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Productivity of Emory and Dewey soils for soybeans

William Dale Rhoton

To the Graduate Council:

I am submitting herewith a thesis written by William Dale Rhoton entitled "Productivity of Emory and Dewey soils for soybeans." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Plant, Soil and Environmental Sciences.

Frank F. Bell, Major Professor

We have read this thesis and recommend its acceptance:

George J. Buntley, Vernon H. Reich, Charles R. Graves

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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PRODUCTIVITY OF EMORY AND DEWEY SOILS FOR SOYBEANS

A Thesis

Presented for the

Master of Science

Degree

The University of Tennessee

William Dale Rhoton

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ABSTRACT

In 1974 a soybean (Glycine max) productivity study was conducted on Emory and Dewey soils in Blount County, Tennessee. The yield data were obtained from soybeans grown alone and soybeans following wheat. These yields were related to pH, available phosphorus, exchangeable potassium, rainfall, percent sand, silt, and clay.

When soybeans were grown alone there was a significant difference at the 0.05 level of probability in yields, percent silt, and percent clay between Dewey C3 and the Emory A1 and Dewey B1 soils. When soybeans followed wheat there was also a significant difference in soybean yield and percent clay between Dewey C3 and the Emory A1 and Dewey B1 soils; however, there was a significant difference for silt among all soil mapping units. Available phosphorus, pH, and exchangeable potassium accounted for little of the yield variation as measured by the linear regression analysis.

The three independent variables that gave the best stepwise regression model were percent clay, rainfall, and available phosphorus. These three variables account for 63.3 percent of the total variation in yield.

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CHAPTER I

INTRODUCTION

Since the seventeenth century one of the objectives of many soil scientists has been to increase crop yields. The increase in crop yields, due to advances in agricultural technology, make it necessary to periodically update yield estimates. These yield estimates can be related to characteristics of a specific soil and to soils with similar properties.

The purpose of this study was to determine the yields of soybeans on Emory and Dewey soils and to relate these yields to certain soil properties and characteristics.

CHAPTER II

LITERATURE REVIEW

From the seventeenth century, when Van Helmont conducted his classical willow tree experiment, until the middle of the twentieth century, one of the objectives of many soil scientists has been to increase crop yields. Such increases in crop yields make it necessary to periodically update the yield estimates of soils. These soil productivity studies are useful in evaluating soil characteristics and estimating crop yields on the particular soil being tested and on other soils having similar characteristics.

Some workers have defined soil productivity in terms of soil-crop relationships. Ableiter (1) defined soil productivity as "The power of a soil to produce plants." Fenton (8) stated that soil productivity is the "Ultimate yield capacity of the soil."

Bell and Springer (2) recognized that Tennessee soils vary greatly in their ability to produce crops; therefore, with a knowledge of crop yields under various management levels, "Key" soils can be established. They concluded that with a wide range of "Key" soils accurate yield predictions can be made for other soils with similar properties. Odell and Smith (11) conducted a study of crop yields on a wide range of soil types under various cropping systems in order to compute a productivity index. A maximum of 10 percent of another soil type was permitted in the field, provided the minor type did not differ greatly in productivity from the more extensive type,

Robertson (13) presented a productivity index based on "field yield capacity." This index is calculated by evaluating the yield potentials of each soil type within a field and multiplying this by the number of acres of each soil type. However, because yield potentials are closely related to slope, a 10 percent reduction from the yield potential, for each slope class greater than 6 percent was necessary. Homesley (10) did a similar study relating yield to soils with similar characteristics. He established a base of 0 to 2 percent slope and none to slight erosion, and adjusted the base yield as slope and erosion increased.

Buntley (3) studied four variables affecting soybean yield distribution of high-level management plots under Tennessee conditions. These variables were soil series, slope class, drainage class, and locations within Tennessee. The West Tennessee soils, Grenada, Henry, Vicksburg, Collins, Callaway, and Memphis, averaged 38.0 bushels/acre on experiment station fields. The Middle Tennessee soils, Maury, Dickson, and Sango, averaged 35.7 bushels/acre on experiment station fields. In West Tennessee well-drained bottomland soils averaged 44.6 bushels/acre, moderately well-drained bottomland soils averaged 43.2 bushels/acre, and somewhat poorly-drained bottomland soils averaged 39.0 bushels/acre. He concluded that on upland soils soybean yields decreased with an increase in slope gradient which is attributed to a higher runoff rate and a lower moisture supplying capacity.

Buntley, McCutchen, and Morgan (5) later studied the relationship of rainfall distribution and potential evapotranspiration during flowering and pod-filling stages to soybean yields on Grenada, Henry, Vicksburg, Collins, and Maury soils. They concluded that soybean yields increased significantly on all soils if adequate moisture is available during these critical growth stages.

Buntley (4) then studied the significance of matching crops to soils for maximum yields. He points out that sufficient knowledge of the physical and chemical soil characteristics and crop requirements are necessary for successful crop allocation. He suggested that soybeans should be allocated to soils with adequate drainage, none to slight erosion, a deep rooting zone, a moderately high and preferably high available water holding capacity, and an adequate supply of water especially through flowering and pod-filling stages. Edminster and Carlson (6) reported that when allocating crops for maximum yields the soil must provide certain basic needs. These basic needs include adequate water storage to meet the crop water requirements, physical properties that assure aeration to rooting depths, freedom from toxic chemical compounds and parasitic organisms, and a supply of nutrients to meet plant requirements.

Rust and Odell (14) evaluated soil productivity as affected by mean daily temperature, rainfall distribution, nitrogen applied during the current year, nitrogen applied in the previous year, phosphorus and potassium applied during current and previous year, an index related to the kind and frequency with which legumes and legume-grass mixtures were grown, and the year. The results showed that more variation in yield was associated with rainfall distribution and mean daily temperature than with any other factors.

Graves (9) conducted experiments in Middle Tennessee evaluating soil productivity in terms of corn yield on Huntington, Waynesboro, and Dickson soils. He showed significant yield differences among all soils with various management inputs. Simpson (15) conducted a study evaluating the productivity of Emory A1, Dewey B1, and Dewey C3 soils for soybeans in Blount County, Tennessee. He reported significant yield differences among all three soil mapping units in the experiments conducted at a high level of management. The Emory A1 soils averaged 28.3 bushels/acre, the Dewey B1 soils averaged 25.0 bushels/acre, while the Dewey C3 soils averaged 19.6 bushels/acre. He concluded that this study can be useful in estimating yields of these three soil mapping units and other soils with similar physical and chemical characteristics.

CHAPTER III

METHODS AND PROCEDURES

This soybean productivity study was conducted on Emory and Dewey soils in Blount County, Tennessee in 1974.

The soil mapping units studied were: (1) Emory silt, 0 to 2 percent slope; (2) Emory silt loam, 0 to 2 percent slope; (3) Emory loam, 0 to 2 percent slope; (4) Dewey silt loam, 2 to 5 percent slope, slight to moderate erosion; (5) Dewey loam, 2 to 5 percent slope, slight to moderate erosion; (6) Dewey silt loam, 5 to 12 percent slope, severely eroded; (7) Dewey silty clay loam, 5 to 12 percent slope, severely eroded; (8) Dewey clay loam, 5 to 12 percent slope, severely eroded; (9) Dewey silty clay, 5 to 12 percent slope, severely eroded; (10) Dewey clay, 5 to 12 percent slope, severely eroded. These mapping units can be classified as Emory A1 (1, 2, and 3), Dewey B1 (4 and 5), and Dewey C3 (6, 7, 8, 9, and 10).

I. SELECTION OF EXPERIMENTAL PLOTS

A list of soybean producers was obtained from Mr. Victor Simpson, who conducted a similar study on the soybean yields of Dewey and Emory soils in Blount County in 1973. Appropriate soil mapping units were selected on the farms of soybean producers practicing a high level of management. Each producer provided information concerning his past and present soybean production practices. Management systems for soybean production included both double and single cropping systems. There were five fields for both single and double cropping systems, subsequently one field of the single cropping system was lost due to circumstances beyond the control of the author; consequently the analysis is performed on five fields for double cropping systems and four fields for single cropping systems. Three samples were obtained from each soil mapping unit. Each soil mapping unit occurred three times within each field.

II. RAINFALL DISTRIBUTION

Rainfall gauges were placed in each field and checked twice a week to determine rainfall distribution. Oil was added to each gauge at each checkdate to reduce evaporation.

III. ANALYSIS OF SOIL SAMPLES

Soil samples were collected from each soil mapping unit at a depth of 0-6 and 6-12 inches. These soil samples were analyzed for pH, available phosphorus, and exchangeable potassium by The University of Tennessee Soil Testing Laboratory. Increments of these same samples were analyzed for percent sand, silt, and clay using the pipette method (12).

IV. SOYBEAN SAMPLING AND YIELD DETERMINATION

Three 20-foot row samples were obtained from each soil mapping unit for plant population and yield determination. The above ground plant part was hand harvested, dried, and threshed. Seed yields were adjusted to 13 percent moisture.

V. STATISTICAL ANALYSIS

The experimental design consisted of three samples nested within each soil type, three soil types nested within each field, and cultivars nested within cropping systems. Correlations, regressions, and analysis of variance tables were computed according to the procedures in standard statistical texts. Treatment mean separations were determined using Duncan's New Multiple Range Test.

CHAPTER IV

RESULTS AND DISCUSSION

I. SINGLE CROPPING SYSTEM

The average single cropping system soybean yield for each soil mapping unit is given in Table I. There was no significant yield differences between Emory A1 and Dewey B1 soils at the 0.05 level of probability. However, there was a significant difference between Dewey C3 and the Emory A1 and Dewey B1 soils at the 0.05 level. This low soybean yield on Dewey C3 soils was attributed to a low moisture supplying capacity resulting from a higher percent of clay, a lower percent of silt, and a higher runoff rate on these steeper slopes. Hereafter in this document all statistical tests for significant differences are interpreted at the 0.05 level of probability unless otherwise indicated.

The available moisture supplying capacity may be the principal factor causing yield variation among these soil mapping units. The more important factors influencing available moisture supplying capacity of a soil for plants, under similar rainfall conditions, are: (1) position of soil on the landscape, (2) infiltration rate, (3) available water holding capacity, (4) effective rooting depth for plants, (5) evaporation losses, and (6) water table influences.

TABLE I

AVERAGE SINGLE CROP SOYBEAN YIELDS AND SAND, SILT, AND CLAY PERCENTAGES* OF ALL SOIL MAPPING UNITS IN BLOUNT COUNTY, TENNESSEE--1974

Soil Mapping Unit	Number of Observations	Yield**	Sand**	Silt**	Clay**
		bu/A	-----------percent----------		
Emory A1	12	31.5 a	22.8 a	60.2 a	17.0 b
Dewey B1	12	29.4 a	21.5 a	60.3 a	18.2 b
Dewey C3	12	20.5 b	20.2 a	49.2 b	30.7 a

*Average sand, silt, and clay percentages of all tables were determined from the 6-inch surface horizon.

**Means for any given treatment followed by any letters in common are not significantly different at the 0.05 level of probability according to Duncan's New Multiple Range Test.

The Emory A1 soils (run-on positions) receive water from the surrounding Dewey B1 and Dewey C3 soils (runoff positions); however, water loss from the Dewey B1 soils was slight because of the milder slope gradient. The infiltration rate of the Dewey C3 soil is lower than the other two soils because of the steeper slopes, smaller pores resulting from a higher clay percentage, and a lower organic matter content. The available water holding capacity of the Emory A1 and Dewey B1 soils is higher than the Dewey C3 soils because little of the A horizon of Emory A1 or Dewey B1 soils has been lost through erosion; therefore, more silt loam surface is present resulting in a higher available water holding capacity. The effective rooting depth and evaporation losses were not measured; however, it should be noted that the Emory A1 and Dewey B1 soils had a higher silt percentage, therefore favoring deeper water penetration and a deeper rooting zone to maximize water efficiency. The depth of the water table was not a principal factor in this study and will not be discussed.

The average percentages of sand, silt, and clay of the 6-inch surface horizon on the single cropping system plots also are given in Table I. There was no significant difference in the percent silt and clay between the Emory A1 and Dewey B1 soils, but there was a significant difference between Dewey C3 and the other two soils. This is to be expected since most of the A horizon (which is usually silt loam in the Dewey soils) has been lost through erosion. The silt loam surface of surrounding Dewey uplands has been deposited on the Emory sites. This supports the earlier indication that soybean yields decrease with an increase in percent slope and clay content and a decrease in percent silt, all of which influences the moisture supplying capacity (15).

The average pH, available phosphorus, and exchangeable potassium of the 6-inch surface horizon for the single cropping system plots are shown in Table II. Since the linear regression analysis showed little contribution of these in explaining yield variation, the Duncan's New Multiple Range Test was not made, however in examining the table a downward trend in yield from a high value of available phosphorus and exchangeable potassium of Emory A1 to Dewey C3 may be noted. There is very little difference in pH values on the three soil mapping units. The pH, available phosphorus, and exchangeable potassium values for the 6 to 12-inch subsurface horizon are given in Appendix A.

II. DOUBLE CROPPING SYSTEM

The double cropping system (Soybeans--Wheat) yield of the soil mapping units is given in Table III. There was no significant difference in soybean yield between Emory A1 and Dewey B1 soils; however, there was a significant difference between Dewey C3 and the other two soils. Again, this low soybean yield on Dewey C3 was attributed to the low moisture supplying capacity of this soil.

The average percentages of sand, silt, and clay for the double cropping system plots also are given in Table III. There was a significant difference in the percent clay between Dewey C3 and the Emory A1 and Dewey B1 soils; however, there was no significant difference between

TABLE II

AVERAGE pH, AVAILABLE PHOSPHORUS, AND EXCHANGEABLE POTASSIUM* ACROSS ALL SOIL MAPPING UNITS OF THE SINGLE CROPPING SYSTEM IN BLOUNT COUNTY, TENNESSEE--1974

Soil Mapping Unit	Number of Observations	pH	P	K
			-----Lbs/A-----	
Emory A1	12	5.9	23.7	280
Dewey B1	12	6.0	15.0	262
Dewey C3	12	5.8	12.1	216

*Average pH, available phosphorus, and exchangeable potassium of all tables were determined from the 6-inch surface horizon unless otherwise specified.

TABLE III

AVERAGE DOUBLE CROP SOYBEAN YIELDS AND SAND, SILT, AND CLAY PERCENTAGES OF ALL SOIL MAPPING UNITS IN BLOUNT COUNTY, TENNESSEE--1974

Soil Mapping Unit	Number of Observations	Yield*	Sand*	Silt*	Clay*
		by/A	----------	percent	----------
Emory A1	15	22.5 a	19.9 b	63.6 a	16.5 b
Dewey B1	15	22.9 a	23.3 a	58.7 b	18.0 b
Dewey C3	15	15.5 b	19.3 b	49.2 c	31.5 a

*Means for any given treatment followed by any letters in common are not significantly different at the 0.05 level of probability according to Duncan's New Multiple Range Test.

Emory A1 and Dewey B1 soils. There was a significant difference in the percent silt among all soil mapping units.

The average pH, available phosphorus, and exchangeable potassium for the double cropping system plots is given in Table IV. Since the available phosphorus and exchangeable potassium values are at relatively high levels and pH is in the optimum range for high soybean yields, apparently these variables do not explain the significant yield differences that were obtained.

III. SINGLE CROPPING SYSTEM VERSUS DOUBLE CROPPING SYSTEM

The average soybean yields and sand, silt, and clay percentages for both cropping systems are given in Table V. There was no significant difference between cropping systems in the percent sand, silt, and clay; however, there was a significant difference in yield. The average yield of the single cropping system was 27.1 bushels/acre, while the double cropping system averaged 20.3 bushels/acre. This low soybean yield of the double cropping system may be attributed to early frost and/or late planting dates. The early frost occurred October 4. The average planting date of the single cropping system plots is June 6, while the average planting date of the double cropping system plots is June 30. Due to these late planting dates on the double cropping system plots, visual frost damage was more pronounced; therefore, the reduction in yield could be attributed to these factors. Planting dates are shown in Appendix B.

TABLE IV

AVERAGE pH, AVAILABLE PHOSPHORUS, AND EXCHANGEABLE POTASSIUM ACROSS ALL SOIL MAPPING UNITS OF THE DOUBLE CROPPING SYSTEM IN BLOUNT COUNTY, TENNESSEE--1974

Soil Mapping Unit	Number of Observations	pH	P	K
			-----Lbs/A------	
Emory A1	15	6.2	16.5	220
Dewey B1	15	6.6	23.7	225
Dewey C3	15	6.3	19.4	222

TABLE V

AVERAGE SOYBEAN YIELDS AND SAND, SILT, AND CLAY PERCENTAGES OF BOTH CROPPING SYSTEMS IN BLOUNT COUNTY, TENNESSEE--1974

Cropping System	Number of Observations	Yield	Sand	Silt	Clay
		bu/A	------------	percent	------------
Single Crop	36	27.1*	21.5 N.S.	56.5 N.S.	21.9 N.S.
Double Crop	45	20.3*	20.8 N.S.	57.2 N.S.	22.0 N.S.

*Significant at the 0.05 level of probability.

N.S. Not significant at the 0.05 level of probability.

IV. COMBINED ANALYSIS OF SINGLE CROP AND DOUBLE CROP SYSTEMS

The two soybean cultivars used for both cropping systems were Lee 68 and Dare. There was no significant difference in yield between cultivars.

The average soybean yields of all soil mapping units for both cropping systems are given in Table VI. There was no significant difference in yield between Emory A1 and Dewey B1 soils; however, there was a significant difference between Dewey C3 and the Emory A1 and Dewey B1 soils for the combined analysis. The Emory A1 soils averaged 26.5 bushels/acre, Dewey B1 soils averaged 25.8 bushels/acre, while the Dewey C3 soils averaged 17.7 bushels/acre. Again, this low yield on Dewey C3 soils may be attributed to a low moisture supplying capacity of this soil mapping unit.

The average sand, silt, and clay percentages of all soil mapping units for both cropping systems are given in Table VI. There was a significant difference in the percent clay between Dewey C3 and the Emory A1 and Dewey B1 soils; however, there was no significant difference between Emory A1 and Dewey B1 soils. There were significant differences in silt content of the 6-inch surface layer among all soil mapping units.

Linear regression and correlation coefficients for both cropping systems are given in Table VII. Yield was used as the dependent variable, while pH, available phosphorus, exchangeable potassium, plant population, rainfall, percent sand, percent silt, and percent clay were tested separately as the independent variables. The percent clay was highly significant at the 0.01 percent level of probability which accounted for

TABLE VI

AVERAGE SOYBEAN YIELDS AND SAND, SILT, AND CLAY PERCENTAGES OF ALL SOIL MAPPING UNITS ACROSS BOTH CROPPING SYSTEMS IN BLOUNT COUNTY, TENNESSEE--1974

Soil Mapping Unit	Number of Observations	Yield*	Sand*	Silt*	Clay*
		by/A	-----------	percent	-----------
Emory A1	27	26.5 a	21.2 ab	62.1 a	16.7 b
Dewey B1	27	25.8 a	22.5 a	59.4 b	18.1 b
Dewey C3	27	17.7 b	19.7 b	49.2 c	31.1 a

*Means for any given treatment followed by any letters in common are not significantly different at the 0.05 level of probability according to Duncan's New Multiple Range Test.

TABLE VII

LINEAR REGRESSION AND CORRELATION COEFFICIENTS, USING YIELD AS THE DEPENDENT VARIABLE, ACROSS BOTH CROPPING SYSTEMS IN BLOUNT COUNTY, TENNESSEE--1974

Independent Variable	Regression b	Correlation r	Probability of "F" Value
Clay	-0.475	-.598	.0001
Rain	1.052	.503	.0001
Plant Population	0.035	.429	.0001
Silt	0.348	.417	.0001
Sand	0.429	.330	.0026
Phosphorus	0.113	.216	.0529
Potassium	0.016	.182	.1036
pH	0.945	.075	.5091

35.8 percent of the total variation and had a negative correlation of -0.598. Again this illustrates that as percent clay increases soybean yields decrease. The "b" value for clay was -0.475. This indicates that each percentage point increase of clay resulted in a yield reduction of 0.475 bushels/acre in the range of clay content found in these soils.

When tested separately rainfall, plant population, and percent silt were also highly significant at the 0.01 percent level. Rainfall accounted for 25.3 percent, plant population accounted for 18.4 percent, and silt accounted for 17.4 percent of the total variation. All of these variables had positive correlation coefficients and "b" values. This illustrates that as these variables increase yields also increase. The high percent of the total variation due to plant population is attributed to a high soybean yield on the only field with extremely high plant population in 23-inch row widths. The yield variation contributed by phosphorus, potassium, and pH was not significant.

The add on stepwise regression models, using yield as the dependent variable, across both cropping systems are shown in Table VIII. The best model with yield as the dependent variable included percent clay, rainfall, and available phosphorus as independent variables. This model accounted for 63.3 percent of the total variation. When any other variable was added, the model was not significantly improved at the 10 percent level of probability; therefore, these other measurements in this study are not needed to accurately predict yield variation.

TABLE VIII

STEPWISE REGRESSION MODELS, USING YIELD AS THE DEPENDENT VARIABLE, ACROSS BOTH CROPPING SYSTEMS IN BLOUNT COUNTY, TENNESSEE--1974

Regression Model	R^2	Probability of "F" Value
Clay	.358	.0001
Clay, Rain	.582	.0001
Clay, Rain, P	.633	.0418
Clay, Rain, P, K	.640	.1912
Clay, Rain, P, K, pH	.649	.1087
Clay, Rain, P, K, pH, Population	.653	.6056
Clay, Rain, P, K, pH, Population, Sand	.655	.5957

V. SOYBEAN YIELD COMPARISON ON EMORY AND DEWEY SOILS IN BLOUNT COUNTY, TENNESSEE IN 1973 AND 1974

D. V. Simpson measured yields on Emory and Dewey soils for the single cropping soybean system in Blount County, Tennessee in 1973. He reported a significant difference in yield among Emory A1, Dewey B1, and Dewey C3 soils at the 0.05 level of probability. The average yield for Emory A1 soils was 28.3 bushels/acre, the Dewey B1 soils averaged 25.0 bushels/acre, while the Dewey C3 soils averaged 19.6 bushels/acre.

This study which was conducted in 1974 measured the yields of Emory and Dewey soils for single cropping and double cropping systems in Blount County, Tennessee. There was no significant difference in yield between Emory A1 and Dewey B1 soils for either cropping system at the 0.05 level of probability. There was a significant difference in yield between Dewey C3 and the Emory A1 and Dewey B1 soils for both cropping systems. In the combined analysis of both cropping systems, the Emory A1 soils averaged 26.5 bushels/acre, the Dewey B1 soils averaged 25.8 bushels/acre, while the Dewey C3 soils averaged 17.7 bushels/acre. These average yields on both cropping system plots were lower than in the previous year; however, it should be noted that there was little difference in soybean yields between the two studies comparing the two single cropping systems.

These two studies combined give a broader base for a more accurate prediction of soybean yields for these soils and soils with similar physical and chemical properties.

CHAPTER V

SUMMARY AND CONCLUSIONS

The purpose of this study was to determine the yields of Emory and Dewey soil mapping units for soybeans and relate these yields to certain soil properties and characteristics. Two cultivars, Dare and Lee 68, were used under single and double cropping systems.

Soil samples from each plot were analyzed for pH, available phosphorus, exchangeable potassium, percent sand, silt, and clay. For the single cropping system plots, there was a significant difference in soybean yield, percent silt, and percent clay between Dewey C3 and the Emory A1 and Dewey B1 soils at the 0.05 level of probability. For the double cropping system plots and the combined analysis of the single cropping and double cropping system plots, there was a significant difference in soybean yield and percent clay between Dewey C3 and the other two soils. There was a significant difference in silt among all soil mapping units.

The linear regression analysis showed little contribution of pH, available phosphorus, and exchangeable potassium in explaining yield; therefore, the Duncan's New Multiple Range Test was not made using these variables. The best stepwise regression model with yield as the dependent variable included percent clay, rainfall, and available phosphorus as the independent variables. This model accounted for 63.3 percent of the total variation.

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LITERATURE CITED

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APPENDIXES

APPENDIX A

TABLE IX

AVERAGE pH, AVAILABLE PHOSPHORUS, AND EXCHANGEABLE POTASSIUM OF THE 6-12 INCH SUBSURFACE HORIZON ON EMORY A1 SOILS ACROSS ALL FIELDS IN BLOUNT COUNTY, TENNESSEE--1974

Field Number	pH	P	K
		-----------lbs/A	---------
1	6.0	23	140
	5.8	30	120
	6.2	21	180
2	5.2	11	220
	5.5	6	200
	5.4	5	110
3	5.8	10	190
	5.5	13	160
	5.4	18	220
4	6.4	5	150
	6.5	4	90
	6.2	4	80
5	6.0	11	130
	6.2	15	120
	5.8	9	130
6	6.5	15	180
	6.5	15	170
	6.6	13	120
7	6.5	15	230
	5.9	9	240
	6.1	11	170
8	6.3	8	140
	5.9	12	180
	6.0	9	210
9	6.0	18	160
	5.8	13	260
	6.3	12	210

TABLE X

AVERAGE pH, AVAILABLE PHOSPHORUS, AND EXCHANGEABLE POTASSIUM OF THE 6-12 INCH SUBSURFACE HORIZON ON DEWEY B1 SOILS ACROSS ALL FIELDS IN BLOUNT COUNTY, TENNESSEE--1974

Field Number	pH	P	K
		----------lbs/A----------	
1	6.0	15	170
	5.7	21	180
	6.4	12	110
2	5.6	9	140
	5.8	8	160
	5.4	8	100
3	5.9	11	170
	5.8	15	220
	5.8	14	210
4	6.1	5	70
	6.5	6	80
	5.7	5	110
5	5.8	10	180
	6.2	6	170
	5.8	12	180
6	6.4	11	180
	6.2	15	210
	6.2	23	240
7	6.1	5	130
	6.3	9	180
	5.8	6	170
8	6.0	14	190
	5.9	14	240
	6.2	9	110
9	6.2	13	160
	5.6	8	110
	5.7	8	160

TABLE XI

AVERAGE pH, AVAILABLE PHOSPHORUS, AND EXCHANGEABLE POTASSIUM OF THE 6-12 INCH SUBSURFACE HORIZON ON DEWEY C3 SOILS ACROSS ALL FIELDS IN BLOUNT COUNTY, TENNESSEE--1974

Field Number	pH	P	K
		----------lbs/A----------	
1	5.9	16	180
	6.3	12	120
	6.2	11	210
2	5.4	4	120
	5.6	4	150
	5.7	4	160
3	5.8	9	150
	5.7	8	200
	6.1	7	190
4	5.3	10	140
	5.2	8	180
	5.8	6	100
5	6.0	14	210
	5.8	9	180
	6.0	8	130
6	6.5	10	140
	6.2	9	140
	6.5	12	120
7	6.1	6	150
	6.2	11	140
	5.8	13	170
8	5.9	11	180
	5.7	16	220
	5.8	12	160
9	6.1	8	120
	6.0	7	160
	6.4	10	130

APPENDIX B

TABLE XII

PLANTING DATES OF SOYBEANS ACROSS ALL FIELDS IN BLOUNT COUNTY, TENNESSEE--1974

Field Number	Cropping System	Planting Dates
1	Single	May 19
2	Single	June 12
3	Single	June 12
4	Single	June 13
5	Double	June 26
6	Double	June 27
7	Double	June 28
8	Double	July 2
9	Double	July 5

VITA

William Dale Rhoton was born in Fayetteville, Tennessee on November 20, 1951. He attended grammar school at Lynchburg, Tennessee and was graduated from Moore County High School in 1969. The following summer he entered Tennessee Technological University in Cookeville, Tennessee, and in June 1973, he received his Bachelor of Science degree in Agriculture.

In the fall of 1973, he entered the University of Tennessee and began study toward a Master of science degree with a major in Plant and Soil Science. In the winter of 1974, he accepted a departmental teaching assistantship. He received this degree in June, 1975.

He is married to the former Sharon Kay Burgin of Knoxville and they have one daughter, Rebecca Kay.