OPTIMUM FARM ORGANIZATIONS OF REPRESENTATIVE IRRIGATED FARMS IN SOUTHWESTERN OKLAHOMA

By

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OPTIMUM FARM ORGANIZATIONS OF REPRESENTATIVE IRRIGATED FARMS IN SOUTHWESTERN OKLAHOMA

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CHAPTER I

INTRODUCTION

Southwestern Oklahoma was a part of the Dust Bowl of the Midwest during the 1930's. The area is no longer a blanketed area of grit, dust, and poverty. Farmers have learned to control and live with the climatic adversities. As a result, farmers in the area can obtain fairly satisfactory returns to resources used by dryland cropping enterprises if they make sound management decisions. Futhermore, the availability of underground water supplies suitable for irrigation give a potential for greater production level and increased farm earnings.

The use of an irrigation system results in a more complex farm organization and a greater need for sound management. A farmer using irrigation typically has a limited water supply to distribute to alternative cropping enterprises. He also has different types and productivity levels of soils which have different yield potentials for various crops under dryland and irrigated conditions. Alternative irrigated crops also yield a different return per acre inch of water when irrigated at various levels. Thus, the farmer using irrigation must determine not only which crops should be grown on each alternative soil type

on the farm, but also which crops are to be irrigated and at what level. Hence, the optimum use of the farm's fixed resources (including the supply of irrigation water) is a critical organizational decision that must be made by the operator. The purpose of this study is to determine the optimum organization of several representative irrigated farms in southwestern Oklahoma.

Objectives

The objectives of this study are (1) to determine the cost and returns for alternative irrigated crops on the major soils of southwestern Oklahoma, and (2) to determine what combination of irrigated and dryland enterprises give the greatest return to the operator's fixed resources for representative farm situations in southwestern Oklahoma.

Cost and return budgets have been completed for all major crops grown in the study area: alfalfa, cotton, grain sorghum, wheat, peanuts, ensilage, forage sorghum, and soybeans. With the exception of soybeans, these crops are adapted to both dryland and irrigated production. Soybeans have yielded very little profit in this area except when irrigated. The use of irrigation on certain soils in the study area gives greater increase in yields than on others. The clay soils become very productive when irrigation water is applied. For instance, grain sorghum under dryland conditions planted on clay soils will produce

low returns; yet, when irrigated, the crop becomes very productive and is well adapted to clay soils.

A typical farm for each of the major areas in southwestern Oklahoma using ground water for irrigation is defined. The land, supply of irrigation water, program allotments, available labor and capital are specified for each of these farms. This information is used in conjunction with the estimated costs and returns for alternative enterprises to determine that combination of enterprises which maximize returns to the fixed resources available on the farm.

The optimum allocation of irrigation water among alternative crop enterprises on the farm is also a problem in other areas of the state of Oklahoma. The panhandle counties--Texas, Cimarron, and Beaver--have underground water accessible for irrigation purposes. John Green has completed a study of this area and has shown that irrigation is a profitable investment when a farmer has sufficient irrigable land, an adequate water supply and the managerial ability to obtain the input-output relationships assumed [1, p. 120].

Studies have been made in other states on alternative enterprises using irrigation water. A study conducted in the Texas High Plains showed irrigation to be a profitable investment on many farms in the area [2, pp. 101-112].

Description of the Study Area

Size and Location

The study area is composed of eleven counties. They are Beckham, Caddo, Comanche, Cotton, Grady, Greer, Harmon, Jackson, Kiowa, Tillman, and Washita (Figure 1). These counties have 202,800 acres of land under irrigation of which 120,140 acres are irrigated by ground water [3]. The counties having the greatest irrigation potential are Caddo, which obtains water from the Rush Springs Sandstone water bearing formation; Harmon, which receives its underground water from the Dog Creek Shale formation; and Jackson and Tillman, which are provided with water from the Terrace Deposits (shaded area of Figure 1). There are approximately 769,629 acres suitable for irrigation in these three water-bearing formations: 429,090 acres in the Rush Springs Sandstone formations, 122,878 acres in the Dog Creek Shale formations, and 217,661 acres in the Terrace deposits [4]. Of this potentially irrigatable land, approximately 160,075 acres are currently being irrigated in these water bearing formations with 97,225 acres utilizing water obtained from ground sources [3, pp. 2-4].

Soils

Three broad soil classifications, clay, loam, and sandy, are all found in the eleven county area. Based on information and classification of soils by U. S. Soil

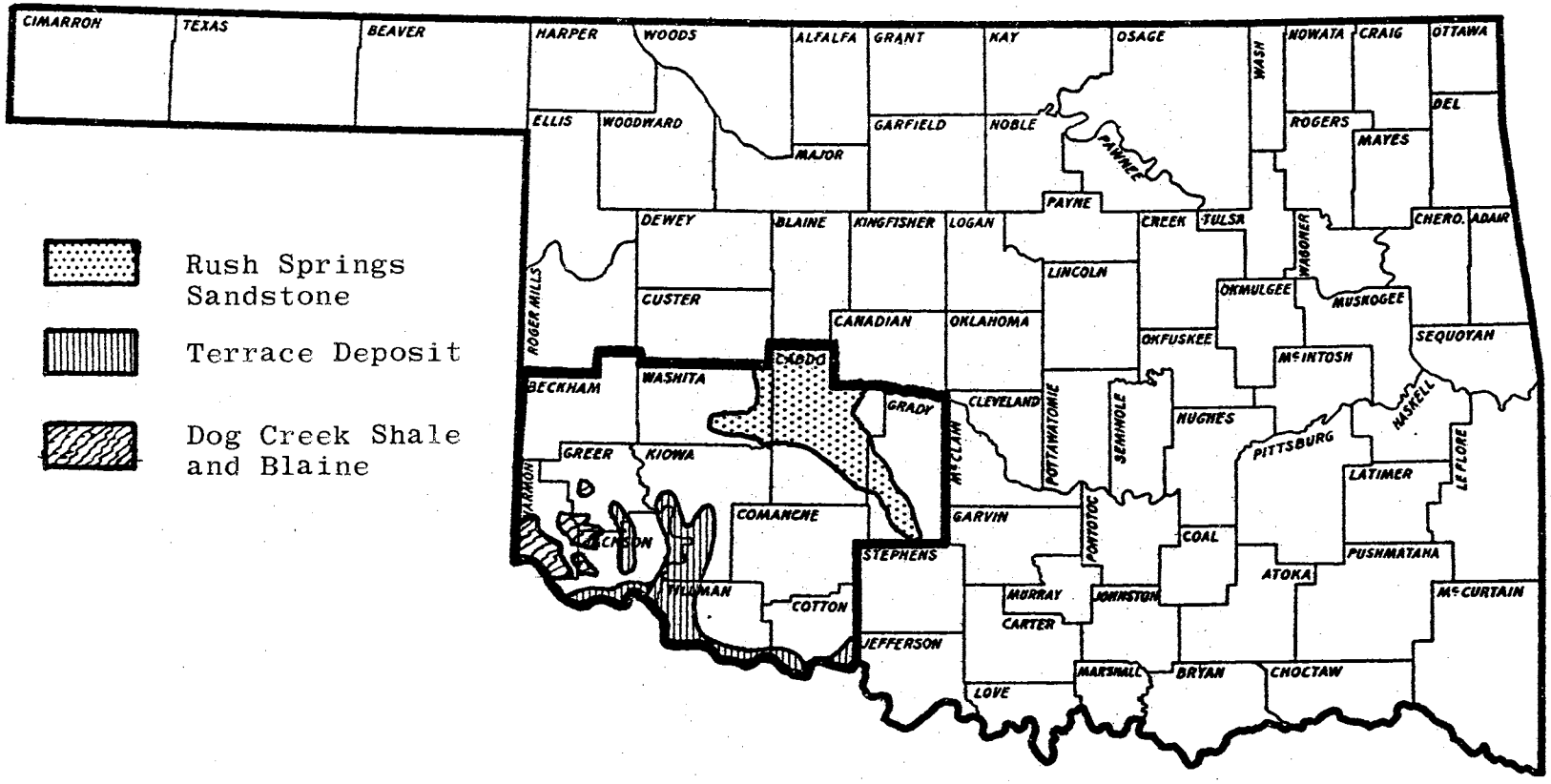

Figure 1. Location of Study Area and Water Bearing Formations.

Conservation Service, the cropland soils used in this study and budget preparation are divided into nine productivity classes as described in the following three categories of soils.

Clay Soils

Productivity classes for clayey soils can be distinguished as follows:

1. C_b - Land Capability Class IIs; deep, level (0 to 1 percent slope) with negligible to moderate erosion; Soil Units 1 and 5; and Foard-Tillman equivalents.
2. C_c - Land Capability Class IIIe; deep, moderately sloping (1 to 3 percent slopes with negligible to moderate erosion; Soil Units 1 and 5; and Foard-Tillman equivalents.
3. C_d - Land Capability Class IVe; sloping (3 to 5 percent slopes) with negligible to moderately severe erosion; Soils Units 1 and 5; and Foard-Tillman equivalents.

Loam Soils

Productivity classes for loamy soils can be distinguished as follows:

1. L_a - Land Capability Class I; deep, level (0 to 1 percent slope) with negligible to moderate erosion; Soil Units 2, 4, 7 and 9; Upland-Tipton, St. Paul, and Cary Soils; Bottomland-Spurs and Canadian Soils (or their equivalents).

2. L_b - Land Capability Class II; deep, moderately sloping (0 to 3 percent slopes) with negligible to moderate erosion; same soils as above.
3. L_c - Land Capability Class III; sloping (3 to 5 percent slopes) with negligible to moderately severe erosion, or moderately sloping (B slopes) with moderately severe erosion; same soils as above plus Quinlan and Vernon Soils (or their equivalents).

Sandy Soils

Productivity classes for sandy soils can be distinguished as follows:

1. S_b - Land Capability Class II; deep, level to moderate slope (0 to 3 percent); Soils Units 70, 7x, 12 and 12x; Miles, Dill, Pratt, and Enterprise Soils (or their equivalents).
2. S_c - Land Capability Class III; deep, moderately sloping (3 to 5 percent); same soils as S_b above.
3. S_d - Land Capability Class IV; sloping (5 to 8 percent), and contains the same soils as above plus some Brownfield and Nobscott Soils (deep-plowed Brownfield Soils would be included in the S_b group).

All the C_b, C_c, L_a, L_b, S_b and S_c soils are suited for irrigation.

Climate

Rainfall is considered one of the most limiting factors in crop production in the study area. The average annual rainfall from the reporting stations over the past ten years in the eleven county area is 27.9 inches. Even more critical than the average annual rainfall is its distribution during the growing season. Table I shows the ten-year average monthly rainfall for twelve reporting stations. The average rainfall for May is 4.06 inches; June, 4.03 inches; July, 2.69 inches; August, 2.28 inches; and September, 3.51 inches for the twelve reporting stations. In order to achieve maximum economic yield for many crops, rainfall must be supplemented with irrigation during the growing season.

Average annual rainfall increases as one moves from west to east across the study area. The rainfall reported at Hollis in the extreme southwestern part of the study area for the ten year period averaged 22.77 inches. Walters, located in the extreme southeastern section, has a ten year average rainfall of 31.894 inches. The northeastern portion of this study area is represented by the reporting station at Anadarko, with an average rainfall of 30.247 inches. Although there is variation in the average rainfall from west to east, the rainfall during the growing season is such that the crop budgets developed are suitable for the entire study area.

TABLE I

TEN YEAR MONTHLY RAINFALL AVERAGES
AT REPORTING STATIONS

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Altus	.651	1.172	1.675	2.073	3.936	3.807	2.083	2.166	3.056	2.817	1.035	1.147	25.888
Anadarko	.685	1.089	1.862	2.527	4.068	3.904	2.951	3.004	4.381	2.530	1.854	1.392	30.247
Apache	.757	1.221	1.832	2.696	5.117	4.461	2.925	2.304	4.844	2.972	2.034	1.488	32.651
Carnegie 3ENE	.629	1.203	1.545	2.425	3.829	4.552	2.640	2.490	4.364	2.412	1.389	1.326	28.804
Chattanooga 3NE	.896	1.005	1.374	3.106	3.775	3.664	2.571	2.687	3.108	2.657	1.573	1.140	27.556
Frederick	.749	1.030	1.457	2.700	3.793	4.072	2.420	2.335	2.929	2.546	1.876	1.140	27.047
Hobart Faa Airport	.462	.993	1.500	2.299	4.375	4.042	2.633	1.534	3.579	2.832	1.199	1.008	26.456
Hollis	.465	.780	1.085	1.970	2.968	3.937	2.016	1.872	3.088	2.513	.968	1.108	22.770
Lawton	1.162	1.182	1.618	2.572	4.913	4.172	2.872	2.101	3.192	2.972	2.244	1.496	30.496
Mangum Res. Sta.	.513	1.055	1.339	1.989	3.403	3.543	2.641	1.929	3.231	2.585	1.128	1.068	24.424
Tipton 4S	.690	1.035	1.384	2.412	4.198	4.059	2.639	2.161	3.208	2.356	1.786	1.044	26.972
Walters	1.236	1.116	1.890	2.931	4.312	4.133	3.879	2.733	3.080	2.742	2.133	1.709	31.894
Monthly Average	.741	1.073	1.547	2.475	4.057	4.029	2.689	2.276	3.505	2.661	1.624	1.256	27.933

*Source: Climatological Data for Oklahoma, U.S. Department of Commerce Weather Bureau. The averages are computed for the ten-year period January 1957 through December, 1966.

Temperature also has a part in crop production. The average temperature in the eleven county area during the summer growing season is 81.8 degrees. The frost free dates are from approximately March 25 to November 10, giving an average growing season of 230 days [5].

Major Enterprises

The major crops grown in the study area are cotton, grain sorghum, peanuts, alfalfa, forage sorghums, wheat, ensilage, and soybeans. The livestock enterprises are mainly cow-calf and feeder steers.

Higher yields from crops are obtained from irrigated soils. In 1967, 140,025 acres of these crops were irrigated in the three water bearing formation (Table II). Ground water irrigation was used on 85,602 acres. This is 61 percent of the total irrigated acreage.

Cotton was the crop with the most acreage irrigated, 39,000 acres. Peanuts, grain sorghum, alfalfa, and small grains all had over 20,000 acres irrigated. All these crops were grown in all three areas except peanuts which are grown only in Caddo County or the Rush Springs Sandstone water area.

TABLE II

ACREAGES OF CROPS GROWN IN THE THREE IRRIGATION AREAS, ACREAGES IRRIGATED AND ACREAGES IRRIGATED BY GROUND WATER, 1967

	Irrigated In 1967	Irrigated By Ground Water In 1967
	(--------Acres----------)	
Cropland	141,025	85,602
Cotton	39,000	16,630
Grain Sorghum	25,950	13,978
Forage Sorghum	5,450	2,617
Alfalfa	21,000	13,480
Peanuts	28,000	25,200
Small Grain	20,600	13,697

Source: [3, pp. 8-10].

Typical Farm Situation

Census data indicate most farms in southwestern Oklahoma have 200 to 499 acres of cropland [6, pp. 289-295]. For purpose of this study 360 acres of cropland was chosen as the representative acreage. An additional 640 acres of native pasture is provided for the livestock operation.

A representative 360 acre cropland farm was developed for the three irrigation areas (Table III). The farm for the Rush Springs Sandstone water bearing formation contains 72 percent sandy soils and 28 percent loam soils with no clay soils. The farm for the Dog Creek Shale and Blaine formation has 59 percent sandy, 8 percent loam and 33 percent clay soils. The Terrace Deposits representative farm has 68 percent sandy, 24 percent loam and 8 percent clay soils.

A survey of irrigated farms in the area indicated that the typical irrigation well served approximately 360 acres of cropland. Therefore, the typical farm is assumed to have one irrigation well. The discharge of the well is assumed to be 600 gallons per minute for each of the three areas. However, the depth of wells vary by areas. In Caddo County the depth is 300 feet with the well and distribution system estimated to have an initial cost of $10,358.83. The initial cost of a 100 foot well in Harmon County with the distribution system for surface irrigation at $7,714.95. The new cost of a 65 foot well in Tillman County with the distribution system for surface irrigation is estimated at $6,263.55 and for sprinkler irrigation at $7,148.04. These depths

represent the average depth to the water bearing formations in each of the three areas. The costs include well drilling, pump, motor, and distribution systems. A more complete discussion of the investment costs is presented in Table XI [7].

TABLE III

CHARACTERISTICS OF THE REPRESENTATIVE FARM USED IN THE STUDY FOR THE THREE IRRIGATION AREAS

	Rush Springs Sandstone Area	Dog Creek Shale & Blaine	Terrace Deposits
		- Percent -	
Cropland	100	100	100
L_a	8	2	11
L_b	10	4	10
L_c	3	2	3
S_b	29	27	33
S_c	29	23	24
S_d	14	9	11
C_b		17	5
C_c		11	3
C_d		5	
		- Acres -	
Cropland	360	360	360
Native Pasture	640	640	640

Thesis Organization

The remainder of this thesis is divided into four chapters. Chapter II describes the theoretical concepts used in formulating the enterprise budgets and the general

model. Chapter III presents the linear programming profit maximizing model with a description of the restrictions and activities used in each of the three areas. Chapter IV is devoted to an explanation of the optimum organization for each of the representative farms. Chapter V summarizes the previous three chapters, gives the author's conclusions, and discusses the need for further study.

CHAPTER II

THEORETICAL CONCEPTS

Each farm is an individual unit; an independent business concern which makes its own management decisions. Land, labor, machinery, buildings, the irrigation system, and institutional programs are the fixed resources limiting the output of the farm. The farm operator is confronted with the organization of the farm. The decisions faced are (1) what is to be produced, (2) how production is to be organized, (3) how the products are to be distributed, (4) how resources are to be rationed over the short run periods during which their supplies are fixed, and (5) how the productive capacity of the operation is to be maintained and expanded [8, p. 14]. In planning the organization the manager must consider the family goals. These goals may consist of (1) having a family vacation, (2) taking part in community activities, (3) maintaining a neat farmstead, (4) stabilizing farm income, and (5) maximizing farm income. It is assumed in this study that the primary objective of a farm business is to use the limiting resources to maximize returns. Marginal analysis and linear programming serve as tools in accomplishing this task.

Production Economics

In crop enterprises a production function is the relationship between resources used (land, labor, irrigation water, and capital) and the amount of crop produced. Within a given production period, say one year, certain inputs such as water, land, and institutional programs are fixed, while others such as fertilizer, herbicides, insecticides, and machinery operating costs are variable. Water is a variable input in the production of an acre of a specific crop even though it may be a fixed resource to the farm. In general form, the production function for a given crop can be written as:

$$Y = f(x|k)$$

where Y is output, x represents the variable inputs, and k represents the fixed inputs.

A producer must decide what combination of the variable resources should be used and the output level of each product. Assuming the length of time considered is the length of the production cycle, the production function can be considered as one of short run, and the following assumptions made. First, for the short run, the production function is based on the premise that technology is given, and certain fixed inputs are at predetermined levels and cannot be altered during the production process. Second, the production function is a single valued function with continuous first and second order partial derivatives. Third, the input and output variables assume only nonnegative

values. Fourth, the production function presupposes technical efficiency and states the maximum output obtainable from every possible input combination. With these assumptions, the short run production function can be written as:

$$q = f(x_1, x_2, \ldots, x_n)$$

where q is the output and $x_i (i = 1,2,\ldots,n)$ represents the level of variable inputs.

Assume that a farmer has only two products he can produce; cotton and grain sorghum. The inputs to produce them are many, but for purposes of this theoretical discussion, assume only fertilizer and water are variable. The marginal physical products resulting from the use of water and nitrogen must be examined in order to determine the amount of water and nitrogen to apply. At equilibrium the marginal value product of nitrogen equals the marginal resource cost. Any amount of nitrogen added beyond this level will add more to the cost than to the return. At equilibrium, the marginal value product of water equals the marginal resource cost. Any amount of water beyond this will add more to the cost than to the return. The same conditions hold in the application of nitrogen and water to cotton. These equilibrium conditions are stated more rigorously below. Assume the following linear cost function applies,

$$C = a + w_1x_1 + w_2x_2 + \ldots + w_nx_n$$

where

$$w_i \quad (i = 1,2,\ldots,n)$$

are given and is the market price of x_i and a is the fixed cost. Net returns to the fixed resources are given by:

$$NR = TR - C$$

where P is the market price of q, and TR = Pq. Substituting the above expressions for TR and C results in:

$$NR = Pq - a - w_1x_1 - w_2x_2 - \ldots - w_nx_n.$$

Economic theory indicates that net returns are maximized where the following first order conditions hold:

$$NR_1 = p\frac{\partial q}{\partial x_1} - w_1 = 0$$

$$NR_2 = p\frac{\partial q}{\partial x_2} - w_2 = 0$$

$$\vdots$$

$$NR_n = p\frac{\partial q}{\partial x_n} - w_n = 0$$

where

$$NR_i = \frac{\partial NR}{\partial x_i} \quad (i = 1,2,\ldots,n).$$

The first order conditions may be stated in several different ways. One way is to note that $\frac{\partial q}{\partial x_1} = MP_i$ $(i = 1,2, \ldots,n)$ where MP_i is the marginal physical productivity of $i^{\underline{th}}$ factor, so PMP_i is equal to the value marginal product of the $i^{\underline{th}}$ factor (VMP_i). At equilibrium, $VMP_i = w_i$. Since the equality holds for all the inputs, the condition can be written as follows:

$$\frac{VMP_1}{w_1} = \frac{VMP_2}{w_2} = \ldots = \frac{VMP_n}{w_n} = 1.$$

The ratio of VMP and price is the same for each factor and equal to unity.

Factor-Factor Relationships

In the production of cotton, nitrogen and water serve as the variable inputs to produce a specified output. All combinations of the two variable inputs that will produce the specified level can be plotted and result in a smooth curve such as that in Figure 2. This curve is referred to as an isoquant.

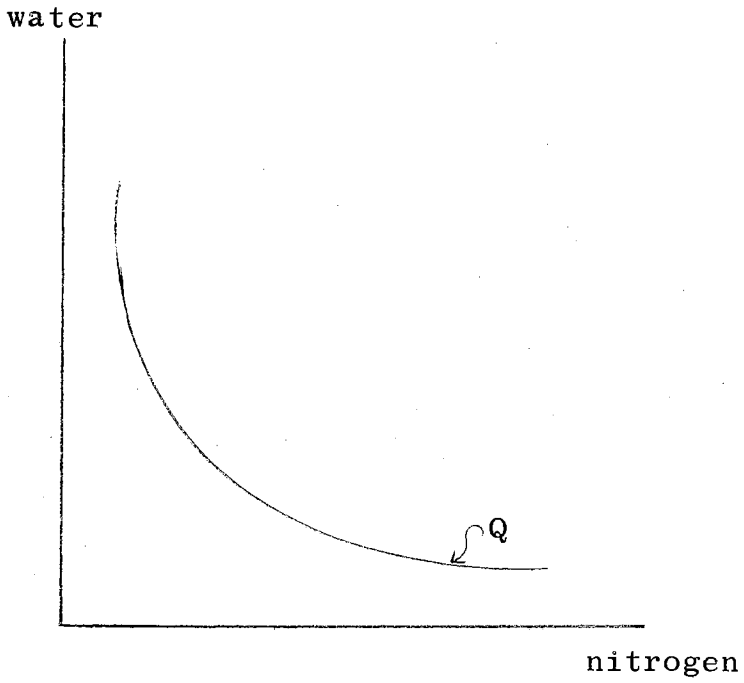

Figure 2. Classical Isoquant for Nitrogen and Water

If the i^{th} and j^{th} first order equation mentioned above are considered, then the i^{th} equation may be divided by the j^{th} equation and the following results obtained:

$$\frac{VMP_i}{VMP_j} = \frac{w_i}{w_j} = \frac{PMP_i}{PMP_j} = \frac{w_i}{w_j} = \frac{MP_i}{MP_j} = \frac{w_i}{w_j} = - \text{ MRFS}$$

where (MRFS) is equal to the marginal rate of factor substitution between the i^{th} and j^{th} factors. Thus the equilibrium combination of two variable inputs i and j, say water and nitrogen, is obtained with the quantities of i and j resulting in the negative marginal rate of factor sustitution being equal to the ratio of the input prices.

Product-Product Combinations

The problem now facing the farmer, with two possible crops, is which one or what combination of each should be grown. With the available information it is possible to construct a line of attainable combinations. This may be explained graphically with the aid of Figure 3.

If all the available resources were used to produce cotton, x_a amount could be produced. If all resources were used to produce grain sorghum, x_b amount could be produced. The line from point x_a to x_b gives the maximum attainable combinations.

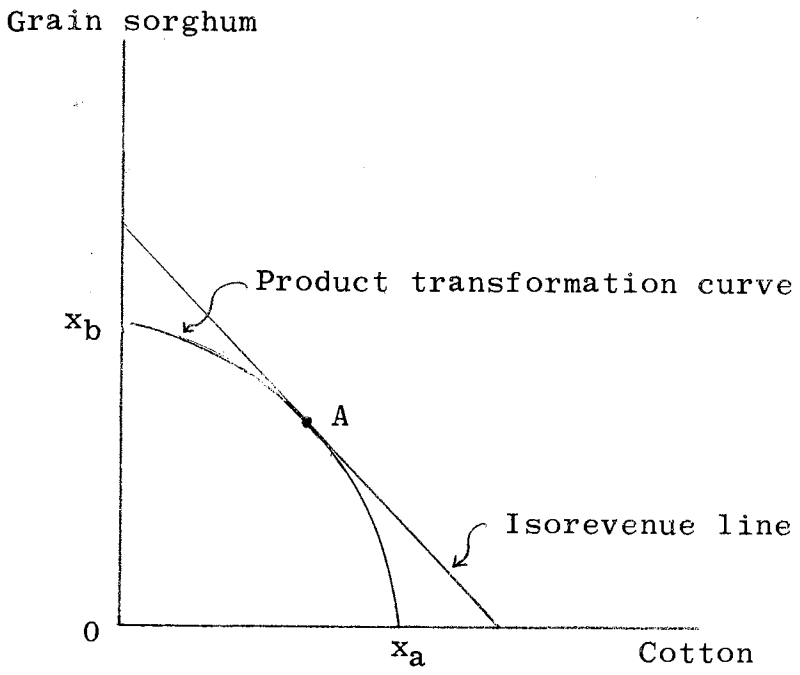

Figure 3. Product transformation curve and isorevenue line

The farmer should operate where the marginal rate of product substitution equals the price ratio to maximize returns to the set of fixed resources. This occurs at point A in Figure 3, where the iso-revenue line is tangent to the product transformation curve. The necessary conditions for equilibrium when nitrogen and water are used in both the production of cotton and grain sorghum are as follows:

$$\frac{MVP_{NC}}{P_N} = \frac{MVP_{WC}}{P_W} = \frac{MVP_{NGS}}{P_N} = \frac{MVP_{WGS}}{P_W} = 1$$

where N refers to nitrogen, W refers to water, P is price, C stands for cotton, and GS refers to grain sorghum.

Certain factors such as irrigation water, land, operator labor and institutional programs are variable in the production of a single crop, but are fixed to the farm. The above equilibrium conditions must be modified to indicate the optimum allocation of such limiting resources. The equilibrium condition existing for the use of a fixed input such as irrigation water between cotton and grain sorghum is as follows:

$$\frac{MVP_{WC}}{P_W} = \frac{MVP_{WGS}}{P_W} = \geq 1.$$

If data were available to estimate the continuous production functions, marginal analysis would be sufficient to analyze the optimum combination of enterprises. However, this information is not available. Therefore, an alternative technique, linear programming, requiring somewhat less input data is used in this study.

Linear Programming Maximization Model

The major components of a linear programming model are, (1) the objective function, (2) constraints, and (3) nonnegativity restrictions. The general profit maximizing model for linear programming is:

maximize $$\pi = \sum_{j=1}^{n} c_j x_j$$

$$\text{subject to} \quad \sum_{j=1}^{n} a_{ij}x_j \leq r_i \quad (i = 1,2, \ldots ,m)$$

$$\text{and} \quad x_j \geq 0 \quad (j = 1,2, \ldots ,n).$$

The choice variables (activities) are denoted by x_j (with $j = 1,2, \ldots ,n$). Their coefficients in the objective function are a set of given constants and are the net returns to the fixed resource per unit of the activity. The right hand sides are represented by r_i ($i = 1,2, \ldots ,m$), another set of constants that represents the restrictions imposed on the program. The restrictions in optimum farm organization problems are typically the quantities of the fixed resources available on the farm. The coefficients of the choice variables in the constraints are denoted by a_{ij} and represent the quantity of the resource required to produce one unit of the j^{th} activity [9, p. 586].

Linear Programming Assumptions

The assumptions necessary to properly set up a linear programming model to determine the optimum farm organization are as follows [10, p. 264]:

1. There are several variable and fixed factors used in the production of each output. A firm may produce more than one output. A given product may be produced by several activities each using different factor input ratios; the number of activities may exceed the number of products.

2. The price of the farm's inputs and outputs are given and fixed during the production process.

3. The objective of the entrepreneur is to maximize profits subject to the constraints imposed by the nature of the activities and the amount of fixed factors which are available.

4. Each activity is characterized by a set of ratios of the quantities of the factors to the levels of each of the outputs. These ratios are constant and independent to the extent to which each activity is used.

5. The farm is constrained in its selection of activity levels by its fixed endowment of certain resources required to support the activities. The farm's fixed factors are perfectly divisible in use but there is an upper limit on the total quantity of each fixed factor available.

6. Two or more activities can be used simultaneously, subject to the limitations of the fixed factors available to the farm, and if this is done the quantities of the outputs and inputs will be the arithmetic sums of the quantities which would result if the activities were used separately.

7. The exact nature of the farm's activities has been predetermined by a set of technical decisions by persons involved.

8. All the farm's factors and products are perfectly divisible.

Factor-Factor Relationship in Linear Programming

The above assumptions indicate that each activity in the linear programming model requires a specific combination of resources. For instance a particular activity to produce a given unit of output on one acre of land may require w_1 units of water and n_1 units of nitrogen. This plots as a single point, T_1 in Figure 4.

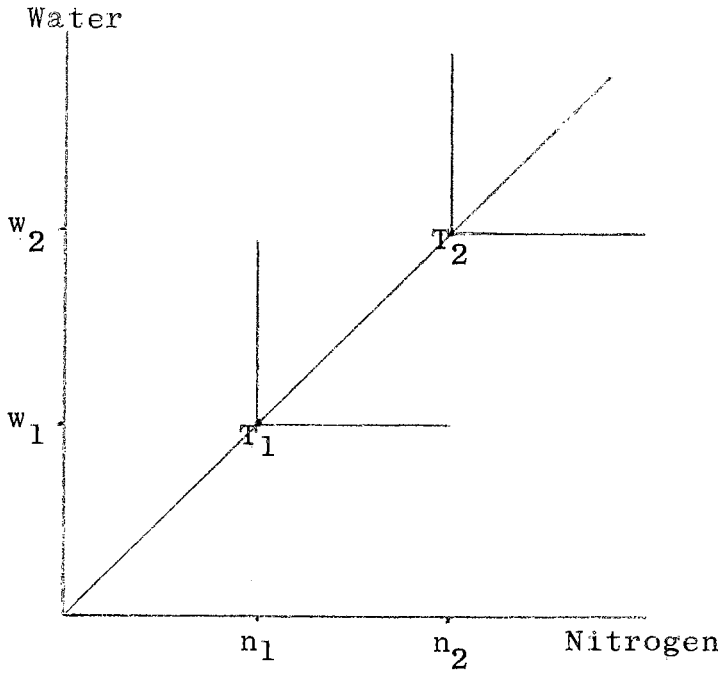

Figure 4. Linear Programming Isoquant for Nitrogen and Water

Since w_1 and n_1 are two constants, $f(w_1,n_1)$ refers only to the value of the production function at a specific point in the domain. Because of the assumption of constant returns to scale in linear programming it can be seen that if the same amount of water and nitrogen were added to another acre of land, thereby doubling the use of water and nitrogen, the output would be doubled and is represented by T_2 in Figure 4. The line joining points T_1 and T_2 could be called an activity path.

Suppose a specified output level can be obtained by different combinations of inputs such as assumed in marginal analysis. The range in relevant input combinations can be represented in linear programming by a series of

activities. For instance, assume a specified yield of cotton can be produced with different combinations of water and nitrogen. These different input combinations may appear as shown in Figure 5. If the points a_1, a_2, a_3, and a_4 result in the same output level, then the three line segments connecting these points represent a linear approximation of the smooth theoretical isoquant assumed in marginal analysis. Including several activities of this type permits the programming model to select the optimum input combinations as it determines the optimum organization of the business. If the optimum organization included a combination of two activities, it indicates some input combination along the line segment connecting the two represents the optimum amount of water and nitrogen to achieve that output.

In this study the amount of each of the variable resources necessary for the production of enterprises was calculated from budgets which show input requirements, outputs, cost and net returns per acre to land, overhead, management, and risk. The concepts of marginal analysis were used to determine the input levels utilized in the budgets. Persons familiar with the study area were interviewed to obtain their estimates of the production resulting from additional units of irrigation water. By utilizing this information and results of agronomic experiments, stage II of production was determined for each crop enterprise. Budgets were prepared specifying three

irrigation levels in stage II for each of the crops. The other variable inputs were added for each specified level of irrigation water which current knowledge indicates will result in maximum economic efficiency (MRC = MR).

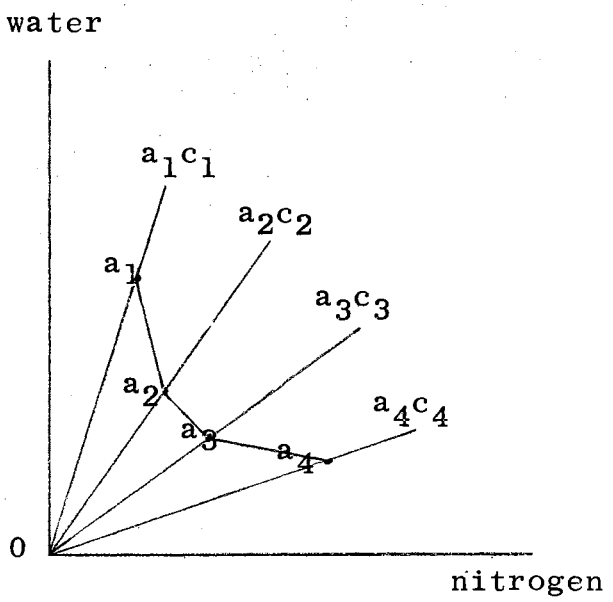

Figure 5. Isoquant for given levels of nitrogen and water in a multi-process case for linear programming in the production of a specified level of cotton

Product-Product Relationship In Linear Programming

Linear programming utilizes linear constraints on the fixed resources to approximate the continuous theoretical product-product possibilities curve. Assume only two products, grain sorghum and cotton, and four constraints are being considered in the analysis graphed in Figure 6.

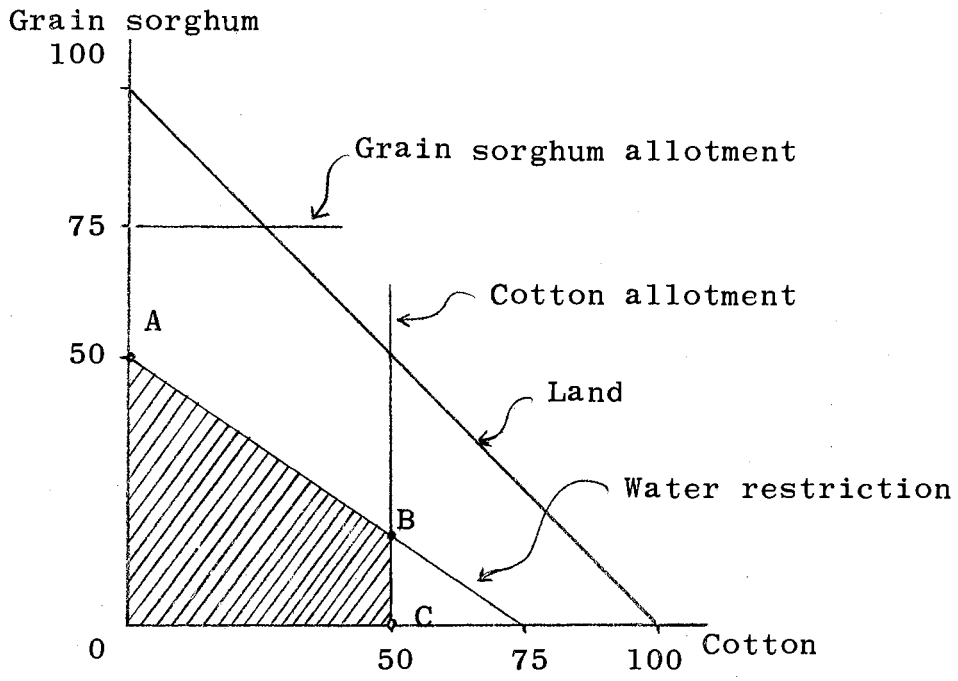

Figure 6. Constraints placed on the production of cotton and grain sorghum

There are 100 acres of land suitable for the production of either cotton or grain sorghum. If a line is drawn connecting the two points, then any combination along this line could be produced with the 100 acres of available land. Grain sorghum is restricted to 75 acres by allotment. Cotton is restricted to 50 acres by the cotton allotment. If all irrigation water is used in the production of grain sorghum, then production would be limited to 50 acres. If all irrigation water is applied to cotton; 75 acres could be grown. A line connecting these two points indicates that any combination of acreage along the line could be produced with the water supply. However, the cotton

allotment restricts cotton production to 50 acres. The area bounded by lines connecting points A, B, C, and 0 is the feasible solution region. The two segments AB and BC are the linear programming approximation of the product transformation curve shown in Figure 3.

The optimum combination of products will occur at one of the extreme points on the boundary of the feasible region. To locate an extreme point is to find a basic feasible solution. The simplex method is used to find the optimum combination of outputs. The idea of the simplex method is to start with some initial extreme point, compute the value of the objective function, and then see whether the latter can be improved by moving to another extreme point. This procedure continues until it is impossible to increase the value of the objective function. If no further improvements are made then the optimum combination of products has been found [9, p, 604].

In Figure 6, the optimum combination of cotton and grain sorghum will occur at one of the points A, B, or C depending on the objective function. The iso-revenue line touches an extreme point on the basic feasible region. This is comparable to the profit maximizing point of the classical marginal product-product model in Figure 3. The profit maximizing point occurs where the iso-revenue line is tangent to the production possibility curve.

Baumol concludes that linear programming and marginal analysis are not so different. The programming view of

production is restrictive only in that it assumes that the production function is linear and homogenous and that it deals with changes that are abrupt and discontinous, so that the smooth production curves associated with classical production analysis are not obtained. Linear programming probes more deeply than marginal analysis because it enables the user to see what lies behind the production function in terms of the optimum choice of process combinations for any set of input or output levels [11, p. 294].

The concepts of marginal analysis and linear programming have been developed and discussed in this chapter. These concepts will be used in Chapters III and IV in determining the optimum farm organization for representative farms in each of the three parts of the study area.

CHAPTER III

MATRIX DEVELOPMENT FOR LINEAR PROGRAMMING MODEL

This chapter is devoted to setting up the linear programming profit maximizing models. It consists of a description of (1) the right hand sides for the representative farms in the three water bearing formations, and (2) the activities composing the three representative farm situations.

Right Hand Side Development For The Tillman County Area

A large portion of the Terrace Deposit is located in Tillman County. Consequently the soils and institutional restrictions of Tillman County are used to develop the representative farm for the Terrace Deposit Formation. The right hand side for this situation is discussed below and shown in Appendix Table A-XIII.

Land

A 360 acre cropland farm has been selected as the representative farm size for each of the three water bearing formations. The 360 acres of cropland is subdivided into

productivity classes based on the proportion of each soil in the county. The acreage consists of 39 acres of L_a soils, 36 acres of L_b soils, 11 acres of L_c soils, 18 acres C_b soils, 11 acres of C_c soils, 119 acres of S_b soils, 86 acres of S_c soils, and 40 acres of S_d soils [4].

Institutional Programs

The farm manager is faced with compliance of government programs in the production of wheat, grain sorghum, and cotton. The representative farm, when producing the three crops is assumed to be restricted by 38 acres of conserving base, 155 acres of wheat, 50 acres of feed grain and 86 acres of cotton. The operator can participate in (1) wheat, feed grain, and cotton, (2) wheat and cotton, (3) feed grain and cotton, (4) cotton, (5) wheat and feed grain, (6) wheat, (7) feed grain, or (8) none of the programs. If the farm signs up for any combination of wheat or feed grain, then 20 percent of the feed grain must be diverted without payment. An additional 30 percent may be diverted and payment received. The minimum diversion acreage (GSDM) is placed in the right hand sides of the model as an equality. The maximum diversion entry (GSDX) is entered in the right hand side as greater than or equal to the additional acreage eligible to receive payments.

Grain sorghum may be substituted for wheat, but each acre of grain sorghum planted above the base allotment reduces the diversion payment by one acre as a result of

the substitution. The total acreage of grain sorghum can never exceed the combined wheat and .8 of the feed grain base. This substitution necessitates the use of the grain sorghum registry entry. Wheat may be planted on the feed grain base without penalty.

When cotton is grown the operator must divert a minimum of 5 percent of the farm's allotment and receive payment for these acres. An additional 30 percent may be diverted and receive lesser payments per pound times the normal yield on these acres. The cotton minimum diversion acreage (CTDM) is set in the right hand side as an equality. The additional cotton diverted acreage (CTDX) is entered in the right hand side of the model as greater than or equal to the acreage qualifying for payment.

Labor

It is assumed the farm operator is available to work eight hours per day for each of 26 days per month. This eight hours is in addition to the time devoted to the managerial processes provided by the operator. The owner-operator provides 208 hours per month. It is assumed that additional labor may be hired as needed. The annual labor supply has been divided into 4 periods. Labor 1 has 416 hours available, and is the combined months of January and February. Labor 2 is March, April and May grouped together, providing 624 hours. June, July, and August provides 624 hours of labor and composes labor 3. September ,

October, November and December makes up labor period 4 and has 832 hours available for use by the farm operations. The farm operation is allowed to hire additional labor needed for any labor period.

Native Pasture

In addition to the 360 acres of cropland it is assumed that the farm has 640 acres of native pasture. This land is not suited to irrigation and does not compete with the cropping enterprises for the available water. The pasture provides .9 AUM's per acre, resulting in a total of 576 AUM's available for livestock. Sorghum stubble is treated as native pasture and also contributes to the supply allowing additional stocking of livestock, if the farm organization contains grain sorghum.

Production and Certificate Inventories

This maximization model uses the principal of production inventories equal to zero for all the activities used in the program. These inventories are accounting procedures that allow the accumulation of production from a set of crop activities that may be either sold or used on the farm. In addition to the production inventories it is necessary to use certificate inventories to control price support payments when the farm is participating in the various institutional program. These certificate inventories

are placed in the right hand side as greater than or equal to zero. The certificate accounting procedures accumulate the production of each crop eligible for price support payments as provided for by the regulations governing the payments. It is also necessary to control the price support payments. This necessitates the use of maximum certificate payment controls. These control restrictions are constructed such that price support payments are made only when the specified crops in the program are eligible to receive payments.

Annual Capital

It is assumed that the farm operator has to borrow all the annual operating capital required to operate the farm. It is also assumed that he has sufficient borrowing capacity to obtain all the money that can be profitably used in the business.

Irrigation Water Restriction

It is assumed the representative farm has a 600 gallon per minute irrigation well. The well produces 1.324 acre inches of water for each of 25 days per month. A total of 761 acre inches of water can be pumped per month. A restriction has been included for each month, making a total of twelve water equations.

Variation In Restrictions For Representative Farms For Other Areas

Appendix Table A-XIII, XIV and XV contain the right hand sides for the linear programming profit maximization models for the three water bearing formations. The right hand side values for the representative farm are given in Appendix Table A-XIII. The primary difference between Appendix Table A-XIII and A-XIV are the productive classes of land and the institutional programs. The 360 acres of cropland on this farm in the Dog Creek Shale and Blaine water bearing formation located in Harmon County is assumed to contain 11 acres of L_a soils, 14 acres of L_b soils, 7 acres of L_c soils, 58 acres of C_b soils, 40 acres of C_c soils, 18 acres of C_d soils, 97 acres of S_b soils, 83 acres of S_b soils, and 32 acres of S_c soils [4]. This representative farm has 119 acres of wheat allotment, 72 acres of feed grain allotment, and 155 acres of cotton allotment. The right hand side values for each of the other restrictions are the same as those discussed for the Tillman County area.

Appendix Table A-XV differs from A-XIII and A-XIV by the productivity classes of soils and the institutional programs. The typical cropland farm is composed of 29 acres of L_a soils, 36 acres of L_b soils, 22 acres of L_c soils, 104 acres of S_b soils, 104 acres of S_c soils, and 65 acres of S_d soils [4]. The farm is assumed to have 108 acres of wheat allotment, an 83 acre feed grain base,

68 acres of cotton allotment and 43 acres of peanut allotment. Peanut allotment has been added as a restriction to the previously discussed institutional constraints. It is assumed that peanut production will exist in each combination of government programs. Appendix Table A-XV is developed for the Rush Springs Sandstone water bearing formation primarily found in Caddo County. Most of the irrigated farms in Caddo County are composed of loams and sands. Peanuts are the primary irrigated crop, and most of the irrigation water is used for their production. Peanuts are not adapted to clay soils and the majority of the irrigated farms do not contain these soils. The clay soils are found in the rolling areas, and in the timber sections of the county. For these reasons the representative farm is composed only of loam and sandy soils. A summary of the row abbreviations with a brief description are listed in Appendix Table A-XVI.

Alternative Farm Programs

It is possible for any of the representative farms to participate in (1) the 1968 upland cotton program, (2) the 1968 feed grain program, and (3) the 1968 wheat program simultaneously. However a farm operator may choose to comply with one, two, three, or none of the programs. In order to determine the best enterprise combination for the representative farm operation it was necessary to set up restrictions in the right hand side for the farm

complying with (1) the wheat, feed grain, and cotton program (PWSC), (2) the wheat and cotton programs (PWC), (3) the feed grain and cotton program (PSC), (4) the cotton program (PC), (5) nonparticipation (NPWSC), (6) the wheat and feed grain programs (PWS), (7) the wheat program (PW), and (8) the feed grain program (PS). Comparing the net returns for the eight right hand sides indicates which program participation combination is the most profitable. Appendix Table A-XVII is a summary of the alternative right hand sides used in the model with a short description of each.

Activity Development

The right hand sides contain the quantities of the restricting factors in the production of various enterprises on the representative farms. These constraints are listed horizontally and referred to as rows. The activities or enterprises that utilize the available resources are listed vertically as columns. Coefficients are placed in the matrix corresponding to the exhaustable resources used in their production. The enterprise coefficients were obtained from irrigated crop budgets [7] and dryland crop budgets [12] previously prepared for crops in southwestern Oklahoma.

Appendix Table B-XVIII, XIX and XX shows a listing of the tableaus for each of the three water bearing formations. Cow-calf, feeder steers, buy hay, substitution, diversion,

crop production, sell, borrow capital, and hire labor compose the activities used in the program model.

A description of each of the activities is provided to assist in the interpretation of the tableaus. Appendix Table B-XXI lists all the activities used in the models and gives a short description of each.

Institutional Program Control Activities

Control activities are used to incorporate the provisions of the government program in the model. The right hand side values provide the restrictions necessary to control these activities. If the farm is participating in the feed grain program, it is necessary to divert 20 percent of the base without payment. The activity, DVMGS, forces 20 percent of the feed grain base to be diverted. A maximum of 50 percent of the base may be diverted with diversion payments received on the additional 30 percent. These payments are based on 45 percent of the total loan rate times the established per acre farm yield. The activity, DVXGS, incorporates this alternative. An additional activity, STGSW, was included to permit grain sorghum to be substituted for wheat. The substitution of grain sorghum for wheat necessitates construction of activities to perform the transaction if the substitution occurs in programming. An accounting procedure GSDR was included in the model with a greater than or equal to the zero value used in the right hand side. Corresponding to the

GSDR entry and under the substitution activity (STGSW) a positive one was entered, and a negative one was entered under maximum diversion of grain sorghum (DVXGS) corresponding to the grain sorghum registry (GSDR). These activities reduce the diversion payment acre for acre until the minimum diversion is reached. A negative one was entered under the substitution activity (STGSW) and parallel to the grain sorghum allotment entry (GSAL) in the right hand side to provide additional acreage for production of grain sorghum. If grain sorghum is substituted for wheat then two other right hand sides are necessary, and are listed as WSC2 and WS2. Grain sorghum receives a price support payment of 53 cents per cwt. on 50 percent of the feed grain base times the established yield. The activity to accomplish this is PSPGS.

It is not necessary to divert land to grow wheat in compliance with the government program. However, the activity is restricted by an allotment. This restriction warrants a price support payment for the controlled production. The payment activity (PWHCT) is based on 40 percent of the projected yield times $1.36 per bushel of wheat.

Diversion activities must also be included for cotton production. It is necessary to divert 5 percent of the base allotment. The minimum diversion activity (DVMCT) includes a payment of 10.76 cents per pound for the farm's projected yield per acre. The maximum diversion

activity (DVXCT) makes payment of 6 cents per pound times the projected yield per acre for an additional 30 percent.

A price support payment activity (PSPCT) pays cotton 12.24 cents per pound, based on the farm's projected yield times 65 percent of the farm's effective allotment.

In the event that peanut prices fall below 75 percent parity, a price support payment activity would have to be introduced into the model. Prices received for peanuts in this study are above 75 percent of parity, thereby not warranting price support payment.

Crop Activities

Both irrigated and dryland crops adapted to the study area were used in developing the cropping activities. The typical crops grown on farms in the Terrace Deposit Water bearing formations are as follows: (1) alfalfa, (2) cotton, (3) ensilage, (4) forage sorghum, (5) grain sorghum, (6) soybeans, and (7) wheat. The only difference between the cropping activities in this area and that of Dog Creek Shale and Blaine water bearing formations is the deletion of ensilage.

Forage sorghum hay, soybeans and ensilage are not normally grown under irrigation in the Rush Springs Sandstone water bearing formation. Surveys conducted in the area indicate these crops were not competitive with other crops contained in the model. These crops have been

eliminated from the activities in the programming model of Appendix Table B-XX.

Livestock Activities

Five livestock activities were selected for use in programming the representative farms. These activities are (CCF1, CCF2, CCF3, FSF1, and FSF2). The first three are cow-calf activities. All three assume fall calving and grazing on range. The first two assumes selling of calves on July 20. They differ only by the addition of hay to CCF2. The third activity assumes small grain grazing and selling calves in June. The two feeder steer activities (FSF1 and FSF2) assume fall buying in September. FSF1 sells in July and utilizes range, hay, and cotton seed cake. FSF2 sells in March and grazes on small grain pasture supplements by hay and cotton seed cake [13, pp. 32, 33, 34, 40 and 41].

Buy Hay Activity

The operator may either grow forage sorghum and alfalfa hay on the farm or they may be purchased (BYFH and BYAH) from outside sources.

Hired Labor Activity

The model assumes labor may be hired at $1.75 per hour for any of the labor periods. (HLB1, HLB2, HLB3, and HLB4) represent hired labor for (1) January and

February, (2) March, April, and May, (3) June, July, and August, and (4) September, October, November, and December respectively. These activities were introduced to allow the farm to use as much of the land, water, and program allotments as necessary to obtain the optimum combination of enterprises for the representative farm.

Summary of the Farm Situation

The representative farm consist of 360 acres of cropland and 640 acres of pasture. The cropland is broken down into productivity classes for each of the three water bearing formations described earlier in Chapters I and III. The farm contains one irrigation well capable of pumping 600 gallons per minute. It is further assumed that none of the pasture land will be irrigated and the stocking rate based accordingly.

The entreprenuer is the owner-operator, and returns are to his labor, machinery and irrigation equipment, management, overhead and risk.

CHAPTER IV

OPTIMUM ORGANIZATION OF THE REPRESENTATIVE FARMS

The problem of the optimum organization of enterprises confronts the farm manager in planning the annual operation of the farm business. Linear programming techniques may be used by the operator to assist with the decision making process. Representative farms from each of the water bearing formations have been programmed and the optimum organization of these farms will be discussed in this chapter.

Description Of The Optimum Organization Tables

The various institutional programs make it necessary to program an optimum organization of the representative farm for each of eight different program participations possibilities (Tables IV, VII, and X). Within these tables the activities are grouped into categories. The production activities consist of the various enterprises produced on the alternative classes of land at each of the water levels and the number of cows in the herd. The buy activity provides the livestock the amount of hay necessary in their production. Diversion is necessary to

comply with the government programs. Complying with the regulations of the institutional programs entitles the producer to receive price support payments. The sales activities indicate the quantity of production sold. The net returns are computed for the various programs and provides the entrepreneur the necessary information to make decisions relating to the enterprise combinations and program participation level that will give the greatest return to the fixed resources of the farm. The table also shows the amount of annual capital and hired labor necessary, and the months in which the irrigation water supply is exhausted.

Optimum Organizations For The Terrace Deposit

Column (5) in Table IV shows the optimum organization of the farm when participating only in the wheat program. Grain sorghum production is composed of 35.63 acres of S_b soil with 20 acre inches of irrigation water, 46 acres of S_c, and 40 acres of S_d dryland soils. Wheat production is obtained from 17.75 acres of L_a soils, with 16 acre inches of water, 21.25 acres of L_a soils, with 20 acre inches of water, 36 acres of L_b soils, with 20 acre inches of water, 11 acres of L_c dryland soils, 18 acres of C_b soils and 11 acres of C_c soils, with 20 acre inches of water, and 40 acres of S_c dryland soils. Twenty-eight acre inches of irrigation water is applied to 21.88 acres, and 32 acre inches to 16.12 acres of S_b soils in the production of

TABLE IV

OPTIMUM ORGANIZATION OF THE REPRESENTATIVE FARM IN THE TERRACE DEPOSIT WATER BEARING FORMATION FOR PARTICIPATION IN THE VARIOUS INSTITUTIONAL PROGRAMS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
				Wheat	Sorghum	Cotton	Wheat & Cotton	Wheat & Sorghum	Sorghum & Cotton	Wheat, Sorghum & Cotton	Non Participation
Activity	Description	Water Level	Unit	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity
Production											
Grain Sorghum	S_b	20"	Acre	35.63	25.00			30.25			31.70
Grain Sorghum	S_b	Dryland	Acre			74.30					
Grain Sorghum	S_c	Dryland	Acre	46.00		86.00	45.30		14.30	14.30	86.00
Grain Sorghum	S_d	Dryland	Acre	40.00		35.70	35.70		10.70	10.70	40.00
Wheat	L_a	16"	Acre	17.75				7.00			
Wheat	L_a	20"	Acre	21.25	23.38			26.63			
Wheat	L_b	20"	Acre	36.00	36.00			36.00			36.00
Wheat	L_c	Dryland	Acre	11.00	11.00	11.00	11.00	11.00	11.00	11.00	9.02
Wheat	C_b	20"	Acre	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
Wheat	C_c	20"	Acre	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00
Wheat	C_d	Dryland	Acre		15.00						
Wheat	S_b	16"	Acre				50.85			50.85	
Wheat	S_b	Dryland	Acre				23.45			23.45	
Wheat	S_c	20"	Acre				40.70		51.63	40.70	
Wheat	S_c	Dryland	Acre	40.00				25.13			
Wheat	S_d	Dryland	Acre					20.24			
Alfalfa	L_a	32"	Acre								39.00
Alfalfa	S_b	24"	Acre								
Alfalfa	S_b	28"	Acre	21.88	38.00	38.00	38.00	38.00	38.00	38.00	
Alfalfa	S_b	32"	Acre	16.12							40.27
Alfalfa	S_b	Dryland	Acre								31.16
Cotton	L_a	24"	Acre			39.00	39.00		39.00	39.00	
Cotton	L_b	24"	Acre			36.00	36.00		36.00	36.00	
Cotton	S_b	24"	Acre			1.13	1.13		1.13	1.13	
Cotton	S_b	Dryland	Acre			5.57	5.57		5.57	5.57	
Ensilage	L_a	12"	Acre		10.63			5.38			
Ensilage	L_c	Dryland	Acre								
Ensilage	S_b	Dryland	Acre						74.30		
Ensilage	S_c	Dryland	Acre		86.00			60.86	20.07	31.00	
Forage Sorghum	L_c	Dryland	Acre								1.98
Soybeans	S_b	16"	Acre		15.75						15.85
Soybeans	S_b	20"	Acre	45.38	40.25			50.75			
Cow-Calf	Native		Head	12.00	16.00	35.00	12.00	14.00	23.00	12.00	25.00
Cow-Calf	SG & Native		Head	49.00	41.00	13.00	46.00	45.00	30.00	46.00	28.00

Buy										
Forage Hay	Buy	Ton	12.72	11.09	4.14	12.25	12.12	8.42	12.25	
Diversion										
Min. Grain Sorghum	Sell	Acre		10.00			10.00	10.00	10.00	
Max. Grain Sorghum	Sell	Acre		15.00			9.75	15.00	15.00	
Min. Cotton	Sell	Acre			4.30	4.30		4.30	4.30	
Max. Cotton	Sell	Acre								
Price Supports										
Grain Sorghum	Received	Cwt.		812.50			983.13	253.60	253.60	
Wheat	Received	Bu.	2498.90			2324.94	2432.10		2324.94	
Cotton	Received	Cwt.			556.27	556.27		556.27	556.27	
Sales										
Grain Sorghum	Sell	Cwt.	4047.62	1625.00	4317.80	1639.20	1966.25	507.20	507.20	4673.04
Wheat	Sell	Bu.	6247.25	5144.75	1626.00	5812.35	6080.25	3588.03	5812.35	3374.59
Cotton Lint	Sell	Cwt.			855.76	855.76		855.76	855.76	
Cotton Seed	Sell	Cwt.			1370.22	1370.22		1370.22	1370.22	
Ensilage	Sell	Ton		1093.75			727.00	1036.55	310.00	
Alfalfa	Sell	Ton	388.88	378.41	385.36		377.38	381.08	377.25	973.15
Soybeans	Sell	Bu.	1815.00	2177.00			2030.00			475.63
Net Returns		Dol.	21898.71	19001.90	25664.12	28272.43	22148.71	25567.48	28524.36	20518.85
Annual Capital	Used	Dol.	18042.72	17364.44	15515.62	19678.94	17913.63	17951.99	19667.58	15881.80
Hired Labor										
Labor 2	Used	Hrs.	48.88	45.65		42.92	34.12		27.17	
Labor 4	Used	Hrs.	52.74			55.94	35.51		55.94	41.70
Water Depleted										
March		A.In.	X			X	X		X	
June		A.In.								X
July		A.In.	X	X	X	X	X	X	X	X
August		A.In.	X	X	X	X	X	X	X	X

alfalfa. These alfalfa activities satisfy the conserving acres restriction placed on the farm in order to participate in the institutional programs. It is not profitable to include cotton, ensilage or forage sorghum in this organization of enterprises. Soybeans are produced on 45.38 acres of S_b soils, with 20 acre inches of irrigation water. The cow-calf operation contains 61 cows. Of this number, 12 head are carried on native pasture, and 49 head on a combination of small grain and native pasture. The cow-calf operation necessitates the buying of 12.72 tons of forage hay. The operator is not required to divert acres to participate in the wheat program. Wheat certificate payments are received on 2,498.9 bushels of wheat. The farm sold 4,047.62 cwt. of grain sorghum, 6,247.25 bushels of wheat, 1,815 bushels of soybeans and 388.88 tons of alfalfa hay. The optimum organization of enterprises used 48.88 hours of hired labor in period two, and 52.74 hours in period four. Irrigation water was exhausted in March, July, and August. These activities used $18,042.72 of operating capital, and show net returns of $21,898.71.

The optimum combination of enterprises for the farm participating only in the feed grain program is shown in column 6 of Table IV. The results indicate that additional acres are diverted above the minimum, and grain sorghum acreage is reduced to be in compliance with the feed grain program. Ensilage enters the optimum solution whenever grain sorghum production is controlled indicating that

ensilage is the next most profitable crop to grain sorghum in the combination of crop enterprises. Net returns for this solution were $2,897 less than for the organization participating in the wheat program. The annual capital and hired labor requirement were also reduced.

The optimum organization for participation in the cotton program is shown in column 7 of Table IV. Cotton is produced on L_a, L_b, and S_b productivity levels of soils causing a reduction of wheat and voiding soybean production. Grain sorghum and alfalfa production utilize most of the S_b soils. Net returns for this solution were increased $6,663 over the solution in column 6 and $3,766 over the solution in column 5. The annual capital was less in this program than the two previous programs, also the solution did not require hired labor.

The combinations of these three programs indicates that the maximum amount of feed grain acres are diverted except when wheat and grain sorghum are grown in combination, staying within bounds of the allotments. This combination shows only 9.75 acres of grain sorghum diverted for payment. This indicates that it is more profitable to produce grain sorghum than to divert the maximum acreage. The maximum amount eligible for payment in any of the feed grain compliance programs on this farm is 15 acres.

Wheat enters the optimum farm organization in all the combinations of right hand sides. Whenever cotton is

produced it replaces wheat grown on productivity classes L_a and L_b soils. Cotton enters the program only when complying with the cotton program. A factor contributing to the inclusion of wheat production is the cow-calf activity using small grain pasture. By utilizing this pasture, returns are increased in the production of wheat. In general the high irrigation water level is applied to wheat. This water level gives the operator the greatest production of grain and AUM's of grazing. Wheat does not have to compete with other crops for irrigation water during the production process since no other crops are irrigated in this period.

Soybeans are grown on productivity class S_b soil under irrigation. This activity replaces cotton and is grown only when cotton is not being produced.

Only enough alfalfa to satisfy the 38 conserving acres restriction is included except when the farm is not participating in any of the various institutional programs. When payments from government program compliance is not included alfalfa is a competitive crop and is produced at a level above 38 acres. This indicates that if price support payments are not provided, the profitability of the farm organization would be improved by growing alfalfa. Whenever price support payments are available crops are grown to the extent of their respective allotments. Net returns to the fixed resources are the highest when the farm is participating in all the institutional programs

simultaneously. The optimal organization for this situation is shown in column 11 of Table IV.

Shadow prices in Table V show the value of an additional unit of a resource, if it were available to the farm. These prices would be a valuable aid in assisting the farm manager with planning the expansion of the farming operation. This table not only shows the value of an additional unit of a resource, but also shows the price necessary for an activity to enter the solution. An example is soybeans. The price received for a bushel of soybeans if $2.65. The price necessary for the crop to be competitive with cotton would be $3.42, $3.22, $3.36, and $3.10 as shown respectively in columns 6, 7, 9, and 10 in Table V.

Table VI assists in the analysis of the optimum organization of activities. This table lists the activities, shows the present cost or return of each activity, and the upper and lower price or cost limits. The computer routine is a minimizing model. Consequently, the numbers preceded by a negative sign indicate returns, while those activities that are positive indicate the cost of production or use. The absolute value of limit 1 is the maximum permissible return of the basic variable. If the return exceeds this value, then another variable would enter the basis. The absolute value of limit 2 is the minimum return of the basic variable. If the return dropped below this limit, another variable would enter the basis.

TABLE V

SHADOW PRICES OF THE REPRESENTATIVE FARM IN THE TERRACE DEPOSIT WATER BEARING FORMATION FOR PARTICIPATION IN THE VARIOUS INSTITUTIONAL PROGRAMS

(1) Activity	(2) Description	(3) Unit	(4) Wheat	(5) Sorghum	(6) Cotton	(7) Wheat & Cotton	(8) Wheat & Sorghum	(9) Sorghum & Cotton	(10) Wheat, Sorghum & Cotton	(11) Non Participation
Total Cropland		Acre	15.49	8.55	16.59	15.49	9.84	9.96	9.74	0.00
Land	L_a	Acre	32.81	30.97	38.29	42.37	33.76	40.68	43.43	38.43
Land	L_b	Acre	32.81	30.97	38.29	42.37	33.76	40.68	43.43	38.22
Land	L_c	Acre	15.89	13.75	6.04	15.27	16.85	12.40	16.33	21.44
Land	C_b	Acre	32.59	30.60	26.79	35.04	33.55	30.06	36.10	37.93
Land	C_c	Acre	14.19	17.49	13.60	16.63	15.14	16.93	17.69	24.89
Land	C_d	Acre	0.00	.78	0.00	0.00	0.00	0.00	0.00	8.19
Land	S_b	Acre	17.32	17.82	10.99	15.07	22.80	13.38	16.13	28.59
Land	S_c	Acre	7.32	9.57	7.32	7.32	8.27	8.38	8.38	23.91
Land	S_d	Acre	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.59
Land	Conserving	Acre	42.03	53.59	27.97	19.16	45.71	31.88	23.85	0.00
Wheat & Sorghum	Allotment	Acre	0.00	0.00	0.00	0.00	8.57	0.00	9.19	0.00
Wheat	Allotment	Acre	3.88	0.00	0.00	4.50	0.00	0.00	0.00	0.00
Grain Sorghum	Allotment	Acre	0.00	34.23	0.00	0.00	24.92	10.52	1.33	0.00
Grain Sorghum	Min. diversion	Acre	15.49	42.78	16.59	15.49	43.34	20.48	20.26	0.00
Grain Sorghum	Max. diversion	Acre	27.85	.56	26.75	27.85	0.00	22.86	23.08	43.34
Cotton	Allotment	Acre	43.69	50.63	28.91	23.97	95.50	32.16	28.66	59.18
Cotton	Min. diversion	Acre	0.00	0.00	13.68	19.72	0.00	17.06	20.78	0.00
Labor Period	2	Hour	1.75	1.75	0.00	1.75	1.75	1.39	1.75	0.00
Labor Period	4	Hour	1.75	0.00	0.00	1.75	1.75	0.00	1.75	1.75
Ensilage	Production	Ton	6.47	6.00	6.29	6.47	6.00	6.00	6.00	6.25
Forage Hay	Production	Ton	20.00	20.00	20.00	20.00	20.00	20.00	20.00	19.93
Alfalfa	Production	Ton	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
Soybean	Production	Bu.	2.65	2.65	3.42	3.22	2.65	3.36	3.10	2.65
Native and Sorghum Stubble	Pasture	AUM	2.64	3.85	4.23	2.64	2.64	3.93	2.64	3.02
Small Grain	Pasture	AUM	2.17	3.64	4.36	2.16	2.17	3.79	2.17	2.89
Wheat	Production	Bu.	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60
Cotton Seed	Production	Cwt.	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
Grain Sorghum	Production	Cwt.	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93
Cotton	Production	Cwt.	20.50	20.50	20.50	20.50	20.50	20.50	20.50	20.50
Wheat	Certificate	Bu.	1.36	0.00	0.00	1.36	1.36	0.00	1.36	0.00
Grain Sorghum	Certificate	Cwt.	0.00	.53	0.00	0.00	.53	.53	.53	0.00
Cotton	Certificate	Cwt.	6.64	6.36	12.24	12.24	12.24	12.24	12.24	8.79
Irrigation Water	March	A.In.	1.12	0.00	0.00	.73	1.12	0.00	.73	0.00
Irrigation Water	June	A.In.	0.00	0.00	0.00	0.00	0.00	0.00		6.93
Irrigation Water	July	A.In.	2.77	1.94	7.51	9.05	1.43	7.20	9.05	1.23
Irrigation Water	August	A.In.	1.35	2.16	3.19	1.35	1.81	3.19	1.35	1.21

TABLE VI

COST AND RETURN RANGES FOR THE OPTIMUM ORGANIZATION OF THE TERRACE DEPOSIT REPRESENTATIVE FARM PARTICIPATING IN THE VARIOUS INSTITUTIONAL PROGRAMS

Activity	Description	Water Level	Unit	Present Level	Wheat		Sorghum		Cotton		Wheat & Cotton	
					Limit 1	Limit 2	Limit 1	Limit 2	Limit 1	Limit 2	Limit 1	Limit 2
Production												
Cow-Calf	Native	—	Head	-57.81	-66.21	-51.06	-71.92	-55.82	-74.35	-56.31	-67.79	-55.88
Cow-Calf	SG & Native	—	Head	-68.97	-73.50	-64.19	-70.15	-59.49	-69.98	-57.85	-70.27	-62.27
Grain Sorghum	S_b	20"	Acre	55.87	52.62	57.55	55.31	58.81				
Grain Sorghum	S_b	Dryland	Acre	18.74					9.87	18.84		
Grain Sorghum	S_b	Dryland	Acre	18.56	17.60	23.24			Infinite	20.34	16.98	22.63
Grain Sorghum	S_c	Dryland	Acre	18.15	10.83	19.10			12.11	23.35	10.83	19.72
Wheat	L_a	16"	Acre	39.19	37.97	39.19						
Wheat	L_a	20"	Acre	44.47	44.47	45.69	44.47	46.21				
Wheat	L_a	20"	Acre	44.47	Infinite	44.47	Infinite	44.47				
Wheat	L_c	Dryland	Acre	20.72	Infinite	29.18	Infinite	23.97	20.63	23.62	Infinite	28.56
Wheat	C_c	20"	Acre	44.47	Infinite	44.55	Infinite	46.29	Infinite	47.27	Infinite	46.08
Wheat	C_c	20"	Acre	41.22	Infinite	43.22	Infinite	21.71	Infinite	45.94	Infinite	44.75
Wheat	C_d	Dryland	Acre	24.18			Infinite	24.61				
Wheat	S_a	16"	Acre	44.11							43.80	44.95
Wheat	S_b	Dryland	Acre	25.12							23.44	25.43
Wheat	S_c	20"	Acre	45.81							43.64	46.13
Wheat	S_c	Dryland	Acre	27.70	22.96	25.65						
Wheat	S_d	Dryland	Acre									
Alfalfa	L_a	32"	Acre									
Alfalfa	S_a	24"	Acre	139.42					138.27	154.44		
Alfalfa	S_b	28"	Acre	157.91	157.48	158.27	Infinite	161.16	142.80	159.06	152.52	161.60
Alfalfa	S_b	32"	Acre	171.27	170.91	170.70					164.35	176.66
Alfalfa	S_b	Dryland	Acre									
Cotton	L_b	24"	Acre	185.90	138.45	185.90	140.44	185.90	Infinite	195.80	Infinite	193.01
Cotton	L_b	24"	Acre	185.90					Infinite	196.96	Infinite	193.01
Cotton	S_b	24"	Acre	180.90					171.00	189.77	173.79	185.69
Cotton	S_b	Dryland	Acre	57.04					27.00	66.60	11.30	62.52
Ensilage	L_a	12"	Acre	73.02			66.50	73.02	37.37	40.36		
Ensilage	S_b	Dryland	Acre									
Ensilage	S_c	Dryland	Acre	40.78	36.09	41.45	Infinite	41.38			36.09	42.70
Forage Sorghum	L_c	Dryland	Acre									
Soybeans	S_b	16"	Acre	40.14			39.16	40.33	12.27	41.06		
Soybeans	S_b	20"	Acre	42.10	40.36	43.18	41.82	43.57			19.23	48.25
Buy												
Forage Hay	Buy		Ton	20.00	18.00	29.69	18.00	30.00	18.00	26.52	18.00	25.42
Diversion												
Min. Grain Sorghum	Sell		Acre		Infinite	Infinite	Infinite	Infinite	Infinite	Infinite	Infinite	Infinite
Max. Grain Sorghum	Sell		Acre	-43.34	Infinite	-15.49	Infinite	-42.78	Infinite	-16.59	Infinite	15.49
Min. Cotton	Sell		Acre	-59.18	-99.24	-33.00	-101.23	-33.00	Infinite	Infinite	Infinite	Infinite
Max. Cotton	Sell		Acre									

Price Supports											
Grain Sorghum	Received	Cwt.	- .53	Infinite	0	- .55	0	Inifinite	0	Inifinite	0
Wheat	Received	Bu.	- 1.36	- 1.87	- 1.08	0.00	0.00	0.00	0.00	- 1.46	- .91
Cotton	Received	Cwt.	-12.24	Infinite	- 6.64	Infinite	- 6.36	-16.61	- 6.76	-22.33	- 9.41
Sales											
Grain Sorghum	Sell	Cwt.	- 1.93	- 1.95	- 1.87	- 1.94	- 1.45	- 2.26	- 1.93	- 2.13	- 1.72
Wheat	Sell	Bu.	- 1.60	- 1.80	- 1.49	- 1.61	- 1.58	- 1.60	- 1.49	- 1.64	- 1.42
Cotton Lint	Sell	Cwt.	-20.50	-24.81	-16.86	-24.63	-16.68	-23.34	-16.93	-27.05	-18.65
Cotton Seed	Sell	Cwt.	- 2.40	- 5.10	- .12	- 4.98	- .01	- 4.20	- .24	- 6.57	- 1.28
Soybeans	Sell	Bu.	- 2.65	- 2.69	- 2.62	- 2.75	- 2.63				
Ensilage	Sell	Ton	- 6.00			- 6.06	- 5.97				
Alfalfa	Sell	Ton	-25.00	-25.48	-24.40	-28.00	-21.70	-28.00	-24.08	-28.00	-22.91
Labor											
Labor 2	Hired	Hour	1.75	.57	3.12	1.39	3.70			1.43	3.40
Labor 4	Hired	Hour	1.75	1.19	2.35					1.60	2.54

TABLE VI (CONTINUED)

Activity	Description	Water Level	Unit	Present Level	Wheat & Sorghum		Sorghum & Cotton		Wheat Sorghum & Cotton		Non Participation	
					Limit 1	Limit 2	Limit 1	Limit 2	Limit 1	Limit 2	Limit 1	Limit 2
Production												
Cow-Calf	Native	—	Head	- 57.81	- 68.98	- 52.45	- 67.92	- 55.19	- 67.79	- 55.88	- 61.07	- 57.07
Cow-Calf	SG & Native	—	Head	- 68.97	- 71.99	- 61.46	- 70.73	- 62.18	- 70.27	- 62.26	- 69.47	- 66.72
Grain Sorghum	S_b	20"	Acre	55.37	54.84	58.88					26.76	56.78
Grain Sorghum	S_b	Dryland	Acre	18.74								
Grain Sorghum	S_c	Dryland	Acre	18.56			17.97	19.35	18.04	19.88	Infinite	20.70
Grain Sorghum	S_d	Dryland	Acre	18.15			9.77	18.73	9.77	18.66	Infinite	23.06
Wheat	L_a	16"	Acre	39.19	38.68	39.19						
Wheat	L_a	20"	Acre	44.47	44.47	45.50						
Wheat	L_b	20"	Acre	44.47	Infinite	44.47					44.26	47.19
Wheat	L_c	Dryland	Acre	20.72	Infinite	29.18	Infinite	23.90	Infinite	28.56	20.43	23.27
Wheat	C_b	20"	Acre	44.47	Infinite	44.55	Infinite	46.49	Infinite	46.08	Infinite	45.38
Wheat	C_c	20"	Acre	41.22	Infinite	43.22	Infinite	45.16	Infinite	44.75	Infinite	45.94
Wheat	C_d	Dryland	Acre	20.93							Infinite	29.12
Wheat	S_b	16"	Acre	44.11					43.85	44.77		
Wheat	S_b	Dryland	Acre	25.12								
Wheat	S_c	20"	Acre	45.81			45.21	46.91	44.48	46.13		
Wheat	S_c	Dryland	Acre	24.70	22.97	25.21						
Wheat	S_d	Dryland	Acre	24.18	23.15	24.91			24.46	25.38		
Alfalfa	L_a	32"	Acre	161.43							Infinite	161.64
Alfalfa	S_b	24"	Acre	139.42			137.97	151.19			171.06	171.86
Alfalfa	S_b	28"	Acre	157.91	Infinite	159.75	146.14	159.36	152.52	161.60		
Alfalfa	S_b	32"	Acre	171.27					164.93	176.66		
Alfalfa	S_b	Dryland	Acre	57.63							56.72	57.84
Cotton	L_a	24"	Acre	185.90	Infinite	185.90	Infinite	195.05	Infinite	193.01		
Cotton	L_b	24"	Acre	185.90			Infinite	196.14	Infinite	193.01		
Cotton	S_b	24"	Acre	180.90			171.75	188.44	173.79	185.69	123.07	186.11
Cotton	S_b	Dryland	Acre	57.04			33.50	62.27	20.68	62.44		
Ensilage	L_a	12"	Acre	73.02	68.92	73.02					37.73	41.62
Ensilage	S_b	Dryland	Acre	43.28			35.74	44.08				
Ensilage	S_c	Dryland	Acre	40.78	40.26	42.51	39.98	41.23	31.58	42.40		
Forage Sorghum	L_c	Dryland	Acre	57.45							49.69	57.74
Soybeans	S_b	12"	Acre	36.28							34.99	45.62
Soybeans	S_b	16"	Acre	40.14			14.69	41.30				
Soybeans	S_b	20"	Acre	42.10	25.52	43.13			23.92	47.73		
Buy												
Forage Hay	Buy	—	Ton	20.00	18.00	29.55	18.00	26.59	18.00	25.42		
Diversion												
Min. Grain Sorghum	Sell	—	Acre		Infinite	Infinite	Infinite	Infinite	Infinite	Infinite	Infinite	0
Max. Grain Sorghum	Sell	—	Acre	- 43.34	- 47.56	- 42.31	Infinite	- 20.48	Infinite	- 20.26	- 83.86	- 33.00
Min. Cotton	Sell	—	Acre	- 59.18			Infinite	Infinite	Infinite	Infinite		
Max. Cotton	Sell	—	Acre									

Price Supports												
Grain Sorghum	Received	--	Cwt.	- .53	- .56	- .40	- .82	0	- .79	- .41	Infinite	0
Wheat	Received	--	Bu.	- 1.36	- 1.57	- .57			- 1.46	- .84		
Cotton	Received	--	Cwt.	- 12.24	Infinite	- 5.78	- 17.75	- 8.24	- 22.33	- 9.87	Infinite	- 8.79
Sales												
Grain Sorghum	Sell	--	Cwt.	- 1.93	- 1.94	- 1.87	- 2.07	- 1.45	- 2.06	- 1.87	- 1.97	- 1.88
Wheat	Sell	--	Bu.	- 1.60	- 1.69	- 1.28	- 1.62	- 1.54	- 1.64	- 1.39	- 1.60	- 1.58
Cotton Lint	Sell	--	Cwt.	- 20.50	Infinite	- 16.30	- 24.08	- 17.89	- 27.05	- 18.96	- 26.21	- 18.26
Cotton Seed	Sell	--	Cwt.	- 2.40	Infinite	.22	- 4.68	- .82	- 6.56	- 1.46	- 5.97	- 1.00
Soybeans	Sell	--	Bu.	- 2.65	- 2.80	- 2.62					- 2.69	- 2.26
Ensilage	Sell	--	Ton	- 6.00	- 6.10	- 5.94	- 6.23	- 5.95	- 6.92	- 5.35		
Alfalfa	Sell	--	Ton	- 25.00	- 27.55	- 20.79	- 28.00	- 23.84	- 28.00	- 22.91	- 25.25	- 24.94
Labor												
Labor 2	Hired	--	Hour	1.75	.78	3.81			1.43	2.65		
Labor 4	Hired	--	Hour	1.75	1.38	2.69			1.60	2.54	1.66	2.14

When considering cost, limit 1 is the minimum permissible cost of the basic variable. If the cost dropped below this limit, another variable would enter the basis. Limit 2 is the maximum permissible cost of the basic variable. If the cost exceeds this value, then another variable would enter the basis. These ranges assume only the one variable is allowed to change while all others are held constant. As each variable is changed the upper and lower limits of other variables change.

Optimum Organizations For The Dog Creek Shale and Blaine Formations

The activities included in the model for this area are very similar to that of the Terrace Deposits. However, the institutional programs and the productivity classes of land are different.

Table VII lists the optimum organization of the various right hand sides used in the production of enterprises in the Dog Creek Shale and Blaine Formations. Wheat production again entered every right hand side. Whenever price supports were available, all the crops eligible to receive payment were produced to their maximum allotments. The program indicates that the maximum amount of feed grain was diverted, but the diversion of cotton varied, never reaching the maximum acreage. Soybeans replaced cotton in the farm organization when the price support was not received on cotton production. Cotton replaced wheat

TABLE VII

OPTIMUM ORGANIZATION OF THE REPRESENTATIVE FARM IN THE DOG CREEK SHALE AND BLAINE DEPOSIT WATER BEARING FORMATIONS FOR PARTICIPATION IN THE VARIOUS INSTITUTIONAL PROGRAMS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
				Wheat	Sorghum	Cotton	Wheat & Cotton	Wheat & Sorghum	Sorghum & Cotton	Wheat, Sorghum & Cotton	Non Participation
Activity	Description	Water Level	Unit	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity
Production											
Grain Sorghum	L_a	12"	Acre	8.53							
Grain Sorghum	C_b^a	16"	Acre								1.02
Grain Sorghum	C_b^b	20"	Acre	16.88	25.58			27.42			30.69
Grain Sorghum	S_b^b	20"	Acre	11.55	8.25			8.58			
Grain Sorghum	S_c^c	Dryland	Acre	83.00	2.17	30.00	16.00		29.96	26.00	83.00
Grain Sorghum	S_d	Dryland	Acre	32.00		32.00	32.00		6.00		32.00
Wheat	L_a	16"	Acre		4.58						
Wheat	L_a	20"	Acre		6.42						
Wheat	L_b	20"	Acre	14.00	14.00			14.00			14.00
Wheat	L_c^c	Dryland	Acre	7.00	7.00	7.00	7.00	7.00		7.00	4.64
Wheat	C_b^b	16"	Acre			5.75	5.75			5.75	
Wheat	C_b^c	20"	Acre	41.12	32.42	52.25	52.25	30.58	55.04	52.25	26.29
Wheat	C_c^c	20"	Acre	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Wheat	C_d^c	Dryland	Acre	16.88	14.00						18.00
Wheat	S_c^c	16"	Acre					3.78			
Wheat	S_c^c	20"	Acre					8.65			
Wheat	S_c^c	Dryland	Acre		80.83		14.00	14.99			
Alfalfa	L_a	28"	Acre					11.00			
Alfalfa	L_a^a	32"	Acre	2.48							11.00
Alfalfa	C_b^b	28"	Acre						2.96		
Alfalfa	S_b^b	28"	Acre	35.52	38.00	38.00	38.00	27.00	35.04	38.00	
Alfalfa	S_b^b	32"	Acre								68.27
Alfalfa	S_b^b	Dryland	Acre								12.88
Cotton	L_a	24"	Acre			11.00	11.00		11.00	11.00	
Cotton	L_b^b	24"	Acre			14.00	14.00		14.00	14.00	
Cotton	L_c^c	Dryland	Acre						7.00		
Cotton	S_b^c	Dryland	Acre			59.00	59.00		61.96	59.00	
Cotton	S_c^b	24"	Acre			51.13	51.13		51.13	51.13	
Cotton	S_c^c	Dryland	Acre			1.87	1.87		1.91	5.87	
Forage Sorghum	L_c	Dryland	Acre								2.36
Soybeans	S_b	12"	Acre								15.85
Soybeans	S_b^b	16"	Acre								
Soybeans	S_b^b	20"	Acre	49.93	50.75						
Cow-Calf	Native		Head	17.00	13.00	16.00	16.00	17.00	18.00	16.00	21.00
Cow-Calf	SG & Native		Head	41.00	47.00	40.00	41.00	40.00	38.00	40.00	34.00

Buy										
Forage Hay	Buy	Ton	10.96	12.53	10.76	10.99	10.81	10.31	10.76	
Diversion										
Min. Grain Sorghum	Sell	Acre		14.00			14.00	14.00	14.00	
Max. Grain Sorghum	Sell	Acre		22.00			22.00	22.00	22.00	
Min. Cotton	Sell	Acre			8.00	8.00		8.00	8.00	
Max. Cotton	Sell	Acre			10.00	10.00			6.00	
Price Supports										
Grain Sorghum	Received	Cwt.		1187.38			1054.00	383.58	286.00	
Wheat	Received	Bu.	1936.80			1995.70	1932.74		1861.30	
Cotton	Received	Cwt.			632.88	632.88		651.16	640.68	
Sales										
Grain Sorghum	Sell	Cwt.	4802.88	2374.75	1236.00	928.00	2108.00	767.15	572.00	4616.48
Wheat	Sell	Bu.	4842.00	6821.92	4653.25	4989.25	4831.85	4351.93	4653.25	4059.12
Cotton Lint	Sell	Cwt.			972.81	972.81		1000.79	984.81	
Cotton Seed	Sell	Cwt.			1567.40	1567.40		1613.62	1587.20	
Alfalfa	Sell	Ton	380.97	376.98	378.74	378.51	378.69	376.23	378.74	907.58
Soybeans	Sell	Bu.	1997.00	2030.00			2569.00			475.63
Net Returns		Dol.	21112.57	18789.46	26264.94	28850.64	20555.43	26866.18	29347.73	20035.61
Annual Capital	Used	Dol.	17231.32	18041.77	18953.78	19109.43	16698.22	18653.55	18809.37	16789.29
Hired Labor										
Labor 2	Used	Hrs.	58.22		46.39	39.30	12.97	28.06	26.55	
Labor 4	Used	Hrs.	3.37	62.48	8.69	17.97			10.33	85.85
Water Depleted										
March		A.In.	X	X	X	X	X		X	
April		A.In.								X
June		A.In.								X
July		A.In.	X	X	X	X	X	X	X	X
August		A.In.	X	X	X	X	X	X	X	X

on L_a, L_b, and S_b soils whenever produced. If the farm was not participating in any institutional programs, the optimum organization would consist of 146.71 acres of grain sorghum, 102.93 acres of wheat, 92.15 acres of alfalfa, 2.36 acres of forage sorghum and 15.85 acres of soybeans. The organization indicating the greatest net return is the farm participating in all of the institutional programs.

Table VIII shows the value of an additional unit of resource for the various programs participated in by the representative farm. The present level of costs and returns and the upper and lower limits for the different optimum farm organizations are shown in Table IX.

Optimum Organizations For The Rush Springs Sandstone Formation

This area is located in the extreme northeast section of the study area. Farming varies somewhat from that of the other two areas. Peanuts are the chief crop grown. Cotton, grain sorghum, alfalfa and wheat are considered as the major crops grown in combination with peanuts. Most of the wheat is grown under dryland conditions. Surveys conducted indicated that clay soils would not be contained in the representative farm situation. In classifying the soils in the water bearing formations, clay soils were found in the rolling and rough brokenland sections of Caddo County.

TABLE VIII

SHADOW PRICES OF THE REPRESENTATIVE FARM IN THE DOG CREEK SHALE AND BLAINE WATER BEARING FORMATIONS FOR PARTICIPATION IN THE VARIOUS INSTITUTIONAL PROGRAMS

(1) Activity	(2) Description	(3) Unit	(4) Wheat	(5) Sorghum	(6) Cotton	(7) Wheat & Cotton	(8) Wheat & Sorghum	(9) Sorghum & Cotton	(10) Wheat, Sorghum & Cotton	(11) Non Participation
Total Cropland		Acre	0.00	8.19	14.51	14.51	0.00	20.26	20.34	0.00
Land	L_a	Acre	37.41	24.58	48.13	48.13	30.60	48.21	48.13	38.43
Land	L_b	Acre	37.12	24.58	48.13	48.13	27.94	48.21	38.13	33.90
Land	L_c	Acre	17.57	13.26	6.61	16.87	8.57	6.01	14.92	21.44
Land	C_b	Acre	36.90	24.30	15.53	33.41	27.72	14.89	31.46	33.62
Land	C_c	Acre	18.50	11.26	2.57	15.01	9.31	1.88	13.06	20.58
Land	C_d	Acre	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.19
Land	S_b	Acre	28.52	14.55	21.53	21.53	21.92	21.61	21.53	28.59
Land	S_c	Acre	22.81	5.66	8.30	8.30	0.00	8.38	8.30	23.91
Land	S_d	Acre	15.49	0.00	.98	.98	0.00	0.00	0.00	16.59
Land	Conserving	Acre	43.93	45.78	13.33	13.33	48.56	8.95	7.49	0.00
Wheat & Sorghum	Allotment	Acre	0.00	0.00	0.00	0.00	26.70	0.00	0.00	0.00
Wheat	Allotment	Acre	17.69	0.00	0.00	3.88	0.00	0.00	0.00	0.00
Grain Sorghum	Allotment	Acre	0.00	15.89	0.00	0.00	1.94	0.00	0.00	0.00
Grain Sorghum	Min. Diversion	Acre	0.00	24.08	14.51	14.51	28.64	20.26	20.34	0.00
Grain Sorghum	Max. Diversion	Acre	43.34	19.26	28.83	28.83	14.70	23.08	23.00	43.34
Cotton	Allotment	Acre	59.18	50.99	18.49	18.49	33.00	12.85	12.66	59.18
Cotton	Min. Diversion	Acre	0.00	0.00	26.18	26.18	26.18	26.07	26.18	0.00
Cotton	Max. Diversion	Acre	0.00	0.00	0.00	0.00	0.00	0.00		0.00
Labor Period	2	Hour	1.75	0.00	1.75	1.75	1.75	1.75	1.75	0.00
Labor Period	4	Hour	1.75	1.75	1.75	1.75	1.73	1.28	1.75	1.75
Forage Hay	Production	Ton	20.00	20.00	20.00	20.00	20.00	20.00	20.00	19.93
Alfalfa	Production	Ton	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
Soybean	Production	Bu.	2.65	2.65	3.58	3.37	2.65	3.71	2.65	2.65
Native and Sorghum Stubble	Pasture	AUM	2.64	3.02	2.64	2.64	2.65	2.97	2.64	3.02
Small Grain	Pasture	AUM	2.17	2.89	2.17	2.17	2.18	2.56	2.17	2.89
Wheat	Production	Bu.	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60
Cotton Seed	Production	Cwt.	5.61	2.40	2.40	2.40	2.40	2.40	2.40	2.40
Grain Sorghum	Production	Cwt.	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93
Cotton	Production	Cwt.	20.50	20.50	20.50	20.50	20.50	20.50	20.50	20.50
Wheat	Certificate	Bu.	1.36	0.00	0.00	1.36	1.36	0.00	1.36	0.00
Grain Sorghum	Certificate	Cwt.		.53	0.00	0.00	.53	.53	.53	0.00
Cotton	Certificate	Cwt.		7.20	12.24	12.24	3.52	12.24	12.24	7.94
Irrigation Water	March	A.In.	.78	.68	.46	1.14	.81		1.14	
Irrigation Water	April	A.In.								1.08
Irrigation Water	June	A.In.								6.39
Irrigation Water	July	A.In.	3.13	4.14	7.30	9.14	3.06	7.27	7.30	1.33
Irrigation Water	August	A.In.	1.58	2.05	3.19	1.35	2.16	3.19	3.19	1.16

TABLE IX

COST AND RETURN RANGES FOR THE OPTIMUM ORGANIZATION OF THE DOG CREEK SHALE AND BLAINE FORMATION REPRESENTATIVE FARM PARTICIPATING IN THE VARIOUS INSTITUTIONAL PROGRAMS

Activity	Description	Water Level	Unit	Present Level	Wheat		Sorghum		Cotton		Wheat & Cotton	
					Limit 1	Limit 2	Limit 1	Limit 2	Limit 1	Limit 2	Limit 1	Limit 2
Production												
Cow-Calf	Native	--	Head	- 57.81	- 69.15	- 46.33	- 59.28	- 43.48	- 60.45	- 44.14	- 69.15	- 50.63
Cow-Calf	Sg & Native	--	Head	- 68.97	- 77.25	- 61.35	- 78.70	- 67.98	- 78.15	- 67.20	- 73.79	- 61.35
Grain Sorghum	L_a	12"	Acre	41.05	38.67	41.57						
Grain Sorghum	C_b	16"	Acre	51.91								
Grain Sorghum	C_b	20"	Acre	57.40	57.11	58.90	55.42	58.53				
Grain Sorghum	S_b	20"	Acre	55.87	54.82	56.23	54.51	57.19				
Grain Sorghum	S_c	Dryland	Acre	18.55	Infinite	32.17	14.60	20.81	17.83	24.55	17.60	28.11
Grain Sorghum	S_d	Dryland	Acre	18.15	Infinite	32.91			Infinite	19.13	Infinite	19.10
Wheat	L_a	16"	Acre	39.19			37.80	39.19				
Wheat	L_a	20"	Acre	44.47			44.47	45.68				
Wheat	L_b	20"	Acre	44.47	44.18	45.79	Infinite	44.47				
Wheat	L_c	Dryland	Acre	20.72	Infinite	26.07	Infinite	33.98	Infinite	21.48	Infinite	31.74
Wheat	C_b	16"	Acre	39.27					37.45	39.63	37.97	41.19
Wheat	C_b	20"	Acre	44.47	41.84	44.76	43.34	44.55	43.78	46.29	42.55	45.77
Wheat	C_c	20"	Acre	41.22	Infinite	44.54	Infinite	43.22	Infinite	42.60	Infinite	43.14
Wheat	C_d	Dryland	Acre	20.93	15.58	23.56	15.26	21.44				
Wheat	S_c	20"	Acre	45.81								
Wheat	S_c	Dryland	Acre	24.70			22.44	27.35			13.68	25.40
Alfalfa	L_a	28"	Acre	149.23								
Alfalfa	L_a	32"	Acre	161.43	160.69	161.78						
Alfalfa	C_b	28"	Acre	139.63								
Alfalfa	S_b	24"	Acre	139.42					138.95	141.31		
Alfalfa	S_b	28"	Acre	157.91	157.43	158.43	Infinite	159.27	143.93	158.38	152.52	161.60
Alfalfa	S_b	32"	Acre	171.27							163.90	176.66
Alfalfa	S_b	Dryland	Acre	57.63								
Cotton	L_a	24"	Acre	185.90			134.45	185.90	Infinite	194.46	Infinite	194.46
Cotton	L_b	24"	Acre	185.90	129.38	186.19			Infinite	201.02	Infinite	200.32
Cotton	L_c	Dryland	Acre	40.95								
Cotton	S_c	Dryland	Acre	57.04					56.32	57.73	45.16	57.73
Cotton	S_b	24"	Acre	177.35					169.84	178.04	168.79	178.04
Cotton	S_c	Dryland	Acre	53.99					53.30	54.71	53.30	54.97
Forage Sorghum	L_c	Dryland	Acre	57.45								
Soybeans	S_b	12"	Acre	36.28								
Soybeans	S_b	16"	Acre	40.14								
Soybeans	S_b	20"	Acre	42.10	41.05	44.32	28.42	42.76			13.40	48.90
Soybeans	C_b	16"	Acre	40.14					6.82	40.52		
Buy												
Forage Hay	Buy		Ton	20.00	18.00	29.11	18.00	24.06	18.00	23.33	18.00	23.92

Diversion												
Min. Grain Sorghum	Sell	Acre				Infinite	Infinite	Infinite	Infinite	Infinite	Infinite
Max. Grain Sorghum	Sell	Acre	- 43.34	Infinite	0.00	Infinite	- 24.08	Infinite	- 14.51	Infinite	- 14.51
Min. Cotton	Sell	Acre	- 59.18	Infinite	- 33.00	- 95.24	- 33.00	Infinite	Infinite	Infinite	Infinite
Max. Cotton	Sell	Acre	- 33.00					- 33.98	- 26.38	- 33.98	- 32.30
Price Supports											
Grain Sorghum	Received	Cwt.	- .53	Infinite	0.00	- 1.58	- .29	Infinite	0.00	Infinite	0.00
Wheat	Received	Bu.	- 1.36	- 1.66	- .87	Infinite	- 7.20			- 1.91	- 1.07
Cotton	Received	Cwt.	- 12.24	Infinite	0.00			- 14.02	- 11.74	- 12.60	- 11.74
Sales											
Grain Sorghum	Sell	Cwt.	- 1.93	- 2.04	- 1.91	- 2.45	- 1.81	- 1.96	- 1.66	- 2.11	- 1.27
Wheat	Sell	Bu.	- 1.60	- 1.72	- 1.40	- 1.84	- 1.56	- 1.69	- 1.58	- 1.82	- 1.48
Cotton Lint	Sell	Cwt.	- 20.50	- 25.64	65.80	- 25.18	- 17.22	- 21.66	- 20.17	- 20.73	- 20.17
Cotton Seed	Sell	Cwt.	- 2.40			- 5.32	- .35	- 3.13	- 2.20	- 2.54	- 2.20
Soybeans	Sell	Bu.	- 2.65	- 2.68	- 2.59	- 2.70	- 2.44				
Alfalfa	Sell	Ton	- 25.00	- 25.98	- 24.54	- 28.00	- 21.28	- 28.00	- 24.63	- 28.00	- 23.47
Labor											
Labor 2	Hired	Hour	1.75		4.31				2.82	.82	3.13
Labor 4	Hired	Hour	1.75	.53	4.66	.55	1.87	.46	1.98	1.15	4.14

TABLE IX (CONTINUED)

Activity	Description	Water Level	Unit	Present Level	Wheat & Sorghum		Sorghum & Cotton		Wheat Sorghum & Cotton		Non Participation	
					Limit 1	Limit 2	Limit 1	Limit 2	Limit 1	Limit 2	Limit 1	Limit 2
Production												
Cow-Calf	Native	--	Head	- 57.81	- 72.55	- 57.66	- 72.37	- 54.76	- 69.15	- 43.55	- 69.40	- 53.12
Cow-Calf	SG & Native	--	Head	- 68.97	- 69.07	- 59.07	- 71.02	- 59.19	- 78.55	- 61.35	- 72.12	- 61.19
Grain Sorghum	L^a	12"	Acre	41.05								
Grain Sorghum	C^b	16"	Acre	51.91							48.51	54.03
Grain Sorghum	C^b	20"	Acre	57.40	49.40	62.04					52.88	59.10
Grain Sorghum	S^b	20"	Acre	55.87								
Grain Sorghum	S^b	Dryland	Acre	18.55	3.85	20.49	18.42	19.89	9.48	18.63	Infinite	21.41
Grain Sorghum	S^c_d	Dryland	Acre	18.15			16.27	18.26			Infinite	23.06
Wheat	L^a	16"	Acre	39.19								
Wheat	L^a	20"	Acre	44.47								
Wheat	L^a	20"	Acre	44.47	41.80	45.68					39.94	46.59
Wheat	L^b	Dryland	Acre	20.72	Infinite	29.29			Infinite	29.79	20.43	28.47
Wheat	C^c_b	16"	Acre	39.27					36.99	41.19		
Wheat	C^c_b	20"	Acre	44.47	38.99	45.76	43.63	46.29	42.55	46.75	42.70	47.27
Wheat	C^c_c	20"	Acre	41.22	Infinite	44.43	Infinite	43.10	Infinite	43.14	Infinite	45.74
Wheat	C^c_d	Dryland	Acre	20.93							Infinite	29.12
Wheat	S^c	16"	Acre	43.61	43.60	44.82						
Wheat	S^c	20"	Acre	45.81	44.60	45.84						
Wheat	S^c	Dryland	Acre	24.70	23.21	24.73						
Alfalfa	L^c	28"	Acre	149.23	Infinite	151.32						
Alfalfa	L^a	32"	Acre	161.43							Infinite	163.34
Alfalfa	C^a	28"	Acre	139.63			135.63	140.47				
Alfalfa	S^b	24"	Acre	139.42			133.21	139.58	132.05	154.79		
Alfalfa	S^b	28"	Acre	157.91	155.24	161.16	157.77	161.60	142.54	161. 60		
Alfalfa	S^b	32"	Acre	171.27							166.74	172.08
Alfalfa	S^b	Dryland	Acre	57.63							52.60	58.64
Cotton	L^a	24"	Acre	185.90			Infinite	194.38	Infinite	194.46	129.12	190.42
Cotton	L^b	24"	Acre	185.90	160.74	188.57	Infinite	200.94	Infinite	201.02		
Cotton	L^c	Dryland	Acre	40.95			Infinite	45.79				
Cotton	S^b	Dryland	Acre	57.04			53.04	57.73	41.57	57.73		
Cotton	S^c	24"	Acre	177.35			168.87	178.04	168.79	178.04		
Cotton	S^c	Dryland	Acre	53.99			53.30	54.12	53.91	62.29		
Forage Sorghum	L^c	Dryland	Acre	57.45							49.69	57.74
Soybeans	S^c	12"	Acre	36.28							34.49	41.31
Soybeans	S^b	16"	Acre	40.14	38.21	41.03						
Soybeans	S^b	20"	Acre	42.10	40.77	44.03						
Buy												
Forage Hay	Buy		Ton		20.00	19.58	27.19	18.00	23.57	18.00	23.92	
Diversion												
Min. Grain Sorghum	Sell		Acre		Infinite	Infinite	Infinite	Infinite	Infinite	Infinite		
Max. Grain Sorghum	Sell		Acre	- 43.34	Infinite	- 28.64	Infinite	- 20.26	Infinite	- 20.34	Infinite	0.00
Min. Cotton	Sell		Acre	- 59.18	Infinite	Infinite	Infinite	Infinite	Infinite	Infinite	- 89.92	- 33.00
Max. Cotton	Sell		Acre	- 33.00	- 95.36	- 21.03			- 41.30	- 32.92		

Price Supports												
Grain Sorghum	Received	Cwt.	- .53	- .86	- .35	- .73	- .41	- 1.35	- .49	Infinite	0.00	
Wheat	Received	Bu.	- 1.36	- 1.37	- .16			- 1.56	- .49			
Cotton	Received	Cwt.	- 12.24	Infinite	- 3.52	- 17.89	- 12.18	- 12.28	- 7.98	Infinite	- 7.94	
Sales												
Grain Sorghum	Sell	Cwt.	- 1.93	- 2.10	- 1.84	- 2.03	- 1.87	- 2.34	- 1.91	- 1.97	- 1.87	
Wheat	Sell	Bu.	- 1.60	- 1.60	- 1.12	- 1.61	- 1.52	- 1.68	- 1.25	- 1.61	- 1.50	
Cotton Lint	Sell	Cwt.	- 20.50	- 22.78	- 14.83	- 24.17	- 20.46	- 20.53	- 17.73	- 25.66	- 17.71	
Cotton Seed	Sell	Cwt.	- 2.40	- 3.82	- 1.14	- 4.71	- 2.38	- 2.42	- .72	- 5.63	- .65	
Soybeans	Sell	Bu.	- 2.65	- 2.86	- 2.55			- 3.88	Infinite	- 2.71	- 2.28	
Alfalfa	Sell	Ton	- 25.00	- 27.79	- 24.58	- 25.11	- 23.52	- 28.00	- 23.47	- 26.00	- 24.71	
Labor												
Labor 2	Hired	Hour	1.75	1.72	3.52	.93	1.98	1.63	5.60			
Labor 4	Hired	Hour	1.75					1.55	4.43	.98	3.14	

Eight right hand sides were programmed representating the combinations of various institutional programs. Peanut production was allowed in all the combinations of programs. Table X reveals the optimum organization of enterprises for the different government programs participated in by the representative farm.

Cotton enters the solution when price support payments are available and replaces some of the wheat on L_a, L_b, and S_c soils and grain sorghum on S_b soils. Maximum cotton diversion did not enter the optimum solution. However, the maximum diversion of grain sorghum occured when participating in the feed grain program. Grain sorghum, wheat, peanuts and alfalfa were in every optimum organization of enterprises. Thirty-eight acres of alfalfa was in every solution to satisfy the conserving acres restriction, except when the farm was not participating in institutional programs. Column 12 displays the optimum organization under non governmental restrictions. The optimum combination of enterprises that displays the greatest net return is when the representative farm is participating concurrently in all institutional programs.

Tables XI and XII list the shadow prices and the upper and lower limits of the activities contained in the enterprise combinations for the representative farm situations. Table XI reflects the importance of peanut production in this area. The value of peanut allotment ranges from $150.64 to $222.08 per acre.

TABLE X

OPTIMUM ORGANIZATION OF THE REPRESENTATIVE FARM IN THE RUSH SPRINGS SANDSTONE WATER BEARING FORMATION FOR PARTICIPATION IN THE VARIOUS INSTITUTIONAL PROGRAMS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
				Wheat	Sorghum	Cotton	Wheat & Cotton	Wheat & Sorghum	Sorghum & Cotton	Wheat, Sorghum & Cotton	Non Participation
Activity	Description	Water Level	Unit	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity
Production											
Grain Sorghum	L_a	12"	Acre		9.38						
Grain Sorghum	L_b	16"	Acre	6.25							12.25
Grain Sorghum	S_b	20"	Acre	23.00	23.00			29.25			
Grain Sorghum	S_b	Dryland	Acre			15.13					
Grain Sorghum	S_c	Dryland	Acre	76.75	8.63	104.00	42.00	11.75	41.00	41.00	104.00
Grain Sorghum	S_d	Dryland	Acre	65.00		61.00	61.00				65.00
Wheat	L_a	Dryland	Acre	29.00	19.63	8.86	8.88	29.00	8.88	8.88	1.00
Wheat	L_b	Dryland	Acre	29.75	36.00		36.00	36.00	15.13	36.00	23.75
Wheat	L_c	Dryland	Acre	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00
Wheat	S_c	Dryland	Acre	27.25	95.38		41.13	21.00	63.00	41.13	
Wheat	S_d	Dryland	Acre		23.00				19.00		
Alfalfa	L_a	28"	Acre								28.00
Alfalfa	S_b	24"	Acre			32.25	32.25		32.25	32.25	56.50
Alfalfa	S_b	28"	Acre			5.75	5.75		5.75	5.75	4.50
Alfalfa	S_b	32"	Acre	38.00	38.00			38.00			
Cotton	L_a	Dryland	Acre			20.13	20.13		20.13	20.13	
Cotton	L_b	24"	Acre			36.00			20.88		
Cotton	S_b	24"	Acre			7.86	23.00		23.00	23.00	
Cotton	S_c	24"	Acre				20.88			20.88	
Peanuts	S_b	15"	Acre	43.00	43.00		43.00	36.75	43.00	43.00	43.00
Peanuts	S_c	15"	Acre					6.25			
Cow-Calf	Native		Head	37.00	33.00	41.00	36.00	36.00	36.00	36.00	40.00
Cow-Calf	SG & Native		Head	11.00	16.00	3.00	10.00	11.00	10.00	10.00	5.00
Buy											
Forage Hay	Buy		Ton	3.82	5.07	1.86	3.53	3.89	3.53	3.53	2.26
Diversion											
Min. Grain Sorghum	Sell		Acre		17.00			17.00	17.00	17.00	
Max. Grain Sorghum	Sell		Acre		25.00			25.00	25.00	25.00	
Min. Cotton	Sell		Acre			4.00	4.00		4.00	4.00	
Max. Cotton	Sell		Acre								

Price Supports										
Grain Sorghum	Received	Cwt.		1100.19			1079.88	451.00	451.00	
Wheat	Received	Bu.	1230.20			1172.75	1245.20		1172.75	
Cotton	Received	Cwt.			357.69	327.61			327.61	
Sales										
Grain Sorghum	Sell	Cwt.	4747.25	2200.38	3749.00	2022.00	2159.75	902.00	902.00	4229.75
Wheat	Sell	Bu.	3075.50	5048.63	864.88	2931.88	3113.00	3210.63	2931.88	1317.50
Cotton Lint	Sell	Cwt.			550.22	503.78		535.09	503.78	
Cotton Seed	Sell	Cwt.			884.38	810.08		860.18	810.08	
Alfalfa	Sell	Ton	414.18	412.93	347.33	345.66	414.11	345.66	345.66	913.36
Peanuts	Sell	Cwt.	1634.00	1634.00		1634.00	1621.50	1634.00	1634.00	1634.00
Net Returns		Dol.	25885.64	24413.21	29194.22	30216.25	24908.64	29100.00	30502.88	26322.40
Annual Capital	Used	Dol.	16240.35	16953.04	16212.78	17130.00	15579.89	17057.94	16798.92	16049.63
Water Depleted										
March		A.In.								
June		A.In.								X
July		A.In.	X	X	X	X	X	X	X	X
August		A.In.	X		X	X		X	X	X

TABLE XI

SHADOW PRICES OF THE REPRESENTATIVE FARM IN THE RUSH SPRINGS SANDSTONE WATER BEARING FORMATION FOR PARTICIPATION IN THE VARIOUS INSTITUTIONAL PROGRAMS

(1) Activity	(2) Description	(3) Unit	(4) Wheat	(5) Sorghum	(6) Cotton	(7) Wheat & Cotton	(8) Wheat & Sorghum	(9) Sorghum Cotton	(10) Wheat, Sorghum & Cotton	(11) Non Participation
Total Cropland		Acre	15.25	8.69	16.59	16.59	0.00	8.69	0.00	0.00
Land	L_a	Acre	32.50	25.27	17.37	31.16	23.84	25.27	23.84	33.96
Land	L_b	Acre	25.95	20.35	13.06	24.62	17.30	20.35	17.30	29.04
Land	L_c	Acre	17.36	13.93	6.04	16.02	8.70	13.93	8.70	22.63
Land	S_b^c	Acre	29.00	23.11	10.99	19.86	20.40	18.28	12.54	33.46
Land	S_c	Acre	8.66	6.31	7.32	7.32	0.00	6.32	0.00	23.91
Land	S_d^c	Acre	1.34	0.00	0.00	0.00	0.00	0.00	0.00	16.59
Land	Conserving	Acre	34.24	41.71	14.85	3.52	54.31	15.15	27.43	0.00
Wheat & Sorghum	Allotment	Acre	0.00	0.00	0.00	0.00	28.06	0.00	28.06	0.00
Wheat	Allotment	Acre	4.15	0.00	0.00	4.15	0.00	0.00	0.00	0.00
Grain Sorghum	Allotment	Acre	0.00	14.73	0.00	0.00	1.68	14.73	1.68	0.00
Grain Sorghum	Min. Diversion	Acre	0.00	23.42	16.59	16.59	29.74	23.42	29.74	0.00
Grain Sorghum	Max. Diversion	Acre	28.09	19.91	26.75	26.75	13.60	19.92	13.60	43.34
Cotton	Allotment	Acre	43.93	50.49	39.92	26.13	37.87	39.92	50.04	59.18
Cotton	Min. Diversion	Acre	0.00	0.00	2.66	16.46	21.31	10.56	9.14	0.00
Alfalfa	Production	Ton	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
Native and Sorghum Stubble	Pasture	AUM	4.23	4.23	4.23	4.23	4.23	4.23	4.23	4.23
Small Grain	Pasture	AUM	4.36	4.36	4.36	4.36	4.36	4.36	4.36	4.36
Wheat	Production	Bu.	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60
Cotton Seed	Production	Cwt.	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
Grain Sorghum	Production	Cwt.	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93
Cotton	Production	Cwt.	20.50	20.50	20.50	20.50	20.50	20.50	20.50	20.50
Peanut	Allotment	Acre	203.89	208.87	163.20	150.64	222.08	163.35	174.55	212.33
Peanut	Production	Cwt.	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00
Wheat	Certificate	Bu.	1.36	0.00	0.00	1.36	1.36	0.00	1.36	0.00
Grain Sorghum	Certificate	Cwt.	0.00	.53	0.00	0.00	.53	.53	.53	0.00
Cotton	Certificate	Cwt.	3.63	4.86	12.24	12.24	0.00	12.24	12.24	8.56
Irrigation Water	June	A.In.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.24
Irrigation Water	July	A.In.	1.55	2.79	7.21	7.83	2.49	7.29	7.83	.81
Irrigation Water	August	A.In.	0.00	0.00	2.60	2.60	0.00	2.60	2.60	.75

TABLE XII

COST AND RETURN RANGES FOR THE OPTIMUM ORGANIZATION OF THE RUSH SPRINGS SANDSTONE REPRESENTATIVE FARM PARTICIPATING IN THE VARIOUS INSTITUTIONAL PROGRAMS

Activity	Description	Water Level	Unit	Present Level	Wheat		Sorghum		Cotton		Wheat & Cotton	
					Limit 1	Limit 2	Limit 1	Limit 2	Limit 1	Limit 2	Limit 1	Limit 2
Production												
Cow-Calf	Native		Head	- 57.81	- 74.36	- 56.06	- 74.36	- 48.43	- 74.36	- 49.89	- 74.36	- 57.48
Cow-Calf	SG & Native		Head	- 68.97	- 70.14	- 57.85	- 83.35	- 57.85	- 74.28	- 57.85	- 69.19	- 57.85
Grain Sorghum	L_a	12"	Acre	51.59			47.32	52.13				
Grain Sorghum	L_b	16"	Acre	63.91	53.71	63.97						
Grain Sorghum	S_b	20"	Acre	64.73	64.68	66.41	63.07	67.74				
Grain Sorghum	S_b	Dryland	Acre	18.74					14.43	19.34		
Grain Sorghum	S_b	Dryland	Acre	18.55	17.38	27.43	16.92	20.61	Infinite	25.87	17.38	23.24
Grain Sorghum	S_c	Dryland	Acre	18.15	Infinite	19.32			12.11	25.12	10.83	19.32
Wheat	L_d	Dryland	Acre	21.46	Infinite	24.46	20.92	25.73	19.22	25.77	21.45	30.70
Wheat	L_a	Dryland	Acre	21.14	21.09	30.02	Infinite	21.96			Infinite	21.15
Wheat	L_b	Dryland	Acre	20.72	Infinite	38.08	Infinite	34.65	Infinite	26.76	Infinite	28.91
Wheat	S_c	Dryland	Acre	24.70	15.94	24.75	22.64	26.33			22.01	25.87
Wheat	S_d	Dryland	Acre	24.18			23.26	26.24				
Alfalfa	L_a	28"	Acre									
Alfalfa	S_b	24"	Acre	153.70					146.33	156.46	146.33	159.35
Alfalfa	S_b	28"	Acre	174.57					171.80	178.26		
Alfalfa	S_b	32"	Acre	190.31	Infinite	193.31	Infinite	191.96			168.92	178.26
Cotton	L_a	Dryland	Acre	47.74					14.69	49.98	13.16	47.75
Cotton	L_b	24"	Acre						Infinite	207.79		
Cotton	S_b	24"	Acre	176.96					176.36	181.27	172.20	180.90
Cotton	S_c	24"	Acre	173.41	151.01	179.07	143.38	179.11			169.47	176.10
Peanuts	S_b	15"	Acre	160.56	Infinite	160.61	Infinite	164.16	Infinite	164.79	Infinite	164.80
Peanuts	S_c	15"	Acre									
Buy												
Forage Hay	Buy		Ton	20.00	18.00	30.70	18.00	30.70	18.00	31.75	19.08	31.75
Diversion												
Min. Grain Sorghum	Sell		Acre				Infinite	Infinite	Infinite	Infinite	Infinite	Infinite
Max. Grain Sorghum	Sell		Acre	- 43.34	Infinite	- 15.25	Infinite	- 23.42	Infinite	- 16.59	Infinite	- 16.59
Min. Cotton	Sell		Acre	- 59.18	-112.42	- 36.78	-101.16	- 33.00	Infinite	Infinite	Infinite	Infinite
Max. Cotton	Sell		Acre									
Price Supports												
Grain Sorghum	Received		Cwt.	- .53	Infinite	0.00	- .82	- .34	Infinite	0.00	Infinite	0.00
Wheat	Received		Bu.	- 1.36	- 1.38	- .93	Infinite	0.00	Infinite	0.00	- 1.36	- .93
Cotton	Received		Cwt.	- 12.24	Infinite	- 3.63	Infinite	- 4.86	- 18.43	- 11.31	- 14.64	- 12.21
Sales												
Grain Sorghum	Sell		Cwt.	- 1.93	- 1.96	- 1.69	- 2.08	- 1.83	- 2.11	- 1.90	- 2.12	- 1.72
Wheat	Sell		Bu.	- 1.60	- 1.61	- 1.43	- 1.67	- 1.17	- 1.62	- 1.48	- 1.60	- 1.43
Cotton Lint	Sell		Cwt.	- 20.50	- 22.86	- 14.90	- 23.66	- 15.70	- 24.52	- 19.90	- 22.06	- 20.48
Cotton Seed	Sell		Cwt.	- 2.40	- 3.87	1.10	- 4.38	.60	- 4.96	- 2.02	- 3.39	- 2.39
Alfalfa	Sell		Ton	- 25.00	- 28.00	- 20.99	- 28.00	- 20.99	- 27.18	- 23.14	- 28.00	- 24.28
Peanuts	Sell		Cwt.	- 11.00	Infinite	- 10.97	Infinite	- 9.20	Infinite	- 8.88	Infinite	- 8.88

Activity	Description	Water Level	Unit	Present Level	Wheat & Sorghum		Sorghum & Cotton		Wheat Sorghum & Cotton		Non Participation	
					Limit 1	Limit 2	Limit 1	Limit 2	Limit 1	Limit 2	Limit 1	Limit 2
Production												
Cow-Calf	Native		Head	- 57.81	- 73.42	- 48.43	- 74.36	- 48.43	- 74.36	- 57.48	- 74.36	- 48.43
Cow-Calf	SG & Native		Head	- 68.97	- 93.54	- 58.48	- 81.51	- 57.85	- 69.19	- 57.85	- 89.65	- 57.85
Grain Sorghum	L_a	12"	Acre	51.59								
Grain Sorghum	L_b	16"	Acre	63.91							61.36	65.29
Grain Sorghum	S_b	20"	Acre	64.73	57.42	65.21						
Grain Sorghum	S_c	Dryland	Acre	18.55	4.95	20.23	- 1.37	20.61	4.95	20.23	Infinite	20.29
Grain Sorghum	S_d	Dryland	Acre	18.15							Infinite	26.05
Wheat	L_a	Dryland	Acre	21.46	Infinite	23.95	19.82	26.38	21.45	30.70	18.90	22.83
Wheat	L_b	Dryland	Acre	21.14	Infinite	21.62	20.57	22.78	Infinite	21.15	19.77	23.70
Wheat	L_c	Dryland	Acre	20.72	Infinite	29.42	Infinite	34.65	Infinite	29.42	Infinite	29.15
Wheat	S_c	Dryland	Acre	24.70	24.22	33.19	22.64	25.27	23.02	28.64		
Wheat	S_d	Dryland	Acre	24.18			23.26	26.24				
Alfalfa	L_a	28"	Acre	174.07							172.70	174.07
Alfalfa	S_b	24"	Acre	153.70			146.33	156.50	146.33	159.35		
Alfalfa	S_b	28"	Acre	174.57			171.77	178.26	168.92	178.26	174.57	175.94
Alfalfa	S_b	32"	Acre	190.31	Infinite	193.25					182.94	190.31
Cotton	L_a	Dryland	Acre	47.74			16.51	49.38	10.26	47.75		
Cotton	L_b	24"	Acre	207.19			201.64	207.76			146.01	211.69
Cotton	S_b	24"	Acre	176.96			170.49	182.51	172.20	180.90		
Cotton	S_c	24"	Acre	173.41	Infinite	175.35			169.47	176.10		
Peanuts	S_b	15"	Acre	160.56	160.08	167.87	Infinite	164.80	Infinite	164.80	Infinite	170.32
Peanuts	S_c	15"	Acre	158.96	151.65	159.44						
Buy												
Forage Hay	Buy		Ton	20.00	18.00	30.70	18.00	31.75				
Diversion												
Min. Grain Sorghum	Sell		Acre		Infinite	Infinite	Infinite	Infinite	Infinite	Infinite		
Max. Grain Sorghum	Sell		Acre	- 43.34	Infinite	- 29.74	Infinite	- 23.42	Infinite	- 29.74	Infinite	0.00
Min. Cotton	Sell		Acre	- 59.18	Infinite	Infinite	Infinite	Infinite	Infinite	Infinite	- 85.52	- 33.00
Max. Cotton	Sell		Acre									
Price Supports												
Grain Sorghum	Received		Cwt.	- .53	- .87	- .38	- 2.34	0.00	- 1.77	- .38	Infinite	0.00
Wheat	Received		Bu.	- 1.36	- 1.53	- 1.16			- 1.36	- .24		
Cotton	Received		Cwt.	- 12.24	Infinite	0.00	- 16.93	- 11.65	- 14.64	- 12.21	Infinite	- 8.56
Sales												
Grain Sorghum	Sell		Cwt.	- 1.93	- 2.10	- 1.85	- 2.83	- 1.41	- 2.55	- 1.85	- 2.08	- 1.85
Wheat	Sell		Bu.	- 1.60	- 1.67	- 1.52	- 1.70	- 1.28	- 1.60	- 1.15	- 1.80	- 1.51
Cotton Lint	Sell		Cwt.	- 20.50	- 30.21	- 19.99	- 23.54	- 20.12	- 22.06	- 20.48	- 26.06	- 18.11
Cotton Seed	Sell		Cwt.	- 2.40	- 8.47	- 2.08	- 4.35	- 2.16	- 3.39	- 2.39	- 5.88	- .90
Alfalfa	Sell		Ton	- 25.00	- 28.00	- 20.99	- 27.21	- 23.90	- 28.00	- 24.28	- 25.28	- 22.46
Peanuts	Sell		Cwt.	- 11.00	- 11.23	- 7.35	Infinite	- 8.88	Infinite	- 8.88	Infinite	- 6.12

Summary of Representative Farm Situations

The optimum organization of enterprises of the representative farms from all the water bearing formations contain, grain sorghum, wheat, and alfalfa. In the Rush Springs Sandstone formation peanuts also were in every solution. Cotton is a profitable crop if price supports are available. The livestock enterprise consists of (1) a cow-calf program with fall calving on range, grain sorghum stubble, and wintered on cotton seed cake; selling calves July 20th, and (2) a cow-calf program with fall calving on small grain pasture, range, hay, and cotton seed cake; selling calves July 20th.

With the exception of one occasion the maximum acreage of grain sorghum was diverted when the farm was complying with the feed grain program. Additional cotton diversion occurred only in the Dog Creek Shale and Blaine formation representative farm organizations. Some hired labor was included in most of the optimum farm organizations for the two water bearing areas preceding the Rush Springs Sandstone formation, but labor was not hired in the latter.

Cotton production contributes greatly to the net returns when included in the farm organization. Net returns are lowest when the farm is participating only in the feed grain program.

CHAPTER V

SUMMARY AND CONCLUSIONS

This chapter consists of (1) a summary, which identifies the problem and describes how the objectives were fulfilled, (2) conclusions based on the results obtained, and (3) a discussion of areas for further research suggested in the course of this study.

Summary

The purpose of this study, as stated in Chapter I, was to determine the optimum organization of cropping enterprises for representative irrigated farms in southwestern Oklahoma. Results from a processed series developed for use in this study were used in setting up the linear programming model. The information necessary for programming the representative farms is discussed in Chapter III. The results obtained from programming the farms are presented in Chapter IV.

The objectives of this thesis were (1) to determine the cost and returns for alternative irrigated crops on the major soils of southwestern Oklahoma, and (2) to determine

what combinations of irrigated and dryland enterprises give the greatest return to the operator's fixed resources for representative farm situations in southwestern Oklahoma.

Three areas of southwestern Oklahoma were chosen because of their water bearing formations. These areas are described in Chapters I and III. A 1,000 acre farm, consisting of 360 acres of cropland and 640 acres of native pasture was chosen to represent each of the areas. The cropland acres were categorized into broad classifications and general productivity classes. Institutional programs were imposed on the farms, and all major compliance conditions were programmed.

It was assumed the farm has one 600 GPM irrigation well. Enterprises considered for each area were those that county extension personnel, area agronomists, area economists and farmers indicated were applicable. Each of the optimum solutions for the various right hand sides used, the shadow prices and the upper and lower limits are listed in tables in Chapter IV.

Conclusions

The irrigation water was exhausted in three critical months when complying with any combination of government programs. The water was usually exhausted in March, indicating a high useage by wheat, which was in every optimum solution. Cotton, grain sorghum, alfalfa, and peanuts competed for the available water in July and August.

When the farm was not complying with the institutional programs, a larger acreage of alfalfa was included in the organization and water was also exhausted in June. Whenever the farm participated in any combination of wheat and cotton, the cotton enterprise utilized the L_a and L_b productivity levels of soils, reducing the wheat acreage. Grain sorghum, alfalfa, and cotton consumed the S_b productivity level of soils causing soybeans to be forced out of the optimum solution. When peanuts were considered, they utilized the S_b soils to the limit of the allotted acres.

Both cow-calf and stocker-feeder steers were used in the linear programming model. The small grain pasture was utilized by the cow-calf program in the optimum organizations for all the areas and all the various right hand sides.

This study indicates it is not profitable to produce cotton on irrigated farms in the study area if price support and diversion payments are not available. It further shows that the maximum acreage eligible for diversion was never reached in these programs. This differs from the feed grain diverted acres. In the production of grain sorghum in all but one instance the maximum acreage was diverted when participating in the feed grain program.

The model was allowed to choose between dryland and irrigated crops as desired. In all the solutions irrigation was chosen and used until the irrigation water supply was

exhausted during the crop's critical water usage months. It is concluded from this study that under most conditions irrigation increases net returns to the fixed resources on the representative farms. It may further be concluded that the most profitable organization was attained when complying with all the government programs imposed on the operation of the 1,000 acre farm. The net returns to the representative farms are lowest when the farms participate only in the feed grain program. When not complying with institutional programs net returns are increased over feed grain compliance by $1200 to $1500. Wheat participation improves net returns over non participation approximately $1200 with the exception of the Rush Springs Area. In this area it is $437 more profitable to participate in only the peanut program than to participate in both the peanut and the wheat program. It is assumed that this condition exists because irrigated wheat was not an alternative in this area. The farm income is approximately the same when complying with wheat versus wheat and sorghum. Cotton contributes approximately $5,000 to net income when grown jointly with wheat and approximately $6,000 with sorghum.

Need For Further Study

Each year more acres of cropland are being irrigated. In certain areas the water supply is being depleted.

Studies need to be conducted on the efficiency of use of water from these formations.

It appears that underground sources of suitable water are limited in the study area. One problem existing is the contamination of underground water by chemicals harmful to crops and soils. A study of filtering systems may need to be conducted to determine if this supply of water has potential as a future source of suitable irrigation water. Also several streams in the study area cannot be used as irrigation water supplies because of contamination from salt deposits. If these streams could be routed around the deposits a suitable supply of water may be available for irrigation purposes. A feasibility study needs to be conducted to determine if water could profitably be filtered and if rerouting streams would provide an economical source of water for plant use.

Another area for study is the feasibility of importing water to replenish the supply in reservoirs in water districts. In the process of conducting surveys in the water districts it was noted that the farm manager was often faced with the decision of choosing which crop to allocate the alloted irrigation water. If the reservoirs supplying the irrigation water in the districts could be replenished more acre feet of water would be accessible to the farm manager increasing the productivity of crops.

Also, in conducting research in the peanut producing region of southwestern Oklahoma, interest was shown in the timeliness and the quantity of application of water to peanuts. The response of peanuts to irrigation merits further study because farmers tend to "save" water for peanuts that may be more profitably applied to other crops.

Finally, a large variation exists among leasing arrangements between landowners and tennants on irrigated farms. Studies to determine an equitable arrangement for sharing expenses and equipment would be useful information to parties concerned.

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APPENDIX A

DESCRIPTION OF RIGHT HAND SIDE USED IN THE LINEAR PROGRAMMING MODEL

TABLE XIII

ALTERNATIVE RIGHT HAND SIDE RESTRICTIONS FOR TERRACE DEPOSIT

		PWSC	PWC	PSC	PC	NPWSC	PWS	PW	PS	WSC2	WS2
+	TCPL	360.000	360.000	360.000	360.000	360.000	360.000	360.000	360.000	360.000	360.000
+	LNLA	39.000	39.000	39.000	39.000	39.000	39.000	39.000	39.000	39.000	39.000
+	LNLB	36.000	36.000	36.000	36.000	36.000	36.000	36.000	36.000	36.000	36.000
+	LNLC	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000
+	LNCB	18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000
+	LNCC	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000
+	LNSB	119.000	119.000	119.000	119.000	119.000	119.000	119.000	119.000	119.000	119.000
+	LNSC	86.000	86.000	86.000	86.000	86.000	86.000	86.000	86.000	86.000	86.000
+	LNSD	40.000	40.000	40.000	40.000	40.000	40.000	40.000	40.000	40.000	40.000
	CONS	38.000	38.000	38.000	38.000		38.000	38.000	38.000	38.000	38.000
+	WSAL	205.000	9999.000	9999.000	9999.000	9999.000	205.000	9999.000	9999.000	205.000	205.000
+	WTAL	9999.000	155.000	9999.000	9999.000	9999.000	9999.000	155.000	9999.000	9999.000	9999.000
+	GSAL	50.000	9999.000	50.000	9999.000	9999.000	50.000	9999.000	50.000	9999.000	9999.000
	GSDM	10.000		10.000			10.000		10.000	10.000	10.000
+	GSDX	15.000		15.000			15.000		15.000		
+	CTAL	86.000	86.000	86.000	86.000					86.000	
	CTDM	4.300	4.300	4.300	4.300					4.300	
+	CTDX	25.800	25.800	25.800	25.800					25.800	
+	GSDR										
+	LAB1	416.000	416.000	416.000	416.000	416.000	416.000	416.000	416.000	416.000	416.000
+	LAB2	624.000	624.000	624.000	624.000	624.000	624.000	624.000	624.000	624.000	624.000
+	LAB3	624.000	624.000	624.000	624.000	624.000	624.000	624.000	624.000	624.000	624.000
+	LAB4	832.000	832.000	832.000	832.000	832.000	832.000	832.000	832.000	832.000	832.000
	ALHI										
+	NPSS	576.000	576.000	576.000	576.000	576.000	576.000	576.000	576.000	576.000	576.000
	SGGZ										
	WHPI										
	CSPI										
	GSPI										
	CTPI										
+	WHCI										
+	GSCI										
+	CTCI										
+	WHCX	9999.000	9999.000				9999.000	9999.000		9999.000	9999.000
+	GSCX	9999.000		9999.000			9999.000		9999.000	9999.000	9999.000
+	CTCX	9999.000	9999.000	9999.000	9999.000					9999.000	
	ENSI										
	FSHI										
	SYBI										
-	ANCP										
+	JANW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	FEBW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	MARW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	APRW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	MAYW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	JUNW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	JULW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	AUGW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	SEPW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	OCTW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	NOVW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	DECW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000

TABLE XIV

ALTERNATIVE RIGHT HAND SIDE RESTRICTIONS FOR DOG CREEK SHALE AND BLAINE FORMATION

		PWSC	PWC	PSC	PC	NPWSC	PWS	PW	PS	WSC2	WS2
+	TCPL	360.000	360.000	360.000	360.000	360.000	360.000	360.000	360.000	360.000	360.000
+	LNLA	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	39.000	39.000
+	LNLB	14.000	14.000	14.000	14.000	14.000	14.000	14.000	14.000	36.000	36.000
+	LNLC	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	11.000	11.000
+	LNCB	58.000	58.000	58.000	58.000	58.000	58.000	58.000	58.000	18.000	18.000
+	LNCC	40.000	40.000	40.000	40.000	40.000	40.000	40.000	40.000	11.000	11.000
+	LNCD	18.000	18.000	18.000	18.000	18.000	18.000	18.000	18.000		
+	LNSB	97.000	97.000	97.000	97.000	97.000	97.000	97.000	97.000	119.000	119.000
+	LNSC	83.000	83.000	83.000	83.000	83.000	83.000	83.000	83.000	86.000	86.000
+	LNSD	32.000	32.000	32.000	32.000	32.000	32.000	32.000	32.000	40.000	40.000
	CONS	38.000	38.000	38.000	38.000		38.000	38.000	38.000	38.000	38.000
+	WSAL	191.000	9999.000	9999.000	9999.000	9999.000	205.000	9999.000	9999.000	205.000	205.000
+	WTAL	9999.000	119.000	9999.000	9999.000	9999.000	9999.000	119.000	9999.000	9999.000	9999.000
+	GSAL	72.000	9999.000	72.000	9999.000	9999.000	72.000	9999.000	72.000	9999.000	9999.000
	GSDM	14.000		14.000			14.000		14.000	10.000	10.000
+	GSDX	22.000		22.000			22.000		22.000		
+	CTAL	155.000	155.000	155.000	155.000					86.000	
	CTDM	8.000	8.000	8.000	8.000					4.300	
+	CTDX	46.000	46.000	46.000	46.000					25.800	
+	GSDR										
+	LAB1	416.000	416.000	416.000	416.000	416.000	416.000	416.000	416.000	416.000	416.000
+	LAB2	624.000	624.000	624.000	624.000	624.000	624.000	624.000	624.000	624.000	624.000
+	LAB3	624.000	624.000	624.000	624.000	624.000	624.000	624.000	624.000	624.000	624.000
+	LAB4	832.000	832.000	832.000	832.000	832.000	832.000	832.000	832.000	832.000	832.000
	ALHI										
+	NPSS	576.000	576.000	576.000	576.000	576.000	576.000	576.000	576.000	576.000	576.000
	SGGZ										
	WHPI										
	CSPI										
	GSPI										
	CTPI										
+	WHCI										
+	GSCI										
+	CTCI										
+	WHCX	9999.000	9999.000				9999.000	9999.000		9999.000	9999.000
+	GSCX	9999.000		9999.000			9999.000		9999.000	9999.000	9999.000
+	CTCX	9999.000	9999.000	9999.000	9999.000					9999.000	
	FSHI										
	SYBI										
-	ANCP										
+	JANW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	FEBW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	MARW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	APRW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	MAYW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	JUNW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	JULW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	AUGW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	SEPW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	OCTW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	NOVW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	DECW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000

TABLE XV

ALTERNATIVE RIGHT HAND SIDE RESTRICTIONS FOR RUSH SPRINGS SANDSTONE FORMATION

		PWSC	PWC	PSC	PC	NPWSC	PWS	PW	PS	WSC2	WS2
+	TCPL	360.000	360.000	360.000	360.000	360.000	360.000	360.000	360.000	360.000	360.000
+	LNLA	29.000	29.000	29.000	29.000	29.000	29.000	29.000	29.000	39.000	39.000
+	LNLB	36.000	36.000	36.000	36.000	36.000	36.000	36.000	36.000	36.000	36.000
+	LNLC	22.000	22.000	22.000	22.000	22.000	22.000	22.000	22.000	11.000	11.000
+	LNSB	104.000	104.000	104.000	104.000	104.000	104.000	104.000	104.000	119.000	119.000
+	LNSC	104.000	104.000	104.000	104.000	104.000	104.000	104.000	104.000	86.000	86.000
+	LNSD	65.000	65.000	65.000	65.000	65.000	65.000	65.000	65.000	40.000	40.000
	CONS	38.000	38.000	38.000	38.000		38.000	38.000	38.000	38.000	38.000
+	WSAL	191.000	9999.000	9999.000	9999.000	9999.000	191.000	9999.000	9999.000	205.000	205.000
+	WTAL	9999.000	108.000	9999.000	9999.000	9999.000	9999.000	108.000	9999.000	9999.000	9999.000
+	GSAL	83.000	9999.000	83.000	9999.000	9999.000	83.000	9999.000	83.000	9999.000	9999.000
	GSDM	17.000		17.000			17.000		17.000	10.000	10.000
+	GSDX	25.000		25.000			25.000		25.000		
+	CTAL	68.000	68.000	68.000	68.000					86.000	
	CTDM	4.000	4.000	4.000	4.000					4.300	
+	CTDX	20.000	20.000	20.000	20.000					25.800	
+	GSDR										
+	LAB1	416.000	416.000	416.000	416.000	416.000	416.000	416.000	416.000	416.000	416.000
+	LAB2	624.000	624.000	624.000	624.000	624.000	624.000	624.000	624.000	624.000	624.000
+	LAB3	624.000	624.000	624.000	624.000	624.000	624.000	624.000	624.000	624.000	624.000
+	LAB4	832.000	832.000	832.000	832.000	832.000	832.000	832.000	832.000	832.000	832.000
	ALHI										
+	NPSS	576.000	576.000	576.000	576.000	576.000	576.000	576.000	576.000	576.000	576.000
	SGGZ										
	WHPI										
	CSPI										
	GSPI										
	CTPI										
+	WHCI										
+	GSCI										
+	CTCI										
+	WHCX	9999.000	9999.000				9999.000	9999.000		9999.000	9999.000
+	GSCX	9999.000		9999.000			9999.000		9999.000	9999.000	9999.000
+	CTCX	9999.000	9999.000	9999.000	9999.000					9999.000	
	FSHI										
	SYBI										
-	ANCP										
+	JANW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	FEBW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	MARW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	APRW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	MAYW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	JUNW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	JULW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	AUGW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	SEPW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	OCTW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	NOVW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	DECW	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000	761.000
+	PNAL	43.000	43.000	43.000	43.000	43.000	43.000	43.000	43.000		
+	PNPI										

TABLE XVI

DESCRIPTION OF ROW ABBREVIATIONS USED IN THE LINEAR PROGRAMMING MODEL

TCPL	Total crop land
LNLA	Land L_a
LNLB	Land L_b
LNLC	Land L_c
LNCB	Land C_b
LNCC	Land C_c
LNCD	Land C_d
LNSB	Land S_b
LNSC	Land S_c
LNSD	Land S_d
CONS	Conserving acres
WSAL	Wheat and grain sorghum allotment
WTAL	Wheat allotment
GSAL	Grain sorghum allotment
GSDM	Grain sorghum minimum diversion
GSDX	Grain sorghum maximum diversion
GSDR	Grain sorghum diversion register
CTAL	Cotton allotment
CTDM	Cotton minimum diversion
CTDX	Cotton maximum diversion
PNAL	Peanut allotment
LAB1	Labor - January, February
LAB2	Labor - March, April, and May
LAB3	Labor - June, July, and August
LAB4	Labor - September, October, November and December
ENSI	Ensilage inventory
FSHI	Forage sorghum hay inventory
ALHI	Alfalfa hay inventory
SYBI	Soybean inventory
NPSS	Native pasture and grain sorghum stubble
SGGZ	Small grain grazing
WHPI	Wheat production inventory
GSPI	Grain sorghum production inventory
CTPI	Cotton production inventory
WHCI	Wheat certificate inventory
GSCI	Grain sorghum price support inventory
CTCI	Cotton price support inventory
WHCX	Wheat certificate available
GSCX	Grain sorghum price support available
CTCX	Cotton price support available
ANCP	Annual operating capital
JANW	January water available
FEBW	February water available
MARW	March water available
APRW	April water available
MAYW	May water available

TABLE XVI (CONTINUED)

JUNW	June water available
JULW	July water available
AUGW	August water available
SEPW	September water available
OCTW	October water available
NOVW	November water available
DECW	December water available

TABLE XVII

DESCRIPTION OF THE TEN ALTERNATIVE RIGHT HAND SIDES USED IN THE LINEAR PROGRAMMING MODEL

PWSC	Participating in wheat, grain sorghum, and cotton
PWC	Participating in wheat and cotton
PSC	Participating in grain sorghum and cotton
PC	Participating in cotton
NPWSC	Non participating in wheat, grain sorghum and cotton
PWS	Participating in wheat and grain sorghum
PW	Participating in wheat
PS	Participating in sorghum
WSC2	Participating in wheat, sorghum and cotton under 1968 provisions substituting grain sorghum for wheat
WS2	Participating in wheat and sorghum under 1968 provisions substituting grain sorghum for wheat

APPENDIX B

DESCRIPTION OF MATRICES USED IN THE LINEAR PROGRAMMING MODEL

TABLE XVIII

ACTIVITY MATRIX FOR TERRACE DEPOSIT WATER BEARING FORMATION

		CCF1	CCF2	CCF3	FSH1	FSG2	BYFH	BYAH	DVMGS	DVXGS	STGSW	GSLAL	GSLAM	GSLAH	GSLBL	GSLBM
	COST	-57.810	-74.380	-68.970	-40.600	-22.960	20.000	28.000	0.000	-43.340	43.340	41.050	51.910	58.320	40.780	49.730
+	TCPL								1.000	1.000		1.000	1.000	1.000	1.000	1.000
+	LNLA											1.000	1.000	1.000		
+	LNLB														1.000	1.000
+	LNLC															
+	LNCB															
+	LNCC															
+	LNCD															
+	LNSB															
+	LNSC															
+	LNSD															
	CONS															
+	WSAL								1.000	1.000	-1.000	1.000	1.000	1.000	1.000	1.000
+	WTAL															
+	GSAL								1.000	1.000	-1.000	1.000	1.000	1.000	1.000	1.000
	GSDM								1.000							
+	GSDX									1.000						
+	CTAL															
	CTDM															
+	CTDX															
+	GSDR									-1.000	1.000					
+	LAB1	2.700	3.960	3.960	2.460	0.900						0.198	0.198	0.198	0.198	0.198
+	LAB2	2.880	3.750	3.750	2.370	1.020						2.189	2.189	2.748	2.189	2.189
+	LAB3	1.500	1.500	1.500	0.840							2.010	2.569	2.569	2.010	2.596
+	LAB4	9.270	9.930	9.930	3.360	1.140										
	ENSI															
	FSHI	0.025	0.790	0.260	1.000	0.400	-1.000									
	ALHI	0.025	0.790	0.260	1.000	0.400		-1.000								
	SYBI															
+	NPSS	13.400	11.000	9.000	3.000							-0.450	-0.550	-0.600	-0.400	-0.500
	SGGZ			4.400		2.700										
	AFAM															
	WHPI															
	CSPI															
	GSPI											-55.000	-65.000	-70.000	-52.000	-63.000
	CTPI															
+	WHCI															
+	GSCI											-27.500	-32.500	-35.000	-26.000	-31.500
+	CTCI															
+	WHCX															
+	GSCX															
+	CTCX															
-	ANCP	208.080	215.600	222.010	150.680	131.390						12.980	16.910	19.160	12.980	16.080
+	JANW															
+	FEBW															
+	MARW															
+	APRW													4.000		
+	MAYW															
+	JUNW											4.000	4.000	4.000	4.000	4.000
+	JULW											8.000	12.000	12.000	8.000	12.000
+	AUGW															
+	SEPW															
+	OCTW															
+	NOVW															
+	DECW															

TABLE XVIII (CONTINUED)

		GSLBH	GSLAD	GSLBD	GSLCD	GSCBL	GSCBM	GSCBH	GSCCL	GSCCM	GSCCH	GSSBL	GSSBM	GSSBH	GSSBD	GSSCD
	COST	58.140	18.240	18.040	17.950	43.050	51.910	57.400	37.700	46.560	52.970	40.600	48.750	55.870	18.740	18.550
+	TCPL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	LNLA		1.000													
+	LNLB	1.000		1.000												
+	LNLC				1.000											
+	LNCB					1.000	1.000	1.000								
+	LNCC								1.000	1.000	1.000					
+	LNCD															
+	LNSB											1.000	1.000	1.000	1.000	
+	LNSC															1.000
+	LNSD															
	CONS															
+	WSAL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	WTAL															
+	GSAL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	GSDM															
+	GSDX															
+	CTAL															
	CTDM															
+	CTDX															
+	GSDR															
+	LAB1	0.198	0.450	0.450	0.450	0.198	0.198	0.198	0.198	0.198	0.198	0.198	0.198	0.198	0.800	0.800
+	LAB2	2.748	0.390	0.390	0.390	2.189	2.189	2.748	2.189	2.189	2.748	2.189	2.189	2.748	0.630	0.630
+	LAB3	2.569	0.680	0.680	0.680	2.010	2.569	2.569	2.010	2.569	2.569	2.010	2.569	2.569	0.560	0.560
+	LAB4		0.470	0.470	0.470											
	ENSI															
	FSHI															
	ALHI															
	SYBI															
+	NPSS	-0.550	-0.300	-0.300	-0.300	-0.450	-0.550	-0.600	-0.400	-0.450	-0.500	-0.400	-0.450	-0.500		
	SGGZ															
	AFAM															
	WHPI															
	CSPI															
	GSPI	-68.000	-24.000	-22.000	-16.000	-55.000	-65.000	-70.000	-40.000	-50.000	-55.000	-50.000	-60.000	-65.000	-24.000	-22.000
	CTPI															
+	WHCI															
+	GSCI	-34.000	-12.000	-11.000	-8.000	-27.500	-32.500	-35.000	-20.000	-25.000	-27.500	-25.000	-30.000	-32.500	-12.000	-11.000
+	CTCI															
+	WHCX															
+	GSCX															
+	CTCX															
-	ANCP	19.160	5.080	5.080	5.330	13.810	16.910	19.160	12.140	15.240	17.500	12.980	16.080	18.330	5.340	5.340
+	JANW															
+	FEBW															
+	MARW															
+	APRW	4.000						4.000			4.000			4.000		
+	MAYW															
+	JUNW	4.000				4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000		
+	JULW	12.000				8.000	12.000	12.000	8.000	12.000	12.000	8.000	12.000	12.000		
+	AUGW															
+	SEPW															
+	OCTW															
+	NOVW															
+	DECW															

TABLE XVIII (CONTINUED)

		GSSDD	SALGS	PSPGS	WHLAL	WHLAM	WHLAH	WHLBL	WHLBM	WHLBH	WHLAD	WHLBD	WHLCD	WHCBL	WHCBM	WHCBH
	COST	18.150	-1.930	-0.530	34.300	39.190	44.470	34.300	39.190	44.470	21.460	21.140	20.720	34.300	39.270	44.470
+	TCPL	1.000			1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	LNLA				1.000	1.000	1.000				1.000					
+	LNLB							1.000	1.000	1.000		1.000				
+	LNLC												1.000			
+	LNCB													1.000	1.000	1.000
+	LNCC															
+	LNCD															
+	LNSB															
+	LNSC															
+	LNSD	1.000														
	CONS															
+	WSAL	1.000			1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	WTAL				1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	GSAL	1.000														
	GSDM															
+	GSOX															
+	CTAL															
	CTOM															
+	CTOX															
+	GSDR															
+	LAB1	0.800			0.051	0.609	0.609	0.051	0.609	0.609	0.040	0.040	0.040	0.051	0.609	0.609
+	LAB2	0.630			1.118	1.118	1.677	1.118	1.118	1.677	0.020	0.020	0.020	1.118	1.118	1.677
+	LAB3	0.560			0.748	0.748	0.748	0.748	0.748	0.748	0.970	0.970	0.970	0.748	0.748	0.748
+	LAB4				1.606	1.606	1.606	1.606	1.606	1.606	0.340	0.340	0.340	1.606	1.606	1.606
	ENSI															
	FSHI															
	ALHI															
	SYBI															
+	NPSS															
	SGGZ				-1.700	-1.900	-1.900	-1.700	-1.900	-1.900	-0.600	-0.500	-0.400	-1.600	-1.800	-1.800
	AFAM															
	WHPI				-40.000	-45.000	-50.000	-40.000	-45.000	-50.000	-33.000	-30.000	-26.000	-40.000	-45.000	-50.000
	CSPI															
	GSPI	-18.000	1.000													
	CTPI															
+	WHCI				-16.000	-18.000	-20.000	-16.000	-18.000	-20.000	-13.200	-12.000	-10.400	-16.000	-18.000	-20.000
+	GSCI	-9.000		1.000												
+	CTCI															
+	WHCX															
+	GSCX			1.000												
+	CTCX															
−	ANCP	5.340			14.320	16.500	18.740	14.320	16.500	17.610	9.070	9.070	9.070	14.320	16.500	18.740
+	JANW															
+	FEBW					4.000	4.000		4.000	4.000					4.000	4.000
+	MARW				4.000	4.000	8.000	4.000	4.000	8.000				4.000	4.000	8.000
+	APRW				4.000	4.000	4.000	4.000	4.000	4.000				4.000	4.000	4.000
+	MAYW															
+	JUNW															
+	JULW															
+	AUGW															
+	SEPW															
+	OCTW															
+	NOVW				4.000	4.000	4.000	4.000	4.000	4.000				4.000	4.000	4.000
+	DECW															

TABLE XVIII (CONTINUED)

		WHCCL	WHCCM	WHCCH	WHCBD	WHCCD	WHCDD	WHSBL	WHSBM	WHSBH	WHSCL	WHSCM	WHSCH	WHSBD	WHSCD	WHSDD
	COST	33.050	37.940	41.220	20.070	19.750	20.930	37.680	44.110	48.310	37.480	43.610	45.810	25.120	24.700	24.180
+	TCPL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	LNLA															
+	LNLB															
+	LNLC															
+	LNCB				1.000											
+	LNCC	1.000	1.000	1.000		1.000										
+	LNCD						1.000									
+	LNSB							1.000	1.000	1.000				1.000		
+	LNSC										1.000	1.000	1.000		1.000	
+	LNSD															1.000
	CONS															
+	WSAL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	WTAL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	GSAL															
	GSDM															
+	GSDX															
+	CTAL															
	CTDM															
+	CTDX															
+	GSDR															
+	LAB1	0.051	0.609	0.609	0.050	0.050	0.050	0.051	0.609	0.609	0.051	0.609	0.609	0.050	0.050	0.050
+	LAB2	1.118	1.118	1.677				1.118	1.118	1.677	1.118	1.118	1.677			
+	LAB3	0.748	0.748	0.748	1.070	1.070	1.070	0.748	0.748	0.748	0.748	0.748	0.748	1.160	1.160	1.160
+	LAB4	1.606	1.606	1.606	0.480	0.480	0.480	1.606	1.606	1.606	1.606	1.606	1.606	0.410	0.410	0.410
	ENSI															
	FSHI															
	ALHI															
	SYBI															
+	NPSS															
	SGGZ	-1.500	-1.700	-1.700	-0.600	-0.500	-0.400	-1.200	-1.500	-1.500	-1.200	-1.500	-1.500	-0.400	-0.300	-0.200
	AFAM															
	WHPI	-30.000	-35.000	-40.000	-25.000	-22.000	-18.000	-35.000	-39.000	-42.000	-31.000	-35.000	-38.000	-28.000	-24.000	-20.000
	CSPI															
	GSPI															
	CTPI															
+	WHCI	-12.000	-14.000	-16.000	-10.000	-8.800	-7.200	-14.000	-15.600	-16.800	-12.400	-14.000	-15.200	-11.200	-9.600	-8.000
+	GSCI															
+	CTCI															
+	WHCX															
+	GSCX															
+	CTCX															
-	ANCP	14.320	16.500	17.610	8.470	8.470	9.460	16.110	19.110	20.700	16.110	19.110	19.870	10.850	10.850	10.850
+	JANW															
+	FEBW		4.000	4.000					4.000	4.000		4.000	4.000			
+	MARW	4.000	4.000	8.000				4.000	4.000	8.000	4.000	4.000	8.000			
+	APRW	4.000	4.000	4.000				4.000	4.000	4.000	4.000	4.000	4.000			
+	MAYW															
+	JUNW															
+	JULW															
+	AUGW															
+	SEPW															
+	OCTW															
+	NOVW	4.000	4.000	4.000				4.000	4.000	4.000	4.000	4.000	4.000			
+	DECW															

TABLE XVIII (CONTINUED)

		SALWH	PWHCT	CTLAL	CTLAM	CTLAH	CTLBL	CTLBM	CTLBH	CTLAD	CTLBD	CTLCD	CTCBL	CTCBM	CTCBH	CTCBD
	COST	-1.600	-1.360	140.180	174.040	185.900	140.180	174.040	185.900	47.740	46.250	40.950	115.280	154.290	168.150	39.500
+	TCPL			1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	LNLA			1.000	1.000	1.000				1.000						
+	LNLB						1.000	1.000	1.000		1.000					
+	LNLC											1.000				
+	LNCB												1.000	1.000	1.000	1.000
+	LNCC															
+	LNCD															
+	LNSB															
+	LNSC															
+	LNSD															
	CONS															
+	WSAL															
+	WTAL															
+	GSAL															
	GSDM															
+	GSDX															
+	CTAL			1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	CTDM															
+	CTDX															
+	GSDR															
+	LAB1			0.198	0.198	0.198	0.198	0.198	0.198	0.560	0.560	0.560	0.198	0.198	0.198	0.620
+	LAB2			1.914	1.914	2.473	1.194	1.914	2.473	0.170	0.170	0.170	1.914	1.914	2.473	0.640
+	LAB3			2.569	3.128	3.128	2.569	3.128	3.128	0.680	0.680	0.680	2.569	3.128	3.128	0.720
+	LAB4									0.580	0.580	0.580				0.540
	ENSI															
	FSHI															
	ALHI															
	SYBI															
+	NPSS															
	SGGZ															
	AFAM															
	WHPI	1.000														
	CSPI			-12.800	-16.000	-17.600	-12.800	-16.000	-17.600	-6.200	-5.800	-4.130	-8.000	-12.000	-13.000	-3.700
	GSPI															
	CTPI			-8.000	-10.000	-11.000	-8.000	-10.000	-11.000	-3.750	-3.500	-2.500	-5.000	-7.500	-8.500	-2.250
+	WHCI		1.000													
+	GSCI															
+	CTCI			-5.200	-6.500	-7.150	-5.200	-6.500	-7.150	-2.440	-2.280	-1.630	-3.250	-4.860	-5.530	-1.460
+	WHCX		1.000													
+	GSCX															
+	CTCX															
-	ANCP			31.470	38.180	39.950	31.470	38.180	39.950	8.720	8.720	8.720	29.970	38.180	39.950	8.750
+	JANW															
+	FEBW															
+	MARW															
+	APRW															
+	MAYW					4.000			4.000						4.000	
+	JUNW			4.000	4.000	4.000	4.000	4.000	4.000				4.000	4.000	4.000	
+	JULW			8.000	8.000	8.000	8.000	8.000	8.000				8.000	8.000	8.000	
+	AUGW			4.000	8.000	8.000	4.000	8.000	8.000				4.000	8.000	8.000	
+	SEPW															
+	OCTW															
+	NOVW															
+	DECW															

TABLE XVIII (CONTINUED)

		CTCCD	CTCDD	CTSBL	CTSBM	CTSBH	CTSCL	CTSCM	CTSCH	CTSBD	CTSCD	CTSDD	DVMCT	DVXCT	SALCL	SALCS
	COST	39.310	36.340	137.130	169.540	180.900	135.360	167.770	177.350	57.040	53.990	49.530	-59.180	-33.000	-20.500	-2.400
+	TCPL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000		
+	LNLA															
+	LNLB															
+	LNLC															
+	LNCB															
+	LNCC	1.000														
+	LNCD		1.000													
+	LNSB			1.000	1.000	1.000				1.000						
+	LNSC						1.000	1.000	1.000		1.000					
+	LNSD											1.000				
	CONS															
+	WSAL															
+	WTAL															
+	GSAL															
	GSDM															
+	GSDX															
+	CTAL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000		
	CTDM												1.000			
+	CTDX													1.000		
+	GSDR															
+	LAB1	0.620	0.620	0.198	0.198	0.198	0.198	0.198	0.198	0.530	0.530	0.530				
+	LAB2	0.640	0.640	1.914	1.914	2.473	1.914	1.914	2.473	0.710	0.710	0.710				
+	LAB3	0.720	0.720	2.569	3.128	3.128	2.569	3.128	3.128	0.980	0.980	0.980				
+	LAB4	0.540	0.540							0.410	0.410	0.410				
	ENSI															
	FSHI															
	ALHI															
	SYBI															
+	NPSS															
	SGGZ															
	AFAM															
	WHPI															
	CSPI	-3.300	-2.480	-12.000	-14.400	-16.000	-11.600	-14.000	-15.200	-5.780	-4.950	-3.700				1.000
	GSPI															
	CTPI	-2.000	-1.500	-7.500	-9.000	-10.000	-7.250	-8.250	-9.500	-3.500	-3.000	-2.250			1.000	
+	WHCI															
+	GSCI															
+	CTCI	-1.300	-0.980	-4.880	-5.850	-6.500	-4.710	-5.360	-6.180	-2.280	-1.950	-1.460				
+	WHCX															
+	GSCX															
+	CTCX															
-	ANCP	9.510	9.510	31.570	39.270	40.820	31.370	39.270	40.820	11.960	11.960	11.960				
+	JANW															
+	FEBW															
+	MARW															
+	APRW															
+	MAYW					4.000			4.000							
+	JUNW			4.000	4.000	4.000	4.000	4.000	4.000							
+	JULW			8.000	8.000	8.000	8.000	8.000	8.000							
+	AUGW			4.000	8.000	8.000	4.000	8.000	8.000							
+	SEPW															
+	OCTW															
+	NOVW															
+	DECW															

TABLE XVIII (CONTINUED)

		PSPCT	ENLAL	ENLAM	ENLAH	ENLBL	ENLBM	ENLBH	ENLAD	ENLBD	ENLCD	ENCBL	ENCBM	ENCBH	ENCBD	ENCCD
	COST	-12.240	73.020	90.130	103.090	73.020	90.130	103.090	45.270	42.770	40.270	53.020	72.130	87.090	33.390	30.890
+	TCPL		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	LNLA		1.000	1.000	1.000				1.000							
+	LNLB					1.000	1.000	1.000		1.000						
+	LNLC										1.000					
+	LNCB											1.000	1.000	1.000	1.000	
+	LNCC															1.000
+	LNCD															
+	LNSB															
+	LNSC															
+	LNSD															
	CONS															
+	WSAL															
+	WTAL															
+	GSAL															
	GSDM															
+	GSDX															
+	CTAL															
	CTDM															
+	CTDX															
+	GSDR															
+	LAB1								0.450	0.450	0.450				0.480	0.480
+	LAB2		2.240	2.240	2.240	2.240	2.240	2.240	0.390	0.390	0.390	2.240	2.240	2.240	0.710	0.710
+	LAB3		2.010	2.569	3.128	2.010	2.569	3.128	0.680	0.680	0.680	2.010	2.569	3.128	0.400	0.400
+	LAB4								0.470	0.470	0.470				0.630	0.630
	ENSI		-22.000	-26.000	-28.000	-22.000	-26.000	-28.000	-12.500	-11.250	-10.000	-12.000	-17.000	-20.000	-6.250	-5.000
	FSHI															
	ALHI															
	SYBI															
+	NPSS															
	SGGZ															
	AFAM															
	WHPI															
	CSPI															
	GSPI															
	CTPI															
+	WHCI															
+	GSCI															
+	CTCI	1.000														
+	WHCX															
+	GSCX															
+	CTCX	1.000														
-	ANCP		11.520	14.700	17.800	11.520	14.700	17.800	9.030	9.030	9.030	11.520	14.700	17.800	9.030	9.030
+	JANW															
+	FEBW															
+	MARW															
+	APRW															
+	MAYW															
+	JUNW		4.000	4.000	4.000	4.000	4.000	4.000				4.000	4.000	4.000		
+	JULW		8.000	8.000	8.000	8.000	8.000	8.000				8.000	8.000	8.000		
+	AUGW			4.000	8.000		4.000	8.000					4.000	8.000		
+	SEPW															
+	OCTW															
+	NOVW															
+	DECW															

TABLE XVIII (CONTINUED)

		ENSBD	ENSCD	ENSDD	SALEN	FSLAL	FSLAM	FSLAH	FSLBL	FSLBM	FSLBH	FSLAD	FSLBD	FSLCD	FSCBL	FSCBM
	COST	43.280	40.780	35.780	-6.000	92.070	123.620	149.410	92.070	123.620	149.410	68.530	63.090	57.450	82.470	111.140
+	TCPL	1.000	1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	LNLA					1.000	1.000	1.000				1.000				
+	LNLB								1.000	1.000	1.000		1.000			
+	LNLC													1.000		
+	LNCB														1.000	1.000
+	LNCC															
+	LNCD															
+	LNSB	1.000														
+	LNSC		1.000													
+	LNSD			1.000												
	CONS					1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	WSAL															
+	WTAL															
+	GSAL															
	GSDM															
+	GSDX															
+	CTAL															
	CTDM															
+	CTDX															
+	GSDR															
+	LAB1	0.800	0.800	0.800								0.450	0.450	0.450		
+	LAB2	0.630	0.630	0.630		1.988	1.918	3.106	1.988	1.918	3.106	0.390	0.390	0.390	1.988	1.988
+	LAB3	0.560	0.560	0.560		2.569	3.128	3.128	2.569	3.128	3.128	0.080	0.080	0.080	2.569	3.128
+	LAB4						0.559	0.559		0.559	0.559	0.470	0.470	0.470		0.559
	ENSI	-11.250	-10.000	-7.500	1.000											
	FSHI					-6.000	-7.800	-9.000	-6.000	-7.800	-9.000	-5.000	-4.500	-4.000	-5.000	-6.500
	ALHI															
	SYBI															
+	NPSS															
	SGGZ															
	AFAM															
	WHPI															
	CSPI															
	GSPI															
	CTPI															
+	WHCI															
+	GSCI															
+	CTCI															
+	WHCX															
+	GSCX															
+	CTCX															
-	ANCP	9.280	9.280	9.280		7.160	13.610	19.140	7.160	13.610	19.140	6.350	6.350	6.160	7.160	13.610
+	JANW															
+	FEBW															
+	MARW															
+	APRW															
+	MAYW							8.000			8.000					
+	JUNW					4.000	8.000	8.000	4.000	8.000	8.000				4.000	8.000
+	JULW					8.000	4.000	4.000	8.000	4.000	4.000				8.000	4.000
+	AUGW					4.000	8.000	8.000	4.000	8.000	8.000				4.000	8.000
+	SEPW						4.000	4.000		4.000	4.000					4.000
+	OCTW															
+	NOVW															
+	DECW															

TABLE XVIII (CONTINUED)

		FSCBH	FSCBD	FSCCD	FSSBL	FSSBM	FSSBH	FSSBD	FSSCD	FSSDD	SALFS	AFLAL	AFLAM	AFLAH	AFLBL	AFLBM
	COST	135.010	41.340	36.040	82.470	109.220	130.210	63.790	58.670	48.110	-18.000	131.910	149.230	161.430	122.310	139.630
+	TCPL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000		1.000	1.000	1.000	1.000	1.000
+	LNLA											1.000	1.000	1.000		
+	LNLB														1.000	1.000
+	LNLC															
+	LNCB	1.000	1.000													
+	LNCC			1.000												
+	LNCO															
+	LNSB				1.000	1.000	1.000	1.000								
+	LNSC								1.000							
+	LNSO									1.000						
	CONS	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000		1.000	1.000	1.000	1.000	1.000
+	WSAL															
+	WTAL															
+	GSAL															
	GSOM															
+	GSDX															
+	CTAL															
	CTDM															
+	CTDX															
+	GSOR															
+	LAB1		0.480	0.480				0.800	0.800	0.800		0.559	0.559	0.559	0.559	0.559
+	LAB2	3.106	0.510	0.510	1.988	1.988	3.106	0.510	0.510	0.510		1.118	1.118	1.118	1.118	1.118
+	LAB3	3.128	0.400	0.400	2.569	3.128	3.128	0.080	0.080	0.080		1.677	2.236	2.795	1.677	2.236
+	LAB4	0.559	0.630	0.630		0.559	0.559					2.895	2.895	2.895	2.895	2.895
	ENSI															
	FSHI	-7.500	-2.500	-2.000	-5.000	-6.300	-7.000	-4.500	-4.000	-3.000	1.000					
	ALHI											-9.000	-10.250	-11.000	-8.000	-9.250
	SYBI															
+	NPSS															
	SGGZ															
	AFAM															
	WHPI															
	CSPI															
	GSPI															
	CTPI															
+	WHCI															
+	GSCI															
+	CTCI															
+	WHCX															
+	GSCX															
+	CTCX															
-	ANCP	19.140	5.600	5.600	7.160	13.610	19.140	6.700	6.700	6.700		18.780	19.680	20.560	18.780	1 .670
+	JANW											4.000	4.000	4.000	4.000	4.000
+	FEBW															
+	MARW															
+	APRW											4.000	4.000	4.000	4.000	4.000
+	MAYW	8.000					8.000					4.000	4.000	4.000	4.000	4.000
+	JUNW	8.000			4.000	8.000	8.000					8.000	8.000	8.000	8.000	8.000
+	JULW	4.000			8.000	4.000	4.000					4.000	4.000	4.000	4.000	4.000
+	AUGW	8.000			4.000	8.000	8.000						4.000	8.000		4.000
+	SEPW	4.000				4.000	4.000									
+	OCTW															
+	NOVW															
+	DECW															

TABLE XVIII (CONTINUED)

		AFLBH	AFLAD	AFLBD	AFLCD	AFCBL	AFCBM	AFCBH	AFCCL	AFCCM	AFCCH	AFCBD	AFSBL	AFSBM	AFSBH	AFSBD
	COST	151.830	56.830	52.030	42.430	122.310	139.630	151.830	74.310	103.470	123.030	36.810	139.420	157.910	171.270	57.630
+	TCPL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	LNLA		1.000													
+	LNLB	1.000		1.000												
+	LNLC				1.000											
+	LNCB					1.000	1.000	1.000				1.000				
+	LNCC								1.000	1.000	1.000					
+	LNCD															
+	LNSB												1.000	1.000	1.000	1.000
+	LNSC															
+	LNSD															
	CONS	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	WSAL															
+	WTAL															
+	GSAL															
	GSDM															
+	GSDX															
+	CTAL															
	CTDM															
+	CTDX															
+	GSDR															
+	LAB1	0.559				0.559	0.559	0.559	0.559	0.559	0.559		0.559	0.559	0.559	
+	LAB2	1.118	0.130	0.130	0.130	1.118	1.118	1.118	1.118	1.118	1.118		1.118	1.118	1.118	0.130
+	LAB3	2.795	0.940	0.940	0.940	1.677	2.236	2.795	1.677	2.236	2.795	1.110	1.677	2.236	2.795	0.460
+	LAB4	2.895	0.730	0.730	0.730	2.895	2.895	2.895	2.895	2.895	2.895	0.560	2.895	2.895	2.895	0.730
	ENSI															
	FSHI															
	ALHI	-10.000	-3.500	-3.000	-2.000	-8.000	-9.250	-10.000	-3.000	-5.500	-7.000	-1.500	-9.000	-10.250	-11.000	-3.500
	SYBI															
+	NPSS															
	SGGZ															
	AFAM															
	WHPI															
	CSPI															
	GSPI															
	CTPI															
+	WHCI															
+	GSCI															
+	CTCI															
+	WHCX															
+	GSCX															
+	CTCX															
-	ANCP	20.760	1.810	1.810	1.810	18.780	19.670	20.560	18.780	19.670	20.560	0.910	18.780	19.670	20.560	2.120
+	JANW	4.000				4.000	4.000	4.000	4.000	4.000	4.000		4.000	4.000	4.000	
+	FEBW															
+	MARW															
+	APRW	4.000				4.000	4.000	4.000	4.000	4.000	4.000		4.000	4.000	4.000	
+	MAYW	4.000				4.000	4.000	4.000	4.000	4.000	4.000		4.000	4.000	4.000	
+	JUNW	8.000				8.000	8.000	8.000	8.000	8.000	8.000		8.000	8.000	8.000	
+	JULW	4.000				4.000	4.000	4.000	4.000	4.000	4.000		4.000	4.000	4.000	
+	AUGW	8.000					4.000	8.000		4.000	8.000			4.000	8.000	
+	SEPW															
+	OCTW															
+	NOVW															
+	DECW															

TABLE XVIII (CONTINUED)

		AFSCD	AFSDD	SALAF	SBLAL	SBLAM	SBLAH	SBLBL	SBLBM	SBLBH	SBCBL	SBCBM	SBCBH	SBSBL	SBSBM	SBSBH
	COST	52.830	43.230	-25.000	36.280	40.140	42.100	36.280	40.140	42.100	36.280	40.140	42.100	36.280	40.140	42.100
+	TCPL	1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	LNLA				1.000	1.000	1.000									
+	LNLB							1.000	1.000	1.000						
+	LNLC															
+	LNCB										1.000	1.000	1.000			
+	LNCC															
+	LNCD															
+	LNSB													1.000	1.000	1.000
+	LNSC	1.000														
+	LNSD		1.000													
	CONS	1.000	1.000													
+	WSAL															
+	WTAL															
+	GSAL															
	GSDM															
+	GSDX															
+	CTAL															
	CTDM															
+	CTDX															
+	GSDR															
+	LAB1															
+	LAB2	0.130	0.130		2.189	2.189	2.189	2.189	2.189	2.189	2.189	2.189	2.189	2.189	2.189	2.189
+	LAB3	0.460	0.460		2.010	2.569	3.128	2.010	2.569	3.128	2.010	2.569	3.128	2.010	2.569	3.128
+	LAB4	0.730	0.730													
	ENSI															
	FSHI															
	ALHI	-3.000	-2.000	1.000												
	SYBI				-30.000	-36.000	-40.000	-30.000	-36.000	-40.000	-30.000	-36.000	-40.000	-30.000	-36.000	-40.000
+	NPSS															
	SGGZ															
	AFAM															
	WHPI															
	CSPI															
	GSPI															
	CTPI															
+	WHCI															
+	GSCI															
+	CTCI															
+	WHCX															
+	GSCX															
+	CTCX															
-	ANCP	2.120	2.120		11.410	12.680	13.930	11.410	12.680	13.930	11.410	12.680	13.930	11.410	12.680	13.930
+	JANW															
+	FEBW															
+	MARW															
+	APRW															
+	MAYW															
+	JUNW					4.000	4.000		4.000	4.000		4.000	4.000		4.000	4.000
+	JULW				4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000
+	AUGW				8.000	8.000	12.000	8.000	8.000	12.000	8.000	8.000	12.000	8.000	8.000	12.000
+	SEPW															
+	OCTW															
+	NOVW															
+	DECW															

TABLE XVIII (CONTINUED)

		SALSB	ACINT	HLB1	HLB2	HLB3	HLB4
	COST	-2.650	0.070	1.750	1.750	1.750	1.750
+	TCPL						
+	LNLA						
+	LNLB						
+	LNLC						
+	LNCB						
+	LNCC						
+	LNCD						
+	LNSB						
+	LNSC						
+	LNSD						
	CONS						
+	WSAL						
+	WTAL						
+	GSAL						
	GSDM						
+	GSDX						
+	CTAL						
	CTDM						
+	CTDX						
+	GSDR						
+	LAB1			-1.000			
+	LAB2				-1.000		
+	LAB3					-1.000	
+	LAB4						-1.000
	ENSI						
	FSHI						
	ALHI						
	SYBI	1.000					
+	NPSS						
	SGGZ						
	AFAM						
	WHPI						
	CSPI						
	GSPI						
	CTPI						
+	WHCI						
+	GSCI						
+	CTCI						
+	WHCX						
+	GSCX						
+	CTCX						
-	ANCP		-1.000				
+	JANW						
+	FEBW						
+	MARW						
+	APRW						
+	MAYW						
+	JUNW						
+	JULW						
+	AUGW						
+	SEPW						
+	OCTW						
+	NOVW						
+	DECW						

TABLE XIX

ACTIVITY MATRIX FOR DOG CREEK SHALE AND BLAINE WATER BEARING FORMATION

The activities for Dog Creek Shale and Blaine Formation are identical to those for Terrace Deposits with the following activities deleted from the latter:

ENLAL	ENCBL
ENLAM	ENCBM
ENLAH	ENCBH
ENLBL	ENCBD
ENLBM	ENCCD
ENLBH	ENSBD
ENLAD	ENSCD
ENLBD	ENSDD
ENLCD	SALEN

TABLE XX

ACTIVITY MATRIX FOR RUSH SPRINGS SANDSTONE WATER BEARING FORMATION

		CCF1	CCF2	CCF3	FSH1	FSG2	BYFH	BYAH	DVMGS	DVXGS	STGSW	GSLAL	GSLAM	GSLAH	GSLBL	GSLBM
	COST	-57.810	-74.380	-68.970	-40.600	-22.960	20.000	28.000	0.000	-43.340	43.340	51.590	66.100	76.060	51.420	63.920
+	TCPL								1.000	1.000		1.000	1.000	1.000	1.000	1.000
+	LNLA											1.000	1.000	1.000		
+	LNLB														1.000	1.000
+	LNLC															
+	LNSB															
+	LNSC															
+	LNSD															
	CONS															
+	WSAL								1.000	1.000		1.000	1.000	1.000	1.000	1.000
+	WTAL															
+	GSAL								1.000	1.000	-1.000	1.000	1.000	1.000	1.000	1.000
	GSDM								1.000							
+	GSDX									1.000						
+	CTAL															
	CTDM															
+	CTDX															
+	GSDR									-1.000	1.000					
+	LAB1	2.700	3.960	3.960	2.460	0.900						0.198	0.198	0.198	0.198	0.198
+	LAB2	2.880	3.750	3.750	2.370	1.020						2.189	2.189	2.748	2.189	2.189
+	LAB3	1.500	1.500	1.500	0.840							2.010	2.569	2.569	2.010	2.596
+	LAB4	9.270	9.930	9.930	3.360	1.140										
	ALHI	0.025	0.790	0.260	1.000	0.400		-1.000								
+	NPSS	13.400	11.000	9.000	3.000							-0.450	-0.550	-0.600	-0.400	-0.500
	SGGZ			4.400		2.700										
	WHPI															
	CSPI															
	GSPI											-55.000	-65.000	-70.000	-52.000	-53.000
	CTPI															
+	WHCI															
+	GSCI											-27.500	-32.500	-35.000	-26.000	-31.500
+	CTCI															
+	WHCX															
+	GSCX															
+	CTCX															
-	ANCP	208.080	215.800	222.010	150.680	131.390						16.530	21.640	25.080	16.530	20.810
+	JANW															
+	FEBW															
+	MARW															
+	APRW													4.000		
+	MAYW															
+	JUNW											4.000	4.000	4.000	4.000	4.000
+	JULW											8.000	12.000	12.000	8.000	12.000
+	AUGW															
+	SEPW															
+	OCTW															
+	NOVW															
+	DECW															
+	PNAL															
+	PNPI															

TABLE XX (CONTINUED)

		GSLBH	GSLAD	GSLBD	GSLCD	GSCBL	GSCBM	GSCBH	GSCCL	GSCCM	GSCCH	GSSBL	GSSBM	GSSBH	GSSBD	GSSCD
	COST	75.880	18.240	18.040	17.950	43.050	51.910	57.400	37.700	46.560	52.970	45.920	56.550	64.730	18.740	18.550
+	TCPL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	LNLA		1.000													
+	LNLB	1.000		1.000												
+	LNLC				1.000											
+	LNSB											1.000	1.000	1.000	1.000	
+	LNSC															1.000
+	LNSD															
	CONS															
+	WSAL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	WTAL															
+	GSAL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	GSDM															
+	GSDX															
+	CTAL															
	CTDM															
+	CTDX															
+	GSDR															
+	LAB1	0.198	0.450	0.450	0.450	0.198	0.198	0.198	0.198	0.198	0.198	0.198	0.198	0.198	0.800	0.800
+	LAB2	2.748	0.390	0.390	0.390	2.189	2.189	2.748	2.189	2.189	2.748	2.189	2.189	2.748	0.630	0.630
+	LAB3	2.569	0.680	0.680	0.680	2.010	2.569	2.569	2.010	2.569	2.569	2.010	2.569	2.569	0.560	0.560
+	LAB4		0.470	0.470	0.470											
	ALHI															
+	NPSS	-0.550	-0.300	-0.300	-0.300	-0.450	-0.550	-0.600	-0.400	-0.450	-0.500	-0.400	-0.450	-0.500		
	SGGZ															
	WHPI															
	CSPI															
	GSPI	-68.000	-24.000	-22.000	-16.000	-55.000	-65.000	-70.000	-40.000	-50.000	-55.000	-50.000	-60.000	-65.000	-24.000	-22.000
	CTPI															
+	WHCI															
+	GSCI	-34.000	-12.000	-11.000	-8.000	-27.500	-32.500	-35.000	-20.000	-25.000	-27.500	-25.000	-30.000	-32.500	-12.000	-11.000
+	CTCI															
+	WHCX															
+	GSCX															
+	CTCX															
-	ANCP	25.080	5.080	5.080	5.330	13.810	16.910	19.160	12.140	15.240	17.500	16.530	20.810	24.250	5.340	5.340
+	JANW															
+	FEBW															
+	MARW															
+	APRW	4.000						4.000			4.000			4.000		
+	MAYW															
+	JUNW	4.000				4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000		
+	JULW	12.000				8.000	12.000	12.000	8.000	12.000	12.000	8.000	12.000	12.000		
+	AUGW															
+	SEPW															
+	OCTW															
+	NOVW															
+	DECW															
+	PNAL															
+	PNPI															

TABLE XX (CONTINUED)

		GSSDD	SALGS	PSPGS	WHLAL	WHLAM	WHLAH	WHLBL	WHLBM	WHLBH	WHLAD	WHLBD	WHLCD	WHCBL	WHCBM	WHCBH
	COST	18.150	-1.930	-0.530	999.999	999.999	999.999	999.999	999.999	999.990	21.460	21.140	20.720	34.300	39.270	44.470
+	TCPL	1.000			1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	LNLA				1.000	1.000	1.000				1.000					
+	LNLB							1.000	1.000	1.000		1.000				
+	LNLC												1.000			
+	LNSB															
+	LNSC															
+	LNSD	1.000														
	CONS															
+	WSAL	1.000			1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	WTAL				1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	GSAL	1.000														
	GSDM															
+	GSDX															
+	CTAL															
	CTDM															
+	CTOX															
+	GSDR															
+	LAB1	0.800			0.051	0.609	0.609	0.051	0.609	0.609	0.040	0.040	0.040	0.051	0.609	0.609
+	LAB2	0.630			1.118	1.118	1.677	1.118	1.118	1.677	0.020	0.020	0.020	1.118	1.118	1.677
+	LAB3	0.560			0.748	0.748	0.748	0.748	0.748	0.748	0.970	0.970	0.970	0.748	0.748	0.748
+	LAB4				1.606	1.606	1.606	1.606	1.606	1.606	0.340	0.340	0.340	1.606	1.606	1.606
	ALHI															
+	NPSS															
	SGGZ				-1.700	-1.900	-1.900	-1.700	-1.900	-1.900	-0.600	-0.500	-0.400	-1.600	-1.800	-1.800
	WHPI				-40.000	-45.000	-50.000	-40.000	-45.000	-50.000	-33.000	-30.000	-26.000	-40.000	-45.000	-50.000
	CSPI															
	GSPI	-18.000	1.000													
	CTPI															
+	WHCI				-16.000	-18.000	-20.000	-16.000	-18.000	-20.000	-13.200	-12.000	-10.400	-16.000	-18.000	-20.000
+	GSCI	-9.000		1.000												
+	CTCI															
+	WHCX															
+	GSCX			1.000												
+	CTCX															
-	ANCP	5.340			14.320	16.500	18.740	14.320	16.500	17.610	9.070	9.070	9.070	14.320	16.500	18.740
+	JANW															
+	FEBW					4.000	4.000		4.000	4.000					4.000	4.000
+	MARW				4.000	4.000	8.000	4.000	4.000	8.000				4.000	4.000	8.000
+	APRW				4.000	4.000	4.000	4.000	4.000	4.000				4.000	4.000	4.000
+	MAYW															
+	JUNW															
+	JULW															
+	AUGW															
+	SEPW															
+	OCTW															
+	NOVW				4.000	4.000	4.000	4.000	4.000	4.000				4.000	4.000	4.000
+	DECW															
+	PNAL															
+	PNPI															

TABLE XX (CONTINUED)

		WHCCL	WHCCM	WHCCH	WHCBD	WHCCD	WHCDD	WHSBL	WHSBM	WHSBH	WHSCL	WHSCM	WHSCH	WHSBD	WHSCD	WHSDD
	COST	33.050	37.940	41.220	20.070	19.750	20.930	999.999	999.999	999.999	999.990	999.990	999.990	25.120	24.700	24.180
+	TCPL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	LNLA															
+	LNLB															
+	LNLC															
+	LNSB							1.000	1.000	1.000				1.000		
+	LNSC										1.000	1.000	1.000		1.000	
+	LNSD															1.000
	CONS															
+	WSAL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	WTAL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	GSAL															
	GSDM															
+	GSDX															
+	CTAL															
	CTDM															
+	CTDX															
+	GSDR															
+	LAB1	0.051	0.609	0.609	0.050	0.050	0.050	0.051	0.609	0.609	0.051	0.609	0.609	0.050	0.050	0.050
+	LAB2	1.118	1.118	1.677				1.118	1.118	1.677	1.118	1.118	1.677			
+	LAB3	0.748	0.748	0.748	1.070	1.070	1.070	0.748	0.748	0.748	0.748	0.748	0.748	1.160	1.160	1.160
+	LAB4	1.606	1.606	1.606	0.480	0.480	0.480	1.606	1.606	1.606	1.606	1.606	1.606	0.410	0.410	0.410
	ALHI															
+	NPSS															
	SGGZ	-1.500	-1.700	-1.700	-0.600	-0.500	-0.400	-1.200	-1.500	-1.500	-1.200	-1.500	-1.500	-0.400	-0.300	-0.200
	WHPI	-30.000	-35.000	-40.000	-25.000	-22.000	-18.000	-35.000	-39.000	-42.000	-31.000	-35.000	-38.000	-28.000	-24.000	-20.000
	CSPI															
	GSPI															
	CTPI															
+	WHCI	-12.000	-14.000	-16.000	-10.000	-8.800	-7.200	-14.000	-15.600	-16.800	-12.400	-14.000	-15.200	-11.200	-9.600	-8.000
+	GSCI															
+	CTCI															
+	WHCX															
+	GSCX															
+	CTCX															
-	ANCP	14.320	16.500	17.610	8.470	8.470	9.460	16.110	19.110	20.700	16.110	19.110	19.870	10.850	10.850	10.850
+	JANW															
+	FEBW		4.000	4.000					4.000	4.000		4.000	4.000			
+	MARW	4.000	4.000	8.000				4.000	4.000	8.000	4.000	4.000	8.000			
+	APRW	4.000	4.000	4.000				4.000	4.000	4.000	4.000	4.000	4.000			
+	MAYW															
+	JUNW															
+	JULW															
+	AUGW															
+	SEPW															
+	OCTW															
+	NOVW	4.000	4.000	4.000				4.000	4.000	4.000	4.000	4.000	4.000			
+	DECW															
+	PNAL															
+	PNPI															

TABLE XX (CONTINUED)

		SALWH	PWHCT	CTLAL	CTLAM	CTLAH	CTLBL	CTLBM	CTLBH	CTLAD	CTLBD	CTLCD	CTCBL	CTCBM	CTCBH	CTCBD
	COST	-1.600	-1.360	154.370	191.780	207.190	154.370	191.780	207.190	47.740	46.250	40.950	115.280	154.290	168.150	39.500
+	TCPL			1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	LNLA			1.000	1.000	1.000				1.000						
+	LNLB						1.000	1.000	1.000		1.000					
+	LNLC											1.000				
+	LNSB															
+	LNSC															
+	LNSD															
	CONS															
+	WSAL															
+	WTAL															
+	GSAL															
	GSDM															
+	GSDX															
+	CTAL			1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	CTDM															
+	CTDX															
+	GSDR															
+	LAB1			0.198	0.198	0.198	0.198	0.198	0.198	0.560	0.560	0.560	0.198	0.198	0.198	0.620
+	LAB2			1.914	1.914	2.473	1.194	1.914	2.473	0.170	0.170	0.170	1.914	1.914	2.473	0.640
+	LAB3			2.569	3.128	3.128	2.569	3.128	3.128	0.680	0.680	0.680	2.569	3.128	3.128	0.720
+	LAB4									0.580	0.580	0.580				0.540
	ALHI															
+	NPSS															
	SGGZ															
	WHPI	1.000														
	CSPI			-12.800	-16.000	-17.600	-12.800	-16.000	-17.600	-6.200	-5.800	-4.130	-8.000	-12.000	-13.000	-3.700
	GSPI															
	CTPI			-8.000	-10.000	-11.000	-8.000	-10.000	-11.000	-3.750	-3.500	-2.500	-5.000	-7.500	-8.500	-2.250
+	WHCI		1.000													
+	GSCI															
+	CTCI			-5.200	-6.500	-7.150	-5.200	-6.500	-7.150	-2.440	-2.280	-1.630	-3.250	-4.860	-5.530	-1.460
+	WHCX		1.000													
+	GSCX															
+	CTCX															
-	ANCP			36.200	44.100	47.050	36.200	44.100	47.050	8.720	8.720	8.720	29.970	38.180	39.950	8.750
+	JANW															
+	FEBW															
+	MARW															
+	APRW															
+	MAYW					4.000			4.000						4.000	
+	JUNW			4.000	4.000	4.000	4.000	4.000	4.000				4.000	4.000	4.000	
+	JULW			8.000	8.000	8.000	8.000	8.000	8.000				8.000	8.000	8.000	
+	AUGW			4.000	8.000	8.000	4.000	8.000	8.000				4.000	8.000	8.000	
+	SEPW															
+	OCTW															
+	NOVW															
+	DECW															
+	PNAL															
+	PNPI															

TABLE XX (CONTINUED)

		CTCCD	CTCDD	CTSBL	CTSBM	CTSBH	CTSCL	CTSCM	CTSCH	CTSBD	CTSCD	CTSDD	DVMCT	DVXCT	SALCL	SALCS
	COST	39.310	36.340	132.750	150.390	176.960	129.200	146.840	173.410	57.040	53.990	49.530	-59.180	-33.000	-20.500	-2.400
+	TCPL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000		
+	LNLA															
+	LNLB															
+	LNLC															
+	LNSB			1.000	1.000	1.000				1.000						
+	LNSC						1.000	1.000	1.000		1.000					
+	LNSD											1.000				
	CONS															
+	WSAL															
+	WTAL															
+	GSAL															
	GSDM															
+	GSDX															
+	CTAL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000		
	CTDM												1.000			
+	CTDX													1.000		
+	GSDR															
+	LAB1	0.620	0.620	0.198	0.198	0.198	0.198	0.198	0.198	0.530	0.530	0.530				
+	LAB2	0.640	0.640	1.913	2.472	3.031	1.913	2.472	3.031	0.710	0.710	0.710				
+	LAB3	0.720	0.720	3.129	3.129	3.129	3.129	3.129	3.129	0.980	0.980	0.980				
+	LAB4	0.540	0.540							0.410	0.410	0.410				
	ALHI															
+	NPSS															
	SGGZ															
	WHPI															
	CSPI	-3.300	-2.480	-12.000	-14.400	-16.000	-11.600	-14.000	-15.200	-5.780	-4.950	-3.700				1.000
	GSPI															
	CTPI	-2.000	-1.500	-7.500	-9.000	-10.000	-7.250	-8.250	-9.500	-3.500	-3.000	-2.250			1.000	
+	WHCI															
+	GSCI															
+	CTCI	-1.300	-0.980	-4.880	-5.850	-6.500	-4.710	-5.360	-6.180	-2.280	-1.950	-1.460				
+	WHCX															
+	GSCX															
+	CTCX															
-	ANCP	9.510	9.510	35.230	44.010	46.750	35.230	44.010	46.750	11.960	11.960	11.960				
+	JANW															
+	FEBW															
+	MARW															
+	APRW															
+	MAYW					4.000			4.000							
+	JUNW			4.000	4.000	4.000	4.000	4.000	4.000							
+	JULW			8.000	8.000	8.000	8.000	8.000	8.000							
+	AUGW			4.000	8.000	8.000	4.000	8.000	8.000							
+	SEPW															
+	OCTW															
+	NOVW															
+	DECW															
+	PNAL															
+	PNPI															

TABLE XX (CONTINUED)

		PSPCT	AFLAL	AFLAM	AFLAH	AFLBL	AFLBM	AFLBH	AFLAD	AFLBD	AFLCD	AFCBL	AFCBM	AFCBH	AFCCL	AFCCM
	COST	-12.240	153.200	174.070	189.810	143.600	164.470	180.210	56.830	52.030	42.430	122.310	139.630	151.830	74.310	103.470
+	TCPL		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	LNLA		1.000	1.000	1.000				1.000							
+	LNLB					1.000	1.000	1.000		1.000						
+	LNLC										1.000					
+	LNSB															
+	LNSC															
+	LNSD															
	CONS		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
+	WSAL															
+	WTAL															
+	GSAL															
	GSDM															
+	GSDX															
+	CTAL															
	CTDM															
+	CTDX															
+	GSDR															
+	LAB1		0.559	0.559	0.559	0.559	0.559	0.559				0.559	0.559	0.559	0.559	0.559
+	LAB2		1.118	1.118	1.118	1.118	1.118	1.118	0.130	0.130	0.130	1.118	1.118	1.118	1.118	1.118
+	LAB3		1.677	2.236	2.795	1.677	2.236	2.795	0.940	0.940	0.940	1.677	2.236	2.795	1.677	2.236
+	LAB4		2.895	2.895	2.895	2.895	2.895	2.895	0.730	0.730	0.730	2.895	2.895	2.895	2.895	2.895
	ALHI		-9.000	-10.250	-11.000	-8.000	-9.250	-10.000	-3.500	-3.000	-2.000	-8.000	-9.250	-10.000	-3.000	-5.500
+	NPSS															
	SGGZ															
	WHPI															
	CSPI															
	GSPI															
	CTPI															
+	WHCI															
+	GSCI															
+	CTCI	1.000														
+	WHCX															
+	GSCX															
+	CTCX	1.000														
-	ANCP		25.880	27.950	30.020	25.880	27.950	30.020	1.810	1.810	1.810	18.780	19.670	20.560	18.780	19.670
+	JANW		4.000	4.000	4.000	4.000	4.000	4.000				4.000	4.000	4.000	4.000	4.000
+	FEBW															
+	MARW															
+	APRW		4.000	4.000	4.000	4.000	4.000	4.000				4.000	4.000	4.000	4.000	4.000
+	MAYW		4.000	4.000	4.000	4.000	4.000	4.000				4.000	4.000	4.000	4.000	4.000
+	JUNW		8.000	8.000	8.000	8.000	8.000	8.000				8.000	8.000	8.000	8.000	8.000
+	JULW		4.000	4.000	4.000	4.000	4.000	4.000				4.000	4.000	4.000	4.000	4.000
+	AUGW			4.000	8.000		4.000	8.000					4.000	8.000		4.000
+	SEPW															
+	OCTW															
+	NOVW															
+	DECW															
+	PNAL															
+	PNPI															

TABLE XX (CONTINUED)

		AFCCH	AFCBD	AFSBL	AFSBM	AFSBH	AFSBD	AFSCD	AFSDD	SALAF	ACINT	HLB1	HLB2	HLB3	HLB4	PNLBL
	COST	123.030	36.810	153.700	174.570	190.310	57.630	52.830	43.230	-25.000	0.070	1.750	1.750	1.750	1.750	139.890
+	TCPL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000							1.000
+	LNLA															
+	LNLB															1.000
+	LNLC															
+	LNSB			1.000	1.000	1.000	1.000									
+	LNSC							1.000								
+	LNSD								1.000							
	CONS	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000							
+	WSAL															
+	WTAL															
+	GSAL															
	GSDM															
+	GSDX															
+	CTAL															
	CTDM															
+	CTDX															
+	GSDR															
+	LAB1	0.559		0.559	0.559	0.559						-1.000				
+	LAB2	1.118		1.118	1.118	1.118	0.130	0.130	0.130				-1.000			1.922
+	LAB3	2.795	1.110	1.677	2.236	2.795	0.460	0.460	0.460					-1.000		2.210
+	LAB4	2.895	0.560	2.895	2.895	2.895	0.730	0.730	0.730						-1.000	0.662
	ALHI	-7.000	-1.500	-9.000	-10.250	-11.000	-3.500	-3.000	-2.000	1.000						
+	NPSS															
	SGGZ															
	WHPI															
	CSPI															
	GSPI															
	CTPI															
+	WHCI															
+	GSCI															
+	CTCI															
+	WHCX															
+	GSCX															
+	CTCX															
-	ANCP	20.560	0.910	26.050	28.120	30.320	2.120	2.120	2.120		-1.000					53.100
+	JANW	4.000		4.000	4.000	4.000										
+	FEBW															
+	MARW															
+	APRW	4.000		4.000	4.000	4.000										
+	MAYW	4.000		4.000	4.000	4.000										
+	JUNW	8.000		8.000	8.000	8.000										
+	JULW	4.000		4.000	4.000	4.000										3.000
+	AUGW	8.000			4.000	8.000										6.000
+	SEPW															
+	OCTW															
+	NOVW															
+	DECW															
+	PNAL															1.000
+	PNPI															-30.000

TABLE XX (CONTINUED)

		PNLBM	PNLBH	PNLBD	PNLCD	PNSBL	PNSBM	PNSBH	PNSCL	PNSCM	PNSCH	PNSBD	PNSCD	PNSDD	SALPN
	COST	148.980	158.960	61.610	61.610	141.490	150.580	160.560	139.890	148.980	158.960	61.070	61.070	61.070	-11.000
+	TCPL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
+	LNLA														
+	LNLB	1.000	1.000	1.000											
+	LNLC				1.000										
+	LNSB					1.000	1.000	1.000				1.000			
+	LNSC								1.000	1.000	1.000		1.000		
+	LNSD													1.000	
	CONS														
+	WSAL														
+	WTAL														
+	GSAL														
	GSDM														
+	GSDX														
+	CTAL														
	CTDM														
+	CTDX														
+	GSDR														
+	LAB1														
+	LAB2	1.922	1.922	1.630	1.630	1.922	1.922	1.922	1.922	1.922	1.922	1.630	1.630	1.630	
+	LAB3	2.569	3.128	0.750	0.750	2.010	2.569	3.128	2.010	2.569	3.128	0.750	0.750	0.750	
+	LAB4	0.662	0.662			0.662	0.662	0.662	0.662	0.662	0.662	0.600	0.600	0.600	
	ALHI														
+	NPSS														
	SGGZ														
	WHPI														
	CSPI														
	GSPI														
	CTPI														
+	WHCI														
+	GSCI														
+	CTCI														
+	WHCX														
+	GSCX														
+	CTCX														
-	ANCP	55.270	58.680	31.650	31.650	53.100	55.270	58.680	53.100	55.270	58.680	28.730	28.730	28.730	
+	JANW														
+	FEBW														
+	MARW														
+	APRW														
+	MAYW														
+	JUNW														
+	JULW	6.000	6.000			3.000	6.000	6.000	3.000	6.000	6.000				
+	AUGW	6.000	9.000			6.000	6.000	9.000	6.000	6.000	9.000				
+	SEPW														
+	OCTW														
+	NOVW														
+	DECW														
+	PNAL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	
+	PNPI	-34.000	-36.000	-15.000	-12.000	-32.000	-36.000	-38.000	-30.000	-34.000	-36.000	-15.000	-12.000	-10.500	1.000

TABLE XXI

DESCRIPTION OF THE COLUMN ABBREVIATIONS USED IN THE LINEAR PROGRAMMING MODEL

CCF1	Cow-calf, fall calving, Oct. 30, - range, grain sorghum stubble and cotton seed cake - sell July 20.
CCF2	Cow-calf, fall calving, Oct. 30, - range, grain sorghum stubble, hay and cotton seed cake - sell July 20.
CCF3	Cow-calf, fall calving, Oct. 30, - range, small grain grazing, hay and cotton seed cake - sell June 15.
FSF1	Feeder steers, fall buy, Sept. 10, - range, hay and cotton seed cake - sell July 10.
FSF2	Feeder steers, fall buy, Sept. 10, - small grain pasture and hay - sell March 10.
BYFH	Buy forage sorghum hay
BYAH	Buy Alfalfa hay
STGSW	Substitute grain sorghum for wheat
DVMGS	Divert minimum 20% of grain sorghum
DVXGS	Divert maximum 50% of grain sorghum
GSLAL	Grain sorghum production on L_a soils, 12 inches of water
GSLAM	Grain sorghum production on L_a soils, 16 inches of water
GSLAH	Grain sorghum production on L_a soils, 20 inches of water
GSLBL	Grain sorghum production on L_b soils, 12 inches of water
GSLBM	Grain sorghum production on L_b soils, 16 inches of water
GSLBH	Grain sorghum production on L_b soils, 20 inches of water
GSLAD	Grain sorghum production on L_a dryland soils
GSLBD	Grain sorghum production on L_b dryland soils
GSLCD	Grain sorghum production on L_c dryland soils
GSCBL	Grain sorghum production on C_b soils, 12 inches of water
GSCBM	Grain sorghum production on C_b soils, 16 inches of water
GSCBH	Grain sorghum production on C_b soils, 20 inches of water
GSCCL	Grain sorghum production on C_c soils, 12 inches of water
GSCCM	Grain sorghum production on C_c soils, 16 inches of water
GSCCH	Grain sorghum production on C_c soils, 20 inches of water
GSCBD	Grain sorghum production on C_b dryland soils

TABLE XXI (CONTINUED)

GSCCD	Grain sorghum production on C_c dryland soils
GSCDD	Grain sorghum production on C_d dryland soils
GSSBL	Grain sorghum production on S_b soils, 12 inches of water
GSSBM	Grain sorghum production on S_b soils, 16 inches of water
GSSBH	Grain sorghum production on S_b soils, 20 inches of water
GSSBD	Grain sorghum production on S_b dryland soils
GSSCD	Grain sorghum production on S_c dryland soils
GSSDD	Grain sorghum production on S_d dryland soils
SALGS	Sell grain sorghum
PSPGS	Price support payment on Grain Sorghum
WHLAL	Wheat production on L_a soils, 12 inches of water
WHLAM	Wheat production on L_a soils, 16 inches of water
WHLAH	Wheat production on L_a soils, 20 inches of water
WHLBL	Wheat production on L_b soils, 12 inches of water
WHLBM	Wheat production on L_b soils, 16 inches of water
WHLBH	Wheat production on L_b soils, 20 inches of water
WHLAD	Wheat production on L_a dryland soils
WHLBD	Wheat production on L_b dryland soils
WHLCD	Wheat production on L_c dryland soils
WHCBL	Wheat production on C_b soils, 12 inches of water
WHCBM	Wheat production on C_b soils, 16 inches of water
WHCBH	Wheat production on C_b soils, 20 inches of water
WHCCL	Wheat production on C_c soils, 12 inches of water
WHCCM	Wheat production on C_c soils, 16 inches of water
WHCCH	Wheat production on C_c soils, 20 inches of water
WHCBD	Wheat production on C_b dryland soils
WHCCD	Wheat production on C_c dryland soils
WHCDD	Wheat production on C_d dryland soils
WHSBL	Wheat production on S_b soils, 12 inches of water
WHSBM	Wheat production on S_b soils, 16 inches of water
WHSBH	Wheat production on S_b soils, 20 inches of water
WHSCL	Wheat production on S_c soils, 12 inches of water
WHSCM	Wheat production on S_c soils, 16 inches of water
WHSCH	Wheat production on S_c soils, 20 inches of water
WHSBD	Wheat production on S_b dryland soils
WHSCD	Wheat production on S_c dryland soils
WHSDD	Wheat production on S_d dryland soils
SALWH	Sell Wheat
PWHCT	Wheat certificate payment
CTLAL	Cotton production on L_a soils, 16 inches of water
CTLAM	Cotton production on L_a soils, 20 inches of water
CTLAH	Cotton production on L_a soils, 24 inches of water
CTLBL	Cotton production on L_b soils, 16 inches of water
CTLBM	Cotton production on L_b soils, 20 inches of water
CTLBH	Cotton production on L_b soils, 24 inches of water
CTLAD	Cotton production on L_a dryland soils
CTLBD	Cotton production on L_b dryland soils

TABLE XXI (CONTINUED)

CTLCD	Cotton production on L_c dryland soils
CTCBL	Cotton production on C_b soils, 16 inches of water
CTCBM	Cotton production on C_b soils, 20 inches of water
CTCBH	Cotton Production on C_b soils, 24 inches of water
CTCCL	Cotton production on C_c soils, 16 inches of water
CTCCM	Cotton production on C_c soils, 20 inches or water
CTCCH	Cotton production on C_c soils, 24 inches of water
CTCBD	Cotton production on C_b dryland soils
CTCCD	Cotton production on C_c dryland soils
CTCDD	Cotton production on C_d dryland soils
CTSBL	Cotton production on S_b soils, 16 inches of water
CTSBM	Cotton production on S_b soils, 20 inches of water
CTSBH	Cotton production on S_b soils, 24 inches of water
CTSCL	Cotton production on S_c soils, 16 inches of water
CTSCM	Cotton production on S_c soils, 20 inches of water
CTSCH	Cotton production on S_c soils, 24 inches of water
CTSBD	Cotton production on S_b dryland soils
CTSCD	Cotton production on S_c dryland soils
CTSDD	Cotton production on S_d dryland soils
DVMCT	Minimum diversion 5 per cent of cotton allotment
DVXCT	Maximum diversion 30 per cent of cotton allotment
SALCL	Sell Cotton lint
SALCS	Sell Cotton Seed
PSPCT	Cotton price support payments
ENLAL	Ensilage production on L_a soils, 12 inches of water
ENLAM	Ensilage production on L_a soils, 16 inches of water
ENLAH	Ensilage production on L_a soils, 20 inches of water
ENLBL	Ensilage production on L_b soils, 12 inches of water
ENLBM	Ensilage production on L_b soils, 16 inches of water
ENLBH	Ensilage production on L_b soils, 20 inches of water
ENLAD	Ensilage production on L_a dryland soils
ENLBD	Ensilage production on L_b dryland soils
ENLCD	Ensilage production on L_c dryland soils
ENCBL	Ensilage production on C_b soils, 12 inches of water
ENCBM	Ensilage production on C_b soils, 16 inches of water
ENCBH	Ensilage production on C_b soils, 20 inches of water
ENCBD	Ensilage production on C_b dryland soils
ENCCD	Ensilage production on C_c dryland soils
ENCDD	Ensilage production on C_d dryland soils
ENSBD	Ensilage production on S_b dryland soils
ENSCD	Ensilage production on S_c dryland soils
ENSDD	Ensilage production on S_d dryland soils
SALEN	Sell Ensilage
FSLAL	Forage sorghum hay production on L_a soils, 16 inches of water
FSLAM	Forage sorghum hay production on L_a soils, 24 inches of water
FSLAH	Forage sorghum hay production on L_a soils, 32 inches of water

TABLE XXI (CONTINUED)

FSLBL	Forage sorghum hay production on L_b soils, 16 inches of water
FSLBM	Forage sorghum hay production on L_b soils, 24 inches of water
FSLBH	Forage sorghum hay production on L_b soils, 32 inches of water
FSLAD	Forage sorghum hay production on L_a dryland soils
FSLBD	Forage sorghum hay production on L_b dryland soils
FSLCD	Forage sorghum hay production on L_c dryland soils
FSCBL	Forage sorghum hay production on C_b soils, 16 inches of water
FSCBM	Forage sorghum hay production on C_b soils, 24 inches of water
FSCBH	Forage sorghum hay production on C_b soils, 32 inches of water
FSCBD	Forage sorghum hay production on C_b dryland soils
FSCCD	Forage sorghum hay production on C_c dryland soils
FSCDD	Forage sorghum hay production on C_d dryland soils
FSSBL	Forage sorghum hay production on S_b soils, 16 inches of water
FSSBM	Forage sorghum hay production on S_b soils, 24 inches of water
FSSBH	Forage sorghum hay production on S_b soils, 32 inches of water
FSSBD	Forage sorghum hay production on S_b dryland soils
FSSCD	Forage sorghum hay production on S_c dryland soils
FSSDD	Forage sorghum hay production on S_d dryland soils
SALFS	Sell forage sorghum hay
AFLAL	Alfalfa production on L_a soils, 24 inches of water
AFLAM	Alfalfa production on L_a soils, 28 inches of water
AFLAH	Alfalfa production on L_a soils, 32 inches of water
AFLBL	Alfalfa production on L_b soils, 24 inches of water
AFLBM	Alfalfa production on L_b soils, 28 inches of water
AFLBH	Alfalfa production on L_b soils, 32 inches of water
AFLAD	Alfalfa production on L_a dryland soils
AFLBD	Alfalfa production on L_b dryland soils
AFLCD	Alfalfa production on L_c dryland soils
AFCBL	Alfalfa production on C_b soils, 24 inches of water
AFCBM	Alfalfa production on C_b soils, 28 inches of water
AFCBH	Alfalfa production on C_b soils, 32 inches of water
AFCCL	Alfalfa production on C_c soils, 24 inches of water
AFCCM	Alfalfa production on C_c soils, 28 inches of water
AFCCH	Alfalfa production on C_c soils, 32 inches of water
AFCBD	Alfalfa production on C_b dryland soils
AFCCD	Alfalfa production on C_c dryland soils
AFCDD	Alfalfa production on C_d dryland soils
AFSBL	Alfalfa production on S_b soils, 24 inches of water
AFSBM	Alfalfa production on S_b soils, 28 inches of water
AFSBH	Alfalfa production on S_b soils, 32 inches of water

TABLE XXI (CONTINUED)

AFSBD	Alfalfa production on S_b dryland soils
AFSCD	Alfalfa production on S_c dryland soils
AFSDD	Alfalfa production on S_d dryland soils
SALAF	Sell Alfalfa hay
SBLAL	Soybean production on L_a soils, 12 inches of water
SBLAM	Soybean production on L_a soils, 16 inches of water
SBLAH	Soybean production on L_a soils, 20 inches of water
SBLBL	Soybean production on L_b soils, 12 inches of water
SBLBM	Soybean production on L_b soils, 16 inches of water
SBLBH	Soybean production on L_b soils, 20 inches of water
SBLAD	Soybean production on L_a dryland soils
SBLBD	Soybean production on L_b dryland soils
SBLCD	Soybean production on L_c dryland soils
SBCBL	Soybean production on C_b soils, 12 inches of water
SBCBM	Soybean production on C_b soils, 16 inches of water
SBCBH	Soybean production on C_b soils, 20 inches of water
SBCBD	Soybean production on C_b dryland soils
SBCCD	Soybean production on C_c dryland soils
SBSBL	Soybean production on S_b soils, 12 inches of water
SBSBM	Soybean production on S_b soils, 16 inches of water
SBSBH	Soybean production on S_b soils, 20 inches of water
SBSBD	Soybean production on S_b dryland soils
SBSCD	Soybean production on S_c dryland soils
SBSDD	Soybean production on S_d dryland soils
SALSB	Sell Soybeans
PNLBL	Peanut production on L_b soils, 9 inches of water
PNLBM	Peanut production on L_b soils, 12 inches of water
PNLBH	Peanut production on L_b soils, 15 inches of water
PNLBD	Peanut production on L_b dryland soils
PNLCD	Peanut production on L_c dryland soils
PNSBL	Peanut production on S_b soils, 9 inches of water
PNSBM	Peanut production on S_b soils, 12 inches of water
PNSBH	Peanut production on S_b soils, 15 inches of water
PNSCL	Peanut production on S_c soils, 9 inches of water
PNSCM	Peanut production on S_c soils, 12 inches of water
PNSCH	Peanut production on S_c soils, 15 inches of water
PNSBD	Peanut production on S_b dryland soils
PNSCD	Peanut production on S_c dryland soils
PNSDD	Peanut production on S_d dryland soils
SALPN	Sell peanuts
ACINT	Interest charge on annual capital
HLBI	Hire labor for period one (Jan. and Feb.)
HSB2	Hire labor for period two (Mar., Apr., and May)
HLB3	Hire labor for period three (Jun., July., and Aug.)
HLB4	Hire labor for period four (Sep., Oct., Nov., and Dec.)

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