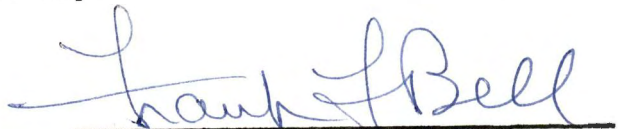


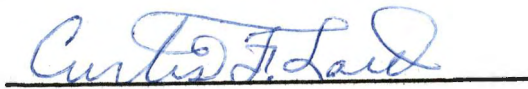
August 16, 1966

To the Graduate Council:

I am submitting herewith a thesis written by William Larry Homesley entitled "Effects of Agronomic and Management Factors on Estimated Returns from Selected Crops in Sequatchie Valley." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agronomy.


Major Professor

We have read this thesis and
recommend its acceptance:




Accepted for the Council:


Dean of the Graduate School

EFFECTS OF AGRONOMIC AND MANAGEMENT FACTORS ON
ESTIMATED RETURNS FROM SELECTED CROPS
IN SEQUATCHIE VALLEY

A Thesis
Presented to
the Graduate Council of
The University of Tennessee

In Partial Fulfillment
of the Requirements for the Degree
Master of Science

by
William Larry Homesley
August 1966

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CHAPTER I

INTRODUCTION

Sound adjustments in farming require accurate predictions of costs and returns for different crops and their most profitable allocations in a cropping system for various soil, climatic and management conditions. It is imperative that one should know the relationship between crops and soils to make these adjustments. For profitable crop production, both physical and chemical characteristics of the soil must be taken into consideration. Physical properties such as texture, structure, drainage, presence of pans, depth, and available moisture supplying capacity greatly influence the suitability of a crop to a particular soil and the most profitable allocation of a crop in a cropping system.

After the physical aspects of soil-crop suitability have been considered, the fertility status of the soil should be taken into consideration. By combining physical relationships regarding crop suitability to soils with available fertility level, better estimates of crop yields can be established. A knowledge of the available soil fertility level may also provide a logical means for determining the effect of available fertility level of soils on the most profitable crop allocation.

The University of Tennessee in cooperation with the Tennessee Valley Authority and the Soil Conservation Service initiated a study in 1964 to determine the effects of soil suitability, available fertility level and farm size on the estimated returns and most profitable allocation of crops among soils of the Sequatchie Valley. The purposes of this study were:

1. To aggregate the soil mapping units in the Sequatchie Valley into groups that would have similar yield potential and give similar response to fertilization and other management inputs.

2. To determine the level of phosphorus, potassium and pH of the soils of the Sequatchie Valley.

3. To estimate costs and returns from selected crops as affected by soil management group, soil fertility level and farm size.

4. To determine the optimum allocation of crops among the various soil groups at different fertility levels and farm sizes using net return to land, labor and management as the sole criterion for allocation.

5. To determine the allocation of selected crops among the various soil management groups using net return at different fertility levels and farm sizes but restricting the allocation by using certain soil loss tolerance values.

6. To compare allocation of crops with gross income as the sole criterion for allocation with the allocation derived from a net income basis.

CHAPTER II

METHODS AND PROCEDURES

The Study Area

The Tennessee portion of the Sequatchie Valley makes up a large portion of Bledsoe, Sequatchie and Marion Counties. The Valley, which extends into Alabama, is about 65 miles in length and ranges in width from 4 miles in the northern portion to nearly 8 miles in the southern portions (17). The topography of the area is generally rolling in nature; however, there is a sizeable acreage of relatively level bottomland along the Sequatchie River which flows through the Valley.

Farming systems are primarily combinations of crop and livestock enterprises. Corn is the major crop grown in the area. Hay (mainly lespedeza) and small grains make up the largest portion of the remainder of the crop acreage grown. Livestock are generally limited to the number that can be supported by grain and forage produced on a particular farm. The entire Sequatchie Valley area is classified as rural; however, there are a few small towns with 1,000 to 2,000 population.

The Sampling Unit

The farm unit was selected as the sampling unit for the study. It was felt that identifying and sampling the soils by

farm units would be a useful approach to the problem by providing a means of determining the levels and distribution of soils fertility in Sequatchie Valley and their relationship to soil management group, farm types or classes and land use. The use of individual farms as the sampling unit would facilitate a farm management study or summary of the project in the future.

Procedure Used in Sampling and Stratification

All farms listed by the Agricultural Stabilization and Conservation Service were proportionally grouped by size to insure a distribution of all sizes of farms. The size classes were less than 100 acres, 100 to 179 acres and greater than 179 acres. The distribution and number of farms by size and county are presented in Tables 1 and 2.

The sampling was accomplished by numbering each farm in a size class consecutively from one end of the valley to the other and selecting every tenth farm after randomizing the starting point; thus providing about a ten percent sample of the total farm area.

Criteria for Grouping Soil Mapping Units

The soil mapping units were classified into groups with similar physical properties and land use potential. Major emphasis was placed on profile characteristics such as texture, structure, presence of a pan, depth and textural profile development. All soils in a particular group were expected to give

TABLE 1. Number of farms occurring in Sequatchie Valley
distributed by size and county

Farm Size (acres)	County			Total
	Bledsoe	Sequatchie	Marion	
10-99	145	145	303	593
100-179	84	53	106	243
180 and over	131	41	68	240
Total	360	239	477	1,076

TABLE 2. Number of sample farms in Sequatchie Valley
distributed by size and county

Farm Size (acres)	County			Total
	Bledsoe	Sequatchie	Marion	
10-99	11	14	30	55
100-179	8	4	10	22
180 and over	12	4	7	23
Total	31	22	47	100

similar response to added inputs because they would have the same productive potential.

Soils with different degrees of slope and erosion were grouped in a way that would best reflect the capability of the soils. Soils that differed enough in drainage class to definitely influence their crop suitability and land use potential were grouped separately.

As a general rule soils of the same physiographic position were grouped together providing they were similar in physical properties. Some deviation in grouping occurred when a soil of one physiographic position had physical properties and productive potential that more closely resembled soils of another physiographic position. In these cases the soil would be included with other soils that would be subjected to similar systems of management.

Description of Soil Groups

The soils included in this study were grouped into eleven soil management groups. A list of the soils that make up each group are presented in Table 3. A description of the eleven soil groups and a representative soil for each group is presented below.

Group I. These are level to nearly level, well-drained bottomland soils with no profile development. They are moderately permeable, have very high moisture-supplying capacity, and allow

TABLE 3. Soils of Sequatchie Valley included in each management group

Group ^a	Soils
I	<u>Huntington</u> , Barbourville, Emory
II	<u>Etowah</u> , Bolton, Greendale, Hermitage, Minvale, Sequatchie
III	<u>Cumberland</u> , Allen, Fullerton, Holston, Jefferson, Waynesboro, Greendale cherty, Sequatchie gravelly
IV	<u>Fullerton cherty</u> , Allen cobbly, Jefferson cobbly, Minvale cherty, Pace cherty, Waynesboro cobbly
V	<u>Talbott</u> , Colbert, Swaim
VI	<u>Clarksville cherty</u> , Allen stony, Armuchee, Muskingum, Teas, E. and F slopes of Group III and IV
VII	<u>Rockland</u> , Bouldery colluvium, Cobbly alluvium, Gullied land, Stony colluvium, Talbott rocky
VIII	<u>Lindside</u> , Whitwell
IX	<u>Capshaw</u> , Captina, Pace, Wolftever
X	<u>Taft</u> , Robertsville
XI	<u>Melvin</u> , Prader

In the remainder of this presentation soil groups will be referred to by the name of the soil underlined in the table. For example, soil group I will be referred to as the Huntington Group.

extensive root penetration and root development. Huntington is a representative soil of this group.

Group II. These are gently sloping to sloping, well-drained terrace and old colluvial soils with slight profile development. They vary from slightly to moderately eroded. They are favorable for extensive root development and permeable enough to permit circulation of air and moisture. Their moisture-supplying capacity varies with the texture and slope, but it is generally high. Etowah is a representative soil of this group.

Group III. These are sloping to moderately steep, well-drained soils of the uplands and high terraces with medium profile development. They vary from moderately to severely eroded. They are moderately permeable and, where not severely eroded, have a moderately high moisture-supplying capacity. Cumberland is a representative soil of this group.

Group IV. These are sloping to steep, well-drained soils of the uplands and high terraces with medium profile development. They vary from slightly to severely eroded. These soils differ from Group III in that there is gravel or chert throughout the profile. The moisture-supplying capacity is moderate to low because of the gravel or chert. The gravel and chert also interfere with but do not prevent cultivation. Fullerton Cherty is a representative soil of this group.

Group V. These are sloping to moderately steep, well-drained soils of the uplands with heavy profile development. They vary from moderately to severely eroded. These soils have a massive clay B horizon which reduces movement of air and water. The moisture supplying capacity ranges from medium to very low. Talbott is a representative soil of this group.

Group VI. These are shallow, excessively drained soils of the steep uplands. Large amounts of chert are common on the surface and in the soil layers. They are permeable to roots, air and water. The moisture-supplying capacity is very low. Clarksville Cherty is a representative soil of this group.

Group VII. These land types have various limitations that limit them for agricultural use. Steepness of slope, presence of stones and excessive erosion are some of the limitations. Rockland is a representative of this group.

Group VIII. These are nearly level to level, somewhat poorly to moderately well-drained, bottomland soils with no profile development. The permeability is moderate, and the moisture-supplying capacity is high. These soils are associated with a high water table and they are often flooded for short periods. Lindside is a representative soil of this group.

Group IX. These are gently sloping to sloping, moderately well-drained soils of the low stream terraces with a fragipan. They vary from slightly to moderately eroded. These soils have a fragipan at approximately two feet which restricts the movement of air, water and roots. Permeability is moderate in these soils above the pan. The moisture-supplying capacity is medium. Capshaw is a representative soil of this group.

Group X. These are level to nearly level, poorly to somewhat poorly drained soils of the stream terraces with a fragipan. These soils are mottled throughout the profile and have a pan at about one foot from the surface. The water table is at or near the surface in rainy seasons, especially during winter and early spring. For this reason the soils are very poorly aerated at times and root development is restricted. The moisture-supplying capacity is excessive in winter and low in the summer. Taft is a representative soil of this group.

Group XI. These are level, poorly drained bottomland soils with no profile development. Plant roots are generally confined to the upper part of the profile, as the lower part is saturated with water and poorly aerated most of the time. These soils have a medium moisture-supplying capacity. These soils are subject to frequent flooding. Melvin is a representative

soil for this group. Further description of the soils and topography may be found in Soil Survey of Marion County (18).

Soil Sampling Procedure

Preparation of maps and work sheets:

1. Soil maps for the sample of farms selected in the Marion County portion of the Sequatchie Valley were provided by Xerox reproduction of the published (3.2" = 1 mile scale) soil maps of the county soil survey report. For Bledsoe and Sequatchie Counties, photographic reproductions (8" = 1 mile scale) were made of farm soil maps through the Soil Conservation Service staff.

2. The soil group to which each mapping unit belonged was indicated on the soil map by placing an identifying color block within the mapping unit boundary. This was done for all open land on each farm.

3. The farmer's name and address, the farm map number, county, the soil groups, and the mapping units and acreages of each were recorded on the work sheet. Soil mapping units in wooded areas were measured and recorded but not sampled.

4. Soil mapping units within a soil group, which were less than 3 acres in size and not contiguous to other soil mapping units in the same group, were not sampled; however, they were measured and recorded on the work sheet.

5. After measuring the acreages of each mapping unit, the exact location of each boring was indicated by a small dot on the map. The dots were spaced as equally as possible throughout the mapping unit, but none were located within 100 feet of the soil boundary.

Field sampling:

1. The farmer was contacted for permission to sample his land. At that time it was determined if the farm boundary was correct and if all acres of land farmed by this farmer were included in the sample.

2. If the farm boundaries were not correct the new sample units and all pertinent data were added to the bottom of the work sheet.

3. Sample borings were made as closely to the designated spots as possible except where cartographic detail had been generalized along soil boundaries. No boring was made within 100 feet of the soil boundary. Each boring site was sampled with a standard soil test tube, probed to a depth of 6 inches.

4. Soil samples were prepared for analysis at the University of Tennessee. Composite soil samples were then sent to the soil testing laboratory in Nashville where the levels of P, K and pH were determined.

Selection of Crops for Consideration

Crops were selected for consideration that were being grown in the area. Crops that appeared to have potential in the area were also considered. It was recognized that certain crops which are relevant under certain circumstances have been omitted. However, the crops selected include all the alternative choices involved in most corpping systems.

The crops considered were: corn, soybeans, wheat, oats, alfalfa, red clover-orchardgrass, fescue-ladino clover, orchardgrass-ladino clover and sudangrass. Because the type of livestock system was not considered, the pasture crops were considered to be harvested for hay. The type of livestock system might appreciably change the relative value of these crops as compared with the other crops under other specified considerations and conditions.

Yield Estimates

As far as possible long term yield data were summarized for each crop on soils that were representative of each soil group. In some instances soils that were not included in a soil group but were similar to soils in the group were used for yield estimates. Where yield data for particular crops on certain soil groups were not available, multiple judgment of the agronomy staff and members of the Soil Conservation Service was used to reach an estimate. The summarized yields from which the estimates were derived are in Appendix A.

Estimates based on long term yields result in a more accurate prediction of the yields of a particular crop or crops on a soil over time. A yield estimate derived in this manner reflects the influences of inter year variation in climatic conditions which results in different yields on the same soils from year to year. The major factors influencing the inter year variations in yields are the amount and distribution of rainfall and temperature. Estimated yields for the various crops are presented for each soil group at a base slope and erosion of B1 in Table 4. The slope and erosion of B1 was selected as a base because this represents the soil phase with the least slope gradient and degree of erosion for the majority of the soil groups in this study. For the soil groups with an A1 phase, the yield would be the same as for B1. The effects of increases in slope gradient and degree of erosion are discussed in the next topic.

Yield Adjustments for Different Slope Gradient and Degree of Erosion

The slope of the land has an influence on the rate of infiltration of water into a soil. As the slope gradient increases, the rate of infiltration decreases (11). As moisture is usually the limiting factor in the production of summer crops, an increase in slope gradient usually results in less yield for those crops due to less available water. The amount

TABLE 4. Estimated yields per acre of selected crops by soil groups at a base slope and erosion of B1

Soil Group	Corn (bu.)	Soybeans (bu.)	Wheat ^a (bu.)	Oats ^b (bu.)	Alfalfa (tons)	Red Clover			Fescue- Ladino (tons)	Orchard- grass Ladino (tons)	Sudan- grass (tons)
						Orchard- grass (tons)	Lespedeza (tons)	Orchard- grass Ladino (tons)			
Huntington	105	30	37	62	2.8	2.8	2.0	3.4	3.4	3.4	3.0
Etowah	85	30	40	67	3.2	2.6	1.8	3.0	3.0	3.0	2.6
Cumberland	72	25	40	67	3.2	2.4	1.6	2.8	2.8	2.8	2.3
Fullerton Cherty	68	20	34	57	2.5	2.3	1.4	2.7	2.7	2.7	2.0
Talbott	66	18	33	55	2.2	1.7	1.0	2.0	2.0	2.0	1.4
Clarksville Cherty	- ^c	- ^c	- ^c	- ^c	- ^c	- ^c	- ^c	1.3	1.3	- ^c	- ^c
Rockland	- ^c	- ^c	- ^c	- ^c	- ^c	- ^c	- ^c	- ^c	- ^c	- ^c	- ^c
Lindside	100	30	30	50	-	2.5	2.0	3.0	3.0	3.0	2.9
Capshaw	70	25	36	60	2.3	2.0	1.6	2.5	2.5	2.5	2.0
Taft	55	25	25	42	-	1.2	1.3	2.3	2.3	2.3	2.0
Melvin	55	25	20	33	-	-	1.6	2.5	2.5	2.5	2.6

^aStraw yield can be obtained by multiplying grain yield by 70. Example for Huntington Group:
37 x 70 = 2,590 lb. straw.

^bStraw yield can be obtained by multiplying grain yield by 30. Example for Huntington Group:
62 x 30 = 1,860 lb. straw.

^cCrop not suited to this soil group.

of A horizon influences the rate of infiltration of water into a soil and the available moisture-supplying capacity of a soil. The A horizon is usually loam or silt loam in texture and granular in structure. These properties are responsible for the higher infiltration rate and moisture-supplying capacity. These properties are also desirable for good seedbed preparation and seedling emergence. As erosion increases yields are generally reduced because some of the A horizon, with its more favorable physical properties that affect moisture relationships and seedling emergence, has been removed.

To determine the effect of slope and erosion on yields, a model was developed from which decreases in yield due to slope gradient and degree of erosion could be derived. Soils were grouped into three classifications according to profile development. It was assumed that reduction in yield due to slope and erosion would increase as profile development increased. Different reduction factors were estimated for warm season and cool season crops due to the difference in amount and distribution of rainfall during the growing period of these two kinds of crops. The model developed to arrive at the adjustments in yield due to increase in slope and erosion is presented in Table 5. An example of how this model can be applied is presented below:

Question: What is the yield of corn on Etowah B3?

TABLE 5. Crop yield^a decrements as influenced by increases in soil profile development and by increases in gradient of slope and degree of erosion

Slope and Erosion	Profile Development ^b							
	Slight ^c		Medium				Heavy ^c	
	Warm Season Crops	Cool Season Crops	Warm Season Crops	Cool Season Crops	Warm Season Crops	Cool Season Crops	Warm Season Crops	Cool Season Crops
B1	100	100	100	100	100	100	100	100
B2	97	100	95	100	92	100	92	100
B3	80	92	70	92	60	72	60	72
C1	94	97	94	97	94	97	94	97
C2	91	97	89	97	86	97	86	97
C3	74	89	64	79	54	69	54	69
D1	90	95	90	95	90	95	90	95
D2	87	95	85	95	82	95	82	95
D3	70	87	60	77	50	67	50	67
E1	d	93	d	93	d	93	d	93
E2	d	93	d	93	d	93	d	93
E3	d	85	d	75	d	65	d	65

^aYields expressed as a percentage of the base slope and erosion of B1 which is established as 100 percent.

^bRefers mainly to textural differentiation.

^cProfile development for the soils in this study is discussed in the section on description of soil groups.

^dNot applicable.

- Procedure:
1. Look up the yield for corn on the Etowah Group in Table 4, page 17. Record 85 bu.
 2. Look up the percent reduction in yield for B3 in Table 5, page 19. This would be the value under the slight profile development for cultivated summer crops. Record 80 percent.
 3. Multiply $85 \times .80$ bu. = 68 bushels corn per acre for Etowah B3.

Soil Loss Estimation

Average annual soil loss in tons per acre was estimated for each soil group by means of the soil loss prediction equation (Soil Loss Estimation in Tennessee, unpublished data). Soil loss was not evaluated on alluvial soils and poorly drained upland soils because it usually is not considered a significant factor. The equation for estimating field soil loss from rainfall is:

$$A = R K L S C P \quad (19)$$

where A = average annual soil loss in tons per acre

R = the rainfall factor

K = the soil factor

L = length of slope

S = percent slope

C = cropping-management factor

P = practice factor

The R and K factors in the above equation were derived from the Soil Loss Estimation in Tennessee Handbook. A composite slope and erosion value was determined for each soil group by listing the number of acres of each slope and erosion class within a soil group and taking an average of the total. The S factor was derived from this calculation. The L factor was determined by measuring several mapping units in each soil group and taking an average of the total. The P factor used in this study was contouring. The data used for predicting soil loss for each soil group are presented in Table 6. Data are presented only for soil groups where erosion would be a significant factor.

Method of Analysis

The technique used to determine allocation of crops among soils in this study was budgeting analysis. A budget was developed for each crop considered. These budgets show the costs and returns per acre for each crop considered. The budget form and most of the production costs were derived from budgets prepared by the Agricultural Economics Department (University of Tennessee Department of Agricultural Economics, unpublished data). The rates of fertility used at the three soil test levels are recommended rates published by the University of Tennessee College of Agriculture (16). The rates of fertility for the different crops are given in Appendix B.

TABLE 6. Values used in the soil loss prediction equation to calculate soil loss from different cropping systems

Soil Group	Average Slope & Erosion	Erosion							R	L ft.	S (%)	P
		1 and 2			3							
		K	T	T/K	K	T	T/K					
Huntington	Al ^b											
Etowah	C2	.34	4	12	.34	3	9	250	200	6	contour	
Cumberland	C2	.36	4	11	.36	3	8	250	275	10	contour	
Fullerton Cherty	D2	.30	3	10	.30	2	7	250	275	13	contour	
Talbott	C2	.42	2	5	.42	1	2	250	300	10	contour	
Clarksville Cherty	E1	.32	2	6	.36	1	3	250	325	22	contour	
Rockland	-											
Lindside	Al ^b											
Capshaw	B2	.42	3	7	.46	2	4	250	250	4	contour	
Taft ^a	Al ^b											
Melvin	Al ^b											

^aIn this study the Taft Group consisted of low terraces with little to no slope. In an area where this group occurs on rolling topography soil loss should be considered.

^bSince no appreciable soil loss will occur on these soil groups equation values were omitted.

Budgets for each crop are presented in Appendix C. Due to difficulty in printing, only the fertility costs for the medium soil test level are included. To adjust for a low or high soil test level, multiply the cost per unit times the recommended rate of fertility for the particular soil test level in question. All other items in the budget would remain the same.

Partial budgets were derived from these complete budgets to determine the net return for a crop on a soil group where the yields were less than the yield specified in the complete budget. The changes resulting from less yield were a reduction in total receipts and a reduction in harvesting cost. The adjustments were made by multiplying the expected yield by the assumed price of the crop to get total receipts. Harvesting costs were determined by multiplying the yield by the cost per unit. All other units were assumed to remain unchanged with a reduction in yield.

CHAPTER III

RESULTS AND DISCUSSION

Acreage Distribution of Soil Groups

The number of acres of each soil group and the percentage of the total acreage sampled is presented in Table 7. The Cumberland Group contained the largest acreage of any soil group. The Taft Group had the smallest acreage of the groups considered. The Clarksville Cherty Group and the Rockland Group, which make up 24 percent of the acreage, cannot be considered for extensive agricultural use due to their physical limitations. This leaves 76 percent of the acreage of the Sequatchie Valley to be considered for alternative cropping systems.

Soil Test Distribution by Soil Groups

The soil test distribution by soil groups is presented in Table 8. All soil groups followed the same trend in phosphorus level. The majority of the acreage within each soil group tested low in phosphorus. Only a small percentage of the acreage in any soil group tested high in phosphorus. The Etowah Group had the lowest percentage testing low in phosphorus and the highest acreage percentage testing high. However, even in this group 62.8 percent of the acreage tested low in phosphorus.

TABLE 7. Number and percent of sample acreage in each soil group in Sequatchie Valley

Soil Group	Number of Acres	Percent of Total
Huntington	1,356	10.3
Etowah	2,128	16.2
Cumberland	3,378	25.7
Fullerton Cherty	600	4.6
Talbott	444	3.4
Clarksville Cherty	1,898	14.5
Rockland	1,250	9.5
Lindside	892	6.8
Capshaw	636	4.8
Taft	87	.7
Melvin	454	3.5
Total	13,123	100.0

TABLE 8. Percent of sample acreage testing low, medium and high in phosphorus, potassium and pH by soil groups in Sequatchie Valley

Soil Group	Percent of Acreage Testing									
	Phosphorus					Potassium				
	Low	Med.	High	Low	Med.	High	Low	Med.	High	pH
										<5.6 5.6-6.5 >6.5
Huntington	74.5	16.4	9.1	64.5	25.1	10.4	17.7	77.7	4.6	
Etowah	62.8	15.5	21.7	18.4	30.7	50.9	11.6	82.2	6.2	
Cumberland	74.7	15.2	10.1	8.5	23.5	68.0	24.7	67.1	8.2	
Fullerton Cherty	71.8	27.1	1.1	34.0	38.9	27.1	42.7	55.0	2.3	
Talbott	70.9	9.4	19.7	5.6	44.1	50.3	27.9	68.8	3.3	
Clarksville Cherty	76.5	22.4	1.1	23.8	54.1	22.1	34.4	63.3	2.3	
Rockland	Not Sampled									
Lindside	67.1	21.1	9.8	63.6	25.8	10.6	17.8	76.4	5.8	
Capshaw	82.0	12.2	5.8	43.8	43.8	12.4	20.2	74.4	5.4	
Taft	87.7	0	12.3	66.7	7.0	26.3	0	100.0	0	
Melvin	91.5	6.2	2.3	91.1	8.9	0	63.6	34.1	2.3	
Average	76.1	14.6	9.3	42.0	30.2	27.8	26.1	69.9	4.0	

The potassium level of the soil groups was somewhat more variable. There was a wide range in the acreage percentage testing low, medium and high among soil groups. In the Cumberland Group only 8.5 percent of the acreage tested low in potassium; whereas, 91.1 percent of the acreage tested low in potassium in the Melvin Group. On the average the soil groups followed the same trend in potassium level as in phosphorus level but the difference between the three levels was much less.

The majority of the acreage within each soil group tested between 5.6 and 6.5 in pH. There was some variation among soil groups as to the acreage percentage testing below 5.6 and from 5.6 to 6.5. However, only a very small percentage of the acreage tested above 6.5 in any soil group.

The main conclusion that can be drawn from the soil test data is that a large proportion of the soils of the Sequatchie Valley are low or medium in phosphorus, potassium and pH. These data indicate that phosphorus is more deficient than potassium in all soils sampled. It is evident from the results that soil group cannot be used as a predictor of fertility level. Past cropping history and fertility use may have a greater influence on fertility level than the natural fertility of the soils.

Estimated Net Returns from Crops Across all Soil Groups

The estimated net returns per acre from crops across soil groups, on three farm sizes and at three levels of initial

fertility, is presented in Tables 9 through 18. For all crops, the net income per acre increased as the level of initial fertility increased. There was some variation in the amount of increase among the various crops. Most crops showed a greater increase in net income per acre from a low to medium level of initial fertility than from a medium to high level of fertility. The greatest increase in net income per acre with an increase in initial fertility level was obtained with alfalfa and the least with lespedeza. This points out the fact that the relationship between net income and fertility level of the soil is related to the fertility requirements of the crop. Crops with a low fertility requirement do not result in as great a change in net income per acre with a change in initial fertility level as do crops with a high fertility requirement.

For all crops the net income per acre was greater on the medium size farm than on the small farm. This was due to more efficient use of machinery assumed owned on these two farm sizes. All crops did not follow the same trend from the medium size to the large size farm. The net income per acre remained about the same for most annual crops except corn. Corn and the perennial hay crops resulted in a decrease in net income per acre from the medium size farm to the large size farm. Some harvesting equipment was assumed owned on the large farm, whereas, the crops were considered to be custom harvested on the other size farms.

TABLE 9. Net income (dollars per acre) from corn across soil groups
on three farm sizes at three soil test levels

Soil Group	Farm Size								
	Small			Medium			Large		
	Low	Med.	High	Low	Med.	High	Low	Med.	High
Huntington	57	61	64	67	71	74	63	68	70
Etowah	31	35	38	40	44	47	37	41	44
Cumberland	19	24	27	29	33	36	25	29	32
Fullerton Cherty	13	18	20	22	26	29	18	23	25
Talbott	12	16	19	21	25	28	17	22	24
Clarksville Cherty ^a									
Lindside	52	56	59	61	65	68	58	62	65
Capshaw	21	25	28	30	34	37	26	30	33
Taft	10	14	17	19	23	26	15	19	22
Melvin	10	14	17	19	23	26	15	19	22

^aNot suited.

TABLE 10. Net income (dollars per acre) from soybeans across soil groups on three farm sizes at three soil test levels

Soil Group	Farm Size											
	Small			Medium						Large		
	Low	Med.	High	Low	Med.	High	Low	Med.	High	Low	Med.	High
Huntigton	33	37	41	40	44	48	41	45	49	41	45	49
Etowah	29	33	37	35	40	44	37	41	45	37	41	45
Cumberland	19	23	27	26	30	34	27	31	35	27	31	35
Fullerton Cherty	4	9	13	11	15	19	12	16	21	12	16	21
Talbott	-1	4	8	6	10	14	7	11	16	7	11	16
Clarksville Cherty ^a												
Lindside	33	37	41	40	44	48	41	45	49	41	45	49
Capshaw	21	26	30	28	32	37	29	34	38	29	34	38
Taft	24	28	32	31	35	39	32	36	40	32	36	40
Melvin	24	28	32	31	35	39	32	36	40	32	36	40

^aNot suited.

TABLE 11. Net income (dollars per acre) from wheat across soil groups
on three farm sizes at three soil test levels

Soil Group	Farm Size								
	Small			Medium			Large		
	Low	Med.	High	Low	Med.	High	Low	Med.	High
Hantington	41	45	48	45	49	52	46	50	53
Etowah	46	50	53	50	54	57	51	55	58
Cumberland	46	50	53	50	54	57	51	55	58
Fullerton Cherty	30	34	37	34	38	41	35	39	42
Talbott	30	34	37	34	38	41	35	39	42
Clarksville Cherty ^a									
Lindside	26	30	33	30	34	37	30	35	38
Capshaw	38	43	45	43	47	50	43	48	50
Taft	15	19	22	19	23	26	19	24	26
Melvin	4	8	11	8	12	15	8	13	16

^aNot suited.

TABLE 12. Net income (dollars per acre) from oats across soil groups
on three farm sizes at three soil test levels

Soil Group	Farm Size											
	Small			Medium						Large		
	Low	Med.	High	Low	Med.	High	Low	Med.	High	Low	Med.	High
Huntington	19	23	26	23	28	30	24	28	31	24	28	31
Etowah	23	27	30	27	31	34	27	32	34	27	32	34
Cumberland	23	27	30	27	31	34	27	32	34	27	32	34
Fullerton Cherty	12	17	20	17	21	24	17	21	24	17	21	24
Talbott	12	16	19	16	20	23	16	20	23	16	20	23
Clarksville Cherty ^a												
Lindside	9	13	16	13	17	20	13	17	20	13	17	20
Capshaw	18	22	25	22	26	29	22	26	29	22	26	29
Taft	2	6	9	6	10	13	6	10	13	6	10	13
Melvin	-5	-2	1	-2	2	5	-2	2	5	-2	2	5

^aNot suited.

TABLE 13. Net income (dollars per acre) from alfalfa hay across soil groups on three farm sizes at three soil test levels

Soil Group	Farm Size								
	Small			Medium			Large		
	Low	Med.	High	Low	Med.	High	Low	Med.	High
Huntington	17	25	30	23	31	37	18	26	32
Etowah	28	34	39	34	40	45	29	35	40
Cumberland	28	34	39	34	40	45	29	35	40
Fullerton Cherty	11	18	23	18	24	28	12	18	23
Talbott	4	10	15	10	16	21	4	10	15
Clarksville Cherty ^a									
Lindside ^a									
Capshaw	3	10	19	9	16	25	3	11	19
Taft ^a									
Melvin ^a									

^aNot suited.

TABLE 14. Net income (dollars per acre) from red clover-orchardgrass hay across soil groups on three farm sizes at three soil test levels

Soil Group	Farm Size									
	Small			Medium			Large			
	Low	Med.	High	Low	Med.	High	Low	Med.	High	
Huntington	26	30	35	31	36	41	31	36	41	
Etowah	20	25	30	25	30	35	25	30	35	
Cumberland	17	21	26	22	26	31	21	26	31	
Fullerton Cherty	15	19	24	20	24	29	19	24	29	
Talbott	4	8	13	8	13	18	7	12	17	
Clarksville Cherty ^a										
Lindside	20	25	30	25	30	35	25	30	35	
Capshaw	11	16	21	16	20	25	15	20	25	
Taft	-4	1	6	1	6	11	1	4	9	
Melvin ^a										

^aNot suited.

TABLE 15. Net income (dollars per acre) from lespodeza hay across soil groups on three farm sizes at three soil test levels

Soil Group	Farm Size											
	Small			Medium						Large		
				Soil Test Level								
	Low	Med.	High	Low	Med.	High	Low	Med.	High	Low	Med.	High
Huntington	19	22	25	22	25	28	23	26	28	23	26	28
Etowah	12	14	17	15	18	20	15	18	21	15	18	21
Cumberland	10	12	15	13	16	18	13	15	18	13	15	18
Fullerton Cherty	4	7	10	7	10	13	7	10	12	7	10	12
Talbott	-2	1	4	1	4	7	1	4	6	1	4	6
Clarksville Cherty ^a												
Lindside	19	22	25	23	25	28	23	26	28	23	26	28
Capshaw	10	12	15	13	16	18	13	15	18	13	15	18
Taft	7	9	12	10	12	15	9	12	15	9	12	15
Melvin	12	15	18	15	18	21	15	18	21	15	18	21

^aNot suited.

TABLE 16. Net income (dollars per acre) from fescue-ladino hay across soil groups on three farm sizes at three soil test levels

Soil Group	Farm Size											
	Small			Medium						Large		
	Low	Med.	High	Low	Med.	High	Low	Med.	High	Low	Med.	High
Huntington	20	23	27	26	29	33	22	25	29			
Etowah	13	16	20	19	22	21	15	18	21			
Cumberland	10	13	17	16	19	23	11	15	18			
Fullerton Cherty	9	12	16	15	18	32	10	13	17			
Talbott	1	4	8	7	10	14	1	4	8			
Clarksville Cherty	-8	-4	1	-1	2	5	-8	-5	-1			
Lindside	14	17	21	20	24	27	16	19	23			
Capshaw	7	10	14	13	16	20	8	11	15			
Taft	5	8	12	11	14	18	6	9	13			
Melvin	7	10	14	13	16	20	8	11	15			

TABLE 17. Net income (dollars per acre) from orchardgrass-ladino hay across soil groups on three farm sizes at three soil test levels

Soil Group	Farm Size								
	Small			Medium			Large		
	Low	Med.	High	Low	Med.	High	Low	Med.	High
Huntington	35	39	43	41	45	49	37	41	45
Etowah	25	29	33	32	35	39	27	31	35
Cumberland	22	26	30	28	32	36	23	27	31
Fullerton Cherty	18	22	27	24	28	33	19	23	28
Talbott	5	10	16	11	16	22	5	10	16
Clarksville Cherty ^a									
Lindside	25	29	34	32	37	40	27	31	36
Capshaw	16	20	24	22	26	30	17	21	25
Taft	12	17	23	18	23	29	13	18	24
Melvin	14	19	25	20	25	31	13	18	23

^aNot suited.

TABLE 18. Net income (dollars per acre) from sudangrass hay across soil groups on three farm sizes at three soil test levels

Soil Group	Farm Size								
	Small			Medium			Large		
	Low	Med.	High	Low	Med.	High	Low	Med.	High
Huntington	27	29	32	32	34	37	32	35	37
Etowah	14	16	19	18	21	24	18	21	23
Cumberland	8	11	13	13	15	18	12	15	17
Fullerton Cherty	2	5	8	7	10	13	6	9	11
Talbott ^a									
Clarksville Cherty ^a									
Lindside	25	27	30	30	32	35	30	33	35
Capshaw	8	11	13	13	15	18	12	15	18
Taft	8	11	13	13	15	18	12	15	18
Melvin	19	22	25	24	27	30	24	27	30

^aNot suited.

The cost for the large farm may also be somewhat misleading in that they represent costs for a farm of approximately 180 to 250 acres. This would indicate that maximum efficiency was not obtained from the machinery. The per unit cost for a farm larger than this would probably be less and thus the decrease in net income per acre probably would not occur as indicated in this study.

Although both farm size and fertility level resulted in a difference in net income per acre from a crop on the various soil groups, the greatest differences in net income per acre for a particular crop occurred among the soil groups. These differences in net income per acre for the various crops were due to the physical properties of the soils in each soil group.

The profitability of the warm season crops such as corn, soybeans, lespedeza and sudangrass was greatly influenced by the moisture supplying capacity of the soils. The net return per acre from corn and soybeans declined 44 and 28 dollars, respectively, from the Huntington and Fullerton Cherty Group. Because these crops grow during the summer when moisture is limited, the moisture relationship of the soil is of vital importance in determining yields which effect net return. The net return for warm season crops decreased as the moisture-supplying capacity of the soil decreased.

Moisture supplying capacity of the soil did not have as great an influence on net income per acre for the cool season crops. This was due to the fact that these crops grow during the time of year when moisture is usually not a limiting factor. For these crops, other physical properties such as internal and surface drainage seem to exert the greatest influence on net income. Comparing the net return per acre from small grains on the Huntington and Fullerton Cherty Group the difference was only 10 dollars per acre. This is considerably less reduction in net return from small grain as compared with the warm season crops. There was a considerable difference in net income from small grain on the well drained soil groups as compared with the poorly drained soil groups. This indicates that excessive moisture is more likely to be a problem on cool season crops than lack of moisture.

These results seem to indicate that the most important factor in determining net income from a particular crop on a soil are the physical properties of the soil and the ability of the crop in question to produce on them.

Estimated Net Returns from Crops within Soil Groups

The estimated returns from crops within soil groups, on three farm sizes and at three levels of initial fertility, are presented in Tables 19 through 27. Although fertility level and farm size resulted in differences in net income, there was

TABLE 19. Net income (dollars per acre) from all crops on Huntington soil group
on three farm sizes at three soil test levels

Crop	Farm Size								
	Small			Medium			Large		
	Low	Med.	High	Low	Med.	High	Low	Med.	High
Corn	57	61	64	67	71	74	63	67	70
Soybeans	33	37	41	40	44	48	41	45	49
Wheat	41	45	48	45	49	52	46	50	53
Oats	19	23	26	23	28	30	24	28	31
Alfalfa	17	25	30	23	31	37	18	26	32
Red Clover-Orchardgrass	26	30	35	31	36	41	31	36	41
Lespedeza	19	22	25	22	25	28	23	26	28
Fescue-Ladino	20	23	27	26	29	33	22	25	29
Orchardgrass-Ladino	35	39	43	41	45	49	37	41	45
Sudangrass	27	29	32	32	34	37	32	35	37

TABLE 20. Net income (dollars per acre) from all crops on Etowah soil group
on three farm sizes at three soil test levels

Crop	Farm Size								
	Small			Medium			Large		
	Low	Med.	High	Low	Med.	High	Low	Med.	High
Corn	31	35	38	40	44	47	37	41	44
Soybeans	29	33	37	35	40	44	37	41	45
Wheat	46	50	53	50	54	57	51	55	58
Oats	23	27	30	27	31	34	27	31	34
Alfalfa	28	34	39	34	40	45	29	35	40
Red Clover-Orchardgrass	20	25	30	25	30	35	25	30	35
Lespedeza	12	14	17	15	18	20	15	18	21
Pescue-Ladino	13	16	20	19	22	26	14	18	21
Orchardgrass-Ladino	25	29	33	32	35	39	27	31	35
Sudangrass	14	16	19	18	21	24	18	21	23

TABLE 21. Net income (dollars per acre) from all crops on Cumberland soil group
on three farm sizes at three soil test levels

Crop	Farm Size								
	Small			Medium			Large		
				Soil Test Level					
	Low	Med.	High	Low	Med.	High	Low	Med.	High
Corn	19	24	26	29	33	36	25	29	32
Soybeans	19	23	27	26	30	34	27	31	35
Wheat	46	50	53	50	54	57	51	55	58
Oats	23	27	30	27	31	34	27	32	34
Alfalfa	28	34	39	34	40	45	29	35	40
Red Clover-Orchardgrass	17	21	26	22	26	31	21	26	31
Lespedeza	10	12	15	13	16	18	13	15	18
Fescue-Ladino	10	13	17	16	19	23	11	15	18
Orchardgrass-Ladino	22	26	30	28	32	36	23	27	31
Sudangrass	8	11	13	13	15	18	12	15	17

TABLE 22. Net income (dollars per acre) from all crops on Fullerton cherty soil group on three farm sizes at three soil test levels

Crop	Farm Size								
	Small			Medium			Large		
				Soil Test Level					
	Low	Med.	High	Low	Med.	High	Low	Med.	High
Corn	13	18	20	22	26	29	18	23	25
Soybeans	4	9	13	11	15	19	12	16	21
Wheat	30	34	37	34	38	41	35	39	42
Oats	12	17	20	17	21	24	17	21	24
Alfalfa	11	18	23	17	24	28	12	18	23
Red Clover-Orchardgrass	15	19	24	20	24	29	19	24	29
Lespedeza	4	7	10	7	10	13	7	10	12
Pescue-Ladino	9	12	16	15	18	22	10	13	17
Orchardgrass-Ladino	18	22	27	24	28	33	19	23	28
Sudangrass	2	5	8	7	10	13	6	9	11

TABLE 23. Net income (dollars per acre) from all crops on Talbott soil group
on three farm sizes at three soil test levels

Crop	Farm Size											
	Small			Medium						Large		
				Soil Test Level								
	Low	Med.	High	Low	Med.	High	Low	Med.	High	Low	Med.	High
Corn	12	16	19	21	25	28	17	22	24			
Soybeans	-1	4	8	6	10	14	7	11	16			
Wheat	30	34	37	34	38	41	35	39	42			
Oats	12	16	19	16	20	23	16	20	23			
Alfalfa	4	10	15	10	16	21	4	10	15			
Red Clover-Orchardgrass	4	8	13	8	13	18	7	12	17			
Lespedeza	-2	1	4	1	4	7	1	4	6			
Pescue-Ladino	1	4	8	7	10	14	1	4	8			
Orchardgrass-Ladino	5	10	16	11	16	22	5	10	16			
Sudangrass ^a												

^aNot suited.

TABLE 24. Net income (dollars per acre) from all crops on Lindside soil group
on three farm sizes at three soil test levels

Crop	Farm Size								
	Small			Medium			Large		
				Soil Test Level					
	Low	Med.	High	Low	Med.	High	Low	Med.	High
Corn	52	56	59	61	65	68	58	62	65
Soybeans	33	37	41	40	44	48	41	45	49
Wheat	26	30	33	30	34	37	30	35	38
Oats	9	13	16	13	17	20	13	18	20
Alfalfa ^a									
Red Clover-Orchardgrass	20	25	30	25	30	35	25	30	35
Lespedeza	19	22	25	23	25	28	23	26	28
Fescue-Ladino	14	17	21	20	24	27	16	19	23
Orchardgrass-Ladino	25	29	34	32	36	40	27	31	36
Sudangrass	25	27	30	30	32	35	30	33	35

^aNot suited.

TABLE 25. Net income (dollars per acre) from all crops on Capshaw soil group
on three farm sizes at three soil test levels

Crop	Farm Size											
	Small			Medium						Large		
				Soil Test Level								
	Low	Med.	High	Low	Med.	High	Low	Med.	High	Low	Med.	High
Corn	21	25	28	30	34	37	26	30	33			
Soybeans	21	26	30	28	32	37	29	34	38			
Wheat	38	43	45	43	47	50	43	48	50			
Oats	18	22	25	22	26	29	22	26	29			
Alfalfa	3	10	19	9	16	25	4	11	19			
Red Clover-Orchardgrass	11	16	21	16	20	25	15	20	25			
Lespedeza	10	12	15	13	16	18	13	15	18			
Fescue-Ladino	7	10	14	13	16	20	8	11	15			
Orchardgrass-Ladino	16	20	24	22	26	30	17	21	25			
Sudangrass	8	11	13	13	15	18	12	15	17			

TABLE 26. Net income (dollars per acre) from all crops on Taft soil group
on three farm sizes at three soil test levels

Crop	Farm Size								
	Small			Medium			Large		
	Low	Med.	High	Low	Med.	High	Low	Med.	High
Corn	10	14	17	19	23	26	15	19	22
Soybeans	24	28	32	31	35	39	32	36	40
Wheat	15	19	22	19	23	26	19	24	26
Oats	2	6	9	6	10	13	6	10	13
Alfalfa ^a									
Red Clover-Orchardgrass	-4	1	6	1	6	11	-1	4	9
Lespedeza	7	9	12	10	12	15	9	12	15
Fescue-Ladino	5	8	12	11	14	18	6	9	13
Orchardgrass-Ladino	12	17	23	18	23	29	13	18	24
Sudangrass	8	11	13	13	15	18	12	15	17

^aNot suited.

TABLE 27. Net income (dollars per acre) from all crops on Melvin soil group
on three farm sizes at three soil test levels

Crop	Farm Size								
	Small			Medium			Large		
				Soil Test Level					
	Low	Med.	High	Low	Med.	High	Low	Med.	High
Corn	10	14	17	19	23	26	15	19	22
Soybeans	24	28	32	31	35	39	32	36	40
Wheat	4	8	11	8	12	15	8	13	16
Oats	-5	-2	1	-2	2	5	-2	2	5
Alfalfa ^a									
Red Clover-Orchardgrass ^a									
Lespedeza	12	15	18	15	18	21	15	18	21
Pescue-Ladino	7	10	14	13	16	20	8	11	15
Orchardgrass-Ladino	14	19	25	20	25	31	13	18	23
Sudangrass	19	22	25	24	27	30	24	27	29

^aNot suited.

no change in allocation due to these two factors. Corn resulted in the highest net income per acre on the Huntington and Lindside Groups. Wheat was the most profitable on the Etowah, Cumberland, Fullerton Cherty, Talbott and Capshaw Groups. Soybeans were the most profitable crop on the Taft and Melvin Groups.

Wheat proved to be the most profitable crop on all the upland soil groups due in part to the income attributed to the straw. In some instances a market for the straw might not be available which would reduce the value of this crop considerably. Also, wheat is an allotted crop which means that these soil groups cannot be utilized completely by wheat on all farms. Therefore, in some instances it would be necessary to consider the second most profitable crop for these soil groups. In this case corn would become the most profitable crop on the Etowah, Talbott and Capshaw Groups; alfalfa the most profitable crop on the Cumberland Group; and orchardgrass-ladino the most profitable crop on the Fullerton Cherty Group.

Within a soil group fertility level had an influence on the profitability of certain crops. For instance, on the Huntington Group at a low level of initial fertility lespedeza was more profitable than alfalfa on the small and large farm. This same relationship was true on the Huntington and Fullerton Cherty Groups for oats and alfalfa. At a low level of initial fertility oats was the most profitable; whereas, alfalfa was the most profitable at a medium or high level of initial fertility.

Although fertility level of the soil did not result in a change of allocation of crops, the difference in net income for certain crops within a soil group is important. If the alternative choices were less, such as a choice between two hay crops, this fact might become more significant especially in the short run. The fact that some crops have a higher fertility requirement than others might make them less profitable and thus not as desirable especially when maximum income is the sole objective in the selection of a crop or crops to produce.

As mentioned previously the physical properties of a soil group are the most important factors in determining the most profitable crops for a soil group. An increase in farm size resulted in a difference of from 3 to 9 dollars in net income per acre depending on the crop. Fertility level resulted in a difference of from 3 to 14 dollars in net income per acre depending on the crop. The difference in net income from the highest per acre value crop and the lowest per acre value crop within a soil group varied depending on the productive capacity of the soil, but in all instances the difference was great. The greatest difference in net income occurred on the Huntington Group where there was a difference of about 43 dollars in net income per acre from corn, the highest value crop, and lespedeza, the lowest value crop, on that soil group. The difference in net income per acre from the various crops on the other soil

groups ranged from 28 to 40 dollars. This indicates that a large amount of income per acre can be lost by the mis-allocation of crops to soils. It is also evident that matching crops to soils is necessary before any of the other management factors can be used to best advantage.

Effect of Erosion Restriction on Net Income

The data presented in Table 28 compares the net income per acre from the most profitable crop on a soil group without regard to soil loss, with net income from a crop or cropping system that would keep soil loss within the tolerance level. As would be expected the crop or cropping system necessary to keep soil loss within the tolerance level resulted in a reduction in net income per acre.

For the Etowah and Capshaw Groups wheat, the most profitable crop of those considered, can be grown continuously without impairing their productivity due to soil loss. In the case of the Capshaw Group it would probably be necessary to overseed the wheat with lespedeza to keep soil loss within the tolerance. It was assumed that the extra income from the hay would balance out the expense of seeding the lespedeza thus resulting in approximately the same net income.

The difference in net income per acre from a crop with and without regard to soil loss varied from a high of 22 dollars on the Talbott Group to a low of 10 dollars on the Fullerton

TABLE 28. Soil loss estimates and income differences between continuous wheat and other cropping systems

Soil Group	Crop	Soil Loss Tolerance (tons)	Actual Soil Loss (tons)	Necessary Cropping System ^a	Net Return Without Erosion Restriction	Net Return With Erosion Restriction	Difference
Etowah	Wheat	4	5	Wheat continuous	\$54	\$54	\$ 0
Cumberland	Wheat	4	18	Wheat M-M-M Alfalfa continuous	54 54	37 40	17 14
Fullerton Cherty	Wheat	3	25	Meadow continuous	38	28	10
Talbott	Wheat	2	20	Meadow continuous	38	16	22
Clarksville Cherty	Fescue-Ladino	2	2	Meadow continuous	5	5	0
Capshaw	Wheat	3	5	Wheat continuous overseed with annual lespedeza	47	47	0

^a Necessary cropping system refers to a cropping system that will maintain soil loss within the tolerance level.

Cherty Group. This is a large difference in income per acre, but with a much greater soil loss using the more profitable crop productivity would decrease and the difference in net income per acre would decline rapidly with time. With an annual soil loss of 20 tons per acre on the Talbott Group, it is not hard to visualize that the productive capacity of this soil would decline to an extent where it would be difficult to produce any crop profitably.

These results seem to indicate that row crops, which result in excessive erosion, are most profitable on soils with little or no slope. Hay and pasture crops competed favorably with the row crops on sloping land and at the same time held soil loss within the tolerance (see Tables 19 through 27, pages 41 through 49). Wheat proved to be the most profitable crop on the sloping soils, but there may be some question as to the validity of placing as much value on the straw as was done in this study. Without the income from the straw, corn, alfalfa, or orchardgrass-ladino would have been the most profitable crop on the sloping soils. This would indicate that row crops, which are presently being grown on sloping land, may not be the most profitable from either a net income or soil loss basis in many cases. It is recognized that each situation is unique and many different factors play a part in the decision to grow a particular crop on a particular soil. However, it seems likely that some

present systems of production should be re-evaluated in light of this data to determine if growing row crops on sloping land is actually the most profitable alternative available.

Of the crops considered in this study, corn and soybeans are the most critical from a soil loss standpoint on sloping land. These crops are also the most frequently grown for cash crops. For this reason the necessary cropping systems to hold soil loss within the tolerance level on the soil groups where erosion would be a problem are presented in Table 29.

As would be expected, the larger tolerance level resulted in a more intensive row cropping system. For all soil groups where corn or soybeans could be grown, the cropping system was shortened one year using the larger tolerance value. This means that a farmer could grow corn or soybeans more often on the particular soil group in question if he is willing to accept the larger soil tolerance level. In some instances the larger tolerance level may be a more practical figure than the smaller one. Here again it depends on the objectives of the particular person involved.

Because corn or soybeans do not represent the most profitable crop of those considered for these soil groups, the difference in net income from the two systems is not given. This information can be derived by looking up the net return from the particular meadow selected on each soil group.

TABLE 29. Necessary cropping systems for corn and soybeans at two soil loss tolerance levels

Soil Group	Soil Loss Tolerance		Necessary Cropping System for A ^a	Necessary Cropping System for B ^a
	A	B		
Etowah	4	8	Corn--small grain--M-M	Corn--small grain over-seeded with lespedeza
Cumberland	3	6	Corn--small grain--M-M-M-M	Corn--small grain--M-M-M
Fullerton Cherty	3	6	Continuous meadow (hay or pasture)	Corn--small grain--M-M-M-M
Talbott	2	4	Continuous meadow (hay or pasture)	Small grain--M-M-M
Capshaw	3	6	Corn--small grain--M-M	Corn--small grain over-seeded with lespedeza

^aCorn is used as the example in each cropping system. The same system would apply for soybeans.

For the Talbott Group no cropping system including corn or soybeans can be grown and maintain either soil loss tolerance level. For the Fullerton Cherty Group no cropping system including corn or soybeans can be grown and maintain the lower soil loss tolerance level. This indicates that some soils may not be suited for row crops under any circumstances considering the profitability and soil loss criteria.

Gross Income of Crops Across Soil Groups

Gross income per acre for the crops under consideration in this study is presented in Table 30. For all soil groups except one, the crop with the highest gross income per acre also was the crop with the highest net income per acre. On the Melvin Group, sudangrass resulted in the highest gross income per acre; whereas, soybeans were the most profitable from the standpoint of net income per acre. However, it should be pointed out that the difference in gross income per acre between sudangrass and soybeans was small.

These data suggest that for the crops considered gross income can be used as a first approximation at determining the most profitable crop for a particular soil. This is not to suggest that gross income be used as the sole criterion for allocation of crops to soils, but only as one of several guidelines. It does suggest that if gross income can be used with

TABLE 30. Gross income (dollars per acre) from all crops across soil groups

Crop	Hunt- ington	Etowah	Cumber- land	Fuller- ton Cherty	Tal- bott Cherty	Clarks- ville Cherty	Lind- side	Capshaw	Taft	Melvin
Corn	115	85	73	64	63	a	110	74	60	60
Soybeans	75	67	57	42	37	a	75	60	62	62
Wheat	89	94	94	76	76	a	81	87	59	48
Oats	61	65	65	54	53	a	50	60	41	33
Alfalfa	84	93	93	72	63	a	a	69	a	a
Red Clover- Orchardgrass	70	62	57	55	44	a	62	50	30	a
Lespedeza	50	40	37	30	22	a	50	37	32	40
Fescue-Ladino	68	58	54	52	38	24	60	50	46	50
Orchardgrass- Ladino	85	72	67	65	47	a	75	62	57	62
Sudangrass	75	57	42	42	30	a	72	47	30	65

^aNot suited.

some degree of accuracy it would simplify the problem of selecting most profitable crops for particular soils in many instances.

CHAPTER IV

SUMMARY AND CONCLUSIONS

A ten percent sample of the farms in the Sequatchie Valley were randomly selected for this study. The soils on these farms were combined on the basis of their physical properties into groups that would have similar yield potential. All soil groups were sampled and tested for phosphorus, potassium and pH.

Long term yield data for the crops under consideration in this study were summarized on soils that were representative of each soil group. Yield estimates based on these data were then derived for each crop on each soil group. A means for calculating variation in yield due to slope and erosion was also determined for each soil group.

Budgeting analysis was used to determine the most profitable crop for each soil group. Three farm sizes and three soil test levels were considered in the analysis to determine the effect of these variables on net income per acre. Certain soil loss tolerance levels were established for each soil group and an analysis was made to determine if the most profitable crop derived on the basis of net income would hold soil loss within the tolerance level.

A gross income comparison for each crop on each soil group was made to determine if the crop with the highest gross income corresponded to the most profitable crop derived on a net income basis.

The results of the soil test data indicate that most soils of the Sequatchie Valley are low or medium in phosphorus, potassium and pH. All soil groups tended to be more deficient in phosphorus than potassium. Most of the soil groups tested between 5.6 and 6.5 in pH. Only a small percentage of the acreage tested above 6.5 for any soil group.

Of the crops considered in this study, corn resulted in the highest net income per acre on the Huntington and Lindsides Groups. Wheat was the most profitable on the Etowah, Cumberland, Fullerton Cherty, Talbott and Capshaw Groups. The most profitable crop on the Taft and Melvin Groups was soybeans.

Differences in farm size and soil test level did not result in a change of the most profitable crop on any soil group; however, they did have an effect on the net income per acre. There was an increase of from 3 to 9 dollars in net income per acre from the various crops on the medium size farm as compared to the small farm. There was very little difference in net income per acre on the medium and large size farms. For some crops the net income per acre on the large farm was slightly less than that on the medium size farm.

Net income per acre for all crops increased as the soil test level increased. Crops with a high fertility requirement, like alfalfa, resulted in a large increase in net income per acre from a low to high soil test level. On the other hand, there was very little difference in net income per acre at a low and high soil test level for lespedeza. These results indicate that soil-crop suitability is more important from a standpoint of net income per acre than either farm size or soil test level.

In this analysis, wheat proved to be the most profitable crop on all the soil groups where erosion would be a problem. For the Etowah and Capshaw Groups, wheat could be grown continuously without excessive soil loss. For the other soil groups, one or more years of meadow was necessary as part of the cropping system to keep soil loss within the tolerance. The crop or cropping system necessary to keep soil loss within the tolerance level reduced current net income per acre on these soil groups.

For all soil groups except Melvin, the crop that resulted in the highest net income per acre was also the crop that resulted in the highest gross income per acre. This seems to indicate that gross income can be used as a first approximation at determining the most profitable crop for a particular soil.

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LITERATURE CITED

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APPENDIX A

TABLE 31. Long term corn yields (bushels per acre) summarized by soils including yields from 1954 through 1964

Soil	Years											
	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	Average
Cumberland ^a	54.5	87.5	65.1	56.7	86.7	77.6	83.1	77.0				73.4
Dickson ^a	25.6	71.4	63.3	107.8	92.4	80.7	105.8					78.1
Hartsells ^a	22.2	70.6	69.7									54.1
Hartsells ^b	19.5	62.2	58.8	107.8	69.8	139.8	130.4	126.0	110.4	162.2		98.7
Huntington ^c			149.0	121.7	143.0	148.5	132.7	118.6	111.4	122.4	109.0	128.5
Etowah ^c			115.5	75.0		121.5	100.6	101.2	104.4	100.7	88.0	100.9
Fullerton ^c			91.0	65.0	98.0	74.0	88.3	97.4	97.2	110.6	102.5	91.5

^aLong (12).

^bParks (13).

^cRice (unpublished data).

TABLE 32. Long term variety trial corn yields (bushels per acre) summarized by soils including yields from 1954 through 1964

Soil	Years											Average
	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	
Ennis ^a		122	104	131	180	151	158	151	124	128	99	134.8
Hartsells ^a	30	81	118	104	149	129	122	115	67	139		105.4
Linside ^a	58					107	142		149	130		117.2
Loring ^a	18	97	68	112	85	124	80	104	88	81		85.7
Maury ^a	21	53	67	78	122	96	97	93	99	119		84.5
Sequatchie ^a	81	69	87	64	113	114	99	125	103	69		92.4
Waynesboro ^a		59	83	99	169			133				108.6

^aGibson (2), (3) and (4); Graves (5), (6), (7), (8), (9) and (10); Shelby (14) and (15).

TABLE 33. Long term soybean yields (bushels per acre) summarized by soils including yields from 1955 through 1964

Soil	Years										Average
	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	
Maury ^a	28	29	27	44	51	27	20	30	20	30.7	
Loring ^b					29.4	32.6	40.0	31.8	28.1	32.4	
Tunica ^b					43.7	41.1	43.0			42.6	
Dexter ^b					23.6	21.8	30.6	10.8		21.7	
Hatchie ^b							36.8	17.5	33.5	29.3	
Calloway ^b							29.0	17.2	20.0	22.1	
Grenada ^b							28.8	17.2	26.9	24.3	
Memphis ^c							36.6	27.5	34.9	33.0	
Henry ^d					28.9	27.8				28.3	
Collins ^d					30.3	30.1				30.2	
Grenada ^d					31.9	35.3				33.6	
Collins ^e								38.4	34.7	36.5	
Grenada ^e								28.2	37.0	32.6	
Henry ^e								31.7	30.3	31.0	

^aGibson (3) and (4); Graves (6), (7), (8), (9) and (10); Shelby (14) and (15).

^bLong (unpublished data).

^cParks (unpublished data).

^dMcCutchen (unpublished data).

^eRice (unpublished data).

TABLE 34. Long term alfalfa yields (tons per acre) summarized by soils including yields from 1954 through 1964

Soil	Years											Average
	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	
Cumberland ^a	2.25	2.47	3.17	3.20	3.12	4.03	2.61	3.10	4.39	5.12		3.35
Hartsell ^a	2.59	1.84		2.91	2.75	3.07	1.21	4.26	2.56	2.07		2.58
Memphis ^a	5.27	6.19	5.31	4.55	4.06	5.75	5.78	6.55	3.91	4.16		5.15
Waynesboro ^a	2.54	1.23		1.81	4.24	3.42	3.74		3.07	5.97		3.25
Dickson ^a	3.11			2.62	4.36	4.16	4.36					3.72
Bewleyville ^a								2.05	3.02	5.29	3.16	3.38
Maury ^b	3.81	4.03	5.32	4.62	3.85	4.56	3.72	4.09	3.98	5.79	5.11	4.44
Memphis ^b		4.58	3.73	4.89	3.81							4.25

^aGibson (2), (3) and (4); Graves (6), (7), (8), (9) and (10); Shelby (14) and (15).

^bParks (unpublished data).

TABLE 35. Long term wheat yields (bushels per acre) summarized by soils including yields from 1954 through 1963

Soil	Years											Average
	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963		
Cumberland ^a	58	56	64	43	57	40	54	43	29	43	48.7	
Cumberland ^a	51	17	54	34	42	32		56		59	43.1	
Dickson ^a	49	47	69	48	37	48	66	53	46	49	51.2	
Grenada ^a		20	71	40	55	40	60	52	42	37	46.3	
Hartsells ^a	42	37	47	33	45	42	45	55	53	55	45.4	
Maury ^a	51	53	77	36	48	51	53	40	43	53	50.5	
Cumberland ^b	40	44	53	29	33	43	25	49			39.5	
Dickson	41	30	60	36	36	46	37				40.8	
Hartsells ^b	28	26	29	26	22	36	39	42	12	21	28.1	
Maury ^c	45	32	56	42							43.7	
Memphis ^c		39	39	19	35						33.0	
Dickson					24	32	22	31	28	28	27.5	

^aGibson (2), (3) and (4); Graves (6), (7), (8) and (9); Shelby (14) and (15).

^bLong (12).

^cParks (unpublished data).

TABLE 36. Long term barley yields (bushels per acre) summarized by soil
including yields from 1954 through 1963

Soil	Years										Average
	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	
Cumberland ^a	79	54	89	54	79	64	42	53	44	41	59.9
Cumberland ^a	61	36	60	33	40	63		74		45	51.5
Dickson ^a	38	57	89	61	72	81	94	82	59	69	70.2
Grenada ^a	78	36	111	63	52	68	72	79	58	39	65.6
Hartsells ^a		29	59	40		54	84	70	64	67	58.4
Maury ^a	66	34	102	50	70	53	79	76	72	66	66.8

^aGibson (2), (3) and (4); Graves (6), (7), (8), (9) and (10); Shelby (14) and (15).

TABLE 37. Long term oat yields (bushels per acre) summarized by soils including yields from 1954 through 1963

Soil	Years											Average
	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963		
Cumberland ^a	120	68	90	31	83	38	82	71	41	29	65.3	
Cumberland ^a	80	97	108	46	62	79		90			81.1	
Dickson ^a	101	73	145	83	107	69	80	95	70	87	91.0	
Grenada ^a	83	64	139	44	90	36	103	93	78		81.1	
Hartsells ^a	51	94	56	13		58	103	75	53	94	66.3	
Maury ^a	72	108	154	70	73	41	63	63	59	80	78.3	

^aGibson (2), (3) and (4); Graves (6), (7), (8) and (9); Shelby (14) and (15).

TABLE 38. Long term sudangrass yields (tons per acre) summarized by soils
including yields from 1955 through 1964

Soil	Years										Average
	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	
Dickson ^a		5.63	3.36	3.09	3.19	3.30	2.36	2.55	3.32	2.78	3.29
Etowah ^a	2.18	2.71	1.54		2.05	2.23	8.01	2.17	1.58	1.94	2.71
Maury ^a		5.81	6.03	2.78	3.06	5.06	4.50	2.42	3.81	3.74	4.13
Grenada ^a	4.88	3.09	1.91	1.84	1.48	3.41	3.26	2.77	2.91	2.03	2.77

^aPribough (1).

APPENDIX B

TABLE 39. 1966 University of Tennessee fertilizer recommendations per acre for
nitrogen, phosphate and potash

Crop	Planting or Seeding	Nitrogen Applications		Phosphate Application when Soil Test Indicates			Potash Application when Soil Test Indicates		
		Side or Top Dressing		Low	Med.	High	Low	Med.	High
Alfalfa									
Establishment	0-15	-		120	60	30	240	190	135
Maintenance	-	0		80	45	45	240	190	135
Corn	15-30	60-90		50	30	20	50	30	20
Lespedeza	0	0		40	20	0	40	20	0
Pasture									
Establishment	30	0		120	60	30	90	60	30
Maintenance	-	0-30		45	30	0	45	30	0
Sudangrass	60	0-60		30	20	20	30	20	0
Red Clover	0-15	0		60	30	20	60	30	0
Small Grain	15-30	30		60	40	20	20	0	0
Soybeans	0	0		40	20	0	40	20	0

APPENDIX C

TABLE 40. Estimated costs and returns^a from one acre corn for grain

Item	Unit	Amount	Price	Farm Size		
				Small	Medium	Large
Receipts						
Corn	bu.	105	1.10	115.50	115.50	115.50
Variable Expense						
Seed	lb.	9	.18	1.62	1.62	1.62
Fertilizer						
Nitrogen	lb.	120	.12	14.40	14.40	14.40
Phosphate	lb.	30	.08	2.40	2.40	2.40
Potash	lb.	30	.07	2.10	2.10	2.10
Lime ^b	ton	.5	5.00	2.50	2.50	2.50
Atcazine	lb.	2.5	3.00			7.50
Custom Harvest				6.00	6.00	6.00
Tractor				12.60	9.73	7.68
Other Equipment				8.12	3.63	2.12
Total Variable Expense				49.74	42.38	46.32
Fixed Expense						
Tractor				2.16	1.21	1.07
Other Equipment				2.19	.98	.57
Total Fixed Expense				4.35	2.19	1.64
Total Expense				54.09	44.57	47.96
Net Return to Land, Labor and Management				61.41	70.93	67.54

^aExpressed in dollars and cents.^bPre-emergence (atrazine) is not used on small and medium farms; instead, corn is cultivated three times.

TABLE 41. Estimated costs and returns^a from one acre soybeans for grain

Item	Unit	Amount	Price	Farm Size		
				Small	Medium	Large
Receipts						
Soybeans	bu.	30	2.40	72.00	72.00	72.00
Variable Expense						
Seed	bu.	1	4.25	4.25	4.25	4.25
Fertilizer						
Phosphate	lb.	20	.08	1.60	1.60	1.60
Potash	lb.	20	.07	1.40	1.40	1.40
Lime	ton	.5	5.00	2.50	2.50	2.50
Inoculant				.25	.25	.25
Combine	acre	1	6.50	6.50	6.50	6.50
Tractor				8.77	7.01	6.91
Other Equipment				6.44	2.93	1.94
Total Variable Expenses				31.71	26.44	25.35
Fixed Expense						
Tractor				1.63	.93	1.04
Other Equipment				1.70	.78	.51
Total Fixed Expenses				3.33	1.71	1.55
Total Expense				35.04	28.15	26.90
Net Return to Land, Labor and Management				36.96	43.85	45.10

^aExpressed in dollars and cents.

TABLE 42. Estimated costs and returns^a from one acre wheat for grain

Item	Unit	Amount	Price	Farm Size		
				Small	Medium	Large
Receipts						
Wheat grain	bu.	39	1.70	66.30	66.30	66.30
Straw	ton	1.4	20.00	28.00	28.00	28.00
Variable Expense						
Seed	bu.	2	2.50	5.20	5.20	5.20
Fertilizer						
Nitrogen	lb.	60	.12	7.20	7.20	7.20
Phosphate	lb.	40	.08	3.20	3.20	3.20
Lime	ton	.25	5.00	1.25	1.25	1.25
Combine	acre	1	6.00	6.00	6.00	6.00
Baling ^b	ton	1.4	5.00	7.00	7.00	5.60
Tractor				9.18	7.49	7.89
Other Equipment				2.91	1.42	1.49
Total Variable Expense				41.94	38.76	37.83
Fixed Expense						
Tractor				1.44	.83	.99
Other Equipment				1.04	.41	.42
Total Fixed Expense				2.48	1.24	1.41
Total Expense				44.42	40.00	39.24
Net Return to Land, Labor and Management				49.88	54.30	55.06

^aExpressed in dollars and cents.

^bRake assumed owned on large farm.

TABLE 43. Estimated costs and returns^a from one acre oats for grain

Item	Unit	Amount	Price	Farm Size		
				Small	Medium	Large
Receipts						
Oat Grain	bu.	65	.70	45.50	45.50	45.50
Straw	ton	1	20.00	20.00	20.00	20.00
Variable Expense						
Seed	bu.	2	1.40	2.80	2.80	2.80
Fertilizer						
Nitrogen	lb.	60	.12	7.20	7.20	7.20
Phosphate	lb.	40	.08	3.20	3.20	3.20
Lime	ton	.25	5.00	1.25	1.25	1.25
Combine ^b	acre	1	6.00	6.00	6.00	6.00
Baling ^b	ton	1	5.00	5.00	5.00	4.00
Tractor				7.74	6.22	6.62
Other Equipment				2.91	1.42	1.49
Total Variable Expense				36.10	33.09	32.56
Fixed Expense						
Tractor				1.44	.83	.99
Other Equipment				1.04	.41	.42
Total Fixed Expense				2.48	1.24	1.41
Total Expense				38.58	34.33	33.97
Net Return to Land, Labor and Management				26.92	31.17	31.53

^aExpressed in dollars and cents.

^bRake assumed owned on large farm.

TABLE 44. Estimated costs and returns^a from one acre alfalfa hay (6 Year life)

Item	Unit	Amount	Price	Farm Size		
				Small	Medium	Large
Receipts						
Alfalfa Hay	ton	3.1	30.00	93.00	93.00	93.00
Variable Expense						
Establishment ^b						
Seed	lb.	3.33	.45	1.50	1.50	1.50
Lime	ton	.5	5.00	2.50	2.50	2.50
Inoculant				.10	.10	.10
Fertilizer						
Nitrogen	lb.	3	.12	.36	.36	.36
Phosphate	lb.	10	.08	.80	.80	.80
Potash	lb.	32	.07	2.24	2.24	2.24
Borax	lb.	3	.06	.18	.18	.18
Maintenance ^c						
Fertilizer						
Phosphate	lb.	49	.08	3.92	3.92	3.92
Potash	lb.	131	.07	9.17	9.17	9.17
Insecticide				4.00	4.00	4.00
Baling ^d	ton	3.1	5.00	15.50	15.50	12.40
Tractor				10.86	8.97	12.15
Other Equipment				4.77	1.98	5.28
Total Variable Expense				55.90	51.22	54.60
Fixed Expense						
Tractor				1.93	1.13	1.76

TABLE 44. (continued)

Item	Unit	Amount	Price	Farm Size		
				Small	Medium	Large
Other Equipment				1.22	.51	1.39
Total Fixed Expense				3.15	1.64	3.15
Total Expense				59.05	52.86	57.75
Net Return to Land, Labor and Management				33.95	40.14	35.25

^aExpressed in dollars and cents.

^bEstablishment costs are prorated over six-year period.

^cMaintenance fertilizer prorated over six-year period.

^dRake assumed owned on large farm.

TABLE 45. Estimated costs and returns^a from one acre alfalfa hay
(4 year life)

Item	Unit	Amount	Price	Farm Size		
				Small	Medium	Large
Receipts						
Alfalfa Hay	ton	2.8	30.00	84.00	84.00	84.00
Variable Expense						
Establishment ^b						
Seed	lb.	5	.45	2.25	2.25	2.25
Lime	ton	.5	5.00	2.50	2.50	2.50
Inoculant				.12	.12	.12
Fertilizer						
Nitrogen	lb.	4	.12	.48	.48	.48
Phosphate	lb.	15	.08	1.20	1.20	1.20
Potash	lb.	45	.07	3.15	3.15	3.15
Borax ^c	lb.	4	.06	.24	.24	.24
Maintenance ^c						
Fertilizer						
Phosphate	lb.	51	.08	4.08	4.08	4.08
Potash	lb.	128.75	.07	9.01	9.01	9.01
Insecticide				4.00	4.00	4.00
Baling ^d	ton	2.8	5.00	14.00	14.00	11.20
Tractor				10.35	8.52	11.31
Other Equipment				4.77	1.98	5.28
Total Variable Expense				56.15	51.53	54.82
Fixed Expense						
Tractor				1.93	1.13	1.76

TABLE 45. (continued)

Item	Unit	Amount	Price	Farm Size		
				Small	Medium	Large
Other Equipment				1.22	.51	1.39
Total Fixed Expense				3.15	1.64	3.15
Total Expense				59.30	53.17	57.97
Net Return to Land, Labor and Management				24.70	30.83	26.03

^aExpressed in dollars and cents.

^bEstablishment costs are prorated over four-year period.

^cMaintenance fertilizer prorated over four-year period.

^dRake assumed owned on large farm.

TABLE 46. Estimated costs and returns^a from one acre alfalfa hay (3 year life)

Item	Unit	Amount	Price	Farm Size		
				Small	Medium	Large
Receipts						
Alfalfa Hay	ton	2.3	30.00	69.00	69.00	69.00
Variable Expense						
Establishment ^b						
Seed	lb.	7	.45	3.15	3.15	3.15
Lime	ton	.5	5.00	2.50	2.50	2.50
Inoculant				.16	.16	.16
Fertilizer						
Nitrogen	lb.	5	.12	.60	.60	.60
Phosphate	lb.	20	.08	1.60	1.60	1.60
Potash	lb.	63	.07	4.41	4.41	4.41
Borax	lb.	5	.06	.30	.30	.30
Maintenance ^c						
Fertilizer						
Phosphate	lb.	53	.08	4.24	4.24	4.24
Potash	lb.	126.5	.07	8.85	8.85	8.85
Insecticide				4.00	4.00	4.00
Baling ^d	ton	2.3	5.00	11.50	11.50	9.30
Tractor				9.46	7.73	10.71
Other Equipment				4.77	1.98	5.28
Total Variable Expense				55.54	51.02	55.10
Fixed Expense						
Tractor				1.93	1.13	1.76

TABLE 46. (continued)

Item	Unit	Amount	Price	Farm Size		
				Small	Medium	Large
Other Equipment				1.22	.51	1.39
Total Fixed Expense				3.15	1.64	3.15
Total Expense				58.69	52.66	58.25
Net Return to Land, Labor and Management				10.31	16.34	10.75

^aExpressed in dollars and cents.

^bEstablishment costs are prorated over three-year period.

^cMaintenance fertilizer prorated over three-year period.

^dRake assumed owned on large farm.

TABLE 47. Estimated costs and returns^a from one acre red clover-orchardgrass hay (2 year life)

Item	Unit	Amount	Price	Farm Size		
				Small	Medium	Large
Receipts						
Red Clover-Orchardgrass Hay	ton	2.8	25.00	70.00	70.00	70.00
Variable Expense ^b						
Establishment						
Seed--Red Clover	lb.	8	.45	1.80	1.80	1.80
Seed--Orchardgrass	lb.	4	.32	.64	.64	.64
Lime	ton	.5	5.00	2.50	2.50	2.50
Fertilizer						
Nitrogen	lb.	15	.12	.90	.90	.90
Phosphate	lb.	30	.08	1.20	1.20	1.20
Potash	lb.	30	.07	1.05	1.05	1.05
Maintenance						
Fertilizer						
Phosphate	lb.	30	.08	1.20	1.20	1.20
Potash	lb.	30	.07	1.05	1.05	1.05
Inoculant			.50	.25	.25	.25
Baling ^c	ton	2	5.00	14.00	14.00	11.20
Tractor				8.91	6.98	7.66
Other Equipment				3.57	1.56	2.88
Total Variable Expense				37.07	33.13	32.33
Fixed Expense						
Tractor				1.54	.86	1.08
Other Equipment				.96	.42	.78
Total Fixed Expense				2.50	1.28	1.86

TABLE 47. (continued)

Item	Unit	Amount	Price	Farm Size		
				Small	Medium	Large
Total Expense				39.57	34.41	34.19
Net Return to Land, Labor and Management				30.43	35.59	35.81

^aExpressed in dollars and cents.

^bOnly one-half of seed, establishment and maintenance fertilizer cost is charged per year.

^cRake assumed owned on large farm.

TABLE 48. Estimated costs and returns^a from one acre lespedeza hay (2 year life)

Item	Unit	Amount	Price	Farm Size		
				Small	Medium	Large
Receipts						
Hay	ton	2.0	25.00	50.00	50.00	50.00
Variable Expense ^b						
Seed	lb.	40	.22	4.40	4.40	4.40
Fertilizer						
Phosphate	lb.	20	.08	.80	.80	.80
Potash	lb.	20	.07	.70	.70	.70
Lime	ton	.5	5.00	2.50	2.50	2.50
Baling ^c	ton	2	5.00	10.00	10.00	8.00
Tractor				5.48	4.32	4.99
Other Equipment				2.62	1.26	1.81
Total Variable Expense				26.50	23.98	23.20
Fixed Expense						
Tractor				.92	.53	.66
Other Equipment				.74	.35	.49
Total Fixed Expense				1.66	.88	1.15
Total Expense				28.16	24.86	24.35
Net Return to Land, Labor and Management				21.84	25.14	25.65

^aExpressed in dollars and cents.

^bOnly one-half of seed and establishment fertilizer cost is charged per year.

^cRake assumed owned on large farm.

TABLE 49. Estimated costs and returns^a from one acre fescue-ladino
hay (8 year life)

Item	Unit	Amount	Price	Farm Size		
				Small	Medium	Large
Receipts						
Hay Equivalent	ton	3.4	20.00	68.00	68.00	68.00
Variable Expense						
Establishment ^b						
Seed--Fescue	lb.	2.0	.15	.30	.30	.30
Seed--Ladino	lb.	.25	.65	.16	.16	.16
Fertilizer						
Nitrogen	lb.	3.75	.12	.45	.45	.45
Phosphate	lb.	7.5	.08	.60	.60	.60
Potash	lb.	7.5	.07	.52	.52	.52
Lime	ton	.5	5.00	2.50	2.50	2.50
Maintenance ^c						
Fertilizer						
Phosphate	lb.	19	.08	1.52	1.52	1.52
Potash	lb.	19	.07	1.33	1.33	1.33
Lime	ton	.25	5.00	1.25	1.25	1.25
Seed--Ladino ^d	lb.	.25	.65	.16	.16	.16
Baling ^e	ton	3.4	5.00	17.00	17.00	13.60
Tractor				11.42	9.52	12.19
Other Equipment				4.77	1.98	5.38
Total Variable Expense				41.98	37.29	39.86
Fixed Expense						
Tractor				1.93	1.13	1.76

TABLE 49. (continued)

Item	Unit	Amount	Price	Farm Size		
				Small	Medium	Large
Other Equipment				1.22	.51	1.39
Total Fixed Expense				3.15	1.64	3.15
Total Expense				45.13	38.93	43.01
Net Return to Land, Labor and Management				22.87	29.07	24.99

^aExpressed in dollars and cents.

^bEstablishment costs prorated over eight-year period.

^cMaintenance fertilizer cost prorated over eight-year period.

^dClover re-seeded after four years, cost prorated over eight-year period.

^eRake assumed owned on large farm.

TABLE 50. Estimated costs and returns^a from one acre orchardgrass-ladino hay (6 year life)

Item	Unit	Amount	Price	Farm Size		
				Small	Medium	Large
Receipts						
Hay Equivalent	ton	3.4	25.00	85.00	85.00	85.00
Variable Expense						
Establishment ^b						
Seed--Orchardgrass	lb.	2.5	.32	.80	.80	.80
Seed--Ladino	lb.	.33	.65	.21	.21	.21
Fertilizer						
Nitrogen	lb.	5	.12	.60	.60	.60
Phosphate	lb.	10	.08	.80	.80	.80
Potash	lb.	10	.07	.70	.70	.70
Lime	ton	.5	5.00	2.50	2.50	2.50
Maintenance ^c						
Fertilizer						
Phosphate	lb.	20	.08	1.60	1.60	1.60
Potash	lb.	20	.07	1.40	1.40	1.40
Lime	ton	.25	5.00	1.25	1.25	1.25
Seed--Ladino ^d	lb.	.33	.65	.21	.21	.21
Baling ^e	ton	3.4	5.00	17.00	17.00	13.60
Tractor				11.42	9.52	12.19
Other Equipment				4.77	1.98	5.28
Total Variable Expense				43.26	38.57	41.14
Fixed Expense						
Tractor				1.93	1.73	1.76
						3

TABLE 50. (continued)

Item	Unit	Amount	Price	Farm Size		
				Small	Medium	Large
Other Equipment				1.22	.51	1.39
Total Fixed Expense				3.15	1.64	3.15
Total Expense				46.41	40.21	44.29
Net Return to Land, Labor and Management				38.59	44.79	40.71

^aExpressed in dollars and cents.

^bEstablishment cost prorated over six-year period.

^cMaintenance fertilizer cost prorated over six-year period.

^dClover re-seeded after four years, cost prorated over six-year period.

^eRake assumed owned on large farm.

TABLE 51. Estimated costs and returns^a from one acre orchardgrass-ladino hay (4 year life)

Item	Unit	Amount	Price	Farm Size		
				Small	Medium	Large
Receipts						
Hay Equivalent	ton	3	25.00	75.00	75.00	75.00
Variable Expense						
Establishment ^b						
Seed--Orchardgrass	lb.	3.75	.32	1.20	1.20	1.20
Seed--Ladino	lb.	.5	.65	.32	.32	.32
Fertilizer						
Nitrogen	lb.	7.5	.12	.90	.90	.90
Phosphate	lb.	15	.08	1.20	1.20	1.20
Potash	lb.	15	.07	1.05	1.05	1.05
Lime	ton	.5	5.00	2.50	2.50	2.50
Maintenance ^c						
Fertilizer						
Phosphate	lb.	22.5	.08	1.80	1.80	1.80
Potash	lb.	22.5	.07	1.57	1.57	1.57
Lime ^d	ton	.25	5.00	1.25	1.25	1.25
Baling	ton	3	5.00	15.00	15.00	12.00
Tractor				10.81	8.98	11.68
Other Equipment				4.77	1.98	5.28
Total Variable Expense				42.37	37.75	40.75
Fixed Expense						
Tractor				1.93	1.13	1.76

TABLE 51. (continued)

Item	Unit	Amount	Price	Farm Size		
				Small	Medium	Large
Other Equipment				1.22	.51	1.39
Total Fixed Expense				3.15	1.64	3.15
Total Expense				45.52	39.39	43.90
Net Return to Land, Labor and Management				29.48	35.61	31.10

^aExpressed in dollars and cents.

^bEstablishment cost prorated over four-year period.

^cMaintenance fertilizer cost prorated over four-year period.

^dRake assumed owned on large farm.

TABLE 52. Estimated costs and returns^a from one acre orchardgrass-ladino hay (3 year life)

Item	Unit	Amount	Price	Farm Size		
				Small	Medium	Large
Receipts						
Hay Equivalent	ton	2.5	25.00	62.50	62.50	62.50
Variable Expense						
Establishment ^b						
Seed--Orchardgrass	lb.	5	.32	1.60	1.60	1.60
Seed--Ladino	lb.	.66	.65	.43	.43	.43
Fertilizer						
Nitrogen	lb.	10	.12	1.20	1.20	1.20
Phosphate	lb.	20	.08	1.60	1.60	1.60
Potash	lb.	20	.07	1.40	1.40	1.40
Lime	ton	.5	5.00	2.50	2.50	2.50
Maintenance ^c						
Fertilizer						
Phosphate	lb.	20	.08	1.60	1.60	1.60
Potash	lb.	20	.07	1.40	1.40	1.40
Lime	ton	.25	5.00	1.25	1.25	1.25
Baling ^d	ton	2.5	5.00	12.50	12.50	10.00
Tractor				10.05	8.30	11.04
Other Equipment				4.77	1.98	5.28
Total Variable Expense				40.30	35.76	39.30
Fixed Expense						
Tractor				1.93	1.13	1.76

TABLE 52. (continued)

Item	Unit	Amount	Price	Farm Size		
				Small	Medium	Large
Other Equipment				1.22	.51	1.39
Total Fixed Expense				3.15	1.64	3.15
Total Expense				43.45	37.40	42.45
Net Return to Land, Labor and Management				19.05	25.10	20.05

^aExpressed in dollars and cents.

^bEstablishment cost prorated over three-year period.

^cMaintenance fertilizer cost prorated over three-year period.

^dRake assumed owned on large farm.

TABLE 53. Estimated costs and returns^a from one acre sudangrass hay

Item	Unit	Amount	Price	Farm Size		
				Small	Medium	Large
Receipts						
Hay Equivalent	ton	3	25.00	75.00	75.00	75.00
Variable Expense						
Seed	lb.	20	.15	3.00	3.00	3.00
Fertilizer						
Nitrogen	lb.	75	.12	9.00	9.00	9.00
Phosphate	lb.	20	.08	1.60	1.60	1.60
Potash	lb.	20	.07	1.40	1.40	1.40
Lime ^b	ton	.25	5.00	1.25	1.25	1.25
Baling ^b	ton	3	5.00	15.00	15.00	15.00
Tractor				8.26	6.44	7.19
Other Equipment				2.57	1.56	2.88
Total Variable Expense				43.08	39.25	38.32
Fixed Expense						
Tractor				1.54	.86	1.08
Other Equipment				.96	.42	.78
Total Fixed Expense				2.50	1.28	1.86
Total Expense				45.58	40.53	40.18
Net Return to Land, Labor and Management				29.42	34.47	34.82

^aExpressed in dollars and cents.

^bRake assumed owned on large farm.