closely to the quality of our soil resource (Ayres, 1936). The poem below states this in a personal way:

> " Hordes of gullies now remind us / we should build our lands to stay / and departing leave behind us / fields that have not washed away / Then when our boys assume the mortgage / on the land that's had our toil / they'll not have to ask the question / here's the farm / but where's the soil? (Ayres, 1936)."

Scientists and researchers have long been studying new methods with which to conserve valuable topsoil. No-till leaves the soil undisturbed. Studies of no-till's effectiveness at controlling erosion are conclusive (Tyler et al., 1994). In spite of this, recent research findings raise new questions concerning the long-term impact of no-till on the hydrologic response of soils. A majority of studies on no-till analyze its short-term effects on agricultural lands (Harrold and Edwards, 1972; McGregor et al., 1975; Harrold et al., 1970; Jones et al., 1969; Laflen

and Colvin, 1981; Lal, 1976; Langdale et al., 1979). In these studies, no-till was effective in reducing erosion during periods of excessive rainfall, partially due to the cover present on the suface at the time. Also, the amount of runoff was reduced during these periods of excessive rainfall. On the contrary, other studies show no-till to be effective at controlling erosion, but show that runoff increases with no-till usage (Bicki and Felsot, 1988; Shelton et al., 1983). One long-term study has analyzed no-till on agricultural lands (Burwell and Kramer, 1983). This study was conducted over a period of 24 years. The results revealed 13 percent more runoff for conventional tillage than for conservation tillage. Cumulative soil loss for conventional tillage was 141.1 t/ha (62.9 tons/acre), compared to 60.3 t/ha (26.9 tons/acre) for the conservation tillage treatment. Though many studies have documented no-till's effectiveness for controlling erosion, more long-term research is needed to understand the effects of no-till on erosion and runoff.

OBJECTIVES

Scientist have used short-term data to predict long-term soil losses for no-till without considering the long-term hydrologic response of soils in relation to no-till management systems. To analyze no-till effectively,

studies should answer whether there are long-term impacts of no-till on runoff. By providing an answer to this question we can begin to answer other questions, such as: are there increased or decreased runoff amounts with no-till?; what are the potential implications for chemical movement with no-till?; is there more infiltration and leaching with no-till?; what are the effects of no-till systems on soil properties such as aggregation?; does no-till present a threat to water quality?; can no-till decrease chemical losses carried in eroded sediment? Better comprehension of the effects of no-till can lead to overall improved management strategies for conservation tillage systems. The specific objective of this study was to answer the question of whether there is a long-term impact of no-till on runoff rates and amounts for West Tennessee loess soils. This question is especially important because of the high susceptibility of these soils to erosion (Shelton et al., 1983).

CHAPTER 2

LITERATURE REVIEW

BACKGROUND

Soil erosion is a major problem in the U.S., causing the land resource to be slowly degraded. Also, soil erosion has become a problem because of the chemicals that move downstream in runoff, contaminating the surface water and groundwater supplies. The dilemmas that we face today are a reflection of farm management practices used on soils in the past (King, 1983). Historically, farmers plowed or turned their top soil (Christensen and Magleby, 1983). The top soil is the richest and most fertile part of the soil. This method of tilling is often called conventional tillage, and was a common management practice used in the past. To curb the loss of top soil, researchers studied new methods that combat erosion, produce crops at an economical level, and limit chemical movement to water supplies. Hopefully, the best management practice will be implemented soon, for there is a possibility that our land resource will not be able to feed our growing population in the near future (Ayres, 1936).

In the meantime, while researchers are studying new methods to combat erosion, Congress has passed two laws to

help conserve the soil. The first are the 1972 amendments to the Federal Water Pollution Control Act of the U.S.. These require plans for the control of non-point pollution in drainage water and sediment carrying dissolved and absorbed nutrients from agricultural land (Johnson and Moldenhauer, 1979). The second law is the Food Security Act of 1985, which states that farmers with highly erodible land must apply an acceptable conservation plan to be eligible for certain federal farm program benefits (Yoo and Touchton, 1988). Today, the Natural Resource Conservation Service of the USDA is responsible for writing farm plans for highly erodible land. These plans hopefully will conserve fertile soil for future generations.

Furthermore, through much research, scientists have found a new method called conservation tillage that can reduce soil erosion and conserve soil water (Shelton et al., 1983; Larson, 1979). Conservation tillage systems have been shown to effectively reduce erosion from agricultural sites. In general terms conservation tillage is defined as a tillage system that leaves at least 30% residue cover on the soil surface after planting. The most effective conservation tillage system is no-till (NT), where the soil is left almost completely undisturbed by tillage. There are other conservation tillage methods that could be effective, but no-till (NT) provides the best

opportunities for controlling soil erosion, mainly due to the cover associated with no-till systems (Larson, 1979).

No-till has been proven to be very effective at reducing soil erosion (Mostaghimi et al., 1988; Blevins et al., 1977; Edwards et al., 1988). No-till is effective at reducing erosion for various reasons, beginning with the cover provided. Residue cover protects the soil surface from high intensity storms by absorbing raindrop impact energy. Studies by Miller et al. (1988) and Singer et al. (1980) revealed that when vegetative cover was absent, surface crusts were formed by raindrop impact, thereby reducing infiltration and causing runoff. No-till controls soil loss by maintaining the crop residue cover when it is needed during the spring and summer months, which is when much of the erosive rainfall occurs. In essence, proper management of crop residue can be an effective way to combat erosion.

Also, with no-till management systems there tends to be a buildup of organic matter (OM) in surface layers, which probably can be attributed to the residue cover on the surface. Tyler et al. (1983) and Blevins et al. (1977) found that no-till management increases organic matter in the top 5 to 10 cm of the soil. In general, residue cover increases organic matter, which directly increases soil water content, thereby improving crop yields (Denton and Wagger, 1992).

On poorly drained soils, no-till sometimes doesn't provide positive effects on productivity, probably because of the high water content in the soil. However, in droughty conditions no-till helps retain water, often yielding positive impacts on productivity. Overall, productivity for no-till is about the same as for tillage systems (Yoo et al., 1987).

No-till is also effective in reducing erosion because of its ability to change soil structure, which is one soil characteristic that man can change by implementing soil management practices. Soil structure is broken down into units called aggregates. There are several aggregate types: granular, platy, blocky, and prismatic (Brady, 1990). Granular type aggregates usually exist in the A horizon. The organic matter in this horizon is high (Baver and Rhoades, 1932). Burr and Russell (1927) reported that good aggregation is important in combating erosion processes. Organic matter enhances the formation of aggregates. Thus, application of organic matter to the soil surface can increase aggregation.

No-till is effective in improving soil structure because of residue cover's direct influences on organic matter, soil water content, and aggregation. All the factors aforementioned are dependent upon each other.

Surface soil bulk densities may tend to increase with conversion to no-till. Studies show bulk density increases

in the top 9 in. (228.6 mm) with some no-till systems (Griffth et al., 1977; Gantzer and Blake, 1978; Lindstrom et al., 1984; Edwards et al., 1988). Other studies reveal lower bulk densities with no-till usage (Blevins et al., 1983), therefore the effects of no-till on bulk density are inconclusive.

In addition, increased biological activity is often associated with better soil structure. The increases in cover and OM with the implementation of no-till management systems promote good temperatures and water contents for biological activity. When biological activity increases, macroporosity has a tendency to increase because of the improvement in soil structure, and because earthworms feed on organic matter in soils, creating holes. Earthworms live in vertical burrows, 5 mm in diameter and 1 to 3 m deep. Because of the lack of tillage associated with no-till, large vertical earthworm burrows are allowed to persist, creating pathways for infiltration (Edwards et al., 1989). Studies have revealed rapid water movement downward in earthworm burrows, contributing to high infiltration (Beven and Germann, 1982). Good biological activity in soils enhances aggregation and overall beneficial soil structure effects.

The high antecedent soil water contents resulting from no-till may cause reductions in infiltration, which can lead to more runoff. This is evident in the impact of

antecedent soil water on runoff calculations, as indicated in the SCS curve number approach (Schwab et al., 1993). What is not so clear is what curve numbers and antecedent water corrections should be applied to no-till situations.

In summary, the impacts of no-till on soil hydrology are unclear. The better structure and increased macroporosity usually resulting from no-till tend to increase infiltration rates. On the other hand, increases in bulk density and antecedent soil water tend to decrease infiltration rates. Scientific studies reflect these competing effects.

Some studies show that runoff decreases with no-till usage (Larson, 1979; Mostaghimi et al., 1988; Miller et al., 1988; Beven and Germann, 1982; Griffth et al., 1977; Gantzer and Blake, 1978; Lindstrom et al., 1984; Edwards et al., 1988; Kramer, 1986). On the contrary, other studies show that no-till reduces infiltration and increases runoff (Bicki and Felsot, 1988; Shelton et al., 1983). These studies suggest that the differences in no-till's influence on infiltration may be related to soil type, climate, and the amount of residue on the field.

However, most of the studies were completed within the first few years after conversion of the sites from tillage to no-till. Experiences with long-term no-till indicate that it may take years for the changes in soil structure and bulk density to stabilize (Burwell and Kramer, 1983).

The importance of time as a factor in no-till's impact on infiltration can only be determined by examining the soil's hydrologic response over many years.

The impacts of no-till on hydrology are important because of the resulting impacts on chemical movement, and because of the specific chemical requirements associated with no-till. With the conversion to no-till chemical usage may increase due to the lack of tillage. Chemicals are used to kill weeds, since cultivation is usually not done with no-till systems. The high moisture content associated with no-till systems aids all plant activity, thereby affecting the growth of crops and weeds. Weeds compete for nutrients, disturbing the growth of surrounding crops. Chemicals are used to kill the weeds surrounding the crops and to help promote crop growth, but it is not known what effect this could have on water quality.

We can analyze possibilities of where the water goes by considering chemical transportation. Chemicals can be transported through surface runoff, subsurface percolation and with sediment in surface runoff (Baker and Laflen, 1983). Chemical movement is affected by the persistence and location of the chemical in the soil profile. The impact of no-till on infiltration and runoff dictates the amount of chemical runoff. The chemical location in the soil profile is important, for if it is at the soil surface when rainfall occurs, it will mix with soil and water in a

thin mixing zone. From there the mixture will either infiltrate or run off. Therefore, it is very important to resolve whether the water moves on the soil surface or through the soil profile.

When chemical-laden water infiltrates through the soil, adsorption may take place. Soil adsorption plays a major role in determining concentrations of chemicals between soil and water (Baker and Laflen, 1983). The degree of chemical adsorption will determine how fast chemical removal takes place from the mixing zone. If the water infiltrates into the soil profile, the soil acts as a buffer, tending to break down chemicals and other water contaminants through chemical and microbial degradation.

There will be a lesser impact of contamination on total water supply with the passage of water through the soil. If rainfall doesn't infiltrate through the soil profile but rather immediately becomes runoff from the soil surface, there is no barrier to protect the surface water supply from contamination such as the buffer protection the soil provides for the groundwater supply.

In summary, it is important to understand the impact of no-till on hydrology, as this may control the movement of chemicals to the surface water and groundwater supplies. Though the adsorption and breakdown of chemicals on infiltrating water is greater than that in runoff, it is important to understand how much water infiltrates so that

the roles can be assessed. Based on the information summarized here, it appears that only an understanding of no-till's long-term impact on hydrology will provide an adequate basis for evaluating the impact of no-till on water quality.

CHAPTER 3

MATERIALS AND METHODS

OVERVIEW

The major objective of this study was to answer the question: how does long-term no-till affect runoff rates and amounts? This question was addressed using plots under long-term no-till and tillage systems at the Milan Experiment Station in Milan, Tennessee. Rainfall simulators were used to apply precise amounts and intensities of water to the plots. This experiment was conducted following the format used by Curtis Shelton in 1980-84 (Shelton et al., 1983). The intent was to duplicate those runs by performing the tests on the same dates, and applying the same rainfall amounts and intensities. The primary difference between the two studies was the element of time. A comparison of Curtis Shelton's data and this research was completed by analyzing runoff volume, peak runoff rate, and time to peak. This provided information about the change in hydrologic response of each plot.

EXPERIMENTAL SET-UP

This experiment utilized three plots: tillage single crop soybean, no-till double crop soybean-wheat, tillage double crop soybean-wheat. Each plot is 0.25 acre (0.10 ha) in size. The slopes of the plots range from 5.0 to 8.4 percent, and the soil type on the plots is Lexington silt loam. Each plot is isolated from outside surface water impacts in that it is graded and surrounded by an elevated border. The lower grassed border is used as a channel to collect runoff and to route it through a 1 ft H-type flume for flow measurement.

A float in a stilling well attached to the flume is used to measure water depth in the flume. The float position is measured using a rotary potentiometer that provides a linear relationship between float position and output voltage. The float voltage over time is measured with a Campbell Scientific CR10 data logger. The CR10 was programmed to collect time and voltage information every ten seconds, which could then be converted to flow rate versus time through use of the potentiometer calibration and the flume rating curve.

The water for the artificial rainfall was supplied from a pond. A pump supplied water to twelve sprinklers on each plot, which applied water to the plot. The sprinklers

were designed to apply 0 to 6 in/hr (0 to 152.4 mm/hr) of water. The sprinklers stand 16.5 ft (5.02 m) above ground level. The reason for the sprinkler elevation was an attempt to duplicate natural rainfall energy. The characteristics of artificial rainfall may not be exactly like natural rainfall, but the objective of this study was not to mimic natural rainfall but rather to duplicate earlier runs. Artificial rainfall was applied to a single plot at a time. The rate of application was controlled by the pump motor speed. Due to motor limitations, the actual application rate ranged from 1.5 to 4 in/hr (38.1 mm/hr to 101.6 mm/hr).

The pump pressure was calibrated to make sure the correct application rate was applied. Nine catch cans were set on posts above the canopy of each plot, and the flow was regulated at a series of different pressures. The water was pumped for an extended period at each pressure. The water in each catch can was then measured, and the application rate was calculated for each pressure. A curve for application rate versus pressure reading was developed (Fig. III-1). To apply rainfall at a specific rate, the required pressure from the curve was used. The aforementioned allowed the application rates and periods to duplicate the 1980-84 tests.

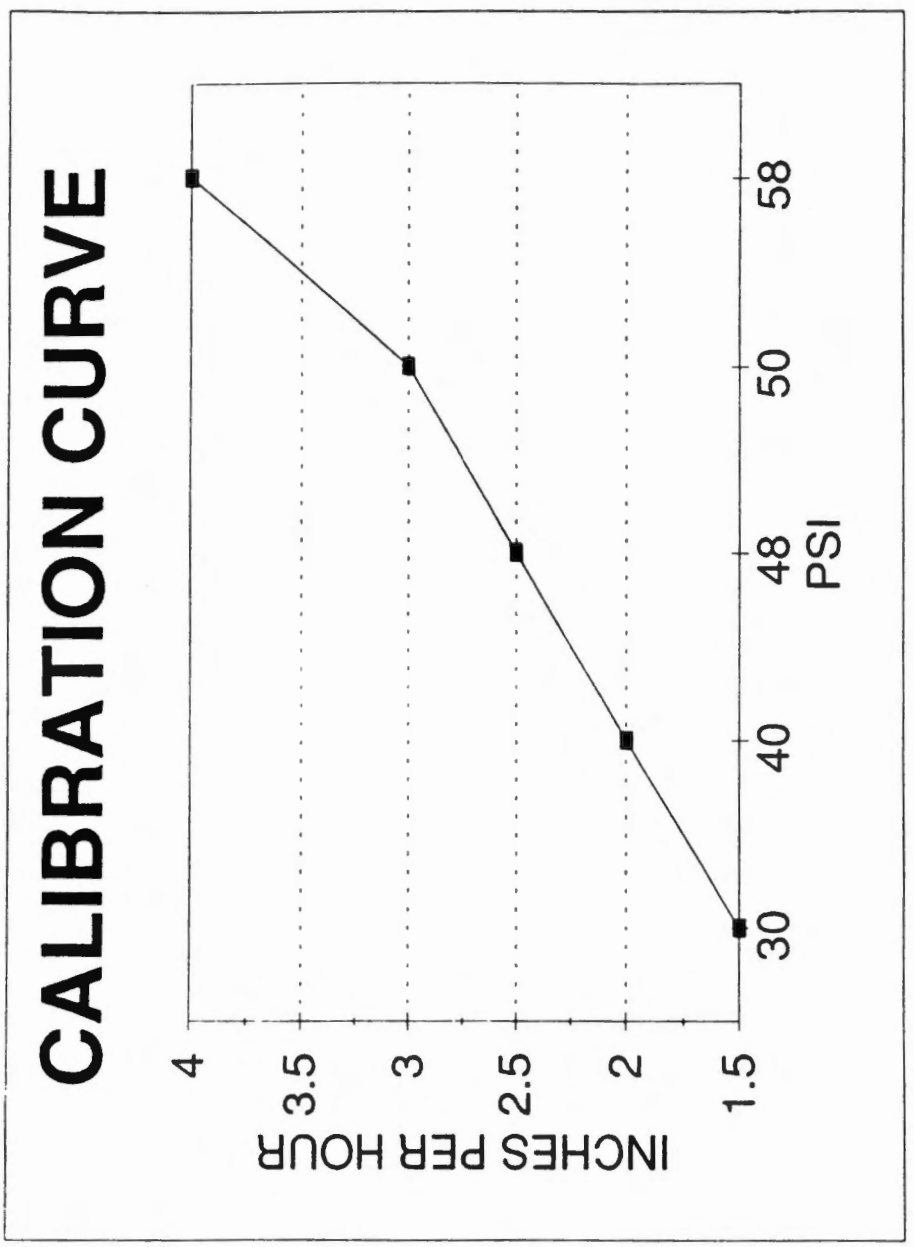

Figure III-1. Calibration curve

CURTIS SHELTON'S TESTS (1980-1984)

Curtis Shelton conducted five tests. The dates for the tests were May 12, 1983, July 3, 1980-81, July 7-8, 1982, August 27, 1984, and October 31, 1980. Shelton's data only supplied three to eight flow rates versus time points for each test. These points were taken manually from paper charts. The complete earlier data was not available, so the few points to define runoff were used. None of the earlier tests accounted for antecedent soil water content.

TESTS (1994)

There were six test dates in 1994, set to coincide with the earlier tests. The six dates were May 19, July 1, July 7-8, August 27, October 31, and November 12, 1994. Some of these dates compared to one or more 1980-84 tests. Antecedent water conditions in the soil were estimated by evaluating rainfall in a three day period before the 1980-84 tests. If rainfall occurred within a three day period, the rainfall simulator would have been operated to reflect those conditions. This correction was not necessary, for none of the tests in 1980-84 was proceeded by rainfall.

The data collected from these tests will allow a comparison of runoff characteristics between the runs from the early 1980's and the tests performed in 1994.

CHAPTER 4

RESULTS AND DISCUSSION

On the following pages figures IV.1-6 shows graphs reflecting the runoff data collected from the earlier and more recent tests. A summary of this information is presented in Table IV-1 on the following page, which the displays the runoff volume for each plot and date, the runoff peak time, the peak rate, and the percentage of applied rainfall that left the plot as runoff.

Most of the runs compared responses from the no-till plot and either the tillage double crop soybean-wheat or tillage single crop soybean. There were two exceptions; the test in May, which was used to trouble-shoot the system, and the test in November, which was used to compare tillage systems.

Several general statements can be made by looking at the results. First, the runoff volumes, peak runoff rates, and percentage of runoff are much greater for the earlier tests than for 1994 tests. This could have been due to a number of factors. First, there may be changes in soil characteristics like what was expected based on the background material. Secondly, the analysis of Shelton's data brought up questions about its validity. For example, Shelton's data reflected

Table IV.1 SUMMARY OF RESULTS

Date	Plot	Volume (ft.^3)	Peak Time (sec)	Peak Rate (cfs)	Rnfall. Time	%Runoff
5/12/83	Tillage Single	1916	720	0.769	1 hr	46.5
5/19/94	Tillage Single	465.2	2550	0.179	1 hr	28.5
7/3/80	No-till	452.4	108	0.211	1 hr	38.8
7/1/94	No-till	0	0	0	1 hr	0
7/3/81	Tillage Double	412.5	488	0.363	30 min	45.7
7/1/94	Tillage Double	74.4	665	0.0987	1 hr	3.80
7/8/83	No-till	685.6	1510	0.302	45 min	48.9
7/8/94	No-till	314.4	1008	0.398	1 hr 15 min	13.0
7/7/82	Tillage Double	885.2	1620	0.693	45 min	43.9
7/7/94	Tillage Double	153.4	960	0.117	1 hr 15 min	5.00
8/27/84	No-till	1643	2772	0.668	1 hr	35.8
8/27/94	No-till	221.3	1470	0.162	1 hr	6.40
8/27/84	Tillage Single	1386	2592	0.598	1 hr	35.5
8/27/94	Tillage Single	30.70	480	0.0447	1 hr	1.00
10/ 31/80	Tillage Single	596.5	1512	0.363	25.2 min	28.2
10/ 31/94	Tillage Single	490.7	6160	0.197	45 min	27.6
10/ 31/80	No-till	1115.2	2376	0.576	40.2 min	65.1
10/ 31/94	No-till	564.8	2610	0.131	1 hr 7 min	25.0
11/12 /94	No-till Tillage Double	324.6 710.3	3300 6160	0.195 0.197	1 hr	23.5 21.7

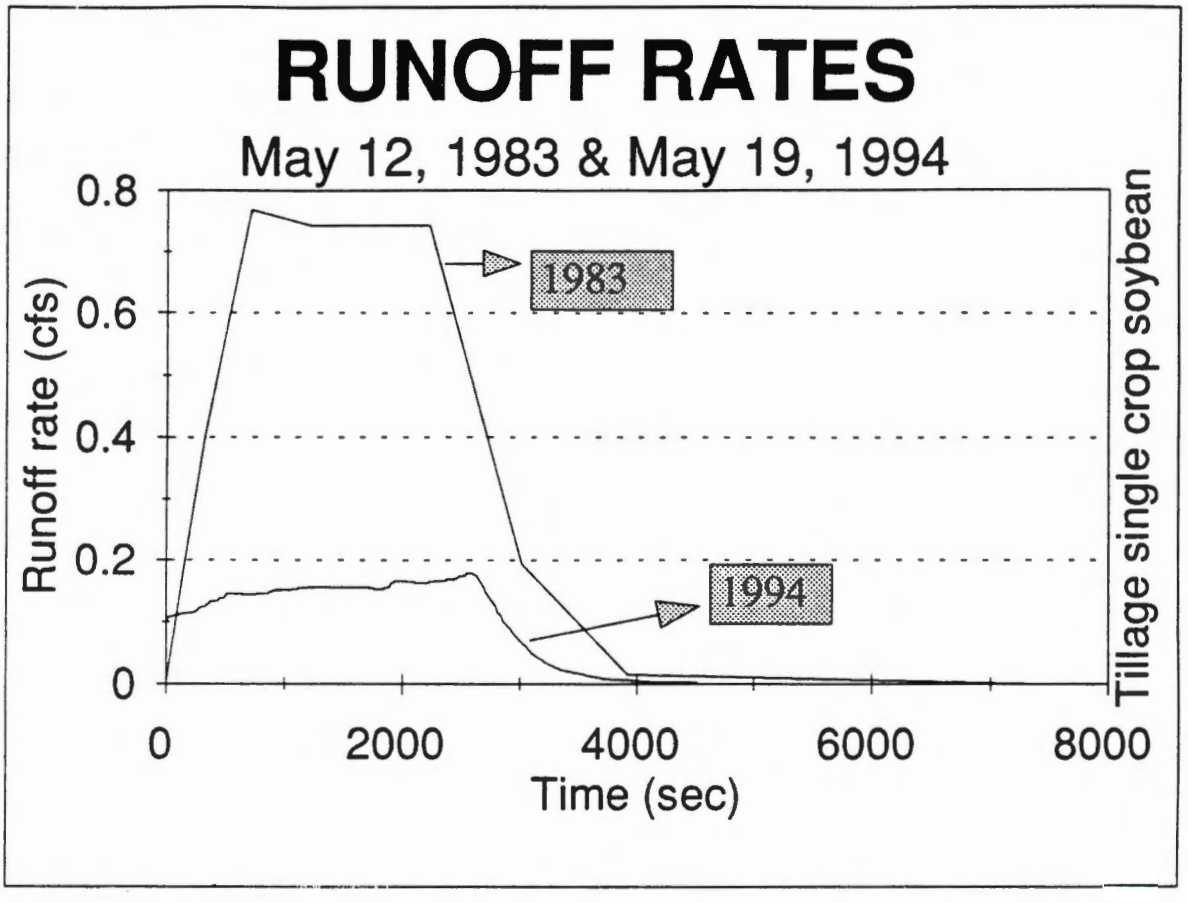

Figure IV-1. Runoff rates for May 12, 1983 & May 19, 1994

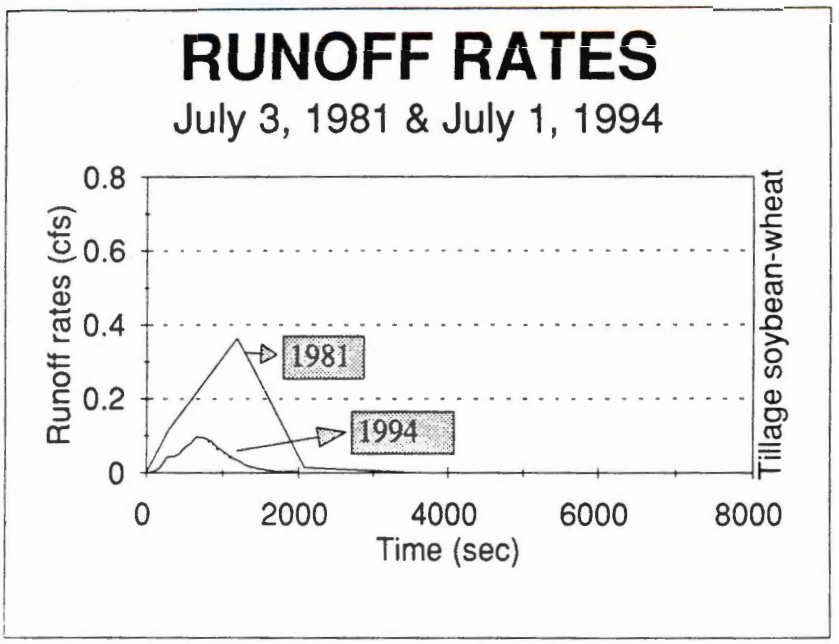

Figure IV-2(a). Runoff rates for July 3, 1981 & July 1,1994

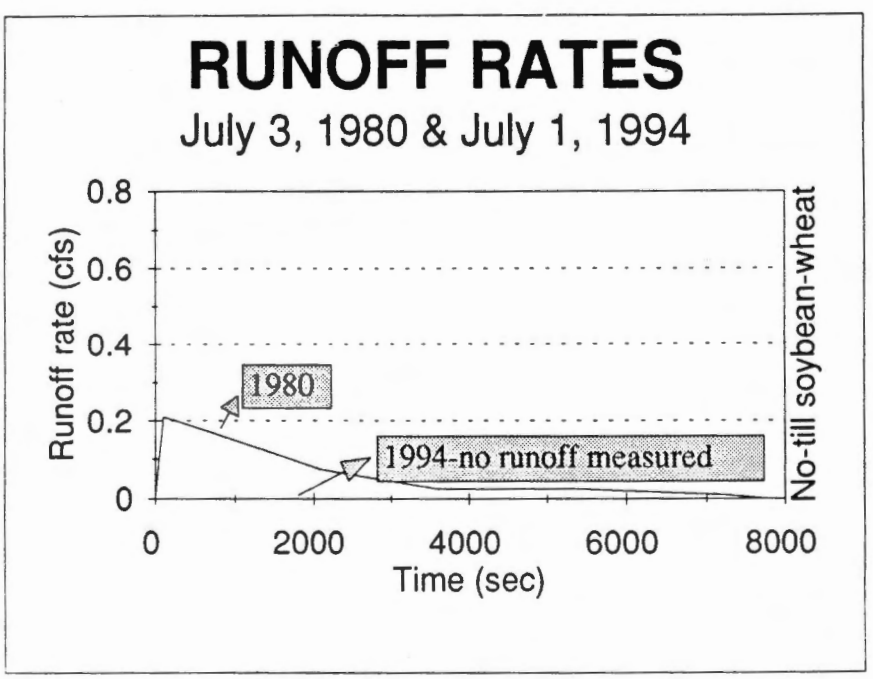

Figure IV-2(b). Runoff rates for July 3, 1980 & July 1,1994

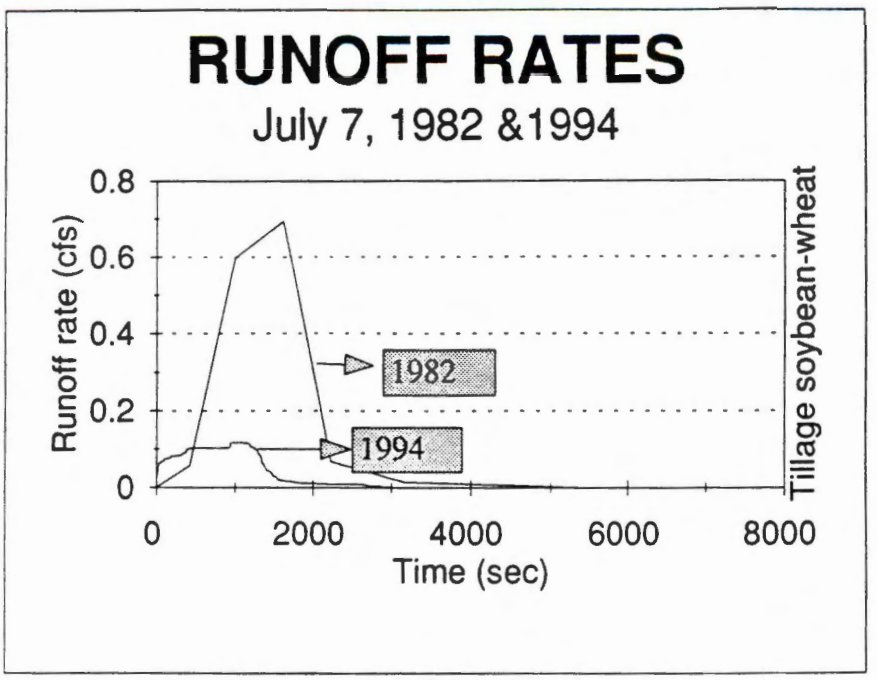

Figure IV-3(a). Runoff rates for July 7, 1982 & 1994

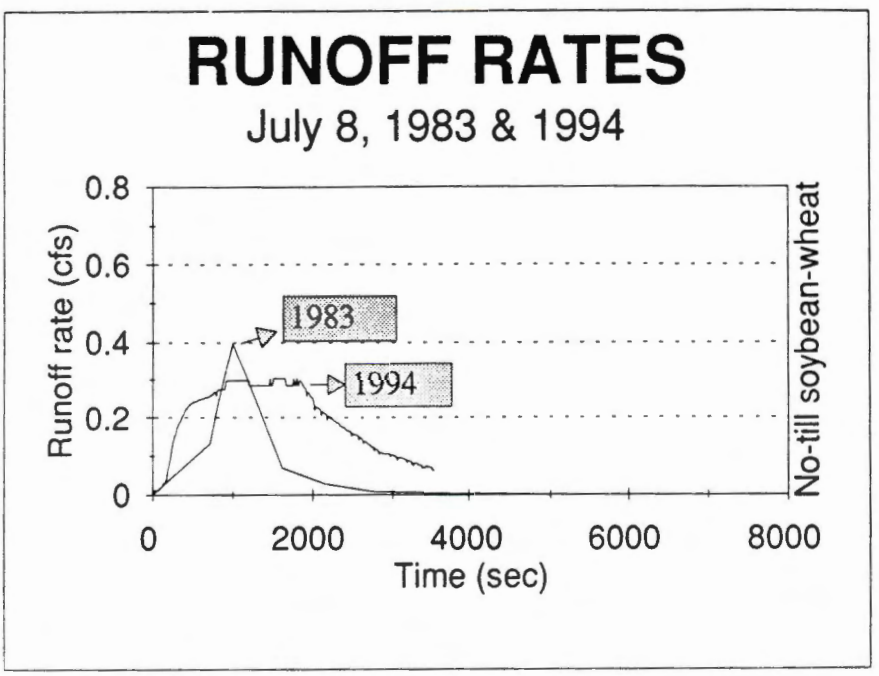

Figure IV-3(b). Runoff rates for July 8, 1983 & 1994

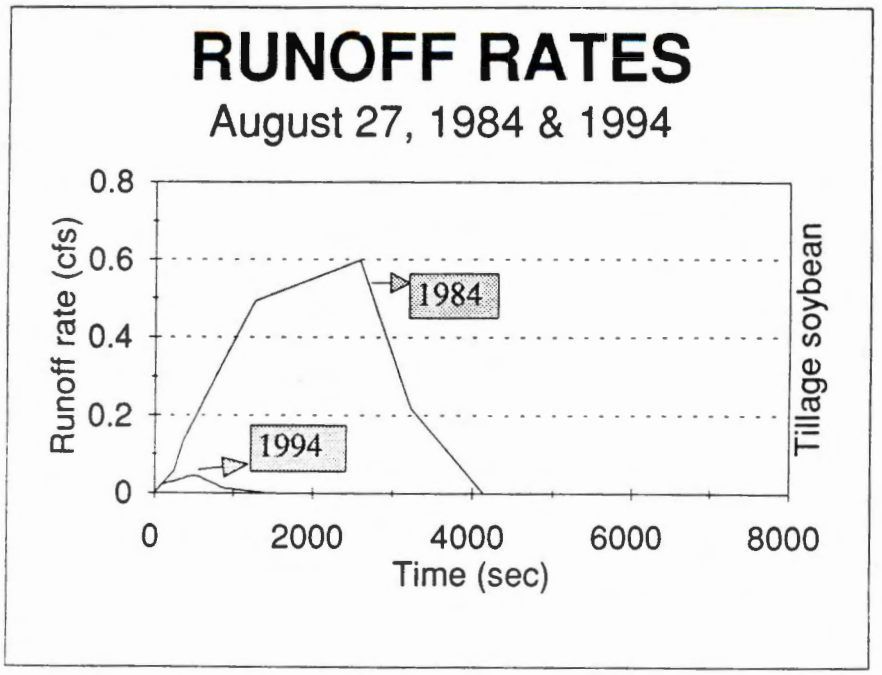

Figure IV-4(a). Runoff rates for August 27, 1984 & 1994

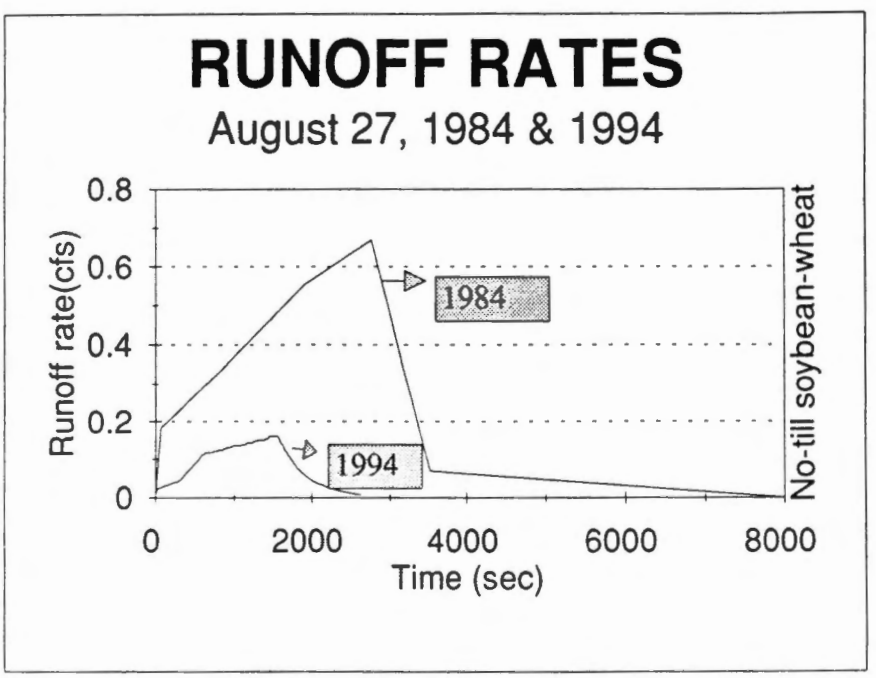

Figure IV-4(b). Runoff rates for August 27, 1984 & 1994

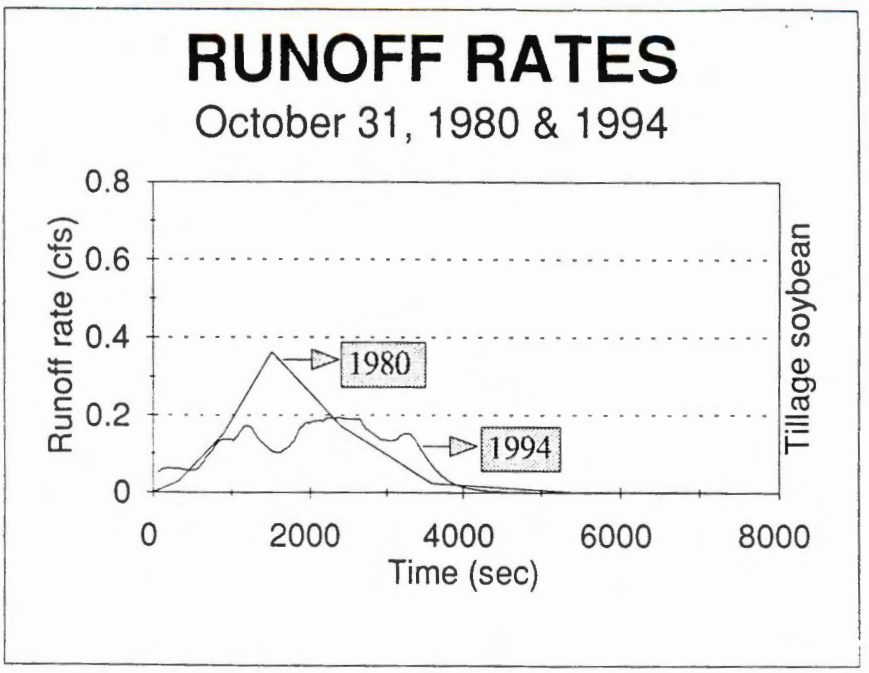

Figure IV-5(a). Runoff rates for October 31, 1980 & 1994

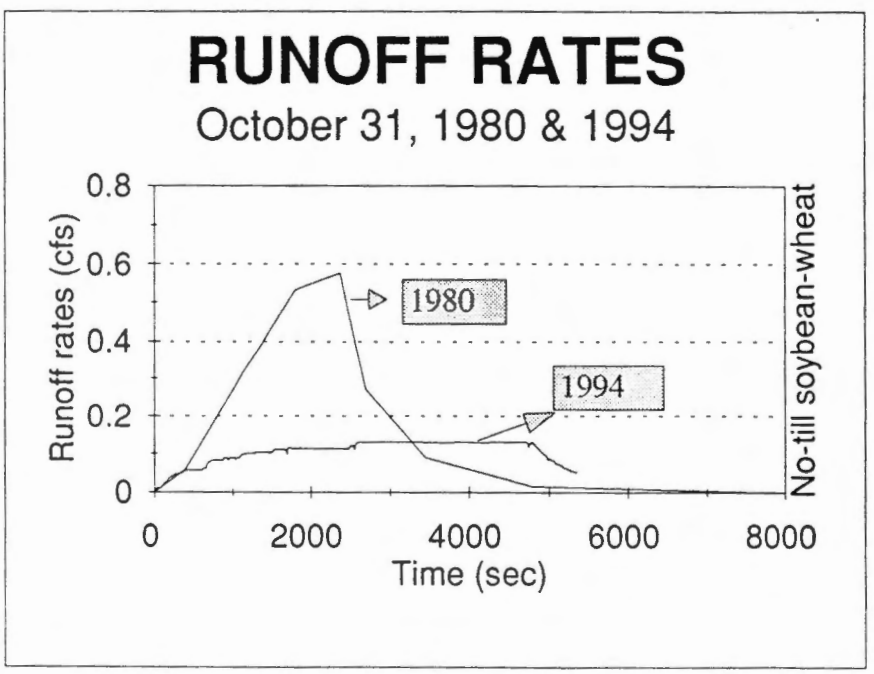

Figure IV-5(b). Runoff rates for October 31, 1980 & 1994

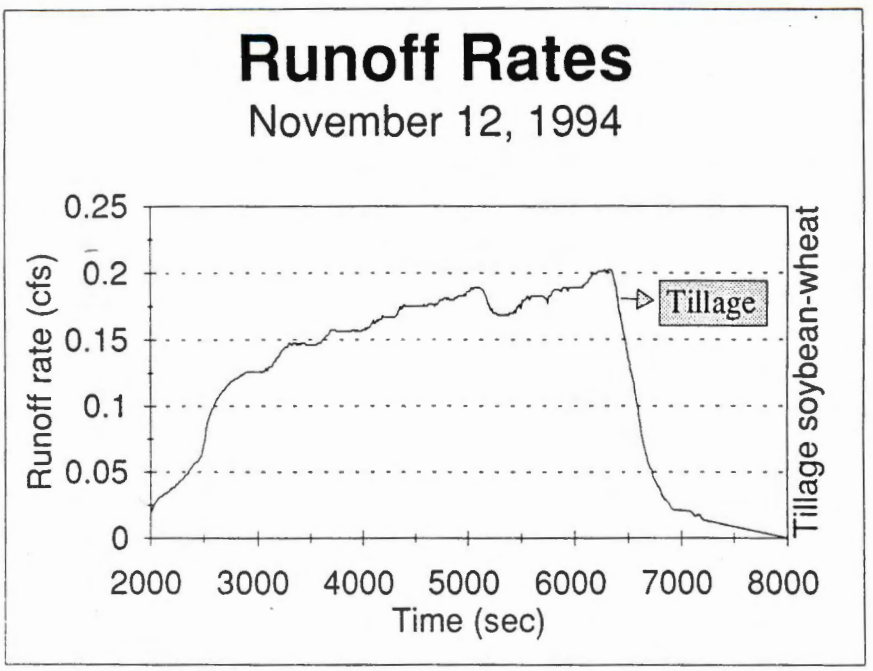

Figure IV-6(a). Runoff rates for November 12, 1994

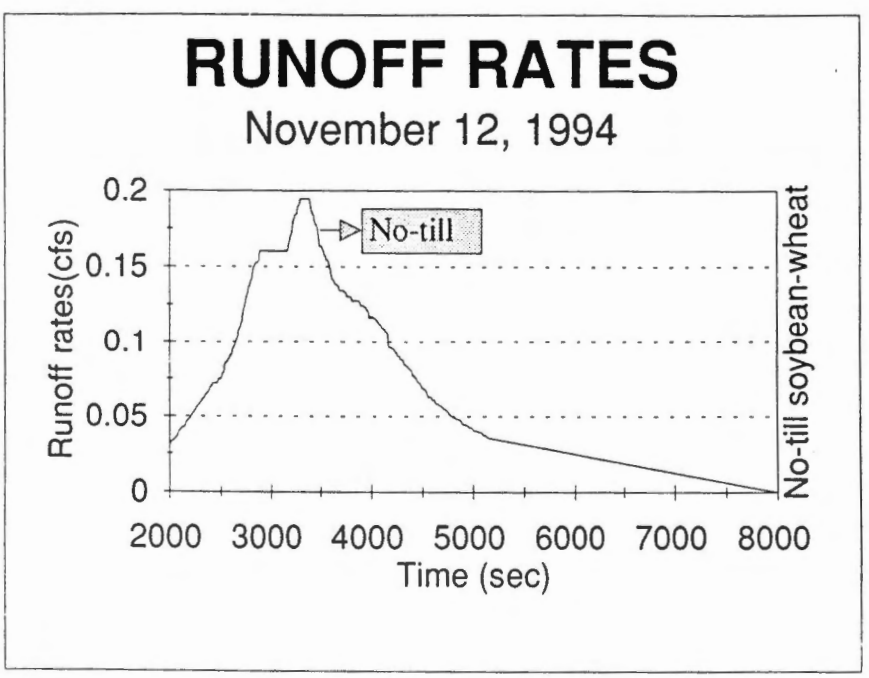

Figure IV-6(b). Runoff rates for November 12, 1994

runoff durations lasting over two hours for rainfall that lasted less than an hour. Conversations with Mr. Shelton indicated runoff always ended within 15-30 min after rainfall application ceased. These numbers could have been read incorrectly from the recorder strip charts or the instrumentation used in his experiments contained errors. Unfortunately, the data strip charts from earlier runs have been destroyed, so there is no way to evaluate the original data. Also, Mr. Shelton used single rainfall gages to measure application rates. Because of possible application non-uniformity and other problems, there is no way of knowing exactly how much simulated rainfall was applied in the early tests. Finally, Mr. Shelton published articles in the 1980's showing runoff and soil loss from the Milan plots (Shelton et al., 1983). His results in those articles are different from the summary information used in this experiment. Mr. Shelton obviously made changes to account for other factors within his data, but what changes he made is unknown.

The other possible explanation for the large differences in runoff volumes is suggested by the consistently low 1994 test figures, which might show that the pump calibration curve changed from the date of calibration and less water was applied then intended.

The second general observation from Table IV.1 is that there appears to be no consistent trend in peak times. If

there had been a significant change in timing it probably would have been due to increased surface storage due to increased roughness. It is not surprising that there is no consistent change here, because there would be no reason for surface roughness to change much over time, which would be the probable case for soil characteristics.

On tests between 1980-84 where both no-till and tillage results can be compared, there was no strong trend in the no-till runoff being higher or lower. Neither is there any difference in the comparisons of the tillage single crop and the tillage double crop. Again, it is not clear how much of the variability is due to actual differences, how much is due to data problems from analysis of the earlier data, or how much is due to problems during the recent tests.

Several additional comments on specific tests can be made. First, the artificial rainfall intensities applied to the plots (as estimated from the pump pressure gauge) matched Shelton's intensities for all runs except on May 19, where 1.80 in/hr (45.72 mm/hr) was applied instead of 3.55 in/hr (90.17 mm/hr) Next, due to a misreading of the old data, on July 1 artificial rainfall was applied for 30 min instead of the 20 min applied on July 3, 1980. The intensities were the same. This should make little difference in the results, since there was no runoff for the July 1, 1994 test.

In addition, a note of interest should be made concerning the July 7 and 8, 1994 tests. The runoff on the no-till plot was greater than on the tillage double crop plot, but it was noted that the crop on the no-till plot had been harvested while the crop had not been harvested on the tillage double crop plot. This suggests that having canopy and the wheat stems in place may cause a significant change in runoff.

One additional note should be made. A comparison between the runoff rates for two tests in 1994 can be completed. After further analysis of the 1994 tests only July 1 can be compared because on this date the rainfall simulator was operated for the same amount of time and intensity, unlike the other dates. Runoff for the no-till plot was 0 compared to 3.8% with tillage double crop. The difference in runoff can be attributed to antecedent soil water conditions. Infiltration has more than likely increased with no-till usage over time. However, this isn't enough information to conclude no-till increases infiltration, thereby reducing runoff.

The test conducted on Nov. 12, 1994 was not a test similar to those conducted in the early 1980's. This was used to look at differences between tillage systems. The test was conducted with the crop removed from both no-till and tillage double crop, with the same intensity and application depth applied to both. The tests showed about

the same amount of runoff for each plot. This indicates that if there is a decrease in runoff over time with no-till, it might be due to the addition of residue to the surface rather than having minimum tillage.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The goal of this study was to look at changes in the hydrologic response of a West Tennessee loess soil under long-term no-till management. Earlier studies show very strongly that no-till is effective in stopping erosion, but leave a lot of questions about what happens to runoff rates due to no-till. Some studies show these rates increasing, while other studies show the rates going down after no-till is implemented.

The literature shows that one of the main things that happens in no-till systems is that soil organic matter slowly builds up, along with all the biological and soil structure changes that occur. If this is in fact occurring, it would seem that no-till impacts on hydrology might not be seen in short-term studies.

This study looked at the impacts of long-term no-till by comparing results of two identical series of test, one run in the early 1980's, and the other in 1994. The same simulated rainfall events were applied in each series, and the resulting runoff hydrographs were compared.

In conclusion, not many answers were found in this study. This is partially based on the question of validity of the data from the earlier tests, since this test

duplicated the earlier one. Suggested further research would include developing a better understanding of those earlier data, running further tests to allow for a more complete statistical analysis, and confirmation that the data collected in the later tests are valid. Better management of test equipment and data could aid this process. This further research could put us one step closer to determining the hydrologic response of soils and how that changes with time.

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