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To the Graduate Council:

I am submitting herewith a thesis written by Clarence Homer Jent, Jr. entitled "An Evaluation of Crop and Soil Management Systems on Selected Farms in Dyer County, Tennessee." 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.

Frank L. Bell
Major Professor

We have read this thesis and recommend its acceptance:

Horace C. Smith Jr.

Curtis F. Laird

Accepted for the Council:

Hilton A. Smith
Dean of the Graduate School

AN EVALUATION OF CROP AND SOIL MANAGEMENT SYSTEMS ON SELECTED FARMS IN DYER COUNTY, TENNESSEE

A Thesis

Presented to

the Graduate Council of

The University of Tennessee

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

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by

Clarence Homer Jent, Jr.

December, 1966

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CHAPTER I

INTRODUCTION

Since 1960, crop and soil management systems that do not provide adequate protection against soil erosion on sloping land have come into widespread use by farmers in West Tennessee. This has been the result of an increasing demand for soybeans and the favorable prices that farmers have received for this crop in recent years. The acreage of soybeans harvested for beans in Tennessee has steadily increased each year for the past six years. In 1960, Tennessee farmers harvested 394,000 acres of soybeans (8). In 1966, the forecast is that 941,000 acres will be harvested (9). The acreage of other cultivated crops remained fairly constant during the period 1960 through 1965 (8).

The more than one-half million acre increase in soybeans since 1960 has occurred largely in West Tennessee counties. In 1965, more than 91 percent of the soybeans grown in the State was in counties west of Kentucky Lake (8). Approximately 60 percent of the soybean acreage was located on the Grenada - Loring - Memphis soil association, an upland area of gently rolling hills with fairly wide, nearly level tops. The short hillsides have a slope range of 3 to 20 percent. The soils have a silt loam surface and erode very readily when unprotected by erosion control measures.

Prior to the build-up in soybean acreage, cotton and corn were given first preference on land selection. These crops were grown primarily on the well-drained or moderately well-drained nearly level hilltops and bottomlands. Soybeans were produced on the level, wet bottomlands and nearly level, fragipan soils. The soybean

acreage was mostly confined to the larger farms where ample level land was available for row crops use. Erosion was not a serious problem under these conditions.

Row crops are now being grown on many thousands of acres of sloping upland where serious erosion hazards exist. Most of this sloping land is being used intensively without any soil conserving practices. In fact, a considerable acreage that was formerly in perennial pasture and hay crops is now used for cropland.

Another factor contributing to increased conservation problems has been the study increase in the number of absentee landowners. This has resulted in more land being cash rented. This usual rental agreement is for one to three years with no land use restrictions. Under such an agreement, the lessee is inclined to use all suitable land for row crops with no consideration for soil conservation or other land improving techniques.

Under the intensive row crop type of agriculture that has evolved in the western part of the State, many landowners and farm operators voice doubt that they can afford to install conservation systems that will provide adequate soil protection.

The objectives of this study were as follows:

1 To determine the effects of selected levels of conservation on estimated net farm income.

To predict the average annual soil loss per acre from sloping cropland on a selected sample of farms in the Grenada - Loring - Memphis soil association in Dyer County, Tennessee.

To relate present soil losses from representative upland soils when used for cropland to future crop yields and farm income.

If it can be determined that conservation programs that provide for erosion control can be installed without seriously

reducing farm income, farmers practicing row crop agriculture should accept conservation practices more readily.

Planners of agricultural programs should find the information obtained from this study useful in identifying problems and deciding on objectives that should receive the most emphasis in the planned programs.

The study should provide some useful guides to agricultural policymakers in formulating agricultural programs that protect the public interest without penalizing farmers with programs that reduce farm income.

Planners of resource development programs such as the small watershed program of the U. S. Department of Agriculture could make use of some of the information gained from this study in estimating the extent of present off-side damages, sedimentation rates, and in projecting the useful life of planned flood control measures. Administrators of such programs could use the information in determining what land use adjustments that are needed and the amount of conservation measures that must be installed by the local people in such projects before they authorize expenditure of public funds for works of improvement.

Local professional agricultural workers in several West Tennessee counties should find the results of the study helpful when advising farmers on their conservation problems and agricultural programs.

CHAPTER II

REVIEW OF LITERATURE

Economic Evaluations of Soil Conservation

A limited number of investigations have been conducted that evaluated different levels of conservation for varying time periods. Most of these studies include economic analysis as well as evaluating the effectiveness of conservation systems in controlling soil losses.

Actual farms where the owners were practicing different degrees of conservation were used in some of the investigations. Others used simulated farms, farming systems, and conservation treatments.

Sauer and Case (4) reported on a ten-year study of three groups of farms located in distinctly different farming areas in Illinois. High and low-conservation farms were compared in each group. A total of 160 farms were studied. Cost and returns were calculated for each year in the ten-year period. All prices were adjusted to 1945 levels.

In McLean County, Illinois, in the heart of the corn belt where sale of corn, soybeans, and oats were the major source of income, the 20 high-conservation farms had average net earnings of $4.77 an acre a year higher than the 20 low-conservation farms in the study group. Crop yields for all crops were higher on the high-conservation farms with corn averaging five bushels an acre higher for the ten-year period.

At the start of the ten-year period, the high-conservation farmers incurred an average conservation expense of $2.78 an acre a year, compared with $1.02 spent by the low-conservation farmers. At the end of the ten-year period, the low-conservation farmers were

doing more toward improving their land and spending almost as much as the high-conservation group. For the ten years, however, the high-conservation farmers spent 53 cents an acre a year more on conservation than the low-conservation farmers. The other two groups of farmers studied showed average net earnings of $6.98 and $6.41 an acre a year higher in favor of the high-conservation farms.

Blosser (3) studied the economics of soil conservation practices on Muskingum and associated soils in Ohio and concluded that the net income from conservation practices used on these soils was influenced by (1) disposition of crops, (2) type of livestock, and (3) efficiency of forage consuming animals. His conclusions were based on budgetary calculations which permitted holding all factors constant except the amount of conservation practices applied. Production data for the computations were obtained from a survey of 55 farms in Coshocton County during 1952. Prices used were averages for the period 1943-52.

Cost and returns for a group of soil depleting practices were compared with two different groups of soil conserving practices. Capital requirements, labor needed, and net income for these groups of practices were calculated for 120 acres under three different types of farming: (1) a crop farm with no livestock, (2) a dairy farm with two different levels of milk production, and (3) a beef cattle farm.

On the crop farm with no livestock, when the crops were sold, net income calculations showed $506 for soil depleting farming and $1711 for conservation farming. Under these conditions conservation farming increased net income $1205, but required 263 hours of

additional labor. Capital needs remained unchanged.

Blosser's (3) calculations showed that both groups of conservation practices would support approximately one-half more livestock than the soil depleting practices, but net income would be low if forage was fed to inefficient animals. The computations also showed two ways that conservation farming could increase net income. One was by producing higher returns per hour of labor. The other was by providing more hours of work.

Sauer, McGurk, and Norton (5) compared two actual farms in Northeastern Illinois, an area where conservation farming usually means planting fewer acres to corn and soybeans and using more for hay and pasture. One of the farms had been operated for many years as a grain farm and the other as a livestock farm. Both farms were predominately the same soil types. Records on land use, yields, and income were kept for a 12-year period.

On the livestock farm half the tillable land, on the average, was planted to corn and soybeans each year; on the grain farm 57 per cent was so planted. The livestock farm had an average of 23 per cent of its tillable land in soil-building legumes, whereas only 14 per cent was in legumes on the grain farm.

Corn yields averaged 56 bushels per acre on the livestock farm and only 40 bushels on the grain farm, while average soybean yields for the 12-year period were about the same for both farms. The livestock farm had 10 bushels a year more oats per acre.

For the entire period of the study $3,819, or $20.53 an acre, was spent on the livestock farm for land improvements, whereas $2,511 or $15.69 an acre, was spent on the grain farm.

The higher crop yields and the greater capital expenditures on the livestock farm were reflected in higher income from this

farm for the last six years as compared with the income from the grain farm. For four of the first six years the grain farm had a higher net income per acre; the net income was about equal for the other two years. The average yearly net income for the 12-year period was $5.80 an acre on the livestock farm and $4.17 on the grain farm.

Sauer et al. concluded from the above study and another study that included more than 100 farms in northeastern Illinois that conservation measures are not only effective in maintaining soils for future use but they are also an important factor in increasing farm incomes. Conservation farming is always more expensive in that higher capital expenditures are required but this is off-set by higher crop yields and more net income per acre.

Ball, Heady and Baumann (2) in an economic evaluation of the use of soil conservation practices in western Iowa found that the minimum time required for a conservation plan to provide a higher annual net farm income than a non-conservation plan to be four years under the assumption of steady prices and five years under assumption of declining prices. They also concluded that overall farm planning for conservation is necessary if the practices that control erosion are to be accepted.

Atkins (1) studied three levels of conservation on a selected upland farm located on the Grenada - Loring - Memphis soil area of West Tennessee. Objectives of the study was to appraise the effects of different levels of soil conservation on crop yields, farm cost, and net farm income over time. Annual soil losses and crop yields over time were estimated for the different levels of conservation on the various soil types occurring on the selected farm.

The estimates were only made for those soils on 2 to 5 per cent slopes on the case study farm.

The levels of conservation analyzed were: (1) low level, consisting of continuous row cropping with contour cultivation and no winter cover crops, (2) moderate level, which was continuous row cropping with parallel stripcropping and no winter cover crops, and (3) high level, which was continuous row cropping, parallel terraces and winter cover crops on cotton land.

The income estimates were based on the assumption that type of farming, production technology, and prices would not change over the period of the study. Any changes in net income would be the result of changes in crop yields resulting from soil change. No consideration was given to the possibility that crop yields might increase under the moderate and high level of conservation.

Soil losses were computed by use of the universal soil loss predicting equation, an emperical equation developed for estimating soil losses caused by rainfall erosion. Soil losses, according to the estimates, would be significantly greater under the low-conservation system than under high conservation.

If the many assumptions made in this study are valid, net income in the early years under high conservation would be reduced below incomes obtained under low conservation. If all cost (cash and noncash) are charged and future incomes are discounted at six per cent per year, high conservation would not be profitable during the lifetime of present farmers under the assumptions of constant technology and constant prices.

A Method of Predicting Soil Loss from Sloping Cropland

Except for the study by Atkins (1), other studies evaluating

the effectiveness of conservation systems in controlling erosion relied on related experience and field observations.

In 1960, Wischmeier (10) introduced what has become known as the universal equation for estimating soil loss caused by rainfall erosion. This is an empirical equation that includes the various interelated factors that contribute to soil loss by rainfall-induced erosion. With appropriate adjustments for local conditions, it is applicable to all areas where soil loss because of rain is significant. Wischmeier states that more than 8, 000 plot-years of basic runoff, soil loss, and associated precipitation and related data from 37 scattered Federal - State research projects in 21 states were assembled and analyzed in arriving at this scheme for predicting soil loss.

The equation is A = RKLSCP. Predicted average annual soil loss in tons per acre per year, A, is the product of the factors R (rainfall), K (soil erodibility), LS (length and steepness of slope), C (cropping and management) and P (supporting conservation practice). How each factor influences erosion and how numerical values are determined for them is explained in the literature cited. Also explained is the need for and how soil loss tolerance values are arrived at for soil types found on sloping land.

CHAPTER III

MATERIALS AND METHODS

Location of Study

Dyer County in western Tennessee was the location of the study. This county was selected for three reasons. Approximately 60 per cent of the land in farms in Dyer County was used for the production of cotton, corn, and soybeans in 1965 (8). About one-third of the county is a part of the Grenada - Loring - Memphis soil association. This soil area represents a large area of sloping upland in West Tennessee where serious erosion problems exists. A soil survey report for Dyer County was released in July of 1966. This made soils maps and interpretative information readily available for all the farms in the county.

Selection of Representative Farms

Two sample farms were selected for the study to determine the effects of different levels of conservation on net farm income compared to intensive row cropping.[1] One was selected in the size range of the average size farm in Dyer County which was 168.8 acres in 1964 (6). This farm was chosen to be representative of farms in the area operated by a single manager. The farmer was

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[1] The two levels of conservation evaluated were: (1) the use of conservation practices that were necessary to keep the estimated average annual soil losses equal to the established tolerance which averaged three tons per acre for the soils on the sample farms, (2) using conservation practices that would maintain estimated average annual soil losses at twice the established tolerance which averaged six tons per acre for the soils on the sample farms.

using medium size (two-row) farm machinery. The other farm was chosen to be representative of a multiple operator-managed unit and was large enough to justify ownership and use of large farm machinery, i.e., four-row equipment.

Both farms were practicing row crop agriculture with most of the tillable land being used for the production of cotton, corn, and soybeans. No commercial livestock enterprises were present on the study farms.

The Council of Agricultural workers in Dyer County were asked to assist in the selection of the representative farms. This Council is composed of all the professional agricultural workers in Dyer County. A number of farms were considered and several were field inspected.

The farms chosen are located in the eastern third of Dyer County on the Grenada - Loring - Memphis soil association area. The topography is gently rolling hills interrupted here and there by fairly broad flats. The short hillsides have a slope range of 3 to 20 per cent.

The soils found on the farms are all silty having developed from Peorian loess parent material. They developed in silty deposits more than 20 feet thick that were dropped by winds blowing across the Mississippi River bottoms. Due to this depth, soil erosion does not cause as drastic reductions in crop yields as is the case for most other soil associations in Tennessee. A brief description of the dominant soils on the two farms follows: Loring soils are well-drained or nearly well-drained soils on the ridgetops and hillsides. They have a brown, silty surface layer with a dark-brown silty clay loam subsoil. A weak fragipan begins about

30 inches below the surface. Cotton, corn, soybeans, hay and pasture produce good yields on the Loring soils. Memphis soils, which are well-drained, have a brown silty surface layer. Their subsoil is dark-brown silty clay loam. They are found on the broader ridgetops and steeper hillsides. Memphis is one of the most productive upland soils in Tennessee. It can produce high yields of all the commonly grown crops. Only a small acreage of Memphis exists on the representative farms. Grenada soils, which are medium in drainage, have a surface layer of brown silt loam and a subsoil of yellowish-brown silt loam. A fragipan begins 12 to 24 inches below the surface. Grenada soils are found on the nearly flat ridgetops and gently sloping hillsides. Row crops, hay and pasture are grown on the Grenada soils. Yields of cotton, soybeans, and small grain are good, but corn yields are only fair, especially in dry years.

Falaya and Collins soils are greyish-brown and brown silt loams. They cover small areas on narrow bottoms. The Falaya soils are somewhat poorly-drained and Collins is moderately well-drained. These soils are used to grow cotton, corn, soybeans, and pasture plants. Drainage systems are normally needed to remove excess water. Calloway and Routon are poorly-drained soils. With adequate surface drainage these soils produce good yields of many crops. Alfalfa and other deep-rooted crops are not adapted. Waverley is a flat, poorly-drained silty first bottom soil with a high water table. The best suited crops are soybeans and other annual plants that can be planted late or water tolerant pasture plants.

A detail description of all the soils of Dyer County can be found in the Soil Survey Dyer County, Tennessee (7).

The smaller farm had 180 acres with 159 acres under cultivation. The large farm had 410 acres with 394 acres under cultivation. Both farms were using the land resources intensively for row crops. Neither farm had a livestock enterprise.

The farms will be referred to in this manuscript as the 180 acre farm and the 410 acre farm to avoid ownership identity of the farms studied.

Soil survey maps, plan maps and other information relative to the two farms are presented in Chapter IV of this manuscript.

Levels of Conservation Chosen For Study

Since evaluating the immediate effects of two levels of conservation on estimated net farm income as compared to intensive row cropping was one objective of the study, the present cropping and soil management systems being used on the study farms was the standard used for the comparisons. The systems in use on the selected farms met the qualifications of low conservation adequately. Under the present management systems, all tillable land is used for row crops each year. Rows and tillage operations are in general up and down the slopes. No recognized conservation practices are being used on either farm with the exception of a surface drainage system on the 410 acre farm. The estimated average annual soil loss per acre from the present cropping and management systems on both farms exceeds 20 tons. This is more than six times the recognized tolerable limits for the soils on these farms.

The established soil loss tolerance for the soils on the selected farms which averaged three tons per acre per year was chosen as the goal for the high level of conservation. This is the standard used by the U. S. Soil Conservation Service as being the

minimum acceptable level of conservation. It is the estimated maximum average soil loss that can be tolerated annually and yet achieve the degree of conservation needed for sustained economic production in the foreseeable future. Tolerance is expressed in tons of soil loss per acre per year.

The goal for the medium level of conservation was set to keep soil losses at twice the established soil loss tolerance. This would be an average annual soil loss of six tons per acre per year for the soils on the representative farms. This level was selected because it represents what was thought to be a reduction of approximately one-half of the present soil losses occurring on most farms in this soil area. Also, it was thought that such a reduction in present soil losses could be achieved without a drastic reduction in net farm income.

The soil loss predicting equation was used to estimate the annual soil losses on all the soil situations (soil type and slope) on the two farms for each of the levels of conservation referred to above. (See Appendix Table XXIII for an example of method of using the soil loss predicting equation).

Evaluation of the Different Levels of Conservation

Plans were prepared using crop and soils management systems along with conservation practices that would keep soil losses within the established goals of the two levels of conservation. Only those conservation practices that could be adapted to the existing land conditions within practical limits were planned for use in the medium and high level of conservation plans. All conservation practices commonly used in Tennessee were considered, but due to irregular topography, contour stripcropping was the only erosion control

measure that could be used extensively on the representative farms. These plans include crops that would maximize income while requiring little additional capital. Government acreage restrictions were honored for the cotton and wheat crops in all plans. Markets are readily available for all crops included in the plans. Livestock enterprises were not added in any of the plans since this would require considerable additional capital investment. All grass and legume meadows grown in the planned crop rotations will be sold as hay.

The plans for the intensive row cropping or low conservation level were those presently employed by the farm managers of the two farms.

Three soil productivity groups were established for the soils found on the study farms. Soils of equal production potential were grouped together primarily for convenience in presenting the information. Crop yield information contained in the Soil Survey Dyer County, Tennessee was used as a basis for the groupings (7). The groupings for the soils on the two study farms are shown in Table I. Yield variations for the soils within a group were minor and the group yield represents an average for all soils in the group. The crop yield estimates in the Soil Survey Report are considered reliable. They represent long-term average yields based on Experiment Station results, crop yield studies conducted by the Tennessee Agricultural Experiment Station and the Soil Conservation Service, farm records, and the multiple judgment of professional agricultural workers.

Estimated net income budgets were prepared for all the crops to be grown in the different cropping systems. Prices used were

TABLE I

SOIL PRODUCTIVITY GROUPS[a]

Soil Phases	Yields per Acre[b]				
	Corn	Cotton	Soybeans[c]	Wheat	Grass and Clover Hay[d]
	bu.	lbs.	bu.	bu.	tons
Group 1					
Loring 2-5 per cent slope	80	725	36	40	2.7
Grenada 2-5 per cent slope	75	650	34	35	2.1
Memphis 2-5 per cent slope	90	750	38	40	2.9
Collins	100	800	40	34	2.7
Falaya	80	700	36	--	2.7
Average[e]	80	725	36	37	2.7
Group 2					
Grenada 2-5 per cent slope severely eroded	60	500	25	30	2.3
Grenada 5-7 per cent slope severely eroded	45	400	20	30	2.1
Loring 5-7 per cent slope severely eroded	60	525	24	30	2.4
Calloway	60	550	32	30	2.3
Waverley	60	500	34	--	2.8
Routon	55	500	35	--	2.2
Average[e]	60	500	30	30	2.2

TABLE I (continued)

SOIL PRODUCTIVITY GROUPS[a]

Soil Phases	Yields per Acre[b]				
	Corn	Cotton	Soybeans[c]	Wheat	Grass and Clover Hay[d]
	bu.	lbs.	bu.	bu.	tons
Group 3					
Grenada 8-12 per cent slope severely eroded	45	400	20	24	1.8
Loring 8-12 per cent slope severely eroded	50	450	20	25	2.2
Loring 12-20 per cent slope severely eroded	--	---	--	--	1.8
Average[e]	50	425	20	25	1.8

[a]Source: U. S. Department of Agriculture. 1965. Soil Survey, Dyer County, Tennessee. Series 1962 No. 5. U. S. Govt. Printing Office, Washington. PP. 32-34. Unpublished data - U. S. Department of Agriculture. Soil Conservation Service.

[b]Yields listed are to be expected only under high-level management.

[c]Per acre yields of soybeans should be reduced by one-third when double cropped with wheat. This is based on experimental information and farmer experience.

[d]Yields of grass and clover hay should be reduced by 50 per cent for the establishment year when Spring seeded.

[e]Some of the averages are rounded.

average prices paid and received by Tennessee farmers in 1965. It was assumed that the same level of technology would be employed for all systems. Also crop yields were assumed to remain the same under high conservation levels as under low.

The budgets were used to prepare estimated net income summaries for each of the systems evaluated. The estimated net income budgets are found the appendix of this manuscript, Table XV through Table XXII. Costs which will remain the same for all the systems such as taxes and depreciation on buildings are not included in the summary for each system.

Soil Loss Survey

A survey was made to determine the estimated average annual soil loss per acre from sloping cropland for all farms in the Grenada - Loring - Memphis soil association area of Dyer County. The estimated average annual soil loss per acre was needed for relating soil losses to future crop yields and farm income.

A 2.5 per cent sample or 17 farms was taken from a list of 653 upland farms. The owners of these farms had, at one time or another, cooperated with their Soil Conservation District; therefore, the sample was somewhat biased since some of the farmers may have applied conservation practices in the past. The sample was randomly selected by taking an equal number of farms from each civil district in the upland part of the county. This number was considered adequate since statistical analysis of the results were considered unnecessary for a survey of this kind.

The universal soil loss predicting equation was used to estimate the annual soil losses for all the sloping cropland on the sample farms (see Appendix Table XXIII for an example of the method of

using the soil loss predicting equation). To gather the necessary information for making the estimates, each farm in the sample was located on a soil survey map. A visit was made to each farm to determine the sloping land being used for cropland and the acreage. The length and steepness of the slopes were measured and recorded along with any conservation practices that were being used. The farm operators were contacted and interviewed to ascertain the cropping and management practices used during the past four years and the estimated crop yields.

Soil loss estimates were computed for each parcel of sloping cropland in the sample. A weighted average annual soil loss per acre was computed for each farm in the sample and for the entire sample.

Soil Loss and Future Crop Yields

To accurately arrive at the effects of continued soil losses on future crop yields and income would require a carefully controlled experiment conducted over a period of years. However, it was thought that some projections could be arrived at by using the results of the soil loss survey conducted on upland farms in Dyer County along with crop yield information for the different soils and degrees of erosion reported in the Soil Survey Dyer County, Tennessee (7).

Grenada, Loring, and Memphis were used as the representative upland soils since most of the upland in Dyer County is classified as one of these soil series. The moderately eroded phase of these soils on 2 to 5 per cent slopes was the only phase used in the projections. This was done because these soils on steeper slope gradients in Dyer County are all already classified in the severely eroded or gullied phases.

The estimated average annual soil loss for Grenada, Loring, and Memphis soils was determined from the soil loss survey conducted as a part of this study. The average depth of soil that would be necessary to remove by erosion to change each of the three soils from the moderately eroded phase to the severely eroded phase was taken from the soil descriptions in the Dyer County soil survey report. Using the established standard of 150 tons as the soil weight per acre-inch, the inches of soil depth differentiating erosion classes and the estimated annual soil loss per acre, an estimate was made of the number of years required to change the three soils from the moderately eroded phase to the severely eroded phase.

Crop yield differences between the two erosion phases were made for corn, cotton, and soybeans. Yields used are those listed in the Soil Survey Dyer County, Tennessee (7).

Gross returns for each of these crops using 1965 prices were used to indicate the differences in farm income. Gross returns were used since net returns tend to vary depending on farm size and kind of machinery used. On a given farm, the relationship would probably hold true for either gross or net returns since the main input variable for net returns would be the reduced cost of harvesting lower yields. Using modern harvesting implements, this difference becomes very minor.

Assumptions made with regard to the relationship of soil losses and yields per acre were: (1) that production practices would be constant at a high level over the period required to erode the soils from the moderately eroded phase to the severely eroded phase, and (2) yield decline would be progressive over the erosion period although only the beginning and ending yields were used for the comparisons.

CHAPTER IV

RESULTS

Low Conservation Level - 180 Acre Farm

The present farm organization of the 180 acre farm was evaluated as the low level of conservation. The farm had 159 acres of land being used continuously for the production of soybeans and cotton. The cotton allotment was 18 acres and the remaining 141 acres were used for soybeans. Nine acres of the remaining 21 were in woodland with miscellaneous uses such as house and barn sites, roads, and vegetable gardens occupying the other acreage.

Figure 1 is a soils map showing the soils, slopes, and degrees of erosion for the soil resources on this farm. Figure 2 shows the present field layout, acreage, and land use.

Under the present plan no conservation practices are used. Row arrangement is up and down the slopes with no consideration for the land contour. Estimated annual soil losses range from a high of 40 tons per acre on one 52 acre area to 5.5 tons on a nearly level 14 acre area. The weighted average annual soil loss per acre for the sloping cropland was 28.9 tons. This is more than 8 times the average established tolerance for the soils on this farm.

The acreage of each crop and the estimated annual net returns for the crops by soil productivity groups are presented in Table II.

Estimated net returns from crops sold are $7,808.55 for this intensive cropping plan.

High Conservation Level - 180 Acre Farm

The system planned for a high level of conservation with average annual soil loss reduced to the tolerance level would allow

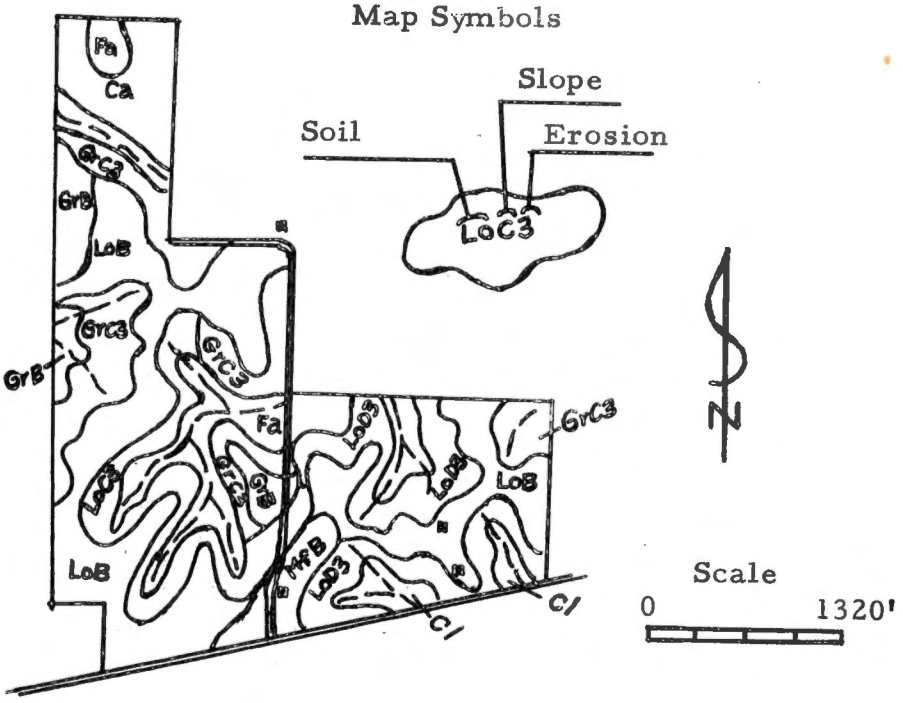


Figure 1. Soils map of 180 acre Dyer County, Tennessee farm.

Map Symbol	Soil Type	Slope and Erosion
Ca	Calloway silt loam	nearly level uneroded
Cl	Collins silt loam	nearly level uneroded
Fa	Falaya silt loam	nearly level uneroded
GrB	Grenada silt loam	2-5 per cent slopes mod. eroded
GrC3	Grenada silt loam	5-8 per cent slopes severely eroded
GrD3	Grenada silt loam	8-12 per cent slopes severely eroded
LoB	Loring silt loam	2-5 per cent slopes mod. eroded
LoC3	Loring silt loam	5-8 per cent slopes severely eroded
LoD3	Loring silt loam	8-12 per cent slopes severely eroded
MfB	Memphis silt loam	2-5 per cent slopes mod. eroded

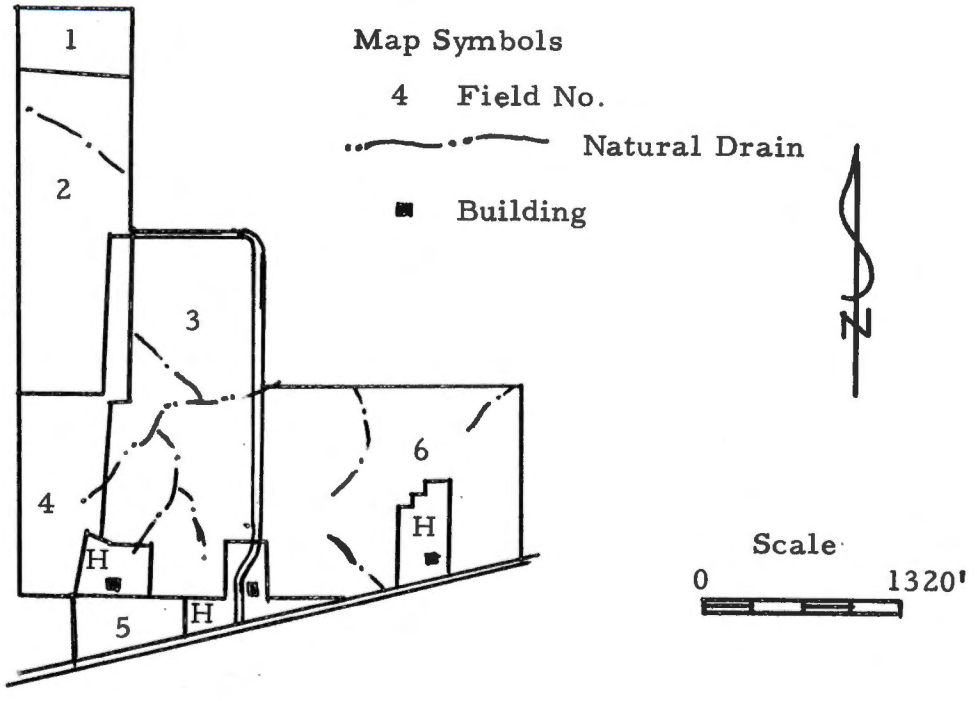


Figure 2. Field layout, acres, and land use for low conservation - 180 acre Dyer County, Tennessee farm.

Field No.	Acres	Land Use
1	9	Woodland
2	36	Cropland (soybeans)
3	48	Cropland (soybeans)
4	18	Cropland (cotton)
5	5	Cropland (soybeans)
6	52	Cropland (soybeans)
H	12	Miscellaneous (house sites, roads, etc.)

TABLE II

ACRES OF CROPS AND ESTIMATED ANNUAL NET RETURNS BY SOIL PRODUCTIVITY GROUPS AND TOTAL RETURNS —180 ACRE DYER COUNTY FARM LOW CONSERVATION LEVEL

Crop	Soil Productivity Group	Acres	Net Returns Per Acre	Total Net Returns
Cotton				
	1	12	$99.98	$1199.76
	2	4	60.61	242.44
	3	2	38.71	77.42
Soybeans				
	1	75	61.13	4584.75
	2	14	44.73	626.22
	3	52	20.73	1077.96
Total estimated annual net returns from all crops				$7,808.55

continued production of the 18 acre cotton allotment but would reduce the annual soybean acreage to 37.

To keep soil losses to tolerance levels a contour stripcropping system must be used on all fields except one nearly level five acre field. A three year crop rotation of one year of row crops followed by two years of grass and clover meadow was the most intensive row crop use possible. It would be necessary to establish 5.5 acres of grassed waterways in the well defined natural drains. Field borders established in meadow crops would be needed on 2.5 acres to facilitate the operation of machinery and for access. There would be a total of 104 acres of grass and clover that would be harvested and sold as hay. This includes eight acres in waterways and field borders. Excluding waterways and field borders, approximately one-third of the meadow acreage will be established each year.

Field boundries would need to be rearranged using contour strip edges as field boundries. Figure 3 shows the field layout, acreages, and land use under this system.

Estimated average annual soil loss from the sloping cropland under this level of conservation would be three tons per acre. This is approximately the average established tolerance for all soils on the farm.

Table III is a summary of crop acreage and estimated annual net returns by soil productivity groups for the high level conservation system.

No charge was made for installing the grassed waterways and field borders since the cost of these practices is primarily the cost of establishing the protective vegetation. Hay will be harvested from these areas along with the meadow strips in the stripcropped

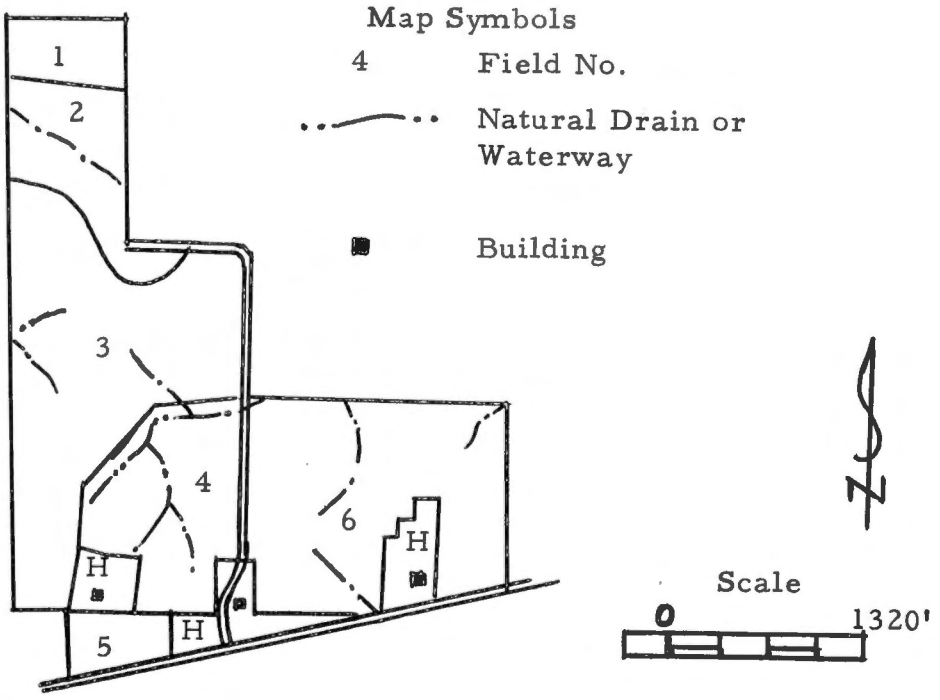


Figure 3. Field layout, acres and land use for high conservation level — 180 acre Dyer County, Tennessee farm.

Field No.	Acres	Land Use
1	9	Woodland
2	18	Cropland (soybean rotation) 1.3 Ac. Waterways and field borders.
3	57	Cropland (cotton rotation) 3 Ac. Waterways and field borders.
4	27	Cropland (soybean rotation) 2Ac. Waterways
5	5	Cropland (soybeans continuous)
6	52	Cropland (soybean rotation) 1.7 Ac. Waterways and field borders
H	12	Miscellaneous Uses

TABLE III

ACRES OF CROPS AND ESTIMATED ANNUAL NET RETURNS BY SOIL PRODUCTIVITY GROUPS AND TOTAL RETURNS —180 ACRE DYER COUNTY FARM HIGH CONSERVATION LEVEL

Crop	Soil Productivity Group	Acres	Net Returns Per Acre	Total Net Returns
Cotton	1	12	$99.98	$1199.76
	2	2	60.61	121.22
	3	4	38.71	154.84
Soybeans	1	20	61.13	1222.60
	2	4	44.73	178.92
	3	13	20.73	269.49
First Year Hay	1	15	18.15	272.25
	2	4	10.90	43.60
	3	12	3.10	37.20
Second Year Hay	1	40[a]	48.91	1956.40
	2	8	33.91	271.28
	3	25	22.13	553.25
Total estimated annual net returns from all crops				$6280.81
Less annual cost of establishing contour stripcropping[b]				44.40
Estimated net returns				$6236.41

[a]The grass waterways and field borders are included in this acreage.

[b]A cost of $3.00 per acre prorated over a 10-year period was made for installation of contour stripcropping on 148 acres.

fields and the establishment cost is included in the estimated net income budget (see Appendix Table XX) used to arrive at the estimated returns from hay sold.

Estimated net returns from all crops under the high conservation level would be $6,236.41. This is $1,572.14 less than the low conservation system.

Medium Conservation Level — 180 Acre Farm

The plan for this level of conservation with average annual soil losses maintained at twice the tolerance level allowed the production of the 18 acre cotton allotment and 60 acres of soybeans annually. Contour stripcropping was still necessary on all the cropland except one five-acre level field; however, it was possible to change the crop rotation so that the land could be used one-half of the time for row crops. A six-year cycle was planned with three years of row crops followed by three years of grass and clover meadow. The same areas would need to be established in grassed waterways and field borders as in the high conservation level plan. There would be a total of 80 acres in grass and clover to be harvested and sold as hay. Excluding the waterways and field borders, approximately one-third of this acreage would need to be established each year. Grassed waterways and field borders would be maintained and renovated as needed.

Some realignment of field boundries would be made so the field edges would conform with the stripcropping system. Figure 4 shows the field layout, acreage, and land use by fields for this plan.

The estimated average annual soil loss per acre with this system would be 5.5 tons. This is slightly less than twice the average tolerance for the soils on the farm.

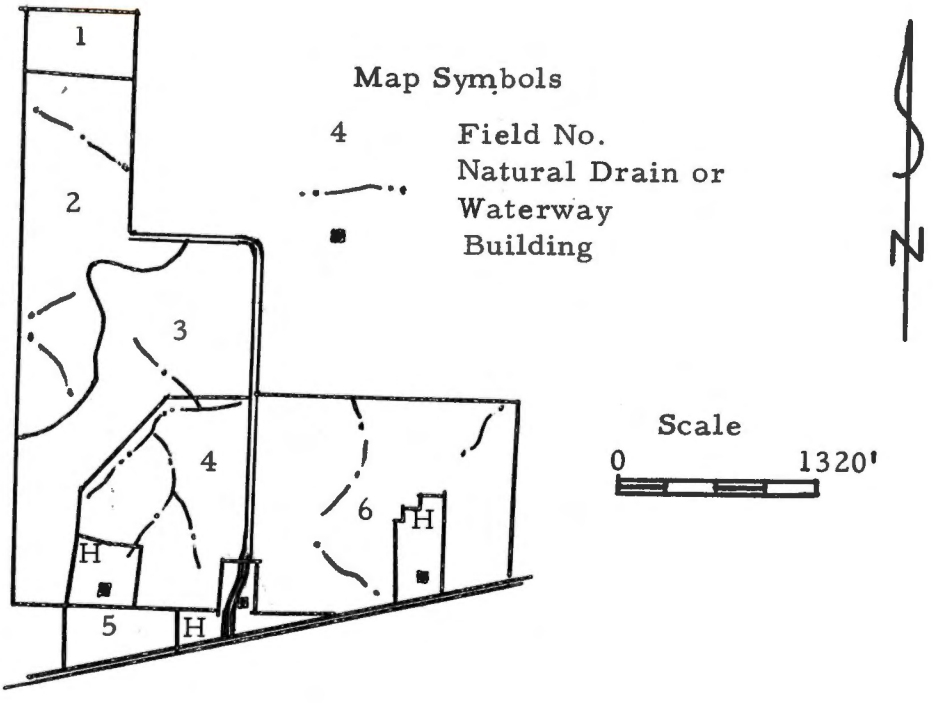


Figure 4. Field layout, acres, and land use for medium conservation level — 180 acre Dyer County, Tennessee farm.

Field No.	Acres	Land Use
1	9	Woodland
2	35	Cropland (soybean rotation) 2.0 Ac. Waterways and field borders.
3	40	Cropland (cotton rotation) 2.3 Ac. Waterways and field borders.
4	27	Cropland (soybean rotation) 2.0 Ac. Waterways.
5	5	Cropland (soybeans continuous)
6	52	Cropland (soybean rotation) 1.7 Ac. Waterways and field borders.
H	12	Miscellaneous uses.

The summary of crop acreage and estimated annual net returns by soil productivity groups for the medium level of conservation are shown in Table IV.

Cost involved in establishing stripcropping, grassed waterways, and field borders were treated the same as for the high conservation plan.

The estimated annual net returns from all crops under the medium conservation level was $6,666.17. This is $430.76 more than the high conservation plan but still $1,142.38 less than the low conservation system.

Low Conservation Level — 410 Acre Farm

As with the 180-acre farm, the present organization of the farm was evaluated as the low conservation level for the 410 acre farm. There was a total of 394 acres being cultivated in row crops on this farm. The remaining 16 acres was land in drainage ditches, farm roads, and building sites. Crops being grown included the 44 acre cotton allotment, 115 acres of corn, and 235 acres of soybeans with 40 acres of the soybean land being double cropped in wheat.

Figure 5 is a soils map showing the soils, slopes, and degrees of erosion for the soil resources on this farm. Figure 6 shows the present field layout, acreages, and land use.

No conservation practices are used under the present plan other than a surface drainage system on the bottomland fields. The weighted average annual soil loss per acre for the sloping cropland is 21.3 tons. This is seven times the average established tolerance for the upland soil on this farm.

TABLE IV

ACRES OF CROPS AND ESTIMATED ANNUAL NET RETURNS BY SOIL PRODUCTIVITY GROUPS AND TOTAL RETURNS — 180 ACRE DYER COUNTY FARM MEDIUM CONSERVATION LEVEL

Crop	Soil Productivity Group	Acres	Net Returns Per Acre	Total Net Returns
Cotton	1	13	$99.98	$1299.74
	2	2	60.61	121.22
	3	3	38.71	116.13
Soybeans	1	33	61.13	2017.29
	2	5	44.73	223.65
	3	22	20.73	456.06
First Year Meadow	1	12	18.15	217.80
	2	4	10.90	43.60
	3	8	3.10	24.80
Second and Third Year Meadow	1	32[a]	48.91	1565.12
	2	7	33.91	237.37
	3	17	22.13	376.21
Total estimated annual net returns from all crops				$6709.97
Less annual cost of establishing contour stripcropping[b]				43.80
Estimated net returns				$6666.17

[a] The grass waterways and field borders are included in this acreage.

[b] A cost of $3.00 per acre prorated over a 10-year period was made for installation of contour stripcropping on 144 acres.

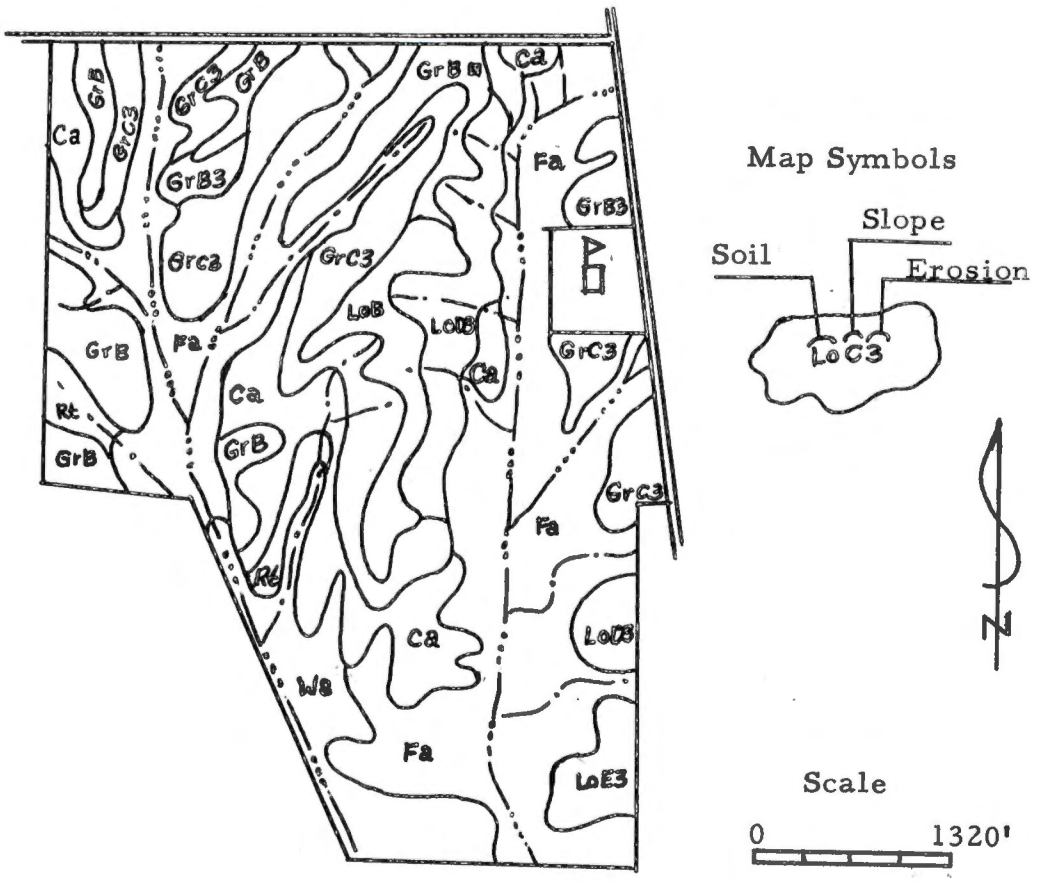


Figure 5. Soils map of 410 acre Dyer County, Tennessee farm.

Map Symbol	Soil Type	Slope and Erosion
Ca	Calloway silt loam	nearly level uneroded
Fa	Falaya silt loam	nearly level uneroded
GrB	Grenada silt loam	2-5 per cent slopes mod. eroded
GrB3	Grenada silt loam	2-5 per cent slopes severely eroded
GrC3	Grenada silt loam	5-8 per cent slopes severely eroded
LoB	Loring silt loam	2-5 per cent slopes mod. eroded
LoD3	Loring silt loam	8-12 per cent slopes severely eroded
LoE3	Loring silt loam	12-20 per cent slopes severely eroded
Rt	Routon silt loam	nearly level uneroded
Ws	Waverly silt loam	nearly level uneroded

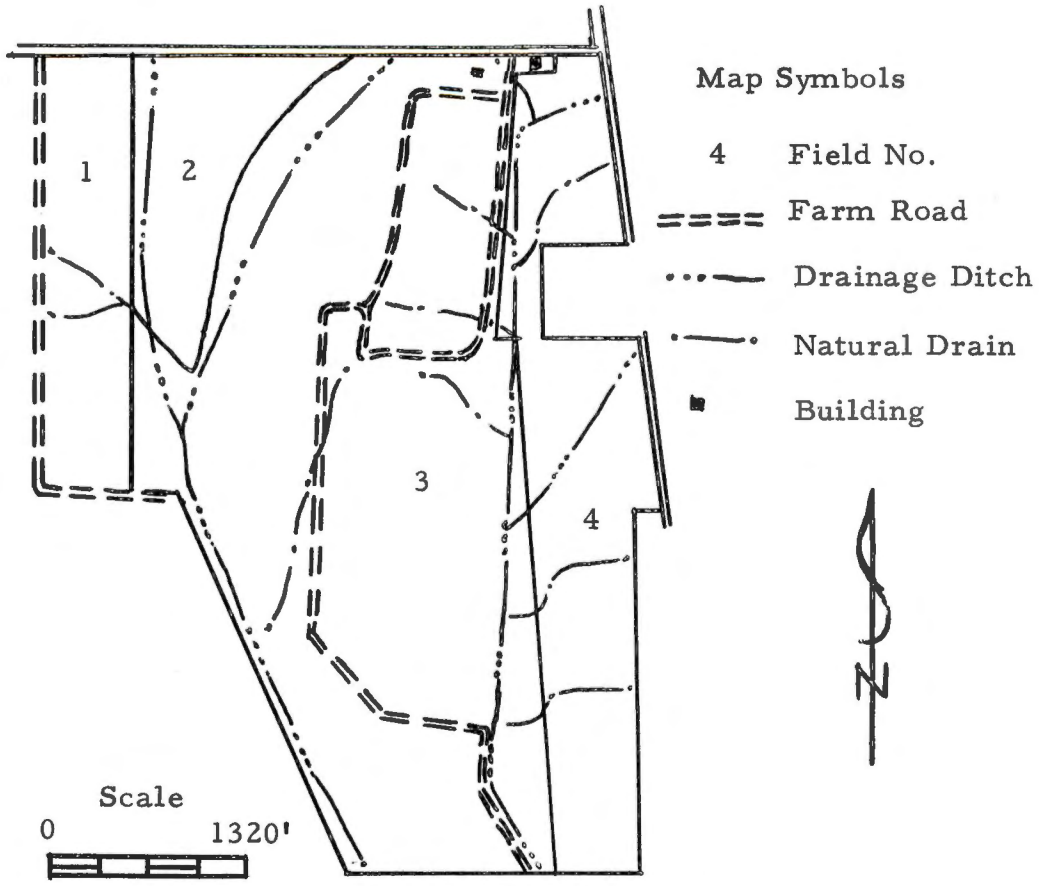


Figure 6. Field layout, acres, and land use for low conservation — 410 acre Dyer County, Tennessee farm.

Field No.	Acres	Land Use
1	45	Cropland (cotton) 1 Ac. ditches
2	25	Cropland (corn) 1 Ac. ditches
3	248	Cropland (soybeans -40 Ac. Wheat double cropped) 12 acres ditches, roads, housesite
4	92	Cropland (corn) 2 Ac. ditches, barn, etc.

A summary of the acres of each crop and the estimated annual net returns by soil productivity groups is presented in Table V for this level of conservation. Estimated net returns would amount to $19, 167..19 for this farm as presently managed..

High Conservation Level — 410 Acre Farm

The conservation system planned that would hold soil losses on the sloping land at the tolerance level would allow the continued production of the 44 acre cotton allotment and 38 acres of the 40 acre wheat allotment. The wheat would be double cropped with soybeans as in the low conservation system. Corn acreage would be reduced 13 acres to 102 acres. Soybeans would be grown on 125 acres annually. This is a reduction of 110 acres. A total of 122 acres would be in grass and clover meadow. This includes 6.5 acres of grassed waterways and 22 acres permanently removed from row crop production.

Figure 7 shows the field layout, acreage, and land use for this plan. The field boundries were realigned to make possible the fitting of the crops to those soils on which they are best suited or to coincide with contour strip edges.

Conservation measures to bring about the reduction in soil loss include 167 acres of contour stripcropping, 6.5 acres of grassed waterways, and 0.67 miles of parallel terraces. The double cropped wheat and soybeans would be grown in a four year contour stripcropping system in field 1. The rotation would be two years of the grain crops followed by two years of meadow with the soybean crops being mulch-planted in the wheat residue using minimum tillage practices. The cotton would also be grown in a four year stripcropping system in field 3. The rotation would consist of two years of cotton followed by two years of grass and clover meadow. Fields

TABLE V

ACRES OF CROPS AND ESTIMATED ANNUAL NET RETURNS BY SOIL PRODUCTIVITY GROUPS AND TOTAL RETURNS — 410 ACRE DYER COUNTY FARM LOW CONSERVATION LEVEL

Crop	Soil Productivity Group	Acres	Net Returns Per Acre	Total Net Returns
Corn	1	71	$ 51.04	$ 3,623.84
	2	16	26.04	416.64
	3	28	13.54	379.12
Cotton	1	25	104.18	2,604.50
	2	9	64.11	576.99
	3	10	41.91	419.10
Soybeans	1	117	59.77	6,991.09
	2	33	45.37	1,497.21
	3	45	21.37	961.65
Soybeans (double cropped)	1	10	37.78	377.80
	2	23	28.18	648.14
	3	7	14.78	103.46
Wheat (double cropped)	1	10	22.48	224.80
	2	23	13.05	300.15
	3	7	6.10	42.70
Total estimated annual net returns from all crops				$19,167.19

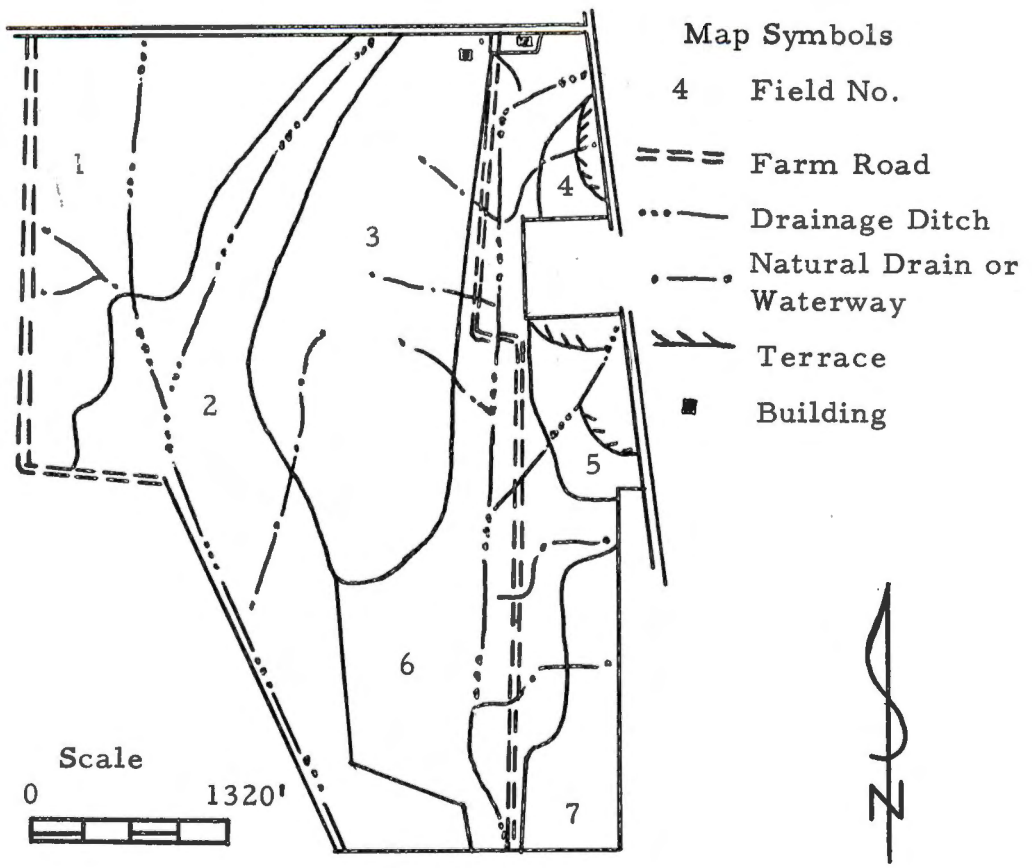


Figure 7. Field layout, acres and land use for high conservation level — 410 acre Dyer County, Tennessee farm.

Field No.	Acres	Land Use
1	77	Cropland (soybeans and wheat double cropped) 1.5 acres ditch and waterways.
2	94	Cropland (cont. soybeans) 7 acres ditches and waterways.
3	90	Cropland (cotton rotation) 1.3 acres waterways.
4	8	Cropland (corn rotation)
5	17	Cropland (corn rotation) 0.8 acres waterways.
6	102	Cropland (cont. corn) 11.5 acres house site, ditches, etc.
7	22	Permanent meadow

4 and 5 would have parallel terraces constructed and be used in a rotation of two years of corn followed by two years of meadow. Fields 2 and 6 would be used continuously for soybeans and corn respectively with residue management practices. Field 7 would be permanently removed from row crop use and be established in grass and clover meadow.

Table VI is a summary of the acres of each crop and the estimated annual net returns by soil productivity groups for the high level of conservation.

Approximately one-half of the grass and clover acreage in the rotation will need to be established each year. The grassed waterways and field 7 will be maintained and renovated when the need arises.

No charge was made for installing the grassed waterways since the cost of this practice is primarily the cost of establishing the protective vegetation. Hay will be harvested from these areas and the establishment cost is included in the estimated net income budget (see Appendix Table XX) used to arrive at the estimated net returns from hay sold. No charge was made for maintenance of the drainage ditches since the drainage system was already installed and maintenance measures will be necessary under all three levels of conservation being evaluated. It is recognized that maintenance cost for the ditches will be much less under a high level of conservation because heavy soil losses would be deposited in the ditches under the low conservation system requiring expensive cleaning operations.

Estimated net returns from all crops under the high conservation level would be $17,784.23. This is $1,382.56 less than the returns for the low conservation system.

TABLE VI

ACRES OF CROPS AND ESTIMATED ANNUAL NET RETURNS BY SOIL PRODUCTIVITY GROUPS AND TOTAL RETURNS — 410 ACRE DYER COUNTY FARM
HIGH CONSERVATION LEVEL

Crop	Soil Productivity Group	Acres	Net Returns Per Acre	Total Net Returns
Corn	1	85	$ 51.04	$ 4,338.40
	2	11	26.04	286.44
	3	6	13.54	91.24
Cotton	1	19	104.18	1,979.42
	2	3	64.11	192.33
	3	23	41.91	963.93
Soybeans	1	39	59.77	2,331.03
	2	48	45.37	2,177.76
	3	--	21.37	---
Soybeans (double cropped)	1	22	37.78	831.16
	2	8	28.18	225.44
	3	8	14.78	118.24
Wheat (double cropped)	1	22	22.48	494.56
	2	8	13.05	104.40
	3	8	6.10	48.80

TABLE VI (cont.)

ACRES OF CROPS AND ESTIMATED ANNUAL NET RETURNS BY SOIL PRODUCTIVITY GROUPS AND TOTAL RETURNS — 410 ACRE DYER COUNTY FARM HIGH CONSERVATION LEVEL

Crop	Soil Productivity Group	Acres	Net Returns Per Acre	Total Net Returns
Hay First Year	1	22	20.83	458.26
	2	5	13.58	67.90
	3	19	5.78	104.82
Hay Second Year	1	38[a]	52.40	1,991.20
	2	6[a]	37.40	224.40
	3	32[a]	25.80	825.60
Total estimated annual net returns from all crops				$17,855.33
Annual cost of establishing contour stripcropping on 167 acres[b]				50.10
Annual cost of establishing parallel terraces on 0.67 miles[c]				21.00
Total cost of conservation practices				71.10
Estimated net returns				$17,784.23

[a] The grass waterways and the 22 acres in field 7 are included in these acreages.

[b] A $3.00 per acre cost prorated over a 10-year period was made for installing contour stripcropping.

[c] A cost of $300.00 per mile prorated over a 10-year period was made for constructing parallel terraces.

Medium Conservation Level — 410 Acre Farm

The goal of this level of conservation is to keep soil losses at twice the established tolerance for the sloping soils on the farm.

The main difference in this plan and the high level of conservation plan is the elimination of the contour stripcropping and parallel terraces and the substitution of contour farming in their place. The length of the rotation cycle was changed to six years with three years of row crops and three years of grass and clover meadow used on the upland fields. The acreages of all crops grown will remain the same as for the high conservation plan.

The field layout, acreages, and land use are the same as shown in Figure 7 page 36 for the high conservation plan.

Approximately one-third of the grass and clover acreage in the rotation will need to be established or reestablished each year. The grass waterways and field 7 will be maintained in the meadow crop and reestablished only when the stand becomes thin and unproductive.

Table VII gives the annual acres of each crop and the estimated annual net returns by soil productivity groups for this plan.

Cost involved in establishing and maintaining the drainage system were treated the same as for the high conservation plan.

Estimated net returns from all crops under the medium conservation level would be $18,237.83. This is $453.60 more than the high conservation plan but still $929.36 less than the low level of conservation.

Soil Loss Survey

The results of the survey made to determine the average annual soil loss per acre are summarized in Table VIII. This

TABLE VII

ACRES OF CROPS AND ESTIMATED ANNUAL NET RETURNS BY SOIL PRODUCTIVITY GROUPS AND TOTAL RETURNS — 410 ACRE DYER COUNTY FARM MEDIUM CONSERVATION LEVEL

Crop	Soil Productivity Group	Acres	Net Returns Per Acre	Total Net Returns
Corn	1	85	$ 51.04	$ 4,338.40
	2	11	26.04	286.44
	3	6	13.54	91.24
Cotton	1	19	104.18	1,979.42
	2	3	64.11	192.33
	3	23	41.91	963.93
Soybeans	1	39	59.77	2,331.03
	2	48	45.37	2,177.76
	3	--	21.37	---
Soybeans (double cropped)	1	22	37.38	831.16
	2	8	28.18	225.44
	3	8	14.78	118.24
Wheat (double cropped)	1	22	22.48	494.56
	2	8	13.05	104.40
	3	8	6.10	48.80

TABLE VII (cont.)

ACRES OF CROPS AND ESTIMATED ANNUAL NET RETURNS BY SOIL PRODUCTIVITY GROUPS AND TOTAL RETURNS — 410 ACRE DYER COUNTY FARM MEDIUM CONSERVATION LEVEL

Crop	Soil Productivity Group	Acres	Net Returns Per Acre	Total Net Returns
Meadow First Year	1	14	20.83	291.62
	2	4	13.58	54.32
	3	12	5.78	69.36
Meadow Second and Third Years	1	46[a]	52.40	2,410.40
	2	7[a]	37.40	261.80
	3	39[a]	25.80	1,007.10
Total estimated annual net returns from all crops				$18,267.75
Less annual cost of marking contour lines on 187 acres at $0.16 per acre				29.92
Estimated net returns				$18,237.83

[a]The grass waterways and the 22 acres in field 7 are included in these acreages.

TABLE VIII

ESTIMATED AVERAGE ANNUAL SOIL LOSS FROM SLOPING CROPLAND IN DYER COUNTY

Farm Number	Sloping Cropland Acres	Total Farm Soil Loss	Avg. Annual Soil Loss Per Acre
		tons	tons
1	41	862.5	21.3
2	240	1772.9	7.4
3	148	4283.0	28.9
4	15	181.0	12.0
5	183	3895.0	21.3
6	110	1567.0	14.2
7	118	1516.0	12.8
8	5	70.0	14.0
9	39	202.6	5.2
10	15	181.0	21.3
11	98	656.4	6.7
12	80	1041.1	13.0
13	112	513.1	4.5
14	8	168.0	21.0
15	19	396.0	20.8
16	45	211.0	4.7
17	29	529.9	17.6
Totals	1305	18046.5	----

Average annual soil loss in tons per acre = $\frac{18046.5}{1305}$ = 13.82 tons.

summary is for all the sloping cropland on the farms in the sample. The estimated average annual soil loss of 13.8 tons per acre is more than four times the average established tolerance for the kinds of soils represented on the sample farms.

A sample that included only those farms that are practicing predominately row crop agriculture would have given a much higher average annual soil loss. Seven farms in the sample that were using the sloping land intensively for row crops averaged more than 21 tons of soil lost per acre per year. As would be expected, the randomly selected sample included a number of farms with sizeable livestock enterprises. Soil losses were considerably lower on these livestock farms. This is attributed to the use of more perennial grasses and legumes in the crop rotations on these farms.

Soil Loss and Future Crop Yields

According to the soil loss survey, the weighted average annual soil loss for Grenada, Loring, and Memphis soils on 2 to 5 per cent slopes was 11.7, 9.8 and 9.2 tons per acre, respectively. From descriptions of these soil series (7) it would be necessary to remove six inches of surface soil from Grenada and eight inches from Loring and Memphis to change them from the moderately eroded to the severely eroded phases. Using 150 tons as the soil weight per acre-inch and the determined average annual soil loss, it would require approximately 75 years to change Grenada on 2 to 5 per cent slopes from the moderately eroded to the severely eroded phase. Likewise it would require 120 and 128 years respectively for enough erosion to occur at the present rate to change Loring and Memphis from the moderately eroded to the severely eroded phase.

Table IX shows the difference in estimated yields and gross income from corn, cotton, and soybeans on moderately eroded and severely eroded phases of Grenada, Loring, and Memphis soils on 2 to 5 per cent slopes.

TABLE IX

ESTIMATED CROP YIELDS AND GROSS RETURNS PER ACRE FROM MODERATELY ERODED AND SEVERELY ERODED PHASES OF GRENADA, LORING, AND MEMPHIS SOILS

Soil and Phase	Corn		Cotton lint		Soybeans	
	Estimated Yield	Gross Returns	Estimated Yield	Gross Returns	Estimated Yield	Gross Returns
	bu.		lbs.		bu.	
Grenada						
2 to 5 per cent slopes, mod. eroded	75	$ 93.75	650	$188.50	34	$81.60
2 to 5 per cent slopes, severely eroded	60	75.00	500	145.00	25	60.00
Difference	15	$ 18.75	150	$ 43.50	9	$21.60
Loring						
2 to 5 per cent slopes, mod. eroded	80	$100.00	725	$200.25	36	$86.40
2 to 5 per cent slopes severely eroded	80	100.00	650	188.50	30	72.00
Difference	0	$ 0.00	75	$ 11.75	6	$14.40

TABLE IX (cont.)

ESTIMATED CROP YIELDS AND GROSS RETURNS PER ACRE FROM MODERATELY ERODED AND SEVERELY ERODED PHASES OF GRENADA, LORING, AND MEMPHIS SOILS

Soil and Phase	Corn		Cotton lint		Soybeans	
	Estimated Yield	Gross Returns	Estimated Yield	Gross Returns	Estimated Yield	Gross Returns
	bu.		lbs.		bu.	
Memphis-						
2 to 5 per cent slopes, mod. eroded	90	$112.50	750	$217.50	38	$91.20
2 to 5 per cent slopes, severely eroded	80	100.00	650	188.50	32	76.80
Difference	10	$ 12.50	100	$ 29.00	6	$14.40

CHAPTER V

DISCUSSION

The Effects of Crop and Soil Management Systems on Farm Profits

If it is assumed that the major goal of farmers is to maximize profits, then it must be concluded from the results of this study that the use of crop and soil management systems that maintain soil losses at established tolerances and twice these tolerances cannot be warranted in the short run. Net farm returns were reduced substantially under both the high and medium levels of conservation when compared with crop and soil management systems that afforded little in the way of conservation. The results of the study relating to farm profits apply only in the short run. Long-term effects of conserving crop and soil management systems on farm profits might be entirely different.

Projections of the long-run effects of continued soil losses at the present rates indicate that probable reductions in yields and farm income are not great enough to have any influence on the decisions of the present farmers during their lifetime. The time period in which the productive potential of these soils change due to erosion is relatively long. However, such changes do occur as is evidenced by the fact that all but the 2 to 5 per cent slopes of Grenada, Loring, and Memphis soils in Dyer County are classified in the severely eroded phases.

A constant level of technology and crop yields were assumed for all the crop and soil management systems evaluated. Studies conducted over a period of years on farms that have installed high levels of conservation show that crop yields increas significantly

over similar farms using low conservation systems. Yield increases of the same magnitude reported from these studies would probably have offset the lower net returns for the medium and high level of conservation on the farms evaluated by this study. Yield increases for the planned conservation systems were not assumed in this study since there was no local data for justifying such an assumption. If the crop and soil management systems planned for the representative farms were applied and evaluated over a period of years, the benefits resulting from the improved conservation systems might agree more closely with other studies that show increased farm profits from installing conservation systems.

The medium level of conservation resulted in higher net returns than the high level but the difference was relatively small on both farms. In view of the small increase, it does not appear that the quality of conservation should be compromised by selecting the medium level as the conservation goal.

Conservation Benefits other than Increased Farm Profits

To evaluate conservation systems solely on the basis of net farm returns leaves many factors unevaluated from the standpoint of the individual farmer and the general public. These factors were recognized at the outset of this study but it was also recognized that the magnitude of such evaluations would be an impossibility due to the time and the resources available for the study. However, those factors that relate to the cost and benefits of soil and water conservation should be discussed.

First, farmers practicing conservation often receive many benefits that cannot be measured by net profit. In fact, they may

never think of them as conservation benefits. Land values are protected and often increased as a result of conservation farming. Drainage systems are less expensive to maintain and costly cleaning operations are unnecessary if soil losses are low. Repair and maintenance cost on farm roads, bridges, and fences are usually less on farms with good conservation programs. Operating cost and the repair of farm machinery are reduced when contour farming is used. And, the personal satisfaction of owning an attractive farm without the cancerous scars of erosion is difficult to give a value.

The Public's Interest in Conservation

The public has a much greater interest in how the land is used and treated today than ever before in history. Millions of dollars of public funds are spent each year as a result of the past and present misuse and abuse of farm lands. Great floods occur and frequently result in untold damages. Expensive flood control programs are necessary. Flood control facilities such as flood retarding reservoirs and improved stream channels have their useful life reduced when heavy soil losses go uncontrolled. Pollution of lakes and streams is caused by the millions of tons of soil that is allowed to wash from unprotected farm lands. This reduces their value for recreational use, sources of clean water, fish and wildlife habitat, and makes them unattractive and dismal reminders of increased farm income for some row crop farmer. Maintenance and repair cost on public roads and highways are much higher in areas where large amounts of soil are allowed to erode from farm lands. There are, no doubt, other public damages that accrue from farming systems that allow excessive soil losses, but these serve to illustrate

the public's interest in conservation.

There is a recognized conflict of interest between the individual farmer and the public. Since this study clearly indicates reduced income for farmers using adequate conservation programs, it might be well for agricultural policymakers to consider subsidy payments to farmers who employ conservation programs that hold soil losses to safe levels. Such payments would offset reduced income resulting from the use of adequate conservation systems. Such a conservation program would allow recurring payments for a complete conservation program applied and maintained on a farm. The present program of the public sharing in the costs of individual conservation practices should be continued.

Recommendations

The study also indicates that research agencies and officials of conservation agencies should give more attention to the perfection of new conservation practices or the modifications of old practices. Such practices are needed to allow the more intensive safe use of sloping land for row crops. Practices on which research is needed includes a number of minimum tillage methods of producing soybeans. The practice of planting soybeans and other row crops in live stands of perennial grasses and using chemicals to retard the growth of the grass needs perfecting. Such a practice would provide excellent erosion control while allowing sloping land to be used for high-value row crops. The planting of soybeans in the residue of prior crops and utilizing the residue as a surface mulch for erosion control is another cultural method that needs testing and perfecting by research. A suitable planter for planting soybeans in heavy crop residues needs

developing. A selective herbicide that will give adequate season-long weed control in soybean fields is needed to enhance the use of mulch planting for soybeans on sloping land.

The effectiveness of a single oversize terrace or a number of terraces spaced further apart than is normal needs evaluating. The use of terraces constructed with steep back-slopes with this part of the terrace established in perennial grass need to be tried to determine if farmers will accept them more readily than conventional constructed terraces. Terrace systems that utilize tile drains as outlets eliminating the need for grassed waterways might appeal to some farmers.

An educational program is needed in Dyer County and in other counties that have large numbers of farms that are cash rented to inform the owners and renters of land on satisfactory rental arrangements with emphasis on long-term agreements. Landowners should be encouraged to require that their land be protected against excessive erosion through the use of conserving crop and soil management systems. Landowners should make concessions to the lessee through longer leases, lower rents, or by paying the cost of installing certain conservation measures.

It is emphasized that the results of this study apply only to the Grenada - Loring - Memphis soil association in Dyer County, Tennessee. In other locations there will be variations in soil depth, texture, parent material, slope gradients, subsoil materials, soil moisture supplying capacity, and climate. These and other factors could influence the results of a study such as this. For example, the harmful effects of continued heavy soil losses would be more serious in other areas of West Tennessee where the mantle of loess

is not as thick and is underlain by sand, clay and gravel deposits. Crop yield reductions and management problems created as a result of continued heavy soil losses would be more serious on the sloping soils of Middle and East Tennessee than for the soils represented in this study. This is because most of the upland soils in these sections of the State have clay or silty clay subsoils and may be underlain by rock at relatively shallow depths.

CHAPTER VI

SUMMARY

Two farms that were considered to be representative of row crop farms in the Grenada - Loring - Memphis soil association area of Dyer County, Tennessee were selected for evaluating the short term effects of different levels of conservation on net farm returns. One farm was in the size range of the average Dyer County farm. This farm was 180 acres in size and was operated by a single manager using medium size farm machinery. The other farm of 410 acres was large enough to justify the use of larger (4-row) farm machinery and was operated by two managers.

Both farms were field inspected and the managers interviewed to determine the present farm organization. The present crop and soil management systems being used on the farms were evaluated as the low level of conservation. The average annual soil losses for the present plans were estimated at more than 21 tons per acre for the sloping cropland on both farms. Plans were developed for each farm for a high and a medium level of conservation. The high conservation plans included crop and soil management systems necessary to keep estimated average annual soil losses to the established tolerance for the soils on the farm. The plans for the medium conservation level called for the use of crop and soil management systems for maintaining average annual soil losses at twice the established tolerance for the soils on the farms.

Budgeting analysis was used to determine the estimated net returns from all crops produced under each level of conservation. The soils on the two farms were grouped in three soil productivity

groups on the basis of their productive potential for the crops grown. Estimated net returns were calculated on the basis of these soil productivity groups for each of the crops.

Estimated net returns summaries were made for both farms for each level of conservation evaluated. The acreage of the various crops grown on each of the soil productivity groups were used in making these summaries. Cost estimates for installing conservation practices were deducted from total returns. Cost that would remain constant for each level of conservation were not included in the summaries.

A soil loss survey was conducted on a representative sample of upland farms to determine the estimated average annual soil loss per acre from all sloping cropland in the Grenada - Loring - Memphis soil association area in Dyer County. The universal soil predicting equation was used to calculate the estimated soil loss. The needed information for using the equation was obtained by field inspection of the farms in the sample and from interviews of the farm operators.

The estimated average annual soil loss from Grenada, Loring, and Memphis soils on 2 to 5 per cent slopes was determined from the soil loss survey. This information was used to estimate the approximate number of years that would be required to change these soils from the moderately eroded phase to the severely eroded phase. Projections were made that reflected probable crop yield reductions and lower gross returns that would result from allowing erosion to continue at present rates until the erosion classification changes from moderate to severe. Corn, cotton, and soybeans were the crops used in these projections.

The result of the evaluations of the different crop and soil

management systems in this study indicate that estimated net crop returns will be lower under the high and medium levels of conservation as compared to the low level on both farms. Table X is a summary of the annual net returns from crops for the three levels of conservation evaluated. Returns for the 180 acre farm were $1,572.14 less for the high conservation and $1,142.38 less for the medium conservation system than the returns from the low conservation system. On the 410 acre farm, returns for the high and medium conservation systems were $1,382.56 and $929.36 less respectively than the low level. The smaller difference in returns for the large farm is attributed to the more efficient use of farm machinery and the availability of more land that could be used annually for row crops.

Estimated average annual soil loss from sloping cropland in Dyer County was found to be 13.8 tons per acre. Estimated average annual soil loss was greater on those farms in the survey that were practicing predominately row crop agriculture. Losses on these farms exceeded 20 tons per acre per year.

The soil loss survey gave an estimated average annual soil loss of 11.7 tons per acre from Grenada silt loam on 2 to 5 per cent slopes. Loring and Memphis silt loams on 2 to 5 per cent slopes had soil losses of 9.8 and 9.2 tons per acre per year respectively.

At present erosion rates, it would require 75 years for enough soil to be lost from Grenada silt loam on 2 to 5 per cent slopes to change the erosion classification from moderately eroded to severely eroded. One hundred and twenty and 128 years respectively would be required to change the moderately eroded phase of Loring and Memphis silt loams on 2 to 5 per cent slopes to the severely eroded phase.

TABLE X

SUMMARY OF ANNUAL NET RETURNS FROM CROPS SOLD FOR THREE LEVELS OF CONSERVATION FOR TWO DYER COUNTY, TENNESSEE FARMS

Conservation Levels	Net Returns	
	180 Acre Farm	410 Acre Farm
Low	$7, 808.55	$19, 167.19
Medium	6, 666.17	18, 237.83
High	6, 236.41	17, 784.23

Crop yields and gross returns would be reduced more on Grenada silt loam on 2 to 5 per cent slopes by continued uncontrolled erosion than on Loring and Memphis soils on the same slopes. However, yield reductions would occur so gradually on all three soils that they would be insignificant during the lifetime of the present farmers.

Benefits not reflected by farm income accrue from using crop and soil management systems that protect farm lands against erosion. These benefits may favorably affect both the individual farmer and the public However, there is some conflict of interest between the goals of the individual farmer and the public. A recommendation for reconciling this conflict is made. Recommendations for some possible courses of action to solve the problem of excessive soil losses on sloping cropland are enumerated.

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LITERATURE CITED

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APPENDIX

TABLE XI

COST OF INSTALLING CONSERVATION PRACTICES IN DYER COUNTY, TENNESSEE 1966[a]

Practice	Unit	Cost
Parallel Terraces	Mile	$30.00
Contour Stripcropping	Acre	3.00
Contour Farming	Acre	0.16

[a]Source: Soil Conservation Service Technical Guides for Dyer County Work Unit. 1966.

TABLE XII

PRICES PAID AND RECEIVED BY TENNESSEE FARMERS 1965[a]

Item	Unit	Price
Purchased:		
Fertilizer 6-12-12	cwt.	$ 2.55
0-20-20	cwt.	2.54
3-12-12	cwt.	1.93
Ammonium nitrate	cwt.	3.90
Lime, Spread	ton	4.50
Cotoran	lb.	4.00
Lorox	lb.	3.00
Atrazine	lb.	3.00
Toxaphene-DDT, 4-2 mix	gal.	2.66
Cottonseed, acid delented	cwt.	15.00
Seed corn	lb.	0.18
Soybean seed	bu.	4.25
Wheat seed	bu.	3.00
Red clover seed	lb.	0.45
Orchardgrass seed	lb.	0.32
Alfalfa-Clover Inoculant	package	0.50
Sold:		
Corn	bu.	$ 1.25
Cotton, lint	lb.	0.29
Cottonseed	lb.	0.023
Red Clover - grass hay	ton	29.00
Soybeans	bu.	2.40
Wheat	bu.	1.39
Custom Rates:		
Cotton picking	cwt.	2.25
Cotton ginning	bale	20.00

[a]Source: Unpublished data Agricultural Economics Department - Tennessee Agricultural Experiment Station, 1965. U.S.D.A. and Tennessee Department of Agriculture. 1966. Tennessee Agricultural Statistics Annual Summary. Bul. T-3.

TABLE XIII

MACHINE HOUR REQUIREMENTS BY TASK PER ACRE BY FARM SIZE FOR MAJOR CROPS[a]

Operation	Size of Farm	
	180-259 Acres	260-600 Acres
-Cotton-		
Cut stalks, 6 ft. Rotary mower	.5	.5
Turn plow	1.1	.9
Disk (2 times)	.4	.3
Plant-fertilize-pre-emerge	.5	.4
Cultivate and sidedress	.6	.3
Post-emerge	.4	.3
Apply insecticide (5 times)	1.5	1.4
Defoliation	.4	.3
Harvest	custom	1.0
Haul to gin	.8	.8
-Corn-		
Cut stalks, 6 ft. Rotary Mower	.5	.4
Turn plow	1.1	.9
Fertilize	.4	.3
Disk (2 times)	1.0	.8
Plant-fertilize-pre-emerge	.5	.4
Sidedress	.6	.3
Harvest, 10 ft. SP combine	---	1.2
Haul	1.5	1.4
-Soybeans-		
Turn plow	1.1	.9
Disk	.5	.4
Plant-fertilize	.5	.3
Cultivate	.6	.3
Combine 7 ft. PTO	1.2	--
Combine 10 ft. S.P.	---	.8

TABLE XIII (cont.)

MACHINE HOUR REQUIREMENTS BY TASK PER ACRE BY FARM SIZE FOR MAJOR CROPS[a]

Operation	Size of Farm	
	180-259 Acres	260-600 Acres
-Forage-		
Mowing	.6	.5
Rake	.5	.4
Bale (per ton)	.6	.5
Haul hay (per acre - 2 man wagon, 1 cutting)	1.4	1.2

[a]Source: Unpublished Data Agricultural Economics Department - Tennessee Agricultural Experiment Station.

TABLE XIV

CALCULATED POWER AND MACHINERY COST PER HOUR OF USE BY SIZE OF FARM AND TYPE OF COST[a]

Machine and Size	Size of Farm					
	180-259 Acres			260-600 Acres		
	Interest	Other	Total Cost	Interest	Other	Total Cost
Tractor, 25 HP	$0.15	$0.94	$1.09	----	----	----
Tractor, 35 HP	----	----	----	$0.14	$1.10	$1.24
Tractor, 45 HP	0.22	1.52	1.74	----	----	----
Tractor, 55 HP	----	----	----	0.19	1.24	1.43
Plow, 2 bottom	0.08	0.34	0.42	----	----	----
Plow, 5 bottom	----	----	----	0.06	0.25	0.31
Plow, Chisel 12 ft.	----	----	----	0.02	0.46	0.48
Disk, 8 ft.	0.07	0.23	2.30	----	----	----
Disk, 12 ft.	----	----	----	0.11	0.38	0.49
Harrow, 2 and 3 Sec.	0.04	0.10	0.14	0.02	0.04	0.06
Planter-fert., 2 row	0.19	0.68	0.87	----	----	----
Planter-fert., 4 row	----	----	----	0.19	0.67	0.86
Cultivator, 2 rows	0.15	0.59	0.74	----	----	----
Cultivator, 4 row	----	----	----	0.21	0.82	1.03
Fert. Spreader 12 ft.	0.09	0.33	0.42	0.09	0.32	0.41
Sprayer, 6 row	0.11	0.54	0.65	0.05	0.24	0.29
Mower, 7 ft.	0.23	0.90	1.13	0.09	0.34	0.43
Rotary mower, 6 ft.	0.24	1.03	1.27	0.10	0.43	0.53
Side del. rake	0.37	1.33	1.70	0.19	0.68	0.87

TABLE XIV (cont.)

CALCULATED POWER AND MACHINERY COST PER HOUR OF USE BY SIZE OF FARM AND TYPE OF COST[a]

Machine and Size	Size of Farm					
	180-259 Acres			260-600 Acres		
	Interest	Other	Total Cost	Interest	Other	Total Cost
Baler PTO	$0.76	$2.86	$3.62	$0.76	$2.86	$3.62
Combine, 7 ft. PTO	0.12	1.56	1.68	----	----	----
Combine, (self prop. corn head, 10 ft.)	----	----	----	1.29	4.87	6.81

[a]Source: Unpublished data Agricultural Economics Department - Tennessee Agricultural Experiment Station. 1965.

TABLE XV

ESTIMATED COST AND RETURNS PER ACRE OF COTTON BY SOIL PRODUCTIVITY GROUPS (CUSTOM MACHINE PICKED)

Item	Unit	Quantity	Price	Amount 180 Acre Farm	Amount 410 Acre Farm
Income					
Soil group 1 Lint	lbs.	725	$ 0.29	$200.25	$200.25
Cottonseed	lbs.	1174	0.023	27.00	27.00
Soil group 2 Lint	lbs.	500	0.29	145.00	145.00
Cottonseed	lbs.	810	0.023	18.63	18.63
Soil group 3 Lint	lbs.	425	0.29	122.25	122.25
Cottonseed	lbs.	688	0.023	15.82	15.82
Expenses					
a. Variable					
Seed, acid delented	lbs.	20	$ 0.15	$ 3.00	$ 3.00
Fertilizer 6-12-12	cwt.	6.0	2.55	15.30	15.30
Ammonium nitrate	cwt.	2.0	3.90	7.80	7.80
Lime, spread	ton	.4	4.50	1.80	1.80
Cotoran (weed control)	lb.	1.8	4.00	7.20	7.20
Insecticide, 4-2 mix of toxaphene-DDT (4 app.)	gal.	2.0	2.66	5.32	5.32
Soil group 1 custom pic.	cwt.	18.99	2.25	42.73	42.73
Ginning	bale	1.5	20.00	30.00	30.00
Soil group 2 custom pic.	cwt.	13.1	2.25	29.48	29.48
Ginning	bale	1.0	20.00	20.00	20.00

TABLE XV (cont.)

ESTIMATED COST AND RETURNS PER ACRE OF COTTON BY SOIL PRODUCTIVITY GROUPS (CUSTOM MACHINE PICKED)

Item	Unit	Quantity	Price	Amount 180 Acre Farm	Amount 410 Acre Farm
Soil group 3 custom pic.	cwt.	11.13	$ 2.25	$ 27.82	$ 27.82
Ginning	bale	.85	20.00	17.00	17.00
Tractor	---	-----	-----	8.15	6.47
Other equipment	---	-----	-----	2.91	1.71
	Total Variable Expenses				
	Soil group 1			$125.21	$121.93
	Soil group 2			100.96	98.68
	Soil group 3			96.30	94.02
b. Fixed					
Tractor	---	-----	-----	1.23	0.70
Other equipment	---	-----	-----	0.83	0.44
	Total Fixed Expenses			$ 2.06	$ 1.14
	Total Expenses				
	Soil group 1			127.27	123.07
	Soil group 2			103.02	99.82
	Soil group 3			98.36	95.16
Net returns to land, labor, capital, and management					
	Soil group 1			$ 99.98	$104.18
	Soil group 2			60.61	64.11
	Soil group 3			38.71	41.91

TABLE XVI

ESTIMATED COST AND RETURNS PER ACRE OF SOYBEANS BY SOIL PRODUCTIVITY GROUPS

Item	Unit	Quantity	Price	Amount 180 Acre Farm	Amount 410 Acre Farm
Income					
Soil group 1-Soybeans	bu.	36	$2.40	$86.40	$86.40
Soil group 2-Soybeans	bu.	30	2.40	72.00	72.00
Soil group 3-Soybeans	bu.	20	2.40	48.00	48.00
Expenses					
a. Variable					
Seed	bu.	1.0	$4.25	$ 4.25	$ 4.25
Fertilizer 0-20-20	cwt.	2.0	2.54	5.08	5.08
Lime, spread	ton	0.4	4.50	1.80	1.80
Lorox (weed control)	lb.	1.0	3.00	3.00	3.00
Tractor	---	---	----	8.10	5,29
Other equipment	---	---	----	3.32	5,21
Total Variable Expenses				$25.55	$24.63
b. Fixed					
Tractor	---	---	----	1.20	0.75
Other equipment	---	---	----	0.52	1.25

TABLE XVI (cont.)

ESTIMATED COST AND RETURNS PER ACRE OF SOYBEANS BY SOIL PRODUCTIVITY GROUPS

Item	Unit	Quantity	Price	Amount 180 Acre Farm	Amount 410 Acre Farm
	Total Fixed Expenses			$ 1.72	$ 2.00
	Total Expenses			27.27	26.63
Net returns to land, labor, capital and management					
	Soil group 1			$59.13	$59.77
	Soil group 2			44.73	45.37
	Soil group 3			20.73	21.37

TABLE XVII

ESTIMATED COST AND RETURNS PER ACRE OF RED CLOVER AND ORCHARD-GRASS HAY BY SOIL PRODUCTIVITY GROUPS - TWO YEAR LIFE-ESTABLISHMENT YEAR

Item	Unit	Quantity	Price	Amount 180 Acre Farm	Amount 410 Acre Farm
Income					
Red clover and orchardgrass hay					
Soil group 1	ton	1.35	$29.00	$39.15	$39.15
Soil group 2	ton	1.1	29.00	31.90	31.90
Soil group 3	ton	0.8	29.00	24.10	24.10
Expenses[a]					
a. Variable					
Red clover seed	lb.	4	$ 0.45	$ 1.80	$ 1.80
Orchardgrass seed	lb.	2	0.32	0.64	0.64
Lime, spread	ton	0.4	4.50	1.80	1.80
Fertilizer (establishment)					
3-12-12	cwt.	3.0	1.93	5.79	5.79
Inoculant	pkt.	.5	0.50	0.25	0.25
Tractor	---	---	----	5.69	4.56
Other equipment	---	---	----	3.21	2.21

TABLE XVII (cont.)

ESTIMATED COST AND RETURNS PER ACRE OF RED CLOVER AND ORCHARD-GRASS HAY BY SOIL PRODUCTIVITY GROUPS - TWO YEAR LIFE-ESTABLISHMENT YEAR

Item	Unit	Quantity	Price	Amount 180 Acre Farm	Amount 410 Acre Farm
	Total Variable Expenses			$19.18	$17.05
b. Fixed					
Tractor	---	---	----	0.86	0.64
Other equipment	---	---	----	0.96	0.63
	Total Fixed Expenses			$ 1.82	$ 1.27
	Total Expenses			21.00	18.31
Net returns to land, labor, capital and management					
	Soil group 1			$18.15	$20.83
	Soil group 2			10.90	13.58
	Soil group 3			3.10	5.78

[a]Establishment costs are prorated over a two-year period.

TABLE XVIII

ESTIMATED COST AND RETURNS PER ACRE OF RED CLOVER AND ORCHARD-GRASS HAY BY SOIL PRODUCTIVITY GROUPS - TWO YEAR LIFE - 2ND. YEAR

Item	Unit	Quantity	Price	Amount 180 Acre Farm	Amount 410 Acre Farm
Income					
Soil group 1					
Red clover-Orchardgrass hay	ton	2.7	$29.00	$78.80	$78.80
Soil group 2					
Red clover-Orchardgrass hay	ton	2.2	29.00	63.80	63.80
Soil group 3					
Red clover-Orchardgrass hay	ton	1.8	29.00	52.20	52.20
Expenses					
a. Variable[a]					
Red Clover seed	lb.	4	$ 0.45	$ 1.80	$ 1.80
Orchardgrass seed	lb.	2	0.32	0.64	0.64
Lime, spread	ton	0.4	4.50	1.80	1.80
Fertilizer (establish) 3-12-12	cwt.	3.0	1.93	5.79	5.79
Fertilizer (maintenance 2nd. year) 0-20-20	cwt.	1.5	2.54	3.81	3.81
Inoculant	pkt.	.5	0.50	0.25	0.25
Tractor	---	---	----	7.00	6.26
Other equipment	---	---	----	5.82	4.18

TABLE XVIII (cont.)

ESTIMATED COST AND RETURNS PER ACRE OF RED CLOVER AND ORCHARD-GRASS HAY BY SOIL PRODUCTIVITY GROUPS - TWO YEAR LIFE - 2ND. YEAR

Item	Unit	Quantity	Price	Amount 180 Acre Farm	Amount 410 Acre Farm
	Total Variable Expenses			$26.91	$24.53
b. Fixed					
Tractor	---	---	----	1.30	0.74
Other equipment	---	---	----	1.68	1.13
	Total Fixed Expenses			$ 2.98	$ 1.87
	Total Expenses			29.89	26.40
Net returns to land, labor, capital and management					
	Soil group 1			$48.91	$52.40
	Soil group 2			33.91	37.40
	Soil group 3			22.31	25.80

[a]Establishment costs are prorated over a two-year period.

TABLE XIX

ESTIMATED COST AND RETURNS PER ACRE OF RED AND LADINO CLOVER-ORCHARDGRASS HAY BY SOIL PRODUCTIVITY GROUPS - THREE YEAR LIFE-ESTABLISHMENT YEAR

Item	Unit	Quantity	Price	Amount 180 Acre Farm	Amount 410 Acre Farm
Income					
Clover-grass hay					
Soil group 1	ton	1.35	$29.00	$39.15	$31.15
Soil group 2	ton	1.1	29.00	31.90	31.90
Soil group 3	ton	0.8	29.00	24.10	24.10
Expenses[a]					
a. Variable					
Red clover seed	lb.	2.6	$ 0.45	$ 1.17	$ 1.17
Ladino clover seed	lb.	1.0	0.75	0.75	0.75
Orchardgrass seed	lb.	2.0	0.32	0.64	0.64
Lime, spread	ton	0.4	4.50	1.80	1.80
Fertilizer (establish) 3-12-12	cwt.	2.0	1.93	3.86	3.86
Inoculant	pkt.	0.3	0.50	0.15	0.15
Tractor	---	---	----	4.71	3.47
Other equipment	---	---	----	3.05	2.19

TABLE XIX (cont.)

ESTIMATED COST AND RETURNS PER ACRE OF RED AND LADINO CLOVER-ORCHARDGRASS HAY BY SOIL PRODUCTIVITY GROUPS - THREE YEAR LIFE-ESTABLISHMENT YEAR

Item	Unit	Quantity	Price	Amount 180 Acre Farm	Amount 410 Acre Farm
	Total Variable Expenses			$16.13	$13.39
b. Fixed					
Tractor	---	---	----	0.73	0.48
Other equipment	---	---	----	0.84	0.58
	Total Fixed Expenses			$ 1.57	$ 1.06
	Total Expenses			17.70	14.45
Net returns to land, labor, capital and management					
	Soil group 1			$21.45	$24.70
	Soil group 2			14.20	17.45
	Soil group 3			6.40	9.65

[a]Establishment costs are prorated over a three-year period.

TABLE XX

ESTIMATED COST AND RETURNS PER ACRE OF RED AND LADINO CLOVER-ORCHARDGRASS HAY BY SOIL PRODUCTIVITY GROUPS-THREE YEAR LIFE-2ND.AND 3RD.YEARS

Item	Unit	Quantity	Price	Amount 180 Acre Farm	Amount 410 Acre Farm
Income					
Soil group 1					
Clover-grass hay	ton	2.7	$29.00	$78.80	$78.80
Soil group 2					
Clover-grass hay	ton	2.2	29.00	63.80	63.80
Soil group 3					
Clover-grass hay	ton	1.8	29.00	52.20	52.20
Expenses					
a. Variable[a]					
Red clover seed	lb.	2.6	$ 0.45	$ 1.17	$ 1.17
Ladino clover seed	lb.	1.0	0.75	0.75	0.75
Orchardgrass seed	lb.	2.0	0.32	0.64	0.64
Lime, spread	ton	0.4	4.50	1.80	1.80
Fertilizer (establish) 3-12-12	cwt.	2.0	1.93	3.86	3.86
Fertilizer (maintenance 2nd year) 0-20-20	cwt.	1.5	2.54	3.81	3.81
Inoculant	pkt.	.3	0.50	0.15	0.15
Tractor	---	---	----	4.78	5.74
Other equipment	---	---	----	5.68	4.06

TABLE XX (cont.)

ESTIMATED COST AND RETURNS PER ACRE OF RED AND LADINO CLOVER-ORCHARDGRASS HAY BY SOIL PRODUCTIVITY GROUPS-THREE YEAR LIFE-2ND. AND 3RD. YEAR

Item	Unit	Quantity	Price	Amount 180 Acre Farm	Amount 410 Acre Farm
Total Variable Expenses				$22.64	$21.98
b. Fixed					
Tractor	---	---	----	0.72	0.78
Other equipment	---	---	----	1.24	1.09
Total Fixed Expenses				$ 1.96	$ 1.87
Total Expenses				24.60	23.85
Net returns to land, labor, capital and management					
Soil group 1				$54.20	$54.95
Soil group 2				39.20	39.95
Soil group 3				27.60	28.35

[a] Establishment costs are prorated over a three-period.

TABLE XXI

ESTIMATED COST AND RETURNS PER ACRE OF CORN BY SOIL PRODUCTIVITY GROUPS—410-ACRE FARM (4-ROW EQUIPMENT)

Item	Unit	Quantity	Price	Amount
Income				
Corn				
Soil group 1	bu.	80	$1.25	$100.00
Soil group 2	bu.	60	1.25	75.00
Soil group 3	bu.	50	1.25	62.50
Expenses				
a. Variable				
Seed	lbs.	9	$0.18	$ 1.62
Fertilizer 6-12-12	cwt.	5.0	2.55	12.75
Ammonium nitrate	cwt.	2.0	3.90	7.80
Lime, spread	ton	0.4	4.50	1.80
Atrazine	lb.	2.5	3.00	7.50
Tractor	---	---	----	6.69
Other equipment	---	---	----	7.95
	Total Variable Expenses			$46.11
b. Fixed				
Tractor	---	---	----	0.95
Other equipment	---	---	----	1.90

TABLE XXI (cont.)

ESTIMATED COST AND RETURNS PER ACRE OF CORN BY SOIL PRODUCTIVITY GROUPS—410 ACRE FARM (4-ROW EQUIPMENT)

Item	Unit	Quantity	Price	Amount
	Total Fixed Expenses			$ 2.85
	Total Expenses			48.96
Net returns to land, labor, capital and management				
	Soil group 1			$51.04
	Soil group 2			26.04
	Soil group 3			13.54

TABLE XXII

ESTIMATED COST AND RETURNS PER ACRE OF WHEAT AND SOYBEANS DOUBLE CROPPED BY SOIL PRODUCTIVITY GROUPS—410 ACRE FARM (4-ROW EQUIPMENT)

Item		Unit	Quantity	Price	Amount
Income - Wheat					
Wheat grain[a]	Soil group 1	bu.	37	$1.39	$51.43
—	Soil group 2	bu.	30	1.39	41.70
	Soil group 3	bu.	25	1.39	34.75
Expenses - Wheat					
a. Variable					
Seed wheat		bu.	1.25	$3.00	$ 3.75
Fertilizer 6-12-12		cwt.	4.0	2.55	10.20
Ammonium nitrate		cwt.	1.0	3.90	3.90
Lime, spread		cwt.	0.4	4.50	1.80
Tractor		---	---	----	3.15
Other equipment		---	---	----	4.44
	Total Variable Expenses Wheat				$27.24
b. Fixed					
Tractor		---	---	----	0.35
Other equipment		---	---	----	1.06
	Total Fixed Expenses Wheat				$ 1.41
	Total Expenses Wheat				28.65

TABLE XXII (cont.)

ESTIMATED COST AND RETURNS PER ACRE OF WHEAT AND SOYBEANS DOUBLE CROPPED BY SOIL PRODUCTIVITY GROUPS—410 ACRE FARM (4-ROW EQUIPMENT)

Item	Unit	Quantity	Price	Amount
Net returns to land, labor, capital and management from wheat				
	Soil group 1			$22.48
	Soil group 2			13.05
	Soil group 3			6.10
Income - Soybeans				
Soybeans Soil group 1	bu.	24	$2.40	$57.60
Soil group 2	bu.	20	2.40	48.00
Soil group 3	bu.	13.4	2.40	34.60
Expenses - Soybeans				
a. Variable				
Soybean seed	bu.	1	$4.25	$ 4.25
Lorox (weed control)	lb.	1	3.00	3.00
Tractor	---	---	----	4.67
Other equipment	---	---	----	5.99
	Total Variable Expenses Soybeans			$17.81
b. Fixed - Soybeans				
Tractor	---	---	----	0.65
Other equipment	---	---	----	1.36

TABLE XXII (cont.)

ESTIMATED COST AND RETURNS PER ACRE OF WHEAT AND SOYBEANS DOUBLE CROPPED BY SOIL PRODUCTIVITY GROUPS—410 ACRE FARM (4-ROW EQUIPMENT)

Item	Unit	Quantity	Price	Amount
	Total Fixed Expenses Soybeans			$ 2.01
	Total Expenses Soybeans			19.82
Net returns to land, labor, capital and management from soybeans				
	Soil group 1			37.78
	Soil group 2			28.18
	Soil group 3			14.78
Total net returns to land, labor, capital and management from wheat and soybeans				
	Soil group 1			$60.26
	Soil group 2			41.23
	Soil group 3			20.88

[a]Wheat straw incorporated into soil and not baled.

TABLE XXIII

METHOD OF ESTIMATING ANNUAL SOIL LOSS PER ACRE[a]

The rate of soil loss depends upon several factors, such as the rainfall characteristics, length and degree of slope, crop management and soil conservation practices. The soil loss predicting equation is a means of combining the effects of these factors into quantative estimates of the annual soil loss per acre. The illustration of the method of estimating soil loss shown below relates to Grenada silt loam on a 5 per cent slope averaging 200 feet in length. The location is Dyer County, Tennessee. The cropping-management has been continuous cotton yielding 500 pounds of lint per acre. Contour farming is practiced.

1. The soil loss predicting equation:

   A = RKLSCP
   A = Soil loss per acre per year
   R = Rainfall-erosion index
   K = Soil erodibility factor
   LS = Soil loss factor adjusted to length and degree of slope
   C = Cropping-management
   P = Conservation practice

2. Substituting the appropriate values in the above equation.

   R = 260
   K = 0.42
   LS = 0.8
   C = .508 (cotton continuous without winter cover)
   P = .50 (contour cultivation on 2.1 to 7.0 per cent slope)
   A = 260 x.42 x .8 x .508 x .50
   A = 22.2 tons of soil loss per acre per year

[a]Source: Unnumbered mimeographed report entitled "Soil Loss Estimation in Tennessee", prepared by members of the Agronomy Department, University of Tennessee, and the Soil Conservation Service, USDA, based on an equation for predicting rainfall erosion losses by W. A. Wischmeier, ARS, U.S.D.A.