August 8, 1947

To the Committee on Graduate Study:

I am submitting to you a thesis written by John L. Henderson entitled "The Relationship of Soils to Various Management Factors and to Management Returns on a Selected Group of Farms in Knox County, Tennessee, 1946" I recommend that it be accepted for nine quarter hours credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

W. P. Ramsey
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and recommend its acceptance:

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Accepted for the Committee

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Dean of the Graduate School

THE RELATIONSHIP OF SOILS TO VARIOUS MANAGEMENT FACTORS AND TO MANAGEMENT RETURNS ON A SELECTED GROUP OF FARMS IN KNOX COUNTY, TENNESSEE, 1946

A THESIS

Submitted to
The Committee on Graduate Study
of
The University of Tennessee
in
Partial Fulfillment of the Requirements
for the degree of
Master of Science



by

John L. Henderson

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CHAPTER I

INTRODUCTION

The Problem

Productive soils are of utmost importance in obtaining high yields of crops and livestock production. It is generally recognized that crop yields vary among the different soil types and phases, as is shown in Appendix II. These variations in yields are great among different classes of soils.

Crop yields also vary greatly among farms on the same type of soil. The difference in yields among farms on the same soil type may be caused by a number of reasons. Important among these reasons are the particular soil and farm management methods applied to the different farms.

This study will attempt to show the relationship between the "potential crop productivity" of twenty farms and a limited number of efficiency factors that have been shown to be related to the financial success of a farmer. In showing this relationship an attempt will be made to compute an index that will show the "relative potential crop productivity" of each farm included in the study.

Source of Data

The data used to determine the "potential crop productivity" of the farms studied were obtained from the

Soil Survey of Knox County, Tennessee. This survey was made by the United States Department of Agriculture, Bureau of Plant Industry, in cooperation with the Tennessee Agricultural Experiment Station and the Tennessee Valley Authority. The survey was started in 1938 and was completed in 1943. The data obtained in this survey have not yet been published. However, data on soils were made available for this study by the Tennessee Valley Authority.

The farm management records used in this study were taken by seniors and graduate students enrolled in a class in farm management at the University of Tennessee. The survey method was used to obtain the data and the work was under the supervision of Dr. W. P. Ranney, professor in Farm Management.

The farms on which the schedules were taken are located in Knox County, Tennessee. All are within a twenty-mile radius of Knoxville.

Farms selected were, for the most part, dairy farms from which milk was sold to the Knoxville wholesale market. However, a few of the farms raised beef cattle, some had laying flocks, and one had a turkey enterprise. Truck crops and tobacco were sold from several of the farms.

The soil survey maps of the Knox County Soil Survey were used to draw up individual soil maps of each farm.

The farm boundaries were determined by visiting the farms and tracing the boundaries on to the county soil maps. The individual farms were then transferred to individual farm maps by use of a device to enlarge the scale of the farms. The percentage of each soil type and phase was determined by use of a planimeter.

Limitations of Data

The crop productivity ratings taken from the Soil Survey of Knox County[1] were used in this study for determining the crop productivity index for each farm.

It is admitted, by those who compiled these ratings that they are only an estimate. It is, however, the best information that is available. The estimates, compiled by those who prepared the Soil Survey of Knox County, are based primarily on observations and interviews with farmers, the county agricultural agent, members of the staffs of the Tennessee Agricultural Experiment Station and the College of Agriculture, and others who have had experience in the agriculture of the county.

The number of farms included in this study is too small to be a representative sample. They were used because

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[1] United States Department of Agriculture, Bureau of Plant Industry, in cooperation with the Tennessee Agricultural Experiment Station and the Tennessee Valley Authority. Soil Survey of Knox County, Tennessee. Unpublished

of the availability of the records and the short time that was available for this study.

Method of Study

The management data collected consisted of (1) land use, (2) crop yields, (3) receipts and expenses, (4) inventories at the beginning and end of the year, (5) livestock production, and (6) other information necessary for the analysis of the farm business. The method of computation of the financial success (operator's management returns) and of certain management factors is shown in the analysis included in Appendix I.

This study attempts to compute a "potential crop productivity" index for twenty farms in Knox County, Tennessee. This index is used to evaluate the relationship of a "potential crop productivity" index to operator's management returns and to various management factors on these farms.

The small number of cases makes it difficult to subsort on the basis of various combinations of different soil types and phases. It is necessary to compute one "statistic" to represent the soil situation on each farm. This statistic is termed the "potential crop productivity" index. The index is a weighted percentage of the total

acreage not in woodland, that fell in the various soil types and phases. It does not reflect the shapes and sizes of the individual tracts of each soil type and phase. It does not take into consideration any differences in soil management between the time the soil survey was made and 1946.

Review of Related Material

Many studies have been made on the analysis of farm business and factors affecting the income of farmers. A number of studies have also been made of the productive capacity of different types of soils under different management practices. Relatively few studies, however, have attempted to show the relationship between the "potential crop productivity" of a farm and the various management factors.

A study was made in California in 1933 in which an index for rating the value of the soils of a farm was computed.[2] The study rated the soils according to character of soil profile, texture of surface soil, and other modifying conditions. The ratings given to each of these three factors were multiplied by each other to give an

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[2] Storie, R. Earl. An Index for Rating The Agricultural Value of Soils. Berkley: University of California, Agricultural Experiment Station, Bulletin Number 556, 1933.

index expressed in percentage. The purpose of this index was to classify and evaluate soils of a farm and was not used to study relationships with other management factors.

Studies of soil productivity indexes have been made by the Agricultural Experiment Station at the University of Missouri[3] and the Extension Service at Ohio State University.[4] These studies were made with the idea of determining the annual gain or loss in productivity of farm land. No attempt was made in these studies to determine the "potential crop productivity" of a farm as it is defined in this study.

A study made at the University of Tennessee[5] shows the relationship between the number of acres in a land class and labor earnings. The study used only a portion of each farm in showing the relationship.

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[3] Klemme, A. W., and Coleman, O. T. Evaluating Annual Changes in Soil Productivity. Columbia: Agricultural Experiment Station, University of Missouri; Bulletin 405, 1939.

[4] Slater, R. M., Lewis, R. D., and Slipher, J. A. Our Heritage--The Soil. Columbus: Agricultural Extension Service, Ohio State University, Bulletin 175, 1941.

[5] Allred, C. E., Bonser, H. J., and Others. Factors Affecting Farm Earnings in Roane County. Knoxville: Agricultural Experiment Station, University of Tennessee, 1941, pp. 85-93.

CHAPTER II

COMPUTING A "POTENTIAL CROP PRODUCTIVITY" INDEX

Crop Productivity Ratings

The average crop yields under three different kinds of treatment of soils management are listed in index form in the Soil Survey of Knox County, Tennessee. The values used in this study are the average yields that may be expected under what is considered to be the best practicable management. Best practices of management include the use of lime and commercial fertilizers when and where needed; proper handling and return of manure and crop residues; careful selection and rotation of crops, including the use of legumes and cover crops; adequate drainage; the use of engineering devices or other means for control of water when necessary; and proper tillage methods.

The average yields of crops are given in the form of a productivity rating for each crop on each soil type, phase, or complex.[6] This rating compares the productivity of each of the soils for each crop to a standard of 100. This standard represents the approximate average yield on the more productive soils obtained without the use of fertilizer and other amendments. Economic considerations

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[6]This information is available in soil survey reports of various Tennessee counties in which a soil survey has been made.

play no part in determining this standard. Since this study deals with the average yields under the best practicable management, the rating will be larger than 100 for some of the crops on certain soil types.

Selection of a Basis for Computation of a "Potential Crop Productivity" Index

In order to compare the potential crop productivity of an entire farm with another farm it is necessary to arrive at some standard of measurement which will apply to all farms. This involves bringing together a number of soil types differing in depth, texture, structure, consistence, quality, and character of organic matter, content of plant nutrients, reaction, drainage, moisture holding capacity, erosion, stoniness, and slope or lay of land. The method of classifying soils takes these factors into consideration.[7] These soil features influenced the crop productivity. Other factors, such as climate, management, and past land use, also have different effects on different types of soils. A relatively large number of factors must then necessarily be taken into consideration in order to compute a potential crop productivity index that will represent the crop productivity of the farm as a whole.

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[7]Soil survey reports of various Tennessee counties.

In this study the crop productivity rating of a soil type is computed by averaging the crop productivity ratings for corn and alfalfa as shown in Appendix II.

These two crops were used in preference to other methods for the following reasons. First, corn represents a row crop and a grain crop grown in this section for which feed production per acre is high. Alfalfa represents a hay crop grown in this section for which feed value per acre is high. Second, corn for grain is one of the best feeds for all classes of livestock and is one of the most widely used concentrates for dairy cattle. Alfalfa stands at the head of the list of all common hay and pasture crops and is commonly taken as the ideal with which other hay is compared.

The Knox County Soil Survey did not list crop productivity ratings for all the soil types for corn and alfalfa. This is especially true of the fourth and fifth-class soils. The rating for the soil types were not listed as these two crops were not commonly grown on that soil because of poor adaptation. An arbitrary crop productivity rating was assigned to these soils depending on the soil class. Fourth-class soils were given a crop productivity rating of twenty-five and fifth-class soils a rating of ten. If crop productivity ratings were listed for either corn or alfalfa, that rating was used.

As is explained in Appendix II on description of soils, fourth and fifth-class soils are not commonly used for crops; fourth-class soils are commonly used for pasture and fifth-class soils for forest. These factors were considered in the assigning of crop productivity ratings to these soil classes.

Illustration of the Method Used in Calculating a "Potential Crop Productivity" Index for a Selected Farm

The calculation of the"potential crop productivity" index for each farm used in this study was done as follows: The percentage of each soil type and phase on each farm was determined. The percentage of each soil type and phase on the farm was then multiplied by the average crop productivity rating given to that soil. The results of this calculation (crop productivity rating weighted according to the percentage of area of each soil type on the farm), are then added to give a "potential crop productivity" index for each farm. An example of calculation is given in Table I.

The crop productivity index includes weighted crop productivity ratings for all soils on each farm except that portion of the farm which is in woodland. The soils of the woodland were not used in computing the index because the woodland, whether on class I, class V, or any other

class soils, is a long term enterprise. Since some farms had very little or no woodland and others had as much as seventy-five acres, the soils used for woodland were not included. The woodland soils would, of course, have a crop productivity rating, depending on the soil type and phase.

TABLE I

AN EXAMPLE OF THE COMPUTATIONS INVOLVED IN THE CALCULATION OF A "POTENTIAL CROP PRODUCTIVITY" INDEX FOR A FARM

I Soil Symbol (Soil Type and Phase) (See Appendix II)	II Planimeter Reading	III Percent of Farm in Soil Type. (Each Reading in Column II Divided by Total of Column II x 100)	IV Crop Productivity Rating (Taken from Appendix II)	V Crop Productivity Rating Weighted According to percent of Farm in Soil Type. (Column III x Column IV)
51B	.08	28.5%	93.5	26.6
55Bn	.04	14.3	97.5	13.9
52	.04	14.3	100.0	14.3
55Cn	.06	21.4	86.0	18.4
53Cn	.02	7.1	83.5	5.9
35	.01	3.6	110.0	4.0
55Dp	.03	10.7	45.0	4.8
Total	.28	99.9	---	87.9 a

a "Potential crop productivity" index for this farm 87.9

TABLE II

"POTENTIAL CROP PRODUCTIVITY" INDEX, OPERATORS' MANAGEMENT RETURNS, VALUE OF FARM PER ACRE, AND OTHER FARM MANAGEMENT FACTORS, TWENTY FARMS, KNOX COUNTY, TENNESSEE, 1946

Farm Number	"Potential Crop Productivity" Index	Operators' Management Returns	Value of Farm per Acre	Acres per Farm	Livestock Efficiency (a)
1	44.8	$1993	$100	54	$15.00
2	53.1	1042	89	135	21.90
3	56.7	2498	76	96	13.46
4	58.2	1488	100	75	17.50
5	60.0	152	213	38	14.71
6	62.8	1649	151	189	8.25
7	67.6	2904	150	82	11.37
8	68.7	388	97	62	7.91
9	68.9	1630	107	131	1.99
10	69.7	2445	206	91	9.10
11	70.3	6424	86	175	10.03
12	70.5	692	129	140	7.13
13	71.7	2412	81	85	8.85
14	72.2	4559	154	111	10.00
15	72.7	576	154	117	5.04
16	75.3	1388	204	49	7.68
17	76.7	612	200	100	1.26
18	78.6	1747	206	64	7.23
19	80.9	256	137	132	7.51
20	87.9	298	224	38	4.91
Average	68.4	$1558	$143	98	$ 8.79

Source: Appendix I, Appendix II, and Appendix III

Note: All farms included are owner-operated.

(a) Livestock returns above feed per work unit on livestock.

TABLE II (Continued)

"POTENTIAL CROP PRODUCTIVITY" INDEX, OPERATORS' MANAGEMENT RETURNS, VALUE OF FARM PER ACRE, AND OTHER FARM MANAGEMENT FACTORS, TWENTY FARMS, KNOX COUNTY, TENNESSEE, 1946

Farm Number	Crop Efficiency (a)	Work Units per Farm	Work Units per $1000 Real Estate	Work Units per $100 Labor Expense	Work Units per $100 Power and Equipment Expense
1	$10.69	339	52	34	41
2	9.01	170	14	49	31
3	9.80	531	73	35	24
4	10.60	161	21	55	168
5	14.08	106	13	14	35
6	9.11	649	23	45	77
7	16.81	406	39	27	59
8	13.47	254	24	25	51
9	17.17	404	29	34	54
10	11.56	563	30	47	82
11	22.77	646	43	64	82
12	20.48	329	18	22	82
13	14.98	448	59	30	62
14	23.40	895	35	27	38
15	13.33	479	24	35	94
16	9.99	707	27	17	44
17	15.62	398	20	21	46
18	16.44	513	31	47	40
19	21.10	343	19	21	23
20	13.64	270	31	33	63
Average	$14.70	433	31	34	60

Source: Appendix I, Appendix II, and Appendix III

Note: All farms included are owner-operated.

(a) Land returns per work unit on crops and pasture.

CHAPTER III

RELATIONSHIP OF A "POTENTIAL CROP PRODUCTIVITY" INDEX TO VARIOUS MANAGEMENT FACTORS AND TO MANAGEMENT RETURNS

Table II lists for each farm included in the study the "potential crop productivity index," operators' management returns, acres per farm, value of farm per acre, and the following management factors ratings: livestock efficiency, crop efficiency, work units per farm, work units per $1000 of real estate, work units per $100 of labor expenses, and work units per $100 of power and machinery expenses.

The range of the potential crop productivity index of the twenty farms was from 44.8 to 87.9. In separating the farms into groups on the basis of the potential crop productivity index an attempt was made to have an equal number of farms in each group. This gives a range of from 44.8 to 62.9 for the first group, a range of from 63.0 to 72.4 for the second group, and a range of from 72.5 to 87.9 for the third group.

It is desirable to stress again, at this point, that these twenty farms are too few to have any significance in relating this study to other sections of Tennessee. It is representative only of the twenty farms studied.

Relationship to Management Returns

The farms having a "potential crop productivity" index of less than 63.0 show an average operator's management

returns[8] of $1470. Farms with an index ranging from 63.0 to 72.4 averaged $2682 per farm while those with an index of 72.5 and over averaged $146 (Table III).

TABLE III

RELATIONSHIP OF A "POTENTIAL CROP PRODUCTIVITY" INDEX TO MANAGEMENT RETURNS, TWENTY FARMS, KNOX COUNTY, TENNESSEE, 1946

"Potential Crop Productivity" Index		Number of Farms	Average Operators' Management Returns
Range	Average		
Under 63.0	55.9	6	$1470
63.0 to 72.4	69.9	8	2682
72.5 and Over	78.7	6	146
Total		20	
Average	68.4		$1558

Source: Table II

Average management returns were more than ten times higher per farm on those farms in the lowest crop productivity range as compared with those within the highest range.

[8] The operator's management returns is the compensation, including the value of family living from the farm, for operator's management; operator's management returns are computed in Appendix I.

The group of farms with a crop productivity index varying from 63.0 to 72.4 had average operator's management returns eighteen times higher than the group with the highest crop productivity index (Figure I).

Operator's management returns

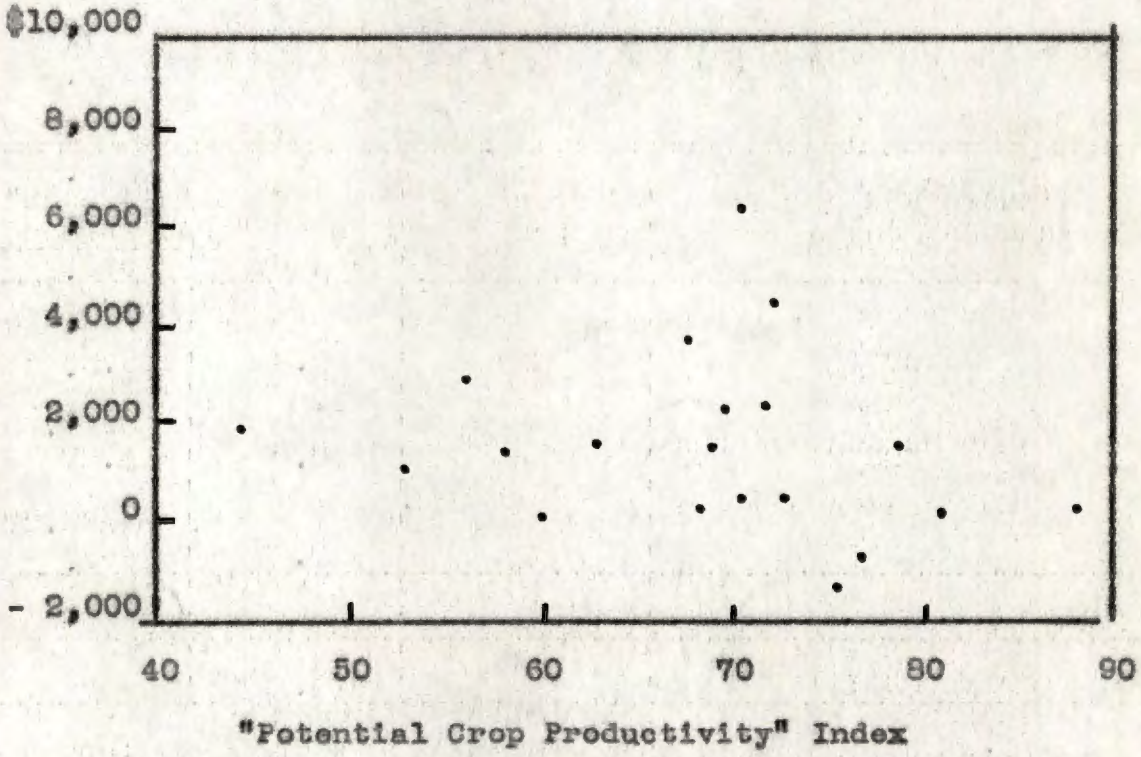


Figure 1. Relationship of a "potential crop productivity" index to management returns, twenty farms, Knox County, Tennessee, 1946

This indicates that, on these farms, factors other than "potential crop productivity" have an important effect on the financial success of the farm operators. The importance

of the effect of some of these other "management factors" are shown in various relationships in the analysis presented in Appendix I.

Relationship to Livestock Efficiency[9]

The livestock efficiency of the farms studied is one of the factors in which the farms with a high "potential crop productivity" index is low. Table IV reveals an inverse relationship between the different ranges of "potential crop productivity" indexes and the livestock efficiency on these farms.

TABLE IV

RELATIONSHIP OF A "POTENTIAL CROP PRODUCTIVITY" INDEX TO LIVESTOCK EFFICIENCY, TWENTY FARMS, KNOX COUNTY, TENNESSEE, 1946

"Potential Crop Productivity Index" Range	Average	Number of Farms	Livestock Efficiency
Under 63.0	55.9	6	$15.14
63.0 to 72.4	69.9	8	8.30
72.5 and Over	78.7	6	3.10
Total		20	
Average	68.4		8.79

Source: Table II

[9]Livestock efficiency is measured by livestock returns above feed per work unit on livestock. See Appendix I.

Farms with an index of less than 63.0 returned $15.14 livestock returns above feed cost per work unit on livestock. This is $12.04 more per unit than were the returns from those farms within the highest range of crop productivity indexes. The farms having the least to work with in the way of potential crop productivity, as measured in this study, seem to have made more efficient use of these forces relating to the efficiency of livestock production.

Livestock efficiency on all farms averaged $8.79. Only the group of farms falling within the lowest range of "potential crop productivity" indexes, surpassed this average figure. However, the difference amounted to as much as $6.84 per productive work unit on livestock. Figure 2 graphically displays the relationship.

Relationship to Crop Efficiency[10]

Farms having the lowest average "potential crop productivity" index also had the lowest average crop efficiency (Table V and Figure 3). The average crop efficiency for all twenty farms was less than the crop efficiency for those farms falling in the two highest "potential crop productivity" indexes. These two highest groups represent approximately 70 percent of the farms.

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[10] Land returns per work unit on crops and pasture.

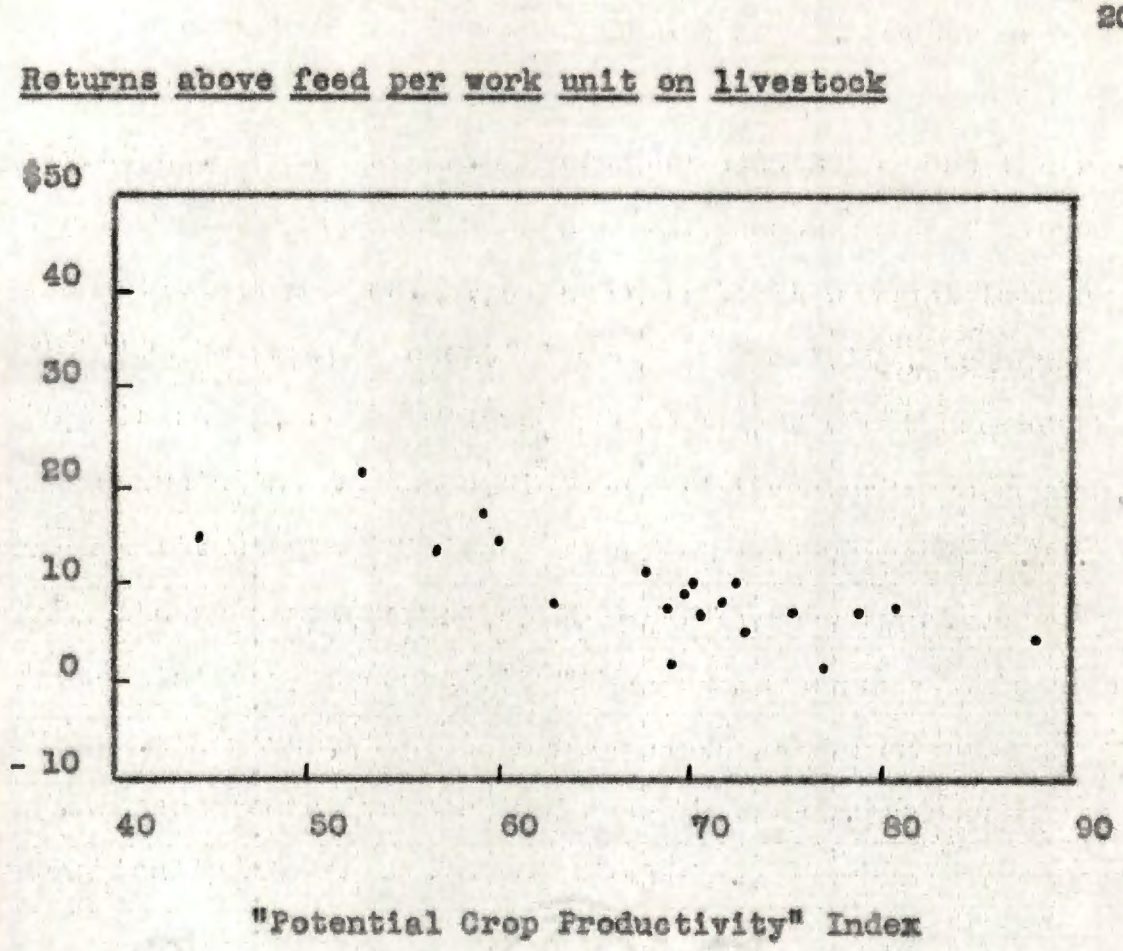


Figure 2. Relationship of a "potential crop productivity" index to livestock efficiency, twenty farms, Knox County, Tennessee, 1946

These had land returns per work unit on crops and pasture per farm averaging 57 percent greater than the returns from those farms in the lowest crop productivity index.

TABLE V

RELATIONSHIP OF A "POTENTIAL CROP PRODUCTIVITY" INDEX TO CROP EFFICIENCY, TWENTY FARMS, KNOX COUNTY, TENNESSEE, 1946

"Potential Crop Productivity" Index		Number of Farms	Crop Efficiency
Range	Average		
Under 63.0	55.9	6	$10.55
63.0 to 72.4	69.9	8	17.66
72.5 and Over	78.7	6	15.02
Total		20	
Average	68.4		$14.70

Source: Table II

Land returns per work unit on crops and pasture

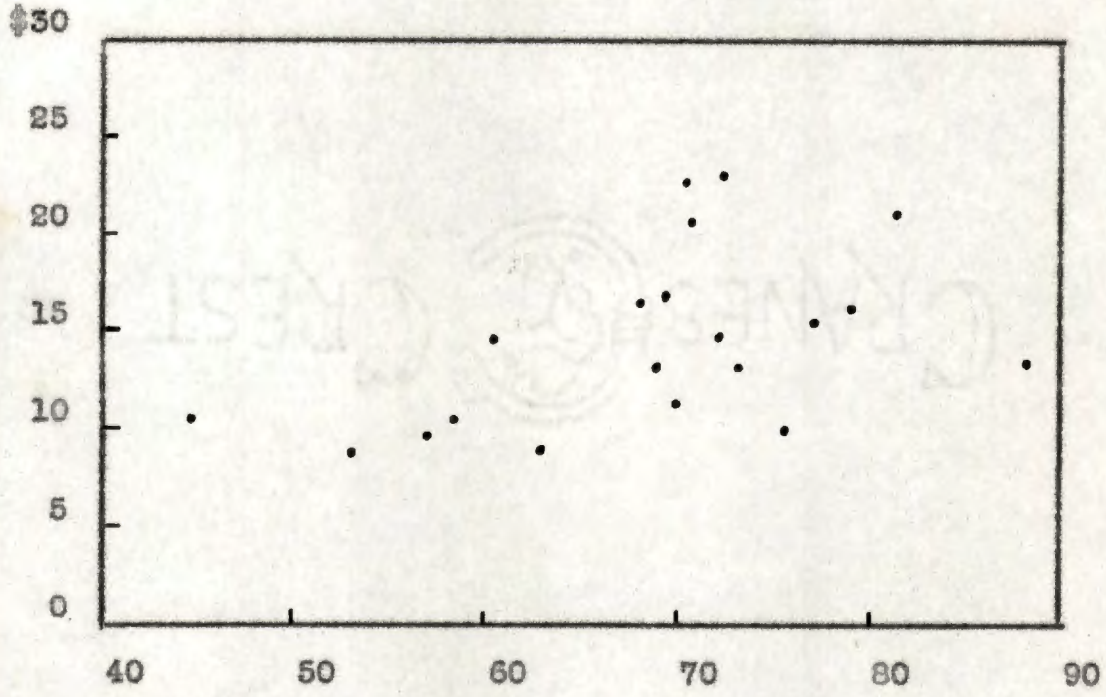


Figure 3. Relationship of a "potential crop productivity" index to crop efficiency, twenty farms, Knox County, Tennessee, 1946

Relationship to Size of Business

Farms with the highest "potential crop productivity" index did not have the largest average size of business. Farms with a productivity index ranging from 63.0 to 72.4 averaged 498 work units per farm while those with an index of 72.5 and over averaged 452 (Table VI). The average number of work units per farm for all farms was 433, which

was nearly one-fourth more work units than on those farms in the lowest range of the "potential crop productivity" index.[11]

The variations in size of business were not great, especially between the groups representing medium and high crop productivity (Figure 4).

TABLE VI

RELATIONSHIP OF A "POTENTIAL CROP PRODUCTIVITY" INDEX TO SIZE OF BUSINESS, TWENTY FARMS, KNOX COUNTY, TENNESSEE, 1946

"Potential Crop Productivity" Index		Number of Farms	Work Units per Farm
Range	Average		
Under 63.0	55.9	6	326
63.0 to 72.4	69.9	8	498
72.5 and Over	78.7	6	452
Total		20	
Average	68.4		433

Source: Table II

[11] The size of business was measured by work units per farm. In the farm management study made on these farms (Appendix I), the farms with the largest size of business had the greatest average management returns when they were in the upper half of three or more of the management factors other than size.

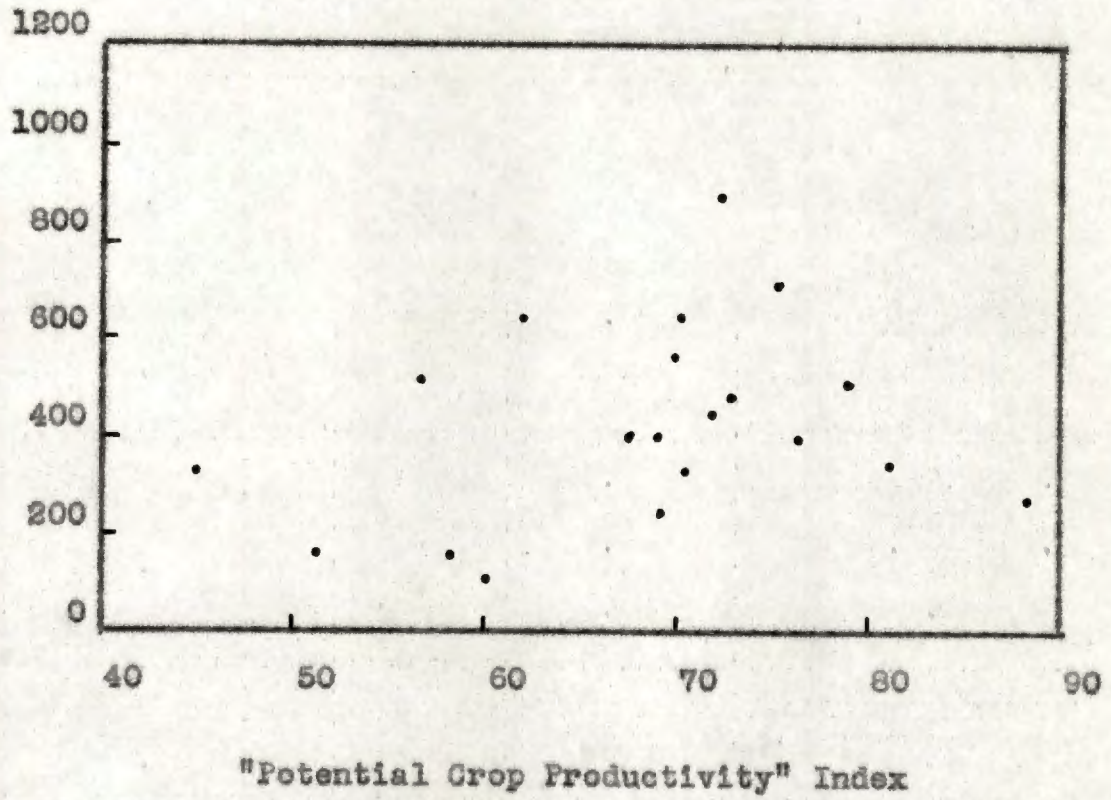


Figure 4. Relationship of a "potential crop productivity" index to size of business, twenty farms, Knox County, Tennessee, 1946

Relationship to Work Units per $1000 Real Estate

It has been found in the farm management study of these twenty farms that increasing the intensity of operations relative to the investment in real estate usually is a means of increasing returns (Appendix I).

The intensity of operations was greater on the farms with small and medium crop productivity indexes as indicated by the number of work units per $1000 of real estate (Table VII and Figure 5).

TABLE VII

RELATIONSHIP OF A "POTENTIAL CROP PRODUCTIVITY" INDEX TO WORK UNITS PER $1000 OF REAL ESTATE, TWENTY FARMS, KNOX COUNTY, TENNESSEE, 1946

"Potential Crop Productivity" Index		Number of Farms	Work Units per $1000 Real Estate
Range	Average		
Under 63.0	55.9	6	32.7
63.0 to 72.4	69.9	8	34.6
72.5 and Over	78.7	6	25.3
Total		20	
Average	68.4		31.0

Source: Table II

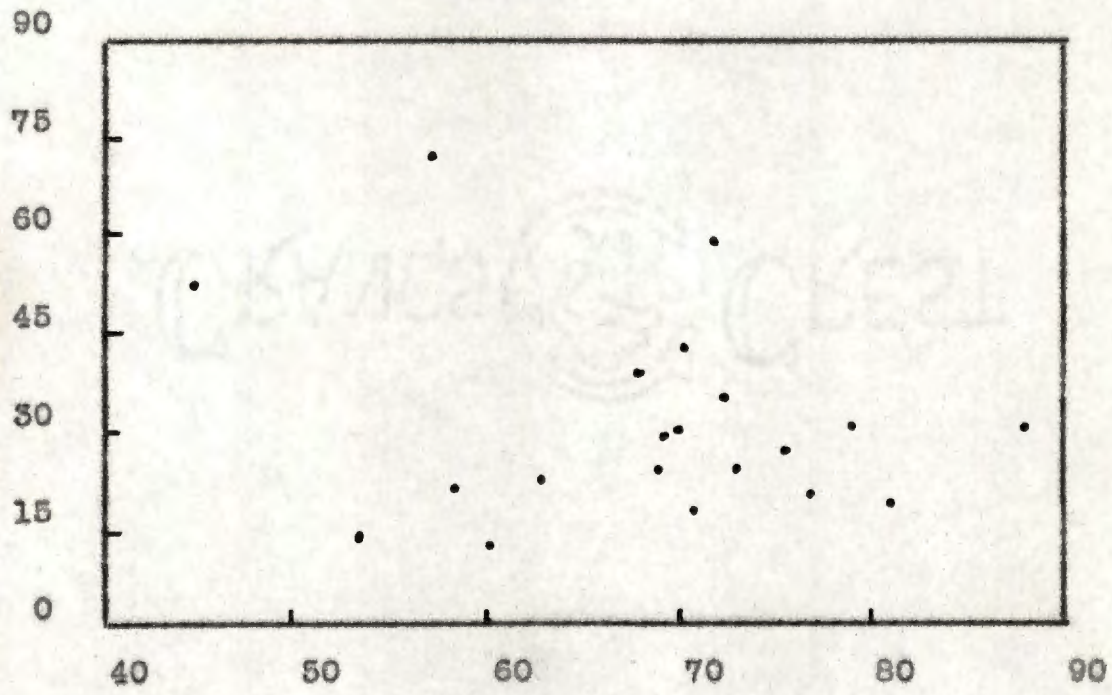


Figure 5. Relationship of a "potential crop productivity" index to work units per $1000 of real estate, twenty farms, Knox County, Tennessee, 1946

Relationship to Work Units per $100 of Labor Expenses

The farm management analysis of these twenty farms revealed that the farms with the largest number of work units per $100 of labor charges had the highest operator's management returns (Appendix I).

Table VIII, however, shows an inverse relationship when comparing the "potential crop productivity" of farms and the number of work units per $100 of labor charges. Figure 6, however, shows very little relationship.

TABLE VIII

RELATIONSHIP OF A "POTENTIAL CROP PRODUCTIVITY" INDEX TO WORK UNITS PER $100 OF LABOR CHARGES, TWENTY FARMS, KNOX COUNTY, TENNESSEE 1946

"Potential Crop Productivity" Index		Number of Farms	Work Units per $100 of Labor Charges
Range	Average		
Under 63.0	55.9	6	39
63.0 to 72.4	69.9	8	35
72.5 and Over	78.7	6	29
Total		20	
Average	68.4		34

Source: Table II

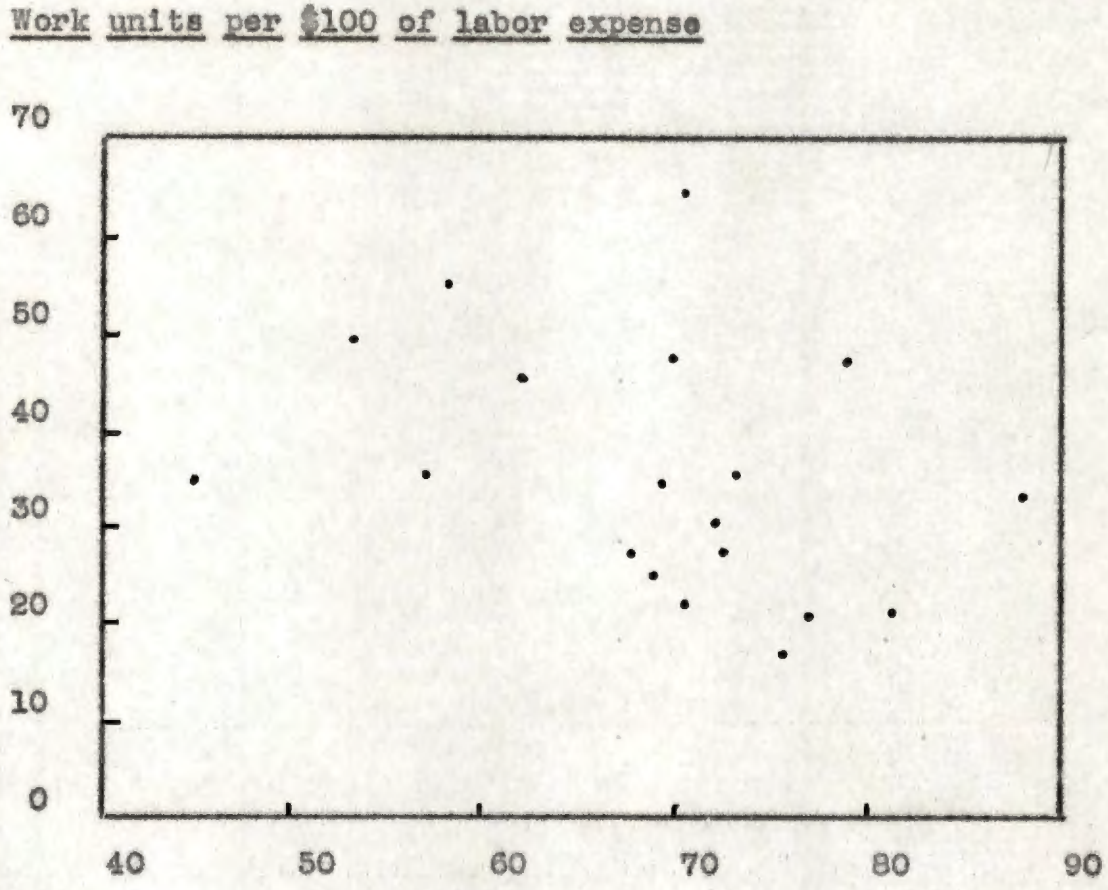


Figure 6. Relationship of a "potential crop productivity" index to work units per $100 of labor expenses, twenty farms, Knox County, Tennessee, 1946

Relationship to Work Units per $100 of Power and Equipment Expenses

The results of the farm management study, (Appendix I), pointed out that farms having the lowest average number of work units per $100 power and equipment charges also had the lowest average operator's management returns.

TABLE IX

RELATIONSHIP OF A "POTENTIAL CROP PRODUCTIVITY" INDEX TO WORK UNITS PER $100 POWER AND EQUIPMENT EXPENSE, TWENTY FARMS, KNOX COUNTY, TENNESSEE, 1946

"Potential Crop Productivity" Index		Number of Farms	Work Units per $100 of Power and Equipment Expense
Range	Average		
Under 63.0	55.9	6	63
63.0 to 72.4	69.9	8	64
72.5 and Over	78.7	6	52
Total		20	
Average	68.4		60

Source: Table II

Farms with a "potential crop productivity" index of 72.5 and over averaged 52 work units per $100 power and equipment expenses per farm compared to an average of 60 for all the farms and 64 for those farms with the medium crop productibility index (Table IX and Figure 7).

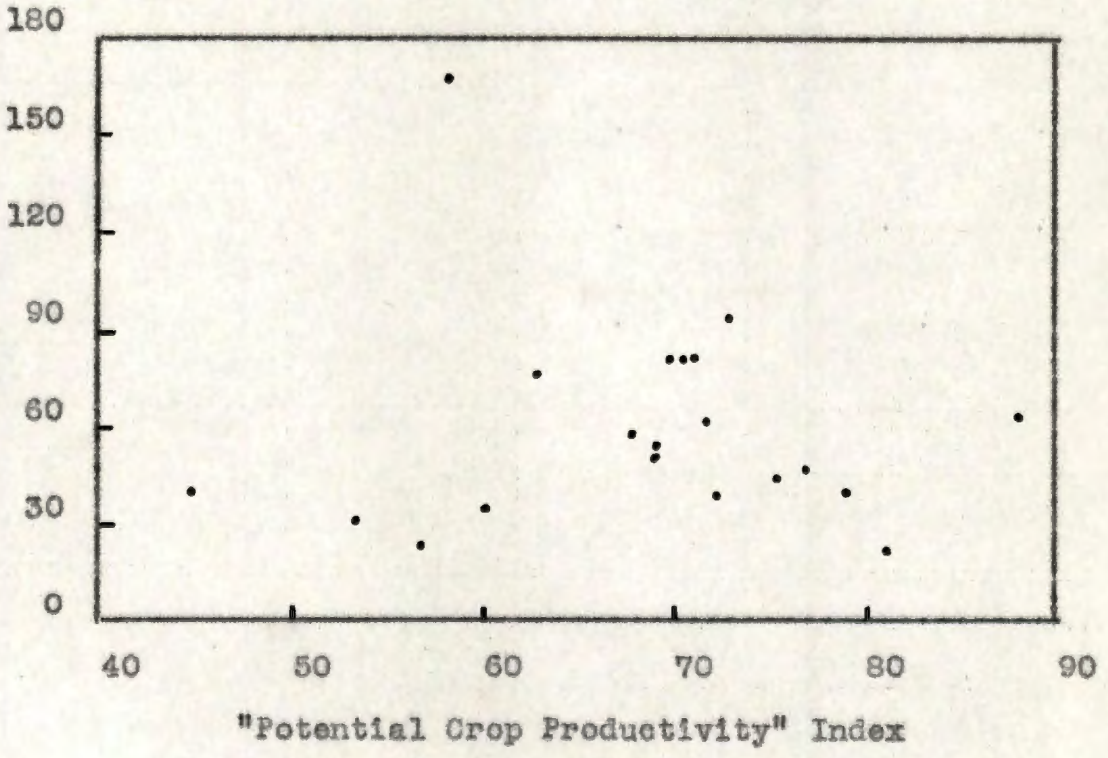


Figure 7. Relationship of a "potential crop productivity" index to work units per $100 power and machinery expenses, twenty farms, Knox County, Tennessee, 1946.

Relationship to the Number of Management Factors in Which "Potential Crop Productivity" Groups were Above the Average of the Farms Studied

The averages of the six management factors for the six farms in the group with the lowest "potential crop productivity" index range (under 63.0) were above the averages for all twenty farms in four of these factors as shown in Table X. These factors were livestock efficiency, work units per $1000 of real estate, work units per $100 of labor expense and work units per $100 of power and equipment expense. These same farms were low in two of the management factors, these factors being crop efficiency and size of business. These farms, even though lacking in crop efficiency and size of business, as well as potential crop productivity, when compared with other farms included in the study, came close to realizing operator's management returns equal to the average returns for the twenty farms. The greater efficiency of the other four management factors were, apparently, partly responsible for offsetting the handicap of comparatively low crop productivity.

Farms with a "potential crop productivity" index ranging from 63.0 to 72.4 were above average of the twenty farms in five of the six management factors. They were

above average in crop efficiency, size of business, work units per $1000 of real estate, work units per $100 of labor expenses, and work units per $100 of power and equipment expenses. The only management factor in which these farms were below average for the twenty farms was livestock efficiency. In this factor they were only slightly below. The average for all farms was $8.80 compared to $8.30 for those in this group. These farms, while not having the highest potential crop productivity, were apparently efficient enough in other factors to have an average operator's management returns of $2682 which was $1124 above the average for all the farms.

Farms that had the highest "potential crop productivity" index were above the average for the twenty farms in only two of the management factors studied, while they were below average in four of them (Table IX). They were above average in crop efficiency and size of business. They were below average in livestock efficiency, work units per $1000 of real estate, work units per $100 of labor expenses, and work units per $100 of power and equipment expenses. Even though this group of farms was above average in two important management factors and at the same time had the highest "potential crop productivity" index, their failure to excel in other management factors

probably had some effect on their operator's management returns, which averaged $146 per farm. Two of these farmers had a minus operator's management returns of $-612 and $-1388 (Table II).

The results of this study indicate that high "potential crop productivity" on the twenty farms studied is not the deciding factor in determining the financial success of these farmers.

TABLE X

RELATIONSHIP OF A "POTENTIAL CROP PRODUCTIVITY" INDEX TO THE NUMBER OF MANAGEMENT FACTORS IN WHICH THE RESPECTIVE GROUP AVERAGES WERE ABOVE OR BELOW THE AVERAGES OF ALL TWENTY FARMS, KNOX COUNTY, TENNESSEE, 1946

"Potential Crop Productivity" Index		Number of Farms	Number of Factors in Which Group Average was Above Average for all Farms	Number of Factors in Which Group Average was Below Average of all Farms
Range	Average			
Under 63.0	56.9	6	4	2
63.0 to 72.4	70.1	8	5	1
72.5 and Over	79.8	6	2	4

Source: Summary of Tables III, IV, V, VI, VII, VIII, and IX

SUMMARY

The data in this study pertain to twenty farms in Knox County, Tennessee. These twenty farms are not a representative sample and are too few to have any significance in relating this study to other farms in the county or to other sections of the state.

A "potential crop productivity" index was computed for each of the twenty farms included in this study.

Relationship of the "potential crop productivity," index to operators' management returns and various management factors on these twenty farms were calculated.

It was found that: (1) the average operator's management returns per farm did not increase consistently with an increase in the "potential crop productivity" index of the farm. (2) There was an inverse relationship between the "potential crop productivity" index and livestock efficiency. (3) When comparing the potential crop productivity" index of these twenty farms to crop efficiency it was found that not all of the farms with a high crop productivity index had a high crop efficiency. They were, however, on the average, approximately one-third more efficient than those within the lowest range of the "potential crop productivity" index. (4) The farms

with the highest "potential crop productivity" index did not in all cases have the largest size of business. (5) Farms with the highest crop productivity index had the lowest work units per $1000 of real estate. (6) An inverse relationship was shown when the "potential crop productivity" index was compared with work units per $100 of labor expenses. (7) The farms having the highest "potential crop productivity" index had the lowest work units per $100 of power and machinery expense.

It may be concluded that, on these twenty farms, the "potential crop productivity," as calculated for this study, was not the deciding factor in determining operator's management returns, but a number of other factors as well are important in determining the financial success of the farmer.

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APPENDIX I

University of Tennessee

Department of Agricultural Economics and Rural Sociology

FARM MANAGEMENT ANALYSIS
OF 20 FARMS
IN KNOX COUNTY, TENNESSEE
FOR THE YEAR 1946

Prepared by

Professor W. P. Ranney
and
Students in Classes in Farm Management

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Introduction

The data used in this analysis were obtained from twenty farmers in Knox County by the survey method. Each of the students in the classes in farm management obtained one schedule, and the remainder were obtained by the instructor. These persons are grateful to each of the farmers for the information so kindly given, and trust that the comparisons of each farmer's figures with the averages will be of help to him in the management of his farm.

The type of farming in Knox County is termed in Bulletin 169, University of Tennessee, Agricultural Experiment Station, as general farming, with emphasis on dairying, truck, and part-time farming. Most of the twenty farmers in this study sold whole milk to the Knoxville wholesale market, a few of them raised some beef cattle, some kept several hundred hens, one raised some turkeys, and truck crops and tobacco were sold from several of the farms.

The twenty farms varied in size from 38 to 189 acres. They varied from 6.0 to 51.7 in the number of animal units[1] of productive livestock kept, and from 106 to 897 in the

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[1] Animal units of the different kinds of livestock were computed according to the data presented on page in the table of information used in computation of the management factors and returns of livestock units.

total number of productive man work units.[2] They varied from $-1388 to $6424 in returns to management.[3]

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[2]The average number of "ten-hour" days of man labor required per head of productive livestock and per acre of crops and pasture (as shown on page 62) and the days of work involved in obtaining miscellaneous income, were used in combining these sources of income into the following measure of size of the farm business: "productive man work units."

[3]Computation of "returns to management" is shown on page 43.

TABLE I

OPERATOR'S MANAGEMENT RETURNS

Gross Farm Returns*	Your Farm	Average of 20 Farms	Average of 7 Farms Highest in Management Returns	Average of 7 Farms Lowest in Management Returns
Milk cows	$___	$4190	$6783	$2364
Other cattle	$___	572	542	321
Hogs	$___	279	326	243
Sheep	$___	13	21	16
Poultry	$___	299	423	324
Colts	$___	11	31	0
Crops, feed, seed and fertilizers	$___	2316	2956	1900
Work off the farm	$___	90	209	56
Miscellaneous	$___	11	21	0
Agricultural Adjustment Receipts	$___	62	48	62
Rental of dwelling (10% of value)	$___	304	231	364
(1) Total gross farm returns	$___	8147	11591	5630

*Gross farm returns include the net cash income and produce used in the home, plus an increase in the inventory or minus any decrease in the inventory. A credit of $15 per animal unit for manure was made for livestock; and the same amount charged to crops. In computing the gross returns for crops and feed, the total value of feed and pasturage consumed on the farm was included as a return, and feed, fertilizers and seed was included among the deductions for this enterprise.

TABLE I (Continued)

OPERATOR'S MANAGEMENT RETURNS

Gross Farm Expenses*	Your Farm	Average of 20 Farms	Average of 7 Farms Highest in Management Returns	Average of 7 Farms Lowest In Management Returns
Workstock	$____	$ 182	$ 252	$ 175.
Machinery & equipment	____	418	527	367.
Buildings & fencing	____	209	213	264.
Farm insurance	____	16	20	12.
Misc. livestock expense	____	42	41	50.
Custom work hired	____	152	255	84.
Hired & cropper labor	____	496	521	650.
Taxes	____	73	69	72.
Rent	____	75	152	21.
General farm expense	____	3	4	3.
Feed for productive livestock	____	3100	4170	2293
(2) Total gross farm expenses	____	4766	6224	3991
(3) Ret. to the Family & Operator's Farm Cap. (1)-(2)	____	3381	5367	1639
Charge for unpaid family labor	____	226	373	86
Charge for operator's labor	____	631	720	681
Charge for use of operator's cap't.	____	966	955	919
(4) Total estimated charges	____	1823	2048	1686
Operator's Management Returns 3 & 4	____	1558	3319	-47

*Gross farm expenses include the cash expenses adjusted for changes in inventories. Workstock expenses also includes feed consumed. The machinery and equipment expense also included fuel, oil and electricity for farm work.

Management Factors Related to Management Returns

It was shown on pages 43 and 44 that there is a wide variation among farms in the returns to management. Some of the reasons may be found in the relationships of certain management factors to the returns to management, as shown below.

TABLE II

RELATION OF "LIVESTOCK RETURNS ABOVE FEED PER WORK UNIT ON LIVESTOCK" TO THE OPERATOR'S MANAGEMENT RETURNS

Range	Average	Number of Farms	Average Operator's Management Returns
Under $5.00	$ .16	4	$ 393.
$5.00 to $9.99	7.91	9	1453.
$10.00 and Over	14.86	7	2357.

Keeping the kind and quality of livestock best adapted to the physical and economic conditions in the locality, feeding balanced rations, and providing proper care and sanitation results in higher productivity and net returns from livestock and greater operator's management returns. (See Table XI)

TABLE III

RELATION OF "LAND RETURNS PER WORK UNIT ON CROPS AND PASTURE TO OPERATOR'S MANAGEMENT RETURNS

(Land returns pertains to the gross returns from crops, feed, seed, and fertilizers as presented in table I, pages 43, 44)

Range	Average	Number of Farms	Average Operator's Management Returns
Under $10.00	$ 9.48	4	$ 950.
$10.00 to $14.99	12.44	8	1219.
$15.00 to $19.99	16.51	4	1417.
$20.00 and Above	21.94	4	2983.

Using improved practices in growing crops and pastures, proper selection of kinds of crops and pastures, and careful adaptation of the highest paying crops and pasturage to the soil, and of numbers of animal units to the pastures, results in higher productivity and net returns from the land, and greater operator's management returns.

TABLE IV

RELATION OF "SIZE OF THE FARM BUSINESS" TO THE OPERATOR'S MANAGEMENT RETURNS

Range in Work Units	Farms with Losses			Farms with Profits					
				Those Ranking in the Upper Half in Less Than 3 of the Management Factors Other Than Size			Those Ranking in the Upper Half in 3 or More of the Management Factors Other Than Size		
	Aver. Work Units	No. of Farms	Aver. Mg't Return	Aver. Work Units	No. of Farms	Average Mg't Returns	Aver. Work Units	No. of Farms	Average Mg't Returns
Under 300	-	0	-	200	4	$ 470	161	1	$1488
300 to 599	402	2	$-1000	384	3	508	463	7	2233
600 & Above	-	0	-	649	1	1649	772	2	5492

TABLE V

RELATION OF "WORK PER $1000 OF FARM REAL ESTATE TO THE OPERATOR'S MANAGEMENT RETURNS

Range	Average	No. of Farms	Average Operator's Management Returns
Under 21	21	4	$ 306
21 to 40	29	12	1734
41 & Above	57	4	3332

Increasing the intensity of operations relative to the investment in real estate usually is a means of increasing the operator's management returns. Farms with high values per acre, call for more intensive enterprises such as tobacco, truck crops, fruit, poultry, and dairying, and or more complete use of the land throughout the year by using double cropping, alfalfa, and pasturing aftermaths and winter cover crops.

TABLE VI

RELATION OF WORK UNITS PER $100 OF LABOR CHARGES"
TO THE OPERATOR'S MANAGEMENT RETURNS

(Labor charges include charges for the operator's and unpaid family labor, wages paid, and the cropper's share of crop and livestock income).

Range	Average	No. of Farms	Average Operator's Management Returns
Under 25	19	5	$-180
25 to 44	31	9	1917
45 & Above	51	6	2466

Having sufficient productive work well distributed throughout the year, proper use of modern machinery and of exchange work with neighbors, careful planning of the work, and simplifying the jobs will aid in getting the optimum amount of work accomplished per $100 labor charge.

TABLE VII

RELATION OF "WORK UNITS PER $100 OF POWER AND EQUIPMENT CHARGES" TO THE OPERATOR'S MANAGEMENT RETURNS

Range	Average	Number of Farms	Average Operator's Management Returns
Under 38	28	4	$ 987
38 to 77	52	11	1416
78 & Above	102	5	2325

(Power and equipment charges includes power and equipment expenses and depreciation and 5% interest on investment in power and equipment).

Some farmers have too much and some too little power and equipment investment and expenses relative to the amount of work accomplished. Having sufficient productive work well distributed throughout the year, careful overhauling of machinery and equipment in spare time, and cooperative ownership and or use of machinery with neighbors in some instances, will aid in getting the optimum amount of work accomplished per $100 of power and equipment charges.

TABLE VIII

RELATION OF "NUMBER OF FACTORS IN WHICH THE FARMER EXCELS" TO THE OPERATOR'S MANAGEMENT RETURNS

No. of Factors in Which Farmer Excells	No. of Farms	Your Farm	The Length of the Shaded Lines are in Proportion to the Average Operator's Management Returns	Average Operator's Management Returns
1 or 0	4	___	xxx	$-339
2	4	___	xxxx	546
3	4	___	xxxxxxxx	1426
4	4	___	xxxxxxxxxxxxx	2608
5 or 6	4	___	xxxxxxxxxxxxxxxxx	3546

(A farmer was considered to excel in a factor is he was in the upper half in rank in respect to that factor).

It takes a lot of managerial ability to excel in most of the above management factors on any one farm. Each farmer will find it worthwhile to see the following tables to see how his farm stands in respect to these factors and to other data related to them.

TABLE IX

COMPARISONS OF YOUR MANAGEMENT FACTORS AND RETURNS WITH THOSE ON THE OTHER FARMS

Operator's Management Returns Factors	Your Farm	Aver. of All 20 Farms	Aver. of 7 Farms Highest in Mg't. Returns	Aver. of 7 Farms Lowest in Management Returns
Operator's Returns	$__	$1558	$3319	$ -47
1. Livestock returns above feed per work unit on productive livestock	$__	8.79	11.11	4.86
2. Land returns per work unit on crops and pasture	$__	14.55	15.72	14.03
3. Total work units	$__	418.	553.	322.
4. Work units per $1000 of farm real estate	$__	31.	47.	23.
5. Work units per $100 of labor charges	$__	34.	38.	24.
6. Work units per $100 of power and equipment charges	$__	60.	55.	50.

TABLE X

LAND USE AND CROP YIELDS

Land Use	Your Farm	Average of 20 Farms	Average of 7 Farms Highest in Management Returns	Average of 7 Farms Lowest in Management Returns
Acres				
Tobacco	--	.5	.4	.4
Corn silage	--	2.5	4.0	1.4
Corn	--	7.7	9.6	7.3
Sorghum feed	--	.3	.7	0
Barley	--	.5	0	1.4
Oats	--	10.8	17.7	5.8
Wheat	--	3.6	4.3	3.9
Small grain hay	--	4.0	2.8	5.5
Soybean hay	--	2.5	3.4	2.6
Alfalfa hay	--	5.2	5.1	2.6
Clover hay	--	.1	0	.1
Clover seed	--	.4	0	.7
Mixed hay	--	4.2	3.4	5.8
Lespedeza hay	--	17.0	20.4	15.3
Lespedeza seed	--	.4	0	0
New seeding, alfalfa	--	2.3	2.7	2.7
Potatoes and truck crops	--	.3	.3	.3
Home garden and orchard	--	.8	.8	.6
Young orchard	--	.1	0	.1
Woods	--	12.4	11.9	3.4

TABLE X (Continued)

LAND USE AND CROP YIELDS

Land Use	Your Farm	Average of 20 Farms	Average of 7 Farms Highest in Management Returns	Average of 7 Farms Lowest in Management Returns
Acres				
All season pasture	--	36.5	39.5	22.6
Fall and spring pasture	--	19.7	26.0	19.4
Total prod. acres of use	--	131.8	153.0	101.9
A. used for more than one pur.	--	30.3	44.0	24.0
T. A. of land in prod. use	--	101.5	109.0	77.9
Farmstead, roads, idle, waste	--	5.7	4.9	6.2
Total acres of land oper.	--	107.2	113.9	84.1
Acres owned	--	97.7	96.3	78.0
Acres rented	--	9.5	17.6	6.1
Yield per acre				
Tobacco, lbs.	--	1557.0	2008.7	1693.6
Corn, bu.	--	34.6	36.3	33.1
Corn silage, tons	--	7.4	9.0	6.0
Sorghum feed	--	6.0	4.0	---
Barley, bu.	--	35.0	---	35.0
Oats, bu.	--	35.6	31.7	36.9
Wheat, bu.	--	28.8	36.8	17.0

TABLE X (Continued)

LAND USE AND CROP YIELDS

Land Use	Your Farm	Average of 20 Farms	Average of 7 Farms Highest in Management Returns	Average of 7 Farms Lowest in Management Returns
Yield per acre				
Small grain hay, tons	--	1.5	1.8	1.5
Soybean hay, tons	--	2.7	3.1	1.7
Alfalfa hay, tons	--	2.5	2.7	2.4
Clover hay, tons	--	1.0	---	1.0
Clover seed, lbs.	--	85.0	---	120.0
Mixed hay, tons	--	1.8	1.9	1.8
Lespedeza hay, tons	--	1.1	1.1	1.0
Lespedeza seed, lbs.	--	111.0	---	---

TABLE XI

LIVESTOCK MANAGEMENT

	Your Farm		Average of 20 Farms		Average of 7 Farms Highest in Management Returns		Average of 7 Farms Lowest in Management Returns	
Animal units of productive livestock	No.	%	No.	%	No.	%	No.	%
Milk cows	--	--	15.3	69.5	22.0	77.5	10.6	57.3
Other cattle	--	--	5.0	22.7	4.4	15.5	6.3	34.1
Sheep	--	--	.2	.9	.3	1.1	.2	1.1
Hogs	--	--	.7	3.2	.6	2.1	.6	3.2
Poultry	--	--	.7	3.2	.8	2.8	.8	4.3
Colts	--	--	.1	.5	.3	1.0	0	0
Total	--	--	22.0	100.0	28.4	100.0	18.5	100.0
Quantity of feed used per animal unit of productive livestock								
Corn, lbs.	--		753		767		782	
Small grain, lbs.	--		613		712		599	
Commercial feeds, lbs.	--		912		858		937	
Total concentrates	--		2278		2337		2318	
Alfalfa	--		1046		930		882	
Other hay	--		2834		2731		3352	
Corn stover	--		206		451		39	
Total dry roughage	--		4086		4112		4273	
Silage	--		1149		1422		1484	
Animal unit months of pasture			7.4		6.5		7.7	

TABLE XI (Continued)

LIVESTOCK MANAGEMENT

	Your Farm	Average of 20 Farms	Average of 7 Farms Highest in Management Returns	Average of 7 Farms Lowest in Management Returns
Value of feed per animal unit of productive livestock				
Concentrates	--	$ 82.	$ 89.	$ 81.
Roughages	--	43.	42.	47.
Pasture	--	12.	12.	11.
Total value of feed	--	$137.	$143.	$139.
Returns from livestock per animal unit	--	$231.	$283	$199.
Returns above feed per animal unit	--	94.	140.	60.
Income from dairy products per animal unit	--	$247.	$290.	$197.
Pounds of butter fat produced per cow	--	235.	273.	187.

The above data indicate that on 7 farms with highest management returns a greater percentage of the animal units of productive livestock were milk cows, and the production per cow was much higher than on the 7 farms with lowest management returns.

TABLE XII

RELATION OF LIVESTOCK EFFICIENCY AND RELATIVE AMOUNT OF LIVESTOCK TO THE OPERATOR'S MANAGEMENT RETURNS

Range in Livestock Returns Above Feed per Work Unit on Productive Livestock						
Range in % of Work Units on Productive Livestock	Below $8.50 Returns Above Feed per Work Unit			Above $8.50 Returns Above Feed per Work Unit		
	% Work Units on Productive Livestock	No. of Farms	Average Operator's Management Returns	% Work Units on Productive Livestock	No. of Farms	Average Operator's Management Returns
Less than 45	42	2	$943	35	1	$1042
45 to 69	61	4	525	54	6	2637
70 and Above	76	4	313	76	3	3017

The significance of high productivity and efficiency of livestock is further illustrated in this table. The advisability of expanding the livestock enterprises on any given farm is dependent on returns above feed that is obtained.

TABLE XIII

FEED USED BY WORKSTOCK

Items	Your Farm	Average of 18* Farms	Average of 7 Farms Highest in Management Returns	Average of 6 Farms** Lowest in Management Returns
Quantity of Feed per Head				
Concentrates, lbs.	--	1586	1459	2352
Roughages, lbs.	--	5561	4514	8250
Pasture, A.U. months	--	4.7	2.5	6.7
Value of Feed Used per Head				
Concentrates	--	$51.	$44.	$80.
Roughages	--	57.	45.	85.
Pasture	--	8.	4.	10.
Total	--	$116.	$93.	$175.
Number of Workstock	--	223	2.6	2.3

* Only 10 of the 20 farms had workstock.

** Only 6 of the 7 low returns farms had workstock.

TABLE XIV

CAPITAL INVESTMENT

Investments	Your Farm	Average of 20 Farms	Average of 7 Farms Highest in Management Returns	Average of 7 Farms Lowest in Management Returns
No. of farms with tractors	--	14	6	5
No. of farms with trucks	--	3	2	1
No. of farms with electricity	--	17	7	6
No. of farms with milking machinery	--	12	6	4
Items of Investment				
Productive livestock	$--	$2394.	$2849.	$1873.
Workstock	--	334.	444.	283.
Crops, feed, & seed	--	1165	1658.	810.
Machinery & equipment	--	2010.	2634.	1814.
Buildings & fencing*	--	5946.	4830.	6478.
Land*	--	8439.	8243.	7820.
Total	--	20288.	20658.	19078.
Operator's share of the total	$--	$19337.	$19036.	$18474.

* The valuations of the farms were checked carefully to see that they were on a basis, reflecting, of course, such factors as quality of soil, value of buildings per acre, size of farm, distance to town, and the kind of highway.

Information Used in Computation of the Management Factors and Returns

1. Animal units were computed as follows:

Kind of livestock	No. of animals per animal unit	Kind of livestock	No. of animals per animal unit
Colt	2	Hogs (under 6 mo.)	10
Milk cows	1	Chickens (over 6 mo.)	100
Other cattle (over 6 mo.)	1	Chickens (under 6 mo.)	200
Other cattle (under 6 mo.)	2	Turkeys (over 6 mo.)	33
Hogs (over 6 mo.)	5	Turkeys (under 6 mo.)	66

2. Productive man work units were computed as follows:

Kind of livestock	Work Units per Head	Kind of land use	Work Units per Acre
Colts	2.	Tobacco (bu.)	44.0
Milk cows	15.	Corn	3.5
Other cattle (o. 6 mo.)	2.	Corn silage	5.0
Other cattle (u. 6 mo.)	1.	Sweet corn	5.8
Hogs (o. 6 mo.)	1.	Irish potatoes	10.0
Hogs (u. 6 mo.)	.5	Tomatoes (gr. wrp.)	20.
Chickens (o. 6 mo.)	.2	String beans	13.
Chickens (u. 6 mo.)	.1	Watermelons	6.
Turkeys (o. 6 mo.)	.4	Home garden	14.
Turkeys (u. 6 mo.)	.2	Strawberries	30.
		Peaches	11.
		Young orchard	2.

2. Productive man work units were computed as follows:

Kind of land use	Work Units per Acre
Small grain	1.0
Pasture	.2
Pasture (fall or spring)	.1
New seeding (small grain)	.5
New seeding (alfalfa)	.7
Alfalfa hay	2.1
Soybean hay	2.0
Small grain hay	1.6
Clover and grass hay	1.3
Lespedeza hay	1.0
Woods	.1

3. Computation of returns to management is shown on pages 43 and 44. Prices used for inventories, crops, feed, and manure were as follows:

Wheat, per bu.	$2.00	Potatoes, per bu.	$ 2.00	Alfalfa hay, ton	$25.
Barley, per bu.	1.70	Gar. veg., bu.	3.00	Soybean hay, ton	22.
Oats, per bu.	1.15	Small gr. seed per A.	8.00	Mixed hay, ton	22.
Corn, per bu.	1.70	Alfalfa seed per A.	20.00	Lesp. & gr., ton	18.
Corn fodder, per T.	12.00	Pasture, per mo.		Grass	18.
Corn stover, per T.	1.50	per animal unit	1.50	Manure	3.
Corn silage, per T.	8.00				

Commercial feed: at price actually paid.

APPENDIX II

DESCRIPTION OF SOIL CLASSES

The soil surveys of various Tennessee counties place each soil (type, phase, or complex) or land type in each county into one of five classes. These classes are known as first, second, third, fourth, and fifth-class soils.

The first-class soils are productive, easy to work, and easy to conserve; hence they are physically very well suited to the production of crops common to the area. These soils have diversity in degree of profile development, in kind of parent material, and in other characteristics, but they are similar as regards conditions of productivity, workability, and conservability. All these soils are relatively well supplied with plant nutrients, although they differ somewhat in this respect. None of these soils are characterized by any important adverse external soil or land conditions; that is, stones are practically absent, slope or lay of land is favorable to soil conservation and cultural operations and severe erosion has not been and is not likely to be a problem.

Compared with first-class soils, the second-class soils are less favorable in productivity, workability, or conservability; nevertheless, they are well suited to the production of crops common to the area. The second-class soils differ from one another in a number of respects.

Although they do not differ widely in regards to conditions of productivity, workability, and conservability, each soil type in this division has one or more detrimental or unfavorable characteristics or conditions. The second-class soils are moderately productive for most of the crops commonly grown. Their physical properties are moderately favorable to tillage and normal circulation and retention of moisture. None of these soils has a pronounced relief, and none is extremely stoney or severely eroded.

Third-class soils possess one or more rather prominent and detrimental features, such as lack of available nutrients, undesirable physical properties, shallowness over bedrock, scarcity or organic matter, steep slope, stoniness, and eroded condition. The degree of prominence of these factors in the soils of this class not only determine the class but provides, to some extent, the basis on which they are separated from one another. Under ordinary conditions the use of these soils for the production of crops requiring tillage is considered feasable so far as the soils themselves are concerned.

The fourth-class soils are characterized by extremely adverse conditions of productivity, workability, or conservability. These soils are, however, moderate in

fertility and moderate to high in content of moisture. Aside from these common features, they differ widely from one another relative to the kind, number, and extent of development of both internal and external soil characteristics.

Soils of the fifth-class make up the least productive soil types. They have one or more very unfavorable or detrimental soil or land features that make them physically unsuitable for growing cultivated crops, and in addition they are so low in inherent fertility or moisture supply that they are not even suited for pasture. These soils are very low in productivity, although they vary somewhat from one another relative to condition of workability and conservability. They may be considered as physically adapted for forest since this is the purpose for which they are best suited.

The description of these soil classes is a summary taken from the Soil Survey of Jefferson County, Tennessee.

TABLE I

CROP PRODUCTIVITY RATINGS OF SOILS FOR CORN AND ALFALFA, AVERAGE OF RATINGS FOR CORN AND ALFALFA, AND CLASSIFICATION OF LAND IN KNOX COUNTY, TENNESSEE

Soil Symbol[d]	Soil Type	Crop Productivity Rating for			Physical Land Classification[b]
		Corn (a) 100 = 50bu.	Alfalfa 100 = 4 Tons	Average of Corn & Alfalfa	
33B	Dewey silt loam	96	87	91.5	1st
35	Abernathy silt loam	120	100	110.0	"
51B	Emory silt loam	100	80	90.0	"
53C	Emory silt loam	90	80	85.0	"
66B	Morrell very fine sandy loam	100	87	93.5	"
39	Huntington silt loam	100	(c)	100.0	"
53B	Dewey silty clay loam	96	87	91.5	"
55Bn	Decatur silty clay loam	100	95	97.5	"
48C	Cumberland silt loam	90	80	85.0	"
49Bn	Cumberland silty clay loam	100	95	97.5	"
32Bm	Decatur silt loam	110	100	105.0	"
45Cn	Etowah silty clay loam	86	70	78.0	2nd
53Cn	Dewey silty clay loam	90	77	83.5	"
55Cn	Decatur silty clay loam	90	82	86.0	"
52	Lindside silt loam	100	(c)	100.0	"
47B	Sequoia silty clay loam	80	75	77.5	"
47Cn	Sequoia silty clay loam	76	67	71.5	"
60Cn	Farragut silt loam and silty clay loam	85	70	77.5	"
130B	Greendale silt loam	70	(c)	70.0	"

TABLE I (Continued)

CROP PRODUCTIVITY RATINGS OF SOILS FOR CORN AND ALFALFA, AVERAGE OF RATINGS FOR CORN AND ALFALFA, AND CLASSIFICATION OF LAND IN KNOX COUNTY, TENNESSEE

Soil Symbol[d]	Soil Type	Crop Productivity Rating for Corn (a) 100 = 50 bu.	Crop Productivity Rating for Alfalfa (a) 100 = 4 Tons	Crop Productivity Rating for Average of Corn & Alfalfa	Physical Land Classification[b]
92	Ooltawah silt loam	100	(c)	100.0	2nd
42Cn	Chato silty clay loam	86	70	78.0	"
46B	Sequoia silt loam	80	75	77.5	"
46C	Sequoia silt loam	70	62	66.0	"
64Bn	Tellico fine sandy loam	80	72	76.0	"
66C	Morrell very fine sandy loam	85	80	82.5	"
88Bn	Bolton silt loam and silty clay loam	80	75	77.5	"
30B	Greendale silt loam	80	70	75.0	"
42Cn	Chato silt loam and silty clay loam	86	70	78.0	"
73	Roane silt loam	90	75	82.5	"
43C	Fullerton silt loam and silty clay loam	76	62	69.0	"
49Cn	Cumberland silty clay loam	90	80	85.0	"
50Bn	Cumberland gravely fine sandy loam and gravely clay loam	80	75	77.5	"

TABLE I (Continued)

CROP PRODUCTIVITY RATINGS OF SOILS FOR CORN AND ALFALFA, AVERAGE OF RATINGS FOR CORN AND ALFALFA, AND CLASSIFICATION OF LAND IN KNOX COUNTY, TENNESSEE

Soil Symbol[d]	Soil Type	Crop Productivity Rating for Corn (a) 100 = 50 bu.	Crop Productivity Rating for Alfalfa (a) 100 = 4 Tons	Average of Corn & Alfalfa	Physical Land Classification[b]
53D	Dewey silty clay loam	60	67	63.5	3rd
53Cp	Dewey silty clay loam	44	32	38.0	"
55Cp	Decatur silty clay loam	44	40	42.0	"
55Dn	Decatur silty clay loam	70	75	72.5	"
41C	Fullerton cherty silt loam and cherty silty clay loam	66	52	59.0	"
41Cn	Fullerton cherty silt loam and cherty silty clay loam	60	50	55.0	"
47Bp	Sequoia silty clay loam	(c)	38	38.0	"
47Cn	Sequoia silty clay loam	70	62	66.0	"
60Dn	Farragut silt loam and silty clay loam	55	62	58.5	"
64Cp	Tellico fine sandy loam	80	72	76.0	"
70B	Conasanga silty clay loam	60	60	60.0	"
70C	Conasanga silty clay loam	46	55	50.5	"
30C	Greendale cherty silt loam	70	52	61.0	"
43D	Fullerton silt loam and silty clay loam	60	50	55.5	"
71Cn	Fullerton cherty loam and cherty clay loam	76	62	69.0	"

TABLE I (Continued)

CROP PRODUCTIVITY RATINGS OF SOILS FOR CORN AND ALFALFA, AVERAGE OF RATINGS FOR CORN AND ALFALFA, AND CLASSIFICATION OF LAND IN KNOX COUNTY, TENNESSEE

Soil Symbol[d]	Soil Type	Crop Productivity Rating for			Physical Land Classification[b]
		Corn (a) 100 = 50 bu.	Alfalfa (a) 100 = 4 Tons	Average of Corn & Alfalfa	
54B	Sequoia-upshur silt loams and silty clay loams	66	50	58.0	3rd
40Cn	Clarksville cherty silt loam and cherty silty clay loam	50	37	43.5	"
48D	Cumberland silt loam	60	67	63.5	"
49Dn	Cumberland silty clay loam	60	67	63.5	"
76Cn	Tallott silty clay loam	64	52	58.0	"
53Dp	Dewey silty clay loam	(c)	50	50	4th
16D	Stony land (Tallott soil material)	(c)	(c)	25	"
47Cp	Sequoia silty clay loam	(c)	(c)	25	"
60Dp	Farragut silt loam and silty clay loam	(c)	(c)	25	"
17	Guthrie silt loam	30	(c)	30	"
18	Melvin silt loam	35	(c)	35	"
64Dp	Tellico fine sandy loam	(c)	(c)	25	"
41Cp	Fullerton cherty silt loam and silty clay loam	(c)	47	47	"
41D	Fullerton cherty silt loam and silty clay loam	(c)	50	50	"

TABLE I (Continued)

CROP PRODUCTIVITY RATINGS OF SOILS FOR CORN AND ALFALFA, AVERAGE OF RATINGS FOR CORN AND ALFALFA, AND CLASSIFICATION OF LAND IN KNOX COUNTY, TENNESSEE

Soil Symbol (d)	Soil Type	Crop Productivity Rating for			Physical (b)
		Corn (a) 100 = 50 bu.	Alfalfa (a) 100 = 4 Tons	Average of Corn & Alfalfa	Land Classification
76Cp	Tabbott silty clay loam	(c)	(c)	25	4th
76Dn	Tabbott silty clay loam	(c)	(c)	25	"
70Cp	Conasanga silt loam and silty clay loam	(c)	(c)	25	"
55Lp	Decatur silty clay loam	40	50	45	"
19D	Armmchee silt loam and silty clay loam and shaley silty clay loam	50	62	56	"
19Dn	Armmchee silt loam and silty clay loam and shaley silty clay loam	44	50	47	"
19E	Armmchee silt loam and silty clay loam and shaley silty clay loam	c	c	25	"
40D	Clarksville cherty silt loam and cherty silty clay loam	40	30	35	"

TABLE I (Continued)

CROP PRODUCTIVITY RATINGS OF SOILS FOR CORN AND ALFALFA, AVERAGE OF RATINGS FOR CORN AND ALFALFA, AND CLASSIFICATION OF LAND IN KNOX COUNTY, TENNESSEE

Soil Symbol[d]	Soil Type	Crop Productivity Rating for Corn (a) 100 = 50 bu.	Crop Productivity Rating for Alfalfa (a) 100 = 4 Tons	Average of Corn and Alfalfa	(b) Physical Land Classification
40Dn	Clarksville cherty silt loam and cherty silty clay loam	36	25	30.5	4th
54Cp	Sequoia upshur silt loams and silty clay loams	c	c	25	"
88Dp	Bolton silt loam and silty clay loam	c	c	25	"
43Dp	Fullerton silt loam and silty clay loam	c	c	25	"
71Dn	Fullerton cherty loam and cherty clay loam	c	50	50	"
15	Atkins silt loam	50	c	50	"
54Cp	Bland-Sequoia silty clay loam, severely eroded phase	c	c	25	"
16D	Rolling stoney land (bland soil material)			25	"
2D, 2C, 2E	Rough gullied land limestone material	c	c	10	5th
19Dp and 19Ep	Armuchee silt loam, silty clay loam, and shaley silty clay loam	c	c	10	"

TABLE I (Continued)

CROP PRODUCTIVITY RATINGS OF SOILS FOR CORN AND ALFALFA, AVERAGE OF RATINGS FOR CORN AND ALFALFA, AND CLASSIFICATION OF LAND IN KNOX COUNTY, TENNESSEE

Soil Symbol[d]	Soil Type	Corn (a) 100 = 50 bu.	Alfalfa (a) 100 = 4 Tons	Average of Corn and Alfalfa	Physical Land Classification[b]
41Dn) 41Dp) 41E) 41Ep)	Fullerton cherty silt loam and cherty silty clay loam	c	c	10	5th
3D) 3E)	Rough gullied land (limestone material)	c	c	10	"
16E	Stoney land (Tallott soil material)	c	c	10	"
43Em) 43Ep)	Fullerton silt loam and silty clay loam	c	c	10	"
4C) 4D) 4E)	Rough gulley land (shaley material)	c	c	10	"
5D	Rough gulley land (shaley material)	c	c	10	"
40E	Clarksville cherty silt loam and cherty silty clay loam	c	c	10	"
88Ep	Bolton silt loam and silty clay loam	c	c	10	"

The following is an explanation of the symbols used in Table I in Appendix II.

(a) The indexes in this column refer to yields that may be expected under the test practices of management.

(b) This is a grouping of soil types and phases according to their relative physical use adaption.

(c) Crop not commonly grown on this type of soil.

(d) The number in this column represents the soil type. The capital letter represents the slope. B = 2 to 5% slope; C = 5 to 12% slope; D = 12 to 25% slope; E = 25% plus slope. The small letters are the erosion classification. m = slightly eroded; n = moderately eroded; p = severely eroded.

Source: United States Department of Agriculture, Bureau of Plant Industry in cooperation with the Tennessee Agricultural Experiment Station and the Tennessee Valley Authority. Soil Survey of Knox County, Tennessee, Unpublished.

APPENDIX III

COMPUTATION OF A "POTENTIAL CROP PRODUCTIVITY" INDEX FOR EACH INDIVIDUAL FARM USED IN THIS STUDY

Farm Number 1

Soil Symbol	Planimeter Reading	Percent of Farm in Soil Type	Crop Productivity Rating	Crop Productivity Rating Weighted According to Percent of Farm in Soil Type
43Cn	.07	12.7	69.0	8.8
30B	.05	9.1	75.0	6.8
71Cn	.09	16.4	69.0	11.3
41Cn	.01	1.8	59.0	1.1
40Dn	.13	23.6	30.5	7.2
40E	.04	7.3	10.0	.7
43Ep	.03	5.5	10.0	.6
41Dn	.03	5.5	10.0	.6
Rented				
3E	.04	7.3	10.0	.7
73	.02	3.6	82.5	3.0
41Cn	.03	5.5	55.0	3.0
43Dn	.01	1.8	55.0	1.0
				44.8

Farm Number 2

Soil Symbol	Planimeter Reading	Percent of Farm in Soil Type	Crop Productivity Rating	Crop Productivity Rating Weighted According to % of Farm in Soil Type
130B	.11	11.0	70.0	7.7
52	.01	1.0	100.0	1.0
76Bn	.05	5.0	58.0	2.9
47Bn	.28	28.0	71.5	20.0
46B	.02	2.0	77.5	1.6
46C	.02	2.0	66.0	1.3
76Cn	.03	3.0	58.0	1.7
41Cn	.01	1.0	55.0	0.5
51B	.06	6.0	93.5	5.6
47Cp	.27	27.0	25.0	6.8
16D	.01	1.0	25.0	.3
43Dp	.11	11.0	25.0	2.7
41D	.02	2.0	50.0	1.0
				53.1

Farm Number 3

Soil Symbol	Planimeter Reading	Percent of Farm in Soil Type	Crop Productivity Rating	Crop Productivity Rating Weighted According to Percent of Farm in Soil Type
51B	.07	8.9	93.5	8.3
39	.02	2.5	150.0	3.8
88Bn	.02	2.5	77.5	1.9
88Cn	.11	13.9	77.5	10.8
30B	.06	7.6	75.0	5.7
42Cn	.02	2.5	78.0	2.0
130B	.05	6.3	70.0	4.4
71Cn	.03	3.8	69.0	2.6
41Cn	.05	6.3	55.0	3.5
43Dn	.05	6.3	55.0	3.5
47Cn	.02	2.5	66.0	1.7
30C	.02	2.5	61.0	1.5
70Cp	.02	2.5	25.0	.6
76Dn	.01	1.3	25.0	.3
55Dp	.04	5.1	50.0	2.6
41D	.02	2.5	50.0	1.3
41Dp	.01	1.3	10.0	.1
41Dn	.01	1.3	10.0	.1
19Dp	.03	3.8	10.0	.4
2E	.01	1.3	10.0	.1
41E	.12	15.2	10.0	1.5
				56.7

Farm Number 4

Soil Symbol	Planimeter Reading	Percent of Farm in Soil Type	Crop Productivity Rating	Crop Productivity Rating Weighted According to Percent of Farm in Soil Type
130B	.09	12.7	70.0	8.9
52	.19	26.8	100.0	26.8
47Bn	.10	14.1	71.5	10.1
54B	.06	8.4	58.0	4.9
19Dp	.08	11.3	10.0	1.1
4D	.02	2.8	10.0	.3
47Cp	.13	18.3	25.0	4.6
16D	.03	4.2	25.0	1.1
54Cp	.01	1.4	25.0	.4
				58.2

Farm Number 5

Soil Symbol	Planimeter Reading	Percent of Farm in Soil Type	Crop Productivity Rating	Crop Productivity Rating Weighted According to Percent of Farm in Soil Type
88Cn	.02	7.1	77.5	5.5
43Cn	.07	25.0	69.0	17.2
53Cn	.06	21.4	83.5	17.9
43Dn	.03	10.7	55.0	5.9
88Dp	.05	17.9	25.0	4.5
41Dn	.05	17.9	50.0	9.0
				60.0

Farm Number 6

Soil Symbol	Planimeter Reading	Percent of Farm in Soil Type	Crop Productivity Rating	Crop Productivity Rating Weighted According to Percent of Farm in Soil Type
51B	.10	9.8	93.5	9.2
51C	.01	1.0	85.0	.9
49B	.01	1.0	97.5	1.0
49Cn	.06	5.9	85.0	5.0
50Bn	.02	2.0	77.5	1.6
50Cn	.12	11.8	77.5	9.1
66C	.01	1.0	82.5	.8
49Dn	.18	17.6	63.5	11.2
76Cn	.36	35.3	58.0	20.5
76Dn	.05	4.9	25.0	1.2
76Cp	.02	2.0	25.0	.5
16C	.04	3.9	25.0	1.0
16D	.03	2.9	25.0	.7
2C	.01	1.0	10.0	.1
				62.8

Farm Number 7

Soil Symbol	Planimeter Reading	Percent of Farm in Soil Type	Crop Productivity Rating	Crop Productivity Rating Weighted According to Percent of Farm in Soil Type
41C	.01	2.9	59.0	1.7
41Cn	.02	5.7	55.0	3.1
53Dn	.01	2.9	63.5	1.8
51B	.03	8.6	93.5	8.0
52	.02	5.7	100.0	5.7
92	.04	11.4	100.0	11.4
50Bn	.04	11.4	77.5	8.8
43Cn	.13	37.1	69.0	25.6
41E	.02	5.7	10.0	.6
43En	.03	8.6	10.0	.9
				67.6

Farm Number 8

Soil Symbol	Planimeter Reading	Percent of Farm in Soil Type	Crop Productivity Rating	Crop Productivity Rating Weighted According to Percent of Farm in Soil Type
30B	.02	0.9	75.0	.7
35	.02	0.9	110.0	.9
53Cn	.81	38.4	83.5	32.1
53Dn	.28	13.3	63.5	8.4
53D	.02	0.9	63.5	.6
43Cn	.39	18.5	69.0	12.8
43Dn	.22	10.4	55.0	5.7
53Dp	.24	11.4	50.0	5.7
40D	.07	3.3	35.0	1.2
41Dn	.04	1.9	30.5	.6
				68.7

Farm Number 9

Soil Symbol	Planimeter Reading	Percent of Farm in Soil Type	Crop Productivity Rating	Crop Productivity Rating Weighted According to Percent of Farm in Soil Type
51B	.28	8.7	93.5	8.1
35	.25	7.8	110.0	8.6
55Bm	.19	5.9	97.5	5.8
43Cn	.56	17.4	69.0	12.0
30B	.24	7.5	75.0	5.6
53Cn	.37	11.5	83.5	9.6
55Cn	.26	8.1	86.0	7.0
43Dn	.03	.9	55.0	0.5
71Cn	.03	.9	69.0	0.6
53Dp	.12	3.7	50.0	1.9
55Cp	.13	4.0	42.0	1.7
88Dp	.07	2.2	25.0	.6
43Dp	.15	4.7	25.0	1.2
41D	.07	2.2	50.0	1.1
55Dp	.28	8.7	45.0	3.9
2C	.05	1.6	10.0	.2
3D	.08	2.5	10.0	.3
88Ep	.06	1.9	10.0	.2
				68.9

Farm Number 10

Soil Symbol	Planimeter Reading	Percent of Farm in Soil Type	Crop Productivity Rating	Crop Productivity Rating Weighted According to Percent of Farm in Soil Type
66B	.09	19.1	93.5	17.9
51B	.02	4.3	93.5	4.0
64Cn	.13	27.7	76.0	21.0
46B	.02	4.3	77.5	3.3
46C	.02	4.3	66.0	2.8
66C	.01	2.1	82.5	1.7
42Cn	.01	2.1	78.0	1.6
64Bn	.01	2.1	76.0	1.6
130B	.01	2.1	70.0	1.5
64Cp	.02	4.3	76.0	3.3
47Cn	.02	4.3	76.0	3.3
70Cn	.02	4.3	50.5	2.2
17	.05	10.6	30.0	3.2
18	.01	2.1	35.0	.7
64Dn	.03	6.4	25.0	1.6
				69.7

Farm Number 11

Soil Symbol	Planimeter Reading	Percent of Farm in Soil Type	Crop Productivity Rating	Crop Productivity Rating Weighted According to Percent of Farm in Soil Type
51B	.08	8.6	93.5	8.0
35	.01	1.1	110.0	1.2
52	.13	14.0	100.0	14.0
51C	.01	1.1	85.0	.9
43Cn	.04	4.3	69.0	3.0
55Cn	.10	10.8	86.0	9.3
47Bn	.05	5.4	71.5	3.9
130B	.04	4.3	70.0	3.0
71Cn	.02	2.2	69.0	1.5
47Cn	.03	3.2	66.0	2.1
53Dp	.12	12.9	50.0	6.4
55Dp	.12	12.9	45.0	5.8
53Cn	.08	8.6	88.5	7.6
18	.08	8.6	35.0	3.0
47Dp	.02	2.2	25.0	.6
				70.3

Farm Number 12

Soil Symbol	Planimeter Reading	Percent of Farm in Soil Type	Crop Productivity Rating	Crop Productivity Rating Weighted According to Percent of Farm in Soil Type
51B	.14	19.2	93.5	18.0
66B	.04	5.5	93.5	5.1
55Cn	.08	11.0	86.0	9.5
64Cn	.23	31.5	76.0	23.9
3D	.01	1.4	10.0	.1
52	.01	1.4	100.0	1.4
64Cp	.06	8.2	76.0	6.2
70B	.01	1.4	60.0	.8
64Dp	.10	13.7	25.0	3.4
17	.04	5.5	30.0	1.6
18	.01	1.4	35.0	.5
				70.0

Farm Number 13

Soil Symbol	Planimeter Reading	Percent of Farm in Soil Type	Crop Productivity Rating	Crop Productivity Rating Weighted According to Percent of Farm in Soil Type
51B	.05	5.9	93.5	5.5
51B	.04	4.7	93.5	4.4
43Cn	.26	30.6	69.0	21.1
30B	.03	3.5	75.0	2.6
43C	.03	3.5	69.0	2.4
53Bn	.04	4.7	91.5	4.3
53Cn	.02	2.4	83.5	2.0
43Dn	.07	8.2	55.0	4.5
43Dp	.03	3.5	25.0	.9
Rented First Tract				
43Cn	.04	4.7	69.0	3.2
43Dn	.02	2.4	55.0	1.3
30B	.01	1.2	75.0	.9
43Dp	.01	1.2	25.0	.3
Rented Second Tract				
43Cn	.03	3.5	69.0	2.4
53Cn	.01	1.2	83.5	1.0
51B	.04	4.7	93.5	4.4
43Dn	.01	1.2	55.0	.7
Rented Third Tract				
53Cn	.02	2.4	83.5	2.0
51B	.02	2.4	93.5	2.2
53Bn	.01	1.2	91.5	1.1
43Cn	.01	1.2	69.0	.8
Rented Fourth Tract				
70Cn	.02	2.4	50.5	1.2
52	.02	2.4	100.0	2.4
4D	.01	1.2	10.0	.1
				71.7

Farm Number 14

Soil Symbol	Planimeter Reading	Percent of Farm in Soil Type	Crop Productivity Rating	Crop Productivity Rating Weighted According to Percent of Farm in Soil Type
51B	.11	8.0	93.5	7.5
60Cn	.07	5.1	77.5	4.0
55Cn	.03	2.2	86.0	2.0
92	.01	0.7	100.0	.7
47Bn	.02	14.6	81.5	11.9
130B	.18	13.1	70.0	9.2
47Cn	.07	5.1	66.0	3.4
60Dp	.03	2.2	25.0	0.6
47Cp	.05	3.6	25.0	0.9
19Dp	.01	0.7	10.0	.1
55Bn	.01	0.7	97.5	.7
Rented First Tract				
42Cn	.01	0.7	78.0	.5
51B	.01	0.7	93.3	.7
47Cp	.03	2.2	25.0	.6
19Dp	.03	2.2	10.0	.2
45Cn	.01	0.7	78.0	.5
130C	.02	1.5	70.0	1.1
47Cn	.03	2.2	66.0	1.5
47Cp	.02	1.5	25.0	.4
144B	.04	2.9	90.0	2.6
24Dn	.02	1.5	25.0	.4
53Cn	.01	0.7	83.5	.6
51B	.01	0.7	93.5	.7
52	.04	2.9	100.0	2.9
Rented Second Tract				
46B	.05	3.6	77.5	2.8
130B	.07	5.1	70.0	3.6
47Cn	.01	.7	66.0	.5
47Bn	.06	4.4	71.5	3.1
Rented Third Tract				
51B	.08	5.8	93.5	5.4
45Bn	.05	3.6	85.0	3.1
				72.2

Farm Number 15

Soil Symbol	Planimeter Reading	Percent of Farm in Soil Type	Crop Productivity Rating	Crop Productivity Rating Weighted According to Percent of Farm in Soil Type
35	.07	7.1	110.0	7.8
55Cn	.37	37.4	83.5	31.2
51B	.01	1.0	93.5	.9
53Cn	.11	11.1	83.5	9.3
52	.07	7.1	100.0	7.1
55Cp	.07	7.1	42.0	3.0
53Cp	.10	10.1	38.0	3.8
53Dn	.01	1.0	63.5	.6
16D	.07	7.1	25.0	1.8
53Dp	.01	1.0	50.0	.5
2D Rented	.02	2.0	10.0	.2
55Cn	.04	4.0	86.0	3.4
55Dp	.01	1.0	50.0	.5
55Cn	.01	1.0	86.0	.9
				72.7

Farm Number 16

Soil Symbol	Planimeter Reading	Percent of Farm in Soil Type	Crop Productivity Rating	Crop Productivity Rating Weighted According to Percent of Farm in Soil Type
88Cn	.10	15.9	77.5	12.3
51B	.01	1.6	93.5	1.5
35	.01	1.6	110.0	1.8
43Cn	.05	7.9	69.0	5.5
30B	.02	3.2	75.0	2.4
53Cn	.04	6.3	83.5	5.3
55Cn	.02	3.2	86.0	2.8
43Dn	.08	12.7	55.0	7.0
53Dp	.01	1.6	50.0	.8
55Dn	.05	7.9	72.5	5.7
Rented Tract				
43Cn	.03	4.8	69.0	3.3
30B	.01	1.6	75.0	1.2
55Dn	.02	3.2	72.5	2.3
55Cn	.10	15.9	86.0	13.7
43En	.01	1.6	10.0	.2
52	.03	4.8	100.0	4.8
53Dn	.01	1.6	63.5	1.0
55Bn	.01	1.6	97.5	1.6
51B	.01	1.6	93.5	1.5
53Cp	.01	1.6	38.0	.6
				75.3

Farm Number 17

Soil Symbol	Planimeter Reading	Percent of Farm in Soil Type	Crop Productivity Rating	Crop Productivity Rating Weighted According to Percent of Farm in Soil Type
55Cn	.15	18.8	86.0	16.2
51B	.20	25.0	93.5	23.4
56Bn	.06	7.5	97.5	7.3
73	.08	10.0	82.5	8.2
45Cn	.03	3.8	78.0	3.0
52	.04	5.0	100.0	5.0
55Dn	.04	5.0	63.5	3.2
53D	.06	7.5	63.5	4.8
55Dp	.07	8.7	45.0	3.9
16D	.04	5.0	25.0	1.3
3D	.03	3.7	10.0	.4
				76.7

Farm Number 18

Soil Symbol	Planimeter Reading	Percent of Farm in Soil Type	Crop Productivity Rating	Crop Productivity Rating Weighted According to Percent of Farm in Soil Type
55Bn	.12	17.1	97.5	16.7
51C	.03	4.3	85.0	3.7
55Cn	.05	7.1	86.0	6.1
53Cn	.10	14.3	83.5	11.9
30B	.02	2.9	75.0	2.2
43Cn	.01	1.4	79.0	1.1
55Dn	.06	8.6	72.5	6.2
53Dn	.04	5.7	63.5	3.6
18	.04	5.7	35.0	2.0
43Dp	.03	4.3	25.0	1.1
Rented First Tract				
43Bn	.02	2.9	91.5	2.7
43Cn	.02	2.9	69.0	2.0
43Dn	.01	1.4	55.0	.8
30B	.01	1.4	75.0	1.1
Second Tract				
53Cn	.03	4.3	83.5	4.6
35	.02	2.9	110.0	3.2
53Bn	.01	1.4	91.5	1.3
43Cn	.02	2.9	69.0	2.0
Third Tract				
30B	.03	4.3	75.0	3.2
43Cn	.02	2.9	69.0	2.0
53Cn	.01	1.4	83.5	1.2
				78.6

Farm Number 19

Soil Symbol	Planimeter Reading	Percent of Farm in Soil Type	Crop Productivity Rating	Crop Productivity Rating Weighted According to Percent of Farm in Soil Type
51B	.36	21.7	93.5	20.3
53Bn	.17	10.2	91.5	9.3
55Bn	.12	7.2	97.5	7.0
32Bm	.09	5.4	105.0	5.7
35	.01	.6	110.0	.6
52	.10	6.0	100.0	6.0
43Cn	.03	1.8	69.0	1.2
43C	.03	1.8	69.0	1.2
53Cn	.08	4.2	83.5	3.5
55Cn	.22	13.3	86.0	11.4
92	.05	3.0	100.0	3.0
30C	.04	2.4	61.0	1.5
53Dn	.03	1.8	63.5	1.1
43Dn	.09	5.4	55.0	3.0
55Cp	.03	1.8	42.0	.8
15	.01	.6	50.0	.3
15B	.01	.6	50.0	.3
18	.04	2.4	35.0	.8
55Dp	.14	8.4	45.0	3.8
41Dn	.01	.6	10.0	.1
				80.9

Farm Number 20

Soil Symbol	Planimeter Reading	Percent of Farm in Soil Type	Crop Productivity Rating	Crop Productivity Rating Weighted According to Percent of Farm in Soil Type
51B	.08	28.5	93.5	26.6
55Bn	.04	14.3	97.5	13.9
52	.04	14.3	100.0	14.3
55Cn	.06	21.4	86.0	18.4
53Cn	.02	7.1	83.5	5.9
35	.01	3.6	110.0	4.0
55Dp	.03	10.7	45.0	4.8
				87.9