ECONOMIC ANALYSIS OF FARM ADJUSTMENT
OPPORTUNITIES IN NORTHEASTERN
AND EAST CENTRAL OKLAHOMA

By

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This study is concerned with the analysis of optimum farm organizations in Northeastern and East Central Oklahoma for alternative soil resource situations. Two decision models -- the linear programming maximization model, and the linear programming minimum resource model -- are developed and utilized in examining the most profitable farm adjustments for both the short-run and the long-run in the study area.

I wish to express my sincere appreciation to my major advisor, Dr. Vernon R. Eidman, for his guidance, assistance, understanding and encouragement throughout this study. Appreciation is also expressed to other members of my advisory committee, Dr. P. Leo Strickland and Dr. Darrel D. Kletke, for their helpful suggestions.

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TABLE OF CONTENTS

Chapter | Page

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

The agricultural economy has experienced tremendous changes in recent years due to technological advancements and economic growth. Technology is here defined to include those forces that increase farm output with given production inputs. New and improved inputs, changes in management, specialization, farm size, and institutions serving agriculture are included as "technology". These forces, together with profitable and productive inputs such as improved seeds, fertilizers, and pesticides, help expand output of farm commodities.[1] Economic growth, defined as an increase in real output of goods and services, in nonfarm sectors increases the amount of capital in relation to labor, and reduces the capital-labor price ratio. This, as well as technological change, has contributed to disequilibrium in agriculture.

The farm manager is thus challenged to make adjustment decisions if he is to take part in the process of economic growth and consequently abate his economic ills. Those farmers whose adjustment decisions are based on sound data analysis and efficient use of available production resources are more able to improve their economic positions.

Farmers have both short- and long-run adjustment opportunities. In the short-run setting, it may be profitable to adjust by altering

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[1]Luther G. Tweeten, Foundations of Farm Policy (Lincoln, 1970), Chapter 6.

the combination of crop and livestock enterprises. However, the capacity to make adjustments in farm organizations differs among farmers. The differences arise from availability of capital, skilled hired labor (although total farm labor is in surplus), and land. In addition to these, differences in age, asset and equity position, experience, and personal preferences cause varying adjustment patterns.

In the long-run, adjustment opportunities can take a different shape. It may be possible to accumulate enough capital for investment in farming or find new uses for the products through research. An increase in farm size may also prove an "effective" adjustment device. More land can be bought or rented. But the reader may note that the ability to buy or rent land and maintain an economic unit depends on the rate at which neighbors retire or can find employment outside farming. Yet, out-migration from agriculture has been inhibited by factors such as: inadequate education to equip farm people for non-farm jobs; preference for the farm way of life by low income farmers; forces of imperfect competition, etc. These factors have contributed substantially to the slow progress in adjustments to economic farming units.

The dilemma confronting the farm firm emanates the following adjustment issues:

(a) What is the optimal combination of resources and enterprises for individual farm units?

(b) Is the attainable net return sufficient for family living with some capital left for reinvestment in the farm operation?

(c) What is the minimum farm size required to provide a specified level of income for the farm family?

This study is intended to provide requisite answers to these questions for farmers in Northeastern and East Central Oklahoma.

Objectives of the Study

The purpose of this study is to determine the most profitable levels and combinations of enterprises for specified resource situations under alternative price conditions, capital levels, allotment situations, production periods, and other restrictions. More specifically the objectives of this study are:

(a) To determine the optimum organization of representative farms for selected soil resource situations in Northeastern and East Central Oklahoma.

(b) To determine the minimum resource requirements as well as the combinations of farm enterprises consistent with minimum resource use to provide specified returns to operator labor, management and risk and pay overhead costs of the farm business.

Description of the Study Area

The geographic area of this study includes all or part of the 20 counties in Northeastern and East Central Oklahoma shown in Figure 1. The study area is characterized by higher rainfall than many other areas of Oklahoma. This accounts for more favorable dryland production conditions. The average annual rainfall for the area is about 39.0 inches. The range is from 42 inches in the eastern part to 36 inches at the western border of the area.[2]

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[2]U. S. Department of Commerce, Climatological Data, Oklahoma, Annual Summary, Vol. 78, No. 13 (Washington, 1969), pp. 211-212.

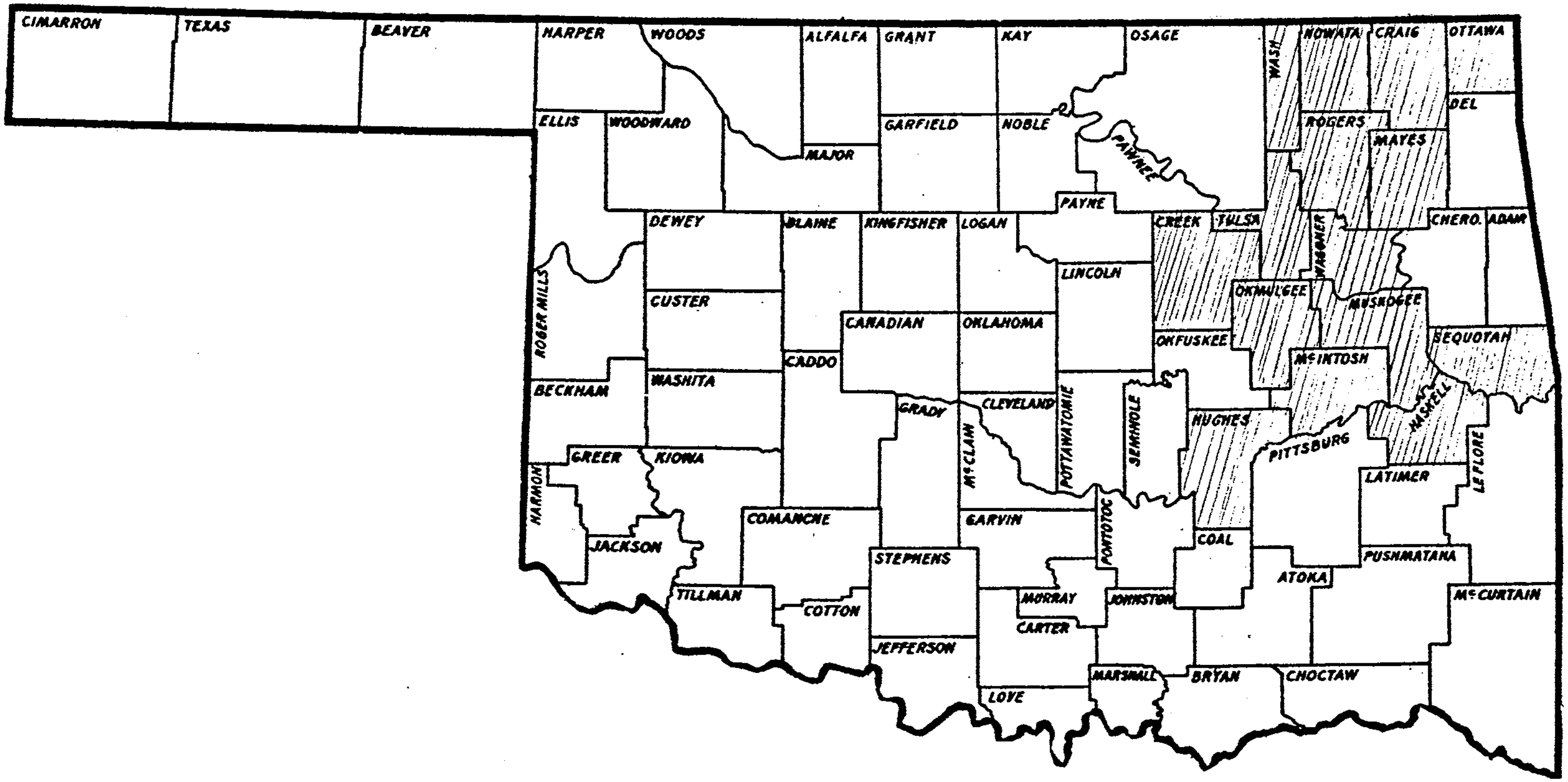

Figure 1. Map of Oklahoma Showing the Study Area.

The soil resource situations considered in the study area include both upland and bottomland soils. The county soil surveys for the area show that there is more upland than bottomland. The proportion of bottomland is larger in the East Central than in the Northeastern section. Furthermore, the whole area has more pasture than cropland, but the proportion of cropland is also greater in Northeastern than in East Central section.[3]

The combined effects of abundant rainfall and fertile soil have given rise to production of a wide variety of crops in the area. The primary cash crops include cotton, grain sorghum, soybeans, wheat, peanuts, alfalfa and bermuda grass pasture. Crops such as corn, barley, oats, and broomcorn are produced to a lesser extent. The federal farm programs have some impact on the acreage of crops included in a farm organization as well as the location of the crops.

In recent years, the trend in agriculture in the area has been toward the production of more livestock and less cash crop. Livestock production includes beef cattle, milk cows, sheep, and hogs. The bulk of the revenue from farm products of the area comes from livestock, mostly beef cattle.

Research Steps Employed in the Study

The basic research steps employed in this study are: (1) delineating the area of study; (2) selecting representative farm resource situations within the area; (3) building enterprise budgets for the area; (4) determining the profitable farm organizations for each soil

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[3]See footnotes 1 and 2 in Chapter III for information on soil data.

situation in the area using a linear programming maximization model; and (5) determining the minimum resource requirements and optimum combination of enterprises to obtain specified levels of income using a linear programming minimum resource model.

Organization of Remainder of Thesis

The remainder of this thesis is organized into five chapters.

The analytical models are developed and evaluated in Chapter II. Linear programming maximization and minimization models are discussed in relation to the objectives specified above. Marginal analysis is also reviewed in this chapter. The final portion of the chapter discusses the extent to which the equilibrium conditions in marginal analysis are met in the linear programming maximization problem.

Chapter III briefly describes the soil resource situations, and the representative farms in the study area. The enterprise budgets are discussed next. This is followed by the description of the assumptions and restrictions used.

The analysis in Chapter IV features short-run farm adjustments. With the use of a linear programming maximization model, optimum farm plans for different land resource situations are determined. The linear programming minimum resource model is utilized in Chapter V to determine the minimum resources required to provide prescribed levels of operator income. Assuming a fixed level of overhead costs, the minimum resource requirements and combinations of farm enterprises that can provide given levels of income under alternative soil resource situations are presented and examined. This is a long-run analysis.

The summary of the study is presented in Chapter VI. The implications of the results are also discussed.

CHAPTER II

THE MODEL

The purpose of this chapter is to present the operational models utilized in this study. The analytical models -- the linear programming maximization model and the linear programming minimum resource model -- are thus developed and evaluated. The traditional marginal analysis model is also reviewed and compared with the operational models.

Linear Programming Maximization Analysis

Linear programming is a mathematical technique. It is used for solving maximization or minimization problems confronting decision-making agencies, subject to a set of linear constraints. In general, the linear objective function may be a profit or cost function.

A linear programming problem has three quantitative components: (a) an objective, which may be either maximization of profit or output, or minimization of cost or input; (b) alternative methods or processes of attaining the objective; and (c) resource restrictions defined by fixed quantities of resources.[1] The assumptions of the linear programming technique include linearity and additivity, divisibility, finiteness and single-value expectations.[2]

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[1] Earl O. Heady and Wilfred Candler, Linear Programming Methods (Ames, 1963), pp. 2-3.

[2] Ibid., pp. 17-18.

Linearity implies that the ratios between all inputs and between inputs and outputs are constant. Additivity assumes that the sum of the total products of two or more activities or processes must be the sum of their individual products. Analogously, the total amount of resources used by many enterprises must be equal to the sum of resources used by the individual processes. Divisibility means that resources and products are assumed continuous -- i.e., factors can be used and products produced in any fractional amount. The assumption of finiteness means a finite number of alternative activities and resource restrictions adequately represent the production alternatives and constraints. Single-value expectations implies perfect knowledge of resource supplies, input-output coefficients, and prices.

In accordance with these assumptions, the entrepreneur seeks a farm organization which will maximize his profit (Π). Generally, a multi-resource, multi-product linear programming maximization model appears as follows:[3]

$$\text{Maximize } \Pi = c_1x_1 + c_2x_2 + \dots + c_nx_n$$

$$\begin{aligned} \text{Subject to} \quad & a_{11}x_1 + a_{12}x_2 + \dots + a_{1n}x_n \leq \gamma_1 \\ & a_{21}x_1 + a_{22}x_2 + \dots + a_{2n}x_n \leq \gamma_2 \\ & \vdots \qquad\quad \vdots \qquad\qquad\quad \vdots \\ & a_{m1}x_1 + a_{m2}x_2 + \dots + a_{mn}x_n \leq \gamma_m \qquad (2.1) \\ \text{and} \quad & x_j \geq 0 \quad (j = 1, 2, \dots, n) \end{aligned}$$

[3]Alpha C. Chiang, <u>Fundamental Methods of Mathematical Economics</u> (New York, 1967), pp. 585-586.

where the n variables denote different products, and m constraints refer to the availability of fixed resources. The output of each product (choice variables) are denoted by x_j (with $j = 1, 2, \ldots, n$), and their coefficients -- a set of given constants -- in the objective function are given by c_j ($j = 1, 2, \ldots, n$). The input-output coefficients are denoted by a_{ij} ($j = 1, 2, \ldots, n$), ($i = 1, 2, \ldots, m$), (m not necessarily equal to n). The γ_i symbols ($i = 1, 2, \ldots, m$) represent the quantity of fixed factors and are the restrictions imposed in the program.

An example of the linear programming maximization model used in this study is presented in Appendix Table XVII. Crop activities considered are grain sorghum, cotton, peanuts, soybeans, wheat, barley, oats, alfalfa, and bermuda grass pasture. Beef cow-calf and stocker buy-sell enterprises are the livestock activities included in the model.

The constraints in the model consist of land, labor, capital and some accounting and institutional restrictions. Because of differences in soils and their productivity, the amounts of the different soil types are included as separate restrictions in the matrix. The operator labor is stratified into four seasonal quantities, and each period denotes a labor restriction. The capital borrowing activity is not restricted, but has a net price which equals the market rate of interest -- eight percent per annum. The amount of pasture available and allotment restrictions for the representative farm are also included in the model.

The linear programming model can be solved using the simplex method.[4] The iterative procedure, which allows systematic selection of

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[4]Heady and Candler, pp. 53-86. The simplex method, sometimes called Dantzig's "simplex algorithm", is one of the most efficient general computational techniques. It was first developed by mathematician George Dantzig.

plans, selects activities which increase profits or decrease costs until an optimum (profit maximizing or cost minimizing) plan is determined.

The criterion (or marginal profit) equation is the choice indicator applied to determine whether profit can be increased by introducing an activity not in the plan:

$$\Delta\Pi = \Sigma c_i \frac{\Delta x_i}{\Delta x_h} - c_h \tag{2.2}$$

where the i^{th} activity is in the plan and the h^{th} activity is not in the plan. If the opportunity cost (the amount of income foregone as some activity is reduced in order to increase another activity by one unit) is less than the amount of revenue added by a one-unit increase of an alternative activity (x_h), profit will be increased by making the change.

Linear Programming Minimum Resource Analysis

The above analysis assumes short-run profit maximization is the objective of the farm firm. But short-run answers may not answer questions involving long-run planning. In the short-run, most of the resources are fixed (e.g., land), and the period is so short that the firm does not have time to change the amounts of the fixed resources. But all resources are variable in the long-run because time is sufficiently long to allow changes in the levels of all resources employed by the firm.

The basic question asked is: What is the minimum farm size required to provide adequate income for family living? The entrepreneur may wish to know the amount of resources he requires to attain a prescribed income target. The linear programming minimum resource model can be used to answer this question, given the income target of the firm, the resource restrictions, and the enterprises to be considered.

Analogous to the maximization program, a minimization program may be written as follows:

$$\text{Minimize } R = a_1x_1 + a_2x_2 + \dots + a_nx_n$$

$$\begin{aligned}
\text{Subject to} \quad & a_{11}x_1 + a_{12}x_2 + \dots + a_{1n}x_n \leq \gamma_1 \\
& a_{21}x_1 + a_{22}x_2 + \dots + a_{2n}x_n \leq \gamma_2 \\
& \vdots \qquad\quad \vdots \qquad\qquad\quad \vdots \\
& a_{m1}x_1 + a_{m2}x_2 + \dots + a_{mn}x_n \leq \gamma_m \\
& c_1x_1 + c_2x_2 + \dots + c_nx_n \geq T \qquad (2.3) \\
\text{and} \quad & x_j \geq 0 \quad (j = 1, 2, \dots, n)
\end{aligned}$$

where R is the resource to be minimized. The a_j's in the objective function denote the quantity of the resource required per unit of the j^{th} product; and x_j is the quantity of the j^{th} product produced. The notations for the choice variables and the coefficients in the constraints have been retained intact; a_{ij} is the quantity of the i^{th} resource required per unit of the j^{th} product; γ_i is the amount of the i^{th} restricted resource; and m is the number of restricted resources. The income constraint (T) is the specified income target, while c_j is the net income from producing one unit of the j^{th} product.

Income Target

Among the key steps in making the linear programming minimum resource model operative are selecting a target income and choosing a criterion function to be minimized. In determining income targets, certain levels of average wage per non-farm worker may be used as the measuring rod for farm income.[5] The minimum resource model analysis assumes that the farm family strives to attain some set income level. The income objective may not be the return to operator labor and management alone, but includes the return to all owned resources. The farmer's evaluation of his actual and potential earnings may also consider factors like land appreciation, interest rate and managerial responsibilities required for the highly capitalized farm business.

Seven income targets in between 0 and $15,000 are assumed in this study. Each level above the zero level is considered comparable to wages in alternative nonfarm employments requiring various degrees of skill and managerial ability. The zero income target is used to determine the size of farm required to cover variable and overhead costs of the business, but provide no return to operator labor and management.

Resource Minimized

Land was chosen as the resource to be minimized in this study. It is, however, possible to select labor or capital as a resource to

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[5] Percy L. Strickland, Jr., James S. Plaxico, and William F. Lagrone, Minimum Land Requirements and Adjustments for Specified Levels, Southwestern Oklahoma, Bulletin B-608 (Stillwater, 1963).

minimize. But land is considered a more appropriate resource to minimize because:

1. Minimization of capital would yield solutions quite similar to the results presented here;

2. Labor is not a limiting factor in the area, and in fact, not in most areas of agriculture;

3. Generally, land is the limiting resource for individual farmer adjustments in the area; and

4. Land prices are high and cannot be estimated without error.

Similar to the maximization model, crop activities in the minimum resource model for this study include grain sorghum, cotton, peanuts, soybeans, wheat, barley, oats, alfalfa, and bermuda grass pasture. Livestock activities are limited to cow-calf and buy-sell stocker enterprises.

The objective function in the minimum resource matrix shows the minimum land required to meet a given level of income. An income restriction row is included in the matrix. The model also includes a land providing activity column. Operator labor constraints are still the four seasonal quantities shown in the maximization model (Appendix Table XVII). Labor hiring columns are also included. Capital can be borrowed at eight percent interest per annum. The input-output coefficients in the matrix are the same as those in the maximization model. The representative acre of land for minimum resource model provides constraints on different soil types, pasture, and allotment restrictions in the same proportions as in the representative farm in maximization model.

Marginal Analysis

One might ask, to what extent does the linear programming maximization solution approximate the equilibrium conditions postulated by economic theory? Economic theory assumes the firm has a given production function. In a multi-product, multi-factor case, the firm's production function may be given (implicitly) by the following model:[6]

$$F(x_1, x_2, \ldots, x_n; q_1, q_2, \ldots, q_m) = 0 \qquad (2.4)$$

for n outputs (j = 1, 2, ..., n), and m inputs (i = 1, 2, ..., m). The function is assumed continuous with continuous first- and second-order partial derivatives. The corresponding profit equation may be given as:

$$\Pi = \sum_{j}^{n} p_j x_j - \sum_{i}^{m} w_i q_i + \lambda f(x_1, x_2, \ldots, x_n; q_1, q_2, \ldots, q_m) \qquad (2.5)$$

where p_j is the price of the j^{th} product and w_i is the price of the i^{th} input. The Π equation (2.5) can be solved using the Lagrange Multiplier. For profit maximization, the first-order conditions require (a) that the marginal rate of product transformation (MRPT) between each pair of products be equal to their price ratios;

$$\frac{\partial x_k}{\partial x_j} = -\frac{p_j}{p_k} \qquad (j, k = 1, 2, \ldots, n) \quad (j \neq k) \qquad (2.6)$$

(b) that each input be utilized up to a point at which the value of its marginal product (VMP) is equal to its price;

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[6] James M. Henderson and Richard E. Quandt, Microeconomic Theory, A Mathematical Approach (New York, 1958), p. 72.

$$p_j \frac{\partial x_j}{\partial q_i} = w_i \qquad \begin{matrix}(j = 1, 2, \ldots, n)\\(i = 1, 2, \ldots, m)\end{matrix} \tag{2.7}$$

and (c) that the rate of technical substitution between each pair of inputs be equal to their price ratios;

$$\frac{\partial q_k}{\partial q_i} = -\frac{w_i}{w_k} \qquad \begin{matrix}(i, k = 1, 2, \ldots, m)\\(i \neq k)\end{matrix} \tag{2.8}$$

The partial derivatives of the production function with respect to the inputs are the marginal physical products of the inputs. The value of marginal product ($p_j \frac{\partial x_j}{\partial q_i}$) of q_i is the rate at which the farm manager would increase his revenue with further application of q_i. The entrepreneur can increase his profit as long as the addition to his revenue from the employment of an additional unit of q_i exceeds its cost.

The second-order conditions require that the marginal products of the q_i inputs be decreasing;

$$\frac{\partial^2 \Pi}{\partial q_i^2} = p_j \frac{\partial^2 x_j}{\partial q_i^2} < 0 \tag{2.9}$$

Lets examine the extent to which these optimality conditions of the marginal analysis model are met in the profit maximizing linear programming problem of this study. There are a number of differences between the two models.

First, for profit maximization, the conventional marginalism requires that the price ratio of any two products be equal to their rate of product transformation. But in linear programming the requirement is that the unit price of each activity (e.g., cotton return per acre) must be less than or equal to the imputed costs[7] of fixed and variable factors used in producing a unit of that activity. In the marginal analysis model, the emphasis is placed on particular products and factors; but "activity" is emphasized in linear programming. Production of any particular product may be carried out by many different activities each using different factor input ratios. Moreover, several stages of production, each of which correspond to a separate activity, may be required in producing a single end product. The rate of product transformation between each pair of products is not defined unless activities associated with each of the products produced are specified.

For this study, an activity is defined for each product, hence, the rate of product transformation between each pair of products (e.g., cotton and peanuts) is defined. The marginal optimality condition is therefore met. However, as the product transformation curve of the linear programming model is represented with a series of straight-line segments instead of a smooth continuous curve, the optimum occurs where the rate of product transformation on one side of the optimal point is less than, and on the other side is greater than the price ratio of the two products.

Second, the optimality condition of marginal analysis requires that each input be utilized up to a point at which the value of its marginal product (VMP) is equal to its price. In linear programming the optimal condition requires rather that the price per unit of a given variable input, for each input-activity combination, be greater than or

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[7]"Imputed costs" refer here to the valuation of a factor based on its alternative uses within the farm firm.

equal to the marginal value imputed to the variable input with regard to the given activity. If the price of the given input exceeds the marginal value imputed to it with regard to the given activity, the input will not be used by that activity. This is similar to the marginalism stipulation that factors can not be used when their costs exceed the value of their marginal product. If the price of the variable input is less than the marginal value imputed to it with regard to the given activity, then the level of use of that input in the activity should be increased. The difference in this requirement between the two models is that marginal value product involves "marginal product" which is not defined under the assumptions of the linear programming model. Again, the point of emphasis is "product" in marginal analysis, while "activity" is stressed in the linear programming model.

Third, the optimality requirement of marginal analysis that the rate of technical substitution between each pair of inputs be equal to their price ratios does not generally hold in the linear programming model. This is because the marginal rate of technical substitution is not defined in the linear programming model unless product labels are assigned to the activities. This study includes one or more activities for each product. When several activities are capable of turning out the same product each with its own input proportions, there exist price-related linear isoquant relationships composed of line segments connecting corresponding points on the various activity rays. The slopes of these segments are then the marginal rates of substitution.[8]

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[8] Thomas H. Naylor and John M. Vernon, Microeconomics and Decision Models of the Firm (New York, 1969), pp. 224-235.

Thus, the rate of technical substitution between a pair of variable inputs (e.g., capital and hired labor) selected for the programmed plans is defined. The optimum condition for any two priced inputs in the linear programming model, however, is not where the rate of technical substitution exactly equals the price ratio of the inputs. The optimum occurs at a corner point having the marginal rate of substitution greater than the price ratio of the two variable inputs on one side and less than the same price ratio on the other side of the corner point. Thus the optimal solution of the profit maximizing linear programming model fulfills the necessary conditions for profit maximization at least in a general manner.

CHAPTER III

DATA DEVELOPMENT

This chapter discusses (a) the soil resource situations and the representative farms in the study area, (b) the general assumptions and restrictions applicable to the models utilized in the analysis, (c) the data sources for enterprise budgets, and (d) the linear programming matrix utilized in programming the farm organization.

Soil Resource Situation

The major upland and bottomland soils suited for crop production in Northeastern and East Central Oklahoma have been combined into four general groups. Each of these four groups has been further divided into productivity classes based on the slope and other characteristics of the land. The upland soils are divided into: (a) loamy with moderately permeable and permeable subsoil -- productivity classes in this group are L_1, L_2, and L_3; (b) loamy with very permeable subsoil, divided into P_1 and P_2 productivity classes; and (c) sandy soils, with S_2 and S_3 productivity classes. The fourth group is the bottomland soils with B_1 and B_2 productivity classes. The soils were categorized into the various groups and productivity classes by soil scientists on the basis of management needs in crop production. Emphasis was placed on yields and machinery practices, fertilizer use, and other input requirements.

Classes L_1 and B_1 soils have comparable yields. Both have high water-holding capacity. The yields on class S_2 soils compare quite closely to those of classes L_1 and B_1. The major difference is that class S_2 has moderate water-holding capacity. The P_1 class also has high yields although its permeability is lower than in class L_1 soils. The varying yields among classes L_2, L_3, P_2, S_3 and B_2 soils reflect the differences in permeability and the slope characteristics. Some of the bottomland in the study area is subject to occasional flooding. The amount of flooding varies widely from farm to farm. Where flooding is severe, however, the land is typically not under cultivation to avoid large flood damages. Definition of soils and yields in each productivity class for upland and bottomland, under dryland conditions is shown in Appendix Table X.

The area of study is subdivided into two sections: Northeastern and East Central Oklahoma. The division is based on land in farms, number and types of farms, cropland available, types of crop and livestock produced, and the soil resource situations in the area. The farm data obtained on the study area indicate a somewhat higher percentage of land in farms in the Northeastern than in the East Central counties: about 80 percent of the approximate land area in the Northeastern section is in farms; while the East Central section has about 75 percent. Furthermore, the acreage of cropland in the Northeastern and East Central sections are about 820,000 acres and 660,000 acres, respectively.[1] The percentage of upland and bottomland farmed in each of the two

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[1] U. S. Department of Commerce, Bureau of Census, U. S. Census of Agriculture (Oklahoma, 1964), pp. 276-283 and Oklahoma State Board of Agriculture and the Oklahoma Crop and Livestock Reporting Service, Annual Report (Oklahoma, 1968), p. 34.

sections also differs. In the Northeast section, about 86 percent and 14 percent of land farmed are upland and bottomland, respectively. On the other hand, the East Central section has about 75 percent in upland and 25 percent in bottomland.[2]

Description of Respective Farm

A representative farm for each resource situation was specified for the maximization programming model. The representative farm in the Northeastern section contains 665 acres of total land. For the upland farm, this is broken down into: cropland, 372 acres; composed of 30.47 acres of L_1, 222.72 acres of L_2, 61.64 acres of L_3, 53.27 acres of P_1, and 3.9 acres of P_2 soils; 256 acres of native pasture; and 37 acres consisting of farmstead, waste and other land. When all the cropland is bottomland, the 372 acres consist of 336.66 acres of B_1 and 35.34 acres of B_2 soils. The resource restrictions assumed for the representative farm in Northeastern Oklahoma are presented in Table I.

The division of total land in the representative farm into the acreages indicated for cropland, pasture, and waste, respectively, is based on the percentage each of the three categories is found on the total land in farms in the study area.[3] Analogously, the number of

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[2]Information on soil data were obtained from : <u>County Soil Surveys</u>, Okmulgee, Rogers, Hughes, Ottawa, Washington, and Creek Counties, U.S.D.A., Soil Conservation Service, in cooperation with Oklahoma Agricultural Experiment Station. U.S.D.A., Soil Conservation Service, <u>Land Use and Treatment Alternatives for the Land Resource Areas in Eastern Oklahoma</u> (Stillwater, 1963).

[3]U. S. Department of Commerce, Bureau of Census, <u>U. S. Census of Agriculture</u> (Oklahoma, 1964), pp. 288-295. The number of acres included in a representative farm in each section of the study area is based on the land resource information obtained from the census of agriculture on the counties shown in Figure 1. The farm size for a representative farm approximates the average size of farms 500 to 999 acres in the study area.

TABLE I

RESOURCE AND ALLOTMENT RESTRICTIONS FOR REPRESENTATIVE FARMS, NORTHEASTERN OKLAHOMA

Item	Unit	Soil Resource Situations	
		Upland	Bottomland
Total Land	Acre	665.00	665.00
Total Cropland	Acre	372.00	372.00
Class L_1	Acre	30.47	
Class L_2	Acre	222.72	
Class L_3	Acre	61.64	
Class P_1	Acre	53.27	
Class P_2	Acre	3.90	
Class B_1	Acre		336.66
Class B_2	Acre		35.34
Native Pasture[a]	Acre	256.00	256.00
Farmstead and Waste	Acre	37.00	37.00
Allotments			
Cotton	Acre	7.60	7.60
Wheat	Acre	37.20	37.20
Total Operator Labor[b]			
Jan.-April	Hour	320.00	320.00
May-July	Hour	240.00	240.00
Aug.-Sept.	Hour	160.00	160.00
Oct.-Dec.	Hour	240.00	240.00
Buildings, Fences, etc.[c]			

[a]Pasture yield is given in AUM. The yield is estimated to be one AUM per acre.

[b]Only 80 hours of operator and family labor is assumed to be available per month. The survey of farming practices in the area indicates that most farmers have off-farm employment.

[c]A set of improvements, including buildings, fences, etc. is assumed for each of the representative farms.

acres of cropland in each soil class reflects the percentage of acreage availability by class of soil in the study area.

The representative farm in the East Central section contains 585 acres of total land, of which 280 acres are cropland, 269 acres are in native pasture, and 36 acres are in farmstead, waste, and other land. The 280 acres of cropland on the upland farm consist of 12.49 acres of L_1, 131.60 acres of L_2, 43.82 acres of L_3, 19.74 acres of P_1, 6.80 acres of P_2, 22.63 acres of S_2, and 42.92 acres of S_3 soils. On a bottomland farm, 189.22 acres is in B_1 soils and 90.78 acres in B_2. The resource restrictions assumed for the representative farm in East Central Oklahoma are presented in Table II.

The representative farm is not necessarily typical of a particular upland or bottomland farm in the area. Alternative combinations of upland and bottomland soils will be programmed which will provide a wider range of estimates representative of more farms in the area particularly with regard to requisite adjustment opportunities.

Assumptions and Restrictions

The two models -- maximization and minimization models -- used in this study employ the same assumptions and restrictions concerning machinery, labor, capital, crop and livestock enterprises, prices, tenure, allotment and overhead costs. These restrictions are discussed next.

Machinery

The machinery complements assumed are based on usual practices in the area according to farmer surveys. Power and machinery costs are

TABLE II

RESOURCE AND ALLOTMENT RESTRICTIONS FOR REPRESENTATIVE FARMS, EAST CENTRAL OKLAHOMA

Item	Unit	Soil Resource Situations	
		Upland	Bottomland
Total Land	Acre	585.00	585.00
Total Cropland	Acre	280.00	280.00
Class L_1	Acre	12.49	
Class L_2	Acre	131.60	
Class L_3	Acre	43.82	
Class P_1	Acre	19.74	
Class P_2	Acre	6.80	
Class S_2	Acre	22.63	
Class S_3	Acre	42.92	
Class B_1	Acre		189.22
Class B_2	Acre		90.78
Native Pasture[a]	Acre	269.00	269.00
Farmstead and Waste	Acre	36.00	36.00
Allotments			
Cotton	Acre	24.10	24.10
Peanuts	Acre	14.00	14.00
Wheat	Acre	10.10	10.10
Total Operator Labor[b]			
Jan.-April	Hour	320.00	320.00
May-July	Hour	240.00	240.00
Aug.-Sept.	Hour	160.00	160.00
Oct.-Dec.	Hour	240.00	240.00
Buildings, Fences, etc.[c]			

[a]Pasture yield is given in AUM. The yield is estimated to be one AUM per acre.

[b]Only 80 hours of operator and family labor is assumed to be available per month. The survey of farming practices in the area indicates that most farmers have off-farm employment.

[c]A set of improvements, including buildings, fences, etc. is assumed for each of the representative farms.

based on one 3-plow and one 4-plow tractor and an associated set of four-row machinery. The new cost assumed for each item is the 1969 dealer list price less 10 percent to adjust more nearly to the price paid by farmers. The explanation of the assumptions made in computing the fixed and variable costs of operation for each item of equipment is given in Appendix Table I of the forthcoming Progress Report.[4]

Harvesting, hauling, and operations involving chemical control of weeds and insects were included in the budgets on a custom basis.[5]

Labor

The amount of operator and family labor available for farm work is specified for each of four periods. The following is the distribution: January through April, 320 hours; May through July, 240 hours; August through September, 160 hours; and October through December, 240 hours. The available hours of operator labor assumed for the representative farms in the area are indicated in Tables I and II. The groupings reflect the heavy work periods for major crops. The analysis assumes hired farm help can be obtained at $1.50 per hour when necessary.

Only 80 hours of operator labor is assumed available for farm work in each month. The survey of farms in the study area indicates that most farmers have from one-half time to full time off-farm employment. While the amount of labor available varies from one situation

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[4]Udoka Johnson Udoka and Vernon R. Eidman, Expected Production Requirements, Costs and Returns, for Alternative Crop Enterprise, Upland and Bottomland Soils, Northeastern and East Central Oklahoma, Oklahoma Agricultural Experiment Station Progress Report, forthcoming (Stillwater, 1970).

[5]D. B. Jeffrey and Odell L. Walker, Custom Service Rates in Oklahoma, Oklahoma Agricultural Extension Service, Fact Sheet No. 118 (Stillwater, 1968).

to another, it seems reasonable to assume that about 80 hours per month is available for farm work. Thus the results obtained in both the maximization and minimization models assume part-time farming operations.

Capital

For the programs in this study, capital is considered unrestricted. The assumption is that the farmer can borrow as much capital as he needs at eight percent interest per annum.

Crop Enterprises

The included crop enterprises are: cotton, grain sorghum, soybeans, wheat, barley, oats, peanuts, bermuda grass pasture, and alfalfa.[6] All these crops (except bermuda grass and supplemental grazing of wheat, barley, oats, alfalfa and grain sorghum stubble) are sold directly for cash. The pasture yields are given in animal unit months (AUM's).[7] The value of pasture and grazing of small grains is realized through livestock; i.e., the market price per AUM of pasture and value of the grazing is not given as these are fed to livestock. The yields used in the budgets were based on harvested acres. The yield data and production practices for all the enterprises assume a high management level. A description of the enterprises and yields in each productivity class can be found in Appendix Table X.

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[6]The input-output data for the enterprises are found in the Progress Report (footnote 4).

[7]Animal unit months (AUM) is defined as the amount of grazing required to feed a 1,000 pound cow and her calf for one month.

Livestock Enterprises

Livestock activities considered in this study are beef-cattle operations: cow-calf and stocker buy-sell (Table III). The beef cow-calf activities include only spring calving, wintered on alternative rations and pasture. Activities permitting claves produced to be transferred to the stocker enterprise are also included. Stocker buy-sell activities include buying in the fall and selling either in spring after wintering on small grain pasture or in the fall after pasturing on native grass. The input-output data for livestock enterprises are based on the budgets in Processed Series P-544.[8] However, the estimated production costs and returns for the beef cow-calf and stocker buy-sell activities have been adjusted to reflect current (1958-1970) prices of calves, steers, and bull-cows. Appendix Tables XI through XV show the enterprise budgets used in the programming analysis.

Prices

The assumed prices paid and received by farmers in the study area are listed in Appendix Table XIX. The prices are current prices (1969) and should not be interpreted as a prediction of prices for any future period. Prices were obtained through interviews with local agricultural supply firms and farmers, and published statistics with consideration given to past price trends and government farm programs. Custom rates used in the budgets are taken to be the most common in

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[8]Kenneth G. Schneeberger, et. al., Resource Requirements, Costs and Expected Returns; Beef Cattle and Improved Pasture Alternatives; East Central and Southeastern Oklahoma, Oklahoma Agricultural Experiment Station, Processed Series P-544 (Stillwater, 1966).

TABLE III

DESCRIPTION OF LIVESTOCK ENTERPRISES FOR NORTHEASTERN AND EAST CENTRAL OKLAHOMA

Item Appendix Tables[a]	Calving Date	Purchasing Date	Marketing Date	Production Practices
Beef Cow-Calf (XI)	Mar. 1		Oct. 10	Winter ration of cottonseed cake, hay and pasture.
Beef Cow-Calf (XII)	Mar. 1		Oct. 10	Winter ration of cottonseed cake and hay (substituted for pasture).
Beef Cow-Calf (XIII)	Mar. 1		Oct. 10	Winter ration of cottonseed cake, hay, and pasture with small grain grazing.
Stocker Buy-Sell (XIV)		Oct. 10	Mar. 1	Winter grazing on small grain pasture with hay, cottonseed cake, and pasture in bad weather.
Stocker Buy-Sell (XV)		Oct. 10	Aug. 10	Winter on cottonseed cake, hay, and pasture; summer graze on pasture.

[a]The number under each enterprise refers to the budget presented in the Appendix Table.

the study area. All harvesting and hauling rates were computed based on custom rates for the area.

Tenure

The farm manager is assumed to be an owner-operator and it is assumed he has 100 percent equity in land. The appropriate principal, interest, net rent payments and overhead expenses must be deducted from the net returns to estimate net returns for other tenure situations following the same organization.

Allotments

The allotment restrictions for this study were estimated from the data obtained from the Agricultural Stabilization and Conservation Service (1970 programs). The estimates of cotton and wheat allotments for the representative farm are 7.6 acres and 37.2 acres, respectively, in Northeastern Oklahoma. In the East Central area, cotton, peanut, and wheat allotments are estimated at 24.1 acres, 14 acres, and 10.1 acres, respectively. Northeastern Oklahoma is not considered a peanut area and no allotment is available for this enterprise.

The minimum resource model assumes that each acre added to the farm contains the same percentage of allotments as those available on the representative farms.

Overhead Costs

Farm overhead costs consist of depreciation and maintenance of buildings and livestock equipment, machinery ownership costs, pick up truck expenses, real estate taxes, telephone, bookkeeping, insurance on buildings and workers, and other general expenses. Allocation of these overhead expenses to individual enterprises is difficult and they are not included in the budgets.

The assumed annual overhead costs for the representative farms in Northeastern and East Central Oklahoma are presented in Appendix Table XVI. The estimates for overhead costs do not include land taxes. Land tax is assumed to be $1.00 per acre and is deducted from returns to operator labor and management for each representative farm in a separate operation to reflect differences in farm size. Following this procedure results in deducting the proper amount of overhead costs for each farm size in both the maximization and minimum resource analysis.

The Linear Programming Matrix for the Representative Farm Program

A representative farm may be defined as a farm which incorporates the characteristics of a group of farms. As indicated above, the programmed plans for this study contain combinations of alternative cropland (upland and bottomland) situations which reflect actual farming situations in the study area. In addition to soil resource situations, a set of other resources are available on the representative farm. These resources and other restrictions constitute the rows in the linear programming matrix. The enterprises considered are also representative of those quite common in the study area. The enterprises appear as columns in the matrix.

In the general matrix constructed (using parametric programming) for this study, there are 42 rows consisting of: the objective function; upland soil restrictions, classes L_1, L_2, L_3, P_1, P_2, S_2, and S_3, respectively; bottomland soils restrictions, classes B_1 and B_2, respectively; native pasture; cotton allotment; peanut allotment; wheat allotment; January-April labor, May-June labor; August-September labor; and October-December labor; annual capital; small grain grazing; wheat certificate level; limit on wheat certificate; cotton payment level; limit on cotton payment; wheat production; barley production; oats production; grain sorghum production; cotton production -- lint and seed; peanut production; prairie and peanut hay production; soybean production; alfalfa production; production of steer calves and heifer calves, respectively; cull cows; cull yearling heifers; stockers for March 1 sell; and stockers for August 10 sell; and a final row indicating the amount of land which is bottomland.

Enterprises considered in the program make up the matrix's columns. Crop activities include wheat, barley, oats, grain sorghum, cotton, peanuts, soybeans, wheat and soybeans, alfalfa, and bermuda grass pasture. Livestock activities are three spring calvings and two stocker buy-sell enterprises. Hay buying and labor hiring are also included. Furthermore, crop and livestock selling activities are also considered. There are 113 columns indicating the activities in the general matrix.

The following are the activities: wheat per acre on L_1, L_2, L_3, P_1, P_2, S_2, S_3, B_1, and B_2, respectively; barley per acre on each of these nine soil classes; oats on each of the nine soil classes; grain sorghum on each of the nine soil classes; cotton on each of the soil classes except L_3 where cotton is not suitable; peanuts on each of the soil classes except L_3 and B_2 which are not suitable for peanut production; soybeans on each of the soil classes except L_3 -- same reason as cotton; wheat and soybeans on each of the same soil classes as soybeans; alfalfa on L_1, L_2, S_2, B_1 -- other soil classes not suitable for alfalfa; bermuda grass on each of the nine soil classes; buy prairie and peanut hay; selling of wheat certificate; selling of wheat, barley, oats, grain sorghum, cotton lint, cotton seed, and peanut hay, respectively; cotton payment; cow-calf activities; stocker buy-sell activities; steer transfer; heifer transfer; buy-stocker; selling of steers, heifiers, stockers on March 1, stockers on August 10, cull cows and cull yearling heifiers; hiring of labor for each of the four periods; and the bottomland restriction.

The "RHS1" (right hand side 1) column indicates the amount of each of the fixed resources available. Another column included in the matrix after "RHS1" is a parametric column used to change the cropland composition of the farm from upland to bottomland by 10-acre increments. The parametric procedure determines an optimum organization with all cropland in upland soils, then determines the optimum with 10 acres in bottomland and the rest in upland, with 20 acres in bottomland and so on, until all cropland is bottomland soils. An example of the matrix used for programming a bottomland farm (not for parametric programming) for this study is presented in Appendix Table XVII.

CHAPTER IV

OPTIMUM SHORT-RUN FARM ORGANIZATIONS

This chapter discusses short-run farm adjustment opportunities in the study area. The optimal solutions of the linear programming maximization model for alternative land resource situations are examined. The plan presented as optimal is the one which maximizes the net return to the operator's land, labor, management, and overhead. The information presented for each representative farm organization includes the (a) farm size, (b) enterprise combinations and land use, (c) labor requirements, (d) capital requirements, and (e) estimate of net returns.

The optimal organization is presented for each of six representative farms. Two of these are in Northeastern Oklahoma. The other four representative plans are for the East Central section. The definition and detailed description of representative farms are presented in Chapter III.

Optimum Upland Farm Organization, Northeastern Oklahoma

The most profitable organization for the upland farm in Northeastern Oklahoma is presented in the third column of Table IV. The combination of enterprises shown maximizes the return to the operator's land, labor, management, and overhead. The crop enterprises included in the optimal plan are grain sorghum, cotton, soybeans and wheat. Livestock activities in the solution are cow-calf and stocker

TABLE IV

OPTIMUM FARM ORGANIZATIONS, UPLAND AND BOTTOMLAND REPRESENTATIVE FARMS, NORTHEASTERN OKLAHOMA

Item	Unit	Level 1[a]	Level 2[b]
I. Total Land	Acre	665.00	665.00
Cropland:			
Upland	Acre	372.00	212.00
L_1	Acre	30.47	17.36
L_2	Acre	222.72	126.93
L_3	Acre	61.64	35.13
P_1	Acre	53.27	30.36
P_2	Acre	3.90	2.22
Bottomland	Acre	0.00	160.00
B_1	Acre	0.00	144.80
B_2	Acre	0.00	15.20
Native Pasture	Acre	256.00	256.00
II. Enterprise Produced or Sold			
Crop:			
Grain Sorghum (L_2)	Acre	0.00	122.03
Grain Sorghum (L_3)	Acre	61.64	35.13
Grain Sorghum (B_2)	Acre	0.00	15.20
Cotton (L_2)	Acre	4.90	4.90
Soybeans (L_1)	Acre	30.47	10.52
Soybeans (L_2)	Acre	217.82	0.00
Soybeans (P_1)	Acre	16.07	0.00
Soybeans (P_2)	Acre	3.90	2.22
Wheat and Soybeans (L_1)	Acre	0.00	6.84
Wheat and Soybeans (P_1)	Acre	37.20	30.36
Alfalfa (B_1)	Acre	0.00	144.80
Sell Grain Sorghum	Cwt.	1,553.33	5,538.65
Sell Cotton (Lint)	Cwt.	19.60	19.60
Sell Cotton (Seed)	Ton	1.55	1.55
Sell Soybeans	Bu.	8,103.93	1,163.88
Sell Wheat	Bu.	1,116.00	1,116.00
Sell Alfalfa	Ton	0.00	651.60
Buy Peanut and Prairie Hay	Ton	22.64	14.79
Livestock:			
Spring Calf (on CSC, hay)	Head	20.00	0.00
Spring Calf (on Native & S.G.)	Head	5.00	29.00
Stockers (Buy Oct. 10-Sell Mar. 1)	Head	7.00	42.00
Sell Steers	Cwt.	55.41	64.18
Sell Stockers (Mar. 1)	Cwt.	43.01	257.08
Sell Cull Cows	Cwt.	30.22	35.01
Sell Cull Heifers	Cwt.	9.07	10.50

TABLE IV (Continued)

Item		Unit	Level 1[a]	Level 2[b]
III.	Labor			
	Operator Labor			
	Jan.-April	Hour	320.00	320.00
	May-July	Hour	240.00	205.60
	Aug.-Sept.	Hour	74.14	88.91
	Oct.-Dec.	Hour	97.01	203.61
	Hired Labor			
	Jan.-April	Hour	281.18	161.76
	May-July	Hour	89.86	0.00
IV.	Capital[c]	Dollar	6,270.95	7,529.87
V.	Net Returns[d]	Dollar	14,218.71	16,969.16

[a]All cropland is upland.

[b]The cropland on this representative farm is composed of 43 percent bottomland and 57 percent upland soils.

[c]Capital is total annual operating capital required for the enterprises included in the optimum organization.

[d]Net return is defined as the return to land, operator labor, management and overhead.

buy-sell enterprises.

All of the available L_1 land (30.47 acres) is planted to soybeans, while the L_3 land (61.64 acres) is planted to grain sorghum. Cotton is planted on L_2 soils with the remainder of this soil class going to soybeans. Enough P_1 land is planted to wheat soybeans double crop to utilize the wheat allotment. The remainder of the P_1 land and all of P_2 land is planted to soybeans.

The effect of allotments on land use is demonstrated by the levels at which cotton and wheat (the only crops with allotment restrictions in this representative farm) enter the optimal solution. The cotton allotment is 7.6 acres. The optimal solution includes only 4.9 acres of cotton -- the minimum acreage required to receive the maximum price support. This indicates that producing cotton and selling at the market price is not as profitable as other crop alternatives.

Wheat is produced on the maximum acreage permitted by the allotment -- 37.2 acres. Soybeans dominate crop activities in respect to land use. Production involves 30.47 acres of L_1, 217.82 acres of L_2, 16.07 acres of P_1 and 3.9 acres of P_2 soils. In addition, the 37.2 acres of wheat and soybeans double crop on P_1 soil increases soybean production to a total of 305.46 acres.

The optimal organization includes both a cow-calf enterprise and additional feeding of part of the calves produced. Twenty-five brood cows are included in the organization. The linear programming solution indicates the steer calves produced should be sold at weaning, but the heifer calves not used as replacements for the cow herd are sold off of small grain pasture March 1.

This study assumes the operator can borrow the amount of capital required at an annual interest rate of eight percent. In the optimal plan, the annual operating capital requirement is $6,270.95. The available January-April and May-July operator labor is completely utilized in the optimal organization. An additional 371 hours of labor are hired during these two periods. Less than one-half the total operator labor for August-September and October-December periods are used in the solution. The requirements and distribution of labor in the organization reflect the characteristics of the activities in the optimal plan. The amount of machine and tractor time required for field operations for the various crop activities are indicated by the higher level of labor used in the first two periods.

Stability Ranges

Stability ranges of cost or revenue per unit of programmed activities are presented in Appendix Table XVIII. The column headed "stability range" indicates the extent to which the cost or revenue per unit may vary before a change occurs in the plan. Any change in the plan may have some effect on the net return.

The ranges of individual enterprise costs or returns are not very wide. Grain sorghum on L_3 soils can be planted at the level shown in Table IV at any operating cost per acre up to $36.44. And cotton operating cost may range between $52.34 and $82.38 without changing the farm organization. Soybeans have rather narrow stability ranges. For example, an increase of $0.68 in operating costs per acre of soybeans on L_1 soils would change the optimal plan in favor of cotton on this soil. The wide stability range of net returns per unit for wheat shows how stable this enterprise is in the organization. Wheat will be produced so long as its revenue per bushel is within the range of $0.98 and $4.32. The interest rate for operating capital can vary from seven percent to 13 percent without changing the optimal organization. Other ranges are interpreted in a similar manner.

Net Return Estimates

The concept of net return as used in the programmed plans relates to the equity position of the farm operator and the return to owned resources. The profit maximized in the linear programming maximization model is the return to land, operator labor, management and overhead. The operator only receives all of this return if he has 100 percent equity in land.

However, not all farmers have full equity in their farms. For farmers who are not full owners (they may have indebtedness or rent part or all the land), land payments and annual interest or cash rent may be deducted from the net return. Furthermore, the farmer with full ownership may decide to compute the return to his labor and management by deducting specified charges for land, taxes and overhead from the net return.

The representative farm net return to land, operator labor, management and overhead is $14,218.71. Suppose that the owner-operator seeks a five percent return on his land investment. Suppose also that land tax of $1.00 per acre and the overhead costs are deducted from the net return. Then the operator's return to his labor and management is $3,810.71. The computation is as follows:

Net Return	$14,218.71
Less:	
Return on Land Investment	5,486.25
Land Taxes	665.00
Overhead Costs	4,256.75
Return to Operator Labor and Management	3,810.71

where land taxes and return on land investment are computed on 665 acres of total land.

Aside from a full equity return estimate, one can compute net returns reflecting different equity positions of the operator. On the one hand, suppose that the operator has 50 percent equity and rents 50 percent of the land under a cash lease arrangement. On the other hand, suppose that he rents all the land under a cash lease; i.e., he owns no land. Following the above procedure, the returns to operator land, labor and management are:

	Owner-Renter	Renter
Net Return	$14,218.71	$14,218.71
Less:		
Land Rent	3,075.59	6,151.18
Land Taxes	332.50	0.00
Overhead Costs	4,256.75	4,256.75
Residual Return to Operators Owned Resources	6,553.87	3,810.78

where land rent is assumed to be 5.606 percent of the land value.[1] Land tax is about 0.606 percent of land value. The computed returns for the owner-operator (who charges five percent return on his land investment) and for the renter are about the same. The owner-operator not making a special land charge has returns to owned land, labor and management of $9,296.96. He can use this money to pay off indebtedness, reinvest in the farm business or reinvest elsewhere, and for family living.

[1]Land value in the study area is assumed to be $165.00 per acre.

Optimum Farm Organization, Alternative Upland and Bottomland Combinations, Northeastern Oklahoma

The representative farm organization with 43 percent of available cropland in bottomland and 57 percent in upland soils is the second optimal farm plan considered for the Northeastern section of the study area. This optimum organization is shown in column four of Table IV.

The amount of bottomland available in the Northeastern section is limited and few farms contain more than 43 percent bottomland. Relatively few changes occur in the optimal organization as bottomland is substituted for upland until 160 acres (43 percent of cropland) of bottomland are included. The upland farm organization and the organization with 43 percent bottomland can be used with linear interpolation procedure to determine the organization to be followed by farmers having any combination of upland and bottomland within this range.

The crop enterprises included are grain sorghum, cotton, soybeans, wheat and alfalfa. Similar to the previous optimal plan, livestock activities are beef cows and stockers. However, the levels at which both crop and livestock activities enter the solution in this upland-bottomland representative farm differ from those in the upland farm organization. The following analysis discusses both the differences and the areas of similarity.

As bottomland is added, B_1 land is planted to alfalfa and B_2 to grain sorghum. Wheat and soybeans double crop remains on P_1 but not enough P_1 land is available to plant the full wheat allotment. The additional wheat-soybeans needed to fulfill the wheat allotment is planted on L_1 soils. The remainder of L_1 soils is in soybeans.

The minimum cotton required for full government payments is planted on L_2 soils, but the remainder of this soil class shifts from soybeans to grain sorghum because of the need for aftermath grazing to complement aftermath grazing of alfalfa by livestock. All of the L_3 land remains in grain sorghum, while all P_2 remains in soybeans.

The optimal organization includes a cow-calf activity and feeding of part of the calves produced as well as stockers purchased. The organization includes 29 brood cows and 42 stockers. Eight heifer claves not used as replacements for the cow herd and 34 fall-buy stockers are sold off of small grain pasture on March 1.

Substantial changes in labor and capital requirements result from the changes in the programmed plan. The increase in annual operator labor is only about 12 percent, while the amount of hired labor is reduced by more than 50 percent. Hired labor for the January-April period is reduced by 119.42 hours, while no hired labor is required for the May-July period. Annual operating capital requirements increased from $6,270.95 to $7,529.87, a change of approximately 20 percent.

The residual return to land, operator labor, management, and overhead is $16,969.16. The return to operator labor and management may be computed as for the upland organization by deducting the charges for land investment, taxes on land, and overhead expenses. The estimated return to operator labor and management is $6,561.16. The comparison of the net returns of the two representative farm organizations show approximately $2,751 more return for the organization with upland-bottomland combinations.[2]

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[2]In this study, land value is assumed the same ($165.00 per acre) for bottomland and upland. An adjustment should be made to reflect a higher land value for bottomland where necessary.

Estimated flood losses have not been deducted from the estimated net returns. Deducting average annual flood damages would probably not affect the optimum combination of crops greatly because most of the bottomland is allocated to alfalfa, a crop considered to be relatively flood tolerant. However, the flood damages would certainly be expected to decrease net returns from the optimum farm plan.

Optimum Upland Farm Organization, East Central Oklahoma

The optimum representative farm organization in upland soils for East Central Oklahoma is shown in column three of Table V. Grain sorghum, cotton, peanuts, soybeans, and wheat are the crop enterprises in the optimal plan. Livestock activities in the solution are those included in the upland soil organization for the Northeastern section. However, the levels at which they are in the plan are different.

Similar to the upland farm organization for the Northeastern section, all of the available L_1 land (12.49 acres) is planted to soybeans, while L_3 land (43.82 acres) is planted to grain sorghum. Peanuts are planted on S_2 land, with the remaining S_2 land (8.62 acres) going to cotton. The additional cotton allotment (7.08 acres) is planted on L_2 land and the remaining L_2 land is planted to soybeans. The representative farm has 14.0 and 24.1 acres of peanuts and cotton allotment, respectively (Table II). The optimal solution includes 14.0 acres of peanut and only 15.7 acres of cotton, the minimum acreage required to receive the full price support. Enough wheat and soybeans double crop to make use of the wheat allotment is planted on P_1 land. The remaining P_1 land and all of the P_2 and S_3 land is planted to soybeans.

TABLE V

OPTIMUM FARM ORGANIZATION, UPLAND AND BOTTOMLAND REPRESENTATIVE FARMS, EAST CENTRAL OKLAHOMA

Item	Unit	Level 1[a]	2[b]	3[c]	4[d]
I. Total Land	Acre	585.00	585.00	585.00	585.00
Cropland:					
Upland	Acre	280.00	160.00	40.00	0.00
L_1	Acre	12.49	7.10	1.79	0.00
L_2	Acre	131.60	74.90	18.81	0.00
L_3	Acre	43.82	25.00	6.26	0.00
P_1	Acre	19.74	11.10	2.82	0.00
P_2	Acre	6.80	4.00	0.97	0.00
S_2	Acre	22.62	13.00	3.23	0.00
S_3	Acre	42.93	25.00	6.13	0.00
Bottomland	Acre	0.00	120.00	240.00	280.00
B_1	Acre	0.00	81.00	162.19	189.22
B_2	Acre	0.00	39.00	77.81	90.78
Native Pasture	Acre	269.00	269.00	269.00	269.00
II. Enterprise Produced or Sold					
Crop:					
Grain Sorghum (L_3)	Acre	43.82	25.00	6.26	0.00
Grain Sorghum (B_2)	Acre	0.00	39.00	72.90	75.08
Cotton (L_2)	Acre	7.08	15.70	9.82	0.00
Cotton (P_2)	Acre	0.00	0.00	0.97	0.00
Cotton (S_2)	Acre	8.62	0.00	0.00	0.00
Cotton (B_2)	Acre	0.00	0.00	4.91	15.70
Peanuts (L_1)	Acre	0.00	1.00	1.79	0.00
Peanuts (L_2)	Acre	0.00	0.00	8.98	0.00

TABLE V (Continued)

Item	Unit	Level			
		1[a]	2[b]	3[c]	4[d]
Peanuts (S_2)	Acre	14.00	13.00	3.23	0.00
Peanuts (B_1)	Acre	0.00	0.00	0.00	14.00
Soybeans (L_1)	Acre	12.49	6.10	0.00	0.00
Soybeans (L_2)	Acre	124.52	59.20	0.00	0.00
Soybeans (P_1)	Acre	9.64	1.00	0.00	0.00
Soybeans (P_2)	Acre	6.80	4.00	0.00	0.00
Soybeans (S_3)	Acre	42.93	25.00	0.00	0.00
Wheat and Soybeans (P_1)	Acre	10.10	10.10	2.82	0.00
Wheat and Soybeans (S_3)	Acre	0.00	0.00	6.13	0.00
Wheat and Soybeans (B_1)	Acre	0.00	0.00	0.00	4.80
Alfalfa (B_1)	Acre	0.00	81.00	162.19	170.42
Sell Grain Sorghum	Cwt.	1,104.26	2,058.14	2,811.17	2,732.91
Sell Cotton (Lint)	Cwt.	64.11	63.00	59.86	56.52
Sell Cotton (Seed)	Ton	5.31	4.96	4.73	4.46
Cotton Payment Sell	Acre	15.70	15.70	15.70	15.70
Sell Peanuts	Cwt.	280.00	278.00	249.48	238.00
Buy Peanut and Prairie Hay	Ton	10.22	6.63	0.52	1.70
Sell Soybeans	Bu.	5,316.79	2,656.44	163.46	115.20
Sell Wheat	Bu.	303.00	303.00	244.03	144.00
Wheat Certificate Sell	Acre	4.80	4.80	4.80	4.80
Sell Alflafa	Ton	0.00	365.00	729.86	766.89
Livestock:					
Spring Calf (on CSC and Hay)	Head	24.00	0.00	0.00	0.00
Spring Calf (on Native and S.G.)	Head	0.00	26.00	25.00	24.00
Stockers (Buy Oct. 10-Sell Mar. 1)	Head	4.00	7.00	45.00	48.00
Stockers (Buy Oct. 10-Sell Aug. 10)	Head	3.00	0.00	0.00	0.00
Sell Steers	Cwt.	52.67	57.41	54.26	53.63
Sell Stockers (Mar. 1)	Cwt.	22.37	44.57	275.92	293.45
Sell Stockers (Aug. 10)	Cwt.	21.56	0.00	0.00	0.00

TABLE V (Continued)

	Item	Unit	Level 1[a]	2[b]	3[c]	4[d]
	Sell Cull Cows	Cwt.	28.73	31.32	29.60	29.25
	Sell Cull Heifers	Cwt.	8.62	9.40	8.88	8.76
III.	Labor					
	Operator Labor					
	Jan.-April	Hour	320.00	320.00	320.00	320.00
	May-July	Hour	240.00	191.34	122.39	115.06
	Aug.-Sept.	Hour	25.62	40.14	36.92	29.61
	Oct.-Dec.	Hour	78.99	105.76	144.97	144.28
	Hired Labor					
	Jan.-April	Hour	205.47	129.30	59.93	56.62
	May-July	Hour	20.83	0.00	0.00	0.00
IV.	Capital[e]	Dollar	5,269.50	4,726.59	6,569.11	6,664.95
V.	Net Return[f]	Dollar	12,554.17	14,517.60	15,626.63	15,720.01

[a]Optimum farm organization with all available cropland in upland soils.

[b]Optimum farm organization with 43 percent of the available cropland in bottomland and 57 percent in upland soils.

[c]Optimum farm organization with 86 percent of the available cropland in bottomland and 14 percent in upland soils.

[d]Optimum farm plan with all available cropland in bottomland soils.

[e]Capital is total annual operating capital required for the enterprises included in the optimum organization.

[f]Net return is defined as the return to land, operator labor, management and overhead.

Peanuts are a highly profitable enterprise in the organization. The wide stability range of net returns per unit for peanuts indicates that this enterprise has a very strong position in the organization.

Analogous to the upland farm in the Northeastern section, soybeans make the greatest use -- approximately 71 percent -- of available cropland. Production is on 12.49 acres of L_1, 124.52 acres of L_2, 9.64 acres of P_1, 6.8 acres of P_2, and 42.93 acres of S_3 soils. Wheat is included in the solution at the full allotment level -- 10.1 acres.

The optimal solution includes a cow-calf activity and additional feeding of part of the calves produced. The organization contains 24 brood cows. The steer calves produced are sold at weaning, while the heifer calves not used as replacements for the cow herd are sold off of pasture March 1 and August 10.

The available operator labor for the periods January-April and May-July are completely utilized. In addition, 205.47 hours and 20.83 hours are hired during the respective periods. About one-half or less of operator labor for the periods August-September and October-December is used by the organization.

The annual operating capital required in the optimal plan is \$5,269.50. Net return to land, operator labor, management and overhead is \$12,554.17. After deducting a land charge, land taxes, and overhead expenses, the return to operator labor and management is \$2,866.17:

Net Return	\$12,554.17
Less:	
Return on Land Investment	4,826.25
Land Taxes	585.00
Overhead	4,256.75
Return to Operator Labor and Management	2,886.17

where land taxes and return on land investment are computed on 585 acres of total land.

The all upland farm organization shows relatively low net returns. In the following sections, organizations for different combinations of upland and bottomland are examined and the changes in net returns are indicated. The optimal plan for the 57 percent upland and 43 percent bottomland combination is discussed first. The organization for 14 percent upland and 86 percent bottomland is discussed next. And finally, the optimal farm organization for all bottomland is presented.

The choice of these combinations is somewhat arbitrary. Relatively few changes occur in the optimal basis as bottomland is substituted for upland. Thus optimal organization for these two combinations can be used with the optimal organization for all upland and all bottomland, and with linear interpolation procedures to determine the organization for any intermediate soil resource combination.

Optimum Farm Organization With 57 Percent of Cropland in Upland and 43 Percent in Bottomland Soils, East Central Oklahoma

The most profitable representative farm organization with 57 percent of cropland in upland and 43 percent in bottomland soils for East Central Oklahoma is given in column four of Table V. The crop enterprises included in the organization are grain sorghum, cotton, peanuts, soybeans, wheat, and alfalfa. Beef cows and stocker sell activities are the livestock enterprises included.

Grain sorghum is planted on all of the available L_3 land (25 acres) and B_2 land (39 acres). Some of the L_2 land is planted to cotton, while the remainder of this soil class is planted to soybeans. Enough P_1 land is planted to wheat and soybeans double crop to utilize the allotment. Peanuts are planted on one acre of L_1 land and all of the

S_2 land. All of the available P_2 land (4 acres), S_3 land (25 acres) and the remainders of the L_1 and P_1 soils respectively are planted to soybeans. Alfalfa is planted on all of the B_1 land.

Consider the changes in the optimal plan when 43 percent of the cropland is shifted from upland to bottomland. Soybean production decreases from 196.38 acres to only 95.30 acres. On the other hand, grain sorghum production increased from 43.82 acres to 64 acres. Availability of bottomland soils in the organization also results in alfalfa entering the optimal plan. The organization includes 81 acres of alfalfa on B_1 soils.

The production of cotton, peanuts and wheat remains at 15.7, 14 and 10.1 acres, respectively, regardless of changes in the organization. Similar to the upland farm organization, the acreage of cotton remains at the minimum required to receive the maximum price support, while the peanut enterprise is in the solution at the maximum allotment.

Livestock activities in the optimal organization include cows with spring calving and additional feeding of part of the calves produced. Twenty-six brood cows and seven stockers are included in the solution. The level at which these activities enter the optimal plan differ somewhat from that in the upland farm. Although the number of heifer calves not sold at weaning is the same as in the upland farm, the linear programming solution indicates they should all be sold off of small grain pasture on March 1.

The change in organization also results in relatively small changes in annual capital and labor requirements. About 10 percent less annual capital is required by the present plan than by the upland soil representative farm (see Table V). Annual operator and hired labor requirements decrease by 7.37 hours and 97 hours, respectively.

The net return to land, operator labor, management, and overhead is $14,517.60. This is an increase of about 16 percent from the upland soil plan. By deducting $9,668 -- the sum of the charges for land investment, land taxes, and overhead expenses -- from $14,517.60 net return, the operator arrives at $4,849.60 return to his labor and management.

Optimum Farm Organization With 14 Percent of Cropland in Upland and 86 Percent in Bottomland Soils, East Central Oklahoma

The result of the programmed plan with a higher proportion of bottomland (86 percent) and less upland (14 percent) is presented in column five of Table V. Crop and livestock enterprises in this optimum organization are the same as those in the organization just analyzed. Crop activities include grain sorghum, cotton, peanuts, soybeans, wheat and alfalfa. Cow-calf and stocker sell activities as well as the crop enterprises are included in the solution at different levels than in previous upland-bottomland farm plans.

As an increasing proportion of the cropland is bottomland, grain sorghum is substituted for soybeans. All of the available P_1 land (2.82 acres) and S_3 land (6.13 acres) is planted to wheat and soybeans double crop. Grain sorghum is planted on all of the L_3 land (6.26 acres) and 72.90 acres of the B_2 land. The remainder of the B_2 land, 9.82 acres of the L_2 land and 0.97 acres of the P_2 land are planted to cotton. Peanuts are planted on all of the L_1 land (1.79 acres), all of the S_2 land (3.23 acres), and the remainder of the L_2 land -- 8.98 acres.

Cotton and peanuts are in the optimal plans at constant levels regardless of the percentage of upland and bottomland combinations. Cotton is planted at the minimum acreage required to receive the full price support -- 15.70 acres. On the other hand, peanuts are still in the solution at the maximum allotment -- 14 acres.

Alfalfa is in the optimum plan at 162.19 acres on the B_1 soil. The alfalfa enterprise is complementary with the stocker buy-sell activities. An increase in the production of alfalfa results in an increase in buy-sell activities. The number of stockers has increased from seven head to 45 head. In addition to feeding of heifer calves produced (seven head), 38 head of stockers are purchased. The 45 stockers are sold off of small grain pasture March 1.

There is an inverse relationship between the labor required by the optimal plan and the proportion of bottomland in the optimal plan. Annual operator as well as hired labor are declining as the proportion of bottomland increases. Hired labor has fallen to only 59.93 hours in the January-April period with no additional labor required for the May-July period. Annual capital requirements, on the other hand, increase as bottomland in the organization is raised. There is an increase of about 39 percent in capital requirements in this optimum plan as compared to the previous plan in which bottomland is only 120 acres. The jump in capital, however, can be explained with the higher level of stocker buy-sell activities (45 head) in the organization.

Net returns tend to increase as the proportion of bottomland increases. Net return to operator land, labor, management and overhead is substantially higher than that of the upland soil representative farm: a difference of \$3,072.46 (see Table V). As net returns increase with an increase in bottomland in each organization, returns to operator labor and management also increase. After deducting $9,668 for the return on land investment, land taxes, and overhead, the estimated return to operator labor and management in the present optimum organization is $5,958.63.

Optimum Bottomland Farm Organization, East Central Oklahoma

The last profit maximizing farm organization for East Central Oklahoma involves the optimum plan with all available cropland in bottomland soils. This farm organization is shown in column six of Table V.

This bottomland soil farm plan compares quite closely with the representative farm having a higher percentage of bottomland just analyzed. Crop and livestock activities are identical except for the levels at which they are present in either organization. Grain sorghum, cotton, peanuts, soybeans, wheat, and alfalfa are the crop enterprises considered in the optimal plan.

As in other upland-bottomland organizations, the optimal solution includes both a cow-calf enterprise and feeding of part of the calves produced as well as a number of purchased stockers. Twenty-four brood cows are included in the organization. The number of cows in the enterprise tend to decrease as bottomland increases. The stocker sell activity, on the other hand, increases as bottomland increases. The linear programming solution indicates the steer calves produced should be sold at weaning, but the heifer calves not used as replacements for the cow herd, in addition to 41 stockers purchased October 10, are sold off of small grain pasture March 1.

Alfalfa is planted on B_1 soils with the remainder of this soil class going to peanuts and wheat soybeans double crop. The available B_2 land is planted to cotton and grain sorghum.

Analogous to other organizations for East Central Oklahoma, the optimal plan includes only 15.70 acres of cotton, while peanut production is the maximum allotment -- 14 acres. Grain sorghum still maintains a strong position in the organization. It is included in the optimal plan at 75.08 acres of B_2 land. The level at which alfalfa is included in the solution has increased to 170.42 acres, while wheat soybeans double crop has decreased to 4.8 acres only.

There are quite negligible changes in capital and labor requirements resulting from the change in organization. Annual capital increases by only \$95.84 as the organization shifts from 86 percent to 100 percent of cropland in bottomland soil. Annual operator labor declines only by 15.33 hours, while hired labor was cut down to only 56.62 hours.

Net returns for the all bottomland farm are only \$93.38 higher than the returns for the farm having 14 percent upland soils. The two net return figures are \$15,770.01 and \$15,676.63, respectively. The return to operator labor and management is \$6,052.01.

Net returns for alternative upland and bottomland combinations considered for East Central Oklahoma range from \$12,554.17 to \$15,720.01. After deductions of \$9,668 for land, taxes, and overhead expenses are made from the net returns, the return to operator labor and management ranges from \$2,886.17 to \$6,052.01. These comparisons of estimated net returns and returns to operator labor and management are presented in Table VI.

TABLE VI

ESTIMATED NET RETURNS[a] AND RETURNS TO OPERATOR LABOR AND MANAGEMENT, UPLAND AND BOTTOMLAND REPRESENTATIVE FARM ORGANIZATIONS, EAST CENTRAL OKLAHOMA

Item	Net Return	Return to Operator Labor and Management
	(Dol.)	(Dol.)
Optimum Farm Organization with all available cropland in upland soils:	12,554.17	2,886.17
Optimum Farm Organization with 43 percent of cropland in bottomland and 57 percent in upland soils:	14,517.60	4,849.60
Optimum Farm Organization with 86 percent of cropland in bottomland and 14 percent in upland soils:	15,626.63	5,958.63
Optimum Farm Plan with all available cropland in bottomland soils:	15,702.01	6,052.01

[a]Net return is return to land, operator labor, management and overhead.

In the analysis of the upland-bottomland farm organization for the Northeastern section, the basis on which the 57 and 43 percents were selected was indicated. The cropland combinations selected for the representative farms in East Central section reflect the amount of each type of land available and the effects each combination has on resource use, enterprise combinations and net return.

As the level of bottomland increases in the organization, the net returns increase. At a lower bottomland combination than the 43 percent of cropland (120 acres), the resulting change in the solution do not depart substantially from the upland farm solution. Crop and livestock activities are similar, with no major change at the levels they are included in the optimal plan; nor would there be much difference in resource use.

With a higher percentage of bottomland (86 percent), the change in the solution results in higher profit (net returns). Although the enterprises considered are the same, their combinations differ. Furthermore, there is a reduction in resource use -- mostly labor.

Summary

The principal purpose of this chapter was to determine the most profitable enterprise combinations for the representative farms in the study area. As pointed out in Chapter II, the linear programming maximization model is utilized to derive the optimal organization of the representative farms. Optimal organizations were obtained for alternative cropland resource combinations of the representative farms.

The two representative farm organizations for Northeastern Oklahoma present some points of interest. Crop and livestock activities are identical in both organizations except for the addition of alfalfa in the organization with upland and bottomland combinations. Cotton and wheat were included in each of the optimum organizations at the same levels. The full wheat allotment is included in each organization while the level of cotton was limited to acres on which government payments apply.

As the organization changed from the upland soil representative farm to one with 43 percent of cropland in bottomland and 57 percent in upland soils, changes occur in the combination of other resources and enterprises. This results in changes in net returns. The net return to operator land, labor, management, and overhead increased about 19 percent as bottomland came into the organization. It is obvious that the organization with some bottomland soil is more profitable than the one with upland soils only.

A similar impact of bottomland combinations is observed in the four representative farm organizations for the East Central section. While almost the same activities entered each optimal solution, the changes in organizations resulted in changes in the net income.

Cotton and peanuts entered each solution at constant levels. Peanuts accounted for greater increase in income for each organization. With its wide stability ranges, peanuts maintained a rather strong position in the organization.

Net returns and returns to operator labor and management increase as the percentage of bottomland in each organization increases. Return to operator labor and management is less for the organization with all available cropland in upland soils. The higher net returns on bottomland soils are affected by factors such as high profitability of livestock activities and peanuts. The differences in net returns between representative farms in the Northeastern and East Central sections reflect farm size and the type and levels of enterprises considered in each organization.

The implication of this analysis, using selected representative farm sizes, is that individual farm organizations can be adjusted to derive maximum returns from given resources. But the returns maximized are relatively small after deductions have been made for return on land investment, land taxes, and overhead costs. The question facing the farm manager is: What farm size is necessary to provide enough income for family living? The answer to this question is provided in the following chapter where minimum resource model organizations are examined.

CHAPTER V

MINIMUM RESOURCE RARM ORGANIZATIONS, NORTHEASTERN AND EAST CENTRAL OKLAHOMA

The purpose of this chapter is to present estimates of the minimum resource requirements and combinations of enterprises that can provide specified levels of income for the farm family under alternative soil resource situations. The linear programming minimum resource model was utilized for estimating this long-run farm adjustment. The program results furnish estimates of (a) the minimum acreage necessary to achieve the specified level of income, (b) the most profitable combinations of enterprises, (c) the operating capital requirement, and (d) the hired labor requirement. For the Northeastern section, estimates were made for upland soil farm organizations only. This is because about 80 percent of land in farms in this section is in upland soils. On the other hand, estimates for the East Central section were made separately for upland and bottomland farm organizations.

Seven income levels (returns to operator labor and management) are assumed. These are: $0.00, $3,000, $5,000, $7,000, $9,000, $12,000, and $15,000. The $0.00 income level is chosen to indicate the farm size required by a "hobby farmer". His emphasis is on off-farm income. Apart from the zero ($0.00) level of return to operator labor and management, the income targets are assumed representative of wages in non-farm employment requiring varied skill and managerial ability. However, most of the returns to operator labor and management presented on the last row of each of Tables VII, VIII, and IX are not exactly equal to the income targets. The reason is that each of the plans was programmed such that resource requirements and enterprise combinations would yield the return to operator labor and management which equals or closely approximates the income target. The linear programming minimum resource model did not include the return to land investment. Land value is assumed to be $165.00 per acre, and the return to land capital is assumed to be five percent of the land value or $8.25 per acre. The return to land is estimated from the program result as this is not included in the model. Since the land return is calculated external to the model, the return to operator labor and management does not exactly equal the specified income target.

The assumptions on rate of interest on borrowed capital, land price, land tax, hired labor price, and return on land capital investment are the same as used in the representative farm situations in Chapter IV. The return to operator labor and management (the target income) is obtained after charges have been made for return to land investment and overhead expenses.

Upland Soils Minimum Resource Organizations, Northeastern Oklahoma

The results for the upland soil resource situation for Northeastern Oklahoma are presented in Table VII. Six income levels ($0.00 through $12,000) are assumed for the Northeastern section. The assumed set of machinery is utilized to capacity by the 1,183 acres required to meet a $12,000 return to operator labor and management. Thus a larger

TABLE VII

ESTIMATED MINIMUM RESOURCE REQUIREMENTS TO OBTAIN SPECIFIED RETURNS TO OPERATOR LABOR AND MANAGEMENT, UPLAND SOILS, NORTHEASTERN OKLAHOMA

Item	Unit	Income Level[a]					
		$0.00[b]	$3,000	$5,000	$7,000	$9,000	$12,000
Resources							
Total Land	Acre	171.00	476.00	616.00	804.00	946.00	1,183.00
Cropland	Acre	101.00	281.95	365.00	475.76	560.80	700.16
Operator Labor	Hour	309.72	731.95	782.61	850.16	878.00	917.58
Hired Labor	Hour	0.00	131.92	335.77	607.56	837.25	1,227.67
Land Capital	Dollar	28,215.00	78,540.00	101,640.00	132,660.00	156,090.00	195,195.00
Annual Capital	Dollar	1,780.46	4,966.10	6,429.16	8,379.92	9,860.14	12,332.23
Crops							
Grain Sorghum	Acre	16.56	46.20	59.81	77.95	91.72	114.72
Cotton	Acre	2.22	6.19	8.00	10.45	12.29	15.37
Soybeans	Acre	65.15	181.93	235.54	307.00	362.23	451.80
Wheat & Soybeans	Acre	17.07	47.63	61.65	80.36	94.56	118.27
Livestock							
Spring Calf (On CSC & Hay)	Head	4.00	10.00	13.00	17.00	20.00	25.00
Spring Calf (On Native & Small Grain)	Head	3.00	9.00	12.00	16.00	19.00	23.00
Stockers (Buy Oct. 10-Sell Mar. 1)	Head	2.00	5.00	7.00	9.00	11.00	13.00
Gross Income	Dollar	7,966.09	22,218.25	28,763.99	37,659.12	44,114.64	55,174.64
Operating Expense	Dollar	3,708.91	10,543.22	13,897.16	18,534.73	21,795.71	27,531.02
Net Return	Dollar	4,257.18	11,675.03	14,866.83	19,124.39	22,318.93	27,643.62
Overhead Costs[c]	Dollar	4,257.18	4,675.03	4,866.83	5,124.39	5,318.93	5,643.62
Return to Land[d]	Dollar	1,410.75	3,927.00	5,082.00	6,633.00	7,804.50	9,759.75
Return to Operator Labor and Management	Dollar	-1,410.75	3,073.00	4.918.00	7,367.00	9,195.50	12,240.25

[a]Income level is defined as specified return to operator labor and management.

[b]The operator seeks minimum resources required to obtain enough income to pay overhead costs only.

[c]Overhead costs include maintenance and repair of buildings and livestock equipment, real estate taxes, machinery fixed costs, pickup truck expenses, telephone, bookkeeping and tax service, and insurance on buildings.

[d]Five percent of the investment in land.

complement of machinery and equipment than considered in the study is required to operate a unit large enough to return $15,000 to operator labor and management.

Crop and livestock activities included in each of the six minimum resource upland farm organizations for the Northeastern section are the same. The only difference is the level at which each enterprise enters the solutions; and this varies with farm size. Furthermore, each crop activity is produced on the same soil type in all the organizations. For example, grain sorghum is produced on L_3 soil at varying levels in all the farm organizations.

$0.00 Return to Operator Labor and Management

The programmed plan which nets zero ($0.00) returns to operator labor and management lists the minimum resource requirements and enterprise combinations required to pay overhead costs of the farm business. The minimum land requirement is 171 acres (column 3, Table VII). The amount of cropland is 101 acres.

The annual operator labor requirement is 310 hours. These include 157 hours for January-April period; 91 hours for May-July period; 33 and 29 hours, respectively, for the periods August-September and October-December. No additional labor is hired for this organization. Total operating capital required is $1,780.

The most profitable organization includes grain sorghum, cotton, soybeans, and wheat and soybeans double crop. Livestock activities which enter the plan are two beef cow-calf and one stocker buy-sell enterprise. Cow-calf activities include cow-calf on cottonseed cake and hay (substituted for pasture), and cow-calf on native and small grain pastures. The buy-sell enterprise involves the fall buy and spring sell activity only.

These crop and livestock enterprises in the minimum resource organizations are essentially the same activities which enter the optimal representative farm organizations under similar land resource situations for Northeastern Oklahoma (Chapter IV). The only difference is that the level at which each of these activities is in the solution under the minimum resource model is proportional to the minimum land required to obtain a specified return to operator labor and management.

$3,000 Return to Operator Labor and Management

The minimum land requirement to achieve the $3,000 income level is 476 acres (column 4, Table VII). This is an increase of about 178 percent or 305 acres from the preceding plan with a $0.00 return to operator labor and management.

With the increase in farm size, the annual operator labor requirement increases from 310.0 hours for a 171-acre farm to 732.0 hours for a 476-acre farm. The hired labor requirement is 132 hours, i.e., 119 hours for January-April period, and 13 hours for the May-July period.

Adjustments in farm size have significant implications in regard to capital requirements. The annual operating capital required for this farm organization is $4,966.00. This is approximately a 178 percent increase in the operating capital required to provide the additional $3,000 of income.

Each crop is in this organization ($3,000 income target farm) at a level 178 percent of that for the 171-acre farm. Cropland use by each crop enterprise has increased by 178 percent. Cow-calf on cottonseed cake and hay (substituted for pasture) increased from 4 units on 171-acre farm to 10 units on the present farm size. Cow-calf on native and small grain pastures and stocker buy-sell activities also increased from three to nine and from two to five units, respectively.

$5,000 Return to Operator Labor and Management

The minimum resource upland soil farm organization for a $5,000 return to operator labor and management is shown in column five, Table VII. The minimum land requirement to meet the $5,000 income target is 616 acres. This is an increase of 140 acres or 30 percent of the minimum land required to attain a $3,000 return to operator labor and management. The annual operator labor requirement is 783 hours. The total available operator labor for the January-April and May-July periods is completely utilized. The labor hired -- 336 hours -- is mainly for these two periods. Annual operator labor required increases by only 51 hours or by about seven percent compared to that required for a 476-acre farm. On the other hand, hired labor required has increased by 204 hours or by 155 percent. The greater amount of labor required for the first two periods reflect the machine time needed for the major crop enterprises.

Annual operating capital required is $6,429. With the increase in farm size from a 476-acre farm to a 616-acre farm, operating capital requirement increases by $1,463 or 30 percent. The percentage increase is similar to that of minimum land requirement.

Cropland use by each crop enterprise in this organization is 30 percent greater than that utilized on a 476-acre farm. The two cow-calf activities have each increased by three head respectively. The increase in buy-sell enterprise is only by two head as farm size shifts from that for $3,000 to that for $5,000 income target.

$7,000 Return to Operator Labor and Management

The minimum resource requirements and enterprise combinations to attain a $7,000 return to operator labor and management are shown in column six, Table VII. The minimum total land and cropland requirements to attain the $7,000 income level are 807 and 475.76 acres, respectively. The percentage increase in minimum land requirement is 30 percent.

With the increase in farm size, the annual operator labor requirement increased from 783 hours for a 616-acre farm to 850 hours for a 804-acre farm. This is an increase in operator labor requirement of 68 hours. Hired labor required for this organization is 608 hours. The hired labor required has thus increased by 81 percent as farm size increased. Annual operating capital required is $8,380. This is an increase of $1,951 or 30 percent compared to that required for a 616-acre farm organization.

The level of each crop enterprise is increased by 30 percent. Livestock activities are in the solution at higher levels in accordance with the size of farm. The three livestock activities increase by four, four, and two units, respectively, as farm size changed from a 616-acre farm to a 804-acre farm.

$9,000 Return to Operator Labor and Management

The minimum land requirement to obtain a $9,000 return to operator labor and management is 946 acres (column 7, Table VII). Cropland available at this farm size is 561 acres. The annual operator labor requirement is 878 hours; while the hired labor requirement is 837 hours. The operating capital required is $9,860.

As farm size changed from an 804-acre farm to a 946-acre farm, the minimum resource requirements and activity levels also changed. The minimum land requirement increased by 142 acres or by about 18 percent. The percentage increase in operating capital required is similar to that of the minimum land requirement. Annual operator labor increased only by 28 hours, while hired labor increased by 230 hours.

The level of cropland used by each crop activity has increased proportionally with the increase in minimum land requirement. The two beef cow-calf activities increase by only three units each while the buy-sell enterprise still maintains two units increase.

<u>$12,000 Return to Operator Labor and Management</u>

Column eight, Table VII, shows the minimum resource requirements and enterprise combinations that yield a $12.000 return to operator labor and management. This organization includes the maximum acreage that the assumed machine and tractor complement can reasonably be expected to handle. At any higher income target, the farm size would be larger, and a larger equipment complement (in excess of that assumed for this study) is required.

The minimum land requirement to obtain the $12,000 return to operator labor and management is 1,183 acres. As the farm organization changed from one which yields a $9,000 to one which yields a $12,000 return to operator labor andmanagement, the minimum land requirement increased by 237 acres or by only 25 percent.

At this farm size, the annual operator labor requirement is 918 hours. This is only 42 hours short of the total available annual operator labor assumed for this study. Additional labor required is hired for the first three periods. The total hired labor required is 1,228 hours. The greatest amount of hired labor is for the January-April period.

Annual operating capital required is $12,332. This is an increase of $2,472 or about 125 percent of that required for the 946-acre farm. The operating capital required thus increases by about the same percentage as the minimum land requirement.

The most profitable levels of livestock activities in the organization are 25 units of cow-calf on cottonseed cake and hay (substituted for pasture); 23 units of cow-calf on native and small grain pastures; and 13 stockers. With the increase in income target from $9,000 to $12,000 the levels of the three livestock enterprises increased by only five, four, and two units, respectively.

Cropland required by grain sorghum increased by only 23 acres compared to the cropland level of this activity in the 946-acre farm. Cotton, soybean, and wheat and soybean double crop enterprises increased by 3.08, 89.57, and 23.71 acres, respectively. The percentage increase in cropland use for each crop enterprise, however, is similar to that in minimum land requirement -- 25 percent.

Upland Soils Minimum Resource Organizations, East Central Oklahoma

The minimum resource program results on upland soils for East Central Oklahoma are presented in Table VIII. Seven income levels are assumed for the farm organizations in this section of the study area.

TABLE VIII

ESTIMATED MINIMUM RESOURCE REQUIREMENTS TO OBTAIN SPECIFIED RETURNS TO OPERATOR LABOR AND MANAGEMENT, UPLAND SOILS, EAST CENTRAL OKLAHOMA

Item	Unit	Income Level[a]						
		$0.00[b]	$3,000	$5,000	$7,000	$9,000	$12,000	$15,000
Resources								
Total Land	Acre	157.00	435.00	561.00	688.00	816.00	986.00	1,199.00
Cropland	Acre	79.90	221.80	286.00	351.07	416.26	502.92	611.40
Operator Labor	Hour	262.10	631.86	688.32	717.52	746.72	785.66	834.33
Hired Labor	Hour	0.00	95.54	249.53	433.75	617.97	863.60	1,170.64
Land Capital	Dollar	25,905.00	71,775.00	92,565.00	113,520.00	134,640.00	162,690.00	197,835.00
Annual Capital	Dollar	1,598.52	4,436.95	5,720.80	7,022.66	8,324.53	10,060.35	12,230.13
Crops								
Grain Sorghum	Acre	12.53	34.79	44.86	55.07	65.28	78.89	95.91
Cotton	Acre	5.01	13.92	17.94	22.03	26.11	31.56	38.36
Peanuts	Acre	7.68	21.31	27.48	33.73	40.09	48.32	58.74
Soybeans	Acre	49.04	136.13	175.52	215.46	255.41	308.65	375.23
Wheat & Soybeans	Acre	5.64	15.65	20.19	24.78	29.37	35.50	43.16
Livestock								
Spring Calf (On CSC & Hay)	Head	7.00	20.00	26.00	32.00	38.00	46.00	56.00
Spring Calf (On Native & Small Grain)	Head	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stockers (Buy Oct. 10-Sell Mar. 1)	Head	2.00	6.00	7.00	9.00	11.00	13.00	16.00
Gross Income	Dollar	7,582.73	21,040.49	27,137.10	33,302.45	39,478.13	47,722.11	58,012.26
Operating Expense	Dollar	3,344.73	9,421.63	12,345.62	15,336.98	18,337.30	22,348.38	27,346.68
Net Return	Dollar	4,238.00	11,618.86	14,791.48	17,965.47	21,140.83	25,373.73	30,665.58
Overhead Costs[c]	Dollar	4,238.00	4,618.86	4,791.48	4,965.47	5,140.83	5,373.73	5,665.58
Return to Land[d]	Dollar	1,295.25	3,588.75	4,628.25	5,676.00	6,732.00	8,134.50	9,891.75
Return to Operator Labor and Management	Dollar	-1,295.25	3,411.25	5,371.75	7,324.00	9,268.00	11,865.50	15,108.25

[a]Income level is defined as the return to operator labor and management.

[b]The operator seeks minimum resources required to obtain enough income to pay overhead costs only.

[c]Overhead costs include maintenance and repair of buildings and livestock equipment, real estate taxes, machinery fixed costs, pickup truck expenses, telephone, bookkeeping and tax service, and insurance on buildings.

[d]Five percent of the investment in land.

The income targets range from \$0.00 to \$15,000. The farm size necessary to obtain a \$15,000 return to operator labor and management is the maximum limit for the available machine and tractor hours. The program results are discussed individually in the following section for each of the assumed income levels.

The same crop and livestock activities are included in all the farm organizations. As farm size increases with the increase in income target, the level at which each enterprise enters the optimal plan also increases.

\$0.00 Return to Operator Labor and Management

The minimum land requirement to obtain a \$0.00 return to operator labor and management is 157 acres (column 3, Table VIII). The available cropland at this farm acreage is 79.90 acres.

The annual operator labor required is 262 hours. A greater portion of operator labor is for the January-April period. No hired labor is required. The annual operating capital required is \$1,599.

The most profitable organization includes grain sorghum, cotton, peanuts, soybeans, wheat and soybeans, cow-calf on cottonseed cake and hay (substituted for pasture), and stocker activities. Grain sorghum is produced on L_3 soil. Cotton and soybeans are produced on the S_3 class, while some of L_1 and all of S_2 are planted to peanuts. The remainder of L_1 and the available L_2 and P_2 are planted to soybeans, while P_1 land is planted to wheat and soybeans double crop.

$3,000 Return to Operator Labor and Management

Column four, Table VIII, shows the minimum resource requirements and enterprise combinations that provide a $3,000 return to operator labor and management. The minimum land requirement to attain this income target is 435 acres of which 221.8 acres is cropland. The minimum land required has increased to about 177 percent of that required to obtain the return to overhead expenses only.

As farm size increased from a 157-acre farm to a 435-acre farm, other minimum resource requirements increased. The annual operator labor requirement, 632 hours, reflects an increase of 141 percent or 370 hours. Hired labor required is 96 hours. And, the annual operating capital required is $4,437. Operating capital has thus increased by $2,838 or by 177 percent.

Cropland utilized by each of the crop activities has also increased by about 177 percent. Cow-calf and buy-sell enterprises have each increased from seven and two units in the 157-acre farm to 20 and six units, respectively, in the 435-acre farm.

$5,000 Return to Operator Labor and Management

The minimum land requirement to obtain a $5,000 return to operator labor and management is 561 acres (column 5, Table VIII). The increase in target income from the $3,000 level to the $5,000 level thus results in a 29 percent or 126-acre increase in the minimum land requirement.

The annual operator labor requirement to meet the $5,000 income target is 688 hours. The increase in operator labor required as farm size increases from 435 to 561 acres is only 56 hours or 9 percent. On the other hand, hired labor requirement -- 250 hours -- shows an increase of about 154 hours or 161 percent.

The annual operating capital requirement is $5,721. The percentage increase in the operating capital requirement is the same as that in the minimum land requirement -- 29 percent.

The acreage of grain sorghum has increased by 10.07 acres or by 29 percent from the $3,000 income target farm organization. The percentage increase in the amount of cropland utilized by each of the other crop enterprises is the same as that for grain sorghum. Cow-calf and buy-sell activities increase by six and one head, respectively, as farm size increases from a 435-acre farm to a 561-acre farm.

$7,000 Return to Operator Labor and Management

The minimum land requirement to obtain a $7,000 return to operator labor and management is 688 acres (column 6, Table VIII). The annual operator labor requirement is 718 hours, while hired labor is 434 hours. And, the annual operating capital requirement is $7,023.

The minimum land requirement has increased by 127 acres or by 23 percent from a $5,000 income target farm organization. Operator labor requirement has increased only four percent, while hired labor increased by 74 percent. The increase in operating capital is 23 percent which is identical to the percentage increase in minimum land requirement.

The percentage increase in cropland utilized by each crop enterprise is the same as that of minimum total land requirement (23 percent) as farm size increases from a 561-acre farm to a 688-acre farm. Cow-calf and buy-sell activities each increase by six and two units, respectively.

$9,000 Return to Operator Labor and Management

Column seven, Table VIII shows the minimum resource requirements and enterprise combinations to obtain a $9,000 return to operator labor and management. The minimum land requirement to achieve this income target is 816 acres. This is an increase in minimum land requirement of 128 acres or 19 percent as net return increases from $7,000 to $9,000.

With the increase in farm size, the annual operator labor requirement is 747 hours. The hired labor requirement is 618 hours. These changes in labor requirements represent increases of four percent and 42 percent, respectively. Annual operating capital requirement is $8,325. The difference between the operating capital required for a 688-acre farm and that for a 816-acre farm is $1,302. This is a 19 percent increase as farm size increases.

Cropland allocated to each of the crop enterprises also increases by 19 percent as farm size increases from a 688-acre farm to an 816-acre farm. The cow-calf activity enters the solution at 38 units. This is six units higher than the level in a 688-acre farm. The buy-sell activity still increases by two more units as a result of the change in target income.

$12,000 Return to Operator Labor and Management

The minimum land requirement to obtain a $12,000 return to operator labor and management is 986 acres (column 8, Table VIII). The increase in the minimum land requirement is 170 acres or 21 percent from a $9,000 income level farm organization to that for a $12,000 income level.

The annual operator labor requirement is 786 hours. The hired labor requirement is 864 hours. The requirement for both operator and hired labor is greater for the periods January-April and May-July than for August-September and October-December periods. Annual operating capital requirement increases from $8,324 for an 816-acre farm to $10,060 for the present farm size. This means an increase of $1,736 or 21 percent in operating capital required to attain a $12,000 income target.

The increase in cropland utilized by each crop activity is similar to percentage increase in minimum land requirement -- 21 percent. The cow-calf activity increases by eight head, and the buy-sell enterprise increases by another two head despite the change in increment on income level from $2,000 to $3,000.

$15,000 Return to Operator Labor and Management

Column nine, Table VIII, lists the minimum resource requirements and the combination of enterprises that provide a $15,000 return to operator labor and management.

The minimum land requirement to attain this income target is 1,199 acres. This is the maximum acreage that the available annual machinery and tractor hours can cover. A farm with more crop acres would require a larger machine complement than assumed in this study. The minimum land requirement for this $15,000 income level is 213 acres or about 22 percent greater than that required for a $12,000 income level organization.

The annual operator labor requirement is 834 hours. About 1,171 hours of hired labor are required. The annual operating capital requirement is $12,230.

The hired labor requirement shows a substantial increase -- 35 percent or 307 hours -- compared to that required for a $12,000 return to operator labor and management. The increase in the operating capital requirement is about 22 percent.

Cropland allocated to each of the crop activities increases proportionally with increase in minimum land requirement as farm size shifts from a $12,000 income target farm organization to that for a $15,000 income level. Cow-calf and buy-sell activities enter the plan at 56 and 16 head, respectively. The cow-calf enterprise has thus increased by 10 head, while the buy-sell activity increased by three head.

Bottomland Soils Minimum Resource Organizations, East Central Oklahoma

The program results of the minimum resource bottomland farm organizations for East Central Oklahoma are presented in Table IX. Analogous to upland soil resource situations in the East Central section of the study area, seven income levels are assumed for the bottomland farm organizations. These income levels are basically the same for the two soil resource situations. The minimum resource requirements to attain the respective income targets for the bottomland organizations are comparatively lower than those required for the upland farm organizations. The bottomland soil program results are presented below for each income level.

TABLE IX

ESTIMATED MINIMUM RESOURCE REQUIREMENTS TO OBTAIN SPECIFIED RETURNS TO OPERATOR LABOR AND MANAGEMENT, BOTTOMLAND SOILS, EAST CENTRAL OKLAHOMA

Item	Unit	Income Level[a]						
		$0.00[b]	$3,000	$5,000	$7,000	$9,000	$12,000	$15,000
Resources								
Total Land	Acre	135.00	336.00	436.00	505.00	609.00	748.00	922.00
Cropland	Acre	68.76	171.32	222.61	257.67	310.81	381.68	470.28
Operator Labor	Hour	171.14	426.40	554.03	607.31	666.57	745.58	844.38
Hired Labor	Hour	0.00	0.00	0.00	34.00	107.00	204.37	326.00
Land Capital	Dollar	22,275.00	55,440.00	71,940.00	83,325.00	100,485.00	123,420.00	152,130.00
Annual Capital	Dollar	1,661.42	4,139.67	5,378.34	6,225.38	7,509.58	9,221.86	11,362.21
Crops								
Grain Sorghum	Acre	17.93	44.68	58.05	67.19	81.06	99.54	122.64
Cotton	Acre	4.31	10.75	13.97	16.17	19.50	23.95	29.51
Peanuts	Acre	6.61	16.45	21.39	24.76	29.86	36.67	45.18
Wheat & Soybeans	Acre	2.29	5.71	7.42	8.59	10.36	12.72	15.68
Alfalfa	Acre	37.62	93.72	121.78	140.96	170.03	208.80	257.27
Livestock								
Spring Calf (On Native & Small Grain)	Head	6.00	15.00	19.00	23.00	27.00	33.00	41.00
Stockers (Buy Oct. 10-Sell Mar. 1)	Head	10.00	26.00	33.00	39.00	46.00	57.00	70.00
Gross Income	Dollar	9,428.98	23,491.43	30.522.02	35,329.64	42,617.65	52,335.00	64,481.69
Operating Expense	Dollar	5,211.12	13,008.20	16,901.79	19,614.88	23,760.41	29,287.33	36,195.64
Net Return	Dollar	4,207.86	10,483.23	13,620.23	15,714.76	18,857.24	23,047.67	28,286.05
Overhead Costs[c]	Dollar	4,207.86	4,483.23	4,620.23	4,714.76	4,857.24	5,047.67	5,286.05
Return to Land[d]	Dollar	1,113.75	2,772.00	3,597.00	4,166.25	5,024.25	6,171.00	7,606.50
Return to Operator Labor and Management	Dollar	-1,113.75	3,228.00	5,403.00	6,833.75	8,975.75	11,829.00	15,393.50

[a]Income level is defined as specified return to operator labor and management.

[b]The operator seeks minimum resources required to obtain enough income to pay overhead costs only.

[c]Overhead costs include maintenance and repair of buildings and livestock equipment, real estate taxes, machinery fixed costs, pickup truck expenses, telephone, bookkeeping and tax service, and insurance on buildings.

[d]Five percent of the [redacted].

$0.00 Return to Operator Labor and Management

The minimum resource requirements and enterprise combinations that can provide the return to overhead costs of the farm business only are presented in column three, Table IX. The minimum land requirement to obtain a $0.00 return to operator labor and management or the return to overhead costs is 135 acres. The annual operator labor requirement is 171 hours, while the hired labor requirement is at zero level. Annual operating capital requirement is $1,661.

Crop activities considered in this organization, and, in fact, in all seven bottomland minimum resource farm organizations, include grain sorghum, cotton, peanuts, wheat and soybeans double crop, and alfalfa. Grain sorghum and cotton are produced on B_2 soils while peanuts, wheat and soybeans double crop and alfalfa, respectively, are produced on B_1 land in all minimum resource bottomland organizations.

Livestock activities included in the organizations are cow-calf on native and small grain pastures and stocker buy-sell enterprises. The cow-calf activity is in the solution for the $0.00 income target farm organization at a level of six head, while the buy-sell activity is in the plan at the ten head level.

Although the crop and livestock activities considered are the same in all seven minimum resource bottomland farm organizations, the level at which each enterprise enters the solution varies with farm size.

$3,000 Return to Operator Labor and Management

The minimum land requirement to obtain a $3,000 return to operator labor and management is 336 acres (column 4, Table IX). From $0.00 to

$3,000 income target, the minimum land requirement has increased by 201 acres or by 149 percent.

The increase in farm size utilizes more operator labor. The operator labor requirement is 426 hours, an increase of 255 hours (149 percent) compared to operator labor required for a 135-acre farm. The hired labor requirement is zero, while the annual operating capital requirement is $4,140. Thus operating capital increases by $2,478 or 149 percent.

Each of the crop enterprises enters the solution at a level 149 percent higher than on a 135-acre farm. Cow-calf and buy-sell activities increased by nine and 16 units, respectively.

<u>$5,000 Return to Operator Labor and Management</u>

The minimum land requirement to attain a $5,000 return to operator labor and management is 436 acres (column 5, Table IX). The increase in the minimum land requirement is 100 acres or about 30 percent due to the change in income target from $3,000 to $5,000.

As farm size increases, the operator labor requirement increases from 426 hours for a 336-acre farm to 554 hours for a 436-acre farm. This is an increase of 128 hours or 30 percent. The hired labor requirement for this farm organization is zero hours. The annual operating capital requirement is $5,378. The percentage increase in capital requirement is identical to that for minimum land requirement (30 percent).

The level of cropland allocated to each crop activity has increased proportionally with the increase in land required for a $3,000 to a $5,000 return to operator labor and management. The cow-calf activity increases by four units, while a buy-sell enterprise increases by seven units.

$7,000 Return to Operator Labor and Management

The minimum land requirement to obtain a $7,000 return to operator labor and management is 505 acres (column 6, Table IX). This indicates an increase of 69 acres or about 16 percent meets the $2,000 increase in the income target.

The annual operator labor requirement is 607 hours. This means only 53 hours of operator labor is added to the amount required for a 436-acre farm. The hired labor requirement is 34 hours, and it is required in the January-April period. The annual operating capital requirement is $6,225. This increases by $847, or the same percentage increase as minimum land requirement.

As usual, cropland allocated to each crop enterprise increases by the same percentage as the increase in minimum land requirement. For example, cropland utilized by alfalfa is 140.96 acres in this organization. This is about 16 percent greater than the cropland acreage required by alfalfa on a 436-acre farm. Cow-calf and buy-sell enterprises increased by four and six units, respectively.

$9,000 Return to Operator Labor and Management

The minimum land requirement to obtain a $9,000 return to operator labor and management is 609 acres (column 7, Table IX). The minimum land requirement increases by 104 acres or by 21 percent as the income target is increased from $7,000 to $9,000.

The annual operator labor requirement is 667 hours while labor hired (which is for the period of January-April only) is 107 hours. The annual operating capital requirement is $7,510. With the increase in farm size, the operator labor requirement increases by only 59 hours, while hired labor increases by 73 hours. Annual operating capital has increased by $1,284 or by 21 percent.

Each of the crop enterprises are included in the solution at a higher level (about 21 percent) than is the case in a 505-acre farm. As farm size increases the cow-calf enterprise increases by four units, and the buy-sell activity by seven units.

<u>$12,000 Return to Operator Labor and Management</u>

The minimum land requirement to attain a $12,000 income level is 748 acres (column 8, Table IX). This shows an increase in the minimum acreage requirement of 139 acres or of 23 percent from acreage required to meet a $9,000 income level.

The increase in farm size also results in some increases in annual operator labor. The annual operator labor requirement is 746 hours. This is about 79 hours or 12 percent greater than operator labor required for a 609-acre farm. Hired labor needed for the present organization is 204 hours; and this is about 91 percent higher than that required for a $9,000 income target farm. The annual operating capital requirement is $9,222.

Cropland utilized by each crop enterprise increases by the same percentage as land -- 23 percent. The beef cow-calf activity increases by six units, while the buy-sell activity increases by 11 units as farm organization changes from one for a $9,000 to that for a $12,000 return to operator labor and management.

$15,000 Return to Operator Labor and Management

The minimum land requirement necessary to obtain a $15,000 return to operator labor and management is 922 acres (column 9, Table IX). The annual operator and hired labor requirements are 844 hours and 326 hours, respectively. Operating capital needed for this farm organization is $11,362.

The minimum land requirement increases by 174 acres or by 23 percent as the income target changes from $12,000 to $15,000. With the increase in farm size, the annual operator labor, hired labor, and operating capital has each increased by 99 hours, 122 hours, and $2,140, respectively.

Cropland utilized by grain sorghum is 122.64 acres. This is about 23 percent more cropland used by grain sorghum crop than existed on a 748-acre farm. Cropland allocations to cotton, peanuts, wheat and soybeans, and alfalfa enterprises, respectively, also increased by 23 percent. Cow-calf and buy-sell enterprises enter the solution at 41 and 70 head levels, respectively. This is an increase of eight head in the cow-calf activity and 13 head in the buy-sell activity.

Summary

The purpose of this chapter was to present estimates of the minimum resource requirements and combinations of enterprises that can provide specified levels of income for the farm family in the study area. The linear programming minimum resource model was utilized to estimate the farm size necessary to obtain specified income levels. Estimates of the minimum resource requirements and most profitable combinations of enterprises were made for alternative land resource situations.

For Northeastern Oklahoma, six minimum resource upland farm organizations were determined for the six income levels selected for this section of the study area. On the other hand, seven income levels were selected for East Central Oklahoma, and the minimum resource farm organizations were programmed separately for upland and bottomland resource situations for this section.

Each of the farm organizations contained minimum resource requirements and enterprise combinations that provide a specified return to operator labor and management after charges have been made for returns to land capital investment and overhead expenses. However, one exception was the farm organization which contained minimum resource requirements and enterprise combinations necessary to provide a return only to the overhead costs of the farm business.

Crop and livestock activities were the same in all six upland farm organizations in Northeastern Oklahoma. But the levels at which each activity entered each organization differed as farm size increased. For example, as farm size increased, changes occurred in the percentages of cropland planted to each crop enterprise. In essence, the level of cropland used by each crop activity increased proportionally with the increase in minimum land requirements. There was also no change in the type of soil used by each crop enterprise as a result of the increase in farm size.

The seven minimum resource farm organizations for upland and bottomland soils, respectively, in East Central Oklahoma have characteristics similar to those indicated above on upland farms in the Northeastern section. That is, crop and livestock activities considered were the same in all seven farm organizations for each land resource situation. And the level at which each enterprise entered each organization increased as farm size increased.

The minimum resource requirements to obtain any specified returns to operator labor and management tend to be larger on the upland farm organizations for Northeastern Oklahoma than for the upland farm organizations in the East Central section. Less capital and other resources (including land) are required to obtain each specified return to operator labor and management in the bottomland farm organizations. A realitively small amount of hired labor was required for each organization. Most of the labor utilized by each of the bottomland farm organizations was operator labor. Only a small amount of January-April labor was hired for each of the last four bottomland organizations with higher income targets, i.e., for organizations with $7,000, $9,000, $12,000, $15,000 income levels, the amounts of labor hired were 34, 107, 204, and 326 hours, respectively.

Bottomland soil farm organizations (with less minimum resource requirements to obtain the specified income levels) appear to be more profitable. It is apparent that minimum resource requirements to obtain each return to operator labor and management are affected by factors such as enterprise combinations and high profitability of cotton, peanuts and stocker buy-sell activities.

The results of the two linear programming models (maximization and minimum resource models) compare quite closely in regard to enterprises considered. Crop and livestock enterprises selected are the same for the representative farms and the minimum resource farms. However, with the increased labor requirements of the minimum resource farm organizations, some enterprises were not combined in the same proportions as the comparable representative farms.

One might ask, to what extent do the results of the two models compare as a means for making individual farm adjustments? The differences found in individual farm organizations provide the answer to this question. Some resources (land in particular) are fixed in the maximization model while all resources are variable in the minimum resource model. Hence, given relevant income goals and a land-based type of agriculture, the minimum resource model seems more appropriate in considering individual farm adjustments over time.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The basic objectives of this study were (a) to determine the optimum organization of representative farms under alternative soil resource situations for Northeastern and East Central Oklahoma, and (b) to determine the minimum resource requirement and combinations of enterprises that can provide specified levels of return to operator labor and management. The decision models of the farm firm utilized to examine the individual farm adjustments were (1) the linear programming maximization model and (2) the linear programming minimum resource model.

The soil resource situations considered in the study area included both upland and bottomland soils. The soils were combined into four general groups, and each of these four groups were further divided into productivity classes based on the slope, productivity, and other characteristics of the land. The upland soils were divided into (a) loamy with moderately permeable and permeable subsoil; (b) loamy with very permeable subsoil, and (c) sandy soils. The fourth group was the bottomland soils. Some of the soil classes have comparable yields, while the yields varied in others due to differences in permeability and the slope characteristics.

A representative farm for the alternative soil resource situations was specified for the maximization model. A representative farm was not regarded as a typical farm in the area; rather it was defined as a farm which incorporates the characteristics of a group of farms. With different combinations of upland and bottomland soils for the representative farms, the programmed plans were quite representative of most farms in the area particularly with regard to requisite adjustment opportunities. For each soil resource situation for the minimization model, each acre of land contained the same proportions of each soil productivity class, cropland, native pasture, and allotments as the representative farm.

Crop enterprises which were considered in determining the optimal organizations for the two models included grain sorghum, cotton, peanuts, soybeans, wheat, and alfalfa. Livestock activities included cow-calf and stocker buy-sell enterprises.

Estimates of prices paid and received by farmers were based on 1969 prices in the study area. The estimates of cotton, peanut, and wheat allotments were based on current (1970) programs.

Farm Adjustment Results

Optimum farm organizations were obtained for alternative cropland combinations using the linear programming maximization model and the linear programming minimum resource model. With given resources and enterprises to be considered, the maximization model was used to determine the most profitable resource and enterprise combinations for the representative farms. The minimum resource model -- with land as the resource to minimize -- was utilized to determine the minimum resource requirements and combinations of enterprises to attain specified levels of income for the farm family in the study area.

Maximization Model

The optimal organization was presented for each of the six representative farms in the study area. Two of these represent Northeastern Oklahoma, while the remaining four are for the East Central section.

Crop and livestock enterprises were the same in the two representative farm organizations for the Northeastern section except for alfalfa which was included whenever bottomland was included in the soils on the farm. Cotton and wheat were included in both optimum plans at the same levels. Wheat entered each solution at the maximum allotment acreage, while cotton was limited to the minimum acreage necessary to receive the maximum price support.

With the change in soil resources from all upland to a combination of upland and bottomland, changes occurred in the most profitable combination of other resources and enterprises. Thus, the net return to operator land, labor, management, and overhead for the organization with 57 percent upland and 43 percent bottomland increased by 19 percent. It was evident, therefore, that the organization with some bottomland soils was more profitable than one with upland soils only. However, estimated flood losses have not been deducted from the net returns. The flood damages would naturally decrease the net return for the optimum farm organization.

For East Central Oklahoma, crop and livestock activities included in the four optimal representative farm organizations were identical. However, the level of each enterprise in the organization and the level of net return were different.

Cotton and peanuts are included in each optimal plan at constant levels. Peanuts are a highly profitable enterprise, and account for an increase in income for each organization. The wide stability ranges of net returns per unit for peanuts reflect its strong position in the optimal plans.

The results of the maximization model indicate that the degree of potential farm adjustment varied substantially with specific resource situations. Net returns and returns to operator labor and management increase as the percentage of bottomland in each organization increases. Return to operator labor and management is rather small for the organization with all available cropland in upland soils. Factors such as high profitability of peanuts and livestock enterprises have some effect on net returns. The differences in net returns between representative farms in the Northeastern and East Central sections reflect the differences in farm size as well as type and levels of enterprises considered in each organization.

The returns maximized in the maximization model are rather small after deductions of the charges to land investment, land taxes, and overhead expenses. The results of the maximization model thus raise the question of what is an adequate farm size to provide enough income for family living.

Minimization Model

The minimum resource requirements to obtain specified levels of return to operator labor and management are determined for alternative land resource situations in Northeastern and East Central Oklahoma. In contrast with the assumptions for the maximization model, all resources (including land) are assumed variable in the minimization model.

Six minimum resource upland farm organizations were programmed for Northeastern Oklahoma. The specified levels of return to operator labor and management were $0.00, $3,000, $5,000, $7,000, $9,000, and $12,000. The minimum resource requirements to obtain each of the six income levels ranged from 171 acres of land and $1,780.46 of annual operating capital for $0.00 (or $4,257.18 return to overhead costs) to 1,183 acres of land and $12,332.23 of operating capital for $12,000 income level.

Crop and livestock enterprises were the same in all six optimal solutions. The level of cropland required by each crop activity increased proportionately with the increase in minimum land requirement; and, there was no change in the soil class utilized by each crop enterprise as a result of the increase in farm size. Grain sorghum, cotton, soybeans, and wheat soybeans double crop were the crop activities included in the optimal solutions. Livestock activities considered were cow-calf and stocker buy-sell enterprises.

Seven optimal minimum resource organizations were obtained separately for upland and bottomland soils in the East Central section. The levels of return to operator labor and management ranged from $0.00 to $15,000.

The minimum resource requirements to obtain each of the income targets for the upland farms ranged from 157 acres of land and $1,598.52 of annual operating capital for $0.00 (or $4,238.00 return to overhead costs) to 1,199 acres of land and $12,230.13 operating capital for $15,000 income level. For the bottomland organizations, the range in minimum resource requirements were from 135 acres of land and $1,651.42 of annual operating capital for $0.00 (or $4,207.86 return to overhead costs) to 922 acres of land and $11,362.21 operating capital for the $15,000 income target.

Crop and livestock activities included in the seven organizations for each land situation were the same except for alfalfa which was added to other crop enterprises in the bottomland farms. But the levels at which each enterprise entered each organization increased as farm size increased.

The minimum resource requirements to obtain each of the specified returns to operator labor and management were larger on upland farms than on bottomland farms. Relatively less capital and other resources were required for each of the bottomland farm organizations. Analogous to the maximization model, the high profitability of peanut and livestock activities was apparent in minimum resource bottomland farms.

Although the results of the maximization model and the minimization model compared quite closely in regards to enterprises considered, differences occurred in enterprise combinations, resource use, and in net returns. Estimated net returns of the representative farms were affected in part by restrictions imposed on land resource. As all resources were variable (including land) in the minimum resource model, an adequate farm size could be obtained to derive sufficient income for the farm family.

Implications of the Results

The programming analysis of this study was developed from input-output coefficients, costs and prices, resource situations, level of technology, and other constraints applicable to Northeastern and East

Central Oklahoma. Because of these factors, the results of this study have direct application to this study area.

The results of the study indicate that alfalfa has a relative advantage on bottomland soils, while cultivated crops (e.g., grain sorghum, soybeans, etc.) and wheat have the relative advantage on upland soils.

Farmers who have favorable soil resource situations, managerial ability, and allotment can plant peanuts more profitably than other crops. Grain sorghum production is also a profitable alternative when both the value of the grain and the stubble for grazing is considered. Producing cotton and selling at the market price (with no support payment) is not as profitable as other crop alternatives.

The profit maximization model is a useful analytical tool to determine the most profitable enterprise combination on part-time farms. The minimum resource model is a more appropriate procedure to determine the size of unit needed to provide a specified farm income level for part-time farms. The procedure is flexible enough to permit incorporating returns to other fixed resources in meeting the income target. Factors such as the equity level, yields, interest rate, off-farm employment and land appreciation affect the expected farm size. However, the minimum resource model is capable of evaluating the effect of each of these factors.

Among the assumptions made for this study is that the farm operator owns some of the resources utilized on the farm. Further research is thus needed to determine how a farm family in the study area, without any resources (including land), can acquire sufficient resources requisite for part-time farming to obtain additional income.

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APPENDIX

TABLE X

DEFINITION OF SOILS AND YIELDS IN EACH PRODUCTIVITY CLASS FOR UPLAND AND BOTTOMLAND, NORTHEASTERN AND EAST CENTRAL OKLAHOMA

Class L_1. This class includes deep, nearly level, loamy, well-drained soils. Examples of the soil series representative of this class are Choteau silty loam, Dennis silty loam, Newtonia silty loam, Okemah silty loam, and Vanoss silty loam or loam as well as other moderately permeable and permeable subsoils.

Class L_2. Soils in this class are moderately deep, very gently sloping and well-drained. Key series in this class include Bates loam, Choteau silty loam, Dennis silty loam and others in L_1 class.

Class L_3. This class includes deep, loamy moderately well-drained steeper sloping soils. Soil series of this class are the same as in class L_1, except that it does not have Okemah but has Bates silty loam.

Class P_1. This grouping includes nearly level, loamy, somewhat poorly drained upland soils. Among the few soil series in this class are Parsons silty loam, and Taloka silty loam as well as other very slowly permeable subsoils.

Class P_2. This class is similar to class P_1 except that the soils are gently sloping with 1-3 percent slope.

Class S_2. Soils in this class are moderately deep, loamy, and well-drained sandy soils on uplands. Among the few examples of this soil series are Hartsells fine sandy loam, Konawa fine sandy loam, and Linker fine sandy loam.

Class S_3. This class is similar to S_2 except that the soils are deeper in slope and subject to somewhat severe water erosion.

Class B_1. This class includes deep, nearly level, well-drained, loamy alluvial soils. Examples of the soil series representative of this class are Kaw silty clay loam, Reinach, Verdigris clay loam, Yahola clay loam, and Mason silty or clay loam.

Class B_2. In this class are deep, somewhat poorly drained, nearly level soils on bottomlands. They are flooded occasionally, but for only a few hours at a time. Soil series in this class include Lightning silty loam, Osage clay, and Roebuck clay.

TABLE X (Continued)

Enterprise[a]	Unit	Productivity Class								
		L_1	L_2	L_3	P_1	P_2	S_2	S_3	B_1	B_2
Cotton (Lint)	Cwt.	4.50	4.0	b	3.75	3.0	4.50	3.0	4.50	3.60
Cotton (Seed)	Ton	0.356	0.316	b	0.296	0.237	0.356	0.237	0.356	0.284
Grain Sorghum	Cwt.	36.40	33.60	25.20	30.80	28.00	33.60	28.00	42.00	36.40
Soybeans	Bu.	30.0	27.0	b	27.0	24.0	26.0	22.0	32.0	24.0
Wheat	Bu.	35.0	32.0	28.0	35.0	29.0	35.0	30.0	35.0	27.0
Barley	Bu.	47.0	43.0	37.0	47.0	39.0	47.0	40.0	47.0	36.0
Oats	Bu.	58.0	53.0	46.0	58.0	48.0	58.0	50.0	58.0	45.0
Peanuts	Cwt.	18.0	17.0	b	16.0	15.0	20.0	12.0	17.0	b
Peanut Hay	Ton	1.0	0.9	b	0.9	0.8	1.1	0.7	0.9	b
Wheat and Soybeans	Bu.-Wheat	30.0	27.0	b	30.0	25.0	30.0	26.0	30.0	23.0
	Soybeans	23.0	21.0	b	21.0	18.0	20.0	17.0	24.0	18.0
Bermuda Grass	AUM	6.0	5.0	4.0	4.5	4.5	4.5	3.0	6.5	3.5
Alfalfa	Ton	3.5	3.0	b	b	b	3.0	b	4.5	b

[a]Fertilizer rates and machinery operations are specified in individual enterprise budgets. Yield of native pasture over all productivity classes is estimated to be 1.0 AUM per acre.

[b]The enterprise is not considered suitable for the productivity class.

TABLE XI

ESTIMATED PRODUCTION REQUIREMENTS AND INCOME FOR BEEF COW HERD (25-COW UNIT); CALVES BORN MARCH 1; NOT CREEP FED; WINTER RATION OF COTTONSEED CAKE, HAY AND PASTURE: SELLING GOOD-CHOICE FEEDER CALVES OCTOBER 10

(1) Livestock Investment

Item	Head	Animal Units	Value Per Head	Total Value
Brood Cows	25	25	175.00	4,375.00
Bulls	1	1	325.00	325.00
Heifers Over One Year	4	2	130.00	520.00
Calves Weaned	22	--	--	
				5,220.00

(2) Production

Item	Head (No.)	Wt. (Lbs.)	Prices (Dol./Cwt.)	Value Per Head (Dol.)	Total Value (Dol.)
Steer Calves	11	485	28.30	137.26	1,509.86
Heifer Calves	7	460	24.39	112.19	785.33
Cull Cows	3	987	14.97	147.75	443.25
Cull Yearling Heifers	1	900	16.11	144.99	144.99
Death Loss[a]					-125.28
					2,758.15

(3) Annual Inputs

Item	Unit	Rate	Number	Total	Price	Total Value
Pasture	AUM	12.00	28.0	336.0		
CSC	Cwt.	1.2	28.0	33.6	3.80	127.68
Hay Cost	Ton	0.67	28.0	18.76	8.46[d]	157.58
Minerals and Salt	Lb.	30.00	28.0	840.00	0.30	25.20
Vet. and Med.	Dol.	2.00	28.0	56.00		56.00
Bull Depreciation	Dol.	35.00	1.0	35.00		35.00
Hauling and Marketing	Cwt.			124.16	0.50	62.08
Taxes[b]	Dol.					52.25

TABLE XI (Continued)

(3) Annual Inputs (Cont.)

Item	Unit	Rate	Number	Total	Price	Total Value
Miscellaneous Costs[c]	Dol.					153.75
Annual Int. on Capt.	Dol.			6,401.24	0.08	512.10
(4) Total Specified						1,181.64
(5) Returns to Land, Labor and Management						1,576.51

Labor Requirements (Man Hr./Cow)				
Jan.-Apr.	May-July	Aug.-Sept.	Oct.-Dec.	Total
8.29	0.92	0.32	1.86	11.39

Annual Capital Requirements (Dol.)	
Operating Capital	247.02
Fixed Capital	6,154.22

[a]An annual average death loss is assumed 2.40 percent among cows and replacement heifers.

[b]Tax is based upon a rate prepared for estimates made by the Oklahoma Tax Commission.

[c]Miscellaneous costs reflect the annual cost for depreciation and maintenance on barns, fences and corrals.

[d]This is a baling cost. The budget requires hay fed to be produced from excess pasture. (It is a common practice to bale excess forage from bermuda during the late spring when the bermuda is making very rapid growth.) This item is designated Hay Cost to distinguish it from Hay Purchase.

TABLE XII

ESTIMATED PRODUCTION REQUIREMENTS AND INCOME FOR BEEF COW HERD (25-COW UNIT); CALVES BORN MARCH 1; NOT CREEP FED; WINTER RATION OF COTTONSEED CAKE AND HAY (SUBSTITUTED FOR PASTURE); SELLING GOOD-CHOICE FEEDER CALVES OCTOBER 10

(1) Livestock Investment

Item	Head	Animal Units	Value Per Head	Total Value
Brood Cows	25	25	175.00	4,375.00
Bulls	1	1	325.00	325.00
Heifers Over One Year	4	2	130.00	520.00
Calves Weaned	22	--		
				5,220.00

(2) Production

Item	Head (No.)	Wt. (Lbs.)	Prices (Dol./Cwt.)	Value Per Head (Dol.)	Total Value (Dol.)
Steer Calves	11	485	28.30	137.26	1,509.86
Heifer Calves	7	460	24.39	112.19	785.33
Cull Cows	3	987	14.97	147.75	443.25
Cull Yearling Heifers	1	900	16.11	144.99	144.43
Death Loss[a]					-125.28
					2,758.15

(3) Annual Inputs

Item	Unit	Rate	Number	Total	Price	Total Value
Pasture	AUM	10.0	28.0	280.0		
CSC	Cwt.	1.2	28.0	33.6	3.80	127.68
Hay	Ton	0.90	28.0	25.2	18.00[d]	453.60
Minerals & Salt	Lb.	30.00	28.0	840.0	0.03	25.20
Vet. & Med.	Dol.	2.00	28.0	56.0		56.00
Bull Depreciation	Dol.	35.00	1.0	35.00		35.00
Hauling and Marketing	Cwt.			121.46	0.50	60.73

TABLE XII (Continued)

(3) Annual Inputs (Cont.)

Item	Unit	Rate	Number	Total	Price	Total Value
Taxes[b]	Dol.					52.25
Miscellaneous Costs[c]	Dol.					179.46
Annual Int. on Capt.	Dol.			6,678.60	0.80	534.29

(4) Total Specified Costs 1,524.21

(5) Returns to Land, Labor, and Management 1,233.94

Labor Requirements (Man Hr./Cow)				
Jan.-Apr.	May-July	Aug.-Sept.	Oct.-Dec.	Total
9.11	0.92	0.32	2.06	12.41

Annual Capital Requirements (Dol.)	
Operating Capital	345.36
Fixed Capital	6,333.24

[a]An annual average death loss is assumed 2.40 percent among cows and replacement heifers.

[b]Tax is based upon a rate prepared for estimates made by the Oklahoma Tax Commission.

[c]Miscellaneous costs reflect the annual cost for depreciation and maintenance on barns, fences and corrals.

[d]This is a baling cost. The budget requires hay fed to be produced from excess pasture. (It is a common practice to bale excess forage from bermuda during the late spring when the bermuda is making very rapid growth.) This item is designated Hay Cost to distinguish it from Hay Purchase.

TABLE XIII

ESTIMATED PRODUCTION REQUIREMENTS AND INCOME FOR BEEF COW HERD (25-COW UNIT); CALVES BORN MARCH 1; NOT CREEP FED; WINTER RATION OF COTTONSEED CAKE, HAY AND PASTURE WITH SOME SMALL GRAIN PASTURE; SELLING GOOD-CHOICE FEEDER CALVES OCTOBER 10

(1) Livestock Investment

Item	Head	Animal Units	Value Per Head	Total Value
Brood Cows	25	25	175.00	4,375.00
Bulls	1	1	325.00	325.00
Heifers Over One Year	4	2	130.00	520.00
Calves Weaned	22	--		
				5,220.00

(2) Production

Item	Head (No.)	Wt. (Lbs.)	Prices (Dol./Cwt.)	Value Per Head (Dol.)	Total Value (Dol.)
Steer Calves	11	485	28.30	137.26	1,509.86
Heifer Calves	7	460	24.39	112.19	785.33
Cull Cows	3	987	14.97	147.75	443.25
Cull Yearling Heifers	1	900	16.11	144.99	144.99
Death Loss[a]					-125.28
					2,758.15

(3) Annual Inputs

Item	Unit	Rate	Number	Total	Price	Total Value
Pasture	AUM	9.5	28.0	266.0		
Small Grain Pasture	AUM	2.5	28.0	70.0		
CSC	Cwt.	0.73	28.0	20.44	3.80	77.67
Hay Cost	Ton	0.26	28.0	7.28	8.40[d]	61.15
Minerals & Salt	Lbs.	30.0	28.0	840.00	0.03	25.20
Vet. and Med.	Dol.	2.0	28.0	56.00		56.00
Bull Depreciation	Dol.	35.0	1.0	35.00		35.00

TABLE XIII (Continued)

(3) Annual Inputs (Cont.)

Item	Unit	Rate	Number	Total	Price	Total Value
Hauling and Marketing	Cwt.			124.16	0.50	62.08
Taxes[b]	Dol.					52.25
Miscellaneous Costs[c]	Dol.					120.23
Annual Int. on Capt.	Dol.			5,957.84	0.08	476.63
(4) Total Specified Costs						966.21
(5) Returns to Land, Labor, and Management						1,761.94

Labor Requirements (Man Hr./Cow)					Annual Capital Requirements (Dol.)	
Jan.-Apr.	May-July	Aug.-Sept.	Oct.-Dec.	Total	Operating Capital	126.59
9.11	0.86	0.88	2.52	13.37	Fixed Capital	5,831.25

[a]An annual average death loss is assumed 2.40 percent among cows and replacement heifers.

[b]Tax is based upon a rate prepared from estimates made by the Oklahoma Tax Commission.

[c]Miscellaneous costs reflect the annual cost for depreciation and maintenance on barms, fences and corrals.

[d]This is a baling cost. The budget requires hay fed to be produced from excess pasture. (It is a common practice to bale excess from bermuda during the late spring when the bermuda is making very rapid growth.) This item is designated <u>Hay Cost</u> to distinguish it from Hay Purchase.

TABLE XIV

ESTIMATED PRODUCTION REQUIREMENTS AND INCOME FOR WINTER PASTURING GOOD STOCKER CATTLE; FALL BUY OCTOBER 10; WINTERED ON SMALL GRAIN PASTURE WITH HAY, COTTONSEED CAKE, AND PASTURE IN BAD WEATHER: SELL MARCH 1

(1)	Livestock Investment				
	Item	Unit	Amount	Price	Total Value
	Calf	Cwt.	4.50	28.30	127.35
(2)	Production				
	Item				
	Feeder	Cwt.	6.15	24.76	152.27
	Less 1% Death Loss				-1.52
	Total				150.75
(3)	Annual Inputs				
	Item				
	Calf	Cwt.	4.50	28.30	127.35
	Small Grain Pasture	AUM	2.2		
	Pasture	AUM	0.20		
	Hay	Ton	0.15	18.00	2.70
	CSC	Cwt.	0.20	3.80	0.76
	Vet. & Med.	Dol.			1.00
	Minerals	Lb.	6.0		0.18
	Hauling and Marketing	Cwt.	6.15		3.10
	Taxes	Dol.	20.00	0.05	1.00
	Miscellaneous Costs	Dol.			1.48
	Annual Int. On Capt.	Dol.	71.31	0.08	5.71
(4)	Total Specified Costs				143.28
(5)	Returns to Land, Labor, and Management				7.47

Labor Requirements (Man Hr./Cow)

Jan.-Apr.	May-July	Aug.-Sept.	Oct.-Dec.	Total
0.90	--	--	0.94	1.84

Annual Capital Requirements (Dol.)

Operating Capital	64.72
Fixed Capital	6.59

TABLE XV

ESTIMATED PRODUCTION REQUIREMENTS AND INCOME FOR PASTURING GOOD STOCKER CATTLE; FALL BUY OCTOBER 10; ROUGHED THROUGH WINTER ON COTTONSEED CAKE, HAY, AND PASTURE; SUMMER GRAZE ON PASTURE AND SELL AUGUST 10

(1)	Livestock Investment				
	Item	Unit	Amount	Price	Total Value
	Calf	Cwt.	4.50	28.30	127.35
(2)	Production				
	Item				
	Feeder	Cwt.	7.16	24.78	177.43
	Less 1% Death Loss				-1.77
	Total				175.66
(3)	Annual Inputs				
	Item				
	Calf	Cwt.	4.50	28.30	127.35
	Pasture	AUM	5.8		
	CSC	Cwt.	1.0	3.80	3.80
	Hay Cost	Ton	0.37	8.40	3.11
	Vet. and Med.	Dol.	0.80		0.80
	Minerals	Lb.	16.0	0.03	0.48
	Hauling and Marketing	Cwt.	7.16	0.50	3.58
	Taxes	Dol.	20.00	0.05	1.00
	Miscellaneous Costs	Dol.			3.01
	Annual Int. On Capt.	Dol.	120.08	0.08	9.61
(4)	Total Specified Costs				152.74
(5)	Returns to Land, Labor, and Management				22.92

Labor Requirements (Man Hr./Stocker)

Jan.-Apr.	May-July	Aug.-Sept.	Oct.-Dec.	Total
1.90	0.65	0.26	1.03	3.84

Annual Capital Requirements (Dol.)

Operating Capital	102.87
Fixed Capital	17.21

TABLE XVI

ASSUMED ANNUAL OVERHEAD COSTS FOR A REPRESENTATIVE FARM IN NORTHEASTERN AND EAST CENTRAL OKLAHOMA

Item	Annual Cost
I. Depreciation and Maintenance	
Buildings[a]	$ 261.00
Livestock Equipment	
Permanent Fencing[b]	219.84
Temporary Fencing[c]	14.00
Feed Troughs and Corrals	18.30
II. Machinery Fixed Costs	
2 - 4 Plow, Tractor and Equipment	2,491.61
Shop Tools	50.00
Pickup Truck[d]	
Interest on Investment	75.00
Depreciation	305.00
Gas, Oil, Lubrication	405.00
Repairs	105.00
Insurance (Liability Only)	25.00
Butane Storage Tank (500 Gal.)	8.00
Grain Auger and 4-Wheel Trailer	51.00
III. Taxes	
Land[e]	
Pickup Truck (License)	13.00
IV. Miscellaneous	
Telephone	75.00
Bookkeeping and Tax Service	40.00
Insurance on Buildings and Workers	100.00
Total Overhead Costs	$4,256.75

[a]Assumes a 20 ft. x 20 ft. farm shop, a 30 ft. x 50 ft. pole type shed (open on one side), and two 1,000-bushel metal grain bins.

[b]Assumes a 4-wire barbed fence with three cross fences on 1/2-section of land.

[c]Assumes enough wire and posts for one mile of temporary fence.

[d]Odell L. Walker, Machinery Combinations for Oklahoma Panhandle Grain Farms, Oklahoma State University, Agricultural Experiment Station Bulletin B-630 (Stillwater, 1964).

[e]Land tax in this area is assumed $1.00 per acre. It is not included in Total Overhead figure because of the variation in size of farm in the two sections of the study area.

TABLE XVII

PROFIT MAXIMIZATION LINEAR PROGRAMMING MATRIX FOR BOTTOMLAND SOILS IN REPRESENTATIVE FARM, EAST CENTRAL OKLAHOMA

	Unit	Wheat on B_1	Wheat on B_2	Barley on B_1	Barley on B_2	Oats on B_1	Oats on B_2	Grain Sorghum on B_1	Grain Sorghum on B_2	Cotton on B_1	Cotton on B_2	Peanuts on B_1	Soybeans on B_1	Soybeans on B_2
Objective Function		-25.84	-25.28	-25.55	-24.78	-28.42	-27.51	-33.67	-32.97	-86.36	-76.99	-89.61	-27.48	-26.92
Bottomland B_1	Acres	1.00	—	1.00	—	1.00	—	1.00	—	1.00	—	1.00	1.00	—
Bottomland B_2	Acres	—	1.00	—	1.00	—	1.00	—	1.00	—	1.00	—	—	1.00
Native Pasture	AUM	—	—	—	—	—	—	—	—	—	—	—	—	—
Cotton Allotment	Acres	—	—	—	—	—	—	—	—	1.00	1.00	—	—	—
Peanut Allotment	Acres	—	—	—	—	—	—	—	—	—	—	1.00	—	—
Wheat Allotment	Acres	1.00	1.00	—	—	—	—	—	—	—	—	—	—	—
Jan.-Apr. Labor	Hours	0.05	0.05	0.05	0.05	0.05	0.05	0.85	0.85	1.63	1.63	0.93	1.13	1.13
May-July Labor	Hours	0.33	0.33	0.33	0.33	0.33	0.33	0.75	0.75	0.96	0.96	1.29	0.82	0.82
Aug.-Sept. Labor	Hours	0.98	0.98	0.98	0.98	0.98	0.98	—	—	—	—	—	—	—
Oct.-Dec. Labor	Hours	0.32	0.32	0.32	0.32	0.32	0.32	0.49	0.49	—	—	—	—	—
Annual Capital	Dol.	13.00	13.00	12.15	12.15	13.73	13.73	15.89	15.89	24.51	24.51	38.07	13.63	13.63
Small Grain Grazing (One Season)	AUM	-0.90	-0.70	-0.90	-0.70	-0.90	-0.70	—	—	—	—	—	—	—
Wheat Certificate	Acres	-1.00	-1.00	—	—	—	—	—	—	—	—	—	—	—
Limit on Wheat Certificate	Acres	—	—	—	—	—	—	—	—	—	—	—	—	—
Wheat Production	Bu.	-35.00	-27.00											
Barley Production	Bu.			-47.00	-36.00									
Oats Production	Bu.					-58.00	-45.00							
Grain Sorghum Production	Cwt.							-42.00	-36.40					
Cotton Production (Lint)	Cwt.									-4.50	-3.60			
Cotton Production (Seed)	Ton									-0.356	-0.284			
Peanut Production	Cwt.											-17.00		
Prairie and Peanut Hay	Ton											-0.90		
Soybeans Production	Bu.												-32.00	-24.00
Alfalfa Production	Ton													
Steer Calf Production	Cwt.													
Heifer Calf Production	Cwt.													
Stocker (450 Lb.)	Head													
Cull Cow Production	Cwt.													
Cull Yearling Heifer Production	Cwt.													
Mar. 1 Stockers	Cwt.													
Aug. 10 Stockers	Cwt.													
Cotton Payment	Acre													
Limit on Cotton Payment	Acre													

TABLE XVII (Continued)

	Unit	Wheat and Soybeans on B_1	Wheat and Soybeans on B_2	Alfalfa on B_1	Bermuda Grass on B_1	Bermuda Grass on B_2	Wheat Certi-ficate Sell	Cow-Calf on CSC, Hay and Pasture	Cow-Calf on CSC and Hay (Substituted for Pasture)	Cow-Calf on Native and Small Grain Pasture
Objective Function		-50.01	-49.10	-56.81	-8.80	-14.26	48.64	-25.06	-26.03	-21.72
Bottomland B_1	Acres	1.00	---	1.00	1.00	---	---			
Bottomland B_2	Acres	---	1.00	---	---	1.00	---			
Native Pasture	AUM	---	---	---	-6.50	-3.50	---	13.44	11.20	10.64
Cotton Allotment	Acres	---	---	---	---	---	---			
Peanut Allotment	Acres	---	---	---	---	---	---			
Wheat Allotment	Acres	1.00	1.00	---	---	---	---			
Jan.-Apr. Labor	Hours	0.05	0.05	0.05	0.16	0.16	---	8.29	9.11	9.11
May-July Labor	Hours	0.97	0.97	---	0.39	0.39	---	0.92	0.92	0.86
Aug.-Sept. Labor	Hours	1.70	1.70	---	---	---	---	0.32	0.32	0.88
Oct.- Dec. Labor	Hours	0.16	0.16	---	---	---	---	1.86	2.06	2.52
Annual Capital	Dol.	25.21	25.21	9.32	9.77	9.77	---	9.88	13.81	5.06
Small Grain Grazing (One Season)	AUM	-0.80	-0.60	-1.00	---	---	---			2.80
Wheat Certificate	Acres	-1.00	-1.00	---	---	---	1.00			
Limit on Wheat Certificate	Acres	---	---	---	---	---	1.00			
Wheat Production	Bu.	-30.00	-23.00							
Barley Production	Bu.									
Oats Production	Bu.									
Grain Sorghum Production	Cwt.									
Cotton Production (Lint)	Cwt.									
Cotton Production (Seed)	Ton									
Peanut Production	Cwt.									
Prairie and Peanut Hay	Ton							0.75	1.00	0.29
Soybeans Production	Bu.	-24.00	-18.00							
Alfalfa Production	Ton			-4.50						
Steer Calf Production	Cwt.							-2.20	-2.20	-2.20
Heifer Calf Production	Cwt.							-1.29	-1.29	-1.29
Stocker (450 Lb.)	Head									
Cull Cow Production	Cwt.							-1.20	-1.20	-1.20
Cull Yearling Heifer Production	Cwt.							-0.36	-0.36	-0.36
Mar. 1 Stockers	Cwt.									
Aug. 10 Stockers	Cwt.									
Cotton Payment	Acres									
Limit on Cotton Payment	Acres									

TABLE XVIII (Continued)

	Unit	Stockers Oct. 10–Mar. 1	Stockers Oct. 10–Aug. 10	Wheat Production Sell	Barley Production Sell	Oats Production Sell	Grain Sorghum Production Sell	Cotton Production Sell	Peanuts Production Sell	Soybeans Production Sell	Alfalfa Production Sell
Objective Function		-7.52	-12.67	1.25	0.80	0.70	1.85	18.50	12.00	2.30	22.50
Bottomland B_1	Acres										
Bottomland B_2	Acres										
Native Pasture	AUM	0.20	5.80								
Cotton Allotment	Acres										
Peanut Allotment	Acres										
Wheat Allotment	Acres										
Jan.-Apr. Labor	Hours	0.90	1.90								
May-July Labor	Hours	---	0.65								
Aug.-Sept. Labor	Hours	---	0.26								
Oct.-Dec. Labor	Hours	0.94	1.03								
Annual Capital	Dol.	56.48	94.63								
Small Grain Grazing (One Season)	AUM	2.20									
Wheat Certificate	Acres										
Limit on Wheat Certificate	Acres										
Wheat Production	Bu.			1.00							
Barley Production	Bu.				1.00						
Oats Production	Bu.					1.00					
Grain Sorghum Production	Cwt.						1.00				
Cotton Production (Lint)	Cwt.							1.00			
Cotton Production (Seed)	Ton										
Peanut Production	Cwt.								1.00		
Prairie and Peanut Hay	Ton	0.15	0.37								
Soybeans Production	Bu.									1.00	
Alfalfa Production	Ton										1.00
Steer Calf Production	Cwt.										
Heifer Calf Production	Cwt.										
Stocker (450 Lb.)	1.00	1.00									
Cull Cow Production	Cwt.										
Cull Yearling Heifer Production	Cwt.										
Mar. 1 Stockers	Cwt.	-6.09									
Aug. 10 Stockers	Cwt.		-7.09								
Cotton Payment	Acres										
Limit on Cotton Payment	Acres										

TABLE XVII (Continued)

	Unit	Borrowed Capital	Transfer Steers to Stockers	Transfer Heifers to Stockers	Sell Steers	Sell Heifers	Buy Stockers	Sell Cull Cows	Sell Yearling Heifers	Sell Stockers Mar. 1	Sell Stockers Aug. 10	Sell Cotton Seed	Cotton Payment Sell
Objective Function		-0.08	0.00	0.00	28.30	24.39	-129.60	14.97	16.11	24.76	24.78	48.00	64.78
Bottomland B_1	Acres												
Bottomland B_2	Acres												
Native Pasture	AUM												
Cotton Allotment	Acres												
Peanut Allotment	Acres												
Wheat Allotment	Acres												
Jan.-Apr. Labor	Hours												
May-July Labor	Hours												
Aug.-Sept. Labor	Hours												
Oct.-Dec. Labor	Hours												
Annual Capital	Dol.	-1.00											
Small Grain Grazing (One Season)	AUM												
Wheat Certificate	Acres												
Limit on Wheat Certificate	Acres												
Wheat Production	Bu.												
Barley Production	Bu.												
Oats Production	Bu.												
Grain Sorghum Production	Cwt.												
Cotton Production (Lint)	Cwt.												
Cotton Production (Seed)	Ton											1.00	
Peanut Production	Cwt.												
Prairie and Peanut Hay	Ton												
Soybeans Production	Bu.												
Alfalfa Production	Ton												
Steer Calf Production	Cwt.		4.85		1.00								
Heifer Calf Production	Cwt.			4.60		1.00							
Stocker (450 Lb.)	Head		-1.00	-1.00			-1.00						
Cull Cow Production	Cwt.							1.00					
Cull Yearling Heifer Production	Cwt.								1.00				
Mar. 1 Stockers	Cwt.									1.00			
Aug. 10 Stockers	Cwt.										1.00		
Cotton Payment	Acres												1.00
Limit on Cotton Payment	Acres												1.00

TABLE XVII (Continued)

	Unit	Sell Peanut Hay	Buy Peanut Hay	Hire Labor Jan.-Apr.	Hire Labor May-July	Hire Labor Aug.-Sept.	Hire Labor Oct.-Dec.		RHS1
Objective Function		18.00	-21.00	-1.50	-1.50	-1.50	-1.50		
Bottomland B_1	Acres							$\leq$	189.22
Bottomland B_2	Acres							$\leq$	90.78
Native Pasture	AUM							$\leq$	269.00
Cotton Allotment	Acres							$\leq$	24.10
Peanut Allogment	Acres							$\leq$	14.00
Wheat Allotment	Acres							$\leq$	10.10
Jan.-Apr. Labor	Hours			-1.00				$\leq$	320.00
May-July Labor	Hours				-1.00			$\leq$	240.00
Aug.-Sept. Labor	Hours					-1.00		$\leq$	160.00
Oct.-Dec. Labor	Hours						-1.00	$\leq$	240.00
Annual Capital	Dol.							$\leq$	0.00
Small Grain Grazing (One Season)	AUM							$\leq$	0.00
Wheat Certificate	Acres							$\leq$	0.00
Limit on Wheat Certificate	Acres							$\leq$	4.80
Wheat Production	Bu.							$\leq$	0.00
Barley Production	Bu.							$\leq$	0.00
Oats Production	Bu.							$\leq$	0.00
Grain Sorghum Production	Cwt.							$\leq$	0.00
Cotton Production (Lint)	Cwt.							$\leq$	0.00
Cotton Production (Seed)	Ton							$\leq$	0.00
Peanut Production	Cwt.							$\leq$	0.00
Prairie and Peanut Hay	Ton	1.00	-1.00					$\leq$	0.00
Soybeans Production	Bu.							$\leq$	0.00
Alfalfa Production	Ton							$\leq$	0.00
Steer Calf Production	Cwt.							$\leq$	0.00
Heifer Calf Production	Cwt.							$\leq$	0.00
Stocker (450 Lb.)	Head							$\leq$	0.00
Cull Cow Production	Cwt.							$\leq$	0.00
Cull Yearling Heifer Production	Cwt.							$\leq$	0.00
Mar. 1 Stockers	Cwt.							$\leq$	0.00
Aug. 10 Stockers	Cwt.							$\leq$	0.00
Cotton Payment	Acres							$\leq$	0.00
Limit on Cotton Payment	Acres							$\leq$	0.00

TABLE XVIII

STABILITY RANGES OF SELECTED ACTIVITIES WITH ALTERNATIVE LAND RESOURCE SITUATIONS, REPRESENTATIVE FARMS OF NORTHEASTERN AND EAST CENTRAL OKLAHOMA

Activity	Unit	Cost (-)[a] or Return (+)[b]	Stability Range
		(Dol.)	(Dol.)
Upland Soil Representative Farm, Northeastern Oklahoma:			
Crop:			
Grain Sorghum (L_3)	Acre	-29.02	-36.44 to inf.
Cotton (L_2)	Acre	-81.70	-82.38 to -52.34
Soybeans (L_1)	Acre	-27.34	-28.02 to -23.94
Soybeans (L_2)	Acre	-27.13	-27.33 to -26.45
Soybeans (P_1)	Acre	-27.13	-28.70 to -24.90
Soybeans (P_2)	Acre	-26.92	-30.09 to inf.
Wheat and Soybeans (P_1)	Acre	-49.80	-52.03 to inf.
Sell Grain Sorghum	Cwt.	+1.85	1.74 to 1.86
Sell Cotton (Lint)	Cwt.	+18.50	14.70 to 19.86
Sell Cotton (Seed)	Ton	+48.00	0.00 to 65.00
Sell Soybeans	Bu.	+2.30	2.29 to 2.44
Sell Wheat	Bu.	+1.25	0.98 to 4.31
Livestock:			
Spring Calf (On CSC and Hay)	Head	-26.03	-26.11 to -21.38
Spring Calf (On Native & S.G.)	Head	-21.72	-40.12 to -21.60
Stockers (Buy Oct 10-Sell Mar. 1)	Head	-7.52	-7.61 to 6.93
Sell Steers	Cwt.	+28.30	28.20 to 30.88
Sell Stockers (Mar. 1)	Cwt.	+24.76	24.74 to 27.13
Sell Cull Cows	Cwt.	+14.97	14.78 to 19.70
Sell Cull Heifers	Cwt.	+16.11	15.47 to 31.88
Annual Capital	Dol.	-0.08	0.07 to 0.13

TABLE XVIII (Continued)

Activity	Unit	Cost (-)[a] or Return (+)[b]	Stability Range
		(Dol.)	(Dol.)
<u>Upland Soil Representative Farm, East Central Oklahoma</u>:			
Crop:			
Grain Sorghum (L_3)	Acre	-29.02	-36.41 to inf.
Cotton (L_2)	Acre	-81.70	-82.38 t0 -73.19
Cotton (S_2)	Acre	-86.61	-95.12 to -60.35
Peanuts (S_2)	Acre	-90.86	-117.12 to inf.
Soybeans (L_1)	Acre	-27.34	-28.02 to -23.95
Soybeans (L_2)	Acre	-27.13	-27.33 to -26.45
Soybeans (P_1)	Acre	-27.13	-28.70 to -24.90
Soybeans (P_2)	Acre	-26.92	-30.09 to inf.
Soybeans (S_3)	Acre	-26.78	-27.43 to inf.
Wheat and Soybeans (P_1)	Acre	-49.80	-52.03 to inf.
Sell Grain Sorghum	Cwt.	+1.85	1.74 to 1.86
Sell Cotton (Lint)	Cwt.	+18.50	14.70 to 19.86
Sell Cotton (Seed)	Ton	+48.00	11.12 to 65.00
Sell Peanuts	Cwt.	+12.00	5.56 to inf.
Sell Soybeans	Bu.	+2.30	2.29 to 2.45
Sell Wheat	Bu.	+1.25	0.98 to 4.32
Livestock:			
Spring Calf (On CSC and Hay)	Head	-26.03	-26.11 to -19.60
Stockers (Buy Oct. 10-Sell Mar. 1)	Head	-7.52	-7.61 to 0.95
Stockers (Buy Oct. 10-Sell Aug. 10)	Head	-12.67	-16.21 to -12.57
Sell Steers	Cwt.	+28.30	28.20 to 31.22
Sell Stockers (Mar. 1)	Cwt.	+24.76	24.74 to 26.15
Sell Stockers (Aug. 10)	Cwt.	+24.78	24.28 to 24.79
Sell Cull Cows	Cwt.	+14.97	14.78 to 20.33

TABLE XVIII (Continued)

Activity	Unit	Cost (-)[a] or Return (+)[b]	Stability Range
		(Dol.)	(Dol.)
Sell Cull Heifers	Cwt.	+16.11	15.47 to 31.88
Annual Capital	Col.	-0.08	0.07 to 0.13
<u>Bottomland Soil Representative Farm, East Central Oklahoma</u>:			
Crop:			
Grain Sorghum (L_3)	Acre	-32.97	-39.30 to -30.45
Cotton (B_2)	Acre	-76.99	-79.51 to -44.00
Peanuts (B_1)	Acre	-89.61	-173.38 to inf.
Wheat and Soybeans (B_1)	Acre	-50001	-58.68 to -46.70
Alfalfa (B_1)	Acre	-56.81	-58.56 to -48.13
Sell Grain Sorghum	Cwt.	+1.85	1.67 to 1.92
Sell Cotton (Lint)	Cwt.	+18.50	9.67 to 21.30
Sell Cotton (Seed)	Ton	+48.00	0.00 to 83.01
Sell Peanuts	Cwt.	+12.00	7.07 to inf.
Sell Soybeans	Bu.	+2.30	1.46 to 2.35
Sell Wheat	Bu.	+1.25	0.01 to 1.36
Sell Alfalfa	Ton	+22.50	22.11 to 24.43
Livestock:			
Spring Calf (On Native & S.G.)	Head	-21.72	-40.13 to -8.75
Stockers (Buy Oct. 10-Sell Mar. 1)	Head	-7.52	-10.66 to -6.94
Buy Stockers	Head	-129.60	115.46 to 132.72
Sell Steers	Cwt.	+28.30	26.72 to 34.19
Sell Stockers (Mar. 1)	Cwt.	+24.76	24.24 to 27.13
Sell Cull Cows	Cwt.	+14.97	0.00 to 25.78
Sell Cull Heifers	Cwt.	+16.11	0.00 to 52.13
Annual Capital	Dol.	-0.08	0.00 to 0.13

TABLE XVIII (Continued)

[a]Cost per unit is shown as a negative figure, it is the operating expense.

[b]Revenue per unit is shown as a positive figure.

TABLE XIX

ASSUMED PRICES PAID AND RECEIVED BY FARMERS,
NORTHEASTERN AND EAST CENTRAL OKLAHOMA

Item	Unit	Price
		(Dol.)
<u>PRICES PAID</u>		
Seed:		
Cotton	Cwt.	12.00
Wheat	Bu.	2.85
Grain Sorghum	Cwt.	21.00
Barley	Bu.	1.60
Oats	Bu.	1.50
Hop Colver	Lb.	1.25
Lespedeza	Lb.	0.18
Soybeans	Lb.	0.06
Peanuts	Lb.	0.28
Alfalfa	Lb.	0.52
Custom Rates:		
Combining Wheat	Acre	5.00
Combining Grain Sorghum	Acre	5.50
Combining Soybeans	Acre	6.00
Combining Oats	Acre	5.00
Combining Barley	Acre	5.00
Combining Peanuts	Acre	11.00
Hauling Wheat	Bu.	0.07
Hauling Grain Sorghum	Cwt.	0.13
Hauling Soybeans	Bu.	0.07
Hauling Oats	Bu.	0.07
Hauling Barley	Bu.	0.07
Cotton Stripping	Cwt. (Cotton Seed)	1.25

TABLE XIX (Continued)

Item	Unit	Price
		(Dol.)
Cotton Hauling	Bale	5.00
Cotton Ginning, Wrapping, and Misc. Charges	Cwt. (Cotton Seed)	1.15
Dig and Shake Peanuts	Acre	3.50
Sack and Haul Peanuts	Bu.	0.20
Hay Mowing	Acre	1.50
Hay Raking	Acre	1.25
Hay Baling	Bale	0.15
Bermuda Sprigging	Acre	15.00
Hand Hoeing	Hr.	1.25
Hay Hauling	Bale	0.15
Spraying or Dusting (Chemicals Not Included)	Acre	1.25
Pre-Emergence Herbicide (Disc Operation Incl., Chemical Not Incl.)	Acre	2.25
Bulk Fertilizer Spreader Rental	Acre	0.75
Fuel and Lubricant:		
Gasoline	Gal.	0.24
LP Gas	Gal.	0.11
Diesel Oil	Gal.	0.145
Motor Oil	Gal.	1.25
Lubricant (Grease)	Lb.	0.30
Fertilizer and Chemicals:		
Nitrogen (Dry)	Lb.	0.075
Phosphorus (Dry)	Lb.	0.08
Potassium (Dry)	Lb.	0.05

TABLE XIX (Continued)

Item	Unit	Price
		(Dol.)
Dry Peanut Insecticide (Di-Syston) (Custom)	Application/acre	1.00
Peanut Fungicide (Custom)	Application/acre	6.75
Lime (Custom Applied)	Ton	4.50
Peanut Herbicide (Custom)	Application/acre	6.00
Cotton Insecticide (Custom)	Application/acre	12.00
Cotton Herbicide (Custom)	Application/acre	6.00
Grain Sorghum Insecticide (Custom)	Application/acre	2.00
Grain Sorghum Herbicide (Custom)	Application/acre	3.00
Soybeans Herbicide (Custom)	Application/acre	6.00
Wheat Insecticide (Custom)	Application/acre	0.45
Oats Insecticide (Custom)	Application/acre	0.45
Barley Insecticide (Custom)	Application/acre	0.45
Alfalfa Insecticide (Custom)	Application/acre-Py-Syston	1.27
	Parathion	4.50
Land[a]	Acre	165.00
Hired Labor	Hour	1.50
PRICES RECEIVED		
Crops:		
Wheat	Bu.	1.25
Barley	Bu.	0.80
Grain Sorghum	Cwt.	1.85
Oats	Bu.	0.70
Cotton (Lint)	Cwt.	18.50
Cotton (Seed)	Ton	48.00
Soybeans	Bu.	2.30

TABLE XIX (Continued)

Item	Unit	Price
		(Dol.)
Peanuts	Cwt.	12.00
Alfalfa Hay	Ton	22.50
Baled Peanut Straw (In Field)	Ton	18.00

[a]Land value ($165 per acre) is assumed the same for both upland and bottomland. Adjustment should be made to reflect a higher value of bottomland when necessary.

VITA

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