

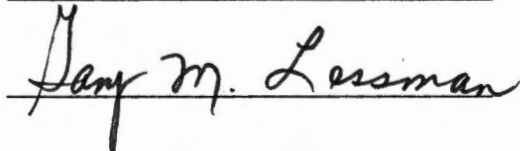
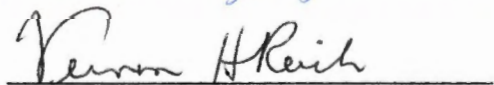
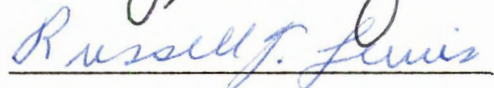
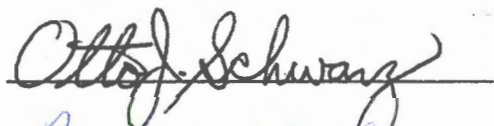
To the Graduate Council:

I am submitting herewith a dissertation written by Ronald Hugh Rogers entitled "Phosphorus, Potassium, Calcium, Magnesium, Manganese, and Zinc Extracted by Three Soil Extractants at Different Soil-Solution Ratios." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Plant and Soil Science.



William L. Parks, Major Professor

We have read this dissertation
and recommend its acceptance:



Accepted for the Council:



Vice Chancellor
Graduate Studies and Research

Thesis

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PHOSPHORUS, POTASSIUM, CALCIUM, MAGNESIUM, MANGANESE,
AND ZINC EXTRACTED BY THREE SOIL EXTRACTANTS
AT DIFFERENT SOIL-SOLUTION RATIOS

A Dissertation
Presented for the
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Degree
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Ronald Hugh Rogers

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ABSTRACT

Sixty soil samples, representing 20 soil series, were analyzed by each of three soil testing procedures (Double Acid, the Tennessee soil testing procedure, and a newly proposed procedure by Mehlich) at six soil to solution extracting ratios (1:4, 1:6, 1:8, 1:10, 1:15, and 1:20) in triplicate for P, K, Ca, Mg, Mn, and Zn. The soil test procedures were compared to each other and to other standard extraction procedures that are generally used for the tested elements. The extraction procedures used were Bray 1 for P, 0.1N HCl for Zn, and neutral normal ammonium acetate for K, Ca, Mg, and Mn. Phosphorus was determined colorimetrically on a Technicon AutoAnalyzer, potassium was determined by flame emission on a Technicon Flame Photometer III, and calcium, magnesium, manganese, and zinc were determined by atomic absorption spectrophotometry.

The experimental design used was a nested design. Regression and correlation were performed using the amount of the test elements extracted by each soil test procedure as the dependent variable. Duncan's New Multiple Range Test was used to separate significantly different means.

The chemical extractant, soil-solution extracting ratio, soil sample, and all interactions affected the amount of P, K, Ca, Mg, Mn, and Zn measured. The coefficients of determination (R^2) were high, indicating that most of the variance in the tested elements could be explained by the analysis of variance model chosen. The coefficients of variation

(C.V.) differed only slightly among chemical extractants for the same element indicating similar data dispersion for the chemical extractants.

In general, except for Ca and Mg, each increase in soil-solution ratio from 1:4 to 1:20 resulted in significant increases in the amount of P, K, Mn, and Zn measured for all extractants. The data for Ca and Mg were more variable and the same trend was not evident. Across soil-solution ratios, the Tennessee procedure extracted significantly more P, K, Mn, and Zn, and the Double Acid procedure extracted significantly more Ca and Mg than the other extractants. Although there were differences in the amounts of the test elements measured, the amount of P, K, Ca, Mg, Mn, and Zn extracted by each chemical extractant was highly correlated to the amount of the elements extracted by the other generally used extraction methods.

Regression analyses indicated a linear relationship between P, K, and Zn extracted by all three chemical extractants and the soil-solution extraction ratio used. Only for the Tennessee extractant was the soil-solution extraction ratio a significant predictor for Ca. There was a curvilinear relationship for Mg and Mn with soil-solution extracting ratio with all of the chemical extractants tested.

Based on the data collected and the statistical analyses performed, there appears to be little, if any, real difference in the three tested procedures. The Tennessee and Double Acid extractants in most cases extracted more of the tested elements, but correlation analysis indicates all procedures to be highly correlated to standard extraction procedures. The data dispersion, as shown by the coefficients of variation, was very similar for all chemical extractants for each tested chemical.

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CHAPTER I

INTRODUCTION

Over the years, many researchers have felt that biological methods, the use of various seedlings, bacteria, or fungi, were the most accurate means of determining available soil nutrient levels. These tests assumed that the organisms uptake and nutrient utilization was the same as that of crop plants. Evidence indicated that this probably was not the case. Since most of the biological tests require considerable time to complete, these procedures have gradually been discontinued in the United States. Various chemical extraction procedures, differing mainly in the type and strength of chemical used, replaced the biological methods. These chemical soil testing techniques need to be continually evaluated and upgraded in order to assure accuracy and reliability of soil fertility estimates.

The purpose of this study was to evaluate two extraction procedures currently in use, the Double Acid ($0.025N\ H_2SO_4$ in $0.05N\ HCl$), the Tennessee extractant ($1\% (NH_4)_2SO_4$ in $0.05N\ H_2SO_4$), and one newly proposed extractant by Mehlich (33) ($0.2N\ NH_4Cl$, $0.2N$ acetic acid, $0.015N\ NH_4F$, and $0.012N\ HCl$). Six soil to solution ratios (1:4, 1:6, 1:8, 1:10, 1:15, and 1:20) were studied on 60 soils from different physiographic regions of Tennessee. Analyses included P, K, Ca, Mg, Mn, and Zn. All samples were analyzed in triplicate, and the results from each of the methods were compared to each other and to the other standard extraction procedures.

CHAPTER II

LITERATURE REVIEW

Introduction

Soil testing is used to assess the relative adequacies of available nutrients and to provide guidance on amounts of fertilizer required to obtain optimum growth conditions for plants (31). To accomplish these objectives, representative samples, acceptable analytical procedures, and proper calibration are all necessary.

Bray (15) listed three requirements for any successful soil test as follows:

1. The extracting solution and the procedure used should extract the total or a proportionate amount of the available form of a nutrient from soils with variable properties.
2. The amount of the nutrient in the extract should be measured with reasonable accuracy and speed.
3. The amounts extracted should be correlated with the growth and response of each crop to the element under consideration.

Various soil properties such as cation exchange capacity (CEC), and sorption-desorption mechanisms, as well as the chemical extractant and extraction procedure affect the amount of the nutrient measured.

Problems in Soil Testing Analysis

Fraps and Fudge (21) reported on the solubility of different forms of phosphate in $0.2N$ HNO_3 , $0.75N$ HCl , $0.002N$ H_2SO_4 , and $0.52N$ acetic acid in 10% sodium acetate. Calcium phosphates were soluble in all extractants. Apatite was not completely soluble, while rock phosphate

was soluble in the HCl and HNO_3 , less soluble in the H_2SO_4 , and insoluble in the acetic acid. Ballaux and Peaslee (5) proposed the grouping of soils on the basis of P sorption-desorption. This could allow fertilizer recommendations for a wider range of soils without the need for costly field calibration research.

Ryden and Syers (44) investigating the labile phosphate pool in soils, found that sorbed P existed in two forms, chemisorbed P and physically sorbed P. The amounts of inorganic P extracted by the Olsen bicarbonate method were considerably greater than the physically sorbed P. However, in calcareous soils, the chemisorbed and physically sorbed P was approximately equal. The estimate of physically sorbed P from the sorption isotherm was equal to the amount of P removed from the soil by two water extractions, lending support for the water extraction for P determination. White and Beckett (56) found that the labile P pool reached equilibrium only after two to three months of aeration at a constant temperature. Up until that time, the equilibrium constant depended on shaking time and soil to solution ratio used. The Ca status of the soils also affects P.

Hassett and Walker (22) noted the effect of shaking time on the Bray P1 test and found that shaking times of one or five minutes on soils of low P status removed a proportionally higher amount of P than from high P testing soils. They proposed calculation of an equilibrium time of shaking to control this variability.

Saeed and Fox (45) demonstrated a linear relationship between Zn concentrations and suspension pH. At a pH above 7.0, a general

increase was noted. For calcareous soils, the relationship between Zn solubility and pH was nonlinear. Sidhu et al. (47) measured the thermodynamic parameters ΔG , ΔH , and ΔS , and found Zn adsorption to follow the linear form of the Langmuir equation. The desorption of Zn was inversely related to the buffering capacity of the soil. Shuman (46) equilibrated eight concentrations of Zn in four soils and determined Zn conformed to the Langmuir equation. The CEC was also related to adsorptive capacity.

MacLean (28) found a significant correlation between K uptake and exchangeable K in surface soil samples. Amounts of nonexchangeable K in soils and uptake of this fraction by plants was also highly correlated. Omar and El Kobbia (39) in research on the interrelationships of K and Mg, reported a one way competition with Mg uptake being reduced by increased K, and K absorption not affected by Mg. Soil test data, if used correctly, could limit Mg deficiency due to over fertilization with K. Alston (2) reported that the concentration of Mg in equilibrium soil solutions was generally a less acceptable Mg availability indicator than activity ratios. A significant proportion of the Mg concentration variation in ryegrass could be explained by the K content of the soils in which the ryegrass was grown. Prince et al. (42) reporting on the Mg supplying capacity of New Jersey soils, found no correlation between total soil Mg and crop producing ability. The most important factor in Mg uptake was soil available K. If Mg was less than 6% of the exchange complex, crops were likely to be Mg deficient. Adams and Henderson (1) in research concerning Mg availability as related to different soil

types, studied plants grown at deficient and sufficient lime and K levels. Soils with less than 4% of the CEC as Mg were Mg deficient. On Mg deficient soils, the availability of Mg to crops tended to be greater at the higher K levels. The availability of Mg on the same soil was less at the higher soil pH. Magnesium availability on soils not deficient in Mg was higher at lower K levels.

Bear and Toth (7) reporting on research concerning the influence of Ca on other soil cations stressed the importance of soil Ca. They suggest that ideally, 65% of the exchange complex should be Ca, 10% Mg, 5% K, and 20% H.

Cameron et al. (17) reported on research to determine the accuracy of field sampling on soil test results, found that with as many as 30 core samples per field, there was considerable inaccuracy in N and P measurements. Conductivity and pH were somewhat less variable. The number of cores needed for a given accuracy level increased very little for fields of up to 40 hectares in size. Degree of variation was higher within the same field than between fields.

Olson et al. (38) reporting on research conducted in Nebraska, found that different soil series could be grouped with regard to pH, P, and K status. Subsoil tests correlated very well with topsoil, indicating little need for subsoil testing.

Chemical Soil Test Procedures

Among the earliest rapid chemical tests for available nutrients was the Dyer method proposed in 1894 as reported by Tyner (53). After

considerable study on plant root acidity, Dyer decided that a 1% solution of citric acid should be of proper strength for extracting available soil nutrients.

Spurway (50) in 1933 devised a soil extracting solution of 1 part acetic acid to 3 parts distilled water. To the soil extract, various reagents were added to give colorimetric determinations of NO_3 , NH_3 , NO_2 , P, K, Ca, Mg, Fe, Al, CO_3 , Mn, Cl, and Na. The color development was then compared to a chart of colors for each tested element.

Morgan (34) in 1941 proposed his Universal Soil Testing Extract of 0.5N acetic acid buffered to pH 4.8 with sodium acetate. All elements under study were then determined in the same extract much the same way as Spurway (50) did. Morgan felt this extraction would work on all soils for all elements. Peech and English (41) in 1944 and Lunt et al. (27) in 1950 advocated Morgan's extractant with only a few minor adjustments in the method of determination of the separate elements after extraction.

Truog (52) proposed in 1930 that soil P be divided into readily available and difficultly available rather than available and unavailable forms. Differences in recommendations then could be based on crop and cropping intensity. The extraction procedure proposed was 0.002N H_2SO_4 , buffered with $(\text{NH}_4)_2\text{SO}_4$, to a pH of 3.0, with a soil to solution ratio of 1:200 be used to extract readily available P.

Bray (14) and Bray and Kurtz (16) reporting on P extraction research noted that most methods of P extraction involving acids were effective in extracting adsorbed P except when the absorbed P was

present in very large amounts. This explains why acid methods gave proportionately higher values on soils of high P status. Thus Bray proposed different extraction procedures for the different forms of P. For adsorbed P, the Bray P1 procedure ($0.03\text{N } \text{NH}_4\text{F}$ in 0.025N HCl and 1:7 soil to solution ratio with 1 minute shaking time) was proposed. For combined adsorbed and acid soluble P, the Bray P2 method ($0.03\text{N } \text{NH}_4\text{F}$ in 0.10N HCl and 1:7 soil to solution ratio with 40 second shaking time) was proposed. Olsen et al. (37) proposed a 0.5 M solution of NaHCO_3 at pH 8.5 for P determination. The extraction mechanism was based on the increased solubility of Ca-phosphates as a result of lowering the Ca^{++} activity in solution. Approximately 50% of the surface adsorbed P was extracted.

Soltnapour et al. (48) found little difference in correlation coefficients between displaced soil solution, 0.01M CaCl_2 extract, and the Double Acid extraction as P extraction procedures. He concluded that all methods were equal in soil P extraction. Mehlich (32) in 1953 proposed the North Carolina Double Acid method which is well suited to a wide range of neutral to acid soils with a CEC of less than 15 meq/100 grams soil. The extract is 0.05N HCl in $0.025\text{N H}_2\text{SO}_4$ with an original soil to solution ratio of 1:4 and 5 minutes shaking time. The procedure is applicable to mass analysis as P, K, Ca, Mg, Mn, Na, and Zn can all be determined in a single soil extract. Mehlich (33) in 1976 proposed a new soil extractant composed of 0.2N acetic acid, $0.015\text{N } \text{NH}_4\text{F}$, $0.2\text{N } \text{NH}_4\text{Cl}$, and 0.012N HCl . The objective was to develop a soil test extractant for several elements over a wide range of soil

properties that would eliminate the need to group soils for recommendations.

Seatz developed the extraction procedure currently in use at the Tennessee Soil Testing Laboratory (43). The extracting solution is 1% $(\text{NH}_4)_2\text{SO}_4$ in 0.05N H_2SO_4 with a 1:4 soil to solution ratio and a 3 minute shaking time. This procedure is similar to Truog's except that it is a stronger extracting solution.

Paauw (40) found a high correlation between water extractable soil P and plant response. He found no response difference due to soil properties such as pH or organic matter. Upon evaluation of different soil types from three continents, high correlation between the method and plant response was found. One single regression line could be fitted for all soils. Deionized water was used at a soil to solution ratio of 1:60. The soil was moistened and allowed to stand 22 hours, then shaken for 1 hour and filtered. The resultant solution was then analyzed for P.

McIntosh (30) modified the original Morgan method for the Vermont Soil Testing Laboratory. The Na^+ ion was replaced by NH_4^+ in the acetate solution. This increased measurement of K, Mg, Mn, and Ca. He proposed a second extraction for P of 1.25N ammonium acetate and 0.03N NH_4F . Phosphorus test results were found to be highly variable on acid to slightly acid soils.

Yaalon and Koyumdjisky (58) reported a considerable difference in ammonium and sodium acetate for displacing exchangeable K in soils.

The higher replacing power of NH_4^+ explains why ammonium acetate displaced 50% more K in montmorillonitic soils than sodium acetate. For highly leached soils, sodium acetate extracts more K due to NH_4^+ fixation. Groupings based on exchangeable K will need to be adjusted based on extracting chemical (58).

Lombin and Fayemi (26) evaluated 10 extraction procedures for available Mg on Nigerian soils. Among the methods studied were neutral N ammonium acetate, Morgan's extractant, 1N NH_4NO_3 , 0.05N HCl , and 0.025N CaCl_2 . Results indicated that all methods extracted the same form of Mg and thus all would work well on soils of the type studied. Correlation and regression analysis indicated that Morgan's extractant and the ammonium acetate gave better prediction of Mg uptake by corn.

Micronutrient Soil Testing

Hodgson (23) predicted that as the demand for higher yields increases, and the plant's major element requirements are met, more and more cases of micronutrient deficiency are likely to occur. Factors such as pH, organic matter, microbes, and seasonal variation affect micronutrient availability.

Mortvedt (35) contends that plant tissue analysis may be better than chemical soil analysis as micronutrient indicators since soil tests for micronutrients have not been widely adapted and used. A recent trend has been to use the same extractant for a variety of elements. The Double Acid extractant has been used to test for Zn and Mn as well as Ca, Mg, P, and K. Acid extractants are not suited for

calcareous soils, and in these regions, chelating agents have been used for trace elements. Bingham and Martin (11) and Bingham et al. (12) found severe Cu deficiency induced in citrus by heavy P fertilization. Plant growth in the soils treated with high rates of P fertilization was reduced. Copper application only partly reversed the effect. Zinc adsorption was reduced, while Fe and Mn adsorption were unaffected. Bingham and Garber (13) also found excessive P fertilization to cause severe Cu deficiency symptoms in plants. In acid soils, reduced uptake of B and Zn was noted, while Mn and Mo uptake increased. In alkaline soils, Mo uptake was reduced. Solubility of Mn, B, and Mo paralleled the uptake data.

Sorensen et al. (49) reporting on research concerning Zn, Mn, and Fe extraction by 0.1N HCl, reported wide differences in the amount of Zn extracted in relation to length of shaking and soil to solution ratio. There was little difference in the amounts of Mn and Fe extracted with respect to soil type. Soil organic matter was closely related to the amounts of all three nutrients measured. Martens and Chesters (29) determined plant uptake of Zn could best be predicted by a multiple regression equation using pH, 0.1N HCl extracted Zn, and clay content as the independent variables. Soil organic matter did influence Zn measured, but was not significant enough to enter into the regression equation.

Wear and Evans (55) evaluated 0.05N HCl and 0.025N H₂SO₄, 0.1N HCl, and 0.05M EDTA to determine soil Zn levels in relation to Zn uptake by corn and sorghum. For corn, the correlation coefficients were 0.89,

0.82, and 0.62 respectively, and for sorghum 0.70, 0.63, and 0.44. The Double Acid extractant gave the best correlation for both crops.

Lindsay and Norvell (24) in 1969 proposed an approach by which the equilibrium between chelating agents and metal ions can be predicted from formation constants. Specific metal-ligand complexes and the change in concentration relating to pH were predicted.

Follett and Lindsay (20) studied 11 soils fertilized with Zn, Fe, Mn, and Cu and soil test determination performed by the DTPA micronutrient soil test. The conclusion reached was that the DTPA soil test was effective for micronutrient cation availability evaluation. Soil test levels reported by the DTPA procedure agreed with observed oat and corn responses. Lindsay and Norvell (25) in 1978 proposed a new DTPA micronutrient soil test for use on neutral and calcareous soils. The extract is composed of 0.005M DTPA, 0.1M triethanolamine, and 0.01M CaCl_2 , adjusted to a pH 7.3. Ten grams of soil and 20 ml of extractant are shaken for 2 hours. The extract was tested for Zn, Fe, Mn, and Cu. The procedure was successful in separation of Colorado soils on the basis of crop response to the tested elements.

Possible Trends of the Future

Woodruff (57) on research on the energy of replacement of Ca by K found that energy of exchange was a good measure of the intensity factor for a balanced supply of cations from the exchange complex in soils. Calcium for K replacement energies of -3,500 to -4,000 calories indicate K deficiency while -2,500 to -3,000 calories indicate a proper

balance. Other cations will affect the energies, but the principle appeared universal in soil application.

Beckett (8, 9) proposed as a basis of evaluation of soil fertility the activity ratios of $K/(Ca + Mg)$. He found the activity ratio gave a good indication of labile soil K provided soils of widely different Ca and Mg status were not compared. The activity ratio was a measure of the intensity factor of the soil. Beckett et al. (10) extensively studied soil K and quantity-intensity (Q/I) relationships and conformation of the ratio laws, and found that release of fixed K was slow in comparison to fixation of K. The Q/I relations were not altered greatly by addition or release of K.

Baker (3, 4) and Stout and Baker (51) beginning in 1971, proposed an approach to soil testing based on equilibration with soil testing solutions. This work was in many ways similar to the work of Beckett (8, 9, 10) and the energy of exchange as shown by Woodruff (57). Baker prepared solutions which contained each element for which the soil was being tested. Serious problems for P tests were noted, but K, Mg, Ca, Zn, Fe, and Mn test results were promising. The soil was mixed with the testing solution and allowed to equilibrate. Changes in concentration in the test solution were then determined. This procedure shows promise for future soil testing and may be important immediately for grouping soils for soil test recommendations by present extraction procedures.

CHAPTER III

MATERIALS AND METHODS

Sample Collection and Preparation

Sixty different soil samples, representing 20 soil series of different P and K fertility levels were collected from different physiographic regions of Tennessee. The soil samples were air dried and ground to pass through a 2 mm sieve. The ground samples were placed in a Patterson-Kelley Model 1897 twin shell dry blender and thoroughly mixed to assure a homogenous representative sample. A one gallon cardboard container was filled with the mixed sample, and the remainder discarded. From this container, a one pint container was filled and used for subsequent analysis.

Soil series used in this study were Calloway, Memphis, Henry, Collins, Falaya, Loring, Grenada, Maury, Armour, Huntington, Hartsells, Sango, Robertsville, Mountview, Dickson, Sequoia, Whitwell, Etowah, Emory, and Sequatchie.

Laboratory Analysis of Samples

Three soil testing procedures were evaluated at each of six soil to solution ratios (1:4, 1:6, 1:8, 1:10, 1:15, and 1:20). The soil testing procedures considered were the Double Acid, outlined in Appendix A, the procedure used at the Tennessee Soil Testing Laboratory, outlined in Appendix B, and the newly proposed Mehlich Method, outlined in Appendix C. Each soil sample was analyzed in triplicate for all

procedures. Twenty-five ml of extracting solution was added to an appropriate weight of soil in a 125 ml Erlenmeyer flask to give the desired soil to solution ratio. Samples were then shaken for 30 minutes on a rotary shaker at 180 cycles per minute. The samples were then filtered through Whatman No. 2 filter paper into glass filter funnels. The extract was analyzed for P, K, Ca, Mg, Mn, and Zn. Phosphorus was determined colorimetrically on the Technicon AutoAnalyzer. Phosphorus in the Double Acid and Mehlich procedures was determined by the Ascorbic Acid Single Reagent Method of Murphy and Riley (36) as reported by Watanabe and Olsen (54), outlined in Appendix D. Phosphorus extracted by the Tennessee procedure was determined by the Molybdic Acid-Amino Naphthol Sulfonic Acid Method, as outlined in Appendix E.

Potassium was analyzed by flame emission on a Technicon Flame Photometer III with the flow diagram given in Appendix H. Calcium, magnesium, manganese, and zinc were determined on either the Perkin-Elmer Model 303 or 372 Atomic Absorption Spectrophotometer. Appropriate dilutions for Ca, Mg, and Mn were made by a Thomas Model 31 dilutor before analysis.

Exchangeable cations and CEC were determined by a modification of procedures given in Methods of Soil Analysis (18), as outlined in Appendix F, with NH_4^+ determined colorimetrically on a Technicon AutoAnalyzer as given in Appendix J, 0.1N HCl extractable Zn was determined using the procedure outlined by Cox and Wear (19), as given in Appendix G. Phosphorus determination was performed by the Bray P1 method, as outlined in Appendix H. These methods were used as check procedures to determine the extraction effectiveness of the evaluated soil test procedures.

All glassware was originally rinsed in extracting solution, to remove adsorbed ions, and then rinsed in deionized water. After analyses were begun, glassware was washed in a P-free soap and rinsed twice in distilled water and twice with deionized water. Blanks were run for all analyses periodically to assure no contamination of samples during extraction.

Statistical Analysis

The experimental design was a nested design with samples nested within soils, ratios, and extraction procedures. Analysis of variance, linear regression and curvilinear regression, correlation, and Duncan's New Multiple Range Test (DMR) mean separation were performed. The data were analyzed for each individual chemical extraction used and then for the combined data set. All statistical analysis was performed utilizing the facilities of the University of Tennessee Computing Center and followed standard statistical procedures as outlined by Barr et al. (6).

CHAPTER IV

RESULTS AND DISCUSSION

Sixty soil samples, representing 20 soil series, were analyzed for P, K, Ca, Mg, Mn, and Zn by three chemical extraction procedures at six soil to solution extracting ratios. The results for each replicate and the mean for each soil to solution extraction ratio for each soil sample for all chemical extractants are in Appendixes M through R. The soil samples chosen represent different physiographic regions of Tennessee and were selected to have wide differences in nutrient contents to better evaluate the extraction effectiveness of the tested chemical extraction procedures.

Analyses of variance of each element tested for soil to solution extraction ratio, soils, and the ratio $\times$ soil interaction are given in Tables 1 through 6. Table 7 lists the analysis of variance data for chemical extractant, soil to solution extracting ratio, chemical extractant $\times$ soil-solution ratio interaction, soils, chemical extractant $\times$ soil interaction, soil-solution ratio $\times$ soil interaction, and chemical extractant $\times$ soil-solution ratio $\times$ soil interactions for the combined data for each tested element. In addition, coefficients of variation (C.V.) and coefficients of determination (R^2) by extracting chemicals for each element are also presented.

As can be seen from the data in Table 1, the soil to solution extracting ratio had a significant effect on the amount of P extracted by all three chemical extractants. The largest F value was obtained

Table 1. F Values, Coefficients of Determination (R^2), and Coefficients of Variation (C.V.) for Soil-Solution Ratio and Soils for Phosphorus Extracted by Three Extractants

Source	DF	D.A.	Tenn.	Mehlich
Ratio	5	3,525**	3,446**	9,316**
Soil	59	2,614**	2,306**	4,207**
Ratio $\times$ Soil	295	127**	183**	132**
Error	720			
R^2		.99**	.99**	.99**
C.V. (%)		7.96	9.48	6.36

**Significant at the .01 level of probability.

Table 2. F Values, Coefficients of Determination (R^2), and Coefficients of Variation (C.V.) for Soil-Solution Ratio and Soils for Potassium Extracted by Three Extractants

Source	DF	D.A.	Tenn.	Mehlich
Ratio	5	575**	309**	287**
Soil	59	3,921**	3,580**	2,941**
Ratio $\times$ Soil	295	13**	8**	5**
Error	720			
R^2		.99**	.99**	.99**
C.V. (%)		4.42	3.97	4.64

**Significant at the .01 level of probability.

Table 3. F Values, Coefficients of Determination (R^2), and Coefficients of Variation (C.V.) for Soil-Solution Ratio and Soils for Calcium Extracted by Three Extractants

Source	DF	D.A.	Tenn.	Mehlich
Ratio	5	113**	570**	89**
Soil	59	711**	1,024**	857**
Ratio × Soil	295	15**	32**	7**
Error	720			
R^2	.98**	.98**	.99**	.99**
C.V. (%)		12.05	11.09	11.34

**Significant at the .01 level of probability

Table 4. F Values, Coefficients of Determination (R^2), and Coefficients of Variation (C.V.) for Soil-Solution Ratio and Soils for Magnesium Extracted by Three Extractants

Source	DF	D.A.	Tenn.	Mehlich
Ratio	5	185**	777**	182**
Soil	59	310**	457**	219**
Ratio × Soil	295	3**	9**	2**
Error	720			
R^2		.97**	.98**	.95**
C.V. (%)		10.99	10.37	13.76

**Significant at the .01 level of probability.

Table 5. F Values, Coefficients of Determination (R^2), and Coefficients of Variation (C.V.) for Soil-Solution Ratio and Soils for Manganese Extracted by Three Extractants

Source	DF	D.A.	Tenn.	Mehlich
Ratio	5	1,480**	801**	1,397**
Soil	59	210**	138**	175**
Ratio $\times$ Soil	295	9**	7**	6**
Error	720			
R^2		.97**	.95**	.96**
C.V. (%)		11.60	13.89	12.75

**Significant at the .01 level of probability.

Table 6. F Values, Coefficients of Determination (R^2), and Coefficients of Variation (C.V.) for Soil-Solution Ratio and Soils for Zinc Extracted by Three Extractants

Source	DF	D.A.	Tenn.	Mehlich
Ratio	5	388**	1,004**	2,137**
Soil	59	2,593**	3,186**	542
Ratio $\times$ Soil	295	10**	10**	22**
Error	720			
R^2		.99**	.99**	.99**
C.V. (%)		12.43	11.59	12.95

**Significant at the .01 level of probability.

Table 7. F Values, Coefficients of Determination (R^2), and Coefficients of Variation (C.V.) for Chemical Extractant, Soil-Solution Ratio, Soils, and Interactions for Amounts of P, K, Ca, Mg, Mn, and Zn Extracted by Three Extractants

Source	DF	P	K	Ca	Mg	Mn	Zn
Chemical Extractant	2	15,051**	8,200**	8,286**	119**	1,704**	228**
Soil-Solution Ratio	5	10,853**	1,079**	269**	810**	3,210**	3,151**
Chemical Extractant $\times$ Soil Solution Ratio	10	375**	11**	263**	92**	72**	191**
Soil Series	59	6,422**	10,129**	2,301**	895**	437**	5,427**
Chemical Extractant $\times$ Soil Series	118	572**	33**	100**	13**	30**	445**
Soil Solution Ratio $\times$ Soil Series	295	352**	18**	24**	7**	15**	31**
Chemical Extractant $\times$ Soil Solution Ratio $\times$ Soil Series	590	67**	3**	18**	3**	4**	6**
Error	2160						
R^2		.99**	.99**	.99**	.97**	.96**	.99**
C.V. (%)		8.93	4.36	12.04	11.77	13.01	12.30

**Significant at the .01 level of probability.

for the Mehlich extractant with the Tennessee and Double Acid extractants very similar. The soil samples significantly affected the amount of P measured. This was expected, since the soil samples were selected to show wide variation in both P and K content. The R^2 values were very high indicating that 99% of the variation in P measured by each of the three chemical extractants could be explained by the analysis of variance model chosen. The C.V. values were good, with the largest C.V. of 9.5% obtained from the Tennessee extractant and a low of 6.4% for the Mehlich extractant. The C.V. values indicate little difference in data dispersion among the three extractants.

The soil to solution extracting ratio significantly affected the K extracted by all chemical extractants, as shown in Table 2, but the F values obtained were not as large as for P. The F values for the soil samples were highly significant as expected. The R^2 values were .99 for all extractants, indicating 99% of K variation was explained by the analysis of variance model used. There was very little difference in the C.V. values with the range being from 3.9% for the Tennessee extractant to 4.6% for the Mehlich extractant indicating the data dispersion to be virtually the same for all extractants.

The data in Tables 3 through 6 for Ca, Mg, Mn, and Zn show similar results to the data for P and K. All soil to solution extracting ratios, soil samples, ratio $\times$ soil interactions, and R^2 values were significant at the 1% level of probability. The R^2 values were slightly lower in most cases and the C.V. values were somewhat higher than for P and K. The C.V. values for each element varied

little among the chemical extractants indicating that the data dispersion was similar for the different extractants.

Table 7 presents the results from combined analysis of data for all extractants, and indicates all F values to be significant at the 1% level of probability. The chemical extractant used had a highly significant effect on the amount of the element measured. The F values for the soil to solution extracting ratio were somewhat lower, but were still highly significant. The R^2 values for P, K, Ca, and Zn were .99 and for Mg and Mn were .97 and .96, respectively. This indicates that 96% of the variation in Mn, 97% in Mg, and 99% for P, K, Ca, and Zn were explained by the analysis of variance model chosen.

Once it was determined that the chemical extractant and the soil to solution extracting ratio significantly affected the amount of the elements measured, Duncan's New Multiple Range Test (DMR) for mean separations was performed.

Table 8 shows that as the extraction ratio increases from 1:4 to 1:20, a significant increase in P extracted at each increasing ratio for all three chemical extractants was found. The Tennessee extractant extracted more P at each ratio than either the Double Acid or Mehlich procedures, with the Double Acid intermediate and extracting more P at all ratios than did the Mehlich procedure.

The results for K, as shown in Table 9, were similar to the data for P. As the Double Acid soil to solution extraction ratio increased from 1:4 to 1:20, there was a significant increase in K extracted at each increasing ratio. The same pattern was observed for both the

Table 8. Mean Amount of Phosphorus Extracted by Soil-Solution Ratios for Each Chemical Extractant[†]

Ratio	D.A.	Tenn.	Mehlich
	----- PPM -----		
1:20	69.5 a [@]	92.6 a	45.2 a
1:15	59.4 b	67.4 b	37.4 b
1:10	46.6 c	53.5 c	27.0 c
1:8	39.6 d	46.3 d	23.1 d
1:6	34.3 e	40.6 e	18.1 e
1:4	26.0 f	28.0 f	11.7 f

[†]Mean amount of phosphorus extracted by Bray 1 was 35.4 ppm.

[@]Means separated by Duncan's New Multiple Range, .05 level.

Table 9. Mean Amount of Potassium Extracted by Soil-Solution Ratios for Each Chemical Extractant[†]

Ratio	D.A.	Tenn.	Mehlich
	----- PPM -----		
1:20	121.2 a [@]	148.0 a	146.4 a
1:15	116.2 b	145.4 b	141.6 b
1:10	114.6 c	140.8 c	136.9 c
1:8	112.3 d	141.7 c	136.2 c
1:6	106.8 e	135.0 d	129.4 d
1:4	96.1 f	128.1 e	124.5 e

[†]Mean amount of potassium extracted by ammonium acetate was 151.2 ppm.

[@]Means separated by Duncan's New Multiple Range Test, .05 level.

Tennessee and Mehlich extractants, except that there was no significant difference between the 1:8 and 1:10 ratios. The Tennessee extractant removed slightly more K at all ratios than did the Mehlich procedure.

For Ca, as shown in Table 10, the Double Acid extractant extracted slightly more Ca at all extracting ratios than did the Tennessee procedure, with the Mehlich procedure extracting approximately 50% as much Ca as the Double Acid. For Double Acid, wider soil to solution ratios extracted significantly more Ca, and when considering all soils across all soil-solution extraction ratios each increase in the soil to solution ratio extracted significantly more Ca. However, several soils from the West Tennessee loess area extracted by the Double Acid extractant did not follow this pattern. These soils exhibited a marked decrease in the amount of Ca extracted at the 1:15 and 1:20 soil-solution ratios. Additional analyses on these soils at a later date did not show this decrease in Ca extracted at the 1:15 and 1:20 soil-solution ratios. The values for Ca analyses by the acid extractants will be decreased somewhat since no masking chemicals were added to the soil extracts before analysis by atomic absorption spectrophotometry. The statistical analyses were performed on all the original data and this could have possibly influenced the results obtained for Ca with the Double Acid extractant and care should be used in interpreting this segment of the Ca data. For the Tennessee procedure, the 1:10 and 1:15 ratios appear to be reversed and there was a significant difference between each ratio. For the Mehlich procedure, the 1:20 ratio was the highest, followed by the 1:8, no difference between the

1:15 and 1:4, and then the 1:10 and 1:6 ratios with no significant difference between them.

Table 10. Mean Amount of Calcium Extracted by Soil-Solution Ratios for Each Chemical Extractant[†]

Ratio	D.A.	Tenn.	Mehlich
	----- PPM -----		
1:20	1050.3 a [@]	1037.1 a	508.4 a
1:15	993.6 b	849.1 c	453.6 c
1:10	947.2 c	870.1 b	417.6 d
1:8	894.8 d	710.5 d	483.8 b
1:6	850.2 e	682.9 e	416.1 d
1:4	816.9 f	606.2 f	459.6 c

[†] Mean amount of calcium extracted by ammonium acetate was 1078.4 ppm.

[@] Means separated by Duncan's New Multiple Range Test, .05 level.

For Mg, Table 11, the data were more variable. The Double Acid procedure removed slightly more Mg than did the Tennessee or Mehlich extractants. For Double Acid, the 1:15 extracting ratio extracted the most, the 1:20 was second, with no difference in the 1:10, 1:8, or 1:6 ratios, and the 1:4 ratio extracting significantly less. The Tennessee extractant had the 1:20, 1:8, 1:15, 1:6, 1:10, and 1:4 ratios in that decreasing order. The Mehlich extractant had the 1:20 ratio extracting significantly more, no difference between the 1:15 and 1:10, and then the 1:8, 1:6, and 1:4 in order with significant differences between each.

Both Mn, Table 12, and Zn, Table 13, exhibited similar extraction patterns. For both elements and all extractants, the 1:20 ratio

Table 11. Mean Amount of Magnesium Extracted by Soil-Solution Ratios for Each Chemical Extractant[†]

Ratio	D.A.	Tenn.	Mehlich
	----- PPM -----		
1:20	160.4 b [@]	166.9 a	154.8 a
1:15	167.5 a	149.4 c	150.1 b
1:10	141.9 c	124.8 e	146.5 b
1:8	142.4 c	152.7 b	137.0 c
1:6	141.1 c	144.9 d	121.4 d
1:4	121.2 d	83.5 f	106.2 e

[†]Mean amount of magnesium extracted by ammonium acetate was 122.9 ppm.

[@]Means separated by Duncan's New Multiple Range Test, .05 level.

Table 12. Mean Amount of Manganese Extracted by Soil-Solution Ratios for Each Chemical Extractant[†]

Ratio	D.A.	Tenn	Mehlich
	----- PPM -----		
1:20	421.8 a [@]	413.8 a	341.9 a
1:15	359.9 b	392.9 b	301.1 b
1:10	294.5 c	363.4 c	239.3 c
1:8	252.8 d	303.7 d	216.1 d
1:6	216.7 e	301.6 e	165.3 e
1:4	163.3 f	153.3 f	122.3 f

[†]Mean amount of manganese extracted by ammonium acetate was 69.7 ppm.

[@]Means separated by Duncan's New Multiple Range Test, .05 level.

Table 13. Mean Amount of Zinc Extracted by Soil-Solution Ratios for Each Chemical Extractant[†]

Ratio	D.A.	Tenn.	Mehlich
	----- PPM -----		
1:20	4.0 a [@]	4.9 a	5.3 a
1:15	3.3 b	3.6 b	3.6 b
1:10	3.1 c	3.4 c	2.8 c
1:8	3.0 d	2.9 d	2.5 d
1:6	2.7 e	2.7 e	2.0 e
1:4	2.4 f	2.4 f	1.6 f

[†]Mean amount of zinc extracted by 0.1N HCl was 2.8 ppm.

[@]Means separated by Duncan's New Multiple Range Test, .05 level.

extracted significantly more Mn and Zn. The other ratios were in descending order with each ratio significantly different from the other ratios.

The comparison of the chemical extractants across soil to solution ratios is given in Table 14. For P, the Tennessee procedure extracted significantly more than Double Acid which extracted significantly more than the Mehlich procedure. The Tennessee procedure extracted more K with the Mehlich extractant second and Double Acid extracted the least. Double Acid extracted significantly more Ca than the Tennessee procedure which was significantly higher than the Mehlich extractant. For Mg, the Double Acid procedure extracted significantly more than the Tennessee or Mehlich method, with there being no difference between the Tennessee and Mehlich methods. The data for Mn and Zn show that the Tennessee

procedure extracted significantly more Mn and Zn than did the Double Acid which extracted significantly more of both elements than did the Mehlich procedure.

Table 14. Mean Amount of P, K, Ca, Mg, Mn, and Zn Extracted by Each Chemical Extractant Across All Soil-Solution Ratios

Chemical Extractant	P	K	Ca	Mg	Mn	Zn
	----- PPM -----					
D.A.	45.9 b [@]	111.1 c	925.6 a	145.9 a	282.8 b	3.1 b
Tenn.	54.7 a	139.9 a	792.6 b	137.1 b	321.5 a	3.3 a
Mehlich	26.9 c	135.8 b	456.3 c	135.9 b	230.7 c	2.9 c

[@]Means separated by Duncan's New Multiple Range Test, .05 level.

The results for each soil sample for Bray 1 P, neutral normal ammonium acetate extractable K, Ca, Mg, and Mn, and 0.1N HCl extractable Zn are given in Appendix S. The mean amount of these elements is listed with the results of this study for the corresponding element (Tables 8 through 13, pages 23, 25-27) so that comparisons of the amount of each element measured by the standard extraction procedures can be compared to each extraction ratio for each chemical extractant. In order to compare and evaluate the extraction effectiveness of the chemical extractants used, correlations were performed between P, K, Ca, Mg, Mn, and Zn extracted by the chemical extractant under study, and the standard extraction procedures for the tested elements. Data for these correlation analyses are given in Table 15.

Table 15. Correlation Coefficients (r) of P with Bray 1, Zn with 0.1N HCl, and K, Ca, Mg, and Mn Extracted by Neutral Normal Ammonium Acetate for Each Chemical Extractant

Element	Chemical Extractant	Bray 1	0.1N HCl	Ammonium Acetate		
				K	Ca	Mg
P	D.A.	.74**				
	Tenn.	.71**				
	Mehlich	.84**				
K	D.A.			.87**		
	Tenn.			.88**		
	Mehlich			.89**		
Ca	D.A.				.69**	
	Tenn.				.68**	
	Mehlich				.77**	
Mg	D.A.					.49**
	Tenn.					.48**
	Mehlich					.52**
Mn	D.A.					.25**
	Tenn.					.34**
	Mehlich					.41**
Zn	D.A.		.97**			
	Tenn.		.97**			
	Mehlich		.61**			

**Significant at the .01 level of probability.

A correlation coefficient (r) of 0.84 was obtained when P extracted by the Mehlich procedure was correlated with P extracted by the Bray 1 method on the same soil samples. Correlation coefficients of 0.74 and 0.71 respectively were obtained from Double Acid and the Tennessee extractants. All r values were significant at the 1% level of probability.

There was very little difference among the three extractants when compared to ammonium acetate for K extraction. The Mehlich extractant had a r value of 0.89 and the Tennessee procedures had a r value of 0.88, and the Double Acid procedure had a r value of only slightly less at 0.87. All r values for K were significant at the 1% level of probability.

Correlation coefficients for Ca were somewhat lower than for P or K. A correlation coefficient of 0.77 was obtained for Ca extracted by the Mehlich procedure with Ca extracted by ammonium acetate. The Double Acid and Tennessee procedures had r values of 0.69 and 0.68 respectively. All r values were significant at the 1% level.

The correlation coefficients for Mg were lower than for Ca. The coefficients obtained were 0.52, 0.49, and 0.48 for the Mehlich, Double Acid, and Tennessee procedures respectively. These r values were significant at the 1% level.

The correlation coefficients for Mn were the lowest of any of the r values obtained. Values of 0.41, 0.34, and 0.25 for the Mehlich, Tennessee, and Double Acid procedures respectively were calculated. Although the r values were quite low, they were significant at the 1% level of probability.

There was considerable difference in the r values found for Zn. Correlation coefficients of 0.97, 0.96, and 0.61 were obtained for the Double Acid, Tennessee, and Mehlich procedures respectively. Although the r value for the Mehlich procedure was considerably lower than for either the Tennessee or Double Acid extractants, all r values were significant at the 1% level of probability.

Multiple regression analyses (Tables 16 through 21) were performed to determine if the results were linear. The amount of P, K, Ca, Mg, Mn, and Zn extracted by each of the test procedures was used as the dependent variable, and the soil-solution extracting ratio and soil-solution extracting ratio² were used as the independent variables.

The data for P and K (Tables 16 and 17) were very similar. For both elements and all three chemical extractants, the soil-solution ratio b values were highly significant. The b values for the soil-solution ratio² were very small and not significant. This indicates that the relationship between P and K extracted by each of the chemical extractants and the soil-solution extracting ratio was linear.

The data for Ca (Table 18) shows that the soil-solution extracting ratio had a significant b value only for the Tennessee extractant. The soil-solution ratio² was significant only for the Double Acid extractant. The data for the Tennessee extractant appear to be linear for soil-solution ratio with the data for the Double Acid extractant being curvilinear. The b values for the Mehlich extractant were not significant.

Table 16. Intercept and Multiple Regression b Values for Soil-Solution Ratio and Soil-Solution Ratio² as Independent Variables and Phosphorus Extracted by Each Chemical Extractant at All Soil-Solution Ratios as the Dependent Variable

Parameter Estimate	Chemical Extractant		
	D.A.	Tenn.	Mehlich
Intercept	10.41	17.58	-0.26
Ratio	4.24 **	3.26 **	3.28 **
Ratio ²	-0.07 ns	0.02 ns	-0.05 ns

ns Not significant at the .05 level of probability.

** Significant at the .01 level of probability.

Table 17. Intercept and Multiple Regression b Values for Soil-Solution Ratio and Soil-Solution Ratio² as Independent Variables and Potassium Extracted by Each Chemical Extractant at All Soil-Solution Ratios as the Dependent Variable

Parameter Estimate	Chemical Extractant		
	D.A.	Tenn.	Mehlich
Intercept	83.68	117.37	114.49
Ratio	4.27 **	3.43 **	2.98 **
Ratio ²	-0.12 ns	-0.09 ns	-0.07 ns

ns Not significant at the .05 level of probability.

** Significant at the .01 level of probability.

Table 18. Intercept and Multiple Regression b Values for Soil-Solution Ratio and Soil-Solution Ratio² as Independent Variables and Calcium Extracted by Each Chemical Extractant at All Soil-Solution Ratios as the Dependent Variable

Parameter Estimate	Chemical Extractant		
	D.A.	Tenn.	Mehlich
Intercept	665.55	487.43	421.29
Ratio	56.01 ns	34.35 **	-11.48 ns
Ratio ²	-2.34 **	-0.39 ns	0.61 ns

ns Not significant at the .05 level of probability.

** Significant at the .01 level of probability.

Table 19. Intercept and Multiple Regression b Values for Soil-Solution Ratio and Soil-Solution Ratio² as Independent Variables and Magnesium Extracted by Each Chemical Extractant at All Soil-Solution Ratios as the Dependent Variable

Parameter Estimate	Chemical Extractant		
	D.A.	Tenn.	Mehlich
Intercept	98.07	68.95	71.96
Ratio	7.24**	10.23**	10.23**
Ratio ²	-0.20*	-0.28**	-0.30**

*Significant at the .05 level of probability

**Significant at the .01 level of probability.

Table 20. Intercept and Multiple Regression b Values for Soil-Solution Ratio and Soil-Solution Ratio² as Independent Variables and Manganese Extracted by Each Chemical Extractant at All Soil-Solution Ratios as the Dependent Variable

Parameter Estimate	Chemical Extractant		
	D.A.	Tenn.	Mehlich
Intercept	66.95	11.19	22.06
Ratio	27.04**	49.50**	27.92**
Ratio ²	-0.47**	-1.49**	-0.60**

**Significant at the .01 level of probability.

Table 21. Intercept and Multiple Regression b Values for Soil-Solution Ratio and Soil-Solution Ratio² as Independent Variables and Zinc Extracted by Each Chemical Extractant at All Soil-Solution Ratios as the Dependent Variable

Parameter Estimate	Chemical Extractant		
	D.A.	Tenn.	Mehlich
Intercept	2.11	2.13	1.32
Ratio	0.09 **	0.07 **	0.08 **
Ratio ²	0.00 ns	0.00 ns	0.00 ns

ns Not significant at the .05 level of probability.

** Significant at the .01 level of probability.

The data for Mg and Mn (Tables 19 and 20) indicate that all b values for soil-solution ratios and all soil-solution ratio² were significant. This indicates that Mg and Mn extracted by each of the chemical extractants exhibits a curvilinear relationship with the soil-solution extracting ratio.

As can be seen in Table 21, the data for Zn are very similar to the data for P and K. The b values for soil-solution extracting ratio is highly significant for all chemical extractants. The b values for the soil-solution extracting ratio² were not significant indicating a linear relationship between soil solution ratio and Zn extracted by all extractants.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

Three chemical extraction procedures were compared to each other at six soil to solution extracting ratios and to standard extraction procedures for P, K, Ca, Mg, Mn, and Zn. The standard extraction procedures used were Bray 1 for P, 0.1N HCl for Zn, and neutral normal ammonium acetate for K, Ca, Mg, and Mn. Sixty soil samples, representing 20 soil series from different physiographic regions of Tennessee, were selected to show variation in the tested elements to better evaluate the chemical extractants studied.

Phosphorus was determined colorimetrically on the Technicon AutoAnalyzer using the appropriate manifold for each chemical extractant. Potassium was determined by flame emission on a Technicon Flame Photometer III. Calcium, magnesium, manganese, and zinc were determined by atomic absorption spectrophotometry after necessary dilutions.

Statistical analyses were performed on the collected data. Analyses of variance for the data were computed for each chemical extractant for soil-solution ratio, soil sample, and interaction. The combined data were analyzed for effect of chemical extractant, soil-solution ratio, soils, and interactions. Duncan's New Multiple Range Test analysis for mean separation, correlation, and regression analyses were performed.

Conclusions

The following conclusions were drawn from the results of this study.

1. The soil to solution extracting ratio and the chemical extractant significantly affect the amount of P, K, Ca, Mg, Mn, and Zn measured in a soil sample.
2. The coefficients of determination for the analysis of variance were high indicating that most of the variance in the tested elements was explained by the model used.
3. The coefficients of variation for each tested element differed only slightly among chemical extractants indicating similar data dispersion for the chemical extractants.
4. With the exception of the 1:10 and 1:8 extracting ratios for K extracted by the Tennessee and Mehlich procedures, for P, K, Mn, and Zn, there were significant increases in the amount of the elements measured for each increase in the soil-solution extracting ratio from 1:4 to 1:20.
5. Data for Ca and Mg were more variable and the trend was not as clear as for the other elements with the soil-solution extracting ratio having less effect on the amount of the elements measured.
6. Across soil-solution extracting ratios, the Tennessee procedure extracted significantly more P, K, Mn, and Zn, the Double Acid procedure extracted significantly more Ca and Mg than the other extractants.
7. The amount of P, K, Ca, Mg, Mn, and Zn extracted by each chemical extractant was highly correlated with the amount of each test

element measured by the respective standard extraction procedures, despite wide variations in the amount of the elements extracted by the different chemical extractants.

8. A linear relationship existed between the soil-solution extracting ratio and P, K, and Zn measured by each chemical extractant.

9. Only for the Tennessee extractant was the soil-solution extracting ratio a significant factor for Ca as shown by the regression analysis.

10. The Mg and Mn extracted in the different soil-solution ratios by the different extractants was nonlinear as shown by the significant b values for soil-solution ratio².

11. Although there are differences in the amounts of the test elements extracted by the chemical extractants, based on the data for analysis of variance, correlation and regression, and mean separation, there appears very little, if any, real differences in the extraction effectiveness of the Double Acid or Tennessee procedures, with the Mehlich extractant only slightly less effective as a soil test procedure.

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LITERATURE CITED

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APPENDICES

APPENDIX A

PROCEDURE FOR EXTRACTION OF SOIL BY DOUBLE ACID
AS USED IN THIS STUDY

1. Extracting reagent (0.05N HCl in 0.025N H_2SO_4). Dilute 8.6 ml of concentrated HCl and 1.4 ml concentrated H_2SO_4 to two liters with deionized water.

2. Weigh 6.250, 4.167, 3.125, 2.500, 1.667, or 1.250 grams of soil (to obtain soil to solution ratios of 1:4, 1:6, 1:8, 1:10, 1:15, or 1:20) into a 125 ml Erlenmeyer flask and add one small scoop of Darco G-60 activated carbon to clear the sample.

3. Add 25 ml of extracting solution from a bottle type automatic pipet.

4. Shake for 30 minutes on a rotary shaker at 180 oscillations per minute.

5. Filter through Whatman No. 2 filter paper and collect the extract. The extract should be clear.

6. At this point, the samples are ready for analysis on the Technicon AutoAnalyzer for P and K, and on the Perkin-Elmer Atomic Absorption Spectrophotometer, after necessary dilutions, for Ca, Mg, Mn, and Zn.

APPENDIX B

PROCEDURE FOR EXTRACTION OF SOIL BY THE TENNESSEE PROCEDURE
AS USED IN THIS STUDY

1. Extracting reagent (0.05N H_2SO_4 containing 1% $(\text{NH}_4)_2\text{SO}_4$). Dilute 1.4 ml concentrated H_2SO_4 and 10 grams $(\text{NH}_4)_2\text{SO}_4$ to one liter with deionized water.

2. Weigh 6.250, 4.167, 3.125, 2.500, 1.667, or 1.250 grams of soil (to obtain soil to solution ratios of 1:4, 1:6, 1:8, 1:10, 1:15, and 1:20) into a 125 ml Erlenmeyer flask and add one small scoop of Darco G-60 activated carbon to clear the sample.

3. Add 25 ml of extracting solution from a bottle type automatic pipet.

4. Shake for 30 minutes on a rotary shaker at 180 oscillations per minute.

5. Filter through Whatman No. 2 filter paper and collect the extract. The extract should be clear.

6. At this point, the samples are ready for analysis on the Technicon AutoAnalyzer for P and K, and on the Perkin-Elmer Atomic Absorption Spectrophotometer, after necessary dilution, for Ca, Mg, Mn, and Zn.

APPENDIX C

PROCEDURE FOR EXTRACTION OF SOIL BY MEHLICH METHOD
AS USED IN THIS STUDY

1. Extracting reagent. Dissolve in 750 ml deionized water 0.56 grams ammonium fluoride (NH_4F), 10.7 grams ammonium chloride (NH_4Cl), then add 1 ml concentrated HCl , and 11.5 ml glacial acetic acid and dilute to one liter with deionized water.

2. Weigh 6.250, 4.167, 3.125, 2.500, 1.667, or 1.250 grams of soil (to obtain soil to solution ratios of 1:4, 1:6, 1:8, 1:10, 1:15, and 1:20) into a 125 ml Erlenmeyer flask and add one small scoop of Darco G-60 activated carbon to clear the sample.

3. Add 25 ml of extracting solution from a bottle type automatic pipet.

4. Shake for 30 minutes on a rotary shaker at 180 oscillations per minute.

5. Filter through Whatman No. 2 filter paper and collect the extract. The extract should be clear.

6. At this point, the samples are ready for analysis on the Technicon AutoAnalyzer for P and K, and on the Perkin-Elmer Atomic Absorption Spectrophotometer, after necessary dilution, for Ca, Mg, Mn, and Zn.

APPENDIX D

TECHNICON PROCEDURE FOR THE AUTOMATED SINGLE REAGENT
ASCORBIC ACID P DETERMINATION

Reagents—Sulfuric-Molybdate-Tartrate Solution. Dissolve 100 grams ammonium molybdate ($(\text{NH}_4)_6 \text{Mo}_7 \text{O}_{24} \cdot 4 \text{H}_2\text{O}$) and 2.425 grams antimony potassium tartrate ($\text{K Sb O C}_4\text{H}_4\text{O}_6 \cdot 1/2 \text{H}_2\text{O}$) in 500 ml deionized water. Slowly add 1400 ml concentrated H_2SO_4 and dilute to two liters. Store in polyethylene or pyrex bottle in a dark, refrigerated compartment.

Ascorbic Acid Solution. Dissolve 88.0 grams of ascorbic acid in deionized water and dilute to one liter. Refrigerate in a dark bottle.

Working Solution. Add 20 ml of the molybdate solution and 10 ml of the ascorbic acid and dilute to one liter with deionized water. Allow to stand 30 minutes before using and prepare fresh weekly.

APPENDIX E

SINGLE REAGENT ASCORBIC ACID PHOSPHORUS MANIFOLD

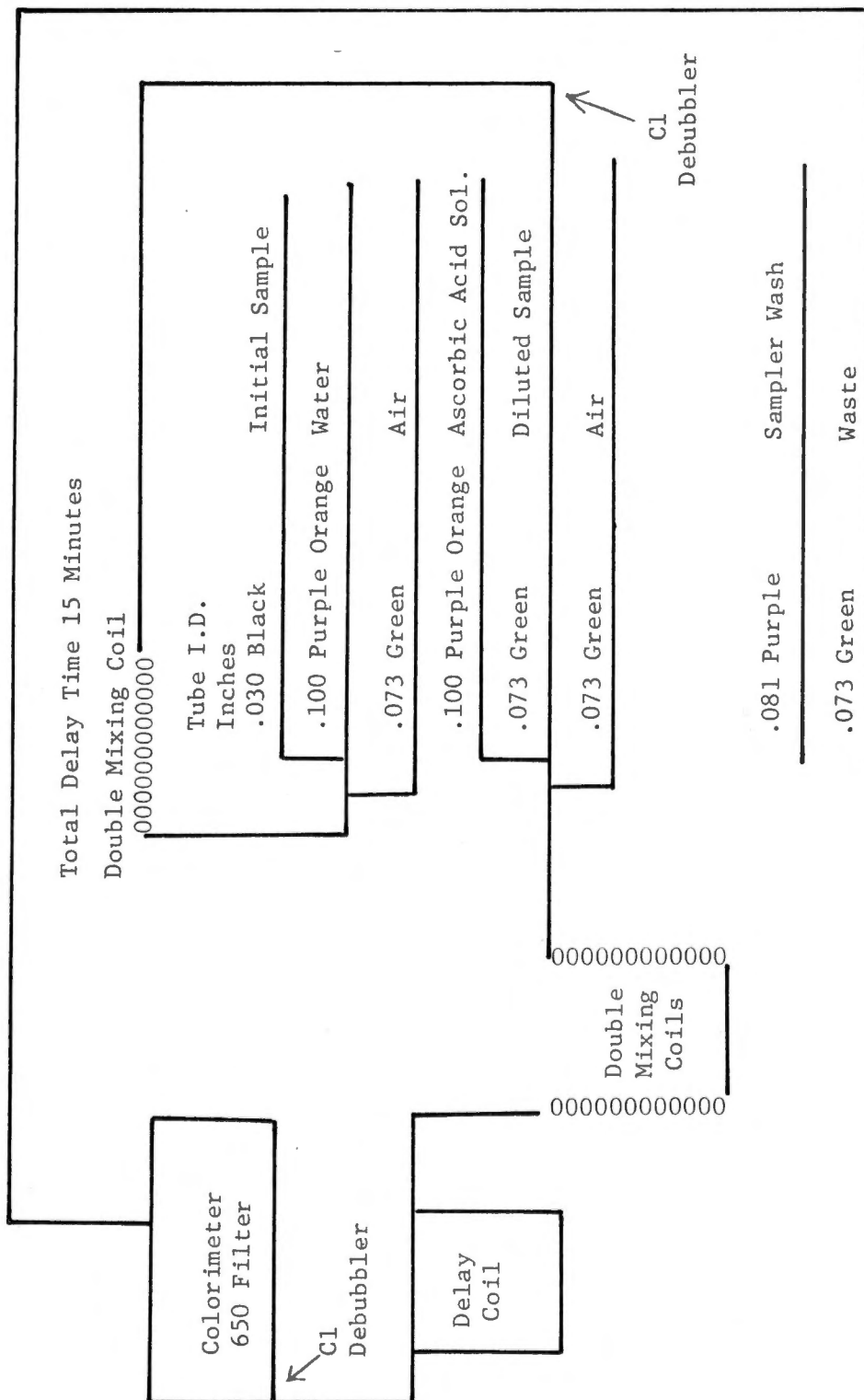


Figure 1. Single Reagent Ascorbic Acid Phosphorus Manifold.

APPENDIX F

TECHNICON PROCEDURE FOR P DETERMINATION BY MOLYBDIC ACID-
AMINO NAPTHOL SULFONIC ACID

Reagents: Molybdic Acid Solution. Dissolve 25 grams ammonium molybdate ($(\text{NH}_4)_6 \text{Mo}_7 \text{O}_{24} \cdot 4\text{H}_2\text{O}$) in 200 ml deionized water heated to 60 degrees C and filtered. Dilute 275 ml concentrated H_2SO_4 to 750 ml. After both solutions have cooled, add the ammonium molybdate to the acid slowly with stirring and dilute to one liter.

Reducing Agent. Amino-Napthol-Sulfonic Acid. Mix thoroughly 2.5 grams 1-amino-2-napthol-4-sulfonic acid (Eastman), 5.0 grams sodium sulfite (Na_2SO_3) and 146.25 grams sodium bisulfite (meta, $\text{Na}_2\text{S}_2\text{O}_5$) and grind the mixture to a fine powder. Dissolve 8.0 grams of the ground mixture in 50 ml of warm deionized water. Allow to stand overnight and filter before using.

Dilute 125 ml of the reducing agent to one liter in deionized water for use with the Technicon AutoAnalyzer manifold shown in Appendix G.

APPENDIX G

MOLYBDIC ACID-AMINO NAPTHOL SULFONIC ACID

PHOSPHORUS MANIFOLD

APPENDIX H

POTASSIUM MANIFOLD

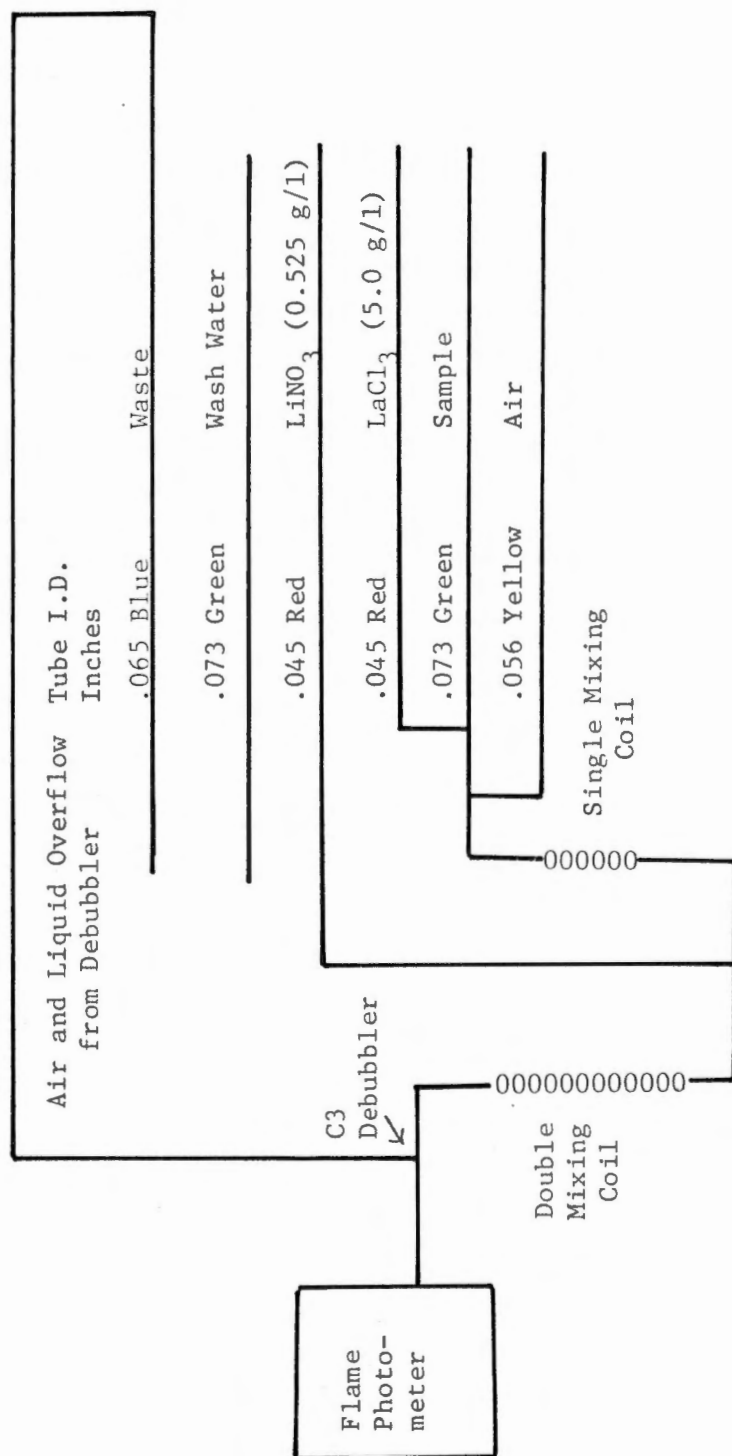


Figure 3. Potassium Manifold.

APPENDIX I

PROCEDURE FOR DETERMINATION OF EXCHANGEABLE
CATIONS AND CEC

Reagents. Ammonium acetate 1N pH 7.0. Dilute 560 ml ammonium hydroxide (sp. gr. 0.90) to two liters with deionized water. Dilute 458 ml glacial acetic acid (99.5%) to two liters with deionized water. Mix the two chemicals together and dilute to a final volume of eight liters with deionized water. Allow to cool and adjust the pH to 7.00 ± 0.05 .

Ethyl alcohol 95%.

A 10% sodium chloride solution adjusted to pH 2.5 with concentrated HCl added dropwise with stirring.

Procedure.

1. Weigh 10 grams of air dry soil (2.0 mm) into a 125 ml Erlenmeyer flask and add 10 ml of ammonium acetate. Shake to wet the soil and allow to stand overnight. Filter through Watman No. 42 filter paper with gentle suction. Repeat if filtrate is not clear. Wash the soil on the filter paper with 8 or more washings of ammonium acetate. The filtration should take no less than one hour to complete with approximately 100 ml extract collected. Transfer to a 100 ml volumetric flask and bring to volume with ammonium acetate. Use this filtrate for determination of exchangeable cations. Refrigerate if the extract is kept more than 24 hours.
2. Wash the soil on the filter paper with at least eight washings of ethyl alcohol. Use at least 90 ml of alcohol and discard the leachate. Apply only gentle suction.
3. Add 10 ml of 10% acidified sodium chloride to the soil on the Buchner funnel. Allow to leach without suction until almost all the NaCl has filtered through or for 30 minutes. Complete replacement of the ammonium by adding five ml increments of NaCl allowing each addition to filter almost completely through. Use only gentle suction. Filtration should take at least one hour and 100 ml of filtrate should be collected. Use this solution for the colorimetric determination of NH_4^+ by the Technicon AutoAnalyzer manifold given in Appendix J to calculate the total CEC.
4. Determine the CEC as follows:

CEC in meq/100 grams =

$$\text{NH}_4 \text{ (}\mu\text{g/g)} \times \frac{\text{Volume}}{\text{Extracted}} \times \text{Dilution} \times \frac{100 \text{ g}}{10 \text{ g}} \times .001 \text{ mg}/\mu\text{g} \times \frac{1}{18.03858}$$

APPENDIX J

AMMONIACAL NITROGEN MANIFOLD

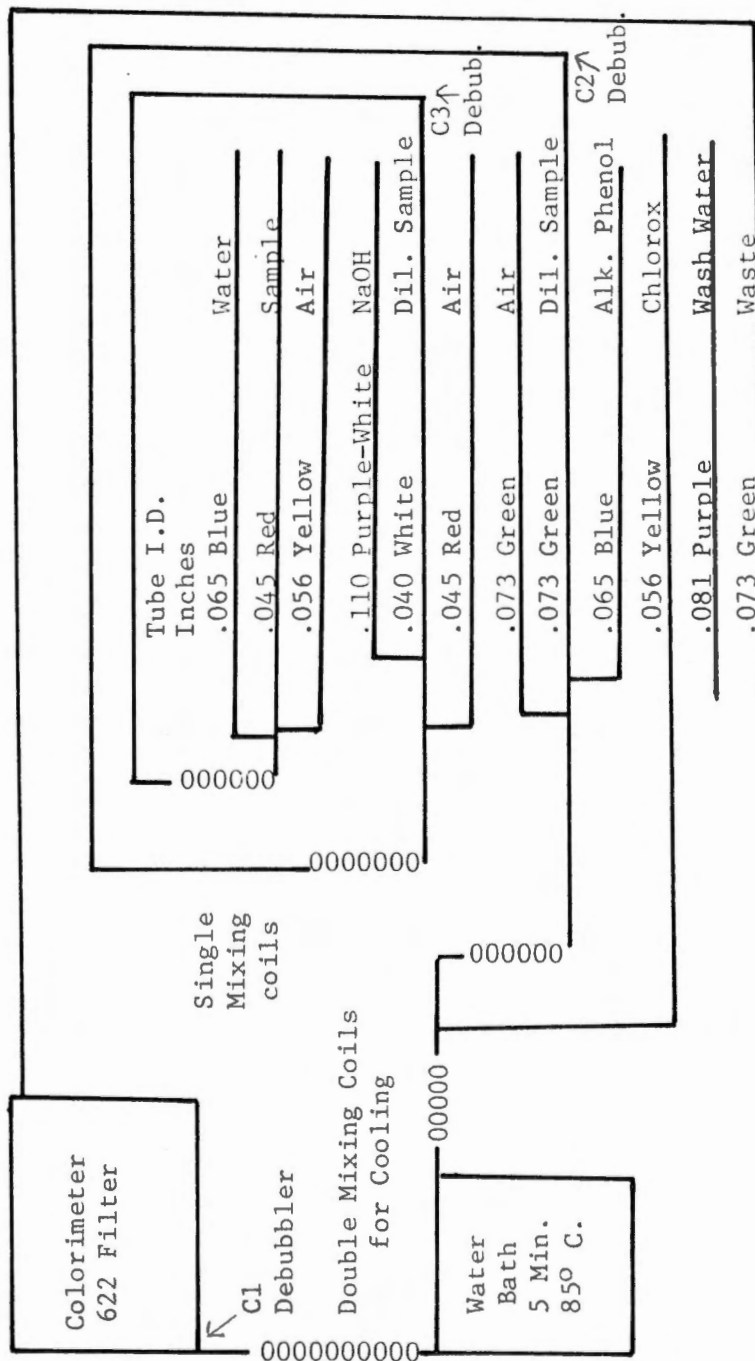


Figure 4. Ammoniacal Nitrogen Manifold.

APPENDIX K

PROCEDURE FOR 0.1N HCl EXTRACTABLE ZINC

1. Extracting reagent. Dilute 17.2 ml of concentrated HCl to two liters with deionized water.
2. Weigh 2.500 grams of soil into a 125 ml Erlenmeyer flask and add 25 ml of extracting solution.
3. Shake for 15 minutes on rotary shaker at 180 oscillations per minute.
4. Gravity filter through Whatman No. 2 filter paper and analyze on an atomic absorption spectrophotometer.

APPENDIX L

PROCEDURE FOR P DETERMINATION BY THE BRAY P1 METHOD

1. Extracting reagent. 0.03N NH_4F -0.025N HCl .
 - A. NH_4F , 1N: Dissolve 37 grams of NH_4F in 400 ml of deionized water and dilute to one liter.
 - B. HCl , 0.5N: Dilute 20.2 ml of concentrated HCl to 500 ml with deionized water.
 - C. Mix 30 ml of 1N NH_4F with 50 ml of 0.5N HCl and dilute to one liter with deionized water.
2. Weigh 2.500 grams of 10-mesh soil into a 125 ml Erlenmeyer flask and add 25 ml of extracting reagent from a bottle type automatic pipet. Shake for 5 minutes on a rotary shaker at 180 oscillations per minute.
3. Filter through Whatman No. 2 filter paper limiting filtration time to 10 minutes.
4. Determine P concentration using the automated Single Reagent Ascorbic Acid P procedure.

APPENDIX M

PPM PHOSPHORUS EXTRACTED BY DIFFERENT SOIL-SOLUTION

RATIOS FOR THREE SOIL EXTRACTANTS

Table 22. PPM Phosphorus Extracted by Different Soil-Solution Ratios for Three Soil Extractants

		EXTRACTANT AND SOIL TO SOLUTION RATIO--												(COLUMN HEADINGS OF 4, 6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)											
SOIL	REP	DOUBLE ACID						TENNESSEE						MEHLICH											
		4	6	8	10	15	20	4	6	8	10	15	20	4	6	8	10	15	20	4	6	8	10	15	20
CALLOWAY	1	9	9	11	14	16	20	11	17	18	19	17	17	2	5	6	8	11	13						
CALLOWAY	2	5	9	9	12	17	20	13	17	18	22	20	20	3	3	6	6	11	12						
CALLOWAY	3	6	11	9	14	9	26	11	18	15	19	22	22	2	4	7	9	12	13						
CALLOWAY	AVG	7	10	10	13	14	22	12	17	17	20	20	20	2	4	6	8	11	13						
MEMPHIS	1	24	22	30	35	53	62	16	35	43	53	67	67	5	10	13	17	24	30						
MEMPHIS	2	18	22	25	33	57	52	16	35	42	48	69	69	5	7	13	14	26	29						
MEMPHIS	3	15	22	26	34	36	55	17	35	42	50	71	71	6	10	15	18	25	29						
MEMPHIS	AVG	19	22	27	34	49	56	16	35	42	50	69	69	5	9	14	16	25	29						
HENRY	1	32	34	36	43	63	70	31	40	51	57	73	73	14	22	27	33	45	51						
HENRY	2	30	32	34	39	62	58	18	39	48	59	77	77	13	22	26	28	44	51						
HENRY	3	26	36	43	43	61	59	32	41	48	58	77	77	15	23	28	29	47	53						
HENRY	AVG	29	34	38	42	62	62	27	40	49	58	76	76	14	22	27	30	45	52						
CALLOWAY	1	8	5	23	16	24	26	7	13	16	20	29	29	1	5	5	6	11	13						
CALLOWAY	2	5	9	13	15	24	28	6	12	18	16	27	27	2	2	5	5	11	11						
CALLOWAY	3	5	12	12	17	14	27	8	11	16	19	25	25	2	4	6	7	12	12						
CALLOWAY	AVG	6	9	16	16	21	27	7	12	17	18	27	27	2	4	5	6	11	12						
COLLINS	1	56	63	67	77	58	110	51	44	58	73	93	93	36	51	59	66	83	93						
COLLINS	2	53	63	67	68	111	102	51	45	57	89	97	97	37	52	61	65	82	90						
COLLINS	3	52	71	69	69	69	104	54	46	57	90	97	97	38	53	62	66	85	96						
COLLINS	AVG	54	66	68	71	93	105	52	45	57	81	96	96	37	52	61	66	83	93						
COLLINS	1	21	23	25	30	42	52	16	32	39	46	56	56	7	13	22	21	42	38						
COLLINS	2	16	21	24	29	42	42	16	33	37	46	55	55	8	11	16	16	42	38						
COLLINS	3	16	26	23	29	44	46	16	33	35	43	53	53	8	13	15	18	32	39						
COLLINS	AVG	18	23	24	29	43	47	16	33	37	45	55	55	8	12	18	18	39	38						
HENRY	1	11	11	13	16	21	26	10	18	22	22	26	26	1	5	6	8	11	14						
HENRY	2	8	10	13	17	21	24	15	18	20	23	30	30	1	5	5	5	10	14						
HENRY	3	7	14	13	17	16	25	11	20	19	24	27	27	1	5	5	7	12	16						
HENRY	AVG	9	12	13	17	19	25	12	19	20	23	28	28	1	4	6	7	11	15						
CALLOWAY	1	5	7	9	12	14	18	6	8	8	9	12	12	1	2	1	1	3	6						
CALLOWAY	2	4	6	9	11	14	18	6	7	7	9	12	12	1	1	1	1	3	5						
CALLOWAY	3	4	10	8	11	12	18	6	8	7	9	12	12	1	2	1	1	3	4						
CALLOWAY	AVG	4	8	9	11	13	18	6	8	7	9	12	12	1	2	1	2	3	6						
COLLINS	1	34	33	34	42	56	66	36	40	50	57	75	75	18	27	34	39	46	53						
COLLINS	2	30	33	35	39	56	52	36	41	49	60	83	83	18	28	33	36	47	54						
COLLINS	3	27	37	33	40	48	57	40	41	48	57	74	74	19	29	34	39	47	52						
COLLINS	AVG	30	34	34	40	53	58	27	41	49	58	77	77	18	28	34	38	47	53						
MEMPHIS	1	16	17	19	24	30	36	15	28	33	35	43	43	5	10	13	16	23	27						
MEMPHIS	2	15	15	19	22	32	32	15	28	31	37	43	43	5	7	12	12	22	27						
MEMPHIS	3	12	19	18	22	29	34	15	28	31	36	44	44	5	10	12	15	25	25						
MEMPHIS	AVG	14	17	19	23	30	34	15	28	32	36	43	43	5	9	12	14	23	26						
COLLINS	1	36	38	43	50	75	80	37	41	52	60	79	79	14	20	28	35	48	59						
COLLINS	2	33	36	42	47	72	70	36	40	51	63	86	86	14	22	26	29	48	61						
COLLINS	3	29	41	40	47	73	66	36	41	50	64	79	79	15	22	27	30	49	59						
COLLINS	AVG	33	38	42	48	73	72	36	41	51	62	81	81	14	21	27	31	48	60						
COLLINS	1	26	25	27	37	48	60	16	37	43	50	62	62	3	5	7	10	18	23						
COLLINS	2	21	23	28	33	48	50	16	35	44	50	72	72	3	4	7	6	19	23						
COLLINS	3	17	26	27	32	46	48	16	36	43	48	69	69	3	5	8	9	20	23						
COLLINS	AVG	21	25	27	34	47	53	16	36	43	49	68	68	3	5	7	8	19	23						

Table 22 (continued)

EXTRACTANT AND SOIL TO SOLUTION RATIO (COLUMN HEADINGS OF -4, -6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)																			
SOIL	REP	DOUBLE ACID					TENNESSEE					MEHLICH							
		-4	-6	-8	-10	-15	-20	-4	-6	-8	-10	-15	-20	-4	-6	-8	-10	-15	-20
FALAYA	1	60	75	87	57	131	136	53	70	90	84	102	102	34	45	58	66	95	95
FALAYA	2	59	69	91	97	120	126	54	72	87	105	87	87	34	49	57	61	82	100
FALAYA	3	55	80	83	86	110	119	54	80	90	87	117	117	36	48	55	62	86	96
FALAYA	AVG	58	75	87	93	120	127	54	74	89	92	102	102	35	47	57	63	88	97
HENRY	1	16	18	24	30	41	48	14	28	36	39	54	54	6	8	13	17	24	31
HENRY	2	15	17	24	31	42	42	13	27	33	40	49	49	6	11	14	14	23	33
HENRY	3	12	19	22	26	26	42	14	30	32	38	48	48	7	10	12	13	24	33
HENRY	AVG	14	18	23	29	36	44	14	28	34	39	50	50	6	10	13	15	24	32
CALLOWAY	1	48	54	62	72	96	114	51	44	58	70	92	92	19	29	39	48	62	70
CALLOWAY	2	45	49	60	68	84	90	45	44	57	80	93	93	19	35	41	43	63	72
CALLOWAY	3	39	54	58	62	72	87	48	44	56	80	93	93	21	32	38	44	60	68
CALLOWAY	AVG	44	52	60	67	84	97	48	44	57	77	93	93	20	32	39	45	62	70
MEMPHIS	1	4	6	9	13	12	16	3	3	3	4	5	5	1	1	1	1	4	5
MEMPHIS	2	4	4	9	12	12	14	2	3	3	4	6	6	1	3	2	1	2	6
MEMPHIS	3	4	6	7	10	15	17	2	3	3	4	6	6	1	1	1	1	3	5
MEMPHIS	AVG	4	5	8	12	13	16	2	3	3	4	6	6	1	2	1	1	3	5
CALLOWAY	1	6	7	11	16	15	22	9	12	14	13	15	15	1	1	1	1	5	8
CALLOWAY	2	5	6	11	15	16	20	8	12	13	13	15	15	1	1	1	1	5	9
CALLOWAY	3	5	7	9	13	16	21	8	12	12	13	13	13	1	1	1	1	7	7
CALLOWAY	AVG	5	7	10	15	16	21	8	12	13	13	14	14	1	2	1	1	6	8
GRENADA	1	25	28	41	38	53	54	30	38	48	54	66	66	9	14	20	26	32	39
GRENADA	2	26	26	29	38	50	48	28	39	47	59	67	67	9	15	20	22	32	41
GRENADA	3	24	26	28	33	50	52	36	39	46	57	70	70	9	16	19	21	34	39
GRENADA	AVG	25	27	33	36	51	51	31	39	47	57	68	68	9	15	20	23	33	40
GRENADA	1	16	16	19	24	29	34	15	29	31	35	44	44	5	7	12	15	20	26
GRENADA	2	15	14	19	24	29	32	15	28	32	36	41	41	4	12	11	12	21	37
GRENADA	3	13	16	18	22	27	34	15	31	32	36	44	44	6	10	11	12	22	24
GRENADA	AVG	15	15	19	23	28	33	15	29	32	36	43	43	5	10	11	13	21	29
LORING	1	7	8	11	16	17	22	9	14	14	13	15	15	1	2	3	6	9	13
LORING	2	7	6	13	17	17	20	9	13	15	17	18	18	1	5	4	4	8	22
LORING	3	6	7	11	14	14	22	9	13	12	14	16	16	2	4	3	3	10	12
LORING	AVG	7	7	12	16	16	21	9	13	14	15	16	16	1	4	3	4	9	16
FALAYA	1	16	19	22	28	41	48	16	32	37	43	56	56	5	7	12	16	24	30
FALAYA	2	15	16	23	29	39	40	15	30	37	42	55	55	5	12	11	13	23	34
FALAYA	3	13	15	22	24	36	42	16	31	38	43	57	57	6	11	10	13	25	29
FALAYA	AVG	15	17	22	27	39	43	16	31	37	43	56	56	5	10	11	14	24	31
MEMPHIS	1	15	17	19	24	32	37	15	28	31	34	47	47	7	8	13	17	25	31
MEMPHIS	2	15	13	19	25	45	32	15	27	31	39	45	45	6	10	13	15	26	29
MEMPHIS	3	13	15	18	22	30	34	15	29	31	34	44	44	7	12	12	15	26	31
MEMPHIS	AVG	14	15	19	24	36	34	15	28	31	36	45	45	7	10	13	16	26	30
CALLOWAY	1	4	6	7	13	9	16	3	4	4	5	7	7	1	1	1	2	3	5
CALLOWAY	2	4	4	11	12	9	24	3	3	4	5	7	7	1	2	1	1	5	4
CALLOWAY	3	4	4	8	9	6	15	3	4	4	5	7	7	1	2	1	3	4	5
CALLOWAY	AVG	4	5	9	11	8	18	3	4	4	5	7	7	1	2	1	2	4	5
FALAYA	1	33	39	40	46	66	76	36	42	52	61	82	82	17	25	29	34	42	48
FALAYA	2	33	35	42	49	65	60	33	42	52	62	81	81	18	26	29	30	43	47
FALAYA	3	29	34	36	42	65	63	42	42	52	63	83	83	21	29	28	33	42	49
FALAYA	AVG	32	36	39	46	65	66	37	42	52	62	82	82	19	27	29	32	42	48

Table 22 (continued)

		EXTRACTANT AND SOIL TO SOLUTION RATIO-----										----- COLUMN HEADINGS OF _4, _6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)									
SOIL	REP	DOUBLE ACID										TENNESSEE									
		_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	MEHLICH	
FALAYA	1	71	110	157	186	240	300	57	100	106	108	199	199	39	57	67	83	111	150		
FALAYA	2	75	108	158	188	248	300	54	98	106	136	222	222	42	58	68	76	112	150		
FALAYA	3	75	121	155	181	248	300	60	100	112	129	222	222	46	68	66	77	109	150		
FALAYA	AVG	74	113	157	185	245	300	57	99	108	124	214	214	42	61	67	79	111	150		
SANG	1	26	32	34	47	27	26	33	29	43	34	45	45	14	21	27	29	39	34		
SANG	2	26	31	43	35	27	32	32	32	30	32	37	37	16	22	28	32	35	46		
SANG	3	29	36	34	44	29	32	29	35	30	34	36	36	15	20	29	33	37	34		
SANG	AVG	27	33	37	42	31	28	31	32	34	33	39	39	15	21	28	31	37	38		
SANG	1	62	76	81	87	81	78	71	82	106	71	99	99	51	63	74	82	89	85		
SANG	2	59	74	80	88	79	83	75	89	72	54	95	95	51	63	70	83	84	98		
SANG	3	62	78	78	91	82	86	72	85	84	80	91	91	52	63	74	80	89	90		
SANG	AVG	61	76	80	89	81	82	73	85	87	68	95	95	51	63	73	82	87	91		
LORING	1	24	25	31	37	48	48	17	37	43	48	61	61	6	9	15	19	28	37		
LORING	2	22	24	34	39	50	48	17	36	44	51	72	72	7	12	14	16	29	36		
LORING	3	21	25	29	33	47	54	17	36	41	51	61	61	8	14	13	17	27	36		
LORING	AVG	22	25	31	36	48	50	17	36	43	50	65	65	7	12	14	17	28	36		
MEMPHIS	1	13	15	19	25	36	40	14	27	31	35	45	45	2	5	6	9	15	24		
MEMPHIS	2	12	13	19	25	33	36	14	26	31	35	44	44	3	5	5	6	15	19		
MEMPHIS	3	11	13	18	23	24	36	15	27	30	35	44	44	3	5	6	7	15	22		
MEMPHIS	AVG	12	14	19	24	31	37	14	27	31	35	44	44	3	5	6	7	15	22		
SANG	1	18	25	34	42	43	48	19	30	31	37	47	47	8	13	17	19	29	32		
SANG	2	20	27	34	42	46	50	17	31	37	37	45	45	9	13	15	21	28	36		
SANG	3	20	30	34	42	45	53	24	30	33	36	46	46	9	13	18	22	27	34		
SANG	AVG	19	27	34	42	45	50	20	30	34	37	46	46	9	13	17	21	28	34		
FALAYA	1	19	19	21	25	29	36	17	33	38	42	43	43	12	18	22	27	33	34		
FALAYA	2	18	22	25	30	30	28	17	33	36	43	42	42	13	18	23	26	32	36		
FALAYA	3	18	19	20	23	33	32	17	34	36	41	44	44	12	19	22	27	31	36		
FALAYA	AVG	19	21	23	31	32	37	17	33	37	42	43	43	12	18	22	27	32	35		
MAURY	1	50	79	56	115	156	168	80	134	130	160	160	160	12	32	49	67	85	104		
MAURY	2	53	79	95	114	150	163	80	121	148	160	160	160	18	31	47	65	84	115		
MAURY	3	53	79	96	113	148	180	76	134	142	160	134	134	14	31	51	66	84	115		
MAURY	AVG	52	79	96	114	151	170	79	130	140	160	151	151	15	31	49	66	84	111		
MAURY	1	29	39	52	60	70	64	35	48	52	65	58	58	3	9	16	17	32	37		
MAURY	2	29	42	52	63	66	67	35	45	51	57	57	57	4	9	14	20	29	48		
MAURY	3	31	44	55	62	68	72	34	46	53	65	54	54	3	9	18	22	29	40		
MAURY	AVG	30	42	53	62	68	68	35	46	52	62	56	56	3	9	16	20	30	42		
AMCUR	1	80	120	160	200	300	400	117	159	183	267	280	280	7	21	35	42	63	83		
AMCUR	2	80	120	160	200	300	400	117	159	194	231	294	294	9	20	33	44	64	86		
AMCUR	3	80	120	160	200	300	400	96	159	188	249	294	294	8	22	37	48	57	83		
AMCUR	AVG	80	120	160	200	300	400	110	159	188	249	289	289	8	21	35	45	61	84		
HUNTINGTON	1	80	120	160	200	300	400	139	170	247	338	480	480	61	100	125	150	200	250		
HUNTINGTON	2	80	120	160	200	300	400	106	204	247	347	480	480	61	100	125	150	200	250		
HUNTINGTON	3	80	120	160	200	300	400	120	210	241	338	467	467	61	100	125	150	200	250		
HUNTINGTON	AVG	80	120	160	200	300	400	122	195	245	341	476	476	61	100	125	150	200	250		
MAURY	1	45	76	52	64	130	176	43	95	84	80	120	120	6	17	28	42	66	88		
MAURY	2	43	70	53	66	128	172	43	89	107	54	112	112	7	16	27	42	66	89		
MAURY	3	46	77	50	69	120	188	43	82	95	107	112	112	8	17	31	39	65	84		
MAURY	AVG	45	74	52	66	126	179	43	89	95	80	115	115	7	17	29	41	66	87		

Table 22 (continued)

EXTRACTANT AND SOIL TO SOLUTION RATIO (COLUMN HEADINGS OF -4, -6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)																									
DOUBLE ACID												MEHLICH													
TENNESSEE												MEHLICH													
SOIL	REP	-4	-6	-8	-10	-15	-20	-4	-6	-8	-10	-15	-20	-4	-6	-8	-10	-15	-20	-4	-6	-8	-10	-15	-20
HARTSELLS	1	18	37	37	60	53	115	11	20	22	23	30	30	1	5	11	13	21	23						
HARTSELLS	2	23	40	47	61	71	109	12	17	22	24	27	27	2	6	8	15	19	31						
HARTSELLS	3	26	42	49	60	76	112	11	16	22	24	27	27	1	6	12	13	19	28						
HARTSELLS	AVG	22	40	44	60	67	112	11	18	22	24	28	28	1	6	10	14	20	27						
HARTSELLS	1	45	65	72	89	88	110	45	70	72	62	99	99	10	28	45	61	77	91						
HARTSELLS	2	45	65	81	87	97	118	46	70	84	54	103	103	13	30	42	62	80	95						
HARTSELLS	3	46	69	77	93	98	120	48	70	72	71	84	84	11	29	51	61	75	96						
HARTSELLS	AVG	45	66	77	90	94	116	46	70	76	62	95	95	11	29	46	61	77	94						
HARTSELLS	1	15	20	14	21	34	38	2	1	2	2	1	1	1	1	1	1	4	3						
HARTSELLS	2	13	23	20	21	38	48	2	2	1	3	2	2	1	1	3	1	3	5						
HARTSELLS	3	13	27	20	21	39	45	2	1	1	2	2	2	1	1	2	1	3	6						
HARTSELLS	AVG	14	23	18	21	37	44	2	1	1	2	2	2	1	1	2	1	3	5						
HUNTINGTON	1	53	65	71	83	89	85	76	95	78	82	99	99	34	51	64	71	85	91						
HUNTINGTON	2	47	65	76	81	81	90	75	95	72	82	95	95	36	53	64	75	83	91						
HUNTINGTON	3	50	65	69	87	87	94	72	82	78	80	91	91	36	51	64	77	84	92						
HUNTINGTON	AVG	50	65	72	84	86	90	74	91	76	81	95	95	35	52	64	74	84	91						
HARTSELLS	1	7	15	8	9	9	11	4	8	8	8	9	9	1	1	1	1	9	6						
HARTSELLS	2	11	17	8	9	11	10	4	6	7	10	10	10	1	1	1	1	4	11						
HARTSELLS	3	13	16	7	9	11	13	6	8	7	11	8	8	1	1	3	2	7	9						
HARTSELLS	AVG	10	16	8	8	10	11	5	7	7	10	9	9	1	1	2	1	7	9						
SANGU	1	7	12	11	14	11	16	8	13	14	18	20	20	1	1	1	2	9	14						
SANGU	2	11	15	12	13	14	15	8	13	14	14	21	21	1	1	1	1	8	14						
SANGU	3	12	18	12	16	12	16	8	12	15	16	18	18	1	1	1	1	7	13						
SANGU	AVG	10	15	12	14	12	16	8	13	14	16	20	20	1	1	1	2	8	14						
ROBERTSVILLE	1	26	40	47	58	55	53	38	45	53	61	57	57	12	21	28	33	46	55						
ROBERTSVILLE	2	28	38	50	62	56	56	36	45	53	51	53	53	12	21	28	34	44	60						
ROBERTSVILLE	3	31	41	53	59	57	60	36	43	51	54	54	54	12	21	29	33	42	57						
ROBERTSVILLE	AVG	28	40	50	60	56	59	37	44	52	55	55	55	11	21	28	33	44	57						
MCOUNTVIEW	1	13	11	18	13	14	15	12	12	16	18	17	17	2	4	8	7	12	14						
MCOUNTVIEW	2	13	13	16	15	14	14	11	14	17	19	18	18	2	5	7	9	11	17						
MCOUNTVIEW	3	13	13	14	16	13	17	14	14	17	18	19	19	2	4	7	6	12	15						
MCOUNTVIEW	AVG	13	12	16	15	14	15	12	13	17	18	18	18	2	4	7	7	12	15						
HARTSELLS	1	5	5	6	5	8	5	5	7	8	12	14	14	1	1	1	1	6	10						
HARTSELLS	2	6	5	8	8	11	8	5	8	11	10	13	13	1	1	1	1	4	11						
HARTSELLS	3	5	5	7	10	7	11	6	9	9	14	12	12	1	2	2	2	6	7						
HARTSELLS	AVG	5	5	7	8	9	8	5	8	9	12	13	13	1	1	1	2	5	9						
DICKSON	1	22	32	27	36	27	26	29	23	29	33	39	39	12	17	22	24	29	34						
DICKSON	2	21	29	29	37	29	32	33	25	28	34	35	35	13	17	22	24	30	34						
DICKSON	3	27	30	30	32	28	32	29	23	30	39	34	34	12	17	23	24	31	42						
DICKSON	AVG	23	30	29	35	28	28	30	24	29	35	36	36	12	17	22	24	30	37						
SANGU	1	23	32	33	36	34	31	27	29	29	33	41	41	8	14	19	23	31	36						
SANGU	2	22	31	37	40	30	32	27	27	31	32	38	38	9	15	17	22	30	40						
SANGU	3	27	32	31	42	31	40	28	30	33	41	41	41	8	15	20	19	29	36						
SANGU	AVG	24	32	34	39	32	34	27	29	31	35	40	40	8	15	19	21	29	36						
DICKSON	1	34	40	41	47	38	47	42	47	44	38	48	48	19	28	33	38	44	45						
DICKSON	2	36	46	47	47	43	45	40	45	46	36	45	45	21	27	34	38	43	47						
DICKSON	3	36	46	43	46	40	45	40	39	37	48	44	44	21	28	35	37	43	49						
DICKSON	AVG	35	44	44	47	40	46	41	44	42	41	46	46	20	28	34	38	43	47						

Table 22 (continued)

		EXTRACTANT AND SOIL TO SOLUTION RATIO----- (COLUMN HEADINGS OF _4, _6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)																							
		DOUBLE ACID						TENNESSEE						MEHLICH											
STL	REP	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20
SEQUONIA	1	4	7	7	4	5	8	7	12	14	11	10	10	1	2	5	4	6	7						
SEQUONIA	2	4	6	6	5	7	7	7	9	9	11	10	10	1	1	4	4	6	6						
SEQUONIA	3	4	7	7	5	5	8	7	11	11	13	11	11	1	2	4	4	5	6						
SEQUONIA	AVG	4	7	7	5	6	8	7	11	11	12	10	10	1	2	4	4	6	6						
WHITWELL	1	10	15	19	19	20	23	13	20	27	29	38	38	3	6	9	9	14	16						
WHITWELL	2	10	15	18	19	20	21	13	20	25	31	38	38	3	7	9	10	14	16						
WHITWELL	3	10	15	19	18	21	22	12	21	26	31	39	39	3	7	9	10	13	17						
WHITWELL	AVG	10	15	19	19	20	22	13	20	26	30	38	38	3	7	9	10	14	16						
SEQUATCHIE	1	32	41	47	58	61	56	29	39	49	60	74	74	11	19	29	32	42	53						
SEQUATCHIE	2	30	41	47	49	60	62	29	39	50	61	75	75	12	19	31	38	45	56						
SEQUATCHIE	3	30	42	49	52	60	60	31	40	50	60	75	75	11	20	30	35	44	54						
SEQUATCHIE	AVG	31	41	48	53	60	59	30	39	50	60	75	75	11	19	30	35	44	54						
HUNTINGTON	1	8	12	13	15	16	14	13	16	21	26	26	26	2	4	8	8	12	14						
HUNTINGTON	2	7	10	13	11	15	12	12	16	24	23	24	24	1	4	6	6	11	14						
HUNTINGTON	3	6	10	13	12	15	14	14	15	23	24	26	26	2	5	6	8	11	15						
HUNTINGTON	AVG	7	11	13	13	15	13	13	16	23	24	25	25	2	4	7	7	11	14						
ETOWAH	1	11	16	22	26	26	33	16	24	32	37	48	48	3	7	12	14	22	29						
ETOWAH	2	12	17	23	26	25	35	16	24	31	37	49	49	3	7	12	13	22	27						
ETOWAH	3	11	16	23	27	26	35	18	25	31	38	50	50	4	8	11	13	21	29						
ETOWAH	AVG	11	16	23	26	26	34	17	24	31	37	49	49	3	7	12	13	22	28						
EMORY	1	44	56	69	64	74	85	28	41	54	66	90	90	8	15	22	25	32	38						
EMORY	2	46	60	65	71	81	79	28	41	54	66	90	90	8	15	22	24	32	39						
EMORY	3	46	61	65	67	78	82	29	40	55	68	89	89	7	16	21	24	33	42						
EMORY	AVG	45	59	66	67	78	82	28	41	54	67	90	90	8	15	22	24	32	40						

APPENDIX N

PPM POTASSIUM EXTRACTED BY DIFFERENT SOIL-SOLUTION
RATIOS FOR THREE SOIL EXTRACTANTS

Table 23. PPM Potassium Extracted by Different Soil-Solution Ratios for Three Soil Extractants

		EXTRACTANT AND SOIL TO SOLUTION RATIO												MEHLICH											
		(COLUMN HEADINGS OF _4, _6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)																							
SOIL	REP	DOUBLE ACID						TENNESSEE																	
		_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20
CALLOWAY	1	49	51	55	45	50	60	80	85	86	85	89	89	69	77	79	76	78	95						
CALLOWAY	2	51	54	47	53	48	54	80	79	81	85	81	81	76	74	75	81	76	95						
CALLOWAY	3	49	53	48	53	52	60	83	84	88	89	92	92	71	80	80	74	76	85						
CALLOWAY	AVG	50	53	50	50	50	58	81	83	85	86	87	87	72	77	78	77	77	91						
MEMPHIS	1	57	66	69	61	72	78	92	101	98	111	108	108	86	95	95	100	106	128						
MEMPHIS	2	63	66	63	73	69	76	95	101	103	107	100	100	87	82	85	109	108	117						
MEMPHIS	3	62	67	72	68	66	80	93	101	106	107	114	114	85	88	103	106	99	112						
MEMPHIS	AVG	61	66	67	67	69	78	93	101	102	108	107	107	86	88	98	105	104	119						
HENRY	1	91	103	110	110	117	126	122	133	139	137	153	153	114	134	123	134	133	152						
HENRY	2	99	105	103	112	114	114	122	126	132	144	136	136	119	124	130	142	124	146						
HENRY	3	98	106	108	112	112	112	128	130	142	136	161	161	124	125	137	139	130	136						
HENRY	AVG	96	105	107	111	111	117	124	130	138	139	150	150	119	128	130	138	129	145						
CALLOWAY	1	99	120	126	126	140	144	136	156	158	170	184	194	133	152	156	163	172	193						
CALLOWAY	2	101	114	119	132	135	136	137	154	162	173	173	173	129	147	154	170	167	187						
CALLOWAY	3	100	115	124	126	131	134	141	155	153	169	192	192	132	145	163	167	161	175						
CALLOWAY	AVG	100	116	123	129	135	138	138	155	158	171	183	183	131	148	158	167	167	185						
COLLINS	1	31	33	28	23	35	42	58	61	52	56	58	58	46	56	50	48	62	70						
COLLINS	2	35	35	26	38	33	38	54	57	48	60	60	60	48	53	52	62	50	63						
COLLINS	3	35	37	32	34	30	38	59	57	56	52	62	62	53	54	58	66	55	65						
COLLINS	AVG	34	35	29	32	33	39	57	58	52	56	60	60	49	54	53	59	56	66						
COLLINS	1	81	91	94	88	102	108	119	131	132	137	140	140	105	125	127	124	145	148						
COLLINS	2	82	90	91	97	99	98	120	131	132	129	136	136	113	118	126	142	135	142						
COLLINS	3	86	94	96	92	95	108	123	131	136	136	152	152	115	119	133	121	130	136						
COLLINS	AVG	83	92	94	92	99	105	121	131	133	134	143	143	111	121	129	129	137	142						
HENRY	1	93	83	94	88	95	102	115	121	132	137	140	140	105	125	123	124	117	148						
HENRY	2	81	87	87	97	99	92	117	121	129	129	136	136	111	118	118	118	133	150						
HENRY	3	78	87	88	92	84	102	115	126	133	129	154	154	109	119	133	125	130	136						
HENRY	AVG	84	87	90	92	93	99	116	123	131	132	143	143	108	121	125	127	127	145						
CALLOWAY	1	49	48	55	40	50	60	77	86	79	88	89	89	65	77	79	72	84	95						
CALLOWAY	2	45	42	43	48	48	54	80	84	81	89	81	81	68	68	75	86	71	96						
CALLOWAY	3	46	50	44	5-	45	54	80	84	85	89	86	86	69	74	80	74	76	89						
CALLOWAY	AVG	47	47	47	47	48	56	79	85	82	89	85	85	67	73	78	77	77	95						
COLLINS	1	77	66	73	67	80	84	90	91	94	96	96	96	76	95	103	91	95	115						
COLLINS	2	67	69	71	77	69	76	91	92	96	96	88	88	85	88	87	105	98	109						
COLLINS	3	67	68	72	73	74	80	91	96	97	93	102	102	83	88	103	92	98	104						
COLLINS	AVG	70	68	72	72	74	80	91	93	96	95	95	95	81	90	98	96	97	109						
MEMPHIS	1	167	177	191	191	200	210	208	217	234	239	261	261	189	221	225	239	244	263						
MEMPHIS	2	152	171	187	186	209	196	207	216	228	246	253	253	192	201	224	250	236	253						
MEMPHIS	3	155	175	176	189	189	198	218	219	239	231	274	274	202	204	238	219	247	238						
MEMPHIS	AVG	158	174	185	189	199	201	211	217	234	239	263	263	194	209	229	236	242	251						
COLLINS	1	49	48	41	34	42	54	63	66	64	67	70	70	55	65	58	57	73	78						
COLLINS	2	43	42	39	48	41	50	64	67	63	67	63	63	60	56	60	72	61	76						
COLLINS	3	42	44	40	44	45	48	65	64	66	66	69	69	57	60	69	55	71	73						
COLLINS	AVG	45	45	40	42	43	51	64	66	64	66	67	67	57	60	62	61	68	76						
COLLINS	1	101	100	106	110	117	132	134	146	166	159	172	172	119	146	148	143	161	173						
COLLINS	2	93	102	103	107	114	114	132	149	155	159	161	161	127	150	150	166	151	171						
COLLINS	3	87	103	104	112	117	118	141	150	172	158	185	185	130	136	152	143	172	159						
COLLINS	AVG	94	102	104	110	116	121	136	148	164	159	173	173	125	141	150	151	161	168						

Table 23 (continued)

-----EXTRACTANT AND SOIL TO SOLUTION PA*10----- (COLUMN HEADINGS OF -4, -6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)																			
SOIL	REP	DOUBLE ACID						TENNESSEE						MEHLICH					
		-4	-6	-8	-10	-15	-20	-4	-6	-8	-10	-15	-20	-4	-6	-8	-10	-15	-20
FALAYA	1	53	45	41	34	42	54	59	58	60	56	58	58	53	56	50	43	62	58
FALAYA	2	45	48	39	48	40	50	54	54	52	52	64	64	54	53	48	58	45	59
FALAYA	3	46	50	40	44	38	54	58	57	56	60	50	50	53	51	50	50	61	61
FALAYA	AVG	48	48	40	42	40	53	57	56	56	56	57	57	53	53	49	50	56	59
HENRY	1	47	42	41	34	42	54	67	76	71	71	77	77	58	68	66	57	73	78
HENRY	2	41	42	39	43	40	44	67	69	63	71	63	63	58	53	60	67	50	76
HENRY	3	42	47	40	44	38	48	72	72	66	67	84	84	59	57	65	60	66	77
HENRY	AVG	43	44	40	40	40	49	69	72	67	70	75	75	58	59	64	61	63	77
HENRY	1	75	69	73	68	72	84	96	101	105	104	108	108	86	98	103	96	106	111
HENRY	2	65	68	68	77	69	76	94	99	99	111	100	100	85	91	95	105	99	109
HENRY	3	66	72	72	73	66	80	96	101	102	100	114	114	89	85	95	92	98	104
HENRY	AVG	69	70	71	73	69	80	95	100	102	105	107	107	87	91	98	98	101	108
LORING	1	61	66	77	67	72	84	95	96	109	100	108	108	83	98	99	96	106	111
LORING	2	60	65	67	72	69	72	91	99	99	107	100	100	83	88	95	100	101	109
LORING	3	62	72	64	68	66	80	96	104	111	100	111	111	85	88	95	92	98	108
LORING	AVG	61	68	69	69	69	79	94	100	106	102	106	106	84	91	96	96	102	109
FALAYA	1	25	18	16	12	20	30	43	56	37	45	39	39	36	38	42	33	39	50
FALAYA	2	23	17	16	23	20	22	44	47	33	41	39	39	36	35	32	39	33	47
FALAYA	3	24	21	16	24	15	26	45	42	35	42	44	44	33	33	35	32	34	44
FALAYA	AVG	24	19	16	20	18	26	44	48	35	43	41	41	35	35	36	35	35	47
LORING	1	258	309	326	326	335	336	320	330	369	357	387	387	320	359	351	373	393	394
LORING	2	237	277	320	309	341	322	320	337	346	357	383	383	331	315	338	372	367	352
LORING	3	238	294	303	306	333	326	320	343	350	363	397	397	312	324	351	350	385	364
LORING	AVG	244	280	311	314	336	328	320	337	355	359	389	389	321	333	347	365	382	370
CALLOWAY	1	45	30	33	23	35	48	56	58	52	63	58	58	51	56	54	48	56	66
CALLOWAY	2	34	35	27	38	33	38	58	62	52	63	57	57	50	53	52	58	49	63
CALLOWAY	3	35	37	24	34	30	42	58	59	50	67	64	64	49	54	54	46	45	61
CALLOWAY	AVG	38	34	28	32	33	43	57	60	51	64	60	60	50	54	53	51	50	63
CALLOWAY	1	45	42	41	34	42	48	65	66	60	71	70	70	51	62	62	57	62	74
CALLOWAY	2	41	48	31	43	41	44	62	64	59	67	69	69	60	59	56	72	57	67
CALLOWAY	3	40	44	24	44	38	42	65	67	62	67	81	81	57	54	65	55	45	73
CALLOWAY	AVG	42	45	32	40	40	45	64	66	60	68	73	73	56	58	61	61	55	71
LORING	1	67	60	65	61	65	78	100	111	113	118	115	115	81	98	103	100	95	119
LORING	2	60	65	63	68	69	72	101	106	103	115	112	112	85	91	95	105	97	113
LORING	3	60	65	64	68	61	76	102	108	107	114	115	119	87	91	103	92	108	112
LORING	AVG	62	63	64	66	65	75	101	108	108	116	115	115	84	93	100	99	100	115
COLLINS	1	80	78	81	77	102	90	96	104	103	117	108	108	86	98	103	96	89	115
COLLINS	2	71	78	79	82	84	82	97	101	99	104	100	100	89	88	95	105	87	109
COLLINS	3	75	81	76	83	81	86	95	101	105	107	114	114	91	91	103	97	108	112
COLLINS	AVG	75	79	79	81	89	86	96	102	102	109	107	107	89	92	100	99	95	112
MEMPHIS	1	158	165	183	191	200	192	194	204	226	217	235	235	171	198	225	206	216	238
MEMPHIS	2	145	168	175	186	194	186	197	196	213	217	223	223	175	188	205	222	209	224
MEMPHIS	3	142	175	184	175	189	194	197	199	219	217	246	246	185	190	223	223	215	230
MEMPHIS	AVG	148	169	181	184	194	191	196	200	219	217	235	235	177	192	218	217	213	231
LORING	1	150	152	171	169	185	192	156	176	188	188	188	188	197	194	192	182	194	206
LORING	2	134	147	159	171	180	176	157	176	188	188	192	192	159	171	181	194	188	204
LORING	3	137	163	164	165	174	182	161	170	192	187	205	205	156	167	193	195	193	207
LORING	AVG	140	154	165	168	180	183	158	174	189	188	198	198	156	172	189	190	192	206

Table 23 (continued)

		EXTRACTANT AND SOIL TO SOLUTION RATIO												COLUMN HEADINGS OF _4, _6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)											
SOIL	REP	DOUBLE ACID						TENNESSEE						MEHLICH											
		_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20						
FALAYA	1	100	93	97	99	110	120	117	128	124	129	127	127	105	119	127	124	117	132						
FALAYA	2	86	93	95	102	107	104	111	121	125	137	136	136	115	118	118	128	114	133						
FALAYA	3	86	95	120	97	102	108	119	123	122	129	145	145	111	113	125	121	130	136						
FALAYA	AVG	91	94	104	99	106	111	116	124	124	132	136	136	110	117	123	124	120	134						
HENRY	1	67	63	65	61	72	84	90	96	94	100	96	96	76	86	95	86	84	107						
HENRY	2	60	63	63	68	69	72	90	94	96	100	100	100	83	77	87	91	76	100						
HENRY	3	60	68	64	68	59	76	91	91	99	96	103	103	81	85	91	92	103	104						
HENRY	AVG	62	65	64	66	67	77	90	94	96	99	100	100	80	83	91	90	86	104						
CALLOWAY	1	134	140	155	153	162	168	163	176	181	195	191	191	149	182	184	191	183	210						
CALLOWAY	2	126	141	147	151	165	158	161	181	191	189	198	198	159	171	173	194	183	191						
CALLOWAY	3	124	147	148	150	161	156	166	177	192	195	206	206	150	170	186	191	204	203						
CALLOWAY	AVG	128	143	150	151	163	161	163	178	188	193	198	198	156	174	181	192	190	201						
MEMPHIS	1	89	91	98	88	102	108	116	131	135	133	134	134	105	122	127	120	128	144						
MEMPHIS	2	82	91	91	102	99	98	117	129	133	133	147	147	115	118	118	128	119	133						
MEMPHIS	3	89	99	96	97	89	102	124	130	136	136	152	152	111	113	125	125	129	136						
MEMPHIS	AVG	87	94	95	96	97	103	119	130	135	134	144	144	110	118	123	124	125	138						
CALLOWAY	1	63	60	65	61	72	78	96	101	101	107	102	102	81	89	95	96	117	107						
CALLOWAY	2	56	60	63	68	69	72	97	101	103	107	111	111	83	91	87	100	108	105						
CALLOWAY	3	60	66	65	68	59	76	99	104	107	107	115	115	85	88	95	92	103	112						
CALLOWAY	AVG	60	62	64	66	67	75	97	102	104	107	109	109	83	89	92	96	109	108						
GRENADA	1	79	86	83	95	102	102	109	105	111	111	111	111	93	91	107	100	122	115						
GRENADA	2	75	80	79	87	92	92	100	106	110	111	111	111	91	95	109	109	116	113						
GRENADA	3	78	84	80	87	81	92	101	106	109	111	117	117	81	97	107	107	108	120						
GRENADA	AVG	77	81	82	86	89	95	101	107	108	111	110	110	88	96	103	105	115	116						
GRENADA	1	79	73	77	72	80	90	90	101	105	100	96	96	81	95	95	86	106	103						
GRENADA	2	71	78	75	78	77	82	91	99	96	100	100	100	89	88	91	95	100	88						
GRENADA	3	71	81	80	82	74	86	93	99	111	96	115	115	89	91	99	92	98	100						
GRENADA	AVG	74	77	77	77	77	86	91	100	104	99	104	104	86	91	95	91	101	97						
LORING	1	37	30	33	23	35	42	59	58	58	60	51	51	46	50	46	43	62	58						
LORING	2	30	29	23	33	26	38	38	57	52	56	56	56	46	50	48	48	64	63						
LORING	3	35	31	28	34	30	38	58	57	55	56	64	64	49	48	46	46	61	61						
LORING	AVG	34	30	28	30	30	39	58	57	52	57	57	57	47	47	49	47	62	61						
FALAYA	1	71	69	73	72	80	90	95	104	101	107	108	108	84	95	95	91	111	103						
FALAYA	2	62	66	67	72	77	88	94	99	103	107	106	106	85	91	91	91	115	107						
FALAYA	3	62	75	72	73	66	80	98	101	112	107	119	119	87	88	99	97	114	104						
FALAYA	AVG	65	70	71	72	74	86	96	101	105	107	111	111	85	91	95	93	113	105						
MEMPHIS	1	87	85	88	88	95	102	107	116	120	122	121	121	100	107	115	115	128	119						
MEMPHIS	2	80	84	87	92	99	98	108	116	121	126	117	117	103	103	107	114	132	116						
MEMPHIS	3	80	91	84	92	89	96	112	121	123	125	130	130	105	111	114	111	130	124						
MEMPHIS	AVG	82	87	90	91	94	99	109	118	121	124	123	123	103	107	112	113	130	120						
CALLOWAY	1	55	54	57	50	57	60	83	88	86	85	83	83	67	80	74	67	84	82						
CALLOWAY	2	53	48	51	58	54	60	82	84	81	93	86	86	76	77	75	76	89	86						
CALLOWAY	3	51	53	52	58	51	60	88	86	87	89	94	94	77	77	76	74	82	89						
CALLOWAY	AVG	53	52	53	55	54	60	84	86	85	89	88	88	73	78	75	72	85	86						
FALAYA	1	107	112	122	115	132	132	125	136	143	137	134	134	121	134	131	124	139	132						
FALAYA	2	102	114	115	122	128	126	122	132	144	142	142	142	121	121	134	133	119	140						
FALAYA	3	100	122	116	121	117	134	126	135	135	136	150	150	120	128	133	130	130	141						
FALAYA	AVG	103	116	118	119	126	131	124	135	137	139	142	142	119	128	133	129	129	138						

Table 23 (continued)

		EXTRACTANT AND SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)																			
		TENNESSEE										MEHLICH									
SOIL	REP	DOUBLE ACID																			
		4	6	8	10	15	20	4	6	8	10	15	20	4	6	8	10	15	20	4	6
FALAYA	1	162	174	191	191	207	204	170	196	218	210	222	222	171	188	205	201	202	201		
FALAYA	2	149	174	179	186	209	196	194	196	213	217	223	223	167	195	197	198	199	223		
FALAYA	3	147	175	184	189	204	204	195	199	222	209	235	235	174	193	208	209	204	216		
FALAYA	AVG	153	174	185	186	202	201	186	197	218	212	227	227	171	192	203	203	202	213		
SANGO	1	77	89	96	96	85	100	101	98	108	107	98	98	106	90	97	98	106	94		
SANGO	2	82	87	100	88	85	92	101	98	98	99	92	92	106	101	110	102	98	101		
SANGO	3	80	89	93	96	85	92	103	98	105	99	86	86	92	100	96	109	104	95		
SANGO	AVG	80	88	96	93	85	95	102	98	104	102	92	92	101	97	101	103	103	97		
SANGO	1	232	278	306	295	305	286	274	286	316	314	330	330	312	291	314	307	322	285		
SANGO	2	229	270	299	295	291	294	278	299	333	302	306	306	303	291	320	307	316	313		
SANGO	3	236	276	292	303	313	294	273	286	311	298	318	318	297	280	294	299	329	300		
SANGO	AVG	232	275	299	298	303	291	275	290	320	305	318	318	304	287	309	304	322	299		
LOPING	1	134	134	150	148	162	156	153	174	181	173	197	197	152	170	176	172	194	181		
LOPING	2	115	138	139	146	158	158	131	176	191	188	198	198	151	159	173	180	167	199		
LOPING	3	118	138	140	150	153	160	158	172	195	179	205	205	156	173	186	177	193	190		
LOPING	AVG	122	137	143	148	158	154	144	161	166	170	184	184	138	155	160	158	178	169		
MEMPHIS	1	114	115	126	126	140	144	144	154	177	173	185	185	133	153	158	165	151	187		
MEMPHIS	2	101	117	119	136	135	142	143	155	169	173	196	196	136	159	155	158	161	186		
MEMPHIS	3	100	125	120	131	130	140	153	155	171	172	188	188	136	156	158	160	163	181		
MEMPHIS	AVG	105	119	122	131	135	142	145	157	171	172	188	188	136	156	158	160	163	181		
SANGO	1	75	84	92	96	85	100	97	104	108	99	116	116	103	98	104	102	106	108		
SANGO	2	72	84	93	96	85	92	97	93	105	102	92	92	101	98	107	102	98	101		
SANGO	3	73	84	89	92	90	100	99	98	101	99	98	98	97	100	96	101	104	108		
SANGO	AVG	73	84	91	95	90	97	98	98	105	100	102	102	99	99	102	102	103	106		
FALAYA	2	73	69	69	67	72	78	93	96	94	100	89	89	83	92	83	81	95	105		
FALAYA	3	65	69	67	63	66	76	91	96	92	99	99	99	83	85	83	86	87	91		
FALAYA	3	66	72	72	68	61	76	93	96	96	100	107	107	85	91	88	83	83	104		
FALAYA	AVG	68	70	69	66	66	77	92	96	94	100	98	98	84	89	85	83	88	100		
MAURY	1	208	267	292	303	306	294	290	322	353	346	367	367	331	327	354	349	392	363		
MAURY	2	208	259	292	299	313	286	294	315	354	354	367	367	321	330	372	371	374	384		
MAURY	3	211	259	299	287	305	311	292	317	354	342	349	349	317	324	335	358	374	375		
MAURY	AVG	209	262	294	296	308	297	292	318	354	342	361	361	323	327	354	359	380	374		
MAURY	1	155	181	193	193	192	189	199	208	227	223	220	220	201	201	213	213	213	214		
MAURY	2	151	175	192	197	195	181	205	203	226	211	220	220	211	207	230	222	226	228		
MAURY	3	148	175	196	193	206	197	197	208	226	211	214	214	212	215	204	215	233	218		
MAURY	AVG	151	177	194	194	194	189	200	206	226	211	218	218	218	208	216	217	231	220		
ARMOUR	1	162	194	214	201	213	214	215	229	242	234	251	251	234	229	242	239	246	247		
ARMOUR	2	160	186	207	209	213	214	211	229	242	234	245	245	220	229	260	234	246	256		
ARMOUR	3	155	192	210	213	227	214	220	234	254	234	245	245	228	226	226	232	246	259		
ARMOUR	AVG	155	191	210	207	218	214	215	231	248	234	247	247	227	228	243	235	246	254		
HUNTINGTON	1	132	163	185	190	192	194	184	187	197	203	196	196	193	201	209	213	214	200		
HUNTINGTON	2	128	158	178	186	195	197	178	182	194	195	196	196	191	196	215	205	226	228		
HUNTINGTON	3	135	158	185	186	199	206	182	192	197	187	190	190	183	193	200	215	213	211		
HUNTINGTON	AVG	132	160	183	187	192	206	181	187	196	195	194	194	194	197	208	211	218	213		
MAURY	1	231	283	303	310	327	327	252	322	346	338	355	355	317	324	336	341	385	377		
MAURY	2	227	268	306	314	320	319	300	309	361	322	355	355	308	319	365	345	368	370		
MAURY	3	229	282	320	310	313	319	296	317	361	338	355	355	303	316	327	342	380	355		
MAURY	AVG	229	278	310	311	315	322	296	316	356	333	355	355	309	320	343	343	378	367		

Table 23 (continued)

		EXTRACTANT AND SOIL TO SOLUTION RATIO--										-- COLUMN HEADINGS OF _4, _6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)									
SOIL	REP	DOUBLE ACID										TENNESSEE									
		_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	MEHLICH	
HARTSELLS	1	95	105	103	108	99	109	125	124	130	127	121	121	129	123	122	124	125	122		
HARTSELLS	2	93	104	100	112	99	109	125	122	133	123	110	110	124	123	137	128	129	128		
HARTSELLS	3	95	98	110	112	107	117	122	124	123	123	123	123	125	122	118	126	130	136		
HARTSELLS	AVG	94	102	104	111	102	112	124	123	132	124	118	118	126	123	126	126	128	129		
HARTSELLS	1	172	199	210	209	206	189	219	229	242	206	221	221	225	218	238	234	252	242		
HARTSELLS	2	161	192	207	209	199	197	219	226	240	234	233	233	220	218	253	239	239	228		
HARTSELLS	3	169	200	214	213	213	197	216	223	247	234	220	220	232	215	233	232	233	232		
HARTSELLS	AVG	167	197	210	210	206	194	218	226	243	225	225	225	226	217	238	235	241	234		
HARTSELLS	1	59	63	61	65	57	76	74	72	71	75	62	62	76	70	71	72	68	72		
HARTSELLS	2	59	62	57	65	57	68	74	70	76	71	68	68	71	70	77	72	72	72		
HARTSELLS	3	56	59	61	65	64	68	73	72	69	67	68	68	72	73	69	75	66	74		
HARTSELLS	AVG	58	61	60	65	59	71	74	71	72	71	66	66	73	71	72	73	69	73		
HUNTINGTON	1	253	304	335	326	327	311	302	333	361	354	361	361	326	324	357	337	373	349		
HUNTINGTON	2	246	299	335	314	327	319	314	328	361	354	367	367	326	330	372	345	374	341		
HUNTINGTON	3	246	293	324	341	341	327	271	333	353	346	373	373	321	329	339	346	368	334		
HUNTINGTON	AVG	248	299	331	327	332	319	296	331	358	351	367	367	324	328	356	343	372	341		
HARTSELLS	1	65	69	75	77	64	76	84	83	82	83	74	74	73	79	79	81	75	86		
HARTSELLS	2	63	67	71	77	71	76	85	78	84	79	74	74	78	79	84	81	79	79		
HARTSELLS	3	65	67	71	77	71	76	80	83	84	83	74	74	79	75	73	79	72	88		
HARTSELLS	AVG	64	68	72	77	69	76	83	81	83	82	74	74	77	77	79	80	75	84		
SANGO	1	56	63	64	65	64	76	80	78	78	82	77	77	73	79	79	77	75	72		
SANGO	2	56	59	57	61	64	68	78	78	84	75	80	80	73	79	77	72	72	79		
SANGO	3	59	59	61	65	64	68	80	77	84	79	83	83	77	75	69	79	72	74		
SANGO	AVG	57	60	61	64	64	71	79	78	82	79	80	80	74	78	74	76	73	75		
ROBERTSVILLE	1	165	194	200	217	199	197	211	229	234	227	226	226	234	218	234	226	233	228		
ROBERTSVILLE	2	172	192	217	217	213	206	215	216	237	223	239	239	216	213	241	226	233	228		
ROBERTSVILLE	3	165	192	217	217	213	222	209	223	240	230	233	233	219	209	219	232	233	225		
ROBERTSVILLE	AVG	167	193	211	217	208	208	212	223	237	227	233	233	223	213	231	228	233	227		
MOUNTVIEW	1	43	44	43	49	43	52	55	62	63	59	49	49	53	54	57	60	56	58		
MOUNTVIEW	2	43	42	43	49	50	52	62	59	62	59	55	55	53	54	62	55	53	58		
MOUNTVIEW	3	43	43	42	49	50	60	57	57	59	59	49	49	54	56	61	58	53	60		
MOUNTVIEW	AVG	43	43	43	49	48	55	58	59	61	59	51	51	53	55	57	58	54	59		
HARTSELLS	1	91	100	100	108	99	117	109	114	115	111	110	110	115	107	115	111	113	111		
HARTSELLS	2	91	101	100	112	99	109	113	109	116	107	110	110	110	107	114	111	111	108		
HARTSELLS	3	88	95	107	104	107	108	110	114	119	111	104	104	112	108	103	109	111	108		
HARTSELLS	AVG	90	99	102	108	102	111	111	112	117	110	108	108	112	107	110	110	112	110		
DICKSON	1	58	60	64	65	57	68	70	72	78	67	62	62	73	68	68	68	62	72		
DICKSON	2	58	59	64	69	57	68	70	67	76	71	62	62	69	65	66	68	66	72		
DICKSON	3	56	59	57	73	57	68	72	70	69	67	62	62	68	64	62	71	66	74		
DICKSON	AVG	57	59	62	69	57	68	71	70	74	68	62	62	70	66	65	69	65	73		
SANGO	1	84	95	93	96	85	92	105	104	112	99	104	104	101	98	97	102	106	101		
SANGO	2	86	93	96	104	92	100	105	104	108	95	98	98	106	98	103	102	98	101		
SANGO	3	86	90	96	96	85	100	103	109	105	107	98	98	101	100	92	96	98	101		
SANGO	AVG	85	93	95	99	87	97	104	106	108	100	98	100	103	99	97	100	101	101		
DICKSON	1	86	92	93	96	85	100	105	109	108	107	98	98	106	107	108	98	106	101		
DICKSON	2	88	93	93	100	85	92	109	104	105	104	104	104	101	104	104	102	98	101		
DICKSON	3	84	90	93	100	85	100	106	109	105	99	98	98	105	103	99	105	98	101		
DICKSON	AVG	86	92	93	99	85	97	107	107	106	103	100	100	104	105	102	102	101	101		

Table 23 (continued)

		-----EXTRACTANT AND SOIL TO SOLUTION RATIO----- (COLUMN HEADINGS OF -4, -6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)												-----MEHLICH-----											
		DOUBLE ACID						TENNESSEE						MEHLICH											
SOIL	REP	-4	-6	-8	-10	-15	-20	-4	-6	-8	-10	-15	-20	-4	-6	-8	-10	-15	-20	-4	-6	-8	-10	-15	-20
SEQUOIA	1	71	77	72	77	80	75	84	81	77	71	71	71	77	78	78	81	83	89	77	78	78	81	83	89
SEQUOIA	2	69	75	74	73	74	79	89	78	81	80	76	76	76	77	77	82	86	90	77	78	77	82	86	90
SEQUOIA	3	71	79	72	75	79	81	86	84	83	82	75	75	75	78	78	85	88	81	77	78	70	85	88	81
SEQUOIA	AVG	70	77	73	75	78	78	86	81	80	78	74	74	74	78	78	83	86	87	78	78	75	83	86	87
WHITWELL	1	79	86	88	85	80	83	95	91	94	88	81	81	86	88	81	85	88	89	86	88	81	85	88	89
WHITWELL	2	80	86	88	81	86	91	86	86	91	89	83	83	92	85	86	87	89	89	92	85	86	87	89	89
WHITWELL	3	77	88	80	84	87	86	91	90	96	96	84	84	91	88	81	88	94	91	91	88	81	88	94	91
WHITWELL	AVG	79	87	85	83	84	87	91	89	94	91	83	83	90	88	83	87	90	90	87	88	83	87	90	90
SEQUATCHIE	1	188	212	220	212	229	226	208	231	260	262	272	272	231	247	264	246	255	257	231	247	264	246	255	257
SEQUATCHIE	2	188	212	216	216	231	241	211	227	254	259	285	285	227	249	260	243	258	261	227	249	260	243	258	261
SEQUATCHIE	3	186	216	228	221	235	219	215	231	260	262	281	281	234	250	279	242	259	257	234	250	279	242	259	257
SEQUATCHIE	AVG	187	213	221	216	232	229	211	230	258	261	279	279	231	249	268	244	261	258	231	249	268	244	261	258
HUNTINGTON	1	133	145	162	152	163	178	152	165	186	181	177	177	177	182	176	173	177	177	177	182	176	173	177	177
HUNTINGTON	2	134	145	156	156	169	178	154	170	172	186	183	183	163	150	184	179	178	151	163	150	184	179	178	151
HUNTINGTON	3	130	147	150	158	163	181	152	169	178	183	187	187	161	182	180	180	166	189	161	182	180	177	174	186
HUNTINGTON	AVG	132	146	156	155	165	179	153	168	179	183	182	182	162	185	180	177	174	186	162	185	180	177	174	186
ETOWAH	1	95	110	107	117	116	115	118	129	131	130	132	132	125	130	133	132	133	133	125	130	133	132	133	133
ETOWAH	2	97	110	114	109	115	117	125	131	128	128	138	138	128	129	134	137	140	140	128	129	134	137	140	140
ETOWAH	3	98	114	115	114	110	123	119	128	132	130	134	134	127	130	136	136	133	141	134	127	130	136	133	141
ETOWAH	AVG	97	111	112	113	114	118	121	129	130	129	135	135	127	130	134	135	135	138	127	130	134	135	135	138
EMORY	1	308	381	399	370	419	471	315	380	423	444	481	481	333	395	446	415	446	492	333	395	446	415	446	492
EMORY	2	305	381	407	389	426	479	310	382	433	452	507	507	343	403	439	418	449	485	343	403	439	418	449	485
EMORY	3	311	380	405	366	419	481	319	369	421	461	494	494	346	406	451	419	457	493	346	406	451	419	457	493
EMORY	AVG	308	381	404	375	421	477	215	377	426	452	494	494	341	368	445	417	451	490	341	368	445	417	451	490

APPENDIX O

PPM CALCIUM EXTRACTED BY DIFFERENT SOIL-SOLUTION
RATIOS FOR THREE SOIL EXTRACTANTS

Table 24. PPM Calcium Extracted by Different Soil-Solution Ratios for Three Soil Extractants

		EXTRACTANT AND SOIL TO SOLUTION RATIO-----												(COLUMN HEADINGS OF 4, 6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)											
		DOUBLE ACID						TENNESSEE						WEHLICH											
SOIL	PEP	4	6	8	10	15	20	4	6	8	10	15	20	4	6	8	10	15	20	4	6	8	10	15	20
CALLOWAY	1	249	253	245	256	210	271	161	138	121	202	210	210	75	54	99	83	132	228						
CALLOWAY	2	165	240	262	210	245	330	159	119	148	217	240	240	74	79	80	94	159	192						
CALLOWAY	3	240	243	249	254	243	209	146	130	148	291	275	275	56	54	99	86	116	268						
CALLOWAY	AVG	219	245	252	240	253	270	155	129	139	237	242	242	68	62	93	88	136	229						
MEMPHIS	1	1622	1614	1785	1326	1475	933	1028	1075	1008	1456	1597	1597	782	704	847	736	864	975						
MEMPHIS	2	1418	1615	1558	1512	1435	893	1124	1077	1019	1534	1566	1566	781	790	792	712	780	920						
MEMPHIS	3	1336	1663	1641	1418	1597	974	1027	1177	1094	1530	1557	1557	707	835	829	663	737	958						
MEMPHIS	AVG	1459	1631	1661	1419	1502	933	1060	1110	1040	1517	1573	1573	757	766	823	704	794	951						
HENRY	1	631	707	725	489	561	505	395	351	359	564	555	555	224	192	354	276	575	385						
HENRY	2	577	631	931	582	561	410	441	372	387	582	615	615	260	192	299	352	360	383						
HENRY	3	489	716	597	535	789	330	441	410	371	611	661	661	279	163	318	366	323	463						
HENRY	AVG	566	685	751	535	637	415	426	378	372	586	610	610	254	182	324	331	419	409						
CALLOWAY	1	1735	2257	2633	1791	2318	1206	1356	1772	1456	2027	2195	2195	1191	1417	1522	1148	1273	1250						
CALLOWAY	2	1927	2371	2184	1744	1791	1054	1565	1591	1421	2085	2330	2330	1302	1132	1431	1075	1132	1188						
CALLOWAY	3	1835	2255	2268	1744	2398	1135	1197	1816	1472	2605	2350	2350	1229	1189	1358	1123	1061	1342						
CALLOWAY	AVG	1927	2294	2262	1760	2336	1132	1374	1726	1450	2239	2292	2292	1240	1246	1437	1115	1155	1260						
COLLINS	1	451	442	640	303	456	310	288	292	305	388	415	415	149	135	263	215	285	346						
COLLINS	2	373	442	680	350	736	330	236	268	306	446	503	503	130	106	226	267	310	345						
COLLINS	3	339	479	513	350	569	250	283	326	305	446	514	514	205	106	245	279	254	383						
COLLINS	AVG	389	454	511	334	567	297	270	295	305	427	477	477	161	116	245	254	283	358						
COLLINS	1	316	328	640	675	315	232	165	164	180	286	328	328	93	89	153	167	183	189						
COLLINS	2	373	442	471	442	212	168	200	181	186	283	254	254	74	109	135	170	175	192						
COLLINS	3	319	321	430	589	192	209	187	174	184	304	328	328	112	109	153	165	133	230						
COLLINS	AVG	343	364	514	569	260	203	195	173	183	292	303	303	93	93	147	167	164	204						
HENRY	1	653	958	937	582	667	544	500	441	469	613	715	715	354	306	409	424	438	464						
HENRY	2	627	858	1062	628	807	450	612	458	483	705	670	670	298	334	354	324	410	460						
HENRY	3	639	637	885	628	878	450	507	459	496	766	756	756	316	249	354	312	392	537						
HENRY	AVG	640	784	963	613	784	481	540	453	483	695	714	714	323	296	372	353	413	487						
CALLOWAY	1	1082	1123	1276	768	877	661	610	520	596	803	891	891	484	420	683	458	558	582						
CALLOWAY	2	781	1160	1098	907	1016	612	673	609	629	886	1206	1206	521	477	464	433	545	575						
CALLOWAY	3	1012	992	1139	814	860	652	765	613	647	976	1019	1019	502	420	537	458	478	652						
CALLOWAY	AVG	958	1092	1171	830	918	642	683	581	624	888	1015	1035	502	439	561	450	527	603						
COLLINS	1	965	1009	1120	862	948	700	624	622	567	848	789	789	353	363	537	445	667	621						
COLLINS	2	1010	1009	1098	768	1088	612	629	756	612	902	936	936	372	391	482	421	478	613						
COLLINS	3	938	1071	1098	814	860	571	615	679	705	980	996	996	409	363	482	421	478	613						
COLLINS	AVG	972	1030	1109	815	965	628	627	686	628	910	907	907	378	372	500	429	541	616						
MEMPHIS	1	676	556	767	489	421	427	354	328	355	548	607	607	262	292	292	312	319	346						
MEMPHIS	2	526	669	764	489	421	330	374	337	329	559	558	558	223	249	281	252	310	368						
MEMPHIS	3	539	480	513	489	543	330	438	355	460	518	561	561	223	263	299	340	271	345						
MEMPHIS	AVG	580	568	681	489	462	362	389	340	381	542	575	575	236	268	305	301	300	353						
COLLINS	1	676	685	854	582	526	466	466	413	340	428	631	631	279	263	263	337	404	503						
COLLINS	2	653	631	1265	535	456	490	387	339	343	608	613	613	223	249	245	337	343	460						
COLLINS	3	489	631	764	582	403	612	392	399	448	451	836	836	335	235	263	312	371	422						
COLLINS	AVG	606	649	974	566	462	523	364	348	377	496	693	693	279	249	257	329	373	462						
COLLINS	1	654	1085	937	1000	702	621	428	391	430	584	666	666	335	363	427	373	387	385						
COLLINS	2	627	782	1015	768	631	491	488	391	458	659	687	687	298	363	336	349	377	383						
COLLINS	3	713	914	932	846	860	571	500	450	460	523	696	696	409	306	482	324	422	422						
COLLINS	AVG	665	927	961	871	731	561	472	411	449	622	693	693	347	344	415	349	362	397						

Table 24 (continued)

-----EXTRACTANT AND SOIL TO SOLUTION RATIO----- (COLUMN HEADINGS OF _4, _6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)																																				
		DOUBLE ACID												TENNESSEE										MEHLICH												
SOIL	REP	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20					
FALAYA	1	331	328	428	210	245	349	174	185	229	309	377	377	74	94	190	155	217	346																	
FALAYA	2	220	228	597	396	245	209	213	218	203	84	395	395	72	109	135	161	243	330																	
FALAYA	3	240	322	597	303	263	218	228	245	269	379	405	405	74	94	190	161	168	288																	
FALAYA	AVG	264	226	541	303	251	255	205	216	234	257	392	392	73	99	172	159	209	315																	
HENRY	1	1284	1463	1488	1047	1440	895	763	863	936	962	1599	1599	539	619	683	615	558	700																	
HENRY	2	1137	1539	1391	1232	1229	692	789	935	884	1050	1429	1429	614	605	701	530	696	882																	
HENRY	3	1289	1111	1125	1140	1352	974	819	1100	763	1235	1190	1190	707	705	737	567	616	728																	
HENRY	AVG	1237	1371	1535	1140	1340	854	790	933	861	1082	1406	1406	620	643	707	571	623	770																	
HENRY	1	834	934	854	675	1018	583	554	578	606	800	833	833	409	363	518	397	472	543																	
HENRY	2	781	1161	542	814	772	571	660	585	625	861	980	980	409	306	391	373	461	537																	
HENRY	3	828	1387	1056	721	739	652	586	597	631	547	776	776	409	306	518	373	461	575																	
HENRY	AVG	818	1161	947	737	843	602	600	587	621	869	863	863	409	325	476	381	465	552																	
LOPING	1	834	1085	1318	675	737	700	576	544	581	782	781	781	409	477	482	373	472	582																	
LOPING	2	781	1085	806	814	825	612	602	534	839	787	813	813	372	420	409	385	478	537																	
LOPING	3	738	756	983	721	836	571	580	550	539	795	836	836	372	420	409	385	478	537																	
LOPING	AVG	784	575	1036	737	795	628	586	543	653	788	810	810	384	439	458	381	465	577																	
FALAYA	1	1194	1803	1658	1093	1244	778	890	1111	1026	1375	1154	1154	707	562	810	518	694	896																	
FALAYA	2	1163	1728	1599	1326	1334	934	866	966	1061	1307	1358	1358	614	648	683	603	646	857																	
FALAYA	3	1337	1307	1432	1233	1352	853	935	952	960	1264	1426	1426	558	591	737	615	496	843																	
FALAYA	AVG	1321	1613	1563	1217	1317	855	897	1010	1016	1315	1313	1313	626	600	743	575	612	875																	
LOPING	1	934	624	1191	771	667	661	541	509	473	725	826	826	409	306	445	349	387	503																	
LOPING	2	704	1161	1349	675	773	571	632	503	538	758	687	687	316	334	445	349	410	498																	
LOPING	3	838	954	1014	675	754	491	520	518	519	746	755	755	316	306	464	324	409	483																	
LOPING	AVG	792	1016	1185	707	731	574	564	510	510	743	756	756	347	315	451	341	402	495																	
CALLOWAY	1	181	140	430	146	140	194	101	78	95	125	157	157	38	49	80	83	121	110																	
CALLOWAY	2	68	102	461	129	140	209	90	104	100	195	213	213	40	49	80	87	125	115																	
CALLOWAY	3	90	125	475	148	227	196	96	100	108	176	182	182	46	54	80	86	129	118																	
CALLOWAY	AVG	113	122	455	141	169	200	96	94	102	165	184	184	41	51	80	85	109	118																	
CALLOWAY	1	789	1085	1021	1182	667	505	496	503	510	1050	771	771	298	306	391	409	404	543																	
CALLOWAY	2	730	820	631	768	667	571	531	654	532	832	743	743	316	363	372	312	444	460																	
CALLOWAY	3	639	756	1182	675	579	692	774	543	518	730	780	780	298	277	391	300	409	537																	
CALLOWAY	AVG	719	887	1045	875	638	589	600	567	520	871	765	765	304	315	385	340	419	513																	
LOPING	1	924	934	1021	524	737	661	561	539	535	682	784	784	409	505	573	421	438	503																	
LOPING	2	806	896	1058	767	1166	671	578	654	441	798	757	797	447	391	445	421	440	537																	
LOPING	3	713	913	1140	814	965	652	548	501	646	831	865	865	409	334	427	421	444	537																	
LOPING	AVG	814	914	1086	829	956	628	562	565	541	770	815	815	422	410	482	421	441	526																	
COLLINS	1	1059	1387	1488	1093	1720	895	998	851	1094	1095	1155	1155	558	562	792	542	745	818																	
COLLINS	2	1086	1350	1187	1605	1496	1014	756	839	921	1134	1054	1054	558	591	573	554	646	897																	
COLLINS	3	1162	1387	1223	1225	1070	692	832	842	810	1253	1170	1170	744	534	610	579	651	882																	
COLLINS	AVG	1102	1375	1298	1341	1429	867	829	844	942	1161	1126	1126	620	562	658	558	681	866																	
MEMPHIS	1	1465	2144	1512	1791	1721	1245	1133	1046	1114	1559	1762	1762	856	875	1011	760	796	975																	
MEMPHIS	2	1494	2068	1934	1419	2212	974	1029	1260	1464	1676	1843	1843	896	1160	1029	688	797	805																	
MEMPHIS	3	1486	1979	1892	1605	2300	974	1162	1225	1450	1769	1910	1910	856	1018	975	784	754	920																	
MEMPHIS	AVG	1482	2064	1913	1605	2078	1064	1108	1177	1343	1668	1838	1838	899	1018	1005	744	782	900																	
LOPING	1	1375	1425	1573	1325	1264	1011	994	1062	1290	1379	1425	1425	856	847	993	736	796	1054																	
LOPING	2	1265	1766	1850	1233	1264	934	1079	1107	1067	1742	1505	1505	763	818	902	700	813	920																	
LOPING	3	1287	1584	1767	1279	1452	974	1117	1124	1098	1677	1661	1661	744	761																					

Table 24 (continued)

		EXTRACTANT AND SOIL TO SOLUTION RATIO										MEHLICH									
		(COLUMN HEADINGS OF _4, _6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)																			
SOIL	REP	DOUBLE ACID										TENNESSEE									
		_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6
FALAYA	1	1127	1388	1573	1186	1299	894	862	808	835	1123	1342	1342	558	562	701	579	635	818		
FALAYA	2	1137	1123	1265	1045	1158	692	802	876	891	1193	1178	1178	521	591	774	518	646	767		
FALAYA	3	1112	1190	1599	1068	1036	854	788	784	780	1141	1242	1242	595	477	737	567	599	806		
FALAYA	AVG	1125	1234	1479	1100	1164	813	817	823	835	1152	1254	1254	558	543	737	555	627	797		
SANGO	1	349	472	427	382	545	895	233	260	401	249	201	201	108	104	99	97	114	186		
SANGO	2	287	319	350	364	506	564	243	320	333	369	191	191	104	98	144	132	132	135		
SANGO	3	301	350	366	379	555	713	230	268	446	281	334	334	102	94	102	127	131	218		
SANGO	AVG	312	380	381	375	535	724	235	283	393	300	242	242	105	98	115	119	126	180		
SANGO	1	924	1003	1236	1106	1382	1284	772	879	921	864	611	611	591	432	503	389	401	363		
SANGO	2	844	913	900	1090	1187	1349	697	982	1077	867	675	675	475	455	483	359	483	586		
SANGO	3	894	960	976	1009	1466	1207	730	943	932	842	636	636	542	441	479	393	411	490		
SANGO	AVG	887	959	1037	1068	1345	1280	733	935	977	858	641	641	536	443	488	380	432	480		
LORING	1	699	669	852	675	877	622	473	460	461	656	788	788	372	391	445	349	421	543		
LORING	2	755	820	722	814	754	531	505	500	490	706	701	701	353	363	409	337	427	498		
LORING	3	689	677	846	768	869	612	492	478	502	696	897	897	372	377	409	337	392	516		
LORING	AVG	714	722	807	752	833	588	490	479	484	686	795	795	366	377	421	341	413	519		
MEMPHIS	1	856	1161	1234	861	1018	856	728	644	662	890	950	950	577	534	683	542	558	621		
MEMPHIS	2	985	1085	1245	861	1650	812	679	641	612	899	946	946	558	648	591	506	545	613		
MEMPHIS	3	863	1111	1223	861	1387	812	687	638	651	981	922	922	521	577	610	513	530	636		
MEMPHIS	AVG	901	1119	1234	861	1352	827	698	641	642	923	939	939	552	586	628	520	544	623		
SANGO	1	1300	1732	1420	1648	1758	2008	1330	1502	1710	1542	1016	1016	943	793	842	774	748	901		
SANGO	2	1584	1577	1682	1694	2034	1961	1446	1492	1622	1718	1349	1349	900	856	830	757	998	703		
SANGO	3	1458	1490	1429	1586	1598	2154	1211	1461	1413	1861	1286	1286	868	832	831	694	938	842		
SANGO	AVG	1447	1600	1510	1643	1757	2041	1329	1485	1582	1707	1217	1217	904	827	834	742	895	815		
FALAYA	2	114	164	184	165	153	125	49	44	58	79	149	149	41	49	62	63	47	77		
FALAYA	3	115	118	182	139	156	128	47	50	53	99	135	135	40	54	44	66	59	71		
FALAYA	3	95	196	164	175	142	118	45	45	54	104	140	140	42	57	44	60	76	77		
FALAYA	AVG	108	159	177	160	150	124	47	46	55	94	141	141	41	53	50	63	61	75		
MAURY	1	2037	1795	2260	2463	2129	2381	1513	1902	1754	2252	1185	1185	1856	1272	1257	1222	1160	1059		
MAURY	2	2268	2444	2425	2612	2079	2111	1486	1828	1753	2205	1247	1247	1787	1131	1725	1422	1466	1167		
MAURY	3	2108	1969	1822	2003	2072	2438	1591	2129	1745	2346	1155	1155	1674	1174	1661	1350	1055	1165		
MAURY	AVG	2138	2003	2169	2359	2093	2310	1530	1953	1751	2268	1196	1196	1772	1192	1548	1331	1227	1130		
MAURY	1	552	1048	1062	1234	1529	1436	838	1047	1068	1065	545	545	605	577	478	503	497	362		
MAURY	2	1000	1051	1030	1060	1219	1229	853	1095	1051	1302	644	644	654	563	535	432	395	374		
MAURY	3	952	977	1019	1235	1380	1421	918	1093	1051	1925	595	595	692	612	507	435	376	402		
MAURY	AVG	568	1025	1037	1176	1376	1362	870	1078	1051	1097	595	595	650	584	507	457	423	379		
ARMOUR	1	1712	1599	1686	1946	2002	2225	1374	1711	1668	2341	977	977	783	741	673	641	507	489		
ARMOUR	2	2147	1719	1930	1775	1880	2304	1362	1903	1703	2142	1217	1217	810	708	710	761	817	506		
ARMOUR	3	1597	1778	1769	1829	2190	2234	1343	1707	1768	2258	1120	1120	890	697	687	570	560	580		
ARMOUR	AVG	1819	1699	1795	1850	2024	2254	1360	1774	1713	2247	1105	1105	828	715	690	657	628	525		
HUNTINGTON	1	3000	4000	4500	5000	6000	7000	2047	3787	4377	4500	6000	6000	2610	1775	2154	2371	1979	1929		
HUNTINGTON	2	3000	4000	4500	5000	6000	7000	2062	3630	4452	4500	6000	6000	2600	1711	2583	2279	2261	1897		
HUNTINGTON	3	3000	4000	4500	5000	6000	7000	1822	3450	4446	4500	6000	6000	2479	1694	2195	2233	2269	1820		
HUNTINGTON	AVG	3000	4000	4500	5000	6000	7000	1977	3622	4425	4500	6000	6000	2563	1727	2311	2294	2170	1862		
MAURY	1	1095	1140	1194	1336	1509	1875	881	1076	1234	1037	895	895	864	709	557	517	510	366		
MAURY	2	1072	1111	1184	1461	1520	1651	886	1217	1073	974	844	844	710	653	564	407	402			
MAURY	3	1071	993	1199	1368	1445	1708	998	1044	1165	1078	719	719	788	639	543	489	390			
MAURY	AVG	1079	1081	1192	1388	1491	1745	922	1112	1157	1030	819	819	787	688	622	525	469	386		

Table 24 (continued)

EXTRACTANT AND SOIL TO SOLUTION RATIO																									
(COLUMN HEADINGS OF _4, _6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)																									
DOUBLE ACID												TENNESSEE													
MEHLICH																									
SITE	REP	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20
HARTSELLS	1	356	356	398	587	612	653	224	280	445	420	198	198	342	200	223	162	172	134						
HARTSELLS	2	297	355	465	518	544	595	242	352	376	276	263	263	256	265	265	170	169	142						
HARTSELLS	3	298	323	440	547	545	768	270	490	491	329	232	232	235	272	292	155	159	162						
HARTSELLS	AVG	317	345	434	551	567	652	245	374	437	342	231	231	278	246	247	162	167	146						
HARTSELLS	1	342	410	416	615	575	556	292	374	415	469	137	137	289	241	208	186	186	154						
HARTSELLS	2	323	354	420	468	641	465	292	363	459	364	178	178	336	260	214	210	180	155						
HARTSELLS	3	354	393	410	488	590	563	306	337	447	310	248	248	321	251	229	185	210	155						
HARTSELLS	AVG	340	399	415	524	602	528	297	358	440	381	188	188	315	251	217	201	192	156						
HARTSELLS	1	220	413	229	279	457	372	117	148	200	157	124	124	95	94	92	86	90	96						
HARTSELLS	2	192	294	214	264	394	391	130	224	212	162	95	95	105	68	85	115	111	109						
HARTSELLS	3	200	310	262	290	498	550	125	159	210	257	162	162	72	97	87	85	108	118						
HARTSELLS	AVG	204	339	235	278	450	438	124	177	207	192	127	127	91	86	88	95	103	108						
HUNTINGTON	1	974	1006	953	1168	1034	1289	742	893	990	864	662	662	525	480	469	422	397	413						
HUNTINGTON	2	844	952	968	1129	1292	1469	755	1042	1024	1115	648	648	519	432	446	363	398	503						
HUNTINGTON	3	892	915	981	1153	1217	1309	793	957	989	953	752	752	518	476	414	446	348	375						
HUNTINGTON	AVG	903	958	967	1150	1181	1356	763	964	1001	977	687	687	521	463	443	410	381	430						
HARTSELLS	1	415	256	321	427	416	475	176	230	280	392	136	136	115	123	100	116	112	106						
HARTSELLS	2	259	289	310	368	564	518	177	216	234	216	141	141	109	117	126	79	107	115						
HARTSELLS	3	256	292	323	344	459	413	198	215	300	232	169	169	115	121	104	83	117	125						
HARTSELLS	AVG	310	279	318	380	480	469	184	220	271	280	149	149	113	120	110	93	112	115						
SANGU	1	310	492	410	450	650	538	236	292	410	319	184	184	164	146	121	156	137	113						
SANGU	2	353	379	382	413	653	623	251	345	395	308	238	238	187	175	133	120	113	167						
SANGU	3	395	393	396	446	699	563	288	329	359	339	238	238	186	165	149	126	127	140						
SANGU	AVG	349	421	396	436	667	575	258	322	388	322	220	220	179	162	134	134	126	140						
ROBERTSVILLE	1	726	766	770	907	886	1062	606	718	790	690	470	470	485	364	411	307	276	264						
ROBERTSVILLE	2	749	742	801	834	964	1034	581	707	816	672	693	693	416	396	490	267	260	334						
ROBERTSVILLE	3	763	866	791	867	954	1013	601	734	803	711	552	552	449	433	379	301	319	258						
ROBERTSVILLE	AVG	746	791	787	869	935	1036	596	720	803	691	572	572	450	398	427	292	285	285						
MOUNTVIEW	1	155	161	254	287	361	333	92	120	188	125	100	100	66	53	66	57	82	86						
MOUNTVIEW	2	139	184	193	180	294	312	81	125	184	113	106	106	56	49	61	69	59	87						
MOUNTVIEW	3	140	194	230	272	297	372	92	114	171	116	99	99	61	69	96	51	80	74						
MOUNTVIEW	AVG	145	180	226	246	317	339	88	120	181	118	102	102	61	57	74	59	74	82						
HARTSELLS	1	524	570	547	672	819	828	402	453	542	512	337	337	278	240	200	265	228	217						
HARTSELLS	2	644	529	658	805	1013	770	427	573	552	443	456	456	274	226	200	201	228	380						
HARTSELLS	3	474	523	586	581	807	856	408	565	633	450	338	338	294	221	201	204	252	252						
HARTSELLS	AVG	547	541	597	686	880	818	412	530	576	468	377	377	282	229	200	223	236	283						
DICKSON	1	725	756	829	869	1002	1100	533	722	778	645	537	537	338	291	245	304	309	299						
DICKSON	2	639	732	915	866	1018	960	586	729	812	793	808	808	330	271	263	293	314	349						
DICKSON	3	657	802	875	876	916	1105	578	751	786	691	695	695	340	263	288	296	308	362						
DICKSON	AVG	674	763	873	870	979	1055	566	734	792	710	680	680	336	275	265	298	310	337						
SANGU	1	289	342	370	460	655	502	241	301	384	280	192	192	137	111	88	109	134	98						
SANGU	2	353	347	390	419	500	547	269	318	412	237	250	250	127	114	101	102	123	129						
SANGU	3	342	349	322	406	428	640	239	321	376	335	258	258	152	122	127	91	94	143						
SANGU	AVG	328	346	361	428	528	563	250	313	391	284	233	233	139	116	105	101	117	123						
DICKSON	1	164	202	278	370	411	495	126	153	223	196	184	184	67	64	54	91	171	206						
DICKSON	2	178	231	339	277	313	346	124	184	240	150	207	207	70	58	43	72	167	208						
DICKSON	3	188	305	270	280	288	464	131	155	215	150	191	191	63	79	87	107	114	175						
DICKSON	AVG	177	246	296	309	337	435	127	164	226	165	194	194	67	67	61	90	151	196						

Table 24 (continued)

EXTRACTANT AND SOIL TO SOLUTION RATIO----- (COLUMN HEADINGS OF _4, _6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)																			
SOIL	REP	DOUBLE ACID					TENNESSEE					MEHLICH							
		_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20
SEQUOIA	1	430	504	486	514	560	654	486	532	590	560	630	630	355	336	299	327	350	374
SEQUOIA	2	467	511	497	526	527	665	523	549	611	584	560	560	361	340	305	296	374	386
SEQUOIA	3	470	504	523	514	560	657	511	560	606	571	558	558	358	336	299	280	358	381
SEQUOIA	AVG	456	506	502	518	549	659	507	547	602	572	583	583	358	337	301	301	361	380
WHITWELL	1	336	364	411	374	420	560	411	476	480	420	490	490	280	252	224	234	210	280
WHITWELL	2	340	336	396	381	415	467	392	420	501	475	504	504	296	264	237	216	216	299
WHITWELL	3	318	347	374	374	420	491	399	429	492	467	490	490	318	280	224	241	214	269
WHITWELL	AVG	331	349	394	376	418	508	401	442	491	454	495	495	298	265	228	230	213	283
SEQUATCHIE	1	280	336	336	327	350	374	318	336	374	374	420	420	262	196	187	191	141	187
SEQUATCHIE	2	296	296	401	342	350	380	336	319	374	380	379	379	247	224	194	186	169	169
SEQUATCHIE	3	374	280	411	327	372	374	327	336	364	392	391	391	243	200	194	179	175	191
SEQUATCHIE	AVG	317	304	383	332	357	376	327	330	371	382	397	397	251	207	192	185	162	182
HUNTINGTON	1	262	280	336	327	350	467	338	336	336	327	420	420	205	168	187	187	189	280
HUNTINGTON	2	252	294	326	299	420	397	299	336	374	308	350	350	200	196	175	154	196	196
HUNTINGTON	3	243	280	299	327	395	374	316	327	314	341	361	361	224	164	150	146	206	187
HUNTINGTON	AVG	252	285	320	318	388	413	176	333	341	325	377	377	210	176	171	162	197	221
ETOWAH	1	168	196	187	234	210	280	187	220	262	287	291	291	168	168	149	161	149	151
ETOWAH	2	174	184	215	194	265	374	224	229	254	269	299	299	194	140	175	149	165	160
ETOWAH	3	187	196	224	187	280	329	216	228	224	291	304	304	206	151	156	174	174	166
ETOWAH	AVG	176	192	209	205	252	328	209	226	247	282	298	298	189	153	160	161	163	159
EMORY	1	1382	1541	1494	1354	1471	1681	1644	1625	1681	1494	1611	1611	1083	897	934	934	911	934
EMORY	2	1550	1536	1551	1402	1504	1588	1606	1681	1831	1635	1681	1681	994	899	926	990	984	927
EMORY	3	1474	1485	1532	1308	1541	1649	1666	1599	1759	1511	1697	1697	1009	1009	971	981	976	940
EMORY	AVG	1469	1521	1526	1355	1505	1639	1639	1635	1757	1547	1663	1663	1029	935	944	968	957	934

APPENDIX P

PPM MAGNESIUM EXTRACTED BY DIFFERENT SOIL-SOLUTION
RATIOS FOR THREE SOIL EXTRACTANTS

Table 25. PPM Magnesium Extracted by Different Soil-Solution Ratios for Three Soil Extractants

-----EXTRACTANT AND SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.-----													
(COLUMN HEADINGS OF _4, _6, _8, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)													

Table 25 (continued)

		EXTRACTANT AND SOIL TO SOLUTION RATIO												MEHLICH											
		(COLUMN HEADINGS OF _4, _6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)																							
SOIL	REP	DOUBLE ACID						TENNESSEE																	
		_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20
FALAYA	1	40	31	35	30	91	86	19	49	69	37	35	35	28	29	56	41	59	58						
FALAYA	2	46	47	39	38	68	79	17	57	83	42	43	43	22	34	51	41	62	58						
FALAYA	3	34	47	40	72	78	86	17	61	80	31	36	36	32	34	56	41	57	65						
FALAYA	AVG	40	42	38	47	79	86	17	56	77	37	38	38	27	32	54	41	59	60						
HENRY	1	102	125	140	150	175	180	60	125	167	109	105	105	97	120	150	151	130	138						
HENRY	2	106	125	139	136	163	180	60	136	166	105	122	122	101	120	150	151	144	127						
HENRY	3	112	145	140	154	188	169	62	151	170	110	112	112	116	126	145	146	139	130						
HENRY	AVG	107	132	135	143	167	175	60	137	168	108	113	113	105	122	145	149	138	132						
HENRY	1	149	143	137	130	146	150	73	136	152	146	127	127	122	136	171	181	162	152						
HENRY	2	162	138	129	131	166	140	84	150	191	139	141	141	142	126	156	183	171	161						
HENRY	3	121	174	141	173	112	140	75	155	183	138	160	160	140	142	197	179	162	166						
HENRY	AVG	144	152	136	145	141	143	77	147	175	141	143	143	135	135	175	181	165	160						
LORING	1	136	149	150	135	159	167	66	113	147	124	108	108	114	145	161	159	153	144						
LORING	2	109	166	149	126	159	120	68	158	172	120	125	125	120	131	150	166	158	155						
LORING	3	100	174	158	140	175	140	62	129	163	113	125	125	120	159	161	166	162	160						
LORING	AVG	115	163	152	134	164	142	65	133	161	119	119	119	118	145	157	164	158	153						
FALAYA	1	98	78	115	88	149	150	51	88	131	95	81	81	81	95	119	151	117	118						
FALAYA	2	131	132	107	107	166	165	49	111	112	96	77	77	85	92	109	124	126	109						
FALAYA	3	85	120	119	107	146	162	45	112	125	88	105	105	79	92	119	124	112	117						
FALAYA	AVG	88	110	122	101	154	159	48	104	123	93	88	88	82	93	116	131	118	115						
LORING	1	198	219	226	242	240	239	122	215	238	212	200	200	207	199	239	234	213	229						
LORING	2	213	208	214	200	259	199	131	243	259	204	246	246	246	200	239	234	235	236						
LORING	3	159	247	215	200	246	228	112	276	240	194	231	231	173	206	255	234	229	223						
LORING	AVG	190	225	218	214	248	222	122	245	246	203	226	226	182	202	244	234	226	229						
CALLOWAY	1	132	162	156	135	173	189	77	146	182	144	129	129	122	128	150	177	162	167						
CALLOWAY	2	124	163	162	140	213	150	69	148	151	140	142	142	112	126	182	166	171	167						
CALLOWAY	3	113	168	147	136	190	158	69	175	173	149	157	157	108	137	171	172	153	171						
CALLOWAY	AVG	123	164	155	137	192	166	72	156	169	144	143	143	114	130	168	172	162	168						
CALLOWAY	1	76	103	85	56	112	82	32	64	107	70	52	52	55	68	88	89	85	86						
CALLOWAY	2	64	103	89	61	81	56	34	95	89	67	69	69	57	70	82	89	94	86						
CALLOWAY	3	64	96	97	80	105	56	36	94	93	59	76	76	57	70	82	83	98	95						
CALLOWAY	AVG	68	101	90	66	99	65	34	84	96	65	66	66	56	69	84	87	92	89						
LORING	1	230	268	275	255	288	320	177	316	373	272	397	397	224	265	312	291	284	296						
LORING	2	213	264	290	284	348	362	165	355	341	284	433	433	226	269	297	291	286	296						
LORING	3	213	272	268	265	359	307	159	423	353	298	438	438	217	286	286	284	281	294						
LORING	AVG	219	268	278	268	332	330	167	365	356	285	423	423	222	273	298	289	284	295						
COLLINS	1	162	203	204	168	207	194	83	153	206	149	156	156	130	156	192	199	178	193						
COLLINS	2	132	170	191	158	200	165	75	164	184	149	157	157	152	159	176	194	183	187						
COLLINS	3	128	174	187	163	200	219	82	203	190	144	154	154	138	160	176	192	171	196						
COLLINS	AVG	141	182	194	163	202	193	80	173	193	147	156	156	138	160	181	195	177	192						
MEMPHIS	1	170	197	205	181	217	230	96	167	233	180	175	175	128	167	197	212	181	184						
MEMPHIS	2	132	201	198	159	226	165	88	205	175	182	194	194	136	170	197	201	181	178						
MEMPHIS	3	136	177	214	173	200	165	96	224	198	164	254	254	132	153	197	190	183	190						
MEMPHIS	AVG	146	192	206	171	214	187	93	199	202	175	208	208	132	163	197	201	182	184						
LORING	1	171	222	184	135	159	163	79	135	214	142	133	133	114	142	182	207	169	167						
LORING	2	113	132	127	149	153	165	79	171	176	163	145	145	124	148	182	181	167	170						
LORING	3	115	177	139	136	200	155	73	210	195	144	142	142	124	153	176	186	171	171						
LORING	AVG	133	157	150	140	171	161	77	172	195	150	140	140	121	148	180	191	169	169						

Table 25 (continued)

EXTRACTANT AND SOIL TO SOLUTION RATIO-----																			
(COLUMN HEADINGS OF _4, _6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)																			
SOIL	RFP	DOUBLE ACID						TENNESSEE						MEHLICH					
		_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20
HARTSELLS	1	90	95	105	130	92	141	59	67	76	81	91	91	57	48	48	63	95	96
HARTSELLS	2	73	87	97	102	91	106	61	81	71	55	89	89	58	44	55	82	79	113
HARTSELLS	3	77	76	124	94	112	117	64	79	110	67	85	85	55	43	69	72	94	117
HARTSELLS	AVG	80	86	109	109	98	121	61	76	86	68	88	88	57	45	57	72	89	109
HARTSELLS	1	75	79	103	118	97	91	57	67	67	67	76	76	45	43	46	64	85	95
HARTSELLS	2	68	78	87	82	96	88	76	84	63	57	77	77	59	47	47	74	87	83
HARTSELLS	3	86	75	120	90	101	89	57	60	73	51	81	81	48	47	46	61	93	83
HARTSELLS	AVG	76	77	103	97	98	89	63	70	68	58	78	78	51	49	46	66	88	87
HARTSELLS	1	94	104	101	94	109	116	63	68	66	65	99	99	66	46	49	70	107	118
HARTSELLS	2	86	105	80	93	98	171	68	81	81	59	90	90	57	47	57	81	97	102
HARTSELLS	3	83	103	115	97	127	141	67	70	78	66	93	93	53	47	51	80	104	99
HARTSELLS	AVG	88	104	99	95	111	143	66	73	75	63	94	94	59	47	52	77	103	106
HUNTINGTON	1	102	100	101	104	90	135	76	77	76	70	92	92	57	55	62	102	96	139
HUNTINGTON	2	80	89	116	103	115	144	76	91	82	95	111	111	57	52	62	68	96	126
HUNTINGTON	3	92	84	117	100	106	168	82	83	74	66	91	91	59	57	53	97	96	119
HUNTINGTON	AVG	91	91	111	102	104	145	78	84	77	77	98	98	58	55	59	89	96	128
HARTSELLS	1	128	104	120	137	111	137	78	92	78	96	127	127	90	71	82	89	111	111
HARTSELLS	2	108	109	126	126	164	155	77	89	94	75	112	112	73	74	86	85	108	106
HARTSELLS	3	104	104	124	115	139	138	92	83	101	74	105	105	75	612	67	85	115	113
HARTSELLS	AVG	113	106	123	126	138	143	82	88	91	82	115	115	79	252	78	86	111	110
SANGO	1	52	74	74	61	82	69	45	48	49	44	68	68	38	31	37	54	70	61
SANGO	2	59	51	65	58	85	97	48	54	52	43	83	83	38	36	38	43	61	88
SANGO	3	58	78	80	68	70	73	50	57	50	42	68	68	39	35	38	61	69	77
SANGO	AVG	56	68	73	62	79	80	48	53	50	43	73	73	38	34	38	53	67	80
POBERTSVILLE	1	82	75	95	93	92	100	61	69	67	53	91	91	56	44	47	78	82	83
POBERTSVILLE	2	77	71	91	76	74	86	63	69	67	54	79	79	48	49	49	63	78	87
POBERTSVILLE	3	77	80	87	76	84	93	63	70	68	51	78	78	52	46	55	68	93	82
POBERTSVILLE	AVG	79	75	91	82	83	93	62	69	67	53	83	83	52	46	50	70	84	84
MOUNTVIEW	1	60	61	95	103	77	83	49	55	50	46	74	74	47	34	38	51	79	108
MOUNTVIEW	2	62	61	70	89	69	84	45	54	54	50	74	74	38	32	34	56	66	88
MOUNTVIEW	3	57	64	99	90	73	97	46	53	58	44	65	65	42	33	36	54	92	90
MOUNTVIEW	AVG	60	62	88	94	73	88	47	54	54	47	71	71	42	33	38	54	75	97
HARTSELLS	1	130	137	129	138	140	148	102	103	106	101	141	141	90	86	81	124	137	135
HARTSELLS	2	139	124	147	150	178	150	116	120	98	86	146	146	83	79	84	98	128	177
HARTSELLS	3	110	112	136	120	172	146	103	114	114	89	134	134	90	75	81	110	141	136
HARTSELLS	AVG	126	124	137	136	163	148	107	112	106	92	140	140	88	80	82	111	135	150
DICKSON	1	28	44	37	35	59	76	17	22	17	16	33	33	26	15	15	37	39	49
DICKSON	2	25	42	51	29	53	72	20	32	20	13	45	45	25	14	18	25	54	43
DICKSON	3	26	40	50	28	30	63	19	26	20	12	43	43	26	12	16	32	41	48
DICKSON	AVG	26	42	46	31	47	70	19	27	19	14	40	40	26	14	16	32	45	47
SANGO	1	43	42	49	47	56	61	34	42	34	32	52	52	31	24	24	38	66	61
SANGO	2	45	40	54	46	47	64	38	40	47	21	46	46	26	23	27	37	54	58
SANGO	3	40	43	44	45	43	82	32	38	35	30	47	47	28	24	26	36	48	63
SANGO	AVG	43	42	49	46	49	69	35	40	39	28	48	48	28	24	26	37	56	61
DICKSON	1	25	30	56	52	44	49	20	25	21	21	39	39	19	15	18	25	64	107
DICKSON	2	26	31	53	35	38	48	22	29	29	15	35	35	18	17	16	24	70	126
DICKSON	3	30	33	35	34	34	69	22	27	32	14	31	31	16	18	20	36	51	135
DICKSON	AVG	27	31	48	40	39	55	21	27	27	17	35	35	18	17	18	28	62	123

Table 25 (continued)

		EXTRACTANT AND SOIL TO SOLUTION RATIO												(COLUMN HEADINGS OF -4, -6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)											
SOIL	REP	DOUBLE ACID						TENNESSEE						MEHLICH											
		-4	-6	-8	-10	-15	-20	-4	-6	-8	-10	-15	-20	-4	-6	-8	-10	-15	-20						
SEQUOIA	1	252	263	258	308	294	308	272	241	272	276	290	287	230	263	269	276	301	299						
SEQUOIA	2	249	269	269	275	287	299	284	256	284	269	276	269	224	255	254	284	303	308						
SEQUOIA	3	261	270	254	306	295	306	277	249	277	288	275	287	231	264	257	280	294	315						
AVG		254	267	260	296	292	304	278	249	278	278	280	281	228	261	257	280	299	307						
WHITWELL	1	125	138	142	140	147	168	126	127	126	134	126	133	121	132	138	149	168	215						
WHITWELL	2	123	132	131	140	147	159	131	118	131	126	129	142	123	136	141	147	175	216						
WHITWELL	3	126	135	143	145	151	161	115	116	115	127	135	140	126	132	135	159	182	215						
AVG		125	135	139	142	148	163	124	121	124	129	130	138	123	133	138	152	175	215						
SEQUATCHIE	1	192	207	213	224	224	224	202	202	213	230	229	255	192	205	220	220	238	234						
SEQUATCHIE	2	198	205	219	215	224	234	196	196	204	227	231	217	187	211	217	234	224	259						
SEQUATCHIE	3	191	211	215	216	209	227	211	211	216	234	229	239	191	210	216	215	241	262						
AVG		194	208	216	218	219	228	203	211	211	230	230	237	190	209	218	223	234	252						
SEQUATCHIE	1	166	177	179	187	196	187	168	168	171	194	191	189	189	164	182	191	196	252						
HUNTINGTON	2	157	168	168	167	189	196	181	182	182	197	199	189	172	205	211	212	196	250						
HUNTINGTON	3	161	159	175	195	179	201	180	180	169	183	187	200	171	201	191	215	209	262						
AVG		161	168	174	190	188	195	180	180	174	191	192	193	169	196	198	208	200	255						
ETOWAH	1	146	152	164	168	182	178	155	155	163	168	159	168	151	165	172	163	182	187						
ETOWAH	2	149	159	164	163	175	224	157	157	171	169	154	166	166	154	169	171	168	191						
ETOWAH	3	151	149	161	175	179	195	158	157	157	161	164	175	158	160	172	177	175	178						
AVG		149	153	163	169	179	199	157	157	164	166	159	170	158	160	171	170	175	185						
ETOWAH	1	224	243	273	262	280	291	235	235	244	254	271	259	228	216	236	248	259	290						
EMORY	2	232	261	273	248	280	280	215	215	254	274	268	273	209	215	240	247	261	286						
EMORY	3	230	259	264	269	274	296	216	216	247	262	252	266	216	230	236	243	273	299						
AVG		229	254	270	260	278	289	222	222	248	263	264	266	218	220	237	246	264	292						

APPENDIX Q

PPM MANGANESE EXTRACTED BY DIFFERENT SOIL-SOLUTION

RATIOS FOR THREE SOIL EXTRACTANTS

Table 26. PPM Manganese Extracted by Different Soil-Solution Ratios for Three Soil Extractants

		EXTRACTANT AND SOIL TO SOLUTION RATIO-- (COLUMN HEADINGS OF _4, _6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)												MEHLICH											
SOIL	REP	DOUBLE ACID						TENNESSEE						MEHLICH											
		_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20						
CALLOWAY	1	172	257	291	358	458	621	194	497	436	531	756	756	193	257	323	316	481	642						
CALLOWAY	2	178	257	287	283	500	665	177	456	404	574	677	677	184	256	322	323	381	569						
CALLOWAY	3	193	233	256	363	428	576	199	438	427	679	501	501	193	241	330	337	303	528						
CALLOWAY	AVG	181	249	278	335	462	620	190	464	422	595	645	645	190	251	325	325	355	580						
MEMPHIS	1	181	213	274	272	325	485	144	378	353	382	372	372	145	182	214	216	306	392						
MEMPHIS	2	181	210	236	305	336	510	150	365	291	412	356	356	144	167	215	227	283	289						
MEMPHIS	3	162	223	247	255	365	378	161	346	359	394	378	378	129	164	269	214	333	346						
MEMPHIS	AVG	175	215	252	277	342	458	152	363	334	396	369	369	139	171	233	219	307	342						
HENRY	1	167	202	205	315	458	462	168	321	407	542	391	391	164	204	295	316	403	483						
HENRY	2	184	184	227	347	402	532	161	414	394	531	470	470	154	192	269	323	361	452						
HENRY	3	162	176	239	298	397	444	167	376	376	432	501	501	164	196	215	296	333	446						
HENRY	AVG	171	187	224	320	419	479	165	370	392	502	454	454	161	197	260	312	366	460						
CALLOWAY	1	155	264	352	357	524	553	182	450	467	473	632	632	115	193	215	273	364	505						
CALLOWAY	2	195	242	313	390	467	665	169	452	421	500	533	533	139	178	215	282	283	429						
CALLOWAY	3	203	276	306	396	600	576	207	411	388	547	526	526	134	158	215	255	295	446						
CALLOWAY	AVG	198	261	324	381	530	598	186	438	425	507	564	564	129	176	215	270	314	460						
COLLINS	1	135	217	257	251	351	621	137	293	315	472	494	494	125	209	269	288	442	460						
COLLINS	2	139	202	227	240	467	488	125	331	366	425	491	491	139	186	215	255	322	452						
COLLINS	3	152	203	256	339	357	463	168	366	338	371	391	391	134	184	215	255	389	437						
COLLINS	AVG	142	207	247	277	418	524	143	330	340	423	459	459	134	193	233	266	384	450						
COLLINS	1	174	210	257	294	391	508	164	395	359	522	398	398	169	230	322	331	384	551						
COLLINS	2	193	224	236	240	385	532	176	433	292	398	494	494	169	237	342	323	342	476						
COLLINS	3	172	259	289	277	397	466	185	379	407	508	560	560	188	254	322	323	351	447						
COLLINS	AVG	180	231	261	270	351	502	175	402	353	476	484	484	175	240	295	326	359	491						
HENRY	1	160	235	265	294	375	508	158	361	369	517	558	558	169	225	295	316	384	528						
HENRY	2	172	188	236	262	353	466	171	440	356	478	461	461	149	218	215	296	361	406						
HENRY	3	155	216	256	298	397	400	184	368	378	465	510	510	152	190	269	323	333	369						
HENRY	AVG	162	213	252	285	375	458	171	390	368	487	510	510	152	211	260	312	359	434						
CALLOWAY	1	130	159	196	251	358	394	117	267	280	349	314	314	106	182	269	216	267	324						
CALLOWAY	2	132	141	176	272	320	356	105	319	290	350	302	302	124	147	161	214	264	266						
CALLOWAY	3	138	163	213	222	303	334	121	268	266	371	329	329	110	139	215	214	295	324						
CALLOWAY	AVG	133	154	195	248	327	361	114	285	279	357	315	315	113	156	215	215	275	305						
COLLINS	1	169	195	274	326	458	462	158	354	345	454	580	580	140	198	269	216	384	483						
COLLINS	2	190	231	253	369	435	687	163	418	321	444	550	550	139	179	215	255	400	452						
COLLINS	3	188	219	323	320	444	620	176	337	338	455	467	467	138	171	295	268	313	437						
COLLINS	AVG	182	215	283	338	446	590	166	370	335	451	532	532	139	183	260	246	366	457						
MEMPHIS	1	167	217	265	315	490	462	167	461	404	646	393	393	183	230	269	273	345	551						
MEMPHIS	2	167	213	270	337	352	642	166	428	379	442	484	484	164	199	269	255	342	406						
MEMPHIS	3	190	209	273	298	428	488	164	350	385	498	543	543	169	209	269	323	351	392						
MEMPHIS	AVG	175	213	269	317	423	531	166	413	389	529	473	473	172	213	269	284	346	450						
COLLINS	1	139	177	205	219	458	394	132	311	354	405	340	340	140	219	242	273	287	406						
COLLINS	2	153	177	219	326	385	488	124	289	312	386	445	445	139	199	269	296	264	406						
COLLINS	3	138	216	247	277	381	478	147	288	260	393	459	459	139	177	269	282	333	346						
COLLINS	AVG	143	190	224	274	408	420	134	296	309	395	415	415	139	198	260	284	295	386						
COLLINS	1	139	195	257	240	441	462	154	272	331	383	493	493	130	182	295	259	364	460						
COLLINS	2	144	174	184	337	484	642	130	353	362	398	347	347	120	192	242	255	322	406						
COLLINS	3	148	180	239	266	334	444	173	322	284	415	502	502	139	184	188	337	351	392						
COLLINS	AVG	144	183	227	281	420	516	152	316	326	399	447	447	130	186	242	284	346	419						

Table 26 (continued)

EXTRACTANT AND SOIL TO SOLUTION RATIO-----																																	
(COLUMN HEADINGS OF _4, _6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)																																	
SOIL	REP	DOUBLE ACID												TENNESSEE										MEHLICH									
		_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20								
FALAYA	1	125	206	213	251	441	507	144	299	449	552	468	468	135	219	349	273	384	483														
FALAYA	2	183	166	244	262	418	643	146	349	313	439	463	463	124	186	242	296	342	452														
FALAYA	3	162	213	264	287	365	532	130	287	413	465	469	469	124	196	242	288	427	346														
FALAYA	AVG	157	195	240	267	408	561	140	312	392	485	467	467	128	200	278	279	384	427														
HENRY	1	144	188	274	315	391	417	175	320	414	412	267	267	145	209	323	273	326	483														
HENRY	2	181	195	236	294	385	510	157	404	371	418	394	394	124	186	242	309	303	452														
HENRY	3	169	216	222	227	357	466	137	332	349	367	484	484	149	196	242	241	295	346														
HENRY	AVG	165	200	244	279	391	464	156	352	378	399	382	382	139	197	269	274	308	427														
CALLOWAY	1	167	199	326	283	441	598	148	321	470	516	505	505	135	214	323	259	345	619														
CALLOWAY	2	165	195	321	315	450	687	142	454	349	589	539	539	129	192	215	323	420	499														
CALLOWAY	3	172	235	314	363	537	576	121	331	457	447	546	546	139	171	295	268	370	437														
CALLOWAY	AVG	168	210	320	320	476	620	137	369	425	517	530	530	134	192	278	283	378	518														
MEMPHIS	1	146	159	248	262	424	394	165	318	381	434	404	404	179	257	323	345	384	460														
MEMPHIS	2	165	202	262	272	352	422	179	381	376	404	361	361	208	256	295	337	400	429														
MEMPHIS	3	138	199	281	320	365	356	153	332	348	449	418	418	203	216	269	350	370	392														
MEMPHIS	AVG	150	200	264	285	380	391	166	344	368	429	394	394	197	243	296	344	385	427														
CALLOWAY	1	135	159	187	240	358	349	145	300	296	443	317	317	120	172	269	288	364	437														
CALLOWAY	2	135	170	193	219	287	466	120	341	319	316	367	367	134	186	188	296	342	359														
CALLOWAY	3	119	180	230	233	334	378	122	279	283	325	372	372	120	158	222	286	370	346														
CALLOWAY	AVG	130	170	203	231	326	398	129	307	299	361	352	352	125	172	260	293	359	381														
GRENADE	1	149	210	256	251	375	553	148	313	360	476	443	443	135	161	269	259	326	437														
GRENADE	2	152	206	264	240	435	554	134	347	378	449	461	461	120	167	215	337	381	382														
GRENADE	3	136	199	249	320	365	497	114	332	362	356	372	372	100	177	242	296	295	392														
GRENADE	AVG	146	205	256	270	392	535	132	331	367	427	425	425	118	168	242	297	334	404														
GRENADE	1	158	187	256	283	358	462	128	292	311	509	430	430	135	209	269	259	345	346														
GRENADE	2	156	188	253	315	336	598	155	346	295	476	480	480	110	205	242	337	342	359														
GRENADE	3	145	223	306	298	334	488	154	388	291	443	567	567	124	190	295	309	370	437														
GRENADE	AVG	153	199	272	299	343	516	146	342	299	476	492	492	123	201	269	302	352	381														
LORING	1	139	173	231	337	408	508	161	330	359	445	441	441	154	219	323	345	423	415														
LORING	2	158	177	202	305	464	488	170	330	336	408	567	567	134	218	322	350	439	406														
LORING	3	145	223	247	298	412	488	124	320	356	421	457	457	149	216	315	350	408	437														
LORING	AVG	147	191	227	313	435	495	152	327	350	425	488	488	146	218	320	348	423	419														
FALAYA	1	167	224	257	315	441	508	173	405	391	428	450	450	164	204	323	374	442	392														
FALAYA	2	156	202	253	326	450	576	164	411	411	433	426	426	169	173	322	350	400	406														
FALAYA	3	153	256	264	331	397	488	137	365	377	436	479	479	159	203	242	323	370	346														
FALAYA	AVG	159	227	258	324	429	524	158	394	393	432	452	452	164	193	296	349	404	381														
MEMPHIS	1	209	271	335	411	524	689	251	489	491	646	736	736	251	320	483	489	598	460														
MEMPHIS	2	209	249	347	411	533	687	250	550	535	553	652	652	203	333	376	433	575	499														
MEMPHIS	3	205	292	323	406	584	664	187	489	520	569	571	571	257	241	322	515	503	528														
MEMPHIS	AVG	208	271	335	409	547	680	229	509	515	589	653	653	237	298	394	479	559	496														
CALLOWAY	1	190	238	317	347	490	530	208	489	471	612	487	487	251	294	483	374	481	415														
CALLOWAY	2	200	248	304	369	451	532	206	448	462	548	546	546	208	321	430	487	478	499														
CALLOWAY	3	181	256	306	341	475	488	170	446	497	525	585	585	257	273	430	474	503	505														
CALLOWAY	AVG	190	247	309	352	472	517	195	461	477	562	539	539	239	296	448	445	487	473														
FALAYA	1	153	238	221	315	391	553	175	378	395	492	389	389	149	246	349	259	364	574														
FALAYA	2	160	213	262	315	385	532	175	358	364	465	430	430	144	224	322	364	361	452														
FALAYA	3	145	232	297	277	334	444	171	336	396	379	444	444	144	209	349	392	389	415														
FALAYA	AVG	153	228	260	302	370	510	174	357	385	445	421	421	146	226	340	338	371	480														

Table 26 (continued)

		EXTRACTANT AND SOIL TO SOLUTION RATIO												(COLUMN HEADINGS OF _4, _6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)											
SOIL	REP	DOUBLF ACID						TENNESSEE						MEHLICH											
		_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20						
FALAYA	1	172	235	300	337	458	598	157	382	383	480	510	510	130	225	349	273	433	619						
FALAYA	2	172	209	278	337	499	576	171	399	442	474	497	497	144	205	269	378	439	452						
FALAYA	3	162	256	306	320	459	532	142	410	423	403	576	576	144	196	269	405	427	415						
FALAYA	AVG	169	233	295	331	472	569	157	397	416	452	528	528	139	209	296	352	433	495						
SANGO	1	69	89	101	85	107	108	58	75	143	81	97	97	47	51	50	57	69	68						
SANGO	2	55	77	89	79	111	83	56	81	73	73	81	81	37	49	53	65	68	64						
SANGO	3	59	79	74	89	125	107	58	84	114	68	95	95	35	55	52	62	70	70						
SANGO	AVG	61	82	88	84	114	99	57	82	113	74	91	91	40	52	52	61	69	67						
SANGO	1	145	177	200	165	206	172	99	153	167	138	165	165	71	73	101	108	125	122						
SANGO	2	120	158	167	181	176	185	96	176	150	180	151	151	56	93	91	101	133	136						
SANGO	3	116	189	167	180	199	160	107	168	147	164	180	180	59	87	86	117	135	146						
SANGO	AVG	127	175	178	175	194	172	101	166	155	161	165	165	62	84	93	109	131	135						
LORING	1	135	181	222	251	335	354	153	363	355	455	340	340	164	209	376	316	364	505						
LORING	2	149	195	184	251	336	378	141	327	321	379	376	376	169	211	295	296	342	406						
LORING	3	148	183	230	244	287	378	143	379	336	359	398	398	169	196	322	323	351	369						
LORING	AVG	144	186	212	249	319	383	146	356	337	398	371	371	167	205	331	312	352	427						
MEMPHIS	1	116	152	222	272	308	417	122	288	341	405	329	329	140	182	269	216	326	551						
MEMPHIS	2	128	141	202	262	352	488	109	278	280	365	368	368	134	192	215	282	303	336						
MEMPHIS	3	148	186	197	233	287	356	961	280	271	327	372	372	139	145	215	350	313	324						
MEMPHIS	AVG	131	160	207	256	316	420	397	282	297	366	356	356	138	173	233	283	314	404						
SANGO	1	303	493	447	559	458	500	236	356	379	297	519	519	108	138	224	202	376	426						
SANGO	2	345	465	468	519	489	542	277	336	318	466	435	435	107	193	231	249	362	378						
SANGO	3	260	373	408	553	554	550	233	353	278	415	527	527	113	152	203	189	394	434						
SANGO	AVG	303	444	441	544	500	531	249	348	325	393	494	494	109	161	219	213	377	413						
FALAYA	2	45	47	65	58	43	100	37	61	89	76	82	82	57	76	81	72	92	103						
FALAYA	3	45	47	38	38	73	135	39	70	91	73	89	89	51	70	107	90	70	97						
FALAYA	3	43	50	63	38	67	91	34	87	89	81	64	64	56	62	96	90	87	97						
FALAYA	AVG	44	48	58	45	61	109	37	73	90	77	78	78	55	69	95	84	83	99						
MAURY	1	260	399	487	623	457	606	216	244	257	365	595	595	90	97	129	146	324	378						
MAURY	2	271	382	553	614	355	560	177	269	291	363	508	508	73	117	124	185	307	346						
MAURY	3	194	441	541	732	542	482	192	305	286	312	602	602	79	116	116	145	313	326						
MAURY	AVG	242	407	527	656	465	549	195	273	278	347	568	568	81	110	123	159	315	350						
MAURY	1	438	662	629	735	901	598	350	420	437	636	848	848	170	201	238	280	469	548						
MAURY	2	422	540	562	830	776	736	322	457	335	532	730	730	158	221	241	322	545	532						
MAURY	3	348	565	624	700	657	806	301	478	379	607	858	858	164	258	214	264	540	618						
MAURY	AVG	403	589	605	755	778	713	324	452	384	592	812	812	164	227	231	289	518	566						
ARMOUR	1	244	265	313	393	327	376	138	224	220	209	352	352	63	80	97	134	215	250						
ARMOUR	2	213	267	330	387	322	332	129	210	228	268	329	329	69	111	105	127	230	234						
ARMOUR	3	225	296	326	400	332	300	124	275	218	285	345	345	69	93	90	134	235	270						
ARMOUR	AVG	227	276	323	393	327	336	130	236	222	254	342	342	67	93	97	132	227	251						
HUNTINGTON	1	239	367	386	466	612	606	174	300	285	311	521	521	104	141	192	225	347	328						
HUNTINGTON	2	211	358	418	494	564	711	207	351	298	350	378	378	101	160	177	195	377	382						
HUNTINGTON	3	216	349	378	485	562	696	172	331	277	339	476	476	108	154	162	221	367	368						
HUNTINGTON	AVG	222	358	394	482	586	671	184	327	287	333	458	458	104	152	177	214	364	359						
MAURY	1	391	457	520	586	785	821	278	454	373	467	727	727	148	166	197	249	365	362						
MAURY	2	302	610	642	772	702	683	311	464	403	429	815	815	148	212	201	237	307	332						
MAURY	3	364	513	646	669	669	773	296	429	424	512	699	699	151	173	197	239	391	474						
MAURY	AVG	352	527	603	676	719	759	295	449	401	469	747	747	149	184	198	242	354	389						

Table 26 (continued)

		EXTRACTANT AND SOIL TO SOLUTION RATIO-- (COLUMN HEADINGS OF -4, -6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)																							
SOIL	REP	DOUBLE ACID						TENNESSEE						MEHLICH											
		-4	-6	-8	-10	-15	-20	-4	-6	-8	-10	-15	-20	-4	-6	-8	-10	-15	-20						
HARTSELLS	1	84	100	104	101	103	135	53	92	96	104	104	104	21	29	36	47	68	66						
HARTSELLS	2	61	98	86	111	116	101	56	115	109	92	122	122	20	35	39	51	72	80						
HARTSELLS	3	52	92	102	110	121	112	59	99	111	83	109	109	20	38	33	55	79	80						
HARTSELLS	AVG	66	97	97	107	113	116	56	102	105	93	112	112	20	34	36	51	73	75						
HARTSELLS	1	104	127	119	141	152	155	73	128	123	113	122	122	35	44	53	65	92	100						
HARTSELLS	2	86	124	134	139	149	137	78	122	120	125	129	129	33	52	56	75	93	100						
HARTSELLS	3	100	133	136	129	139	146	77	120	139	127	137	137	37	56	48	71	100	108						
HARTSELLS	AVG	97	128	130	136	147	146	76	123	127	122	129	129	35	51	52	70	95	103						
HARTSELLS	1	207	227	199	240	229	257	125	188	179	172	221	221	85	102	123	149	177	186						
HARTSELLS	2	192	273	191	259	199	236	124	212	200	211	212	212	72	107	129	144	176	192						
HARTSELLS	3	184	236	200	264	235	210	125	181	198	201	221	221	81	129	144	136	180	184						
HARTSELLS	AVG	194	245	197	254	221	234	125	194	192	195	218	218	79	113	132	143	178	187						
HUNTINGTON	1	270	388	321	448	362	416	176	200	268	262	375	375	83	103	125	196	264	262						
HUNTINGTON	2	210	324	311	390	333	347	186	276	277	273	379	379	78	98	145	154	275	260						
HUNTINGTON	3	219	305	313	434	405	359	174	234	226	318	352	352	85	114	150	190	302	284						
HUNTINGTON	AVG	233	339	315	424	367	374	179	237	257	284	369	369	82	105	140	180	280	269						
HARTSELLS	1	278	247	264	288	336	295	158	232	186	211	262	262	91	103	156	176	214	186						
HARTSELLS	2	194	260	266	307	265	280	146	220	241	235	256	256	90	113	146	162	204	210						
HARTSELLS	3	182	261	254	280	278	237	170	232	222	228	258	248	90	127	146	176	221	222						
HARTSELLS	AVG	218	256	261	292	293	271	158	228	216	225	255	255	90	114	149	171	213	206						
SANGO	1	131	205	156	184	220	217	121	159	169	142	189	176	75	84	103	128	145	146						
SANGO	2	129	175	171	182	185	174	118	178	174	176	176	176	75	103	102	119	143	152						
SANGO	3	150	167	175	179	195	170	132	204	161	150	183	183	74	106	100	124	148	146						
SANGO	AVG	137	182	167	182	200	187	124	180	168	156	183	183	77	98	102	124	145	148						
MCURTVIEW	1	234	229	298	342	341	365	267	276	246	274	338	358	109	121	167	180	238	228						
MCURTVIEW	2	258	311	335	347	298	387	194	318	299	286	350	350	93	128	131	153	265	262						
MCURTVIEW	3	249	321	347	302	347	316	197	250	259	328	336	336	96	131	128	203	273	264						
MCURTVIEW	AVG	247	287	327	330	329	356	219	281	268	296	348	348	99	127	142	179	259	251						
MCURTVIEW	1	51	78	72	84	123	119	49	76	100	73	86	86	34	43	47	58	63	56						
MCURTVIEW	2	58	77	73	79	90	97	54	83	82	62	93	93	36	44	47	52	65	52						
MCURTVIEW	3	49	75	73	81	99	98	52	77	97	77	101	101	34	49	52	59	79	60						
MCURTVIEW	AVG	53	77	73	81	104	105	52	79	93	71	93	93	35	45	49	56	69	56						
HARTSELLS	1	230	308	284	317	330	315	139	223	215	242	319	319	88	104	144	166	237	256						
HARTSELLS	2	238	297	345	344	303	343	199	225	245	245	298	298	75	109	130	154	232	226						
HARTSELLS	3	194	264	309	305	356	300	161	248	210	334	322	322	89	119	135	176	239	244						
HARTSELLS	AVG	217	290	313	322	330	319	166	242	217	274	313	313	84	111	136	165	236	242						
DICKSON	1	58	75	71	79	112	119	37	69	74	63	87	87	27	39	44	53	62	62						
DICKSON	2	48	74	66	77	110	87	50	78	82	71	87	87	22	37	42	51	64	70						
DICKSON	3	44	68	58	78	89	79	46	82	87	62	96	96	25	40	38	61	71	64						
DICKSON	AVG	50	72	65	78	104	95	44	76	81	65	90	90	25	40	41	55	66	65						
SANGO	1	126	147	141	152	199	183	111	160	137	115	151	151	66	75	94	95	116	120						
SANGO	2	105	145	137	163	152	167	111	166	150	126	150	150	59	81	100	101	116	116						
SANGO	3	132	139	127	138	165	176	97	153	142	133	153	153	58	87	78	108	117	116						
SANGO	AVG	121	144	135	151	172	175	106	160	143	125	151	151	61	81	91	101	116	117						
DICKSON	1	62	85	74	88	130	135	54	92	98	60	96	96	51	59	63	80	71	68						
DICKSON	2	58	91	74	81	89	126	64	94	96	64	106	106	49	58	60	63	77	72						
DICKSON	3	66	83	76	87	117	127	65	98	106	75	105	105	52	62	62	81	73	72						
DICKSON	AVG	62	86	75	85	112	129	61	95	100	66	102	102	51	60	62	75	74	71						

Table 26 (continued)

		EXTRACTANT AND SOIL TO SOLUTION RATIO-----												(COLUMN HEADINGS OF _4, _6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)											
SOIL	P/P	DOUBLE ACID						TENNESSEE						MEHLICH											
		_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20						
SEQUOIA	1	261	277	362	558	427	467	243	308	336	374	490	490	118	171	168	205	308	383						
SEQUOIA	2	270	296	359	526	438	427	187	301	316	349	482	482	121	166	183	216	322	396						
SEQUOIA	3	275	311	374	500	553	430	196	308	299	327	490	490	116	165	182	219	311	420						
SEQUOIA	AVG	269	295	365	541	466	441	208	306	317	350	487	487	118	167	178	213	314	400						
WHITWELL	1	319	353	359	397	413	420	318	308	374	327	420	420	179	210	235	252	329	346						
WHITWELL	2	304	347	348	383	399	396	280	311	348	401	399	399	184	214	224	249	329	364						
WHITWELL	3	319	356	376	398	427	308	296	308	336	420	420	420	179	196	226	262	328	420						
WHITWELL	AVG	314	352	361	393	413	375	298	309	353	383	413	413	181	207	228	254	329	377						
SEQUATCHIE	1	235	266	254	304	336	364	205	280	336	374	420	420	125	168	176	210	322	280						
SEQUATCHIE	2	248	275	265	316	374	299	224	261	299	341	369	369	125	174	188	194	296	297						
SEQUATCHIE	3	243	280	279	313	385	299	211	252	298	327	380	380	131	165	187	210	287	355						
SEQUATCHIE	AVG	242	274	266	311	365	321	213	264	311	347	390	390	127	169	184	205	302	311						
HUNTINGTON	1	217	272	288	299	336	318	205	224	299	280	287	287	133	157	202	229	259	308						
HUNTINGTON	2	200	249	265	307	316	327	243	239	301	296	287	287	126	193	187	234	231	329						
HUNTINGTON	3	216	247	243	318	301	342	226	252	299	280	280	280	125	184	196	243	261	355						
HUNTINGTON	AVG	211	256	265	308	318	329	228	238	300	285	306	306	128	178	195	235	250	331						
ETOWAH	1	473	591	661	495	457	831	299	420	448	514	630	630	189	216	250	285	378	514						
ETOWAH	2	469	583	620	499	514	842	301	374	411	511	656	696	215	221	241	288	406	484						
ETOWAH	3	449	569	639	574	516	915	318	336	416	514	701	701	222	219	235	290	402	476						
ETOWAH	AVG	464	581	640	523	509	863	306	377	425	513	676	676	209	219	242	288	395	491						
EMORY	1	458	558	665	635	701	813	336	448	523	560	590	590	250	233	259	327	448	514						
EMORY	2	473	580	648	596	784	826	341	411	516	529	626	626	228	255	306	319	437	519						
EMORY	3	464	579	665	560	820	822	355	420	523	560	630	630	222	241	303	313	427	514						
EMORY	AVG	465	572	659	557	768	820	344	426	521	550	615	615	233	243	303	320	437	516						

APPENDIX R

PPM ZINC EXTRACTED BY DIFFERENT SOIL-SOLUTION
RATIOS FOR THREE SOIL EXTRACTANTS

Table 27. PPM Zinc Extracted by Different Soil-Solution Ratios for Three Soil Extractants

		EXTRACTANT AND SOIL TO SOLUTION RATIO-----												(COLUMN HEADINGS OF _4, _6, _8, _10, _15, _20, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)											
SOIL	REP	DOUBLE ACID						TENNESSEE						MEHLICH											
		_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20						
CALLOWAY	1	2.1	1.4	1.7	1.5	2.2	2.3	2.9	1.8	1.4	2.1	2.6	2.6	1.5	1.8	2.6	3.5	4.4	5.7						
CALLOWAY	2	2.0	1.7	1.6	2.1	2.2	2.5	3.7	1.9	2.3	2.8	2.7	2.7	1.6	2.1	1.8	3.2	4.0	6.1						
CALLOWAY	3	1.7	1.4	1.7	1.7	2.1	2.2	2.5	1.8	1.4	2.1	2.4	2.4	1.7	1.8	2.3	3.1	5.9	6.2						
AVG		1.9	1.5	1.7	1.8	2.2	2.3	3.0	1.8	1.7	2.3	2.6	2.6	1.6	1.9	2.2	3.3	4.8	6.0						
MEMPHIS	1	2.9	2.2	2.5	2.4	2.6	3.3	2.5	2.8	2.9	3.4	4.5	4.5	1.3	1.8	1.9	2.3	4.9	4.1						
MEMPHIS	2	2.7	2.5	2.5	2.4	2.7	3.1	2.0	2.6	2.7	3.7	3.6	3.6	1.6	2.3	2.1	2.8	3.7	4.5						
MEMPHIS	3	2.6	2.3	2.3	2.6	2.4	3.1	2.8	2.7	2.8	2.9	2.8	2.8	1.5	1.9	1.8	2.1	3.1	3.8						
AVG		2.7	2.3	2.4	2.5	2.6	3.2	2.4	2.7	2.8	3.3	3.6	3.6	1.5	2.0	1.9	2.4	3.9	4.1						
HENRY	1	1.6	1.5	1.6	1.6	1.6	2.4	1.4	2.0	1.6	1.9	2.6	2.6	1.3	1.6	1.5	2.3	2.4	4.1						
HENRY	2	1.6	2.1	1.6	1.9	1.9	2.6	1.4	1.9	1.9	3.7	2.5	2.5	1.4	1.6	1.9	2.5	2.9	2.9						
HENRY	3	1.4	1.6	1.8	1.9	2.1	2.3	1.9	1.9	1.8	2.1	2.4	2.4	1.3	1.6	1.6	2.2	3.1	4.7						
AVG		1.5	1.7	1.7	1.8	1.9	2.4	1.6	1.9	1.8	2.6	2.5	2.5	1.3	1.6	1.7	2.3	2.8	3.9						
CALLOWAY	1	2.9	2.4	2.5	2.5	2.7	3.3	2.5	2.6	2.3	3.0	3.8	3.8	1.1	1.6	1.9	2.0	2.4	4.9						
CALLOWAY	2	3.0	2.9	2.4	3.2	2.5	3.4	2.3	2.7	3.6	5.3	4.4	4.4	1.3	1.3	3.0	2.5	2.9	4.5						
CALLOWAY	3	2.6	2.5	3.0	2.8	2.9	3.1	2.1	2.6	2.4	3.3	3.1	3.1	1.4	1.8	1.8	1.9	2.2	5.1						
AVG		2.8	2.6	2.6	2.8	2.7	3.3	2.3	2.6	2.8	3.9	3.8	3.8	1.3	1.6	2.2	2.1	2.5	4.8						
COLLINS	1	1.8	1.9	1.9	1.8	1.8	2.7	1.5	1.9	1.7	2.1	4.8	4.8	1.8	1.8	1.9	2.3	3.9	3.3						
COLLINS	2	1.7	2.0	1.8	2.1	1.9	2.6	1.6	2.2	1.8	3.1	3.2	3.2	1.9	2.1	3.2	3.6	5.4	4.5						
COLLINS	3	1.5	2.1	1.6	1.7	2.1	2.9	1.9	2.0	1.5	2.8	2.2	2.2	1.8	1.8	1.8	2.6	3.1	2.8						
AVG		1.7	2.0	1.8	1.9	1.9	2.7	1.7	2.0	1.7	2.7	3.4	3.4	1.8	1.9	2.3	2.8	4.1	3.5						
COLLINS	1	1.3	1.2	1.1	1.3	1.3	1.9	1.6	1.5	1.2	1.8	2.4	2.4	1.0	1.3	1.4	2.0	1.4	3.3						
COLLINS	2	1.4	2.1	1.0	1.9	1.6	2.1	1.3	1.4	2.6	2.5	2.0	2.0	1.1	1.5	1.6	3.2	2.9	4.5						
COLLINS	3	1.1	1.3	1.4	1.6	1.5	1.8	1.1	1.4	1.1	1.6	2.1	2.1	1.1	1.3	1.5	2.4	1.3	4.6						
AVG		1.3	1.5	1.2	1.6	1.5	1.9	1.3	1.4	1.6	2.0	2.2	2.2	1.1	1.4	1.5	2.5	1.9	4.1						
HENRY	1	2.0	1.1	1.3	1.1	1.3	2.0	1.6	1.3	1.2	1.6	2.1	2.1	0.8	1.2	1.6	2.0	1.0	3.3						
HENRY	2	2.0	1.6	1.3	1.2	1.5	2.4	1.9	2.2	1.3	2.7	2.4	2.4	0.8	1.1	2.3	2.8	2.0	4.5						
HENRY	3	1.7	1.1	1.3	1.2	1.3	2.2	1.0	1.5	1.2	1.6	1.7	1.7	0.7	1.1	1.7	2.5	1.3	4.5						
AVG		1.9	1.3	1.3	1.2	1.4	2.2	1.5	1.7	1.2	2.0	2.1	2.1	0.8	1.1	1.9	2.4	1.4	4.1						
CALLOWAY	1	1.2	1.0	1.1	1.2	1.0	1.9	1.7	1.2	1.1	1.8	2.1	2.1	0.7	1.1	1.0	1.6	3.7	3.3						
CALLOWAY	2	1.1	1.4	1.1	1.2	1.5	1.7	1.3	1.7	1.3	2.3	1.7	1.7	0.7	1.1	1.2	2.5	3.9	4.5						
CALLOWAY	3	1.3	1.1	1.3	1.3	1.2	1.8	1.0	1.5	1.1	1.6	1.5	1.5	0.8	1.6	1.7	1.3	3.2	2.8						
AVG		1.2	1.2	1.2	1.2	1.2	1.8	1.3	1.5	1.2	1.9	1.8	1.8	0.7	1.4	1.3	1.8	3.6	3.5						
COLLINS	1	1.5	1.9	1.9	1.7	1.9	4.1	1.8	2.0	1.7	2.1	2.8	2.8	1.1	1.4	1.5	2.0	2.9	5.7						
COLLINS	2	1.5	1.8	1.9	1.9	2.0	2.9	1.9	1.8	1.7	2.4	2.7	2.7	1.2	2.5	1.9	2.7	2.7	5.3						
COLLINS	3	1.6	2.0	2.0	1.8	2.3	3.4	1.0	1.8	1.8	2.1	2.0	2.0	1.2	2.0	2.1	1.5	3.0	6.2						
AVG		1.5	1.9	1.9	1.8	2.1	3.5	1.6	1.8	1.7	2.2	2.5	2.5	1.2	2.0	1.8	2.1	2.9	5.7						
MEMPHIS	1	2.0	1.7	1.8	1.7	2.0	2.9	1.2	1.8	1.5	2.1	2.6	2.6	1.0	1.5	1.6	2.0	2.9	4.1						
MEMPHIS	2	1.9	2.1	1.7	2.0	1.9	2.9	2.0	2.3	1.8	2.5	2.8	2.8	1.1	1.3	1.7	2.5	2.6	4.5						
MEMPHIS	3	1.8	1.9	1.7	1.9	2.2	2.7	1.5	2.1	1.5	2.2	2.3	2.3	1.3	1.6	1.6	2.1	2.9	4.4						
AVG		1.9	1.9	1.7	1.9	2.0	2.8	1.5	2.1	1.6	2.3	2.6	2.6	1.1	1.6	1.6	2.1	2.9	4.4						
COLLINS	1	1.3	0.9	1.1	1.1	1.0	1.8	1.5	1.7	1.0	1.5	1.9	1.9	1.1	1.1	1.1	1.6	2.2	3.2						
COLLINS	2	1.4	1.1	1.1	1.2	1.3	1.9	1.7	1.6	1.2	1.6	1.6	1.6	1.2	1.3	2.2	2.5	2.6	3.2						
COLLINS	3	1.4	1.0	1.0	1.2	1.1	2.1	1.5	1.6	1.1	1.5	1.4	1.4	1.3	1.3	2.0	2.4	2.4	4.2						
AVG		1.4	1.0	1.1	1.2	1.1	1.9	1.6	1.6	1.1	1.5	1.6	1.6	1.2	1.2	2.2	2.2	2.4	3.5						
COLLINS	1	1.2	1.0	1.3	1.0	1.2	2.0	1.1	1.4	1.3	1.6	2.0	2.0	0.8	1.2	1.6	1.2	2.5	3.3						
COLLINS	2	1.2	1.3	1.3	1.8	1.4	2.1	1.6	1.2	1.6	1.6	2.1	2.1	0.8	1.1	1.8	1.7	2.3	2.9						
COLLINS	3	1.3	1.1	1.2	1.6	1.6	1.8	1.7	1.3	1.0	1.7	1.9	1.9	0.9	1.4	1.5	1.0	2.6	4.5						
AVG		1.2	1.1	1.3	1.5	1.4	2.0	1.5	1.3	1.3	1.6	2.0	2.0	0.9	1.2	1.6	1.3	2.6	3.6						

Table 27 (continued)

		EXTRACTANT AND SOIL TO SOLUTION RATIO (COLUMN HEADINGS OF 4, 6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)																							
SOIL	REP	DOUBLE ACID						TENNESSEE						MEHLICH											
		4	6	8	10	15	20	4	6	8	10	15	20	4	6	8	10	15	20						
FALAYA	1	2.8	2.6	2.6	3.0	2.5	3.4	3.3	3.0	2.7	3.1	4.2	4.2	2.6	2.9	3.6	2.7	3.7	4.9						
FALAYA	2	2.7	2.7	2.6	2.9	2.7	3.6	2.8	3.5	2.9	4.2	3.3	3.3	2.8	2.9	3.2	3.2	3.8	4.5						
FALAYA	3	2.7	2.7	3.0	2.8	2.8	3.3	2.5	3.2	2.7	3.3	2.9	2.9	2.6	3.0	3.4	2.9	3.3	5.2						
FALAYA	AVG	2.7	2.7	2.7	2.9	2.7	3.4	2.9	3.2	2.8	3.5	3.5	3.5	2.7	2.9	3.4	2.9	3.6	4.9						
HENRY	1	1.5	1.3	1.2	1.3	1.5	2.1	1.4	1.6	1.4	1.7	2.2	2.2	1.2	1.3	2.3	2.7	3.0	4.9						
HENRY	2	1.6	2.1	1.2	1.3	1.7	2.3	1.8	2.1	1.5	2.4	2.1	2.1	1.3	1.1	2.4	3.2	2.9	3.9						
HENRY	3	1.6	1.4	1.4	1.7	1.6	1.9	1.2	1.8	1.2	1.6	1.7	1.7	1.4	1.4	2.0	2.6	3.6	5.2						
HENRY	AVG	1.6	1.6	1.3	1.4	1.6	2.1	1.5	1.8	1.4	1.9	2.0	2.0	1.3	1.3	2.2	2.8	3.2	4.7						
HENRY	1	1.4	1.5	1.6	1.6	1.8	2.3	1.5	1.9	1.4	2.2	2.6	2.6	1.1	1.3	2.2	2.1	2.0	3.3						
HENRY	2	1.6	1.6	1.6	1.8	1.9	2.5	1.7	2.0	1.4	2.7	2.4	2.4	1.2	1.5	1.7	2.1	1.9	2.9						
HENRY	3	1.6	1.7	1.7	1.8	2.1	2.2	1.2	2.0	1.3	2.1	2.0	2.0	1.3	1.5	1.7	2.9	2.3	4.5						
HENRY	AVG	1.5	1.6	1.6	1.7	1.9	2.3	1.5	2.0	1.4	2.3	2.3	2.3	1.2	1.4	1.9	2.4	2.1	3.6						
LORING	1	1.0	1.1	1.2	1.3	1.4	3.2	1.0	1.5	1.2	1.6	2.8	2.8	0.9	1.6	2.4	1.6	2.0	3.3						
LORING	2	1.2	1.2	1.3	2.0	1.6	3.2	1.8	1.4	1.4	2.0	1.9	1.7	0.9	1.4	2.1	2.5	2.4	4.5						
LORING	3	1.3	1.4	1.6	1.7	1.7	3.0	1.0	1.5	1.1	1.9	1.7	1.7	0.9	1.8	1.6	1.8	2.3	4.5						
LORING	AVG	1.2	1.2	1.4	1.7	1.6	3.1	1.3	1.5	1.2	1.8	2.1	2.1	0.9	1.8	2.0	2.0	2.2	4.1						
FALAYA	1	1.5	1.5	1.7	1.5	1.9	2.6	1.7	1.8	1.4	2.0	3.0	3.0	0.9	1.5	2.5	1.8	2.7	4.9						
FALAYA	2	1.6	1.5	1.7	1.9	2.0	2.8	1.1	1.6	1.6	2.6	2.2	2.2	0.9	1.3	1.6	2.2	3.1	2.9						
FALAYA	3	1.4	1.6	1.5	1.6	1.7	2.3	1.0	1.7	1.6	2.0	2.0	2.0	0.9	1.3	1.8	2.2	2.6	3.6						
FALAYA	AVG	1.5	1.5	1.6	1.7	1.9	2.6	1.3	1.7	1.5	2.2	2.4	2.4	0.9	1.4	2.0	2.0	2.8	3.8						
LORING	1	7.8	7.8	7.1	7.3	8.0	8.4	5.2	7.1	8.3	7.2	7.2	7.2	3.8	5.2	5.0	5.5	9.6	11.2						
LORING	2	7.7	7.6	7.5	7.6	8.1	8.6	6.9	7.5	8.1	7.4	7.9	7.9	3.8	5.0	5.3	6.2	7.5	9.4						
LORING	3	7.5	7.0	8.9	7.7	7.8	8.3	5.7	7.3	7.7	7.6	7.4	7.4	4.0	5.4	5.5	5.2	8.1	13.2						
LORING	AVG	7.7	7.5	7.8	7.5	8.0	8.4	5.9	7.3	8.0	7.4	7.5	7.5	3.9	5.2	5.3	5.6	8.4	11.3						
CALLOWAY	1	1.4	1.2	1.1	1.2	1.6	2.6	2.1	1.4	1.2	1.8	2.2	2.2	1.3	1.6	2.1	2.6	2.9	3.3						
CALLOWAY	2	1.5	1.3	1.4	1.6	1.8	2.9	1.9	1.5	1.2	2.4	2.5	2.5	1.4	2.1	2.1	2.6	2.7	2.9						
CALLOWAY	3	1.3	1.4	1.7	1.5	1.9	2.8	1.1	1.5	1.4	3.4	1.9	1.9	1.5	1.8	2.6	3.1	3.2	4.5						
CALLOWAY	AVG	1.4	1.3	1.3	1.4	1.8	2.8	1.7	1.5	1.3	2.5	2.2	2.2	1.4	1.8	2.3	2.8	2.9	3.6						
CALLOWAY	1	2.5	2.9	2.3	2.2	2.5	3.2	2.0	2.8	2.6	3.0	4.3	4.3	2.1	2.5	3.5	3.3	4.1	4.1						
CALLOWAY	2	2.6	3.1	2.4	2.5	2.6	3.4	2.2	2.8	2.5	3.4	3.4	3.4	2.2	2.3	2.8	2.9	3.6	3.9						
CALLOWAY	3	3.1	2.8	2.7	2.6	2.8	3.1	1.2	2.8	2.4	4.1	3.6	3.6	2.1	3.0	3.4	3.9	3.5	4.5						
CALLOWAY	AVG	2.7	2.9	2.5	2.4	2.6	3.2	1.8	2.8	2.5	3.5	3.2	3.2	2.1	2.6	3.2	3.4	3.7	4.2						
LORING	1	0.6	0.8	0.9	0.8	0.9	1.5	1.1	1.0	0.8	1.6	1.9	1.9	0.8	1.4	1.7	1.2	2.0	3.3						
LORING	2	0.7	0.9	0.8	0.9	1.2	1.7	1.1	1.2	0.8	1.4	1.9	1.9	0.8	1.6	1.8	1.3	1.9	2.9						
LORING	3	0.7	0.9	1.0	1.1	1.4	1.4	0.7	1.1	0.8	1.2	1.9	1.9	0.6	1.1	1.2	1.6	2.1	4.5						
LORING	AVG	0.7	0.9	0.9	0.9	1.1	1.5	1.0	1.1	0.8	1.4	1.9	1.9	0.7	1.4	1.6	1.4	2.0	3.6						
COLLINS	1	1.4	2.4	1.6	1.7	1.8	2.2	1.1	1.5	1.5	2.0	2.6	2.6	1.2	1.5	1.6	2.0	2.0	3.5						
COLLINS	2	1.8	2.5	1.6	1.8	2.0	2.4	1.4	1.9	1.8	2.3	2.5	2.5	1.3	1.3	2.1	2.8	2.2	4.4						
COLLINS	3	1.4	2.0	2.0	1.9	1.8	2.1	1.3	1.8	1.6	2.1	2.3	2.3	1.1	1.9	1.6	2.4	2.6	3.7						
COLLINS	AVG	1.5	2.3	1.7	1.8	1.9	2.2	1.3	1.7	1.6	2.1	2.5	2.5	1.2	1.6	1.8	2.4	2.3	3.9						
MEMPHIS	1	1.6	2.2	2.0	1.9	2.4	2.7	1.7	1.5	1.3	1.8	2.6	2.6	0.7	1.3	1.4	1.2	1.6	2.9						
MEMPHIS	2	1.6	2.6	2.0	2.1	2.5	2.6	1.9	1.4	1.4	2.2	2.0	2.0	0.7	1.0	1.2	1.7	1.3	2.7						
MEMPHIS	3	1.6	2.4	2.2	2.2	2.3	2.9	1.5	1.6	1.3	2.0	1.8	1.8	0.6	1.5	1.1	1.6	1.4	2.6						
MEMPHIS	AVG	1.6	2.4	2.1	2.1	2.4	2.7	1.7	1.5	1.3	2.0	2.1	2.1	0.7	1.3	1.2	1.5	1.4	2.7						
MEMPHIS	1	31.1	33.0	35.0	37.0	39.5	42.1	35.0	37.0	39.0	42.0	45.0	45.0	7.4	10.4	12.0	13.8	15.5	25.3						
LORING	1	31.1	33.6	35.3	37.0	39.5	44.1	35.0	37.0	39.0	42.0	45.0	45.0	7.3	10.0	11.3	13.6	15.6	27.4						
LORING	2	31.1	33.5	35.9	37.0	39.1	43.5	35.0	37.0	39.0	42.0	45.0	45.0	7.1	10.2	10.9	14.8	14.9	28.8						
LORING	3	31.1	33.4	35.4	37.0	39.4	43.2	35.0	37.0	39.0	42.0	45.0	45.0	7.3	10.2	11.4	14.1	15.3	27.2						
LORING	AVG	31.1	33.4	35.4	37.0	39.4	43.2	35.0	37.0	39.0	42.0	45.0	45.0	7.3	10.2	11.4	14.1	15.3	27.2						

Table 27 (continued)

		EXTRACTANT AND SOIL TO SOLUTION RATIO-- (COLUMN HEADINGS OF _4_, _6_, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)											
		DOUBLE ACID						TENNESSEE					
		4	_6_	_8_	_10_	_15_	_20_	_4_	_6_	_8_	_10_	_15_	_20_
		MEHLICH											
SOIL	REP	_4_	_6_	_8_	_10_	_15_	_20_	_4_	_6_	_8_	_10_	_15_	_20_
FALAYA	1	1.7	1.9	2.1	2.3	2.3	2.7	1.6	2.3	1.9	2.4	3.6	4.1
FALAYA	2	1.8	2.0	2.1	2.4	2.6	2.9	1.7	2.3	2.4	2.8	3.1	2.5
FALAYA	3	2.2	1.9	2.7	2.6	2.7	2.7	1.4	2.2	2.0	2.9	2.7	2.7
FALAYA	AVG	1.9	1.9	2.3	2.4	2.5	2.8	1.6	2.3	2.1	2.7	3.1	3.1
HENRY	1	1.6	1.7	1.7	1.8	1.8	2.3	1.8	2.0	1.7	2.2	3.0	2.0
HENRY	2	1.6	1.7	1.6	2.2	1.9	2.4	1.7	2.0	1.5	3.1	2.2	2.3
HENRY	3	1.9	1.8	2.1	1.9	2.2	2.2	1.2	2.0	1.5	2.2	2.3	2.6
HENRY	AVG	1.7	1.8	2.0	1.9	2.0	2.3	1.6	2.1	1.7	2.5	2.5	2.6
CALLOWAY	1	1.3	1.7	1.5	2.2	1.9	2.3	1.9	1.6	1.6	1.9	2.9	4.1
CALLOWAY	2	1.3	1.3	1.5	2.0	2.2	2.5	1.5	1.6	1.7	2.6	2.5	4.7
CALLOWAY	3	1.5	1.6	1.7	2.1	2.2	2.5	1.7	1.6	1.7	2.0	2.2	4.5
CALLOWAY	AVG	1.4	1.4	1.6	2.1	2.1	2.4	1.7	1.6	1.7	2.2	2.5	4.4
MEMPHIS	1	1.0	1.8	1.3	1.0	1.2	1.6	1.3	1.3	1.0	1.7	2.1	3.3
MEMPHIS	2	1.1	2.0	1.3	1.2	1.6	1.7	1.1	1.4	1.3	1.7	1.9	4.5
MEMPHIS	3	1.2	1.9	1.1	1.4	1.5	1.8	0.7	1.3	1.1	1.9	1.8	4.5
MEMPHIS	AVG	1.1	1.9	1.2	1.2	1.4	1.7	1.0	1.1	1.3	1.8	1.9	4.1
CALLOWAY	1	1.4	1.9	1.7	1.7	2.0	2.8	2.1	1.9	1.9	2.2	2.9	2.9
CALLOWAY	2	1.5	2.0	1.7	2.2	1.9	2.7	1.9	1.8	2.0	4.1	2.3	3.1
CALLOWAY	3	1.6	2.8	2.5	2.1	2.2	2.9	2.2	1.9	1.6	3.2	2.6	2.2
CALLOWAY	AVG	1.5	2.2	1.9	2.0	2.0	2.8	2.1	1.9	1.8	3.2	2.6	3.0
GRENADA	1	2.4	2.8	2.6	3.1	3.1	3.9	2.4	3.3	2.9	3.7	3.9	3.6
GRENADA	2	2.4	2.9	2.6	3.1	3.4	3.7	2.9	3.1	3.2	3.6	3.5	3.4
GRENADA	3	2.5	3.5	3.1	3.2	3.4	3.7	2.9	3.1	3.2	3.6	3.5	3.4
GRENADA	AVG	2.4	3.1	2.8	3.1	3.3	3.8	2.6	3.1	2.8	3.5	3.6	3.3
GRENADA	1	1.4	1.5	1.5	1.5	1.8	2.0	1.4	1.6	1.3	2.3	2.1	1.7
GRENADA	2	1.3	1.7	1.4	1.8	1.6	2.3	1.2	1.4	1.3	1.9	2.0	1.9
GRENADA	3	1.2	2.0	1.9	1.9	2.1	2.2	1.5	1.5	1.3	2.2	2.3	3.0
GRENADA	AVG	1.3	1.7	1.6	1.7	1.8	2.2	1.4	1.5	1.3	2.1	2.1	3.1
LORING	1	1.0	1.5	1.2	1.3	1.5	1.9	1.0	1.6	1.0	1.6	1.6	2.3
LORING	2	1.0	1.6	1.2	1.9	1.3	1.8	1.2	3.3	1.5	2.4	1.6	1.7
LORING	3	0.8	2.1	1.3	1.8	1.5	1.9	1.0	2.1	1.2	2.2	2.5	3.9
LORING	AVG	0.9	1.7	1.2	1.6	1.4	1.9	1.1	2.3	1.2	2.1	2.1	2.5
FALAYA	1	2.2	2.5	2.1	2.5	2.4	3.2	1.1	2.4	2.1	2.7	2.9	3.6
FALAYA	2	2.4	2.6	2.2	3.2	2.6	3.1	1.3	2.4	2.6	2.8	3.0	3.3
FALAYA	3	1.9	2.6	2.7	3.0	2.6	3.3	1.4	2.4	2.1	2.9	3.0	3.0
FALAYA	AVG	2.2	2.6	2.3	2.9	2.5	3.2	1.3	2.4	2.3	2.8	3.0	3.1
MEMPHIS	1	1.9	1.6	1.9	2.1	2.2	2.6	1.2	2.4	1.9	2.5	3.2	3.3
MEMPHIS	2	1.8	1.7	2.0	1.8	2.1	2.7	1.6	2.1	2.3	2.8	3.2	3.6
MEMPHIS	3	1.8	1.4	2.2	1.9	2.0	2.6	1.2	2.3	1.7	2.6	2.8	3.6
MEMPHIS	AVG	1.8	1.6	2.0	1.9	2.1	2.6	1.3	2.3	2.0	2.6	3.1	3.5
CALLOWAY	1	0.8	1.8	1.9	1.1	1.1	2.1	1.3	1.3	1.2	1.4	1.9	1.9
CALLOWAY	2	0.8	1.9	1.8	1.9	1.2	2.4	1.4	1.3	1.0	1.6	1.9	2.5
CALLOWAY	3	0.8	2.2	2.4	1.8	1.3	2.1	1.3	1.3	1.4	1.7	2.1	2.4
CALLOWAY	AVG	0.8	2.0	2.0	1.6	1.2	2.2	1.3	1.3	1.2	1.6	2.0	2.3
FALAYA	1	1.8	2.4	2.1	2.3	2.5	3.0	2.1	2.6	2.1	2.7	2.9	3.0
FALAYA	2	2.3	2.5	2.8	2.4	2.7	2.9	2.0	2.5	3.3	3.7	3.1	3.5
FALAYA	3	2.3	2.8	2.7	2.6	2.6	3.2	1.8	2.4	2.3	2.8	3.0	3.5
FALAYA	AVG	2.1	2.6	2.5	2.4	2.6	3.0	2.0	2.5	2.6	3.1	3.0	3.4

Table 27 (continued)

		EXTRACTANT AND SOIL TO SOLUTION RATIO												(COLUMN HEADINGS OF _4, _6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)											
SOIL	REP	DOUBLE ACID						TENNESSEE						MEHLICH											
		_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20						
FALAYA	1	5.0	5.8	4.9	5.1	5.5	5.8	5.2	5.0	5.1	5.1	6.1	6.1	2.5	3.4	3.1	3.5	3.9	6.5						
FALAYA	2	4.9	5.9	5.7	6.2	5.4	6.0	5.4	5.1	5.7	5.0	5.7	5.7	2.6	3.3	3.2	4.1	4.1	6.1						
FALAYA	3	4.6	5.3	5.7	5.9	5.7	5.8	4.9	5.1	5.0	5.4	5.8	5.8	2.5	3.6	3.4	3.6	3.7	8.0						
FALAYA	AVG	4.8	5.7	5.4	5.7	5.5	5.9	5.2	5.1	5.3	5.2	5.9	5.9	2.5	3.4	3.2	3.7	3.9	6.9						
SANGO	1	1.4	1.8	3.5	2.8	3.8	3.2	1.2	1.3	2.4	1.8	2.3	2.3	1.1	1.6	2.7	2.4	3.9	4.4						
SANGO	2	1.4	2.3	2.6	2.8	4.4	4.5	1.1	1.3	2.3	2.5	2.4	2.4	1.2	1.6	3.1	2.7	2.9	4.1						
SANGO	3	1.6	1.6	3.5	2.5	2.6	3.3	1.4	1.4	2.5	2.4	2.0	2.0	1.4	1.8	2.6	2.3	3.6	4.3						
SANGO	AVG	1.5	1.9	3.2	2.7	3.6	3.7	1.2	1.3	2.4	2.2	2.2	2.2	1.2	1.7	2.8	2.5	3.5	4.3						
SANGO	1	2.7	2.8	3.8	3.6	4.7	5.8	2.5	2.3	3.7	3.2	3.5	3.5	2.3	3.0	4.1	3.8	4.1	5.5						
SANGO	2	2.2	3.0	3.5	3.8	4.7	6.0	2.3	2.8	3.9	3.5	3.5	3.5	2.2	3.1	4.1	4.1	4.6	5.8						
SANGO	3	2.5	2.9	4.4	4.1	4.1	5.2	2.2	2.6	3.3	3.6	3.4	3.4	2.6	3.2	3.8	3.7	4.9	5.7						
SANGO	AVG	2.5	2.9	4.4	4.1	4.1	5.2	2.2	2.6	3.3	3.6	3.4	3.4	2.6	3.2	3.8	3.7	4.9	5.7						
SANGO	1	1.1	1.2	1.3	1.4	1.4	1.7	1.1	1.2	1.4	1.7	2.4	2.4	0.8	1.3	1.4	1.6	1.4	3.3						
LOPING	1	1.2	1.3	1.5	1.3	1.5	1.9	1.2	1.8	1.4	1.5	2.2	2.2	0.8	1.4	1.7	1.6	1.8	3.1						
LOPING	2	1.1	1.3	1.2	1.6	1.7	2.1	1.6	1.7	1.3	1.9	2.1	2.1	0.7	1.1	1.2	1.2	2.0	3.3						
LOPING	3	1.0	1.5	1.9	2.2	1.6	2.1	1.4	1.9	1.5	2.3	2.3	2.3	0.8	1.5	1.9	1.8	2.0	2.8						
LOPING	AVG	1.1	1.4	1.7	2.0	1.5	1.9	1.2	1.8	1.4	1.5	2.2	2.2	0.8	1.4	1.7	1.6	1.8	3.1						
MEMPHIS	1	1.2	1.3	1.5	1.3	1.5	1.9	1.2	1.8	1.4	1.5	2.2	2.2	0.8	1.4	1.7	1.6	1.8	3.1						
MEMPHIS	2	1.1	1.3	1.2	1.6	1.7	2.1	1.6	1.7	1.3	1.9	2.1	2.1	0.7	1.1	1.2	1.2	2.0	3.3						
MEMPHIS	3	1.1	1.4	1.6	1.5	1.7	2.0	2.0	1.9	1.2	1.8	2.2	2.2	0.8	1.3	1.7	1.6	2.0	3.5						
MEMPHIS	AVG	1.1	1.3	1.4	1.5	1.6	2.0	1.6	1.5	1.2	1.7	2.4	2.4	0.7	1.2	1.5	1.4	2.1	3.4						
SANGO	1	1.8	2.3	3.8	2.7	4.3	5.0	1.8	2.2	2.8	2.2	2.8	2.8	1.5	2.7	2.5	2.5	3.5	3.9						
SANGO	2	1.8	2.5	3.1	3.7	3.1	5.4	1.5	2.0	4.1	2.8	3.2	3.2	1.3	2.9	2.9	2.5	3.8	4.0						
SANGO	3	2.2	2.2	3.6	3.2	2.6	3.5	1.6	1.8	2.9	2.6	3.3	3.3	1.8	2.5	2.6	2.4	3.8	4.0						
SANGO	AVG	1.9	2.3	3.5	3.2	3.3	4.6	1.6	2.0	3.3	2.5	3.1	3.1	1.5	2.7	2.7	2.5	3.7	4.1						
FALAYA	2	1.6	1.8	1.1	1.2	1.5	2.0	1.0	1.3	1.1	2.3	2.1	2.1	1.5	1.5	1.4	1.6	1.9	2.9						
FALAYA	3	1.7	1.8	1.4	1.2	1.3	2.1	0.8	2.1	1.2	2.0	3.6	3.6	1.3	1.7	1.6	1.9	2.1	2.8						
FALAYA	AVG	1.7	1.7	1.3	1.2	1.3	2.1	1.1	1.7	1.2	2.4	2.6	2.6	1.2	1.2	1.6	2.1	2.6	3.1						
FALAYA	1	3.4	4.8	5.7	6.8	7.8	7.6	4.6	4.9	5.2	6.0	5.9	5.9	3.1	3.7	5.9	6.2	7.7	9.7						
MAURY	1	3.5	5.4	5.6	5.9	7.4	7.6	4.3	4.7	4.3	5.9	6.7	6.7	3.2	4.1	5.9	5.7	7.4	10.7						
MAURY	2	3.7	5.0	6.0	7.4	6.3	7.6	4.3	4.8	5.6	5.4	7.8	7.8	3.2	3.8	5.2	5.5	7.6	10.3						
MAURY	3	3.5	5.1	5.8	6.7	6.2	7.5	4.4	4.8	5.0	5.8	6.8	6.8	3.2	3.9	5.7	5.8	7.6	10.2						
MAURY	AVG	4.3	6.4	7.8	8.2	11.2	11.0	8.3	7.2	7.5	11.1	9.6	9.6	7.0	7.7	12.0	11.9	15.5	19.1						
MAURY	1	1.3	1.4	2.4	2.7	2.6	2.3	1.1	1.5	2.4	2.6	1.9	1.9	0.6	0.8	1.5	1.3	2.1	2.5						
MAURY	2	1.3	2.8	2.1	1.8	1.9	2.9	0.9	1.2	2.0	2.5	1.8	1.8	0.7	1.5	1.3	1.8	2.3	2.5						
MAURY	3	1.4	2.0	2.4	2.9	2.3	3.0	1.0	1.1	2.8	2.7	1.8	1.8	1.2	1.2	1.7	1.6	2.3	2.5						
MAURY	AVG	1.3	2.1	2.3	2.5	2.3	2.7	1.0	1.3	2.4	2.6	1.8	1.8	0.8	1.2	1.5	1.6	2.2	2.6						
HUNTINGTON	1	2.6	3.6	5.0	6.5	6.0	7.4	2.5	3.4	4.0	2.6	5.0	5.0	0.5	1.7	2.9	3.1	4.9	7.5						
HUNTINGTON	2	2.5	3.9	5.0	5.1	5.4	7.3	2.6	3.4	3.8	2.5	4.8	4.8	1.3	2.1	2.5	3.1	4.6	8.6						
HUNTINGTON	3	2.6	3.7	5.2	5.3	5.3	7.4	2.5	3.4	4.3	2.8	5.2	5.2	1.4	2.1	2.4	3.0	4.8	7.7						
HUNTINGTON	AVG	2.6	3.7	5.1	5.6	5.6	7.4	2.5	3.4	4.0	2.6	5.0	5.0	1.4	2.0	2.6	3.1	4.8	7.9						
MAURY	1	1.6	2.0	3.0	3.1	2.7	5.4	1.3	1.6	2.9	4.3	4.8	4.8	0.8	1.0	1.6	1.8	3.0	5.1						
MAURY	2	1.6	2.5	3.6	3.7	2.9	3.6	1.2	1.6	2.6	4.2	2.8	2.8	0.9	1.5	1.5	1.7	3.4	5.4						
MAURY	3	1.9	2.0	3.1	3.9	2.1	3.5	1.2	1.4	3.1	4.4	3.6	3.6	0.9	1.6	2.0	1.7	2.9	5.6						
MAURY	AVG	1.7	2.2	3.2	3.2	2.6	4.2	1.2	1.5	2.9	4.3	3.7	3.7	0.9	1.4	1.7	1.7	3.1	5.7						

Table 27 (continued)

EXTRACTANT AND SOIL TO SOLUTION RATIO-- (COLUMN HEADINGS OF _4, _6, ETC. REFER TO SOIL TO SOLUTION RATIOS OF 1 TO 4, 1 TO 6, ETC.)																											
DOUBLE ACID														MEHLICH													
TENNESSEE														TENNESSEE													
SOIL	REP	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20	_4	_6	_8	_10	_15	_20		
HARTSELLS	1	1.2	1.6	1.6	1.8	1.7	2.6	0.8	1.0	1.8	2.1	2.0	2.0	1.1	1.1	1.1	2.2	2.0	2.0	1.1	1.1	2.2	2.0	4.7	6.9		
HARTSELLS	2	1.2	1.7	1.9	3.3	2.0	2.9	0.8	1.2	1.7	2.5	1.9	1.9	1.0	1.6	1.5	1.5	2.0	1.9	1.0	1.6	1.5	4.5	5.4			
HARTSELLS	3	1.4	1.4	2.8	1.7	1.6	2.6	0.7	0.9	1.9	2.6	2.6	2.6	1.3	1.5	2.0	1.8	1.8	2.6	1.3	1.5	2.0	5.1	5.7			
AVG		1.3	1.6	2.1	2.3	1.8	2.7	0.8	1.0	1.8	2.4	2.2	2.2	1.1	1.4	1.9	1.9	1.9	2.6	1.3	1.4	1.9	4.8	6.0			
HARTSELLS	1	1.0	1.2	1.6	3.6	2.8	6.2	0.8	1.0	1.7	2.1	1.5	1.5	0.8	1.3	1.4	1.7	3.7	6.0	1.7	1.3	1.4	3.7	6.6			
HARTSELLS	2	1.0	1.6	1.9	1.6	4.0	2.8	0.7	1.2	1.6	2.0	1.7	1.7	0.7	1.5	1.3	2.0	3.1	6.0	1.7	1.5	1.3	3.1	6.0			
HARTSELLS	3	2.1	1.2	2.4	2.6	1.5	4.4	0.7	1.2	1.8	1.8	2.2	2.2	1.0	1.2	1.6	1.5	4.2	6.4	2.0	1.2	1.6	4.2	6.4			
AVG		1.4	1.3	2.0	2.6	2.8	4.5	0.7	1.1	1.7	2.0	1.8	1.8	0.8	1.3	1.4	1.7	3.7	6.3	1.7	1.3	1.4	3.7	6.3			
HARTSELLS	1	2.4	2.9	3.5	3.5	3.6	5.6	2.3	3.4	3.3	2.8	3.6	3.6	3.1	2.6	4.0	3.7	4.4	6.4	3.7	2.5	4.0	4.7	6.7			
HARTSELLS	2	2.6	3.5	3.6	3.9	3.8	5.1	2.4	2.4	3.2	3.3	3.7	3.7	2.5	2.5	3.2	3.7	4.7	6.7	3.7	2.5	4.0	4.7	6.7			
HARTSELLS	3	2.7	3.2	4.0	3.5	3.6	4.4	2.2	2.6	3.5	3.5	3.4	3.4	2.6	2.2	3.9	3.7	4.4	6.1	3.7	2.2	3.9	4.4	6.1			
AVG		2.6	3.2	3.7	3.6	3.7	5.0	2.3	2.8	3.3	3.2	3.6	3.6	2.7	2.4	3.7	3.7	4.7	6.4	3.7	2.4	3.7	4.4	6.4			
HUNTINGTON	1	1.8	2.0	3.5	2.5	4.4	3.5	1.5	1.6	2.4	2.6	2.6	2.6	1.4	1.6	2.3	2.3	3.6	5.8	1.4	1.6	2.3	3.6	5.8			
HUNTINGTON	2	2.0	2.2	2.5	2.6	4.3	3.7	1.4	1.6	2.4	2.5	2.3	2.3	1.2	1.3	2.5	2.5	3.9	5.4	2.3	1.3	2.5	3.9	5.4			
HUNTINGTON	3	2.1	2.0	3.1	3.1	2.8	3.0	1.5	1.7	2.5	2.6	2.5	2.5	1.6	1.9	2.4	2.4	4.1	5.7	2.3	1.2	2.4	4.1	5.7			
AVG		2.0	2.1	3.0	2.7	3.8	3.4	1.5	1.6	2.4	2.6	2.5	2.5	1.4	1.6	2.4	2.4	4.1	5.6	2.4	1.3	2.5	3.9	5.4			
HARTSELLS	1	2.2	2.2	3.6	3.1	4.4	5.6	2.0	2.0	2.7	2.8	2.9	2.9	2.3	2.2	2.4	2.2	3.0	7.5	2.3	2.2	2.4	3.0	7.5			
HARTSELLS	2	1.8	2.5	3.1	3.0	4.4	5.2	1.8	1.9	2.6	2.9	3.1	3.1	2.8	2.3	2.7	3.1	4.5	7.2	3.1	2.2	2.7	3.1	4.5			
HARTSELLS	3	2.2	2.8	4.1	3.3	2.8	3.5	1.8	2.2	2.7	3.1	2.7	2.7	3.0	2.0	2.8	3.2	5.1	7.6	3.0	2.0	2.8	3.2	5.1			
AVG		2.1	2.5	3.6	3.1	3.9	4.8	1.9	2.0	2.7	2.9	2.9	2.9	2.7	2.2	2.7	3.1	4.9	7.4	2.7	2.2	2.7	3.1	4.9			
SANGO	1	1.0	1.1	2.6	2.4	2.3	4.3	0.7	0.9	2.1	2.3	2.3	2.3	1.0	1.1	1.6	1.6	3.9	6.0	1.0	1.1	1.6	3.9	6.0			
SANGO	2	0.9	1.8	2.0	1.4	1.8	3.0	0.7	1.0	2.4	2.2	2.5	2.5	1.1	1.2	1.2	1.2	3.4	7.1	0.9	1.1	1.2	3.4	7.1			
SANGO	3	1.6	1.1	2.4	1.0	1.4	2.4	0.7	0.8	1.8	2.2	2.3	2.3	0.7	1.1	1.5	1.5	3.3	5.9	1.1	1.1	1.5	3.3	5.9			
AVG		1.2	1.3	2.3	1.6	1.8	3.2	0.7	0.9	2.1	2.2	2.4	2.4	0.9	1.1	1.4	1.4	3.5	6.3	1.2	1.2	1.4	3.5	6.3			
POBERTSVILLE	1	1.5	1.6	2.5	3.2	5.8	4.6	1.0	1.4	2.0	2.0	2.0	2.0	1.3	1.2	2.2	2.2	3.4	5.7	1.3	1.2	2.2	3.4	5.7			
POBERTSVILLE	2	1.4	1.7	2.5	1.9	4.6	4.0	1.2	1.4	1.9	2.1	2.0	2.0	1.1	1.6	1.9	2.3	3.7	5.7	1.1	1.6	1.9	3.7	5.7			
POBERTSVILLE	3	1.6	1.6	3.2	3.3	2.5	5.2	1.1	1.3	2.0	2.1	1.9	1.9	1.3	1.8	2.1	2.0	3.6	6.2	1.3	1.8	2.1	3.6	6.2			
AVG		1.5	1.6	2.7	2.8	4.3	4.6	1.1	1.4	2.0	2.1	2.1	2.1	1.2	1.5	2.1	2.1	3.6	5.8	1.2	1.5	2.1	3.6	5.8			
MCUNTVIEW	1	1.1	1.3	3.0	2.3	3.0	3.7	0.7	1.0	2.1	2.1	2.2	2.2	0.9	1.1	1.8	1.8	2.2	5.7	0.9	1.1	1.8	2.2	5.7			
MCUNTVIEW	2	1.0	2.0	1.6	1.3	2.9	2.9	0.7	1.1	2.0	2.2	2.3	2.3	0.9	1.5	1.8	1.9	2.5	5.3	1.1	1.5	1.8	2.5	5.3			
MCUNTVIEW	3	1.3	1.2	2.0	1.8	1.9	2.7	0.7	1.0	2.0	2.3	2.0	2.0	1.1	1.7	2.1	1.8	3.1	5.3	1.3	1.7	2.1	3.1	5.3			
AVG		1.1	1.5	2.2	1.8	2.6	3.1	0.7	1.0	2.0	2.2	2.2	2.2	1.1	1.4	2.0	1.8	2.6	5.4	1.1	1.4	2.0	2.6	5.4			
MOUNTVIEW	1	1.1	1.5	2.2	1.8	2.6	3.1	0.7	1.0	2.0	2.2	2.2	2.2	1.1	1.4	2.0	1.8	2.6	5.4	1.1	1.4	2.0	2.6	5.4			
MOUNTVIEW	2	1.1	1.5	2.2	1.8	2.6	3.1	0.7	1.0	2.0	2.2	2.2	2.2	1.1	1.4	2.0	1.8	2.6	5.4	1.1	1.4	2.0	2.6	5.4			
MOUNTVIEW	3	1.1	1.5	2.2	1.8	2.6	3.1	0.7	1.0	2.0	2.2	2.2	2.2	1.1	1.4	2.0	1.8	2.6	5.4	1.1	1.4	2.0	2.6	5.4			
AVG		1.1	1.5	2.2	1.8	2.6	3.1	0.7	1.0	2.0	2.2	2.2	2.2	1.1	1.4	2.0	1.8	2.6	5.4	1.1	1.4	2.0	2.6	5.4			
HARTSELLS	1	2.3	2.8	3.9	4.3	5.4	4.2	2.2	2.6	3.1	3.0	3.3	3.3	2.4	3.0	3.1	3.8	6.8	8.3	2.4	3.0	3.8	6.8	8.3			
HARTSELLS	2	2.2	3.3	4.1	5.6	3.8	4.6	2.3	2.4	3.0	3.1	3.2	3.2	2.1	3.0	3.1	4.0	6.3	9.4	3.2	3.2	4.0	6.3	9.4			
HARTSELLS	3	2.5	2.9	4.0	3.3	3.7	4.2	2.3	2.5	3.1	3.3	3.2	3.2	2.5	3.2	3.5	3.5	6.7	9.5	3.3	3.2	3.5	6.7	9.5			
AVG		2.3	3.0	4.0	4.4	4.3	4.3	2.3	2.5	3.1	3.1	3.2	3.2	2.3	3.2	3.5	3.7	6.6	9.1	3.2	3.2	3.5	6.6	9.1			
DICKSON	1	0.8	1.0	1.7	1.5	1.1	3.3	0.5	0.7	2.0	2.3	1.4	1.4	0.6	0.9	1.4	1.6	4.0	5.4	0.6	0.9	1.4	4.0	5.4			
DICKSON	2	0.9	1.7	1.5	1.1	1.1	3.3	0.5	0.8	1.9	2.4	1.5	1.5	1.1	1.3	1.9	1.8	3.4	5.3	0.7	1.1	1.9	3.4	5.3			
DICKSON	3	1.7	1.1	1.6	1.2	1.6	2.7	0.6	0.8	1.9	2.4	1.4	1.4	1.1	1.1	2.3	1.6	4.2	5.9	1.1	1.1	2.3	4.2	5.9			
AVG		1.1	1.3	1.8	1.2	1.2	3.2	0.5	0.8	2.0	2.4	1.4	1.4	0.8	1.1	1.9	1.7	3.9	5.5	0.8	1.1	1.9	3.9	5.5			
SANGO	1	1.4	1.1	1.5	1.4	2.1	3.0	0.7	1.2	1.9	1.3	1.8	1.8	0.8	1.1	1.6	1.8	2.4	3.3	1.4	1.1	1.6	2.4	3.3			
SANGO	2	1.0	1.6	1.5	1.5	2.7	1.9	0.8	0.9	1.8	2.3	1.4	1.4	0.7	1.4	1.3	1.7	2.4	3.1	0.9	1.4	1.3	2.4	3.1			
SANGO	3	2.0	1.2	2.2	3.9	1.6	2.4	1.0	1.1	2.0	2.2	1.5	1.5	1.1	1.1	1.7	1.7	2.5	3.1	1.1	1.1	1.7	2.5	3.1			
AVG		1.5	1.3	1.7	2.3	2.1	2.4	0.8	1.1	1.9	1.9	1.6	1.6	0.9	1.1	1.5	1.7	2.4	3.2	1.1	1.1	1.5	2.4	3.2			
DICKSON	1	1.5	1.9	3.1	2.2	2.5	4.1	1.1	1.5	3.4	1.7	2.1	2.1	2.6	1.6	2.2	3.0	3.9	6.1	1.5	1.6	2.2	3.0	6.1			
DICKSON	2	1.5	1.9	3.0	2.0	4.0	3.1	1.3	1.5	3.4	1.7	2.1	2.1	2.6	1.6	2.2	3.0	3.9	6.1	1.5	1.6	2.2	3.0	6.1			
DICKSON	3	1.8	1.8	3.2	2.5	2.8	3.0	1.2	1.6	3.6	2.5	2.6	2.6	2.1	2.1	2.2	2.3	3.6	6.2	2.1	2.2	2.2	3.6	6.2			
AVG		1.6	1.9	3.1	2.2	3.1	3.4	1.2	1.6	3.4	2.2	2.3	2.3	2.3	2.0	2.4	2.7	3.7	6.2	2.0	2.0	2.4	3.7	6.2			

APPENDIX S

SOIL PROPERTIES AS DETERMINED BY OTHER
STANDARD EXTRACTION PROCEDURES

Table 28. Soil Properties as Determined by Other Standard Extraction Procedures

Soil	Bray 1 P	Neutral Normal Ammonium Acetate				0.1N HCl		CEC
		K	Ca	Mg	Mn	Zn		
		----- PPM -----				-----		Meq/100g.
Calloway	11	90	563	125	115	1.6		5.3
Memphis	21	111	1838	192	87	2.7		10.1
Henry	43	146	977	122	94	1.6		6.5
Calloway	9	177	2252	189	54	2.7		10.8
Collins	80	62	754	44	81	1.7		4.8
Collins	30	146	627	111	107	1.4		5.8
Henry	10	141	1073	200	84	1.4		6.7
Calloway	3	83	1232	229	50	1.2		7.7
Collins	43	97	1328	83	70	2.0		6.1
Memphis	22	267	977	232	108	2.5		8.2
Collins	48	67	909	61	40	1.2		3.7
Collins	18	173	1336	233	43	1.7		7.5
Falaya	70	58	483	43	39	3.2		2.2
Henry	25	76	1544	113	40	1.5		6.2
Henry	27	113	1413	157	86	1.6		7.0
Loring	26	109	1354	140	72	1.4		6.7
Falaya	9	44	1685	87	57	2.0		6.8
Loring	33	396	1309	224	100	7.9		9.8
Calloway	4	63	496	144	122	1.4		7.0
Calloway	12	69	1250	75	71	2.6		5.2
Loring	4	120	1416	260	45	1.2		8.6
Collins	26	117	1597	146	47	1.8		6.8
Memphis	56	231	1579	139	33	1.7		7.2
Loring	67	181	1561	105	24	31.1		7.7
Falaya	76	143	1181	90	68	2.2		6.0
Henry	25	108	1507	134	73	1.9		7.0
Calloway	57	188	1471	112	38	1.9		7.3
Memphis	2	152	603	244	114	1.2		7.3
Calloway	5	117	1452	189	65	1.8		8.4

Table 28 (continued)

Soil	Bray 1 P	Neutral Normal Ammonium Acetate				0.1N HCl		CEC
		K	Ca	Mg	Mn	Zn		
		PPM				-----		Meq/100g.
Grenada	29	124	1551	90	34	2.8		7.2
Grenada	19	99	1091	117	43	1.6		6.2
Loring	8	56	925	95	98	1.8		6.4
Falaya	23	106	1242	178	95	2.4		8.6
Memphis	24	123	568	81	240	2.3		6.2
Calloway	2	87	416	162	223	1.1		6.6
Falaya	39	138	1175	121	75	2.4		6.4
Falaya	107	216	1232	110	83	5.9		7.3
Sango	30	190	967	218	118	1.4		8.4
Sango	76	173	1294	245	74	1.8		9.0
Loring	26	99	331	26	38	1.4		5.2
Memphis	15	106	438	32	29	1.8		5.2
Sango	25	327	876	43	30	2.2		5.8
Falaya	31	111	1306	139	57	1.2		7.3
Maury	93	385	1693	155	34	6.4		10.1
Maury	30	237	1089	143	116	11.1		8.4
Armour	58	257	1287	98	42	1.2		10.4
Huntington	200	223	2355	183	42	5.4		12.4
Maury	58	365	1251	173	109	1.9		11.0
Hartsells	27	142	699	67	20	3.8		7.2
Hartsells	82	255	880	75	33	1.5		9.5
Hartsells	20	87	475	80	66	2.8		6.2
Huntington	74	385	962	68	57	1.9		7.0
Hartsells	5	91	508	92	63	2.1		6.0
Sango	9	91	624	52	52	1.2		7.0
Robertsville	47	254	922	64	82	1.5		7.0
Mountview	11	67	379	53	33	1.2		6.7
Hartsells	5	127	735	105	62	2.6		7.3
Dickson	23	78	742	20	9	1.1		4.5

Table 28 (continued)

Soil	Bray 1 P	Neutral Normal Ammonium Acetate				0.1N HCl		CEC
		K	Ca	Mg	Mn	Zn		
		PPM				Meq/100g.		
Sango	30	114	501	33	49	1.0		5.7
Dickson	43	118	431	30	53	2.2		4.3
Sequoia	5	92	802	267	48	3.6		4.8
Whitwell	17	104	789	145	162	3.1		8.0
Sequatchie	51	286	630	218	82	1.9		7.3
Huntington	17	195	595	207	83	2.6		5.9
Etowah	35	155	538	176	143	3.7		7.2
Emory	32	461	2017	265	158	15.6		12.8

VITA

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He entered Tennessee Technological University in September, 1969, and received his Bachelor of Science degree in Plant and Soil Science in June, 1973.

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His wife is the former Linda Harvey of Independence, Tennessee.