# TEMPORAL IMPACTS OF RESTRICTING
# SOIL EROSION ON THE FARM FIRM

By

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TEMPORAL IMPACTS OF RESTRICTING

SOIL EROSION ON THE FARM FIRM

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# CHAPTER I

# INTRODUCTION

## The Problem

Soil erosion has two detrimental effects on the environment. One effect of soil erosion is the loss of soil productivity through removal of plant nutrients and organic matter. The loss of the topsoil lowers the amount of nitrogen and other nutrients available to growing crops. Erosion also diminishes the ability of the soil to absorb water, which reduces the moisture available in the soil to dissolve nutrients required by plants. Continued loss of topsoil over time results in a less fertile soil (37).

The second effect of soil erosion is water pollution. Soil erosion results in sediment, nutrients and pesticides polluting the waterways. One source estimates water pollution caused by soil erosion affects sixty-eight percent of the river basins in the United States (13). Sediment carried by soil erosion represents the greatest volume of wastes entering surface water systems. Excessive sediment loads increase water treatment costs and reduce the economic life of reservoirs and channels.

Sediment also is a transport mechanism for other types of pollutants. Nutrient elements, primarily phosphorous and nitrogen, enter waterways with run-off from lands used for intensive agricultural production. These nutrients contribute to lake eutrophication.

Pesticides are another major pollutant in water resulting from soil erosion. Pesticides enter the waterways by becoming attached to soil particles. Pesticides damage water quality by their presistence in the aquatic environment, accumulating and causing damage in the food chain (19). Because soil erosion adversely affects the environment, society would benefit by reducing soil erosion. Reducing soil erosion would maintain the productivity of the soil and improve water quality.

The soil conservation movement did not gain widespread attention or support until the "dust bowl" days during the 1930's. That disastrous period caused concern over the rapid spread of soil erosion and its effect on soil productivity. The Soil Conservation Service (SCS) was established to develop practices which would reduce soil erosion and to provide technical assistance to farmers. Soil conservation practices recommended by the SCS included terracing, contour plowing, pasture management and cover cropping.

Until recently, water pollution from agricultural sources received little attention. The 1972 amendments to the Federal Water Pollution Control Act (FWPCA), Public Law 92-500 (PL 92-500) formally recognized agriculture as a major source of water pollution. PL 92-500 distinguishes two sources of pollution: point sources, which include industrial and municipal discharges and sewer overflows (13); and non-point sources of pollution which are generated by diffused land use activities and conveyed to waterways through natural processes (19). Non-point sources of pollution include pollution from agricultural activities.

The objective of the FWPCA, as established by PL 92-500, is the restoration and maintenance of the quality of the nation's waters. To achieve this goal, PL 92-500 established a national policy for the development and implementation of area-wide waste treatment systems to assure adequate control of all sources of pollution (19). The program which deals with non-point source pollution is the Water Quality Planning and Management Program (Section 208 of PL 92-500).

Section 208 specifies that regional or state planning agencies are to develop waste treatment management plans for their region. These plans cover six areas:

1. Establish priorities for treatment and time schedules for meeting those priorities
2. Provide mechanisms to coordinate the treatment activities within the area
3. Designate the management structure to be responsible for implementing the plan
4. Provide a means of defining and dealing with non-point sources of pollution
5. Allow for necessary financial arrangements to implement the recommended plan
6. Report the environmental impact on the area of implementing the proposed plan

The final step is to carry out the proposed plan (15, pp. 4-5).

Because non-point pollution enters the waterways at numerous and diffuse locations, the best way to control this source of pollution is by prevention. Thus, control of non-point sources of pollution is site specific (14). In 1977, the United States Department of Agriculture (USDA), with concurrence of the Environmental Protection Agency (EPA), was authorized to formulate strategies for rural lands to control non-point sources of pollution from agriculture (13). These strategies were designated Best Management Practices (BMP's). Best Management Practice refers to a practice, or a combination of practices, that is determined to be the most effective and practical means of preventing or reducing the amount of non-point source pollution to a level compatible with water quality goals (14).

The BMP's for control of non-point sources of pollution from agriculture are aimed at the prevention of pollutant movement from the land rather than treatment of the water after the pollutant enters the waterways. Examples of agricultural BMP's include pasture management, conservation tillage, terracing and diversions. Factors which should be considered when selecting a practice to control non-point pollution problems include soil type, rainfall, agricultural activities and topography (29).

The practices used to control non-point sources of pollution are also practices used to maintain soil productivity[1]. In both cases, the practices reduce soil erosion. By reducing soil erosion, society's goals to maintain soil productivity and improve water quality can be achieved.

To reduce soil erosion caused by farming activities, BMP's must be implemented at the farm level. A policy must be formulated which will induce farmers to adopt soil conservation practices. To develop such a policy, it is important to determine the impact on the farm firm of restricting soil erosion. By knowing the impact BMP's will have on the farm firm, appropriate policy measures can be designed. If, for example, farmers will benefit by reducing soil erosion, then a program to inform farmers of this benefit may be the appropriate policy to follow. However, if adoption of BMP's adversely affects the farm firm,

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[1]Because of the similarity between soil conservation practices and Best Management Practices (BMP's), these terms will be used interchangeably.

farmers must be persuaded to reduce soil erosion. One method of encouraging farmers to reduce soil erosion is to provide financial incentives to adopt BMP's. An alternative policy would be to impose legal penalties for exceeding recommended soil loss limits. Determining the economic impact on the farm firm of restricting soil erosion is a prerequisite to formulating an effective policy aimed at inducing farmers to adopt BMP's.

## Objectives

The objective of this research is to determine the economic impact on the farm firm of restricting soil erosion. The specific objectives of this study are to:

1. Estimate the short run impacts on farm organization, production costs and income of restricting soil erosion

2. Evaluate the long term effect on farm income of restricting soil loss

## Procedure

To analyze the economic impact on the farm firm of restricting soil erosion, the first step was to determine the conservation practices used to reduce soil erosion in the area to be studied. Since it was not feasible to consider all BMP's, some BMP's commonly used in Oklahoma were selected for this analysis.

Information on the physical impact of BMP's on the farming operation was gathered using personal interviews of farmers in the study area. A questionnaire was designed to obtain information from the farmer about the farming operation, the cost to operate and maintain

BMP's and the benefits of BMP's. The names of farmers using these BMP's were obtained from local SCS personnel. The farmers were personally interviewed during the summer of 1980.

Personnel of the SCS and state agronomists were requested to provide data on the cost of installing BMP's and the operation and maintenance activities required by the BMP's. The relationship between soil loss and loss in soil productivity was also discussed with SCS personnel and state agronomists.

The information obtained from the survey was used in conjunction with the Oklahoma State University Enterprise Budget Generator to develop budgets reflecting the costs and returns of various crop and livestock activities for different conservation practices. A linear programming model was formulated using the costs and returns derived from the enterprise budgets. The model maximizes net returns of a farm subject to the resource restrictions faced by the farm firm. The model was used to analyze three representative farms in the study area.

To determine the impact of restricting soil erosion on farm income, net returns were calculated for each farm assuming two alternative scenarios. One scenario assumed soil loss restricted to SCS recommended levels. The other scenario assumed unrestricted soil erosion. The net returns for each scenario were compared for both short term and long term planning horizons.

## Area of Study

The region selected for this study is southwestern Oklahoma and includes Grady, Caddo, Stephens, Custer and Greer counties (Figure 1). This area was selected because of its importance to agricultural

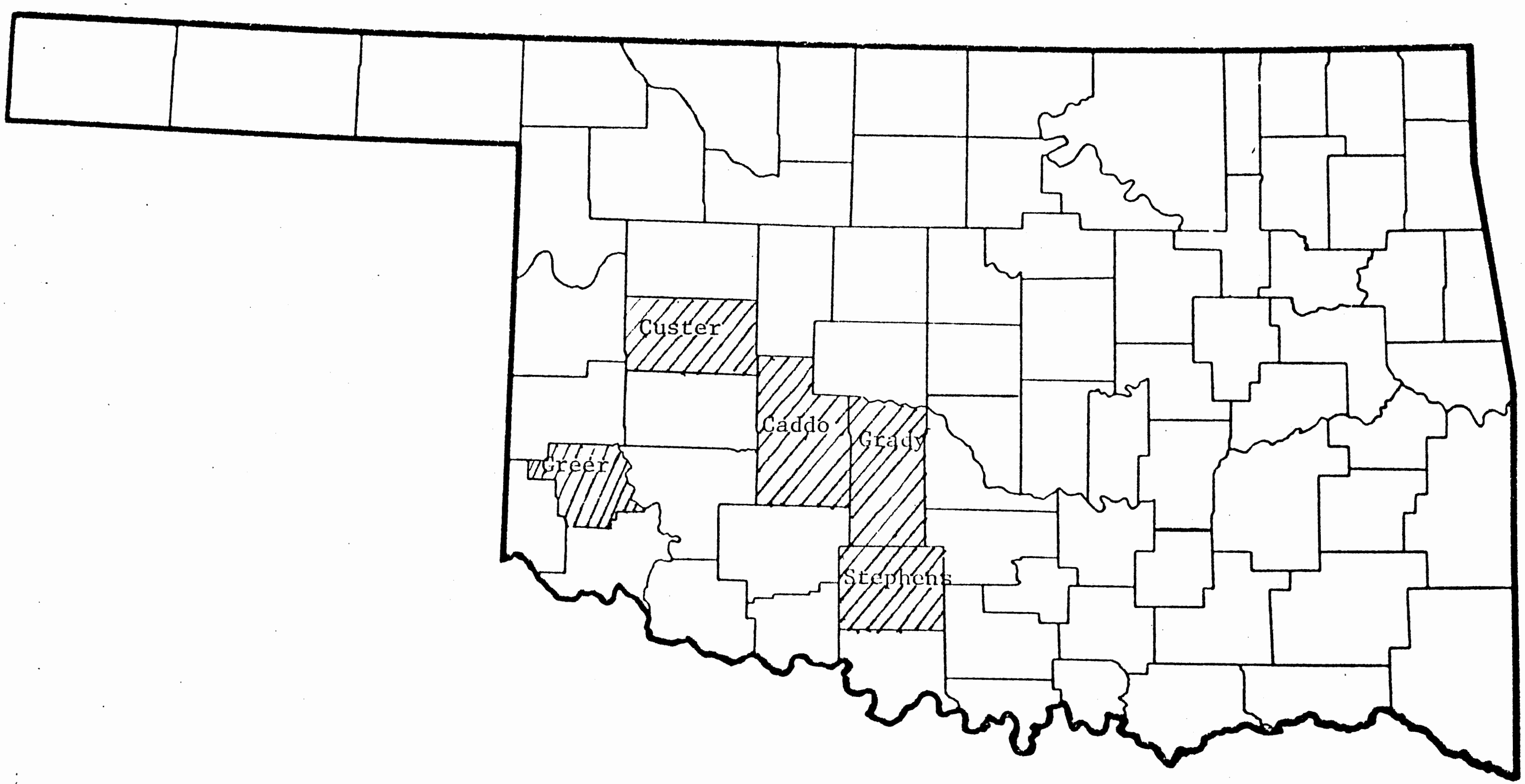


Figure 1. Oklahoma Counties Included in Best Management Practices Study

in Oklahoma. The results of this study may not be applicable to other areas of the state because of different rainfall patterns, agricultural activities and topography.

# CHAPTER II

## REVIEW OF PREVIOUS RESEARCH

### The Soil Erosion Process

The process of detachment and transportation of soil material by erosive agents is known as soil erosion (1). The erosive agents of soil erosion are wind and water. Wind erosion is considered to be less severe than water erosion. One-fourth of the total soil erosion for the entire United States is due to wind erosion; three-fourths is caused by water run-off (31).

Erosion of the soil is a continuous process. Erosion occurs whenever wind or water removes soil particles from undisturbed land areas. While erosion of the soil occurs in the absence of human activities, the erosion process is accelerated by human activities, such as farming (34). One area of concern is the accelerated rate of soil erosion resulting from man's activities and water run-off.

The soil erosion process involves three steps: (1) the loosening of soil particles by the impact of rain drops or by the scouring action of run-off; (2) the movement of the detached particles by running water; and (3) the deposition of the particles at new locations. The erosion process begins when rain drops strike the soil surface loosening the soil granules and detaching particles from the soil mass. When the rain falls faster than it can be absorbed, a sheet of water collects on the surface and moves downhill.

The second step of the erosion process begins as detached soil particles are transported by water run-off. The combined actions of rainfall and water run-off removes continuous layers of soil. This is called sheet erosion. Moving downhill the water run-off grows in volume and erosive force, dislodges soil and carries it along with those particles detached by the raindrops. This is called rill erosion. The principal erosive agents on land during rain storms are raindrops and flowing water.

The final step in the erosion process is the deposition of the transported soil particles. This deposition may occur on upland fields or on bottom lands where crops are damaged. The sediment may fill streams, ponds, and reservoirs. In any case, the depositing of the soil particles where they are not wanted is as damaging as their removal from their original location (37).

## Review of Literature

The passage of PL 92-500 and implementation of Section 208, the Water Quality Planning and Management Program, has sparked a great deal of interest in the economic effects of this program on the agricultural sector. Numerous studies in recent years have focused on the impact on the agricultural industry of implementing Section 208. Previous research can be grouped into three categories.

The first group of studies considers the impact at the national level of imposing soil loss controls on agriculture. In a 1974 study, Nicol, Heady and Madsen (27) simulated changes in national and regional agricultural production patterns resulting from soil erosion controls. The model incorporated major commodities and producing areas and allocated crop production to those areas which had an economic advantage and were compatible with soil loss restraints. Results of the study indicated that soil erosion could be reduced without serious increases in domestic food prices.

A study conducted by Wade and Heady (48, 49) in 1976 evaluated the cost of reducing pollution from agricultural sources. The analysis used an interregional linear programming model which accounted for the interrelationships of land management, erosion and water quality. The model minimized the cost of producing and transporting farm products and the cost of erosion. The study concluded that reductions in water pollution from agriculture could be accomplished through proper management with only a minimal impact on American agriculture.

A 1976 article published by Wade, Nicol and Heady (50) summarized the results of another study conducted at Iowa State University. The study utilized a national model to analyze changes in regional farm income caused by water quality controls. A linear programming model was used which incorporated major producing areas, commodity markets, resources and transportation networks of United States agriculture. The model minimized the cost of producing and transporting agricultural products subject to resource and water quality constraints. The research found that American agriculture has flexibility in meeting product demand, even under rigid pollution control policies. The study also showed that restricting agricultural pollution redistributed farm income among producing regions.

In 1977, Saygideger, Vocke and Heady (32) found that the cost of soil erosion control does not vary proportionately with the level of erosion abated. At a high level of soil erosion, a given reduction in erosion is obtainable without substantial costs. However, when soil losses become relatively low, further reductions in soil erosion become more and more expensive. These findings resulted from a study which used a multi-goal interregional linear programming model of United State agriculture.

A study conducted at Iowa State University in 1977 used an interregional linear programming model of U.S. agriculture to analyze policies designed to abate pollution caused by agricultural production (47). Results showed that agriculture has the capacity to comply with pollution control policies. However, meeting the imposed restrictions caused regional shifts in crop and livestock production.

In summary, research dealing with the economic impact on U.S. agriculture from restricting soil erosion implies that American agriculture has the capacity to meet pollution control policies and satisfy demand for farm products. The studies found that the cost of meeting environmental goals are passed to consumers in the form of higher product prices and the agricultural sector loses little income. Economic theory offers an explanation of this result. First, assume that the agricultural industry approaches pure competition. Also, assume that initially there are no environmental goals and that the industry is in equilibrium, with no incentives for farms to enter or leave the industry. Now assume that government imposes an environmental policy on the agricultural sector. The initial effect of the policy is to increase operating costs throughout the industry. Losses occur as a result of the increased operating cost. The losses force high-cost farms out of the industry. As farms leave the industry, supply decreases increasing product prices. The industry reaches a new equilibrium at a higher product price and lower quantity supplied. Therefore, consumers pay the cost of the environmental policy through higher product prices. In this case the entire agricultural industry is considered. However, Section 208 (PL 92-500) specifies that conservation plans are to be developed and carried out by regional or state agencies. Also, BMP's are site specific and must be implemented at the farm level. Thus, it is important to know the regional and farm level impacts of adopting environmental policies to reduce soil erosion.

The second category of studies deal with the impact on a region or watershed of imposing pollution control policies. In a 1974 article, Jacobs and Timmons (20) summarized the results of a study which analyzed the cost of controlling water quality in the Nishnabotna River Basin in Southwest Iowa. A linear programming model was used to estimate the benefits and costs of reducing soil erosion. Results of the study indicated that pollution from agriculture could be reduced only at substantial cost to the farming industry in the river basin.

A study conducted by Kasal (21) in 1976 measured the trade-off between farm income and environmental goals. A linear programming model was used which maximized profits subject to resource and environmental constraints of an unnamed river basin. Pollution control policies considered were soil loss restrictions, fertilizer use restrictions, land use restrictions and various combinations of the alternative policies. Kasal concluded that farm income decreases as pollution control policies become more restrictive.

A number of studies have been conducted analyzing the economic impact of imposing pollution control measures in the Corn Belt (30, 33, 43, 44, 45). These studies were conducted using linear programming models which included production and marketing activities of the Corn Belt. The studies found that the impact of pollution controls were translated to higher commodity prices which offset higher production costs. This implies that the cost of pollution controls falls more heavily on consumers than producers. These studies concluded that reasonable erosion control programs can be implemented without serious economic impacts on the farming industry of the Corn Belt.

A 1977 study by Alt and Heady (2) estimated the impact of erosion control restrictions on crop production in the Iowa River Basin. The study used a linear programming model which minimized the cost of crop production while meeting environmental goals. Alt and Heady concluded that imposition of pollution control policies increased crop production costs in the Iowa River Basin.

At a seminar sponsored by the Great Plains Agricultural Council in 1977, Swanson (40) presented results of research conducted at the University of Illinois. The research covered six watersheds and dealt with the physical and economic impacts of reducing soil erosion. The studies developed a relationship between depth of topsoil and crop yield to derive a cost of soil loss. The research considered planning periods of one, 20 and 100 years. The studies concluded that the economic impacts of erosion controls differ for different planning horizons. As the planning period considered increases, erosion control measures become profitable.

Taylor, Reneau and Harris (42) reached similar conclusions from a study of the economic impact of Section 208 controls on five Texas watersheds. Their study considered the economics of soil conservation and the economic consequences of various sedimentation control policies.

The researchers related loss of crop productivity to loss of topsoil. The analysis considered planning horizons of 10, 100 and 200 years.

The impact of Section 208 Planning Controls on the Delta area of Mississippi was studied by Marsh and Parvin (23) in 1979. A budget generator was used to calculate costs and returns of different cropping systems. The study compared net returns of the Delta area before and after implementation of Section 208, PL 92-500. The researchers concluded that implementation of Section 208 controls would have an adverse impact on farm income of the Mississippi Delta area.

Research conducted in 1980 by Badger, Lawler and Mapp (3) evaluated the impact of conservation practices on net farm income in the Little Washita River Watershed in Oklahoma. The study used a linear programming model to maximize total returns for the watershed subject to resource and environmental constraints. As erosion control policies became restrictive, agricultural income for the watershed decreased.

Ogg and Heimlich (28) examined ways in which soil conservation plans can incorporate changes in market prices of various crops. The analysis used a linear programming model which maximized profits of the Chowan-Pasquotank River Basin of Virginia and North Carolina. They found that imposition of a rigid conservation program reduced net returns for the region. Thus, the authors concluded that conservation policies need to be flexible with changing market conditions.

In a study of the Palouse Area of the Northwest, Burt (12) investigated the economics of soil conservation. A dynamic programming model was used to maximize the present value of net returns from the land resource. Soil fertility was measured by the percent organic matter and the depth of top-soil. Intensive agricultural production with sound cultural and fertilization practices is economically justified for the Palouse Area.

In 1981, Ervin and Washburn (16) estimated the private economic incentives of adopting selected conservation practices on common soils of Missouri. A capital budgeting model was used to determine the profitability of selected crop enterprises, tillage systems and conservation practices. The net present value of each cropping activity was calculated. The study area was the Salt River Basin of Monroe County and included four major soils: Mexico, Leonard-Armstrong, Armstrong and Putnam. The study found that benefits of soil conservation result from increased crop yields over time. The costs included a direct application cost and an opportunity cost of planting lower-valued soil conserving crops. Another finding was that as the discount rate decreases soil conservation becomes profitable. A 20 year planning period was assumed with discount rates of four, eight and 12 percent. The study also found that it pays to reduce soil erosion as the planning period increases from five to 25 to 50 years. A discount rate of eight percent was assumed.

Berglund and Michalson (4) estimated the cost of reducing soil erosion using Latah Conservation District's five point program to control soil erosion from farmland. The plan includes restricted summer fallow, minimum tillage, divided slopes, cross slope farming and treatment of critical erosion areas. The study area was the Cow Creek Watershed of Latah County, Idaho. A linear programming model was used to estimate the economic impact of adopting the five point program. The study found that adoption of Latah Conservation District's conservation plan would necessitate a shift from high value soil erosive crops to low value soil conserving crops. This would result in a decrease in farm income for the Cow Creek Watershed.

The results of the regional studies differ from the results of the national studies. The studies at the national level found that the costs of reducing pollution from agriculture were passed to the consumers. The regional studies, however, found that the economic impact of implementing BMP's varied from region to region. The regional studies imply that the impact on an area of adopting erosion controls depends on the characteristics of the area. One factor which influences the profitability or cost of restricting soil erosion is the geographical size of the region.[1] If soil erosion controls are imposed on a small geographical region, the costs of the controls will not be passed on to consumers and farm income for the area will drop. The rainfall patterns, topography and predominant soils of a region also influence the cost of restricting soil erosion. These variables influence the amount of soil loss which occurs from a region and little can be done to change these factors. For a region characterized by steep slopes, heavy rains and erodible soils, reducing soil erosion will be costly and farm income for the area will decline. A final factor which will influence the economic impact on a region of adopting BMP's is the crops which the region has a comparative advantage to produce. If, without a soil loss restriction, the most profitable crop enterprises

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[1]The influence the area has on the national agricultural economy also is important.

such as row crops are soil erosive, imposition of a soil loss restriction will reduce farm income of the area. This is because the soil loss restriction forces a shift from profitable soil erosive crops to nonprofitable soil conserving crops. The final group of studies deal with the farm level impacts of restricting soil erosion.

Because of the nature of BMP's, implementation of these measures must be at the farm level. Thus, it is important to know the impact BMP's will have on the farm firm. The final group of studies deal with this issue. In 1964 Swanson and Harshbarger (41) analyzed the economic effect of soil erosion on Swiggert Soil in Illinois. The study used a budgeting procedure which compared discounted net returns for various cropping systems for a 50 year period. The research concluded that the axiom, "soil conservation pays", is not always the case for an individual farmer.

Using a budgeting technique, Van Arsdall and Johnson (46) studied the economic impact of water pollution abatement on family livestock farms. Based on results of the study, Van Arsdall and Johnson concluded that investment in waste management systems would have a detrimental effect on farm income. The authors also stated that the economic impact varied from farm to farm, depending on the farm's resources.

In 1972, Narayanan and Swanson (25) estimated the trade-offs between reducing sediment levels and farm income. The research used a linear programming model to maximize farm income for various sediment levels. The authors concluded that as the level of sedimentation from the farm is decreased, farm income declines.

A 1979 study analyzed the impact of soil loss control policies at the farm level (7). The analysis used a linear programming model which maximized after tax cash income subject to land, labor, capital and crop production relationships. The researchers found that the effect of soil loss controls varied among soil types. The authors concluded that a uniform policy to control soil erosion would be inequitable, because some farms must make major adjustments in management practices while others would continue operation with few changes. Under a uniform policy, income and debt servicing capacity would be significantly different depending on soil characteristics and farm enterprise organization.

White and Partenheimer (51) examined the income effect of implementing erosion control programs to attain SCS soil loss limits. The study analyzed twelve dairy farms in Pennsylvania using a linear programming model and found that restricting soil erosion would cause a reduction in net farm income for ten of the twelve farms. It was also found that the economic effect of implementing erosion control practices was not confined to the initial cost of the practice. Adoption of conservation practices also caused a change in the overall farm plan, shifting from profitable to unprofitable crop rotations.

An economic analysis of terraces for erosion control was the subject of a 1980 study conducted by Mitchell, Brach and Swanson (24). The objective of the study was to determine if terracing systems were economically justified solely from the farmer's viewpoint. The research considered a range of soil types, soil losses, soil loss restrictions, terracing costs and annual operating costs. The authors concluded that when only direct benefits of terraces are considered, farmers who invest in terraces have decreases in net farm income.

The results of the farm level studies correspond with the findings of the regional studies. The impact at the farm level of restricting soil erosion varies from farm to farm. Factors which influence the impact of erosion controls include the kind of soils, topography, climate and management of the farm.

## Summary of Past Research Findings

Previous research of the economic impact of restricting soil erosion can be grouped into three classes: studies at the national, regional and farm level. Studies at the national level show that American agriculture can meet both product demand and environmental goals without a serious loss in income. At present there is no need to reconsider the impact on the national agricultural sector of imposing pollution controls.

The regional and farm level studies imply that the impact of adopting BMP's varies from one region and from one farm to another. Knowing the impact on a region or watershed of reducing soil erosion is important; however, adoption of BMP's must ultimately occur at the farm level. Thus it is necessary to know the farm level impact of restricting soil erosion. Previous research suggests that the impact of restricting soil erosion on a farm in Oklahoma will be different from the impact on a farm in Pennsylvania, Idaho or Illinois. The previously mentioned Oklahoma study was concerned with the impact on a region of reducing soil erosion (3). No study has been conducted in Oklahoma on the farm level impact of restricting soil erosion. Such a study is needed to aid Oklahoma policy makers in developing an effective program to encourage farmers to adopt BMP's.

# CHAPTER III

## SURVEY RESULTS

A field survey was conducted in July and August 1980 to obtain information from farmers about the operation and maintenance of selected BMP's. The survey consisted of two parts: background information about the farming operation and information about the operation and maintenance of selected BMP's.

A total of 36 personal interviews were completed in the study area. It was decided that personal interviews would provide better results than could be obtained from mail questionnaires. The farmers interviewed were farmers who have cooperated with the SCS in implementing soil conservation practices. The number of farmers interviewed and the average size of farm in each county is presented in Table 1. For example, seven farmers who have adopted conservation practices were interviewed in Custer County. Farm size for Custer County ranged from a low of 160 acres to a high of 1,100 acres; the average size farm was 634 acres owned. The majority of the farmers interviewed classified themselves as full time owner operators. The major type of farm organization was the individual family proprietorship. Income from the farming operation accounted for a large share of the family's total income.

The second part of the survey dealt with information regarding the use of selected BMP's. The BMP's included in the survey were pasture management, terraces and erosion control structures. Information obtained about each conservation practice included: (1) the farmers' reason(s) for adopting the BMP's; (2) the normal operation and maintenance activities required by the conservation practices; (3) the estimated useful life of the BMP's; and (4) the benefits the farmers received from using the BMP's. The information obtained from the interviews for each conservation practice is summarized below.

TABLE I

NUMBER AND SIZE OF FARMS INTERVIEWED IN THE BEST MANAGEMENT PRACTICES STUDY, BY COUNTY[a]

| County | Farmers Interviewed | Smallest | Largest | Average |
|---|---|---|---|---|
| | | Acres | | |
| Caddo | 6 | 160 | 920 | 385 |
| Custer | 7 | 160 | 1,100 | 634 |
| Grady | 12 | 120 | 3,400 | 929[b] |
| Greer | 7 | 85 | 1,000 | 450 |
| Stephens | 4 | 220 | 800 | 563 |

[a]The size of farm includes only the acres owned by the farmer.

[b]Average includes two farms of 2,800 and 3,400 acres. Excluding these farms, the largest farm is 850 acres and the average is 495 acres.

## Pasture Management

The purpose of pasture management is to prolong the life of desirable forage species, maintain the quality and quantity of forage and provide soil protection (29). Twenty-seven of the 36 farmers interviewed practiced pasture management. Bermuda and lovegrass were the predominant forages used by farmers in the study area.

The farmers gave three reasons for adopting pasture management: (1) it increases the carrying capacity of the pasture land, thus increasing farm income; (2) it improves the value of the farm; and (3) it aids in soil erosion control.

Normal operation and maintenance activities of pasture management included fertilization and weed control. The fertilization rate varied from farm to farm. To control weeds, the farmers sprayed with the herbicide 2-4, D. Most farmers believed that with proper management, pasture land in bermuda or lovegrass would have a useful life of 20 years or more. One factor influencing the success or failure of pasture management is the weather. The weather is something the farmer has no control over. The majority of the farmers interviewed felt they had benefited from adopting pasture management. The benefits included reduced soil erosion and increased farm income.

## Terraces

Terraces are defined as an earth embankment, channel or a combination ridge and channel constructed across the slope. Terraces are constructed to reduce slope length, reduce soil erosion, prevent gully development and reduce flooding (29). Twenty-five of the 36 farmers interviewed had terraces. The primary reason given for installing terraces was the prevention of soil erosion.

The operation and maintenance of terraces result in increased production costs. Three factors cause the increase in production costs. It takes longer to farm a terraced field compared to a non-terraced field, increasing the farmers' operating cost by increasing labor and machine time. There may be an increase in the custom harvest rate, if custom operators charge more to harvest crops from a terraced field. The maintenance of the terraces also increases production costs. The primary maintenance required on the terraces is to prevent benching. Benching occurs where the profile or slope between the terraces becomes hollowed out. To prevent benching of terraces, the terraces must be "plowed up" occasionally. The "plowing up" of the terrace can be done as the field is readied for planting. The maintenance of terraces increases labor and machine time. With proper operation and maintenance most farmers felt the terraces had a useful life of more than 20 years.

All farmers who had terraces stated that they had benefited from using terraces, primarily in reduced soil erosion. One argument for using terraces is that terraces help maintain soil moisture, increasing crop yields (29). However, the farmers interviewed did not feel that their yields had increased because of the terraces.

## Erosion Control Structures

Erosion control structures are structures built to reduce flood damages downstream by controlling the release rate of flood water, controlling erosion in natural channels and preventing the formulation of gullies (29). Twenty-five of the 36 farmers interviewed had erosion control structures. Most structures were on pasture land. The farmers gave two reasons for installing the erosion control structures: the structures prevent soil erosion and the structures increase the value of the farm.

The operation and maintenance of erosion control structures involves two activities: keeping the spillway and drainage pipe functioning properly and maintaining a grass cover on the structure. The farmers estimated the useful life of erosion control structures to be more than 20 years if properly maintained. Most farmers felt they had benefited from the erosion control structures through reduced soil erosion and through additional stock water.

Due to the variation in size and type of erosion control structures, the installation costs and annual operation and maintenance costs are difficult to estimate. For this reason, erosion control structures were not considered in the budgeting and linear programming analysis in this study.

## Minimum Tillage

Information on minimum tillage was not obtained during the survey. However, minimum tillage has the potential to control soil erosion as well as to reduce labor and machinery costs in producing a crop. Farmers and SCS personnel in the study area expressed interest in the benefits and costs of minimum tillage. For these reasons, minimum tillage was included in the analysis.

Minimum tillage is defined as limiting the number of cultural operations to those that are properly timed and essential to produce a crop and to prevent soil damage. The purpose of minimum tillage is to conserve soil and moisture, maintain soil structure, reduce soil compaction and improve water quality. Minimum tillage also improves soil aeration, permeability and tilth (29). Information about minimum tillage was obtained from SCS and Oklahoma State University agronomists.

Minimum tillage reduces the time spent in cultivation of the soil; i.e., it reduces the amount of labor and machine time required for the cropping operation. Fewer farm implements are needed for minimum tillage which reduces machinery ownership costs. However, increased use of herbicides is required for adequate weed control. The profitability of minimum tillage depends on which is greater, the decreased labor and machinery costs or the increased cost of weed control.

Information regarding the operation and maintenance of selected BMP's reported in this section was used to develop enterprise budgets for the study area. These budgets were used to estimate the impact on annual production costs of reducing soil erosion. The production costs are discussed in the next chapter.

CHAPTER IV

# REPRESENTATIVE STUDY FARMS AND IMPACT OF BMP'S ON PRODUCTION COSTS

## Representative Farms

Representative farms were established in three counties of the study area. These farms were used to analyze the impact of restricting soil erosion on farm production costs, income and organization. The farms were established in Grady, Custer and Greer counties. The information summarized in the previous chapter was used to estimate production costs for various crop enterprises using alternative BMP's.

### Grady County Representative Farm

This representative farm is located six miles south of Chickasha near Ninnekah. The farm includes five different soil series: Dougherty-Eufaula Complex, Kirkland silt loam, Norge silt loam, Renfrow silt loam and Teller loam. The number of acres and expected crop yields for each soil series are presented in Table II. The farm covers 470 acres of land which compares with an average size of 929 acres for the farms interviewed in Grady County.[1] Based on the Census of Agriculture (10), the average size farm in Grady County with sales greater than $2,500 in 1978 was 438 acres.

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[1]Excluding the two largest farms in Grady County, 3,400 acres and 2,800 acres, the average size farm was 495 acres.

TABLE II

NUMBER OF ACRES BY SOIL SERIES AND EXPECTED CROP YIELDS FOR THE GRADY COUNTY REPRESENTATIVE FARM[a]

| Soil Series | Acres | Wheat (bu.) | Grain Sorghum (cwt.) | Alfalfa (tons) | Cotton Lint (lbs.) |
|---|---|---|---|---|---|
| | | ------------Yield Per Acre----------- | | | |
| Dougherty-Eufaula Complex | 120 | -- | -- | -- | -- |
| Kirkland Silt Loam | 55 | 30 | 23 | -- | 400 |
| Norge Silt Loam 1 | 75 | 30 | 26 | 3.0 | 400 |
| Norge Silt Loam 2[b] | 75 | 20 | 20 | -- | -- |
| Renfrow Silt Loam | 45 | 25 | 17 | -- | -- |
| Teller Loam | 100 | 20 | 20 | -- | -- |

[a]Yield estimates are from the Soil Survey of Grady County, Oklahoma (6).

[b]The primary difference between Norge Silt Loam 1 and Norge Silt Loam 2 is the slope.

The expected yields were obtained from the Soil Survey of Grady County, Oklahoma (6). For any given year, yields may be higher or lower than those indicated in Table II because of seasonal variation in rainfall and other climatic factors. The expected yields are based on the experience and records of farmers, soil conservationists and county extension directors. Yield data from nearby counties and field demonstrations also were considered in establishing the estimated yields. The management needed to achieve the indicated yields include providing drainage, proper planting and seeding rates, suitable crop varieties, appropriate tillage practices including time of tillage and seedbed preparation, control of weeds, plant diseases and insects, proper fertilization, harvesting of crops with the smallest possible loss and timeliness of all field work (6, p. 24).

The Dougherty-Eufaula Complex, a gently sloping soil on uplands, is not suited for crop production (Table II). Proper management is needed to provide adequate soil protection (6, p. 7). Kirkland silt loam is a nearly level upland soil. Good management is needed to maintain or improve soil fertility and structure. Erosion can be controlled by growing crops that produce large amounts of residue. Terraces are needed to reduce run-off where soils have a long slope (6, p. 9).

The Norge silt loam soil is divided into two types: Norge silt loam 1 and Norge silt loam 2. The difference is in the slope, with Norge silt loam 2 having a steeper slope. Also, Norge silt loam 2 has been eroded. Each type consists of 75 acres (Table II). Norge silt loam 1 is found on uplands and is gently sloping. Norge silt loam 2 is also found on uplands; however, small rills and shallow gullies have formed in some areas. Controlling water erosion from Norge soils is important. Terraces can be used to control water run-off. Also, leaving a crop residue reduces soil erosion (6, p. 13).

The Renfrow silt loam is a gently sloping soil on uplands. This soil has been eroded and in most areas rills and gullies have formed. The Renfrow soil must be properly managed to provide protection from soil erosion. Terracing and returning large amounts of residue to the soil will protect against soil erosion (6, p. 15).

The Teller loam is found on uplands and has a gentle slope. Small rills and gullies have formed in some areas. Proper management is needed to control water erosion and maintain soil structure. Terraces can be used to control soil erosion (6, p. 15).

Custer County Representative Farm

This 605 acre representative farm is located five miles east of Clinton and one mile south of Highway I-40. In 1978, the average size farm in Custer County with sales greater than $2,500 was 680 acres (9). The 605 acres compares with an average of 634 acres for the farms interviewed in Custer County. The farm includes three major soil types: Carey silt loam, St. Paul silt loam and Woodward-Quinlan Complex. The expected crop yields and number of acres of each soil are presented in Table III. The estimated crop yields are obtained from the Soil Survey of Custer County, Oklahoma (18).

The farm includes 290 acres of Carey silt loam soil (Table III). This soil is divided into two groups: Carey silt loam 1 is gently sloping with one to three percent slopes and Carey silt loam 2 has slopes ranging from three to five percent. Terraces or minimum tillage is needed to reduce soil erosion from Carey soils (18, p. 5).

The St. Paul silt loam is a gently sloping soil. If this soil is well managed, high yields of suitable crops can be expected (Table III). Good management is needed to control soil erosion and maintain soil structure. Terraces, minimum tillage and returning crop residue to the soil are practices which will control soil erosion (18, p. 17).

The Woodward-Quinlan Complex is steeply sloping with slopes of five to twelve percent. Because of the steep slopes this soil is suited only for pasture. Proper management of the pasture is needed to provide adequate protection from soil erosion (18, p. 20).

TABLE III

NUMBER OF ACRES BY SOIL SERIES AND EXPECTED CROP YIELDS FOR THE CUSTER COUNTY REPRESENTATIVE FARM[a]

| Soil Series | Acres | Wheat (bu.) | Grain Sorghum (cwt.) | Alfalfa (tons) | Cotton Lint (lbs.) |
|---|---|---|---|---|---|
| | | ------------Yield Per Acre------------ | | | |
| Carey Silt Loam 1 | 75 | 20 | 20 | 2.4 | 240 |
| Carey Silt Loam 2 | 215 | 20 | 17 | -- | 200 |
| St. Paul Silt Loam | 160 | 20 | 20 | 2.2 | 250 |
| Woodward-Quinlin Complex | 155 | -- | -- | -- | -- |

[a]Yield estimates are from the Soil Survey of Custer County, Oklahoma (18).

[b]The primary difference between Carey Silt Loam 1 and Carey Silt Loam 2 is the slope.

## Greer County Representative Farm

This representative study farm is located five miles east of Brinkmann. Abilene clay loam, Lawton loam, Mansic clay loam and Woodward loam are the predominant soils. The number of acres and expected yields for the different soil series are presented in Table IV. The farm covers 670 acres which comprares with an average of 450 acres for the farms interviewed in Greer County. The average size farm in Greer County with sales greater than $2,500 in 1978 was 699 acres (11). The expected yields are obtained from the Soil Survey of Greer County, Oklahoma (17).

TABLE IV

NUMBER OF ACRES BY SOIL SERIES AND EXPECTED CROP YIELDS FOR THE GREER COUNTY REPRESENTATIVE FARM[a]

| Soil Series | Acres | Wheat (bu.) | Grain Sorghum (cwt.) | Alfalfa (tons) | Cotton Lint (lbs.) |
|---|---|---|---|---|---|
| | | ------------ | Yield Per Acre | ------------ | |
| Abilene Clay Loam | 90 | 22 | 18 | 2.0 | 325 |
| Lawton Loam | 215 | 19 | 16 | 1.8 | 290 |
| Mansic Clay Loam | 100 | 19 | 17 | 2.0 | 310 |
| Woodward Loam | 265 | 17 | 14 | -- | 250 |

[a]Yield estimates are from the Soil Survey of Greer County, Oklahoma (17).

The Abilene clay loam occurs on uplands and is nearly level. This soil is suited for cultivated crops and under proper management is highly productive. However, yields of cotton, grain sorghum and alfalfa are uncertain in years of below normal rainfall. Conserving soil moisture and maintaining soil structure are problems of management (17, p. 8).

The Lawton loam is a gently sloping soil with one to three percent slopes. This soil is easily tilled and is highly productive under proper management. Controlling water erosion and maintaining soil structure are problems in tilled areas. These problems can be handled with terraces and minimum tillage (17, p. 13).

The Mansic clay loam occurs on uplands and is nearly level. If this soil is well managed, good yields of suitable crops and grasses can be expected. However, Mansic soils erode easily if they are tilled excessively. Proper management practices are needed to control soil erosion and maintain soil structure (17, p. 14).

The Woodward loam is a gently sloping soil on uplands. This soil is suited for cultivated crops and pasture. The main management problem is controlling soil erosion. Terraces and minimum tillage can be used to protect against erosion (17, p. 25).

## Impact of BMP's on Annual Production Costs

An enterprise budget is a physical and financial plan for a specific crop or livestock enterprise. The enterprise budget estimates revenues and expenses in producing a particular commodity in a specific time period. Budgets for various crop enterprises using alternative soil conservation practices were calculated for the representative farms using the Oklahoma State University Enterprise Budget Generator. The enterprise budgets were used to analyze the impact on annual production costs of adopting BMP's to reduce soil erosion. The BMP's selected for this study were pasture management, terraces and minimum tillage. Also, minimum tillage and terraces were used in combination.

Grady County Representative Farm

Examples of budgets for the Grady County farm appear in Tables V, VI, VII and VIII. The budgets include production cost estimates for improved pasture, wheat, grain sorghum and cotton using alternative conservation practices.

Pasture. Pasture management is a conservation practice to be used on land not suited for crop production. Also, in some cases cropland may need to be taken out of cultivation and put in pasture to reduce soil erosion to acceptable levels. The estimated production costs of pasture management for the Grady County farm are $32.79 per acre (Table V).[2] The total cost includes an amortized establishment cost. The establishment cost includes the cost of seedbed preparation and seeding or sprigging. The improved pasture is assumed to have a useful life of 20 years. The major cost is for fertilizer, which accounts for almost two-thirds of the total cost of pasture management. The cost of pasture management for the Grady County farm is a significant cost. However, proper management of pasture can increase the carrying capacity of the pasture, while protecting the soil against soil erosion.

Wheat. Terracing and minimum tillage were used as BMP's for wheat production. Also, these two BMP's were used together as an alternative conservation practice. The production costs of wheat for the Grady County farm are presented in Table VI. It is assumed that crop yields are the same for the different conservation practices. The budgets estimate the production costs of wheat on Norge silt loam 1 soil.

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[a]The prices used for this study were prices used by the Oklahoma State University Enterprise Budget Generator for 1980.

TABLE V

PRODUCTION COSTS PER ACRE OF PASTURE MANAGEMENT FOR IMPROVED PASTURE ON THE GRADY COUNTY REPRESENTATIVE FARM[a]

| Operating Inputs | Unit | Price | Quantity | Cost/ Acre |
|---|---|---|---|---|
| Establishment Cost | Acre | $56.00 | 0.05 | $ 2.80 |
| Nitrogen (N) | Lbs. | 0.21 | 50.00 | 10.50 |
| Phosphorus ($P_2O_5$) | Lbs. | 0.22 | 20.00 | 4.40 |
| Potash ($K_2O$) | Lbs. | 0.09 | 20.00 | 1.80 |
| Fertilizer Spreader | Acre | 2.00 | 2.00 | 4.00 |
| Annual Operating Capital | Dol. | 0.15 | 8.80 | 1.32 |
| Labor | Hour | 3.88 | 0.67 | 2.59 |
| Machinery, Fuel, Lube, Repairs | Acre | -- | -- | 2.48 |
| Total Operating Costs | | | | $29.89 |
| Fixed Costs | | | | |
| Machinery Interest | Dol. | 0.15 | 9.40 | 1.41 |
| Depr., Taxes, Insurance | Dol. | -- | -- | 1.49 |
| Total Fixed Costs | | | | 2.90 |
| Total Production Costs | | | | $32.79 |

[a]Modification of OSU Enterprise Budget 83401101.

The production costs for the other soils differ because of the custom hauling charge, which depends on the yield per acre. The expected yield varies with soil series (Table II).

The production costs of wheat using conventional tillage are $100.85 (Table VI). This includes the costs of seed, fertilizer, labor, machinery, harvesting and capital. The production of wheat using conventional tillage includes the following tillage operations: chisel in June, offset disk in July and August, springtooth in September and drill in September.

Terracing results in higher production costs than conventional tillage (Table VI). The higher production costs are due to an increase in labor and machinery costs. Also, the custom combining rate is higher for the terraced field. Labor and machinery costs increase because of a reduced field efficiency for farm equipment. Field efficiency is the ratio of the actual capacity of a machine to its theoretical capacity (22, p. 32). For the Grady County farm, it was assumed that the field efficiency of farm equipment decreased 20 percent with terraces. The reduced field efficiency increased operating time 20 percent, from 1.5 to 1.8 hours per acre (Table VI). The increased labor and machinery costs cause the annual operating capital to increase. The annual terracing cost is $2.00 per acre, assuming a useful life for the terraces at 20 years and government cost sharing of 40 percent. The total production costs for wheat grown on a terraced field are $107.51 per acre (Table VI).

The increased costs due to terraces depend on the terrace spacing for a particular soil. Factors influencing the terrace spacing are the

TABLE VI

PRODUCTION COSTS PER ACRE OF WHEAT PRODUCED ON NORGE SILT LOAM 1 SOILS USING ALTERNATIVE BEST MANAGEMENT PRACTICES ON THE GRADY COUNTY REPRESENTATIVE FARM[a]

| | Unit | Price/ Unit | Conventional Tillage Quantity | Conventional Tillage Cost/ Acre | Terraces Quantity | Terraces Cost/ Acre | Minimum Tillage Quantity | Minimum Tillage Cost/ Acre | Terraces and Minimum Tillage Quantity | Terraces and Minimum Tillage Cost/ Acre |
|---|---|---|---|---|---|---|---|---|---|---|
| Operating Inputs | | | | | | | | | | |
| Wheat Seed | Bu. | $ 5.50 | 1.25 | $ 6.88 | 1.25 | $ 6.88 | 1.25 | $ 6.88 | 1.25 | $ 6.88 |
| Nitrogen (N) | Lbs. | 0.21 | 90.00 | 18.90 | 90.00 | 18.90 | 90.00 | 18.90 | 90.00 | 18.90 |
| Phosphorus ($P_2O_5$) | Lbs. | 0.22 | 20.00 | 4.40 | 20.00 | 4.40 | 20.00 | 4.40 | 20.00 | 4.40 |
| Potash ($K_2O$) | Lbs. | 0.09 | 20.00 | 1.80 | 20.00 | 1.80 | 20.00 | 1.80 | 20.00 | 1.80 |
| Sprayer | Acre | 4.00 | 1.00 | 4.00 | 1.00 | 4.00 | 2.00 | 8.00 | 2.00 | 8.00 |
| Custom Combine | Acre | — | 1.00 | 14.00 | 1.00 | 15.00 | 1.00 | 14.00 | 1.00 | 15.00 |
| Custom Hauling[b] | Bu. | 0.14 | 30.00 | 4.20 | 30.00 | 4.20 | 30.00 | 4.20 | 30.00 | 4.20 |
| Fertilizer Spreader | Acre | 2.00 | 2.00 | 4.00 | 2.00 | 4.00 | 2.00 | 4.00 | 2.00 | 4.00 |
| Miscellaneous Expense | Bu. | 0.14 | 12.00 | 1.68 | 12.00 | 1.68 | 12.00 | 1.68 | 12.00 | 1.68 |
| Annual Operating Capital | Dol. | 0.15 | 29.23 | 4.38 | 31.79 | 4.77 | 33.51 | 5.03 | 35.50 | 5.33 |
| Labor | Hour | 3.88 | 1.55 | 6.01 | 1.79 | 6.93 | 1.08 | 4.19 | 1.19 | 4.64 |
| Terracing[c] | Acre | 40.00 | — | — | 0.05 | 2.00 | — | — | 0.05 | 2.00 |
| Herbicide | Lbs. | 11.75 | — | — | — | — | 1.00 | 11.75 | 1.00 | 11.75 |
| Machinery, Fuel, Lube, Repairs | Acre | — | — | 11.04 | — | 13.75 | — | 6.92 | — | 8.28 |
| Total Operating Costs | | | | $81.29 | | $88.31 | | $91.75 | | $96.86 |
| Fixed Costs | | | | | | | | | | |
| Machinery Interest | Dol. | 0.15 | 66.51 | 9.98 | 65.28 | 9.79 | 39.30 | 5.90 | 39.28 | 5.89 |
| Depr., Taxes, Insurance | Dol. | — | — | 9.58 | — | 9.41 | — | 5.44 | — | 5.25 |
| Total Fixed Costs | | | | $19.56 | | $19.20 | | $11.34 | | $11.14 |
| Total Production Costs | | | | $100.85 | | $107.51 | | $103.09 | | $108.00 |

[a]Modification of OSU Enterprise Budget 76700804.

[b]Assumes a yield of 30 bu. per acre.

[c]Assumes terrace spacing of 100 ft.

soil's erodibility and recommended tolerance limit. Soil erodibility refers to a soil's inherent susceptibility to erosion by rainfall and run-off. The recommended tolerance limit is established by the SCS and is the amount of soil which can be lost annually without adversely affecting the soil's structure. For the Grady County farm, the recommended terrace spacing for all soils is 100 feet (35, p. 39). Production costs will not increase as much as reflected in Table VI for wheat grown on a field with a terrace spacing greater than 100 feet.

The total production costs for wheat grown using minimum tillage are $103.09 per acre (Table VI), an increase of $2.24 over conventional tillage. Minimum tillage results in lower labor and machinery costs than conventional tillage; however, the cost of weed control increases. Labor and machinery costs decrease because of reduced cultivation of the soil. For minimum tillage, the tillage operations include chiseling in August and drilling in September. This compares with chisel, offset disk, springtooth and drill operations for conventional tillage. Also, fewer farm implements are needed which reduces machinery and fixed costs. The cost of weed control includes a herbicide cost of $11.75 and a sprayer cost to apply the herbicide of $4.00 per acre (Table VI)[3].

A final conservation technique considered for wheat production is the use of minimum tillage on a terraced field. This practice costs $108.00 per acre (Table VI). Labor, machinery and fixed costs are less for the terraces and minimum tilled field than for conventional tillage. However, the cost of weed control more than offsets these reduced costs. The labor, machinery, and fixed costs decrease for the same

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[3]For wheat, this study assumes the use of the herbicide Surflan. However, other herbicides also are available for weed control.

reasons as those given for minimum tillage. However, these costs are greater than minimum tillage because of the terraces. The cost of weed control is $15.75, the same as for minimum tillage.

Grain Sorghum. Grain sorghum can be grown using the same BMP's as wheat; terraces, minimum tillage and terraces with minimum tillage. The production costs for the Grady County farm are presented in Table VII. The budgets estimate the production costs of grain sorghum produced on Norge silt loam 1 soils. The production costs of grain sorghum on the other soils of the Grady County farm differ because of the hauling costs. The custom hauling costs vary with the yields per acre.

The annual production costs of grain sorghum using conventional tillage are $96.71 per acre (Table VII). These costs include fertilizer, seed, labor, harvesting, fixed and variable machinery and capital. Conventional tillage of grain sorghum includes the following activities; moldboard plow in April, chisel in April, offset disk in April and May, springtooth in May, planter in May and roll cultivator in June and July.

The costs of producing grain sorghum on a terraced field are $106.39 per acre, $9.68 more than conventional tillage (Table VII). Labor and variable machinery costs increase due to a decrease in the field efficiency of the machinery. It was assumed that the field efficiency of the farm equipment decreased approximately 20 percent due to the terraces. The same cultivation operations used for conventional tillage are used on the terraced field. Labor increases 25 percent from 1.5 to 2.0 hours per acre (Table VII). Again the terrace spacing is 100 feet.

## TABLE VII

## PRODUCTION COSTS PER ACRE OF GRAIN SORGHUM PRODUCED ON NORGE SILT LOAM 1 SOILS USING ALTERNATIVE BEST MANAGEMENT PRACTICES ON THE GRADY COUNTY REPRESENTATIVE FARM[a]

| | Unit | Price/ Unit | Conventional Tillage | | Terraces | | Minimum Tillage | | Terraces and Minimum Tillage | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Quantity | Cost/ Acre | Quantity | Cost/ Acre | Quantity | Cost/ Acre | Quantity | Cost/ Acre |
| Operating Inputs | | | | | | | | | | |
| Grain Sorghum Seed | Lbs. | $ 0.55 | 3.00 | $ 1.65 | 3.00 | $ 1.65 | 3.00 | $ 1.65 | 3.00 | $ 1.65 |
| Nitrogen (N) | Lbs. | 0.21 | 50.00 | 10.50 | 50.00 | 10.50 | 50.00 | 10.50 | 50.00 | 10.50 |
| Phosphorus ($P_2O_5$) | Lbs. | 0.22 | 40.00 | 8.80 | 40.00 | 8.80 | 40.00 | 8.80 | 40.00 | 8.80 |
| Potash ($K_2O$) | Lbs. | 0.09 | 20.00 | 1.80 | 20.00 | 1.80 | 20.00 | 1.80 | 20.00 | 1.80 |
| Custom Combine | Acre | — | 1.00 | 14.00 | 1.00 | 15.00 | 1.00 | 14.00 | 1.00 | 15.00 |
| Custom Hauling[b] | Bu. | 0.14 | 46.00 | 6.44 | 46.00 | 6.44 | 46.00 | 6.44 | 46.00 | 6.44 |
| Miscellaneous Expense | Cwt. | 0.14 | 14.00 | 1.96 | 14.00 | 1.96 | 14.00 | 1.96 | 14.00 | 1.96 |
| Fertilizer Spreader | Acre | 2.00 | 1.00 | 2.00 | 1.00 | 2.00 | 1.00 | 2.00 | 1.00 | 2.00 |
| Annual Operating Capital | Dol. | 0.15 | 16.34 | 2.45 | 19.72 | 2.96 | 19.81 | 2.97 | 22.24 | 3.34 |
| Labor | Hr. | 3.88 | 1.58 | 6.14 | 1.98 | 7.67 | 0.94 | 3.66 | 1.18 | 4.57 |
| Terracing[c] | Acre | 40.00 | — | — | 0.05 | 2.00 | — | — | 0.05 | 2.00 |
| Sprayer | Acre | 4.00 | — | — | — | — | 1.00 | 4.00 | 1.00 | 4.00 |
| Herbicide | Lbs. | 4.25 | — | — | — | — | 2.00 | 8.50 | 2.00 | 8.50 |
| Machinery, Fuel, Lube, Repairs | Acre | — | — | 14.65 | — | 19.24 | — | 8.35 | — | 11.00 |
| Total Operating Costs | | | | $70.39 | | $74.63 | | $74.63 | | $81.56 |
| Fixed Costs | | | | | | | | | | |
| Machinery Interest | Dol. | 0.15 | 90.09 | 13.51 | 90.09 | 13.51 | 54.60 | 8.19 | 61.05 | 9.16 |
| Depr., Taxes, Insurance | Dol. | — | — | 12.81 | — | 12.86 | — | 8.96 | — | 8.86 |
| Total Fixed Costs | | | | $26.32 | | $26.37 | | $17.15 | | $18.02 |
| Total Production Costs | | | | $96.71 | | $106.39 | | $91.78 | | $99.58 |

[a]Modification of OSU Enterprise Budget 73700704.

[b]Assumes a yield of 26 cwt. per acre.

[c]Assumes terrace spacing of 100 ft.

For grain sorghum, the production costs for minimum tillage are $91.78 per acre, less than the costs for conventional tillage (Table VII). In this case, the decreased costs offset the increased herbicide cost. Labor and machinery costs decrease because of the decreased amount of cultivation. For minimum tillage, an offset disk is used in May and a four-row cultivator is used in June and July. Also, fixed costs decrease because fewer implements are needed. The cost of herbicide is $4.25 per pound and two pounds are used per acre[4]. The cost of applying the herbicide is $4.00 per acre. Thus, the total cost of weed control is $12.50 per acre (Table VII).

The production costs for terraces with minimum tillage field of grain sorghum are $99.58 per acre (Table VII). The labor, machinery and fixed costs are greater than the costs for minimum tillage only because of the terraces. The cost of weed control is the same as for minimum tillage.

Cotton. The per acre production costs of cotton grown on Kirkland silt loam and Norge silt loam 1 soils are presented in Table VIII. One budget is for conventional tillage. The conservation practice used for cotton is terraces. In most cases minimum tillage of cotton is not a viable alternative. The per acre costs of cotton production using conventional tillage are $190.18 (Table VIII).

Terracing increases production costs by $10.00 to $200.18 per acre, due to increased labor and machine time (Table VIII). Operating time increases because the field efficiency of farm equipment decreases approximately 20 percent.

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[4]For grain sorghum, this study assumes the use of the herbicide Igrain. However, other herbicides also are available for weed control.

TABLE VIII

PRODUCTION COSTS PER ACRE OF COTTON PRODUCED ON KIRKLAND SILT LOAM AND NORGE SILT LOAM 1 SOILS USING ALTERNATIVE BEST MANAGEMENT PRACTICES ON THE GRADY COUNTY REPRESENTATIVE FARM[a]

| | Unit | Price/ Unit | Conventional Tillage Quantity | Conventional Tillage Cost/ Acre | Terraces Quantity | Terraces Cost/ Acre |
|---|---|---|---|---|---|---|
| Operating Inputs | | | | | | |
| Cotton Seed | Lbs. | $ 0.45 | 18.00 | $ 8.10 | 18.00 | $ 8.10 |
| Nitrogen (N) | Lbs. | 0.21 | 60.00 | 12.60 | 60.00 | 12.60 |
| Phosphorus ($P_2O_5$) | Lbs. | 0.22 | 40.00 | 8.80 | 40.00 | 8.80 |
| Potash ($K_2O$) | Lbs. | 0.09 | 20.00 | 1.80 | 20.00 | 1.80 |
| Pre-emerge Herbicide | Acre | 12.00 | 1.00 | 12.00 | 1.00 | 12.00 |
| Insecticide | Acre | 5.00 | 3.00 | 15.00 | 3.00 | 15.00 |
| Cotton Picker[b] | Lbs. | 0.08 | 400.00 | 32.00 | 400.00 | 32.00 |
| Fertilizer Spreader | Acre | 2.00 | 1.00 | 2.00 | 1.00 | 2.00 |
| Storage and Processing Equipment | Acre | 26.65 | 1.00 | 26.65 | 1.00 | 26.65 |
| Annual Operating Capital | Dol. | 0.15 | 43.79 | 6.57 | 49.02 | 7.35 |
| Labor | Hour | 3.88 | 2.52 | 9.76 | 2.99 | 11.60 |
| Terracing[c] | Acre | 40.00 | -- | -- | 0.05 | 2.00 |
| Machinery, Fuel, Lube, Repairs | Acre | -- | -- | 20.74 | -- | 26.37 |
| Total Operating Costs | | | | $156.02 | | $166.27 |
| Fixed Costs | | | | | | |
| Machinery Interest | Dol. | 0.15 | 117.33 | 17.60 | 116.33 | 17.45 |
| Depr., Taxes, Insurance | Dol. | -- | -- | 16.56 | -- | 16.46 |
| Total Fixed Costs | | | | $ 34.16 | | $ 33.91 |
| Total Production Costs | | | | $190.18 | | $200.18 |

[a]Modification of OSU Enterprise Budget 9378004.

[b]Assumes a yield of 400 lbs. of cotton lint per acre.

[c]Assumes a terrace spacing of 100 ft.

Custer County Representative Farm

The budgets estimating the production costs for the Custer County representative farm are presented in Tables XXIII through XXIX in Appendix A. The budgets include cost estimates for pasture, wheat, grain sorghum and cotton. The same BMP's used for the Grady farm were used for the Custer farm.

Pasture. The production costs of pasture management for the Custer County farm are $25.52 per acre (Table XXIII). The total costs include an establishment cost, fertilizer cost, labor cost, fixed and variable machinery costs and capital costs. As in the case of the Grady County farm, fertilizer is the major cost of pasture management.

Wheat. Production cost estimates for wheat using alternative BMP's are presented in Tables XXIV and XXV in Appendix A. The costs of producing wheat on Carey silt loam 1 (CAB) and St. Paul silt loam (STP) soils are presented in Table XXIV. The costs of growing wheat on Carey silt loam 2 (CAC) soil are shown in Table XXV.

The total costs of producing wheat using conventional tillage are the same for all three soils, $86.79 per acre (Tables XXIV and XXV). These costs include the normal production costs of seed, fertilizer, harvesting, labor, machinery and capital. The tillage operations include the following: chisel in June, July, August and October, offset disk in June and drill in October.

For the Custer County farm, terracing results in higher production costs than conventional tillage. However, terracing of CAB and STP soils results in a smaller increase in the production costs of wheat than does terracing of CAC. Terracing CAB and STP soils results in production costs for wheat of $95.78 per acre (Table XXIV). The field efficiency of machinery decreases approximately 18 percent because of the terraces, which increases labor and machinery costs. The terrace spacing for CAB and STP soils is 130 feet. For CAC soils, the terrace spacing is 100 feet (35, p. 36). Terracing CAC soils decreases the efficiency of farm equipment 20 percent, which increases operating costs. The production costs are $97.28 per acre for wheat grown on CAC soils using terraces (Table XXV).

The costs of minimum tillage is the same for all three soils. The costs of producing wheat using minimum tillage are $88.81 per acre for the Custer County representative farm (Tables XXIV and XXV). Labor and machinery costs decrease because of fewer tillage operations. For minimum tillage, cultivation of the soil includes chisel in August and drill in October. Fewer farm implements are needed which reduces machinery and fixed costs. The cost of weed control is $15.75 per acre (Tables XXIV).

Production costs of wheat on CAB and STP soils using the BMP of terraces with minimum tillage are $92.65 per acre (Table XXIV). The labor, variable machinery and fixed costs are less than conventional tillage because of reduced cultivation of the soil. The cost of weed control is $15.75 per acre. The production costs of terraces with minimum tillage for CAC soils are more than for CAB and STP soils. The costs of using terraces with minimum tillage on CAC soils are $93.46 (Table XXV).

Grain Sorghum. The production costs of growing grain sorghum using the selected BMP's are presented in Table XXVI for CAB and STP soils and in Table XXVII for CAC soils. For grain sorghum, both terracing and custom hauling costs for CAC are different than the costs for CAB and STP.

The production costs of grain sorghum grown on CAB and STP soils using conventional tillage are \$82.78 (Table XXVI). The production costs for CAC soils are slightly less than the costs for CAB and STP soils because of the lower custom hauling charge. The production costs for conventionally tilled grain sorghum on CAC soils are \$82.18 per acre (Table XXVII). The tillage operations are: offset disk in January and May, chisel in February and April, four-row planter in May and four-row cultivator in June and July.

The costs of producing grain sorghum on a terraced field are more than for conventional tillage. The costs of producing grain sorghum on CAB and STP soils using terraces are \$93.95 per acre (Table XXVI). The costs of grain sorghum production on CAC soils using terraces are slightly higher, \$95.20 per acre, due to increased machinery and labor costs (Table XXVII). For CAB and STP soils, field efficiency decreases approximately 18 percent because of the terraces. Terracing of CAC soils reduces the efficiency of machinery 20 percent.

The per acre costs of producing grain sorghum on CAB and STP soils using minimum tillage are \$83.59 (Table XXVI). The costs of using minimum tillage on CAC soils are \$82.99 per acre (Table XXVII). The difference in the costs is due to the custom hauling cost. The cost of using minimum tillage is slightly more than the cost of conventional tillage. Labor, machinery and fixed costs decrease because there are fewer cultivating operations. Minimum tillage includes the following operations: offset disk in May, four-row planter in May and four-row cultivator in June and July. The cost of applying herbicide is \$12.50 per acre.

Producing grain sorghum using terraces with minimum tillage results in higher costs per acre than for conventional tillage. The costs of terraces with minimum tillage for CAB and STP soils are $89.74 per acre (Table XXVI), and for CAC the costs are $90.37 per acre (Table XXVII). As with minimum tillage, labor, machinery and fixed costs are less than for conventional tillage. However, because of the terraces, these costs are greater than the same costs for minimum tillage. The costs for CAC soils of using terraces with minimum tillage are greater than the costs for CAB and STP, because of the differences in the terrace spacing. For all these soils, the cost of weed control is $12.50 per acre.

Cotton. The budgets for cotton grown on CAB and STP soils, and CAC soils are shown in Tables XXVIII and XXIX in Appendix A, respectively. The conservation practice for cotton production is terracing.

The costs of producing cotton on CAB and STP soils for both conventional tillage and terraces are presented in Table XXVIII. The total costs using conventional tillage are $109.91 per acre for CAB and STP soils. The installation of terraces increases total production costs by $14.56 per acre to $205.47. The increased costs result from decreased field efficiency of the farm equipment of 18 percent.

The production costs of growing cotton on CAC soils are presented in Table XXIX. The use of conventional tillage costs $190.91 per acre, compared to $209.12 per acre for a terraced field. The increased costs are a result of increased labor and machine time. For CAC soils, terracing decreases field efficiency 20 percent.

Greer County Representative Farm

Budgets for the Greer County representative farm are presented in Tables XXX through XXVI in Appendix A. The same crops and conservation practices considered for the Grady County and Custer County farms were considered for the Greer County farm.

Pasture. As was the case for the Grady County and Custer County farms, the cost of fertilization is the major cost of pasture management for the Greer County farm. The total production costs of pasture management are $23.43 per acre (Table XXX). Fertilization makes up $18.10 of the total costs. The amortized installation cost is $3.58 per acre.

Wheat. Conservation practices have the same impact on wheat production costs for the Greer County farm as the BMP's did for the Custer and Grady County farms. The wheat production costs produced on Abilene clay loam (ABA) soils are presented in Table XXXI. The production costs of wheat grown on Mansic clay loam (MCA) soils are reflected in Table XXXII.

Conventional tillage of wheat produced on the Greer County farm includes the same tillage operations as wheat grown on the Custer County farm. The costs of wheat produced on ABA soils using conventional tillage are $88.33 per acre (Table XXXI). Terracing of ABA soils decreases efficiency of farm equipment 13 percent, which increases production costs of wheat to $94.86 per acre. The tillage operations for minimum tillage for the Greer County farm are the same as those for the Custer County farm. Minimum tillage of wheat on ABA soils results in production costs of $89.21 per acre, which is slightly greater than the cost of conventional tillage. Total costs to produce wheat using both terraces and minimum tillage are $92.40 per acre.

Producing wheat on MCA soils using conventional tillage costs $89.49 per acre (Table XXXII). The terrace spacing for MCA soils is 100 feet. Terracing reduces the field efficiency of the equipment 20 percent and increases labor and machinery costs. The production costs of wheat using terraces to control erosion are $97.34 per acre. The costs of minimum tillage produced wheat on MCA soils are $88.61 per acre. Terraces with minimum tillage of wheat on MCA soils has production costs of $93.56 per acre. The costs to produce wheat on Lawton loam and Woodward loam are similar to the cost of producing wheat on MCA soils.

Grain Sorghum. The impact of BMP's on the cost of producing grain sorghum on the Greer County farm is similar to the impact on the Custer County farm. The production costs for producing grain sorghum on ABA soils are presented in Table XXXIII in Appendix A. The cost estimates of producing grain sorghum on Lawton loam (LTB) soils are presented in Table XXXIV. The costs of growing grain sorghum on Mansic clay loam and Woodward loam are similar to the production costs for Lawton loam. For the Greer County farm, the tillage operation for grain sorghum production using either conventional or minimum tillage are the same as for the Custer County farm.

The total costs of producing grain sorghum on ABA soils using conventional tillage are $82.38 per acre (Table XXXIII). The costs of growing grain sorghum on a terraced field are $88.47 per acre. Minimum tillage results in per acre costs of $83.36. Producing grain sorghum on ABA using terraces with minimum tillage costs $88.14 per acre.

Growing grain sorghum on LTB soils using conventional tillage costs $81.98 per acre (Table XXXIV). Terracing with 100 feet spacing increases the costs $13.31 to $95.29 per acre. The cost of using minimum tillage is slightly more than conventional tillage. The annual production costs for minimum tillage are $82.96 per acre. Terracing and minimum tillage combined results in production costs of $90.64 per acre.

Cotton. The production costs for cotton for the Greer County representative farm are presented in Tables XXXV and XXXVI in Appendix A. The impact of BMP's on the production costs are the same for the Greer County farm as for the Grady and Custer County farm.

The annual costs of cotton production using conventional tillage on ABA soils are $190.91 per acre (Table XXXV). This compares with costs of $201.58 per acre on terraced ABA soils. This cost increase is due to a 13 percent decrease in field efficiency of farm equipment.

The costs of growing cotton on LTB soils are $190.91 per acre for conventional tillage. Terracing results in an increase in production costs of $18.46 per acre. The costs of producing cotton on a terraced field of LTB soils are $209.36 per acre (Table XXXVI). The costs to produce cotton on Mansic clay loam and Woodward loam are slightly different than the costs for LTB soils.

## Summary of Production Costs

In most cases the adoption of BMP's causes an increase in annual production costs of the crop enterprises. The costs of pasture management are significant. However, farm income may increase because of the increased carrying capacity of the pasture.

For wheat production, the use of BMP's increases production costs for the three representative farms. The BMP which caused the greatest increase in production costs was terracing.

Producing grain sorghum on the Grady County farm using minimum tillage results in lower production costs than conventional tillage. The use of minimum tillage on the Greer and Custer County farms has slightly higher production costs than conventional tillage. The use of terraces and terraces with minimum tillage increase production costs over conventional tillage for grain sorghum production. Terracing increases the cost of producing cotton for all three farms.

The previous section discussed the impact on annual production costs for various crop enterprises of adopting alternative BMP's. The estimated production costs were used to develop a linear programming model, which was used to determine the impact on farm income and organization of restricting soil erosion. A long run time period of 40 years was used.

## CHAPTER V

## IMPACTS OF RESTRICTING SOIL EROSION ON THE FARM FIRM

### The Model

A linear programming model was formulated using the production cost estimates summarized in the previous chapter. The linear programming model was used to analyze the impact of restricting soil erosion on the farm firm.

Linear programming (LP) is a mathematical tool which optimizes an objective function for a set of alternative courses of action subject to limited resources. Linear programming is a versatile tool and has application in areas such as transportation, feed ration formulation and farm management.

The linear programming model used for this study can be expressed as follows:

$$\text{Maximize } Z = C_1X_1 + C_2X_2 + \ldots + C_jX_j$$

subject to the following resource requirements and restrictions:

$$\text{Land} \quad A_{11}X_1 + A_{12}X_2 + \ldots + A_{1j}X_j = b_1$$

$$\text{Labor} \quad A_{21}X_1 + A_{22}X_2 + \ldots + A_{2j}X_j \leq b_2$$

$$\text{Capital} \quad A_{31}X_1 + A_{32}X_2 + \ldots + A_{3j}X_j \leq b_3$$

AUM's[1] $A_{41}X_1 + A_{42}X_2 + . . . + A_{4j}X_j \leq b_4$

$X_j \geq 0$ for all j.

where:

$X_j$'s are the alternative cropping enterprises and activities;

$C_j$'s are the net income and/or costs of the associated activity;

$A_{ij}$'s are the production coefficients for the i-th resource activity; and,

$b_i$'s are the given resource levels or activity restrictions.

Since a farm typically includes several soils and soils have different characteristics (productivity, erodibility, etc.), the land restriction is further classified by soil series. For example, the Greer County farm has four different soil series; thus, has four separate land restrictions.

Two scenarios were analyzed for each farm with the LP model: unrestricted soil erosion and restricted soil erosion. The restricted soil erosion equation was:

Soil loss $S_i$, $A_{s1}X_1 + A_{s2}X_2 + . . . A_{sj}X_j \leq b_i$

where S is the soil series, $X_j$'s are as previously defined, $A_{sj}$'s are the soil loss coefficients for the soil used in the production of j, and bi is the SCS recommended soil loss limit (tons per acre) for S times the number of acres of S. For a particular soil series, soil loss (tons per acre) must average out to the recommended soil loss limit. The recommended soil loss limit is the amount of soil loss which can occur without adversely affecting the soil resource. The

[1]An Animal Unit Month (AUM) is the amount of grazing (forage) required to support one cow unit for one month.

establishment of soil loss levels has little research base. Soil loss limits were established and are periodically revised on the basis of collective judgments by soil scientists. Recommended soil loss values are based on several criteria, one of the most important being sustained productivity (26, p. 87). Four categories of data are needed to solve the linear programming model:

1. The alternative enterprises to be considered
2. The net returns or costs associated with each enterprise
3. The input-output coefficients for each enterprise considered
4. The amount or level of each resource restriction

The alternative crop enterprise activities include cotton, wheat, grain sorghum and alfalfa. Also, native pasture and improved pasture are potential crop activities. Cow-calf operations for both native pasture and improved pasture are included.

Production costs for each enterprise were discussed in the previous chapter. The $C_j$ values were calculated as follows:

$$C_j = P_j Q_j - E_j$$

were $C_j$ is as previously defined, $P_j$ is the price per unit of output j, $Q_j$ is the quantity of j produced and $E_j$ is the production costs of producing j. The product prices are presented in Table IX. The study used 1980 prices. It was assumed that the underlying price relationships for 1980 would exist throughout the study period. The initial crop yields were presented in the previous chapter. The crop yields decrease over time because of lost soil productivity resulting from soil erosion, assuming no advances in technology to offset the lost soil productivity during the study period. The value of $E_j$ does not include labor or capital costs. The LP model charges for these inputs.

TABLE IX

PRICES USED FOR CALCULATING $C_j$ VALUES IN THE LP MODELS FOR THE REPRESENTATIVE FARMS[a]

| Product | Price |
|---|---|
| Wheat | $ 4.25 per bu. |
| Grain Sorghum | 4.75 per cwt. |
| Cotton Lint | 0.70 per lb. |
| Cotton Seed | 0.06 per lb. |
| Alfalfa | 75.00 per ton |
| Steer | 88.00 per cwt. |
| Heifer | 78.00 per cwt. |
| Cull Cow | 58.00 per cwt. |

[a]Prices were those used by the OSU Enterprise Budget Generator during 1980.

The resource requirements were estimated and have been discussed elsewhere. Soil erosion coefficients were calculated using the Universal Soil Loss Equation (USLE) as follows:

$$A = RKLSCP$$

where A is the predicted average annual soil loss in tons per acre, R is the rainfall factor, K is the soil erodibility factor, L is the slope length factor, S is the slope steepness factor, C is the cropping management factor and P is the erosion control practice factor (35)[2]. For example, the estimated average annual soil loss for conventionally

[2]For a fuller discussion of the USLE see (1).

tilled wheat grown on Renfrow silt loam soil is 27.9 tons per acre, calculated as follows:

$$A = (240)\ (0.49)\ (0.82)\ (0.29) = 27.9$$

For Grady County, the rainfall factor (R) is 240 (48, p. 3). The soil erodibility factor (K) is 0.49 for Renfrow silt loam soil (35, p. 12). In practice the factors L and S are combined into a single topographic factor denoted as LS. Assuming a slope length (L) of 600 feet and a slope steepness (S) of four percent, the LS factor is 0.82 (35, p. 16). A typical estimate for the cropping management factor (CP) for continuous wheat using conventional tillage is 0.29 (35, p. 4).

The amount of land available by soil series for each representative farm was presented earlier. The quantity of labor available was estimated assuming the farm family supplies most of the labor. The family provides approximately six hours of labor per day for January, February and December; seven hours per day for March, April, October and November; and eight hours per day for May, June, July, August and September. It was assumed that the family takes two weeks vacation, one week in January and one week in December. The farm was allowed no free capital. The farm operator could acquire all the capital needed at the specified interest rate.

A time period of 40 years was used for this study. Restricting soil erosion may be profitable over a long run time period, because the farmer's major benefits from using conservation practices are higher future crop yields resulting from reduced erosion. Soil erosion reduces soil productivity. However, one characteristic of the erosion-productivity problem is difficulty of detection. Erosion reduces soil productivity so slowly that the reduced productivity may not be noticed until the land is no longer suitable for crop production.

It is difficult to develop a meaningful erosion-productivity relationship because of the number of variables involved. These variables include fertilizer use, improved management skills, weather and climatic conditions and advances in technology especially improved crop varieties (26). Because of the limited information on the erosion-productivity relationship, it was necessary to specify subjectively a relationship to use for this study. Previous research has dealt with this problem by relating productivity to depth of topsoil (16, 24, 42). A study at Texas A&M specified a relationship between the percent of topsoil lost and the percent of initial yield attainable after erosion (42, pp. 24-27). Based on the Texas A&M relationship, this study assumed that the loss of five percent of the topsoil results in a decrease in the yield of wheat of one bushel per acre.[3] Yields for the other crops are adjusted to be comparable with the decreased wheat yield[4].

## Programming Results

The linear programming model was used to analyze the impact on the representative farms of restricting soil erosion. The initial tableaus for the three farms appear in Tables XXXVII, XXXVIII and XXXIX in Appendix B.

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[3] A bulk density of 164 tons per acre inch is assumed for the soils in this study.

[4] The loss of topsoil and decreased yield may vary because of round-off error.

Grady County Representative Farm

The results of the programming for the Grady County representative farm are presented in Tables X through XII. In year one, farm income for the unrestricted scenario is $21,321 (Table X). Based on the assumption of the relationship between soil erosion and productivity, farm income decreases due to decreased yields. Annual income falls from $21,321 in year one to $8,904 in year 40, a decrease of more than one-half. The present value of the income stream is $336,519, using a discount rate of four percent[5].

The salvage value of the farm in year 40 is calculated as:

$$V_F = Y/r$$

where $V_F$ is the value of the farm, Y is the espected future earning potential of the farm and r is the discount rate. In this case, the farm's salvage value considers only the future earning potential of the farm used in agricultural production and ignores non-agricultural incentives to own land. As indicated in Table X, the salvage value of the Grady County farm in year 40 is $222,260 (income of $8,904 in year 40 divided by the discount rate of four percent). This assumes that the income for year 40 will continue indefinitely[6]. Discounting this salvage value gives a present value of $46,301. The net present value of the farm is the sum of the present value of the income stream

[5] The discount rate of four percent is close to the real interest rate for 1980. The real interest rate, price rate less inflation rate was 3.9 percent in 1980. The prime rate was 15.3 percent (50) and Consumer Price Index was 11.4 percent (51).

[6] The salvage value may be over estimated when assuming income in year 40 to be the expected future earning potential of the farm. This is because of the impact of soil erosion on soil productivity.

TABLE X

RETURNS TO LAND, LABOR, RISK AND MANAGEMENT FOR THE GRADY COUNTY REPRESENTATIVE FARM WITH UNRESTRICTED AND RESTRICTED SOIL EROSION

| Years | Annual Income: Unrestricted Soil Erosion | Annual Income: Restricted Soil Erosion[a] |
|---|---|---|
| 1-3 | $ 21,321 | $ 14,142 |
| 4-5 | 21,130 | 14,142 |
| 6-10 | 19,187 | 14,142 |
| 11-15 | 17,718 | 14,142 |
| 16-20 | 16,249 | 12,912 |
| 21-24 | 14,780 | 12,912 |
| 25-29 | 13,311 | 12,912 |
| 30-34 | 11,842 | 11,789 |
| 35-38 | 10,373 | 11,789 |
| 39-40 | 8,904 | 11,789 |
| Total Income (Not Discounted)[b] | $616,178 | $523,700 |
| Present Value of Income Stream, Discounted @ 4 percent | $336,519 | $266,114 |
| Salvage Value of Farm in Year 40 | $222,600 | $294,725 |
| Present Value of the Farm's Salvage Value | $ 46,301 | $ 61,303 |
| Net Present Value of the Grady Farm | $382,820 | $327,417 |

[a]Soil erosion restricted to SCS recommended levels.

[b]Since the annual income is for a one year period, the figures shown must be multiplied by the number of years shown in Column 1 to obtain the total income.

and the present value of the farm's salvage value. The net present value of the Grady County farm is $382,820 for the case of unrestricted soil erosion.

Restricting soil erosion to SCS recommended levels reduced income in year one from $21,321 to $14,142 (Table X). The SCS recommended soil loss limit for the Grady County farm is five tons per acre for each soil (35, pp. 5-14). Income for the restricted case does not decrease as fast as for the unrestricted case. However, income in year one for the restricted case is $7,179 less than the unrestricted case. The income for the restricted case decreases from $14,142 to $11,789 over the 40 year period. The present value of the earnings for the restricted soil erosion case is $266,114. The present value of the farm's salvage value is $61,303 (Table X). The net present value of the farm is $327,417 when soil erosion is restricted.

With unrestricted erosion, the optimum farm plan in year one includes intensive crop production (Table XI). The farm plan includes 130 acres of cotton produced on Kirkland silt loam and Norge silt loam 1 soils. Grain sorghum is produced using minimum tillage (MT) on Teller loam and Norge silt loam 2 soils. Renfrow silt loam is used to produce wheat with conventional tillage (C). Ten cow-calf units are raised on 120 acres of native pasture on the Dougherty-Eufaula soil complex. Because of the impact soil erosion has on productivity, the farm plan changes in year six. After year five, it is more profitable to take Norge silt loam 2, Renfrow silt loam and Teller loam out of crop production and place them in pasture. Twenty-nine cow-calf units are grown on the 340 acres of native pasture. After year six, the farm plan does not change and reductions in net income are due to decreased cotton yields.

TABLE XI

THE OPTIMUM FARM ORGANIZATION OF THE GRADY COUNTY REPRESENTATIVE FARM WITH UNRESTRICTED AND RESTRICTED SOIL EROSION

| Years | Unrestricted Soil Erosion | Restricted Soil Erosion[a] |
|---|---|---|
| 1-5 | 120 Acres Native Pasture | 301 Acres Native Pasture |
| | 130 Acres Cotton (C) | 33 Acres Wheat (MTT) |
| | 175 Acres Grain Sorghum (MT) | 5 Acres Wheat (MT) |
| | 45 Acres Wheat (C) | 66 Acres Cotton (T) |
| | 10 Cow-Calf Units | 31 Acres Alfalfa |
| | | 34 Acres Grain Sorghum (MT) |
| | | 25 Cow-Calf Units |
| 6-15 | 340 Acres Native Pasture | No change from above |
| | 130 Acres Cotton (C) | |
| | 29 Cow-Calf Units | |
| 16-30 | No change from above | 338 Acres Native Pasture |
| | | 66 Acres Cotton (T) |
| | | 31 Acres Alfalfa |
| | | 33 Acres Wheat (MTT) |
| | | 2 Acres Wheat (C) |
| | | 28 Cow-Calf Units |
| 31-40 | No change from above | 340 Acres Native Pasture |
| | | 66 Acres Cotton (T) |
| | | 31 Acres Alfalfa |
| | | 33 Acres Wheat (MTT) |
| | | 29 Cow-Calf Units |

[a]Soil erosion is restricted to SCS recommended levels.

Restricting soil erosion forces land out of crop production and into native pasture. Sixty-four acres of cotton are transferred to other crops: 31 acres to alfalfa and 33 acres to wheat. The cotton produced is terraced (T), which decreases the net returns for cotton. Forty acres of Renfrow silt loam goes from wheat production to native pasture. The five acres of Renfrow soil remaining in wheat is minimum tilled (MT). Thirty-three acres of wheat, terraces and minimum tilled (MTT), are grown on Kirkland silt loam. Thirty-four acres of grain sorghum (MT) are produced. Twenty-five cow-calf units are raised on 301 acres of native pasture. The farm plan for the restricted erosion case changes little from year one through year 40. After 40 years, 39 acres have transferred from crop production to pasture. This includes 34 acres of land previously in grain sorghum and five acres of Renfrow silt loam previously in wheat (Table XI).

The annual soil losses and the potential yields after 40 years are presented in Tables XII and XIII, respectively. Soil erosion is highest for Kirkland silt loam and Norge silt loam 1 soils which are in cotton. After five years, Norge silt loam 2, Renfrow silt loam and Teller loam are in pasture and soil erosion no longer is a major problem (Table XII). Restricting soil erosion results in a higher potential yield in year 40 than when soil erosion is unrestricted (Table XIII). With restricted soil erosion, yields for Kirkland silt loam and Norge silt loam 1 decrease about seven percent. For the unrestricted case, yields for Kirkland silt loam and Norge silt loam 1 decrease by approximately one-fourth.

Because of the high soil losses associated with the optimum plan of the unrestricted case, restricting soil erosion to recommended levels has an adverse impact on farm income for the Grady County Farm. The

TABLE XII

ANNUAL SOIL LOSS FROM THE GRADY COUNTY REPRESENTATIVE FARM WITH UNRESTRICTED AND RESTRICTED SOIL EROSION

| Years | Soil Series | Unrestricted Soil Erosion | | Restricted Soil Erosion[a] | |
|---|---|---|---|---|---|
| | | Total | Avg. Per Acre | Total | Avg. Per Acre |
| | | ---Tons Per Acre--- | | | |
| 1-5 | Dougherty-Eufaula | 379 | 3.16 | 379 | 3.16 |
| | Kirkland Silt Loam | 840 | 15.26 | 275 | 5.00 |
| | Norge Silt Loam 1 | 1,335 | 17.81 | 375 | 5.00 |
| | Norge Silt Loam 2 | 983 | 13.11 | 375 | 5.00 |
| | Renfrow Silt Loam | 1,258 | 27.96 | 225 | 5.00 |
| | Teller | 1,310 | 13.11 | 500 | 5.00 |
| 6-15 | Dougherty-Eufaula | 379 | 3.16 | No change from above | |
| | Kirkland Silt Loam | 840 | 15.26 | | |
| | Norge Silt Loam 1 | 1,335 | 17.81 | | |
| | Norge Silt Loam 2 | 229 | 3.06 | | |
| | Renfrow Silt Loam | 182 | 4.05 | | |
| | Teller Loam | 305 | 3.06 | | |
| 16-30 | Dougherty-Eufaula | No change from above | | 379 | 3.16 |
| | Kirkland Silt Loam | | | 275 | 5.00 |
| | Norge Silt Loam 1 | | | 275 | 5.00 |
| | Norge Silt Loam 2 | | | 229 | 3.06 |
| | Renfrow Silt Loam | | | 225 | 5.00 |
| | Teller Loam | | | 305 | 3.06 |
| 31-40 | Dougherty-Eufaula | No change from above | | 379 | 3.16 |
| | Kirkland Silt Loam | | | 275 | 5.00 |
| | Norge Silt Loam 1 | | | 375 | 5.00 |
| | Norge Silt Loam 2 | | | 229 | 3.06 |
| | Renfrow Silt Loam | | | 182 | 4.05 |
| | Tiller Loam | | | 305 | 3.06 |

[a]Soil erosion is restricted to SCS recommended levels.

TABLE XIII

POTENTIAL PER ACRE YIELDS FOR THE GRADY COUNTY REPRESENTATIVE FARM AFTER 40 YEARS WITH UNRESTRICTED AND RESTRICTED SOIL EROSION

| Soil Series | Wheat (bu.) | Grain Sorghum (cwt.) | Alfalfa (tons) | Cotton Lint (lbs.) |
|---|---|---|---|---|
| Unrestricted Soil Erosion | | | | |
| Dougherty-Eufaula | -- | -- | -- | -- |
| Kirkland Silt Loam | 22 | 15 | -- | 288 |
| Norge Silt Loam 1 | 22 | 18 | 2.2 | 288 |
| Norge Silt Loam 2 | 18 | 17 | -- | -- |
| Renfrow Silt Loam | 21 | 13 | -- | -- |
| Teller Loam | 17 | 17 | -- | -- |
| Restricted Soil Erosion[a] | | | | |
| Dougherty-Eufaula | -- | -- | -- | -- |
| Kirkland Silt Loam | 28 | 21 | -- | 372 |
| Norge Silt Loam 1 | 28 | 24 | 2.8 | 372 |
| Norge Silt Loam 2 | 18 | 17 | -- | -- |
| Renfrow Silt Loam | 22 | 14 | -- | -- |
| Teller Loam | 17 | 17 | -- | -- |

[a]Soil erosion is restricted to SCS recommended levels.

net present value of the farm decreases 12.4 percent because of the soil loss restrictions. Restricting erosion necessitates a shift from crops that are soil erosive to less profitable crops which satisfy the soil loss constraints. Also, conservation practices which increase production costs are required to reduce soil losses to the recommended levels.

Custer County Representative Farm

The results for the Custer County representative farm are summarized in Tables XIV, XV, XVI and XVII. The initial income for the unrestricted case for the Custer County farm is $8,645 (Table XIV). Farm income changes in year six to $7,123. Income for years 10 through 40 is $6,581. The present value of the earnings for the unrestricted case is $141,078. The present value of the farm's salvage value is $32,221. The net present value of the farm is $175,299.

Annual income for the first twelve years is $7,833 when soil erosion is restricted to SCS recommended levels (Table XIV). The recommended soil loss limits are five tons per acre for Carey silt loam and St. Paul silt loam soils. The soil loss limit for Woodward-Quinlan Complex is three tons per acre (35, pp. 5-14). Yearly income decreases to $6,765 in year 13. In year 24, income for the restricted soil loss case equals income for the unrestricted case. The net present value of the Custer County farm is $177,253 when soil conservation practices are used to reduce soil erosion (Table XIV).

The optimum farm plan for the unrestricted soil loss case is presented in Table XV. The initial farm plan includes 75 acres of alfalfa,

TABLE XIV

RETURNS TO LAND, LABOR, RISK AND MANAGEMENT FOR THE CUSTER COUNTY REPRESENTATIVE FARM WITH UNRESTRICTED AND RESTRICTED SOIL EROSION

| Years | Annual Income: Unrestricted Soil Erosion | Annual Income: Restricted Soil Erosion[a] |
|---|---|---|
| 1-5 | $ 8,645 | $ 7,833 |
| 6-9 | 7,123 | 7,833 |
| 10-12 | 6,581 | 7,833 |
| 13-23 | 6,581 | 6,765 |
| 24-40 | 6,581 | 6,581 |
| Total Income (Not Discounted)[b] | $275,728 | $280,288 |
| Present Value of Income Stream, Discounted @ 4 percent | $141,078 | $143,032 |
| Salvage Value of Farm in Year 40 | $164,525 | $164,525 |
| Present Value of the Farm's Salvage Value | $ 34,221 | $ 34,221 |
| Net Present Value of the Custer Farm | $175,299 | $177,253 |

[a]Soil erosion is restricted to SCS recommended levels.

[b]Since the annual income is for a one year period, the figures shown must be multiplied by the number of years shown in Column 1 to obtain the total income.

TABLE XV

THE OPTIMUM FARM ORGANIZATION OF THE CUSTER COUNTY REPRESENTATIVE FARM WITH UNRESTRICTED AND RESTRICTED SOIL EROSION

| Years | Unrestricted Soil Erosion | Restricted Soil Erosion[a] |
|---|---|---|
| 1-9 | 75 Acres Alfalfa | 149 Acres Alfalfa |
| | 137 Acres Cotton (C) | 40 Acres Cotton (C) |
| | 23 Acres Grain Sorghum | 46 Acres Grain Sorghum (MT) |
| | 370 Acres Improved Pasture | 370 Acres Improved Pasture |
| | 117 Cow-Calf Units | 117 Cow-Calf Units |
| 10-12 | 75 Acres Alfalfa | No change from above |
| | 530 Acres Improved Pasture | |
| | 176 Cow-Calf Units | |
| 13-23 | No change from above | 75 Acres Alfalfa |
| | | 52 Acres Cotton (C) |
| | | 478 Acres Improved Pasture |
| | | 157 Cow-Calf Units |
| 24-40 | No change from above | 75 Acres Alfalfa |
| | | 530 Acres Improved Pasture |
| | | 176 Cow-Calf Units |

[a]Soil erosion is restricted to SCS recommended levels.

137 acres of cotton, 23 acres of grain sorghum and 370 acres of improved pasture. Also, 117 cow-calf units are included in the farm plan. Only St. Paul silt loam has an average soil loss greater than the SCS recommended levels (Table XVI). St. Paul silt loam is in 137 acres of cotton and 23 acres of grain sorghum. Soil loss for the other soils are well below the soil loss restrictions. The farm plan changes once in year ten. Cotton and grain sorghum are no longer included in the farm plan. The farm plan for years 10 through 40 consists of 75 acres of alfalfa, 530 acres of improved pasture and 176 cow-calf units.

The optimum farm plan for the Custer County farm when soil erosion is restricted to SCS limits includes 149 acres of alfalfa, 40 acres cotton, 46 acres of grain sorghum, 370 acres of improved pasture and 117 cow-calf units (Table XV). The optimum plan changes in year 13. In year 24, the farm plan for the restricted case is the same as for the unrestricted case and includes 75 acres of alfalfa, 530 acres of improved pasture and 176 cow-calf units.

Annual soil losses are presented in Table XVI. With the exception of St. Paul silt loam soils for years 1 through 12 when soil erosion is not restricted, no erosion problem exists for the Custer County farm.

The potential yields for the Custer County farm after 40 years are shown in Table XVII. Because soil erosion is not a great problem, the potential yields decrease only slightly for the Custer County farm. The potential yields after 40 years are the same for both scenarios.

For the Custer County farm, restricting soil erosion results in a slight increase in the net present value of the farm. The net present value of the farm for the restricted case is $177,253 which compares with $175,299 for the unrestricted case, an increase of 1.1 percent.

TABLE XVI

ANNUAL SOIL LOSS FROM THE CUSTER COUNTY REPRESENTATIVE FARM WITH UNRESTRICTED AND RESTRICTED SOIL EROSION

| Years | Soil Series | Unrestricted Soil Erosion | | Restricted Soil Erosion[a] | |
|---|---|---|---|---|---|
| | | Total | Avg. Per Acre | Total | Avg. Per Acre |
| | | Tons Per Acre | | | |
| 1-5 | Carey Silt Loam 1 | 85 | 1.12 | 85 | 1.12 |
| | Carey Silt Loam 2 | 492 | 2.29 | 492 | 2.29 |
| | St. Paul Silt Loam | 2,081 | 13.00 | 800 | 5.00 |
| | Woodward-Quinlan | 355 | 2.29 | 355 | 2.29 |
| 6-9 | Carey Silt Loam 1 | 85 | 1.12 | No change from above | |
| | Carey Silt Loam 2 | 492 | 2.29 | | |
| | St. Paul Silt Loam | 2,081 | 13.00 | | |
| | Woodward-Quinlan | 355 | 2.29 | | |
| 10-24 | Carey Silt Loam 1 | 85 | 1.12 | No change from above | |
| | Carey Silt Loam 2 | 492 | 2.29 | | |
| | St. Paul Silt Loam | 160 | 1.00 | | |
| | Woodward-Quinlan | 355 | 2.29 | | |
| 24-40 | Carey Silt Loam 1 | No change from above | | 85 | 1.12 |
| | Carey Silt Loam 2 | | | 492 | 2.29 |
| | St. Paul Silt Loam | | | 160 | 1.00 |
| | Woodward-Quinlan | | | 355 | 2.29 |

[a]Soil erosion is restricted to SCS recommended levels.

TABLE XVII

POTENTIAL PER ACRE YIELDS FOR THE CUSTER COUNTY REPRESENTATIVE FARM AFTER 40 YEARS WITH UNRESTRICTED AND RESTRICTED SOIL EROSION

| Soil Series | Wheat (bu.) | Grain Sorghum (cwt.) | Alfalfa (tons) | Cotton Lint (lbs.) |
|---|---|---|---|---|
| Unrestricted Soil Erosion | | | | |
| Carey Silt Loam 1 | 20 | 20 | 2.4 | 250 |
| Carey Silt Loam 2 | 19 | 16 | -- | 190 |
| St. Paul Silt Loam | 18 | 18 | 2.0 | 225 |
| Woodward-Quinlan Complex | -- | -- | -- | -- |
| Restricted Soil Erosion[a] | | | | |
| Carey Silt Loam 1 | 20 | 20 | 2.4 | 250 |
| Carey Silt Loam 2 | 19 | 16 | -- | 190 |
| St. Paul Silt Loam | 18 | 18 | 2.0 | 225 |
| Wood-Quinlan Complex | -- | -- | -- | -- |

[a]Soil erosion is restricted to SCS recommended levels.

One reason for the result is that the farm went to pasture sooner when soil erosion was not restricted. The profitability of crops which are not erosive is another factor which makes soil conservation profitable for the Custer County farm. Finally, only one of the farm's soils exceeded the recommended soil loss limit when soil erosion was unrestricted. Restricting the soil to the recommended levels had little impact on the farm.

Greer County Representative Farm

The estimated annual income for the Greer County farm is presented in Table XVIII. Optimum income for years one through five is $30,785 per year when soil erosion is not restricted. Income decreases over time because of lost productivity resulting from soil erosion. Income decreases approximately 80 percent over the 40 year period. Income in year 40 is $6,179. The present value of the income stream is $364,299. The net present value of the farm when soil erosion is not restricted is $396,360 (Table XVIII).

The net present value of the Greer County farm is $382,785 when soil erosion is restricted during the 40 year period. Income in year one is $18,635. Over the 40 years, income decreases around 43 percent to $10,665. The present value of the income stream is $327,267 (Table XVIII). The recommended soil loss limits for the Greer farm are as follows: five tons per acre for Abilene clay loam, four tons per acre for Lawton loam and Mansic lay loam and three tons per acre for Woodward loam (35, pp. 5-14).

Initially cotton is the most profitable crop to produce on the Greer County farm. The optimum farm plan for the first eight years

TABLE XVIII

RETURNS TO LAND, LABOR, RISK AND MANAGEMENT FOR THE GREER COUNTY REPRESENTATIVE FARM WITH UNRESTRICTED AND RESTRICTED SOIL EROSION

| | Annual Income | |
|---|---|---|
| Years | Unrestricted Soil Erosion | Restricted Soil Erosion[a] |
| 1-5 | $ 30,785 | $ 18,635 |
| 6-8 | 23,859 | 18,635 |
| 9-10 | 23,294 | 18,635 |
| 11-15 | 18,634 | 18,635 |
| 15 | 18,634 | 18,635 |
| 16 | 14,615 | 18,635 |
| 17-20 | 14,615 | 14,405 |
| 21-25 | 9,703 | 14,405 |
| 26-30 | 7,939 | 14,405 |
| 31-32 | 6,179 | 14,405 |
| 33-40 | 6,179 | 10,665 |
| Total Income (Not Discounted)[b] | $508,945 | $613,960 |
| Present Value of Income Stream, Discounted @ 4 percent | $364,229 | $327,267 |
| Salvage Value of Farm in Year 40 | $154,475 | $226,625 |
| Present Value of the Farm's Salvage Value | $ 32,131 | $ 55,458 |
| Net Present Value of the Greer Farm | $396,360 | $382,725 |

[a]Soil erosion is restricted to SCS recommended levels.

[b]Since the annual income is for a one year period, the figures shown must be multiplied by the number of years shown in Column 1 to obtain the total income.

includes 670 acres of cotton when soil erosion is unrestricted (Table XIX). In year nine, the 265 acres of Woodward loam soil goes from cotton to pasture. Seventeen cow-calf units are grown in the pasture. After 31 years, only the 90 acres of Abilene clay loam remains in cotton production. The remaining 580 acres are in improved pasture supporting 154 cow-calf units.

For restricted soil erosion, the optimum plan for years one through 32 includes 20 cow-calf units, 316 acres of native pasture, 72 acres of conventionally tilled cotton and 282 acres of cotton produced on terraced land (Table XIX). For years 33 through 40, the farm consists of 426 acres of native pasture, 22 cow-calf units, 68 acres of cotton conventionally tilled and 176 acres of cotton on terraced land.

The annual soil loss for the restricted and unrestricted scenarios is shown in Table XX. The potential yields after 40 years are presented in Table XXI for both scenarios. Restricting soil erosion on the Greer County farm reduces the net present value of the farm 3.4 percent from $396,360 to $382,820. However, the optimum farm plan for the restricted case is not as variable as the unrestricted case.

## Implementing Conservation Practices

With no outside influence, whether or not to control soil erosion is a farm management decision. The farm operator must decide if the investment in BMP's fits in with his/her goals and objectives. If reducing soil erosion is complementary with the farmer's objectives, little encouragement is needed to induce the farmer to adopt BMP's to reduce soil erosion. On the other hand, if restricting soil erosion

TABLE XIX

THE OPTIMUM FARM ORGANIZATION OF THE GREER COUNTY REPRESENTATIVE FARM WITH UNRESTRICTED AND RESTRICTED SOIL EROSION

| Years | Unrestricted Soil Erosion | Restricted Soil Erosion[a] |
|---|---|---|
| 1-8 | 670 Acres Cotton (C) | 316 Acres Native Pasture<br>72 Acres Cotton (C)<br>282 Acres Cotton (T)<br>20 Cow-Calf Units |
| 9-25 | 265 Acres Native Pasture<br>405 Acres Cotton (C)<br>17 Cow-Calf Units | No change from above |
| 26-30 | 71 Acres Native Pasture<br>409 Acres Improved Pasture<br>190 Acres Cotton (C)<br>113 Cow-Calf Units | No change from above |
| 31-32 | 580 Acres Improved Pasture<br>90 Acres Cotton (C)<br>154 Cow-Calf Units | No change from above |
| 33-40 | No change from above | 426 Acres Native Pasture<br>68 Acres Cotton (C)<br>176 Acres Cotton (T)<br>27 Cow-Calf Units |

[a]Soil erosion is restricted to SCS recommended levels.

TABLE XX

ANNUAL SOIL LOSS FROM THE GREER COUNTY REPRESENTATIVE FARM WITH UNRESTRICTED AND RESTRICTED SOIL EROSION

| Years | Soil Series | Unrestricted Soil Erosion | | Restricted Soil Erosion[a] | |
|---|---|---|---|---|---|
| | | Total | Avg. Per Acre | Total | Avg. Per Acre |
| | | ------Tons Per Acre------ | | | |
| 1-8 | Abilene Clay Loam | 673 | 7.50 | 450 | 5.00 |
| | Lawton Loam | 2,872 | 13.35 | 860 | 4.00 |
| | Mansic Clay Loam | 1,155 | 11.55 | 400 | 4.00 |
| | Woodward Loam | 3,540 | 13.35 | 795 | 3.00 |
| 9-25 | Abilene Clay Loam | 673 | 7.50 | No change from above | |
| | Lawton Loam | 2,872 | 13.35 | | |
| | Mansic Clay Loam | 1,155 | 11.55 | | |
| | Woodward Loam | 252 | 0.95 | | |
| 26-30 | Abilene Clay Loam | 673 | 7.50 | No change from above | |
| | Lawton Loam | 204 | 0.95 | | |
| | Mansic Clay Loam | 1,155 | 11.55 | | |
| | Woodward Loam | 252 | 0.95 | | |
| 31-32 | Abilene Clay Loam | 673 | 7.50 | No change from above | |
| | Lawton Loam | 204 | 0.95 | | |
| | Mansic Clay Loam | 82 | 0.82 | | |
| | Woodward Loam | 252 | 0.95 | | |
| 33-40 | Abilene Clay Loam | No change from above | | 450 | 5.00 |
| | Lawton Loam | | | 860 | 4.00 |
| | Mansic Clay Loam | | | 400 | 4.00 |
| | Woodward Loam | | | 252 | 0.95 |

[a]Soil erosion is restricted to SCS recommended levels.

TABLE XXI

POTENTIAL PER ACRE YIELDS FOR THE GREER COUNTY REPRESENTATIVE FARM AFTER 40 YEARS WITH UNRESTRICTED AND RESTRICTED SOIL EROSION

| | Wheat (bu.) | Grain Sorghum (cwt.) | Alfalfa (tons) | Cotton Lint (lbs.) |
|---|---|---|---|---|
| Unrestricted Soil Erosion | | | | |
| Abilene Clay Loam | 19 | 15 | 1.7 | 280 |
| Lawton Loam | 14 | 11 | 1.4 | 215 |
| Mansic Clay Loam | 13 | 11 | 1.4 | 215 |
| Woodward Loam | 14 | 11 | -- | 205 |
| Restricted Soil Erosion[a] | | | | |
| Abilene Clay Loam | 20 | 16 | 1.8 | 295 |
| Lawton Loam | 17 | 14 | 1.7 | 261 |
| Mansic Clay Loam | 17 | 15 | 1.8 | 280 |
| Woodward Loam | 15 | 12 | -- | 220 |

[a]Soil erosion is restricted to SCS recommended levels.

conflicts with the farmer's goals, the farmer will not adopt BMP's on his/her own initiative. For this study, it was assumed that the farmer's goal was to maximize the net present value of the farm for a planning horizon of 40 years. If restricting soil erosion increases the net present value of the farm, incentives exist for the farmer to adopt BMP's. Conversely, if restricting soil erosion decreases the net present value of the farm for the 40 year period, no incentive exists for the farmer to implement BMP's. The net present value of the farm is measured as the sum of the present value of the farm's income stream for the planning period and the salvage value of the farm at the end of the planning period. In this case, the farm's salvage value considers only the future earning potential of the farm used in agricultural production and ignores non-agricultural incentives to own land.

Assuming the farmer's goal is to maximize the net present value of the farm over the 40 year period, the Custer County representative farm will adopt BMP's to reduce soil erosion. Reducing soil erosion increases the net present value of the Custer farm compared with unrestricted erosion (Table XIV).

No incentives exist for the Grady and Greer representative farms to reduce soil erosion, since restricting soil erosion to SCS recommended levels reduced the net present value of the Grady and Greer farms. Because of the lack of private financial incentives, an economic incentive policy is needed to induce the Grady and Greer farms to adopt BMP's to reduce soil erosion. One option is to pay the farmers a subsidy for restricting soil erosion to SCS recommended levels. The subsidy would be used to offset the decreased profitability of the farm when soil erosion is restricted. The subsidy payment should equal the difference between the farm's value with unrestricted soil erosion and restricted soil erosion. The present value of the payment must equal W:

$$W = NPV_u - NPV_r$$

where W is the present value of the subsidy payment, $NPV_u$ is the net present value of the farm with unrestricted soil loss and $NPV_r$ is the net present value of the farm with restricted soil erosion. The annual payment necessary to offset the decreased net present value due to restricting soil erosion is calculated as:

$$A = W/USPV_{r,t}$$

where A is the annual payment, W is as previously defined and $USPV_{r,t}$ is the present value of $1.00 for a uniform series of t periods with a discount rate of r.

For the Grady County farm, the $NPV_u$ is $382,820 and the $NPV_r$ is $327,417 (Table X). The difference W is $55,403. The annual payment for the 40 year period necessary to equal W is approximately $2,800. The annual payment necessary to equate the difference between $NPV_u$ and $NPV_r$ for the Greer County farm is $689. For the Greer County farm $NPV_u$ equals $396,360 and $NPV_r$ equals $382,745 (Table XVIII).

An alternative policy would be to restrict soil erosion to a level greater than the SCS recommended levels but less than current soil loss rates. This would provide a reduction in soil erosion and offer the farmer some flexibility in maintaining farm income. Restricting soil erosion to twice the SCS recommended levels results in a net present value for the Grady County farm of $401,377 for the 40 year period (Table XXII), an increase of 4.8 percent over the net present value for the farm with unrestricted soil erosion (Table X).

TABLE XXII

RETURNS TO LAND, LABOR, RISK AND MANAGEMENT FOR GRADY AND GREER COUNTY REPRESENTATIVE FARMS WITH SOIL EROSION RESTRICTED TO TWICE THE SCS RECOMMENDED LEVELS

| Years | Annual Income | |
|---|---|---|
| | Grady County | Greer County |
| 1-7 | $ 19,839 | $ 25,150 |
| 8 | 18,060 | 25,150 |
| 9-13 | 18.060 | 19,027 |
| 14-17 | 16,588 | 19,027 |
| 18-20 | 16,588 | 14,308 |
| 21-25 | 15,135 | 14,308 |
| 26-27 | 15,135 | 10,399 |
| 28-33 | 13,686 | 10,399 |
| 34 | 13,686 | 6,971 |
| 35-40 | 12,242 | 6,971 |
| Total Income (Not Discounted)[a] | $638,584 | $618,869 |
| Present Value of Income Stream, Discounted at 4 percent | $337,719 | $363,764 |
| Salvage Value of Farm After 40 Years | $306,050 | $174,275 |
| Present Value of Farm's Salvage Value | $ 63,658 | $ 36,249 |
| Net Present Value of Farm | $401,377 | $400,013 |

[a]Since the annual income is for a one year period, the figures shown must be multiplied by the number of years shown in Column 1 to obtain the total income.

The net present value of the Greer County farm increases almost one percent over the unrestricted case when soil erosion is restricted to twice the SCS levels. The net present value for the Greer County farm with soil erosion restricted to twice the recommended levels is $400,013 (Table XXII). This compares with a net present value for the farm of $396,360 with unrestricted soil erosion (Table XVIII).

## Implications for Farmers

The linear programming model discussed at the beginning of the chapter was used to determine the impact of restricting soil erosion on farm income and organization. The results imply that the impact varies from farm to farm. The Grady County representative farm was adversely affected by restricting soil erosion. The Custer County representative farm benefited by adopting conservation practices. Although restricting soil erosion reduced the net present value of the Greer County farm, the impact was not great. The implication is that a farm's soil resources greatly affect the impact that restricting soil erosion will have on that farm. This is because the soil influences what crops are most profitable to produce. Also the erodibility of the soil varies for different soil series. For a highly erodible soil, reducing soil erosion may require taking the soil out of crop production and putting it into pasture, which may not be as profitable. Conservation practices also may be needed to reduce soil erosion. However, the practices increase production costs and decrease net returns for the enterprise.

Other factors which influence the impact on the farm of restricting soil erosion are the time period and discount rate considered. This study used a 40 year time period. Increasing the time period will increase the profitability of adopting conservation practices. Decreasing the time period will have the opposite effect. For most farmers, a time period of 40 years is probably the upper limit. A real discount rate of four percent was used for this study. Decreasing the discount rate will increase the profitability of restricting soil erosion. Conversely, increasing the discount rate decreases the profitability of erosion control measures.

A final factor which will influence the impact of restricting soil erosion on farm income is the relationship between soil erosion and soil productivity. The results of this study were obtained assuming that the loss of five percent of the topsoil resulted in a decrease of one bushel per acre in wheat yield. Reductions in the yields of the other crops were made comparable with the decrease in wheat yield. Different results may be obtained if an alternative relationship were assumed. For example, if the loss of ten percent of the topsoil is required before productivity is significantly reduced, then soil conservation practices are even less profitable than reflected in this study. Conversely, if significant reductions in output occur when less than five percent of the topsoil is lost, then soil conservation practices may be more profitable than this study suggests.

# CHAPTER VI

## SUMMARY AND CONCLUSIONS

This study analyzed the impact of restricting soil erosion on the farm firm. Best management practices (BMP's) commonly used in Oklahoma to control soil erosion were selected for this research. The BMP's included pasture management, terraces, erosion control structures and minimum tillage. Farmers in southwestern Oklahoma were interviewed concerning the operation and maintenance practices and costs for pasture management, terraces and erosion control structures. Names of farmers who had cooperated with the SCS in implementing these conservation practices were obtained from local SCS personnel. The southwestern Oklahoma counties included in the survey were Grady, Caddo, Stephens, Custer and Greer. Information pertaining to minimum tillage was obtained from SCS personnel and Oklahoma State University agronomists.

Representative study farms were established in Grady, Custer and Greer counties. The impacts of restricting soil erosion on the farm firm were analyzed using the representative farms. Production cost estimates for various crop enterprises using alternative BMP's were calculated using the information obtained from the survey and the Oklahoma State University Enterprise Budget Generator. The crop enterprises included pasture, wheat, grain sorghum and cotton. The BMP's considered were pasture management, minimum tillage, terraces, terraces and minimum tillage combined and conventional tillage.

A linear programming (LP) model was formulated using the costs and returns estimates from the enterprise budgets. The LP model maximized returns to farm land, labor, risk and management subject to the resource restrictions. The basic resource restrictions included land, labor, capital and AUM's. For each representative farm, two scenarios were assumed: (1) unrestricted soil erosion and (2) restricted soil erosion. For the second case, soil losses were restricted to SCS recommended levels. A long-run planning horizon of 40 years was assumed, with a real interest rate of four percent (the prime interest rate minus the annual increase in the Consumer Price Index in 1980).

In most cases, the adoption of BMP's increased annual production costs. One exception was the production of grain sorghum using minimum tillage on the Grady County representative farm. The greatest increase in production costs resulted from the use of terraces.

The impacts of restricting soil erosion on farm income and organization varied from farm to farm. Restricting soil erosion had an adverse impact on the Grady and Greer County farms. For the Custer County farm, it was profitable to control soil erosion.

To reduce soil erosion, BMP's must be implemented at the farm level. Therefore, the impact at the farm level of restricting soil erosion must be considered when formulating economic policies to encourage farmers to adopt BMP's. The findings of this study suggest two factors which should be considered when evaluating alternative conservation policies. One factor is the farmer's goals and objectives. This study assumed an objective of maximizing the net present value of the farm for a planning period of 40 years. The impact of reducing soil erosion will be different given an alternative objective. If a farmer's objective is to pass the farm onto his/her heirs, then adopting soil conservation practices may be an attractive strategy to follow. Also, the impact of restricting soil erosion will be different for different planning horizons.

The second factor which should be considered in soil conservation programs concerns the resources available to the farmer. The soil resource is the primary resource to consider. The soil is the heart of the farming operation and greatly influences what crops are profitable to produce. Also, the erodibility of the soil depends on variables over which the farmer has little or no control. These variables include the soil slope, weather and climatic conditions and the soil's inherent susceptibility to erosion.

The farmer's financial resources also should be considered. This study ignored land payments. However, to a farmer faced with a yearly land payment, maintenance of soil productivity may not seem important. This is especially true for beginning farmers who are faced with cash flow problems during their early years of farming.

## Policy Implications

The findings of this research suggest that policies aimed at reducing soil erosion on farm land should be flexible and should consider the farmer's objectives and resources. For example, the appropriate policy to reduce soil erosion from the Custer County representative farm is an educational program informing the farmer that reducing soil erosion will increase the net present value of the farm.

For the Grady and Greer County representative farms, such an educational program is not appropriate. For those farms, restricting soil erosion to the SCS recommended levels reduced the net present value of the farm. One policy option would be to pay these farmers a subsidy for restricting soil erosion. The present value of the subsidy payment must equal the difference between the net present value for the restricted scenario and the unrestricted scenario. For Grady County, a yearly subsidy payment of $2,800 is needed to offset the decreased net present value of the farm caused by the soil loss restriction. A yearly payment of $689 to the Greer County farm will offset the decreased net present value for the farm when soil erosion is restricted. These payments are based on a 40 year planning period and a real discount rate of four percent.

An alternative policy for the Grady and Greer County farm would be to restrict soil erosion to a level more than the SCS recommended level but less than the current soil loss rates. This would reduce soil erosion and provide the farmer an opportunity to maintain his/her income. The net present value of the Grady farm when erosion is restricted to twice the recommended level is $401,377; which is greater than the net present value for the unrestricted case. The same result occurs for the Greer County farm. Restricting soil erosion to twice the recommended levels provides a net present value of $400,013, which is greater than the net present value for the unrestricted scenario. This alternative reduces soil erosion and increases the net present value of the farm.

## Limitations of Study and Suggestions for Further Research

The major limitation of this research is the lack of a workable relationship between soil loss and productivity loss. This points up the need for further research in this area. Further research in the area of soil erosion and productivity would improve the estimation of SCS recommended soil loss limits. Also, more accuracy in measuring the benefits of restricting soil erosion which accrue to the farm would be obtained with an operable model relating soil loss to productivity loss.

Additional research is needed into the economic impact of BMP's on the farm firm. Also, more research is needed in the impact of BMP's on the agricultural economy of a region. These research efforts need to be conducted because the impact of restricting soil erosion varies from one geographical location to another. The information obtained from these research efforts can be used in formulating alternative conservation policies. The costs of implementing and enforcing the alternative conservation policies must be evaluated to determine an equitable distribution of the cost of reducing soil erosion.

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APPENDICES

# APPENDIX A

# PRODUCTION COSTS FOR THE REPRESENTATIVE FARMS

TABLE XXIII

PRODUCTION COSTS PER ACRE OF PASTURE MANAGEMENT FOR IMPROVED PASTURE ON THE CUSTER COUNTY REPRESENTATIVE FARM[a]

| | Unit | Price/ Unit | Quantity | Cost/ Acre |
|---|---|---|---|---|
| Operating Inputs | | | | |
| Establishment Cost | Acre | $79.00 | 0.05 | $ 3.95 |
| Nitrogen (N) | Lbs. | 0.25 | 50.00 | 12.50 |
| Phosphorus ($P_2O_5$) | Lbs. | 0.28 | 20.00 | 5.60 |
| Annual Operating Cost | Dol. | 0.16 | 5.10 | 0.82 |
| Labor | Hour | 4.00 | 0.12 | 0.48 |
| Machinery, Fuel, Lube, Repairs | Acre | -- | -- | 1.15 |
| Total Operating Costs | | | | $24.50 |
| Fixed Costs | | | | |
| Machinery Interest | Dol. | 0.16 | 3.57 | 0.57 |
| Depr., Taxes, Insurance | Dol. | -- | -- | 0.45 |
| Total Fixed Costs | | | | $ 1.02 |
| Total Production Costs | | | | $25.52 |

[a]Modification of OSU Enterprise Budget 83608301.

## TABLE XXIV

## PRODUCTION COSTS PER ACRE OF WHEAT PRODUCED ON CAREY SILT LOAM 1 AND ST. PAUL SILT LOAM SOILS USING ALTERNATIVE BEST MANAGEMENT PRACTICES ON THE CUSTER COUNTY REPRESENTATIVE FARM[a]

| | Unit | Price/ Unit | Conventional Tillage Quantity | Conventional Tillage Cost/ Acre | Terraces Quantity | Terraces Cost/ Acre | Minimum Tillage Quantity | Minimum Tillage Cost/ Acre | Terraces and Minimum Tillage Quantity | Terraces and Minimum Tillage Cost/ Acre |
|---|---|---|---|---|---|---|---|---|---|---|
| Operating Inputs | | | | | | | | | | |
| Wheat Seed | Bu. | $ 4.50 | 1.00 | $ 4.50 | 1.00 | $ 4.50 | 1.00 | $ 4.50 | 1.00 | $ 4.50 |
| 18-46-0 Fertilizer | Cwt. | 15.00 | 1.00 | 15.00 | 1.00 | 15.00 | 1.00 | 15.00 | 1.00 | 15.00 |
| Nitrogen (N) | Lbs. | 0.25 | 50.00 | 12.50 | 50.00 | 12.50 | 50.00 | 12.50 | 50.00 | 12.50 |
| Sprayer | Acre | 4.00 | 1.00 | 4.00 | 1.00 | 4.00 | 2.00 | 8.00 | 2.00 | 8.00 |
| Custom Combine | Acre | — | 1.00 | 14.00 | 1.00 | 15.00 | 1.00 | 14.00 | 1.00 | 15.00 |
| Custom Hauling[b] | Bu. | 0.20 | 20.00 | 4.00 | 20.00 | 4.00 | 20.00 | 4.00 | 20.00 | 4.00 |
| Annual Operating Capital | Dol. | 0.16 | 26.33 | 4.21 | 28.20 | 4.51 | 26.42 | 4.22 | 27.78 | 4.45 |
| Labor | Hour | 4.00 | 0.61 | 2.45 | 0.71 | 2.85 | 0.28 | 1.13 | 0.32 | 1.26 |
| Terracing[c] | Acre | 35.50 | — | — | 0.05 | 1.77 | — | — | 0.05 | 1.77 |
| Herbicide | Lbs. | 11.75 | — | — | — | — | 1.00 | 11.75 | 1.00 | 11.75 |
| Machinery, Fuel, Lube, Repairs | Acre | — | — | 12.38 | — | 14.75 | — | 5.54 | — | 6.40 |
| Total Operating Costs | | | | $73.04 | | $78.89 | | $80.64 | | $84.63 |
| Fixed Costs | | | | | | | | | | |
| Machinery Interest | Dol. | 0.16 | 56.70 | 9.07 | 56.34 | 9.01 | 27.56 | 4.41 | 26.73 | 4.28 |
| Depr., Taxes, Insurance | Dol. | — | — | 7.68 | — | 7.88 | — | 3.76 | — | 3.74 |
| Total Fixed Costs | | | | $16.75 | | $16.89 | | $ 8.17 | | $ 8.02 |
| Total Production Costs | | | | $86.79 | | $95.78 | | $88.81 | | $92.65 |

[a]Modification of OSU Enterprise Budget 76601204.

[b]Assumes a yield of 20 bu. per acre.

[c]Assumes terrace spacing of 130 ft.

## TABLE XXV

## PRODUCTION COSTS PER ACRE OF WHEAT PRODUCED ON CAREY SILT LOAM 2 SOILS USING ALTERNATIVE BEST MANAGEMENT PRACTICES ON THE CUSTER COUNTY REPRESENTATIVE FARM[a]

| | Unit | Price/ Unit | Conventional Tillage | | Terraces | | Minimum Tillage | | Terraces and Minimum Tillage | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Quantity | Cost/ Acre | Quantity | Cost/ Acre | Quantity | Cost/ Acre | Quantity | Cost/ Acre |
| Operating Inputs | | | | | | | | | | |
| Wheat Seed | Bu. | $ 4.50 | 1.00 | $ 4.50 | 1.00 | $ 4.50 | 1.00 | $ 4.50 | 1.00 | $ 4.50 |
| 18-46-0 Fertilizer | Cwt. | 15.00 | 1.00 | 15.00 | 1.00 | 15.00 | 1.00 | 15.00 | 1.00 | 15.00 |
| Nitrogen (N) | Lbs. | 0.25 | 50.00 | 12.50 | 50.00 | 12.50 | 50.00 | 12.50 | 50.00 | 12.50 |
| Sprayer | Acre | 4.00 | 1.00 | 4.00 | 1.00 | 4.00 | 2.00 | 8.00 | 2.00 | 8.00 |
| Custom Combine | Acre | -- | 1.00 | 14.00 | 1.00 | 15.00 | 1.00 | 14.00 | 1.00 | 15.00 |
| Custom Hauling[b] | Bu. | 0.20 | 20.00 | 4.00 | 20.00 | 4.00 | 20.00 | 4.00 | 20.00 | 4.00 |
| Annual Operating Capital | Dol. | 0.16 | 26.33 | 4.21 | 28.78 | 4.60 | 26.42 | 4.22 | 28.20 | 4.51 |
| Labor | Hour | 4.00 | 0.61 | 2.45 | 0.74 | 2.96 | 0.28 | 1.13 | 0.32 | 1.29 |
| Terracing[c] | Acre | 47.40 | -- | -- | 0.05 | 2.37 | -- | -- | 0.05 | 2.37 |
| Herbicide | Lbs. | 11.75 | -- | -- | -- | -- | 1.00 | 11.75 | 1.00 | 11.75 |
| Machinery Fuel, Lube, Repairs | Acre | -- | -- | 12.38 | -- | 15.47 | -- | 5.54 | -- | 6.63 |
| Total Operating Costs | | | | $73.04 | | $80.40 | | $80.64 | | $85.52 |
| Fixed Costs | | | | | | | | | | |
| Machinery Interest | Dol. | 0.16 | 56.70 | 9.07 | 56.25 | 9.00 | 27.56 | 4.41 | 26.45 | 4.23 |
| Depr., Taxes, Insurance | Dol. | -- | -- | 7.68 | -- | 7.88 | -- | 3.76 | -- | 3.71 |
| Total Fixed Costs | | | | $16.75 | | $16.88 | | $ 8.17 | | $ 7.94 |
| Total Production Costs | | | | $89.79 | | $97.28 | | $88.81 | | $93.46 |

[a]Modification of OSU Enterprise Budget 76601204.

[b]Assumes a yield of 20 bu. per acre.

[c]Assumes a terrace spacing of 100 ft.

TABLE XXVI

PRODUCTION COSTS PER ACRE OF GRAIN SORGHUM PRODUCED ON CAREY SILT LOAM 1 AND ST. PAUL SILT LOAM SOILS USING ALTERNATIVE BEST MANAGEMENT PRACTICES ON THE CUSTER COUNTY REPRESENTATIVE FARM[a]

| | Unit | Price/ Unit | Conventional Tillage Quantity | Conventional Tillage Cost/ Acre | Terraces Quantity | Terraces Cost/ Acre | Minimum Tillage Quantity | Minimum Tillage Cost/ Acre | Terraces and Minimum Tillage Quantity | Terraces and Minimum Tillage Cost/ Acre |
|---|---|---|---|---|---|---|---|---|---|---|
| **Operating Inputs** | | | | | | | | | | |
| Grain Sorghum Seed | Lbs. | $ 0.60 | 5.00 | $ 3.00 | 5.00 | $ 3.00 | 4.00 | $ 3.00 | 5.00 | $ 3.00 |
| Nitrogen (N) | Lbs. | 0.25 | 40.00 | 10.00 | 40.00 | 10.00 | 40.00 | 10.00 | 40.00 | 10.00 |
| Phosphorus ($P_2O_5$) | Lbs. | 0.28 | 30.00 | 8.40 | 30.00 | 8.40 | 30.00 | 8.40 | 30.00 | 8.40 |
| Custom Combine | Acre | -- | 1.00 | 14.00 | 1.00 | 15.00 | 1.00 | 14.00 | 1.00 | 15.00 |
| Custom Hauling[b] | Cwt. | 0.20 | 20.00 | 4.00 | 20.00 | 4.00 | 20.00 | 4.00 | 20.00 | 4.00 |
| Annual Operating Capital | Dol. | 0.16 | 17.20 | 2.75 | 20.85 | 3.34 | 18.22 | 2.92 | 20.36 | 3.26 |
| Labor | Hour | 4.00 | 1.43 | 5.71 | 1.82 | 7.27 | 0.98 | 3.93 | 1.17 | 4.68 |
| Terracing[c] | Acre | 35.50 | -- | -- | 0.05 | 1.77 | -- | -- | 0.05 | 1.77 |
| Sprayer | Acre | 4.00 | -- | -- | -- | -- | 1.00 | 4.00 | 1.00 | 4.00 |
| Herbicide | Lbs. | 4.25 | -- | -- | -- | -- | 2.00 | 8.50 | 2.00 | 8.50 |
| Machinery, Fuel, Lube, Repairs | Acre | -- | -- | 15.04 | -- | 19.84 | -- | 10.14 | -- | 12.48 |
| **Total Operating Costs** | | | | $62.90 | | $72.63 | | $68.89 | | $75.09 |
| **Fixed Costs** | | | | | | | | | | |
| Machinery Interest | Dol. | 0.16 | 66.85 | 10.70 | 71.40 | 11.42 | 49.25 | 7.88 | 49.06 | 7.85 |
| Depr., Taxes, Insur. | Dol. | -- | -- | 9.18 | -- | 9.90 | -- | 6.82 | -- | 6.80 |
| **Total Fixed Costs** | | | | $19.88 | | $21.32 | | $14.70 | | $14.65 |
| **Total Production Costs** | | | | $82.78 | | $93.95 | | $83.59 | | $89.74 |

[a]Modification of OSU Enterprise Budget 73601104.

[b]Assumes yield of 20 cwt. per acre.

[c]Assumes terrace spacing of 130 ft.

TABLE XXVII

PRODUCTION COSTS PER ACRE OF GRAIN SORGHUM PRODUCED ON CAREY SILT LOAM 2 SOILS USING ALTERNATIVE BEST MANAGEMENT PRACTICES ON THE CUSTER COUNTY REPRESENTATIVE FARM[a]

| | Unit | Price/ Unit | Conventional Tillage Quantity | Conventional Tillage Cost/ Acre | Terraces Quantity | Terraces Cost/ Acre | Minimum Tillage Quantity | Minimum Tillage Cost/ Acre | Terraces and Minimum Tillage Quantity | Terraces and Minimum Tillage Cost/ Acre |
|---|---|---|---|---|---|---|---|---|---|---|
| Operating Inputs | | | | | | | | | | |
| Grain Sorghum Seed | Lbs. | $ 0.60 | 5.00 | $ 3.00 | 5.00 | $ 3.00 | 5.00 | $ 3.00 | 5.00 | $ 3.00 |
| Nitrogen (N) | Lbs. | 0.25 | 40.00 | 10.00 | 40.00 | 10.00 | 40.00 | 10.00 | 40.00 | 10.00 |
| Phosphorus ($P_2O_5$) | Lbs. | 0.28 | 30.00 | 8.40 | 30.00 | 8.40 | 30.00 | 8.40 | 30.00 | 8.40 |
| Custom Combine | Acre | — | 1.00 | 14.00 | 1.00 | 15.00 | 1.00 | 14.00 | 1.00 | 15.00 |
| Custom Hauling[b] | Cwt. | 0.20 | 17.00 | 3.40 | 17.00 | 3.40 | 17.00 | 3.40 | 17.00 | 3.40 |
| Annual Operating Capital | Dol. | 0.16 | 17.20 | 2.75 | 21.73 | 3.48 | 18.22 | 2.92 | 20.99 | 3.36 |
| Labor | Hour | 4.00 | 1.43 | 5.71 | 1.89 | 7.55 | 0.98 | 3.93 | 1.21 | 4.84 |
| Terracing[c] | Acre | 47.40 | — | — | 0.05 | 2.37 | — | — | 0.05 | 2.37 |
| Sprayer | Acre | 4.00 | — | — | — | — | 1.00 | 4.00 | 1.00 | 4.00 |
| Herbicide | Lbs. | 4.25 | — | — | — | — | 2.00 | 8.50 | 2.00 | 8.50 |
| Machinery, Fuel, Lube, Repairs | Acre | — | — | 15.04 | — | 20.77 | — | 10.14 | — | 13.02 |
| Total Operating Costs | | | | $62.30 | | $73.96 | | $68.29 | | $75.89 |
| Fixed Costs | | | | | | | | | | |
| Machinery Interest | Dol. | 0.16 | 66.85 | 10.70 | 71.12 | 11.38 | 49.25 | 7.88 | 48.53 | 7.76 |
| Depr., Taxes, Insurance | Dol. | — | — | 9.18 | — | 9.86 | — | 6.82 | — | 6.72 |
| Total Fixed Costs | | | | $19.88 | | $21.24 | | $14.70 | | $14.48 |
| Total Production Costs | | | | $82.18 | | $95.20 | | $82.99 | | $90.37 |

[a] Modification of OSU Enterprise Budget 73601104.

[b] Assumes yield of 17 cwt. per acre.

[c] Assumes terrace spacing of 100 ft.

## TABLE XXVIII

## PRODUCTION COSTS PER ACRE OF COTTON PRODUCED ON CAREY SILT LOAM 1 AND ST. PAUL SILT LOAM SOILS USING ALTERNATIVE BEST MANAGEMENT PRACTICES ON THE CUSTER COUNTY REPRESENTATIVE FARM[a]

| | Unit | Price/ Unit | Conventional Tillage Quantity | Conventional Tillage Cost/ Acre | Terraces Quantity | Terraces Cost/ Acre |
|---|---|---|---|---|---|---|
| Operating Inputs | | | | | | |
| Cotton Seed | Lbs. | $ 0.47 | 15.00 | $ 7.05 | 15.00 | $ 7.05 |
| Pre-emerge Herbicide | Acre | 6.65 | 1.00 | 6.65 | 1.00 | 6.65 |
| Starter Fertilizer | Lbs. | 0.10 | 100.00 | 10.00 | 100.00 | 10.00 |
| Insecticide | Acre | 6.00 | 3.00 | 18.00 | 3.00 | 18.00 |
| Processing Cost | Cwt. | 1.25 | 13.20 | 16.50 | 13.20 | 16.50 |
| Bag, Ties, Ckoff | Bl. | 9.60 | 0.60 | 5.76 | 0.60 | 5.76 |
| Annual Operating Capital | Dol. | 0.16 | 35.35 | 5.66 | 40.77 | 6.52 |
| Labor | Hour | 4.00 | 3.73 | 14.91 | 4.35 | 17.41 |
| Terracing[b] | Acre | 35.50 | -- | -- | 0.05 | 1.77 |
| Machinery, Fuel, Lube, Repairs | Acre | -- | -- | 42.36 | -- | 51.74 |
| Total Operating Costs | | | | $126.89 | | $141.40 |
| Fixed Costs | | | | | | |
| Machinery Interest | Dol. | 0.16 | 212.93 | 34.07 | 213.03 | 34.08 |
| Depr., Taxes, Insurance | Dol. | -- | -- | 29.95 | -- | 29.99 |
| Total Fixed Costs | | | | $ 64.02 | | $ 64.07 |
| Total Production Costs | | | | $190.91 | | $205.47 |

[a]Modification of OSU Enterprise Budget 93602904. Assumes a yield of 250 lbs. of cotton lint per acre.

[b]Assumes terrace spacing of 130 ft.

## TABLE XXIX

## PRODUCTION COSTS PER ACRE OF COTTON PRODUCED ON CAREY SILT LOAM 2 SOILS USING ALTERNATIVE BEST MANAGEMENT PRACTICES ON THE CUSTER COUNTY REPRESENTATIVE FARM[a]

| | Unit | Price/ Unit | Conventional Tillage Quantity | Conventional Tillage Cost/ Acre | Terraces Quantity | Terraces Cost/ Acre |
|---|---|---|---|---|---|---|
| Operating Inputs | | | | | | |
| Cotton Seed | Lbs. | $ 0.47 | 15.00 | $ 7.05 | 15.00 | $ 7.05 |
| Pre-emerge Herbicide | Acre | 6.65 | 1.00 | 6.65 | 1.00 | 6.65 |
| Starter Fertilizer | Lbs. | 0.10 | 100.00 | 10.00 | 100.00 | 10.00 |
| Insecticide | Acre | 6.00 | 3.00 | 18.00 | 3.00 | 18.00 |
| Processing Cost | Cwt. | 1.25 | 13.20 | 16.50 | 13.20 | 16.50 |
| Bag, Ties, Ckoff | Bl. | 9.60 | 0.60 | 5.76 | 0.60 | 5.76 |
| Annual Operating Capital | Dol. | 0.16 | 35.35 | 5.66 | 42.30 | 6.77 |
| Labor | Hour | 4.00 | 3.73 | 14.91 | 4.50 | 18.00 |
| Terracing[b] | Acre | 47.40 | -- | -- | 0.05 | 2.37 |
| Machinery, Fuel, Lube, Repairs | Acre | -- | -- | 42.36 | -- | 54.06 |
| Total Operating Costs | | | | $126.89 | | $145.18 |
| Fixed Costs | | | | | | |
| Machinery Interest | Dol. | 0.16 | 212.93 | 34.07 | 212.58 | 34.01 |
| Depr., Taxes, Insurance | Dol. | -- | -- | 29.95 | -- | 29.93 |
| Total Fixed Costs | | | | $ 64.02 | | $ 63.94 |
| Total Production Costs | | | | $190.91 | | $209.12 |

[a]Modification of OSU Enterprise Budget 93602904. Assumes a yield of 200 lbs. of cotton lint per acre.

[b]Assumes terrace spacing of 100 ft.

TABLE XXX

PRODUCTION COSTS PER ACRE OF PASTURE MANAGEMENT FOR IMPROVED PASTURE ON THE GREER COUNTY REPRESENTATIVE FARM[a]

| | Unit | Price/ Unit | Quantity | Cost/ Acre |
|---|---|---|---|---|
| Operating Inputs | | | | |
| Establishment Cost | Acre | $71.50 | 0.05 | $ 3.58 |
| Nitrogen (N) | Lbs. | 0.25 | 50.00 | 12.50 |
| Phosphorus ($P_2O_5$) | Lbs. | 0.28 | 20.00 | 5.60 |
| Annual Operating Cost | Dol. | 0.16 | 2.68 | 0.43 |
| Labor | Hour | 4.00 | 0.06 | 0.24 |
| Machinery, Fuel, Lube, Repairs | Acre | -- | -- | 0.58 |
| Total Operating Costs | | | | $22.93 |
| Fixed Costs | | | | |
| Machinery Interest | Dol. | 0.16 | 1.79 | 0.29 |
| Depr., Taxes, Insurance | Dol. | -- | -- | 0.21 |
| Total Fixed Costs | | | | $ 0.50 |
| Total Production Costs | | | | $23.43 |

[a]Modification of OSU Enterprise Budget 83608302.

TABLE XXXI

PRODUCTION COSTS PER ACRE OF WHEAT PRODUCED ON ABILENE CLAY LOAM SOILS USING ALTERNATIVE BEST MANAGEMENT PRACTICES ON THE GREER COUNTY REPRESENTATIVE FARM[a]

| | Unit | Price/ Unit | Conventional Tillage Quantity | Conventional Tillage Cost/ Acre | Terraces Quantity | Terraces Cost/ Acre | Minimum Tillage Quantity | Minimum Tillage Cost/ Acre | Terraces and Minimum Tillage Quantity | Terraces and Minimum Tillage Cost/ Acre |
|---|---|---|---|---|---|---|---|---|---|---|
| Operating Inputs | | | | | | | | | | |
| Wheat Seed | Bu. | $ 4.50 | 1.00 | $ 4.50 | 1.00 | $ 4.50 | 1.00 | $ 4.50 | 1.00 | $ 4.50 |
| 18-46-0 Fertilizer | Cwt. | 15.00 | 1.00 | 15.00 | 1.00 | 15.00 | 1.00 | 15.00 | 1.00 | 15.00 |
| Nitrogen (N) | Lbs. | 0.25 | 50.00 | 12.50 | 50.00 | 12.50 | 50.00 | 12.50 | 50.00 | 12.50 |
| Sprayer | Acre | 4.00 | 1.00 | 4.00 | 1.00 | 4.00 | 2.00 | 8.00 | 2.00 | 8.00 |
| Custom Combine | Acre | -- | 1.00 | 14.00 | 15.00 | 15.00 | 1.00 | 14.00 | 1.00 | 15.00 |
| Custom Hauling[b] | Bu. | 0.20 | 22.00 | 4.40 | 22.00 | 4.40 | 22.00 | 4.40 | 22.00 | 4.40 |
| Annual Operating Capital | Dol. | 0.16 | 26.33 | 4.21 | 27.66 | 4.42 | 26.42 | 4.23 | 27.40 | 4.38 |
| Labor | Hour | 4.00 | 0.61 | 2.45 | 0.69 | 2.75 | 0.28 | 1.12 | 0.31 | 1.22 |
| Terracing[c] | Acre | 26.20 | -- | -- | 0.05 | 1.31 | -- | -- | 0.05 | 1.31 |
| Herbicide | Lbs. | 11.75 | -- | -- | - | -- | 1.00 | 11.75 | 1.00 | 11.75 |
| Machinery Fuel, Lube, Repairs | Acre | -- | -- | 12.38 | -- | 14.06 | -- | 5.54 | -- | 6.14 |
| Total Operating Costs | | | | $71.68 | | $77.94 | | $81.04 | | $84.20 |
| Fixed Costs | | | | | | | | | | |
| Machinery Interest | Dol. | 0.16 | 56.68 | 9.07 | 56.44 | 9.03 | 27.56 | 4.41 | 27.75 | 4.44 |
| Depr., Taxes, Insurance | Dol. | -- | - | 7.68 | -- | 7.89 | -- | 3.76 | -- | 3.76 |
| Total Fixed Costs | | | | $16.65 | | $16.92 | | $ 8.17 | | $ 8.20 |
| Total Production Costs | | | | $88.33 | | $94.86 | | $89.21 | | $92.40 |

[a]Modification of OSU Enterprise Budget 75501204.

[b]Assumes a yield of 22 bu. per acre.

[c]Assumes terrace spacing of 200 ft.

TABLE XXXII

PRODUCTION COSTS PER ACRE OF WHEAT PRODUCED ON MANSIC CLAY LOAM SOILS USING ALTERNATIVE BEST MANAGEMENT PRACTICES ON THE GREER COUNTY REPRESENTATIVE FARM[a]

| | | | Conventional Tillage | | Terraces | | Minimum Tillage | | Terraces and Minimum Tillage | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Unit | Price/ Unit | Quantity | Cost/ Acre | Quantity | Cost/ Acre | Quantity | Cost/ Acre | Quantity | Cost/ Acre |
| Operating Inputs | | | | | | | | | | |
| Wheat Seed | Bu. | $ 4.50 | 1.00 | $ 4.50 | 1.00 | $ 4.50 | 1.00 | $ 4.50 | 1.00 | $ 4.50 |
| 18-46-0 Fertilizer | Cwt. | 15.00 | 1.00 | 15.00 | 1.00 | 15.00 | 1.00 | 15.00 | 1.00 | 15.00 |
| Nitrogen (N) | Lbs. | 0.25 | 50.00 | 12.50 | 50.00 | 12.50 | 50.00 | 12.50 | 50.00 | 12.50 |
| Sprayer | Acre | 4.00 | 1.00 | 4.00 | 1.00 | 4.00 | 2.00 | 8.00 | 2.00 | 8.00 |
| Custom Combine | Acre | -- | 1.00 | 14.00 | 1.00 | 15.00 | 1.00 | 14.00 | 1.00 | 15.00 |
| Custom Hauling[b] | Bu. | 0.20 | 19.00 | 3.80 | 19.00 | 3.80 | 19.00 | 3.80 | 19.00 | 3.80 |
| Annual Operating Capital | Dol. | 0.16 | 26.33 | 4.21 | 28.90 | 4.62 | 26.42 | 4.23 | 28.30 | 4.53 |
| Labor | Hour | 4.00 | 0.61 | 2.45 | 0.74 | 2.96 | 0.28 | 1.12 | 0.32 | 1.29 |
| Terracing[c] | Acre | 52.40 | -- | -- | 0.05 | 2.62 | -- | -- | 0.05 | 2.62 |
| Herbicide | Lbs. | 11.75 | -- | -- | -- | -- | 1.00 | 11.75 | 1.00 | 11.75 |
| Machinery Fuel, Lube, Repairs | Acre | -- | -- | 12.38 | -- | 15.47 | -- | 5.54 | -- | 6.63 |
| Total Operating Costs | | | | $72.84 | | $80.47 | | $80.44 | | $85.62 |
| Fixed Costs | | | | | | | | | | |
| Machinery Interest | Dol. | 0.16 | 56.68 | 9.07 | 56.25 | 9.00 | 27.56 | 4.41 | 26.45 | 4.23 |
| Depr., Taxes, Insurance | Dol. | -- | -- | 7.68 | -- | 7.87 | -- | 3.76 | -- | 3.71 |
| Total Fixed Costs | | | | $16.65 | | $16.87 | | $ 8.17 | | $ 7.94 |
| Total Production Costs | | | | $89.49 | | $97.34 | | $88.61 | | $93.56 |

[a]Modification of OSU Enterprise Budget 76601204.

[b]Assumes a yield of 19 bu. per acre.

[c]Assumes terrace spacing of 100 ft.

## TABLE XXXIII

## PRODUCTION COSTS PER ACRE OF GRAIN SORGHUM PRODUCED ON ABILENE CLAY LOAM SOILS USING ALTERNATIVE BEST MANAGEMENT PRACTICES ON THE GREER COUNTY REPRESENTATIVE FARM[a]

| | Unit | Price/ Unit | Conventional Tillage Quantity | Conventional Tillage Cost/ Acre | Terraces Quantity | Terraces Cost/ Acre | Minimum Tillage Quantity | Minimum Tillage Cost/ Acre | Terraces and Minimum Tillage Quantity | Terraces and Minimum Tillage Cost/ Acre |
|---|---|---|---|---|---|---|---|---|---|---|
| Operating Inputs | | | | | | | | | | |
| Grain Sorghum Seed | Lbs. | $ 0.60 | 5.00 | $ 3.00 | 5.00 | $ 3.00 | 5.00 | $ 3.00 | 5.00 | $ 3.00 |
| Nitrogen (N) | Lbs. | 0.25 | 40.00 | 10.00 | 40.00 | 10.00 | 40.00 | 10.00 | 40.00 | 10.00 |
| Phosphorus ($P_2O_5$) | Lbs. | 0.28 | 30.00 | 8.40 | 30.00 | 8.40 | 30.00 | 8.40 | 30.00 | 8.40 |
| Custom Combine | Acre | -- | 1.00 | 14.00 | 1.00 | 15.00 | 1.00 | 14.00 | 1.00 | 15.00 |
| Custom Hauling[b] | Cwt. | 0.20 | 18.00 | 3.60 | 18.00 | 3.60 | 18.00 | 3.60 | 18.00 | 3.60 |
| Annual Operating Capital | Dol. | 0.16 | 17.20 | 2.75 | 19.30 | 3.09 | 19.39 | 3.10 | 20.98 | 3.36 |
| Labor | Hour | 4.00 | 1.43 | 5.71 | 1.63 | 6.53 | 0.98 | 3.92 | 1.12 | 4.48 |
| Terracing[c] | Acre | 26.20 | -- | -- | 0.05 | 1.31 | -- | -- | 0.05 | 1.31 |
| Sprayer | Acre | 4.00 | -- | -- | -- | -- | 1.00 | 4.00 | 1.00 | 4.00 |
| Herbicide | Lbs. | 4.25 | -- | -- | -- | -- | 2.00 | 8.50 | 2.00 | 8.50 |
| Machinery, Fuel, Lube, Repairs | Acre | -- | -- | 15.04 | -- | 17.58 | -- | 10.14 | -- | 11.89 |
| Total Operating Costs | | | | $62.50 | | $68.51 | | $68.66 | | $73.54 |
| Fixed Costs | | | | | | | | | | |
| Machinery Interest | Dol. | 0.16 | 66.85 | 10.70 | 66.90 | 10.70 | 49.26 | 7.88 | 48.92 | 7.83 |
| Depr., Taxes, Insurance | Dol. | -- | -- | 9.18 | -- | 9.26 | -- | 6.82 | -- | 6.77 |
| Total Fixed Costs | | | | $19.88 | | $19.96 | | $14.70 | | $14.60 |
| Total Production Costs | | | | $82.38 | | $88.47 | | $83.36 | | $88.14 |

[a]Modification of OSU Enterprise Budget 73601104.

[b]Assumes yield of 18 cwt. per acre.

[c]Assumes terrace spacing of 200 ft.

## TABLE XXXIV

## PRODUCTION COSTS PER ACRE OF GRAIN SORGHUM PRODUCED ON LAWTON LOAM SOILS USING ALTERNATIVE BEST MANAGEMENT PRACTICES ON THE GREER COUNTY REPRESENTATIVE FARM[a]

| | Unit | Price/ Unit | Conventional Tillage | | Terraces | | Minimum Tillage | | Terraces and Minimum Tillage | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Quantity | Cost/ Acre | Quantity | Cost/ Acre | Quantity | Cost/ Acre | Quantity | Cost/ Acre |
| Operating Inputs | | | | | | | | | | |
| Grain Sorghum Seed | Lbs. | $ 0.60 | 5.00 | $ 3.00 | 5.00 | $ 3.00 | 5.00 | $ 3.00 | 5.00 | $ 3.00 |
| Nitrogen (N) | Lbs. | 0.25 | 40.00 | 10.00 | 40.00 | 10.00 | 40.00 | 10.00 | 40.00 | 10.00 |
| Phosphorus ($P_2O_5$) | Lbs. | 0.28 | 30.00 | 8.40 | 30.00 | 8.40 | 30.00 | 8.40 | 30.00 | 8.40 |
| Custom Combine | Acre | -- | 1.00 | 14.00 | 1.00 | 15.00 | 1.00 | 14.00 | 1.00 | 15.00 |
| Custom Hauling[b] | Cwt. | 0.20 | 16.00 | 3.20 | 16.00 | 3.20 | 16.00 | 3.20 | 16.00 | 3.20 |
| Annual Operating Capital | Dol. | 0.16 | 17.20 | 2.75 | 21.92 | 3.51 | 19.39 | 3.10 | 22.35 | 3.58 |
| Labor | Hour | 4.00 | 1.43 | 5.71 | 1.89 | 7.55 | 0.98 | 3.92 | 1.21 | 4.8[illegible] |
| Terracing[c] | Acre | 52.40 | -- | -- | 0.05 | 2.62 | -- | -- | 0.05 | 2.62 |
| Sprayer | Acre | 4.00 | -- | -- | -- | -- | 1.0 | 4.00 | 1.00 | 4.00 |
| Herbicide | Lbs. | 4.25 | -- | -- | - | -- | 2.0 | 8.50 | 2.00 | 8.50 |
| Machinery, Fuel, Lube, Repairs | Acre | -- | -- | 15.04 | -- | 20.77 | -- | 10.14 | -- | 13.02 |
| Total Operating Costs | | | | $62.10 | | $74.05 | | $68.26 | | $76.16 |
| Fixed Costs | | | | | | | | | | |
| Machinery Interest | Dol. | 0.16 | 66.85 | 10.70 | 71.12 | 11.38 | 49.26 | 7.88 | 48.53 | 7.76 |
| Depr., Taxes, Insurance | Dol. | -- | -- | 9.18 | -- | 9.86 | -- | 6.32 | -- | 6.72 |
| Total Fixed Costs | | | | $19.88 | | $21.24 | | $14.70 | | $14.48 |
| Total Production Costs | | | | $81.98 | | $95.29 | | $82.96 | | $90.64 |

[a]Modification of OSU Enterprise Budget 73601104.

[b]Assumes yield of 16 cwt. per acre.

[c]Assumes terrace spacing of 100 ft.

TABLE XXXV

PRODUCTION COSTS PER ACRE OF COTTON PRODUCED ON ABILENE CLAY LOAM SOILS USING ALTERNATIVE BEST MANAGEMENT PRACTICES ON THE GREER COUNTY REPRESENTATIVE FARM[a]

| | Unit | Price/ Unit | Conventional Tillage Quantity | Conventional Tillage Cost/ Acre | Terraces Quantity | Terraces Cost/ Acre |
|---|---|---|---|---|---|---|
| Operating Inputs | | | | | | |
| Cotton Seed | Lbs. | $ 0.47 | 15.00 | $ 7.05 | 15.00 | $ 7.05 |
| Pre-Emerge Herbicide | Acre | 6.65 | 1.00 | 6.65 | 1.00 | 6.65 |
| Starter Fertilizer | Lbs. | 0.10 | 100.00 | 10.00 | 100.00 | 10.00 |
| Insecticide | Acre | 6.00 | 3.00 | 18.00 | 3.00 | 18.00 |
| Processing Cost | Cwt. | 1.25 | 13.20 | 16.50 | 13.20 | 16.50 |
| Bag, Ties, Ckoff | Bl. | 9.60 | 0.60 | 5.76 | 0.60 | 5.76 |
| Annual Operating Capital | Dol. | 0.16 | 35.35 | 5.66 | 39.38 | 6.30 |
| Labor | Hour | 4.00 | 3.73 | 14.91 | 4.18 | 16.74 |
| Terracing[b] | Acre | 26.20 | -- | -- | 0.05 | 1.31 |
| Machinery, Fuel, Lube, Repairs | Acre | -- | -- | 42.36 | -- | 49.22 |
| Total Operating Costs | | | | $126.89 | | $137.53 |
| Fixed Costs | | | | | | |
| Machinery Interest | Dol. | 0.16 | 212.93 | 34.07 | 211.80 | 33.89 |
| Depr., Taxes, Insurance | Dol. | -- | -- | 29.95 | -- | 29.80 |
| Total Fixed Costs | | | | $ 64.02 | | $ 63.69 |
| Total Production Costs | | | | $190.91 | | $201.58 |

[a]Modification of OSU Enterprise Budget 93602904. Assumes a yield of 325 lbs. of cotton lint per acre.

[b]Assumes terrace spacing of 200 ft.

TABLE XXXVI

PRODUCTION COSTS PER ACRE OF COTTON PRODUCED ON LAWTON LOAM SOILS USING ALTERNATIVE BEST MANAGEMENT PRACTICES ON THE GREER COUNTY REPRESENTATIVE FARM[a]

| | Unit | Price/ Unit | Conventional Tillage Quantity | Conventional Tillage Cost/ Acre | Terraces Quantity | Terraces Cost/ Acre |
|---|---|---|---|---|---|---|
| Operating Inputs | | | | | | |
| Cotton Seed | Lbs. | $ 0.47 | 15.00 | $ 7.05 | 15.00 | $ 7.05 |
| Pre-emerge Herbicide | Acre | 6.65 | 1.00 | 6.65 | 1.00 | 6.65 |
| Starter Fertilizer | Lbs. | 0.10 | 100.00 | 10.00 | 100.00 | 10.00 |
| Insecticide | Acre | 6.00 | 3.00 | 18.00 | 3.00 | 18.00 |
| Processing Cost | Cwt. | 1.25 | 13.20 | 16.50 | 13.20 | 16.50 |
| Bag, Ties, Ckoff | Bl. | 9.60 | 0.60 | 5.76 | 0.60 | 5.76 |
| Annual Operating Capital | Dol. | 0.16 | 35.35 | 5.66 | 42.50 | 6.80 |
| Labor | Hour | 4.00 | 3.73 | 14.91 | 4.50 | 18.00 |
| Terracing[b] | Acre | 52.40 | -- | -- | 0.05 | 2.62 |
| Machinery, Fuel, Lube, Repairs | Acre | -- | -- | 42.36 | -- | 54.07 |
| Total Operating Costs | | | | $126.89 | | $145.45 |
| Fixed Costs | | | | | | |
| Machinery Interest | Dol. | 0.16 | 212.93 | 34.07 | 212.50 | 34.00 |
| Depr., Taxes, Insurance | Dol. | -- | -- | 29.95 | -- | 29.92 |
| Total Fixed Costs | | | | $ 64.02 | | $ 63.92 |
| Total Production Costs | | | | $190.91 | | $209.37 |

[a]Modification of OSU Enterprise Budget 93602904. Assumes a yield of 290 lbs. of cotton lint per acre.

[b]Assumes a terrace spacing of 100 ft.

# APPENDIX B

## INITIAL LINEAR PROGRAMMING TABLEAUS FOR THE REPRESENTATIVE FARMS

## ABBREVIATIONS USED IN LINEAR PROGRAMMING TABLEAUS

| | |
|---|---|
| DE | Dougherty-Eufaula Complex soil |
| KSL | Kirkland silt loam soil |
| NG1 | Norge silt loam 1 soil |
| NG2 | Norge silt loam 2 soil |
| RFO | Renfro silt loam soil |
| TLR | Teller loam soil |
| CAB | Carey silt loam 1 soil |
| CAC | Carey silt loam 2 soil |
| STP | St. Paul silt loam soil |
| WWE | Woodward-Quinlan Complex soil |
| ABA | Abilene clay loam soil |
| LTB | Lawton loam soil |
| MCA | Mansic clay loam soil |
| WOB | Woodward loam soil |
| JMLAB | Labor for the first quarter, January through March |
| AJLAB | Labor for the second quarter, April through June |
| JSLAB | Labor for the third quarter, July through September |
| ODLAB | Labor for the fourth quarter, October through December |
| LABOR | Total labor used |
| LABHIREi | Hired labor for the ith quarter of the year |
| LABHIRE | Total hired labor |
| ANNCAP | Annual capital required |
| INTERCAP | Intermediate capital required |
| ANCAPTAL | Borrowed annual capital |
| INCAPTAL | Borrowed intermediate capital |

| | |
|---|---|
| JSNATP | Native pasture for June through September |
| OFNATP | Native pasture for October through February |
| MMNATP | Native pasture for March through May |
| JSIMPP | Improved pasture for June through September |
| OFIMPP | Improved pasture for October through February |
| MMIMPP | Improved pasture for March through May |
| SOILOSSj | Soil loss coefficient for the jth soil series |
| C | Conventional tillage |
| T | Terraces |
| MT | Minimum tillage |
| MTT | Terraces and minimum tillage |
| W | Wheat |
| GS | Grain sorghum |
| CTN | Cotton |
| CC | Cow-calf |
| NATP | Native pasture |
| IMPP | Improved pasture |

TABLE XXXVII

INITIAL LINEAR PROGRAMMING TABLEAU FOR THE GRADY COUNTY REPRESENTATIVE FARM

MPSX/370 R1.6 SOIL CONSERVATION STUDY PAGE 13 81/222

| ACTIVITY | NATPKSL | NATPDF | NATPNG1 | IMPPDF | NATPNG2 | ANCAPTAL | INCAPTAL | NATPRED | ACTIVITY |
|---|---|---|---|---|---|---|---|---|---|
| OBJECT | .93000- | .93000- | .93000- | 53.83000- | .93000- | .15000- | .15000- | .93000- | OBJECT |
| DE | . | 1.00000 | . | 1.00000 | . | . | . | . | DE |
| KSL | 1.00000 | . | . | . | . | . | . | . | KSL |
| NG1 | . | . | 1.00000 | . | . | . | . | . | NG1 |
| NG2 | . | . | . | . | 1.00000 | . | . | . | NG2 |
| RFD | . | . | . | . | . | . | . | 1.00000 | RFD |
| AJLAB | .09100 | .09100 | .09100 | .54900 | .09100 | . | . | .09100 | AJLAB |
| JSLAB | . | . | . | .12100 | . | . | . | . | JSLAB |
| ANNCAP | .05000 | .05000 | .05000 | 8.58000 | .05000 | 1.00000- | . | .05000 | ANNCAP |
| INTERCAP | 2.00000 | 2.00000 | 2.00000 | 24.75000 | 2.00000 | . | 1.00000- | 2.00000 | INTERCAP |
| JSNATP | .64000- | .64000- | .64000- | . | .64000- | . | . | .64000- | JSNATP |
| OFNATP | .54000- | .54000- | .54000- | . | .54000- | . | . | .54000- | OFNATP |
| MMNATP | .40000- | .40000- | .40000- | . | .40000- | . | . | .40000- | MMNATP |
| JSIMPP | . | . | . | 2.85000- | . | . | . | . | JSIMPP |
| OFIMPP | . | . | . | .52000- | . | . | . | . | OFIMPP |
| MMIMPP | . | . | . | .13000- | . | . | . | . | MMIMPP |
| LABOR | .09100 | .09100 | .09100 | .67000 | .09100 | . | . | .09100 | LABOR |
| SOILOSS1 | . | 3.16000 | . | 5.16000 | . | . | . | . | SOILOSS1 |
| SOILOSS2 | 1.08700 | . | . | . | . | . | . | . | SOILOSS2 |
| SOILOSS3 | . | . | 1.27800 | . | . | . | . | . | SOILOSS3 |
| SOILOSS4 | . | . | . | . | 3.05900 | . | . | . | SOILOSS4 |
| SOILOSS5 | . | . | . | . | . | . | . | 4.05000 | SOILOSS5 |

## TABLE XXXVII (Continued)

MPSX/370 R1.6 SOIL CONSERVATION STUDY PAGE 14 81/222

| ACTIVITY | CCNATP | NATPILE | CCIMPP | IMPPKSL | IMPPNG1 | IMPPNG2 | IMPPRFO | IMPPTLR | ACTIVITY |
|---|---|---|---|---|---|---|---|---|---|
| | . | . | . | . | . | . | . | . | |
| OBJECT | 194.39000 | .93000- | 194.39000 | 27.47000- | 27.47000- | 27.47000- | 27.47000- | 27.47000- | OBJECT |
| KSL | . | . | . | 1.00000 | . | . | . | . | KSL |
| NG1 | . | . | . | . | 1.00000 | . | . | . | NG1 |
| NG2 | . | . | . | . | . | 1.00000 | . | . | NG2 |
| RFO | . | . | . | . | . | . | 1.00000 | . | RFO |
| TLR | . | 1.00000 | . | . | . | . | . | 1.00000 | TLR |
| JMLAB | 4.83200 | . | 2.12500 | . | . | . | . | . | JMLAB |
| AJLAB | 2.26200 | .69100 | 1.64500 | .66800 | .66800 | .66800 | .66800 | .66800 | AJLAB |
| JSLAB | 2.00200 | . | 2.36500 | . | . | . | . | . | JSLAB |
| UDLAB | 2.95200 | . | 1.94500 | . | . | . | . | . | UDLAB |
| ANNCAP | 599.41000 | .05000 | 661.08000 | 8.80000 | 8.80000 | 8.80000 | 8.80000 | 8.80000 | ANNCAP |
| INTERCAP | 122.91000 | 2.00000 | 163.54000 | 9.40000 | 9.40000 | 9.40000 | 9.40000 | 9.40000 | INTERCAP |
| JSNATP | 7.42000 | .64000- | . | . | . | . | . | . | JSNATP |
| OFNATP | 3.24000 | .54000- | . | . | . | . | . | . | OFNATP |
| MMNATP | 2.78000 | .40000- | . | . | . | . | . | . | MMNATP |
| JSIMPP | . | . | 4.00000 | 3.20000- | 5.60000- | 4.40000- | 2.40000- | 4.40000- | JSIMPP |
| OFIMPP | . | . | 1.75000 | .16000- | .28000- | .22000- | .12000- | .22000- | OFIMPP |
| MMIMPP | . | . | 1.50000 | .64000- | 1.12000- | .88000- | .48000- | .88000- | MMIMPP |
| LABOR | 12.04800 | .00100 | 8.08000 | .66800 | .66800 | .66800 | .66800 | .66800 | LABOR |
| SOILOSS2 | . | . | . | 4.08700 | . | . | . | . | SOILOSS2 |
| SOILOSS3 | . | . | . | . | 1.26800 | . | . | . | SOILOSS3 |
| SOILOSS4 | . | . | . | . | . | 3.05900 | . | . | SOILOSS4 |
| SOILOSS5 | . | . | . | . | . | . | 4.05000 | . | SOILOSS5 |
| SOILOSS6 | . | 3.05900 | . | . | . | . | . | 3.05900 | SOILOSS6 |

TABLE XXXVII (Continued)

MPSX/370 R1.6 SOIL CONSERVATION STUDY PAGE 15 81/222

| ACTIVITY | LABHIRE1 | LABHIRE2 | LABHIRE3 | LABHIRE4 | ALENG1 | WKSLC | WNG1C | WNG2C | ACTIVITY |
|---|---|---|---|---|---|---|---|---|---|
| OBJECT | 4.00000- | 4.00000- | 4.00000- | 4.00000- | 77.13000 | 47.02000 | 47.02000 | 5.92000 | OBJECT |
| KSL | . | . | . | . | . | 1.00000 | . | . | KSL |
| NG1 | . | . | . | . | 1.00000 | . | 1.00000 | . | NG1 |
| NG2 | . | . | . | . | . | . | . | 1.00000 | NG2 |
| JMLAB | 1.00000- | . | . | . | . | .06100 | .06100 | .06100 | JMLAB |
| AJLAB | . | 1.00000- | . | . | .20500 | .45700 | .45700 | .45700 | AJLAB |
| JSLAB | . | . | 1.00000- | . | .24000 | 1.03100 | 1.03100 | 1.03100 | JSLAB |
| UDLAB | . | . | . | 1.00000- | . | . | . | . | UDLAB |
| ANNCAP | . | . | . | . | 7.21000 | 29.23000 | 29.23000 | 29.23000 | ANNCAP |
| INTERCAP | . | . | . | . | 22.07000 | 66.51000 | 66.51000 | 66.51000 | INTERCAP |
| LABOR | . | . | . | . | .44500 | 1.54900 | 1.54900 | 1.54900 | LABOR |
| LABHIRE | 1.00000 | 1.00000 | 1.00000 | 1.00000 | . | . | . | . | LABHIRE |
| SOILOSS2 | . | . | . | . | . | 7.50300 | . | . | SOILOSS2 |
| SOILOSS3 | . | . | . | . | 1.50900 | . | 8.75600 | . | SOILOSS3 |
| SOILOSS4 | . | . | . | . | . | . | . | 21.11700 | SOILOSS4 |

## TABLE XXXVII (Continued)

MPSX/370 R1.6 SOIL CONSERVATION STUDY PAGE 16 81/222

| ACTIVITY | WRFOC | WTLRC | WKSLT | WNG1T | WNG2T | WRFOT | WTLRT | WKSLMT | 4....1 ACTIVITY |
|---|---|---|---|---|---|---|---|---|---|
| | . | . | . | . | . | . | . | . | |
| OBJECT | 26.47000 | 5.92000 | 41.08000 | 41.48000 | .38000 | 20.93000 | .38000 | 39.53000 | OBJECT |
| KSL | . | . | 1.00000 | . | . | . | . | 1.00000 | KSL |
| NG1 | . | . | . | 1.00000 | . | . | . | . | NG1 |
| NG2 | . | . | . | . | 1.00000 | . | . | . | NG2 |
| RFO | 1.00000 | . | . | . | . | 1.00000 | . | . | RFO |
| TLR | . | 1.00000 | . | . | . | . | 1.00000 | . | TLR |
| JMLAB | .06100 | .06100 | .06100 | .06100 | .06100 | .06100 | .06100 | .06100 | JMLAB |
| AJLAB | .45700 | .45700 | .50900 | .50900 | .50900 | .50900 | .50900 | .24000 | AJLAB |
| JSLAB | 1.03100 | 1.03100 | 1.21700 | 1.21700 | 1.21700 | 1.21700 | 1.21700 | .78000 | JSLAB |
| ANNCAP | 29.23000 | 29.23000 | 31.79000 | 31.79000 | 31.79000 | 31.79000 | 31.79000 | 33.51000 | ANNCAP |
| INTERCAP | 66.51000 | 66.51000 | 65.28000 | 65.28000 | 65.28000 | 65.28000 | 65.28000 | 39.30000 | INTERCAP |
| LABOR | 1.54900 | 1.54900 | 1.78700 | 1.78700 | 1.78700 | 1.78700 | 1.78700 | 1.08000 | LABOR |
| SOILOSS2 | . | . | 3.12000 | . | . | . | . | 3.10500 | SOILOSS2 |
| SOILOSS3 | . | . | . | 3.72900 | . | . | . | . | SOILOSS3 |
| SOILOSS4 | . | . | . | . | 7.45900 | . | . | . | SOILOSS4 |
| SOILOSS5 | 27.96500 | . | . | . | . | 9.87800 | . | . | SOILOSS5 |
| SOILOSS6 | . | 21.11700 | . | . | . | . | 7.45900 | . | SOILOSS6 |

TABLE XXXVII (Continued)

MPSX/370 R1.6 SOIL CONSERVATION STUDY PAGE 17 81/222

| ACTIVITY | WNG1MT | WNG2MT | WRFOMT | WTLRMT | WKSLMTT | WNG1MTT | WNG2MTT | WRFOMTT | ACTIVITY |
|---|---|---|---|---|---|---|---|---|---|
| OBJECT | 39.53000 | 1.57000- | 18.98000 | 1.57000- | 35.36000 | 35.36000 | 5.74000- | 14.81000 | OBJECT |
| KSL | | | | | 1.00000 | | | | KSL |
| NG1 | 1.00000 | | | | | 1.00000 | | | NG1 |
| NG2 | | 1.00000 | | | | | 1.00000 | | NG2 |
| RFO | | | 1.00000 | | | | | 1.00000 | RFO |
| TLR | | | | 1.00000 | | | | | TLR |
| JMLAB | .06100 | .06100 | .06100 | .06100 | .06100 | .06100 | .06100 | .06100 | JMLAB |
| AJLAB | .24000 | .24000 | .24000 | .24000 | .25000 | .25000 | .25000 | .25000 | AJLAB |
| JSLAB | .78000 | .78000 | .78000 | .78000 | .89000 | .89000 | .89000 | .89000 | JSLAB |
| ANNCAP | 33.51000 | 33.51000 | 33.51000 | 33.51000 | 35.50000 | 35.50000 | 35.50000 | 35.50000 | ANNCAP |
| INTERCAP | 39.30000 | 39.30000 | 39.30000 | 39.30000 | 39.28000 | 39.28000 | 39.28000 | 38.28000 | INTERCAP |
| LABOR | 1.08000 | 1.08000 | 1.08000 | 1.07900 | 1.20000 | 1.20000 | 1.20000 | 1.20000 | LABOR |
| SOILOSS2 | | | | | 1.37600 | | | | SOILOSS2 |
| SOILOSS3 | 3.62300 | | | | | 1.59800 | | | SOILOSS3 |
| SOILOSS4 | | 8.73800 | | | | | 3.19700 | | SOILOSS4 |
| SOILOSS5 | | | 11.57200 | | | | | 4.23400 | SOILOSS5 |
| SOILOSS6 | | | | 8.73800 | | | | | SOILOSS6 |

TABLE XXXVII (Continued)

MPSX/370 R1.6 SOIL CONSERVATION STUDY PAGE 18 81/222

| ACTIVITY | STLRMTT | GSKSLC | GSNG1C | GSNG2C | GSRFUC | GSTLRC | GSKSLT | GSNG1T | 6....1 ACTIVITY |
|---|---|---|---|---|---|---|---|---|---|
| | . | . | . | . | . | . | . | . | |
| OBJECT | 5.74000- | 35.48000 | 48.84000 | 21.88000 | 8.33000 | 21.88000 | 27.83000 | 41.24000 | OBJECT |
| KSL | . | 1.00000 | . | . | . | . | 1.00000 | . | KSL |
| NG1 | . | . | 1.00000 | . | . | . | . | 1.00000 | NG1 |
| NG2 | . | . | . | 1.00000 | . | . | . | . | NG2 |
| RFU | . | . | . | . | 1.00000 | . | . | . | RFU |
| TLR | 1.00000 | . | . | . | . | 1.00000 | . | . | TLR |
| JMLAB | .06100 | . | . | . | . | . | . | . | JMLAB |
| AJLAB | .25000 | 1.34000 | 1.34000 | 1.34000 | 1.34000 | 1.34000 | 1.67500 | 1.67500 | AJLAB |
| JSLAB | .89000 | .24300 | .24300 | .24300 | .24300 | .24300 | .30300 | .30300 | JSLAB |
| ANNCAP | 35.50000 | 16.34000 | 16.34000 | 16.34000 | 16.34000 | 16.34000 | 19.72000 | 19.72000 | ANNCAP |
| INTERCAP | 39.28000 | 90.07000 | 90.09000 | 90.09000 | 90.09000 | 90.09000 | 90.09000 | 90.09000 | INTERCAP |
| LABOR | 1.20000 | 1.58300 | 1.58300 | 1.58300 | 1.58300 | 1.58300 | 1.97800 | 1.97800 | LABOR |
| SOILOSS2 | . | 12.67700 | . | . | . | . | 7.40900 | . | SOILOSS2 |
| SOILOSS3 | . | . | 12.68100 | . | . | . | . | 5.32800 | SOILOSS3 |
| SOILOSS4 | . | . | . | 30.58300 | . | . | . | . | SOILOSS4 |
| SOILOSS5 | . | . | . | . | 40.50100 | . | . | . | SOILOSS5 |
| SOILOSS6 | 3.19700 | . | . | . | . | 30.58300 | . | . | SOILOSS6 |

TABLE XXXVII (Continued)

MPSX/370 R1.6 SOIL CONSERVATION STUDY PAGE 19 81/222

| ACTIVITY | GSNG2T | GSRFOT | GSTLRT | GSKSLMT | GSNG1MT | GSNG2MT | GSRFOMT | GSTLRMT | ACTIVITY |
|---|---|---|---|---|---|---|---|---|---|
| OBJECT | 14.28000 | .73000 | 14.28000 | 33.13000 | 46.54000 | 19.58000 | 6.03000 | 19.58000 | OBJECT |
| KSL | . | . | . | 1.00000 | . | . | . | . | KSL |
| NG1 | . | . | . | . | 1.00000 | . | . | . | NG1 |
| NG2 | 1.00000 | . | . | . | . | 1.00000 | . | . | NG2 |
| RFO | . | 1.00000 | . | . | . | . | 1.00000 | . | RFO |
| TLR | . | . | 1.00000 | . | . | . | . | 1.00000 | TLR |
| AJLAB | 1.67500 | 1.67500 | 1.67500 | .70100 | .70100 | .70100 | .70100 | .70100 | AJLAB |
| JSLAB | .30300 | .30300 | .30300 | .24300 | .24300 | .24300 | .24300 | .24300 | JSLAB |
| ANNCAP | 19.72000 | 19.72000 | 19.72000 | 19.81000 | 19.81000 | 19.81000 | 19.81000 | 19.81000 | ANNCAP |
| INTERCAP | 90.09000 | 90.09000 | 90.09000 | 54.60000 | 54.60000 | 54.60000 | 56.40000 | 54.60000 | INTERCAP |
| LABOR | 1.97800 | 1.97800 | 1.97800 | .94400 | .94400 | .94400 | .94400 | .94400 | LABOR |
| SOILOSS2 | . | . | . | 4.65700 | . | . | . | . | SOILOSS2 |
| SOILOSS3 | . | . | . | . | 5.43500 | . | . | . | SOILOSS3 |
| SOILOSS4 | 10.65600 | . | . | . | . | 13.10700 | . | . | SOILOSS4 |
| SOILOSS5 | . | 14.11200 | . | . | . | . | 17.35800 | . | SOILOSS5 |
| SOILOSS6 | . | . | 10.65600 | . | . | . | . | 13.10700 | SOILOSS6 |

## TABLE XXXVII (Continued)

MPSX/370 R1.6 SOIL CONSERVATION STUDY PAGE 20 81/222

| ACTIVITY | GSKSLMTT | GSNG1MTT | GSNG2MTT | GSRFOMTT | GSTLRMTT | CTNKSLC | CTNNG1C | CTNKSLT | ACTIVITY |
|---|---|---|---|---|---|---|---|---|---|
| | . | . | . | . | . | . | . | . | |
| OBJECT | 27.58000 | 40.99000 | 14.03000 | .48000 | 14.03000 | 166.95000 | 166.95000 | 159.42000 | OBJECT |
| KSL | 1.00000 | . | . | . | . | 1.00000 | . | 1.00000 | KSL |
| NG1 | . | 1.00000 | . | . | . | . | 1.00000 | . | NG1 |
| NG2 | . | . | 1.00000 | . | . | . | . | . | NG2 |
| RFO | . | . | . | 1.00000 | . | . | . | . | RFO |
| TLR | . | . | . | . | 1.00000 | . | . | . | TLR |
| JMLAB | . | . | . | . | . | .43200 | .43200 | .53800 | JMLAB |
| AJLAB | .87500 | .87500 | .87500 | .87500 | .87500 | 1.55500 | 1.55500 | 1.58200 | AJLAB |
| JSLAB | .30200 | .30200 | .30200 | .30200 | .30200 | .28800 | .28800 | .35900 | JSLAB |
| UDLAB | . | . | . | . | . | .24000 | .24000 | .24000 | UDLAB |
| ANNCAP | 22.24000 | 22.24000 | 22.24000 | 22.24000 | 22.24000 | 43.79000 | 43.79000 | 40.02000 | ANNCAP |
| INTERCAP | 61.05000 | 61.05000 | 61.05000 | 61.05000 | 61.05000 | 117.33000 | 117.33000 | 116.33000 | INTERCAP |
| LABOR | 1.17700 | 1.17700 | 1.17700 | 1.17700 | 1.17700 | 2.51500 | 2.51500 | 2.98900 | LABOR |
| SOILOSS2 | 1.98700 | . | . | . | . | 15.26400 | . | 10.37200 | SOILOSS2 |
| SOILOSS3 | . | 2.30900 | . | . | . | . | 17.81300 | . | SOILOSS3 |
| SOILOSS4 | . | . | 4.61800 | . | . | . | . | . | SOILOSS4 |
| SOILOSS5 | . | . | . | 6.11500 | . | . | . | . | SOILOSS5 |
| SOILOSS6 | . | . | . | . | 4.61800 | . | . | . | SOILOSS6 |

TABLE XXXVII (Continued)

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9.....1

| ACTIVITY | CTHUGIT . | RESTRICT . | ACTIVITY |
|---|---|---|---|
| OBJECT | 159.42000 | . | OBJECT |
| DE | . | 120.00000 | DE |
| KSL | . | 55.00000 | KSL |
| NG1 | 1.00000 | 75.00000 | NG1 |
| NG2 | . | 75.00000 | NG2 |
| RFO | . | 45.00000 | RFO |
| TLR | . | 160.00000 | TLR |
| JNLAB | .53800 | 529.00000 | JNLAB |
| AJLAB | 1.58209 | 667.00000 | AJLAB |
| JSLAB | .35900 | 736.00000 | JSLAB |
| ODLAB | .24000 | 571.00000 | ODLAB |
| ANNCAP | 49.02000 | . | ANNCAP |
| INTERCAP | 116.33000 | . | INTERCAP |
| LABOR | 2.98900 | . | LABOR |
| SOILOSS3 | 7.45900 | . | SOILOSS3 |

TABLE XXXVIII

INITIAL LINEAR PROGRAMMING TABLEAU FOR THE
CUSTER COUNTY REPRESENTATIVE FARM

MPSX/370 R1.6 SOIL CONSERVATION STUDY PAGE 12 81/196

| ACTIVITY | LABHIRE1 | LABHIRE2 | LABHIRE3 | LABHIRE4 | ANCAPTAL | INCAPTAL | NATPCAB | NATPCAC | ACTIVITY |
|---|---|---|---|---|---|---|---|---|---|
| OBJECT | 4.00000- | 4.00000- | 4.00000- | 4.00000- | .15000- | .15000- | 3.31000- | 3.31000- | OBJECT |
| CAB | . | . | . | . | . | . | 1.00000 | . | CAB |
| CAC | . | . | . | . | . | . | . | 1.00000 | CAC |
| JMLAB | 1.00000- | . | . | . | . | . | . | . | JMLAB |
| AJLAB | . | 1.00000- | . | . | . | . | .20000 | .20000 | AJLAB |
| JSLAB | . | . | 1.00000- | . | . | . | . | . | JSLAB |
| ODLAB | . | . | . | 1.00000- | . | . | . | . | ODLAB |
| ANNCAP | . | . | . | . | 1.00000- | . | .37000 | .37000 | ANNCAP |
| INTERCAP | . | . | . | . | . | 1.00000- | 6.55000 | 6.55000 | INTERCAP |
| JSNATP | . | . | . | . | . | . | .48000- | .48000- | JSNATP |
| OFNATP | . | . | . | . | . | . | .54000- | .54000- | OFNATP |
| MMNATP | . | . | . | . | . | . | .36000- | .36000- | MMNATP |
| LABOR | . | . | . | . | . | . | .20000 | .20000 | LABOR |
| LABHIRE | 1.00000 | 1.00000 | 1.00000 | 1.00000 | . | . | . | . | LABHIRE |
| SOILUSS1 | . | . | . | . | . | . | 1.00000 | . | SOILOSS1 |
| SOILUSS2 | . | . | . | . | . | . | . | 2.29000 | SOILOSS2 |

TABLE XXXVIII (Continued)

MPSX/370 R1.6 SOIL CONSERVATION STUDY PAGE 13 81/196

| ACTIVITY | NATPSTP | NATPWWE | IMPPCAB | IMPPCAC | IMPPSTP | IMPPWWE | CCNATP | CCIMPP | ACTIVITY |
|---|---|---|---|---|---|---|---|---|---|
| OBJECT | 3.31000- | 3.31000- | 23.65000- | 23.65000- | 23.65000- | 23.65000- | 212.29000 | 203.88000 | OBJECT |
| CAB | . | . | 1.00000 | . | . | . | . | . | CAB |
| CAC | . | . | . | 1.00000 | . | . | . | . | CAC |
| STP | 1.00000 | . | . | . | 1.00000 | . | . | . | STP |
| WWE | . | 1.00000 | . | . | . | 1.00000 | . | . | WWE |
| JMLAB | . | . | . | . | . | . | 4.83000 | 2.13000 | JMLAB |
| AJLAB | .20000 | .20000 | .06000 | .06000 | .06000 | .06000 | 2.26000 | 1.65000 | AJLAB |
| JSLAB | . | . | .06000 | .06000 | .06000 | .06000 | 2.00000 | 2.37000 | JSLAB |
| ODLAB | . | . | . | . | . | . | 2.95000 | 1.95000 | ODLAB |
| ANNCAP | .37000 | .37000 | 5.10000 | 5.10000 | 5.10000 | 5.10000 | 42.14000 | 75.25000 | ANNCAP |
| INTERCAP | 6.55000 | 6.55000 | 3.57000 | 3.57000 | 3.57000 | 3.57000 | 694.98000 | 630.60000 | INTERCAP |
| JSNATP | .48000- | .48000- | . | . | . | . | 7.42000 | . | JSNATP |
| OFNATP | .54000- | .54000- | . | . | . | . | 3.24000 | . | OFNATP |
| MMNATP | .36000- | .36000- | . | . | . | . | 2.78000 | . | MMNATP |
| JSIMPP | . | . | 3.33000- | 3.00000- | 3.33000- | 2.66000- | . | 4.00000 | JSIMPP |
| OFIMPP | . | . | 1.11000- | 1.00000- | 1.11000- | .90000- | . | 1.75000 | OFIMPP |
| MMIMPP | . | . | .56000- | .50000- | .56000- | .44000- | . | 1.50000 | MMIMPP |
| LABOR | .20000 | .20000 | .12000 | .12000 | .12000 | .12000 | 12.04000 | 8.10000 | LABOR |
| SOILOSS1 | . | . | 1.00000 | . | . | . | . | . | SOILOSS1 |
| SOILOSS2 | . | . | . | 2.29000 | . | . | . | . | SOILOSS2 |
| SOILOSS3 | 1.00000 | . | . | . | 1.00000 | . | . | . | SOILOSS3 |
| SOILOSS4 | . | 2.29000 | . | . | . | 2.29000 | . | . | SOILOSS4 |

TABLE XXXVIII (Continued)

MPSX/370 R1.6 SOIL CONSERVATION STUDY PAGE 14 81/196

| ACTIVITY | ALFCAB | ALFSTP | WCABC | WCACC | WSTPC | WCABT | WCACT | WSTPT | ACTIVITY |
|---|---|---|---|---|---|---|---|---|---|
| | . | . | . | . | . | . | . | . | |
| OBJECT | 62.74000 | 48.16000 | 10.94000 | 10.94000 | 10.94000 | 5.59000 | 4.29000 | 5.59000 | OBJECT |
| CAB | 1.00000 | . | 1.00000 | . | . | 1.00000 | . | . | CAB |
| CAC | . | . | . | 1.00000 | . | . | 1.00000 | . | CAC |
| STP | . | 1.00000 | . | . | 1.00000 | . | . | 1.00000 | STP |
| JMLAB | .06000 | .06000 | .06000 | .06000 | .06000 | .06000 | .06000 | .06000 | JMLAB |
| AJLAB | 2.45000 | 2.45000 | .18000 | .18000 | .18000 | .22000 | .23000 | .22000 | AJLAB |
| JSLAB | .25000 | .25000 | .20000 | .20000 | .20000 | .24000 | .25000 | .24000 | JSLAB |
| ODLAB | 1.24000 | 1.24000 | .16000 | .16000 | .16000 | .19000 | .20000 | .19000 | ODLAB |
| ANNCAP | 9.36000 | 9.36000 | 26.33000 | 26.33000 | 26.33000 | 28.20000 | 28.78000 | 28.20000 | ANNCAP |
| INTERCAP | 189.20000 | 189.20000 | 56.70000 | 56.70000 | 56.70000 | 56.34000 | 56.25000 | 56.34000 | INTERCAP |
| LABOR | 4.00000 | 4.00000 | .61000 | .61000 | .61000 | .71000 | .74000 | .71000 | LABOR |
| SOILOSS1 | 1.13000 | . | 6.57000 | . | . | 2.94000 | . | . | SOILOSS1 |
| SOILOSS2 | . | . | . | 15.84000 | . | . | 5.59000 | . | SOILOSS2 |
| SOILOSS3 | . | 1.13000 | . | . | 6.57000 | . | . | 2.94000 | SOILOSS3 |

TABLE XXXVIII (Continued)

MPSX/370 R1.6 SOIL CONSERVATION STUDY PAGE 15 81/196

| ACTIVITY | WCABMT | WCACMT | WSTPMT | WCABMTT | WCACMTT | WSTPMTT | GSCABC | GSCACC | ACTIVITY |
|---|---|---|---|---|---|---|---|---|---|
| OBJECT | 5.95000 | 5.95000 | 5.95000 | 2.34000 | 1.54000 | 2.34000 | 31.38000 | 17.73000 | OBJECT |
| CAB | 1.00000 | . | . | 1.00000 | . | . | 1.00000 | . | CAB |
| CAC | . | 1.00000 | . | . | 1.00000 | . | . | 1.00000 | CAC |
| STP | . | . | 1.00000 | . | . | 1.00000 | . | . | STP |
| JMLAB | .06000 | .06000 | .06000 | .06000 | .06000 | .06000 | .31000 | .31000 | JMLAB |
| AJLAB | . | . | . | . | . | . | .85000 | .85000 | AJLAB |
| JSLAB | .13000 | .13000 | .13000 | .15000 | .16000 | .15000 | .26000 | .26000 | JSLAB |
| UDLAB | .09000 | .09000 | .09000 | .11000 | .11000 | .11000 | . | . | UDLAB |
| ANNCAP | 26.42000 | 26.42000 | 26.42000 | 27.78000 | 28.20000 | 27.78000 | 17.20000 | 17.20000 | ANNCAP |
| INTERCAP | 27.56000 | 27.56000 | 27.56000 | 26.73000 | 26.45000 | 26.73000 | 66.85000 | 66.85000 | INTERCAP |
| LABOR | .28000 | .28000 | .28000 | .32000 | .34000 | .32000 | 1.43000 | 1.43000 | LABOR |
| SOILOSS1 | 2.72000 | . | . | 1.20000 | . | . | 10.87000 | . | SOILOSS1 |
| SOILOSS2 | . | 6.55000 | . | . | 2.40000 | . | . | 26.21000 | SOILOSS2 |
| SOILOSS3 | . | . | 2.72000 | . | . | 1.20000 | . | . | SOILOSS3 |

TABLE XXXVIII (Continued)

MPSX/370 R1.6 SOIL CONSERVATION STUDY PAGE 16 81/196

| ACTIVITY | GSSTPC | GSCABT | GSCACT | GSSTPT | GSCABMT | GSCACMT | GSSTPMT | GSCABMT1 | ....1 ACTIVITY |
|---|---|---|---|---|---|---|---|---|---|
| | . | . | . | . | . | . | . | . | |
| OBJECT | 31.38000 | 23.08000 | 7.96000 | 23.08000 | 26.14000 | 12.49000 | 26.14000 | 21.04000 | OBJECT |
| CAB | . | 1.00000 | . | . | 1.00000 | . | . | 1.00000 | CAB |
| CAC | . | . | 1.00000 | . | . | 1.00000 | . | . | CAC |
| STP | 1.00000 | . | . | 1.00000 | . | . | 1.00000 | . | STP |
| JMLAB | .31000 | .44000 | .46000 | .44000 | . | . | . | . | JMLAB |
| AJLAB | .85000 | 1.07000 | 1.11000 | 1.07000 | .72000 | .72000 | .72000 | .85000 | AJLAB |
| JSLAB | .26000 | .31000 | .32000 | .31000 | .26000 | .26000 | .26000 | .32000 | JSLAB |
| ANNCAP | 17.20000 | 20.85000 | 21.73000 | 20.85000 | 18.22000 | 18.22000 | 18.22000 | 20.36000 | ANNCAP |
| INTERCAP | 66.85000 | 71.40000 | 71.12000 | 71.40000 | 49.26000 | 49.26000 | 49.26000 | 40.06000 | INTERCAP |
| LABOR | 1.43000 | 1.82000 | 1.89000 | 1.82000 | .98000 | .98000 | .98000 | 1.17000 | LABOR |
| SOILOSS1 | . | 4.76000 | . | . | 4.08000 | . | . | 1.73000 | SOILOSS1 |
| SOILOSS2 | . | . | 9.06000 | . | . | 9.83000 | . | . | SOILOSS2 |
| SOILOSS3 | 10.87000 | . | . | 4.76000 | . | . | 4.08000 | . | SOILOSS3 |

TABLE XXXVIII (Continued)

MPSX/370 R1.6 SOIL CONSERVATION STUDY PAGE 17 81/196

| ACTIVITY | GSCACMTT | GSSTPMTT | CTNCABC | CTNCACC | CTNSTPC | CTNCABT | CTNCACT | CTNSTPT | ACTIVITY |
|---|---|---|---|---|---|---|---|---|---|
| OBJECT | 6.34000 | 21.04000 | 62.73000 | 22.93000 | 62.73000 | 51.20000 | 8.88000 | 51.20000 | OBJECT |
| CAB | . | . | 1.00000 | . | . | 1.00000 | . | . | CAB |
| CAC | 1.00000 | . | . | 1.00000 | . | . | 1.00000 | . | CAC |
| STP | . | 1.00000 | . | . | 1.00000 | . | . | 1.00000 | STP |
| JMLAB | . | . | .14000 | .14000 | .14000 | .17000 | .18000 | .17000 | JMLAB |
| AJLAB | .88000 | .85000 | 1.26000 | 1.26000 | 1.26000 | 1.49000 | 1.54000 | 1.49000 | AJLAB |
| JSLAB | .33000 | .32000 | .52000 | .52000 | .52000 | .63000 | .65000 | .63000 | JSLAB |
| ODLAB | . | . | 1.81000 | 1.81000 | 1.81000 | 2.07000 | 2.07000 | 2.07000 | ODLAB |
| ANNCAP | 20.99000 | 20.36000 | 35.35000 | 35.35000 | 35.35000 | 40.77000 | 42.30000 | 40.77000 | ANNCAP |
| INTERCAP | 48.53000 | 49.06000 | 212.93000 | 212.93000 | 212.93000 | 213.03000 | 212.58000 | 213.03000 | INTERCAP |
| LABOR | 1.22000 | 1.17000 | 3.73000 | 3.73000 | 3.73000 | 4.36000 | 4.51000 | 4.36000 | LABOR |
| SOILOSS1 | . | . | 13.36000 | . | . | 5.87000 | . | . | SOILOSS1 |
| SOILOSS2 | 3.46000 | . | . | 32.22000 | . | . | 11.19000 | . | SOILOSS2 |
| SOILOSS3 | . | 1.73000 | . | . | 13.36000 | . | . | 5.87000 | SOILOSS3 |

TABLE XXXVIII (Continued)

MPSX/370 R1.6 SOIL CONSERVATION STUDY PAGE 18 81/196

| ACTIVITY | RESTRICT . | ACTIVITY |
|---|---|---|
| CAB | 75.00000 | CAB |
| CAC | 215.00000 | CAC |
| STP | 160.00000 | STP |
| WWE | 155.00000 | WWE |
| JMLAB | 525.00000 | JMLAB |
| AJLAB | 665.00000 | AJLAB |
| JSLAB | 735.00000 | JSLAB |
| ODLAB | 570.00000 | ODLAB |

# TABLE XXXIX

## INITIAL LINEAR PROGRAMMING TABLEAU FOR THE GREER COUNTY REPRESENTATIVE FARM

MPSX/370 R1.6 SOIL CONSERVATION STUDY PAGE 13 81/208

| ACTIVITY | LABHIRE1 | LABHIRE2 | LABHIRE3 | LABHIRE4 | ANCAPTAL | INCAPTAL | NATPABA | NATPLTB | ACTIVITY |
|---|---|---|---|---|---|---|---|---|---|
| OBJECT | 4.00000- | 4.00000- | 4.00000- | 4.00000- | .15000- | .15000- | 3.31000- | 3.31000- | ORJECT |
| ABA | . | . | . | . | . | . | 1.00000 | | ARA |
| LTB | . | . | . | . | . | . | . | 1.00000 | LTR |
| JMLAB | 1.00000- | . | . | . | . | . | | | JMLAR |
| AJLAB | . | 1.00000- | . | . | . | . | .20000 | .20000 | AJLAR |
| JSLAB | . | . | 1.00000- | . | . | . | . | . | JRLAR |
| ODLAB | . | . | . | 1.00000- | . | . | | | ODLAB |
| ANNCAP | . | . | . | . | 1.00000- | . | .37000 | .37000 | ANNCAP |
| INTERCAP | . | . | . | . | . | 1.00000- | 6.55000 | 6.55000 | INTERCAP |
| JSNATP | . | . | . | . | . | . | .48000- | .48000- | JRNATP |
| OFNATP | . | . | . | . | . | . | .54000- | .54000- | OFNATP |
| MMNATP | . | . | . | . | . | . | .36000- | .36000- | MMNATP |
| LABOR | . | . | . | . | . | . | .20000 | .20000 | LABOR |
| LABHIRE | 1.00000 | 1.00000 | 1.00000 | 1.00000 | . | . | . | . | LABHIRE |
| SOILOSS1 | . | . | . | . | . | . | .53000 | . | SOILOSS1 |
| SOILOSS2 | . | . | . | . | . | . | . | .95000 | SOILOSS2 |

TABLE XXXIX (Continued)

MPSX/370 R1.6 SOIL CONSERVATION STUDY PAGE 14 81/208

| ACTIVITY | NATPMCA | NATPWOB | IMPPABA | IMPPLTB | IMPPMCA | IMPPWOB | CCNATP | CCIMPP | ACTIVITY |
|---|---|---|---|---|---|---|---|---|---|
| OBJECT | 3.31000- | 3.31000- | 22.47000- | 22.47000- | 22.47000- | 22.47000- | 212.29000 | 203.88000 | OBJECT |
| ABA | . | . | 1.00000 | . | . | . | . | . | ABA |
| LTB | . | . | . | 1.00000 | . | . | . | . | LTB |
| MCA | 1.00000 | . | . | . | 1.00000 | . | . | . | MCA |
| WOB | . | 1.00000 | . | . | . | 1.00000 | . | . | WOB |
| JMLAB | . | . | . | . | . | . | 4.83000 | 2.13000 | JMLAB |
| AJLAB | .20000 | .20000 | .06000 | .06000 | .06000 | .06000 | 2.26000 | 1.65000 | AJLAB |
| JSLAB | . | . | . | . | . | . | 5.00000 | 2.37000 | JSLAB |
| ODLAB | . | . | . | . | . | . | 2.95000 | 1.95000 | ODLAB |
| ANNCAP | .37000 | .37000 | 2.68000 | 2.68000 | 2.68000 | 2.68000 | 42.14000 | 75.25000 | ANNCAP |
| INTERCAP | 6.55000 | 6.55000 | 1.79000 | 1.79000 | 1.79000 | 1.79000 | 694.98000 | 630.60000 | INTERCAP |
| JBNATP | .48000- | .48000- | . | . | . | . | 7.42000 | . | JBNATP |
| OFNATP | .54000- | .54000- | . | . | . | . | 3.24000 | . | OFNATP |
| MMNATP | .36000- | .36000- | . | . | . | . | 2.78000 | . | MMNATP |
| JSIMPP | . | . | 2.33000- | 2.33000- | 2.33000- | 2.33000- | . | 4.00000 | JSIMPP |
| OFIMPP | . | . | .77000- | .77000- | .77000- | .77000- | . | 1.75000 | OFIMPP |
| MMIMPP | . | . | .40000- | .40000- | .40000- | .40000- | . | 1.50000 | MMIMPP |
| LABOR | .20000 | .20000 | .06000 | .06000 | .06000 | .06000 | 12.04000 | 8.10000 | LABOR |
| SOILOSS1 | . | . | .53000 | . | . | . | . | . | SOILOSS1 |
| SOILOSS2 | . | . | . | .95000 | . | . | . | . | SOILOSS2 |
| SOILOSS3 | .82000 | . | . | . | .82000 | . | . | . | SOILOSS3 |
| SOILOSS4 | . | .95000 | . | . | . | .95000 | . | . | SOILOSS4 |

TABLE XXXIX (Continued)

MPSX/370 R1.6 SOIL CONSERVATION STUDY PAGE 18 81/208

| ACTIVITY | ALFABA | ALFLTB | ALFMCA | WABAC | WLTBC | WMCAC | WWOBC | WABAT | ACTIVITY |
|---|---|---|---|---|---|---|---|---|---|
| OBJECT | 31.48000 | 16.48000 | 31.48000 | 20.80000 | 8.41000 | 8.41000 | .19000 | 16.61000 | OBJECT |
| ABA | 1.00000 | . | . | 1.00000 | . | . | . | 1.00000 | ABA |
| LTB | . | 1.00000 | . | . | 1.00000 | . | . | . | LTB |
| MCA | . | . | 1.00000 | . | . | 1.00000 | . | . | MCA |
| WOB | . | . | . | . | . | . | 1.00000 | . | WOB |
| JMLAB | .06000 | .06000 | .06000 | .06000 | .06000 | .06000 | .06000 | .06000 | JMLAB |
| AJLAB | 2.45000 | 2.45000 | 2.45000 | .18000 | .18000 | .18000 | .18000 | .21000 | AJLAB |
| JBLAB | .25000 | .25000 | .25000 | .21000 | .21000 | .21000 | .21000 | .23000 | JBLAB |
| ODLAB | 1.24000 | 1.24000 | 1.24000 | .16000 | .16000 | .16000 | .16000 | .19000 | ODLAB |
| ANNCAP | 9.36000 | 9.36000 | 9.36000 | 26.33000 | 26.33000 | 26.33000 | 26.33000 | 27.66000 | ANNCAP |
| INTERCAP | 189.19000 | 189.19000 | 189.19000 | 56.68000 | 56.68000 | 56.68000 | 56.68000 | 56.44000 | INTERCAP |
| LABOR | 4.00000 | 4.00000 | 4.00000 | .61000 | .61000 | .61000 | .61000 | .69000 | LABOR |
| SOILOSS1 | .63000 | . | . | 3.68000 | . | . | . | 1.94000 | SOILOSS1 |
| SOILOSS2 | . | 1.13000 | . | . | 6.57000 | . | . | . | SOILOSS2 |
| SOILOSS3 | . | . | 1.00000 | . | . | 5.68000 | . | . | SOILOSS3 |
| SOILOSS4 | . | . | . | . | . | . | 6.57000 | . | SOILOSS4 |

TABLE XXXIX (Continued)



| ACTIVITY | WLTBT | WMCAT | WABAMT | WLTBMT | WMCAMT | WABAMTT | WLTBMTT | WMCAMTT | ACTIVITY |
|---|---|---|---|---|---|---|---|---|---|
| | . | . | . | . | . | . | . | . | |
| OBJECT | 1.52000 | 1.52000 | 14.05000 | 1.90000 | 1.90000 | 11.14000 | 2.76000- | 2.76000- | OBJECT |
| ABA | . | . | 1.00000 | . | . | 1.00000 | . | . | ABA |
| LTB | 1.00000 | . | . | 1.00000 | . | . | 1.00000 | . | LTB |
| MCA | . | 1.00000 | . | . | 1.00000 | . | . | 1.00000 | MCA |
| JMLAB | .06000 | .06000 | .06000 | .06000 | .06000 | .06000 | .06000 | .06000 | JMLAB |
| AJLAB | .23000 | .23000 | . | . | . | . | . | . | AJLAB |
| JSLAB | .25000 | .25000 | .13000 | .13000 | .13000 | .15000 | .16000 | .16000 | JSLAB |
| ODLAB | .20000 | .20000 | .09000 | .09000 | .09000 | .10000 | .11000 | .11000 | ODLAB |
| ANNCAP | 28.90000 | 28.90000 | 26.42000 | 26.42000 | 26.42000 | 27.40000 | 28.30000 | 28.30000 | ANNCAP |
| INTERCAP | 56.25000 | 56.25000 | 27.56000 | 27.56000 | 27.56000 | 27.75000 | 26.45000 | 26.45000 | INTERCAP |
| LABOR | .74000 | .74000 | .28000 | .28000 | .28000 | .31000 | .33000 | .33000 | LABOR |
| SOILOSS1 | . | . | 1.52000 | . | . | 1.00000 | . | . | SOILOSS1 |
| SOILOSS2 | 2.80000 | . | . | 2.72000 | . | . | 1.26000 | . | SOILOSS2 |
| SOILOSS3 | . | 2.42000 | . | . | 2.35000 | . | . | 1.04000 | SOILOSS3 |

TABLE XXXIX (Continued)

MPSX/370 R1.6          SOIL CONSERVATION STUDY          PAGE 17   81/208

| ACTIVITY | GSABAC | GSLTBC | GSMCAC | GSWOBC | GSABAT | GSLTBT | GSMCAT | GSABAMT | ACTIVITY |
|---|---|---|---|---|---|---|---|---|---|
| | . | . | . | . | . | . | . | . | |
| OBJECT | 22.28000 | 13.18000 | 17.72000 | 4.08000 | 17.35000 | 3.16000 | 3.16000 | 17.03000 | OBJECT |
| ABA | 1.00000 | . | . | . | 1.00000 | . | . | 1.00000 | ABA |
| LTB | . | 1.00000 | . | . | . | 1.00000 | . | . | LTB |
| MCA | . | . | 1.00000 | . | . | . | 1.00000 | . | MCA |
| WOB | . | . | . | 1.00000 | . | . | . | . | WOB |
| JMLAB | .31000 | .31000 | .31000 | .31000 | .36000 | .45000 | .45000 | . | JMLAB |
| AJLAB | .86000 | .86000 | .86000 | .86000 | .98000 | 1.11000 | 1.11000 | .72000 | AJLAB |
| JSLAB | .26000 | .26000 | .26000 | .26000 | .30000 | . | . | .26000 | JSLAB |
| ODLAB | . | . | . | . | . | .32000 | .32000 | . | ODLAB |
| ANNCAP | 17.20000 | 17.20000 | 17.20000 | 17.20000 | 19.30000 | 21.92000 | 21.92000 | 19.39000 | ANNCAP |
| INTERCAP | 66.85000 | 66.85000 | 66.85000 | 66.85000 | 66.90000 | 71.12000 | 71.12000 | 49.26000 | INTERCAP |
| LABOR | 1.43000 | 1.43000 | 1.43000 | 1.43000 | 1.64000 | 1.88000 | 1.88000 | .98000 | LABOR |
| SOILOSS1 | 6.00000 | . | . | . | 3.13000 | . | . | 2.28000 | SOILOSS1 |
| SOILOSS2 | . | 10.87000 | . | . | . | 4.53000 | . | . | SOILOSS2 |
| SOILOSS3 | . | . | 9.40000 | . | . | . | 3.92000 | . | SOILOSS3 |
| SOILOSS4 | . | . | . | 10.87000 | . | . | . | . | SOILOSS4 |

TABLE XXXIX (Continued)

MPSX/370 R1.6 SOIL CONSERVATION STUDY PAGE 18 81/208

| ACTIVITY | GSLTBMT | GSMCAMT | GSABAMTT | GSLTBMTT | GSMCAMTT | CTNABAC | CTNLTBC | CTNMCAC | ACTIVITY |
|---|---|---|---|---|---|---|---|---|---|
| OBJECT | 7.93000 | 12.48000 | 13.03000 | 1.54000 | 6.09000 | 122.43000 | 94.57000 | 110.49000 | OBJECT |
| ABA | | | 1.00000 | | | 1.00000 | | | ABA |
| LTB | 1.00000 | | | 1.00000 | | | 1.00000 | | LTB |
| MCA | | 1.00000 | | | 1.00000 | | | 1.00000 | MCA |
| JMLAB | | | | | | .14000 | .14000 | .14000 | JMLAB |
| AJLAB | .72000 | .72000 | .83000 | .89000 | .89000 | 1.26000 | 1.26000 | 1.26000 | AJLAB |
| JSLAB | .26000 | .26000 | .30000 | .32000 | .32000 | .52000 | .52000 | .52000 | JSLAB |
| ODLAB | | | | | | 1.81000 | 1.81000 | 1.81000 | ODLAB |
| ANNCAP | 19.39000 | 19.39000 | 20.98000 | 22.35000 | 22.35000 | -35.35000 | -35.35000 | -35.35000 | ANNCAP |
| INTERCAP | 49.26000 | 49.26000 | 48.92000 | 48.53000 | 48.53000 | 212.92000 | 212.92000 | 212.92000 | INTERCAP |
| LABOR | .98000 | .98000 | 1.13000 | 1.21000 | 1.21000 | 3.73000 | 3.73000 | 3.73000 | LABOR |
| SOILOSS1 | | | 1.20000 | | | 7.48000 | | | SOILOSS1 |
| SOILOSS2 | 4.08000 | | | 1.73000 | | | 13.36000 | | SOILOSS2 |
| SOILOSS3 | | 3.53000 | | | 1.50000 | | | 11.55000 | SOILOSS3 |

TABLE XXXIX (Continued)

MPSX/370 R1.6 SOIL CONSERVATION STUDY PAGE 19 81/208

| ACTIVITY | CTNWOBC | CTNABAT | CTNLTBT | CTNMCAT | CTNWOBT | RESTRICT | ACTIVITY |
|---|---|---|---|---|---|---|---|
| OBJECT | 62.73000 | 114.41000 | 80.27000 | 96.19000 | 48.43000 | . | OBJECT |
| ABA | . | 1.00000 | . | . | . | 90.00000 | ABA |
| LTB | . | . | 1.00000 | . | . | 215.00000 | LTB |
| MCA | . | . | . | 1.00000 | . | 100.00000 | MCA |
| WOB | 1.00000 | . | . | . | 1.00000 | 265.00000 | WOB |
| JMLAB | .14000 | .16000 | .18000 | .18000 | .18000 | 525.00000 | JMLAB |
| AJLAB | 1.26000 | 1.43000 | 1.55000 | 1.55000 | 1.55000 | 665.00000 | AJLAB |
| JSLAB | .52000 | .60000 | .65000 | .65000 | .65000 | 735.00000 | JSLAB |
| ODLAB | 1.61000 | 1.99000 | 2.13000 | 2.13000 | 2.13000 | 570.00000 | ODLAB |
| ANNCAP | 35.35000 | 39.38000 | 42.50000 | 42.50000 | 42.50000 | . | ANNCAP |
| INTERCAP | 212.92000 | 211.80000 | 212.50000 | 212.50000 | 212.50000 | . | INTERCAP |
| LABOR | 3.73000 | 4.18000 | 4.51000 | 4.51000 | 4.51000 | . | LABOR |
| SOILOSS1 | . | 3.87000 | . | . | . | . | SOILOSS1 |
| SOILOSS2 | . | . | 5.59000 | . | . | . | SOILOSS2 |
| SOILOSS3 | . | . | . | 4.84000 | . | . | SOILOSS3 |
| SOILOSS4 | 13.36000 | . | . | . | 5.59000 | . | SOILOSS4 |

VITA

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