To the Graduate Council:

I am submitting herewith a thesis written by Robert W. Burney entitled "Minimum Capital Requirements for Specified Income Levels in the Delta and Brown Soil Areas of Tennessee." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

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Thesis
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MINIMUM CAPITAL REQUIREMENTS FOR SPECIFIED INCOME LEVELS IN THE DELTA AND BROWN SOIL AREAS OF TENNESSEE

A Thesis

Presented for the

Master of Science

Degree

The University of Tennessee

Robert W. Burney

March 1976

1269802

ACKNOWLEDGMENTS

The author wishes to express his appreciation to those who have made this study possible.

To Dr. Luther H. Keller goes sincere appreciation for his assistance and guidance during the course of this study. Appreciation is also expressed to Dr. S. Darrell Mundy and Dr. Billy Jo Trevena for their helpful suggestions in the writing of this manuscript.

A very special thanks goes to my wife, Elizabeth, and my children, Robert and Anne, for their sacrifices and encouragement provided during the course of my graduate study.

This report is based in part on research developed from regional research project S-67, "Evaluation of the Beef Production Industry in the South." This project is a cooperative effort of State Agricultural Experiment Stations in twelve southern states, the Farm Production Economics Division of the Economic Research Service, and the Tennessee Valley Authority.

The overall objectives of the regional project were (1) to determine various resource characteristics and combinations employed in beef production in the South, evaluate selective operator attributes, and appraise adjustment trends that have occurred, (2) to evaluate the micro and macro effects of selected aspects of alternative beef production systems, and (3) to estimate for selected alternative systems of beef production the relative effects on firm survival and/or growth of

constraints such as forage production risks, price risks, institutional restrictions and changes in value of assets.

This study was conducted in conjunction with partially fulfilling Objective II of Regional Project S-67. Many assumptions were those developed for S-67 by the various subcommittees working on the project. Resource situations and enterprise combinations were to be adapted to the particular study area.

ABSTRACT

The purpose of this study was to determine minimum capital requirements necessary for a specified income level on a representative farm in West Tennessee. A representative farm was assumed to have soil capabilities and yields consistent with the Delta and Brown soil areas. To determine their effects on capital requirements, allowances were made for varying equity levels, wage rates, government programs, labor supplies, land values, income levels, enterprise combinations, and livestock prices. Enterprises considered were those crop and livestock activities assumed to be predominant in the area. Highly specialized activities such as poultry, dairy, hog finishing, vegetable crops, and orchards were not considered. Emphasis was placed on beef production and feeding systems.

Crop and livestock production coefficients used in the study were developed for Regional Project S-67. The linear programming technique was used to minimize capital and to determine the optimum farm organization and farm size necessary for the specified return. Capital requirements ranged from $24,671 to $352,544 for the situations analyzed. Farm size ranged from 40 acres to over 971 acres.

The optimum farm organization generally included feeder pig production, cotton, and corn on relatively small farms. When beef production was forced into the solution, minimum capital requirements and farm size increased significantly.

The other variations had assorted effects on minimum capital requirements. The change to lower livestock prices had a pronounced effect on optimum organization. Land and capital requirements were much higher and income resulted mainly from cotton production. The situation with a higher income target, $10,000, required considerably more capital and land. A situation was also considered with a two man labor supply. Results indicated that it would be preferred to use only seasonal labor when minimizing capital under the assumed conditions.

Various results may be viewed as possible avenues toward improving income while minimizing capital. However, beef production appears to be a poor choice. Beef's necessity for large acreages of forage production make abundant capital a requirement. Production of feeder pigs would be the first choice from among livestock alternatives. When considering cash crops, cotton production was preferred under the conditions specified for the study.

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CHAPTER I

THE PROBLEM AND OBJECTIVES

I. INTRODUCTION

Despite a large net migration of farm workers and operators into nonfarm employment, significant decreases in farm number, and increases in the average size of farms, areas still exist with consistently low farm income. Gross migration from farms has averaged over one million persons per year since 1920.[1] However, the trend in migration has declined in recent years. While total land in farms in the United States has changed little since 1940, the number of farms declined by 3 million and farm size increased from 167 acres to 328 acres between 1940 and 1965.[2] Tennessee has consistently had low realized net income per farm. From 1960 to 1973, the state ranked in the lower seven (forty-fourth to forty-ninth) in realized net income per farm.[3]

In a given year, the farm operator has a particular set of semifixed resources (land, labor, and capital) with which to work. Any farm adjustment made during the short run is limited primarily to shifts

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[1]Luther G. Tweeten, Foundations of Farm Policy (Lincoln: University of Nebraska Press, 1970), p. 247.

[2]Ibid., p. 238.

[3]U.S., Department of Agriculture, Economic Research Service, Farm Income Situation, FIS 224 (Supplement) State Estimates 1949-73 (Washington, D.C.: U.S. Government Printing Office, September, 1974), pp. 8-9.

in use of these resources. Operators of many small farms may be unable to earn an acceptable living due to their limited resources even if such resources were used in an efficient manner. In some cases, cost of additional resources may appear prohibitive, particularly as expansion often involves additional indebtedness.

Therefore, small farmers are faced with a difficult decision concerning ways of achieving a satisfactory level of income. Many farmers have turned to off-farm employment because of the greater certainty of wages or salaries and/or because of dissatisfaction with income levels from farm activities. They have only a vague notion of the size farm required to return an equal level of income. Thus beginning and low income farmers need to know the minimum levels of capital and resources which offer a reasonable chance of providing a specified income. In addition, extension personnel, farm policymakers, lending agencies and others with an interest in farming are concerned with bringing incomes in farming closer to those in the nonfarm sector of the economy.

II. THE PROBLEM

The working ability of farmers is generally considered to be comparable to that of semiskilled or skilled workers in the rest of the economy.[4] Average realized net income per farm for the United States

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[4]D. Gale Johnson, "Comparability of Labor Capacities of Farm and Nonfarm Labor," The American Economic Review, XLIII (June, 1953):311.

was $11,332 in 1973. However, Tennessee ranked forty-eighth with an average income per farm of $3,585 in 1973.[5] Realized net income per farm for the U.S. averaged $9,611 in 1974, compared to $11,332 in 1973. After taxes, the disposable personal income per capita was $4,577 while that of nonfarm residents was $4,625 in 1974. Thus, for the United States, the ratio of farm to nonfarm income was 99 percent. This compares with 113 percent in 1973 and 73 percent in 1970.[6] Income for U.S. farmers in general seems to have improved. However, Tennessee farmers do not compare as favorably to nonfarm workers because they ranked forty-eighth in average income per farm.

III. OBJECTIVES

The objectives of this study were:

1. To determine the minimum capital requirements which would return net farm operator incomes of $7,000 and $10,000 respectively, under specified technical and price conditions in the Delta and Brown Soil areas of Tennessee when (a) all feasible crop and livestock alternatives are included; and (b) alternatives are restricted to beef enterprises plus crop enterprises which are potential feed supplies for beef. Particular attention was given to (1) the most profitable system

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[5]U.S., Department of Agriculture, Economic Research Service, Farm Income Situation, FIS 224 (Supplement) State Estimates 1949-73 (Washington, D.C.: U.S. Government Printing Office, September, 1974), p. 9.

[6]U.S., Department of Agriculture, Economic Research Service, Farm Income Situation, FIS 225 (Washington, D.C.: U.S. Government Printing Office, February, 1975), p. 5.

for finishing beef; (2) the relative profitability of heifer and steer feeding; and (3) the least cost feed combination associated with a given beef production system.

2. To analyze the effect of variations from the base situation in equity levels, wage rates, land values, livestock prices, labor supply, and government programs on the minimum capital requirements which achieve the specified $7,000 and $10,000 income targets.

IV. PROCEDURES

Most of the data included in this study were obtained through regional research project S-67, "Evaluation of the Beef Production Industry in the South," which is presently underway in twelve southern states. These data contain descriptions of representative resource situations and input and output levels for various crop and livestock enterprises. Land values, projected factor and product prices and a summary of soil groups in the area were available from an earlier phase of the regional project.

Resource needs, costs, and returns were determined for 32 livestock and crop enterprise production systems. Crops and forages budgeted were alfalfa hay, conserving base for government programs, corn, corn silage, cotton, lespedeza hay, Midland Bermuda pasture, Midland Bermuda hay, permanent pasture-hay, permanent pasture, soybeans, soybeans-wheat double-cropped, wheat and wheat-red clover hay in rotation. Livestock enterprises budgeted were cow-calf on pasture and hay, cow-calf on pasture and silage, feeder heifers (six systems), feeder steers (six

systems), stocker heifer, stocker steer, sows and feeder pig production and sows and finished hog production.

Because the regional study was concerned with the evaluation of the beef industry, enterprises were restricted, in one phase of the study, to only beef and associated feed production activities. In this situation only beef could be sold. The extent to which land and other resources may be used for beef production in the future is, of course, uncertain. However, these restrictions will enable us to look at potential changes relative to (1) the beef cow herd, (2) production and conditioning of feeder cattle, and (3) cattle feeding in the study area. Because several beef alternatives were included, the competitiveness of various beef systems under various assumed conditions could also be ascertained.

Objective 2 provided for studying the effect of changes in equity levels. Equity levels of 0, 25, 50, 75, and 100 percent were used. Changes in equity levels could be interpreted to represent the proportion of resources owned by the operator, various changes in the interest rate farmers must pay or the desired rate of return on resources. Base interest rates of 6 percent for investment capital and 7 percent for operating capital were used for owner resources. Beef and hog prices were varied by using a low and high price as well as the adopted base price for various types and grades of animals. Major product and factor prices used were those adopted by members of the regional research project in 1972 and represent expected long-term price relationships as viewed in 1972.

Wage rates for hired labor were varied from $1.75 per hour for seasonal hired labor and $4,500 per year for a full-time hired man to $2.65 per hour for seasonal labor and $7,000 per year for a full-time man. Most situations included the option to hire seasonal labor but two situations included a full-time hired man and no seasonal labor. More detailed discussions of procedures are presented in Chapters II and III.

V. LAND VALUES

Considerable variation in land values exists within the Brown Soil and Delta areas of Tennessee. Land values were based on estimates of appraisers and agents of the Federal Land Banks in the study area. Estimates shown in Table I were assigned for land based upon representative values for agricultural use and are considered to be for property without improvements. The base land value of $335.60 per acre is the 1972 estimate for farm sized units with the soil characteristics and type distribution shown in a later section. Analysis was also made using an estimated 1974 land value of $482.00 per acre. Some farmers may consider appreciation as a factor in purchasing land. Land was valued for agricultural use in this study. The production decisions were not influenced by a possible increase in land value through time.

VI. GOVERNMENT PROGRAMS

The analysis for this study was done both with and without government production control and income support programs. For the

TABLE I

ESTIMATED LAND VALUES AND PROPORTION OF TOTAL LAND IN THE DELTA AND BROWN SOIL AREAS OF WEST TENNESSEE

Soil Group	Proportion of Total Land (%)	Estimated Value, 1972[a]	Estimated Value, 1974[b]
I	36	$550.00	$750.00
II	8	375.00	617.50
III	14	320.00	450.00
IV	16	230.00	300.00
Other (Woodland, homestead, roads, waste, etc.)	26	100.00	150.00
Average acre[c]		335.60	482.00

[a]Estimated means for the five groups were provided by Mr. Elihu Meador, a rural appraiser with the Federal Land Bank of Tennessee. (Unpublished thesis, James Atchison).

[b]More current estimations for the five groups were provided by Mr. John Jordan and Mr. Richard Cooper, agents with the Federal Land Bank of Tennessee.

[c]Estimated values for an average acre were determined by weighting the estimated value of the five groups in the proportion in which they appear in the study area.

alternative with governmental programs, the provisions in effect in 1972 were used. In the study area, programs were in effect in 1972 for feed grain, wheat and cotton. Program provisions included a direct payment and a prescribed set-aside acreage designated for conserving use. Program payments could not exceed $55,000 per crop.

The no government program alternative is similar in some respects to the governmental programs in effect in 1974. Under the 1974 program, no allotments were in effect to restrict production of feed grain, wheat or cotton.

VII. ESTIMATING OPTIMUM FARM ORGANIZATION

The minimum capital investment requirements necessary to realize net operator incomes of $7,000 and $10,000 respectively, for the various conditions were estimated using linear programming procedures—specifically the IBM MPS-360 Computer Routine.

Enterprise alternatives included both situations where all feasible crop and livestock enterprises were considered, and where enterprises were restricted to beef and potential sources of feed for beef. Variations were made in equity levels, wage rate, land value, government programs, livestock prices, and labor supply using both income targets.

In the analysis, a base situation was established and then one variation at a time was introduced. The base situation consisted of $7,000 income target, base livestock prices, all feasible enterprises, 1972 government programs, 0 percent equity, base wage rate, 1972 land value, and operator labor plus the option to hire seasonal labor. Then

ten variations each from the base situation were introduced one at a time for all feasible enterprise situations and for beef and beef feed enterprises only. Analysis was also made using a $10,000 income target for both enterprise combinations. Models with all feasible enterprises were included with and without the option to buy corn. A total of nine situations without the option to buy corn were analyzed. With the exception of models varying equity levels, other variations were included at the lowest equity level that achieved a feasible solution. The total number of combinations studied was 31.

CHAPTER II

AREA OF STUDY

I. AREA DESCRIPTION

The area of study consists of the twelve most western counties in Tennessee: Crockett, Dyer, Fayette, Gibson, Hardeman, Haywood, Lake, Lauderdale, Madison, Obion, Shelby, and Tipton counties. This area is commonly called the Delta and Brown Soils area of Tennessee. Historically, this has been the major cotton producing area of the state. However, production of soybeans has been increasing steadily for the past several years and soybeans is now the principal crop in terms of acreage and income. Total acreage of harvested cropland and principal crops produced in the twelve county area are shown in Table II. Location of the study area is shown in Figure 1.

A major concern for this study was the role of beef cattle production in the study area. The number of beef cattle on Tennessee farms has more than tripled from 1950 to 1969. Also, the share of total farm sales in Tennessee contributed by beef cattle had increased from 16.4 percent in 1950 to 25.1 percent in 1969.[1] All cattle and calves other than milk cows in the study area totalled 281,420 in 1964 which was 13 percent of the state total of 2,136,050. By 1969 the number of

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[1]Tennessee Crop Reporting Service, Tennessee Agricultural Statistics Annual Bulletin 1969, Bulletin T-6 (Nashville: Tennessee Crop Reporting Service, 1969).

TABLE II

TOTAL ACREAGE OF CROPLAND HARVESTED AND PRINCIPAL CROPS PRODUCED IN 1969 BY COUNTY IN THE DELTA AND BROWN SOIL AREAS OF WEST TENNESSEE

County	Total Acres of Cropland Harvested	Corn	Corn Cut for Silage or Grazed	Wheat	Soybeans	Hay	Cotton
Crockett	93,830	9,893	1,008	3,368	42,084	5,672	32,197
Dyer	164,054	20,289	1,508	14,575	94,411	7,243	27,366
Fayette	125,731	17,085	3,735	2,188	56,300	10,261	32,384
Gibson	177,430	38,122	4,204	5,900	71,947	12,625	40,166
Hardeman	64,283	10,564	1,636	1,809	28,176	6,090	14,621
Haywood	134,023	14,180	1,397	2,468	74,591	5,426	35,409
Lake	75,884	5,973	—	10,731	44,504	1,091	18,662
Lauderdale	118,958	10,606	1,133	6,102	67,853	3,982	30,765
Madison	89,864	12,469	4,207	692	34,218	8,162	28,801
Obion	148,847	51,630	2,978	10,284	69,477	9,412	7,145
Shelby	119,882	2,091	1,772	5,685	72,035	6,701	28,310
Tipton	121,771	6,046	1,726	3,447	68,133	4,450	38,360
Totals	1,434,555	198,948	25,304	67,249	723,729	81,475	334,186
Percent of Total	100	14	2	5	50	6	23

Source: 1969 Census of Agriculture.

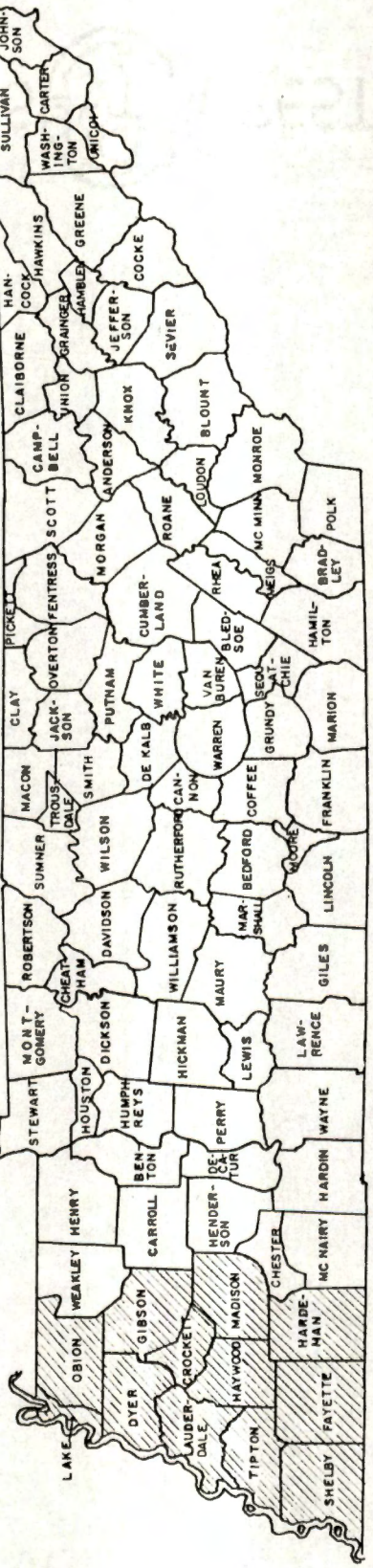


Figure 1. Map of the study area.

cattle and calves other than milk cows in Tennessee had increased to 2,243,754 head, while the twelve county area had declined in cattle numbers to 238,687 head or only 11 percent of the state total.[2] The state total increased to 2,690,000 head in 1974 and cattle numbers in the study area increased to 327,900 or 12 percent of the state total.[3]

Beef cattle enterprises in Tennessee are predominantly of the cow-calf type. The average beef cow herd in Tennessee is roughly the size which can be serviced by one bull, i.e., 25 to 30 cows. In an earlier phase of the regional study, S-67, Cuskaden found that beef herds in the West Tennessee study area averaged slightly larger (31.6 head) than the remainder of the state. Few of the farms surveyed reported the sale of stocker or fat cattle raised from their own herd or bought as calves or yearlings.[4]

Cuskaden also found that hay was the principal feedstuff for beef cow herds in the study area during the winter months. Silage feeding was reported on less than 20 percent, and concentrate feeding on less than 40 percent of the beef farms in West Tennessee that were studied. Farm assets, farm debts, and net farm worth for the average beef farm

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[2]United States Bureau of the Census, United States Census of Agriculture:1969, Tennessee, Sect. 2, Vol. 1 County Data (Washington, D.C.: U.S. Government Printing Office, 1972).

[3]Tennessee Crop Reporting Service, Tennessee Agricultural Statistics Annual Bulletin, 1975, Bulletin T-12 (Nashville: Tennessee Crop Reporting Service, 1975).

[4]Charles M. Cuskaden, Resource Characteristics of Beef and Nonbeef Farms in Tennessee, Bulletin 491 (Knoxville, Tennessee: The University of Tennessee Agricultural Experiment Station, February, 1972), pp. 16-18.

were all more than double those of the average nonbeef farm. However, average operator equity was over 90 percent in all farms studied.[5]

Only about 20 percent of all farms in the study area had sales greater than $10,000 in 1969.[6] In 1966, farms in the U.S. with sales of $10,000 to $19,999 had an average realized net farm income of $6,869. For that same year farms with sales of less than $10,000 comprised 69.2 percent of all farms in the U.S.[7]

The study area includes two metropolitan centers, Memphis and Jackson. The remainder of the area is predominantly rural. In 1969, the 3,047,676 acres in farms of the study area were reported to contain 16,563 farms. Over 74 percent of the acreage in farms was classified as openland. The number of farms in the Delta and Brown Soil areas declined 26 percent between 1964 and 1969. The average farm size increased 35 percent from 156 acres in 1964 to 210 acres in 1969. The number of farms operated by tenants in the area decreased from 41 percent in 1964 to 18 percent in 1969. The number of full owners increased from 37 percent to 57 percent during the same period while part owner operated farms increased by 3 percent.[8]

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[5]Ibid., pp. 3-4.

[6]United States Bureau of the Census, United States Census of Agriculture: 1969, Tennessee, Section 2, Vol. 1 County Data (Washington, D.C.: U.S. Government Printing Office, 1972).

[7]Luther G. Tweeten, Foundations of Farm Policy (Lincoln: University of Nebraska Press, 1970), p. 164.

[8]United States Bureau of the Census, United States Census of Agriculture: 1969, Tennessee, Section 2, Vol. 1 County Data (Washington, D.C.: U.S. Government Printing Office, 1972).

II. SOILS

The soils of the study area have been classified into three major soil associations. Soils of the Delta area along the western boundary of the state have been designated the Sharkey-Robinsonville-Yazoo Association. The soils are derived from alluvium of the Mississippi River and tributary streams. The soils are fertile and vary from fine to medium texture. Extensive areas are poorly drained. The soils with fine texture and poorer drainage are difficult to till and yields are uncertain. However, medium texture soils with good drainage are among the most productive in the state. The lowest and most poorly drained areas may be best suited to forest when drainage is not feasible.

The Memphis-Loring and the Grenada-Loring-Memphis Associations predominate in the remainder of the area. The soils of the uplands are derived from deep or moderately deep loess underlain by Coastal Plain sand and clays. The soils range from poorly drained to well drained, and from low to moderate in fertility. They are easy to till but erode easily.[9]

The elevation ranges from 600 feet above sea level in the east to a low of 250 feet in Memphis. The slopes are nearly level in the west to rolling in the eastern portion. Precipitation of 48-50 inches annually is slightly less than the state average. The growing season ranges from 200 to 226 days.[10]

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[9]Joe A. Martin and B. H. Luebke, Types of Farming in Tennessee, Bulletin 311 (Knoxville, Tennessee: The University of Tennessee Agricultural Experiment Station, March, 1960), pp. 19-20.

[10]Ibid., pp. 58-66.

CHAPTER III

RESOURCE ASSUMPTIONS

I. INTRODUCTION

Linear programming techniques were used to determine the minimum capital requirements for a $7,000 and $10,000 return to operator's labor and management with variations in equity levels, government programs, wage rates, land value, enterprises considered, and labor supply.

II. SOILS

Soils of the study area were classified into use groups based upon similarities in production capabilities. Major soil series, proportions of openland and maximum percentages for use in various enterprises of the Soil Capability Classes are shown in Table III. Openland accounts for 74 percent of the total land. For each ten acres of openland, approximately 3.42 acres are suitable for row crops and only 3.29 acres would be suitable for alfalfa production.

Capability Class I soil can be used more intensively than other classes of soils with only minimal erosion risk. These soils are generally level, well drained and productive. Capability Class II soils present some limitations to use and require certain conservation practices. Soils of SCS Capability Class III are soils with any number of severe limitations that reduce their uses and require special conservation practices or both. Capability Class IV soils are marginal

TABLE III

DESCRIPTION OF SOIL GROUPS FOUND ON REPRESENTATIVE FARMS OF THE STUDY AREA

Soil Group	Predominant Soil Capability Classes	Proportion of Total Land	Maximum Percent of Openland for: Row Crops	Alfalfa
I	I-1, I-2, IIe-1, IIw-1, IIw-2, IIIw-2	36	80	40
II	IIe-2	8	33	100
III	IIIe-1, IIIe-2, IIIw-1, IIIw-3	14	20	75
IV	IVe-1, IVe-2, IVw-1, IVw-2, IVw-3, VIe-1, VIe-2	16	0	0
Other	(Woodland, waste, roads, homesteads, etc.)	26	0	0

Source: Tennessee Conservation Needs Committee, Tennessee Soil and Water Conservation Needs Inventory, Tennessee State Soil Conservation Committee, 1971.

for cultivation and require very restrictive conservation practices. Soils in Capability Class VI are generally suited only for pasture, woodland, or wildlife feed and cover. Some soils of this class may be adapted for orchards or vegetable crops if conservation practices are carefully followed.[1] Land would constitute 70 to 85 percent of total investment for most farms in the study area. With increasing land values, small farmers are finding it more difficult to compete for land with larger farmers and nonfarm land uses.

III. LABOR SUPPLIES

A full-time hired man was assumed to supply 2,250 hours per year which amounts to fifty 45 hour weeks with two weeks vacation. A full-time operator was assumed to supply 2,500 hours of labor or fifty 50 hour weeks with two weeks vacation. Vacations were assumed to be taken during slack periods. Overhead labor for various preparations, management functions, and other additional tasks were predetermined for the particular time periods or included in the labor requirements.

An assumption on overhead labor is that the operator has other members of the family to help with some of these tasks. His wife can help with bookkeeping and children may aid in certain chores. Some flexibility in labor would be possible if the operator could work longer hours during busy seasons.

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[1] U.S., Department of Agriculture, Soil Conservation Service and Others, Tennessee Soil and Water Conservation Needs Inventory (1971), p. 127.

Seasonal hired labor was assumed to be available at $1.75 per hour or $4,500 per year for a full-time man. An alternative higher wage rate of $2.65 per hour or $7,000 per year was used to determine the effect of higher labor cost on the optimum systems. One hour of supervisory labor was required for each twenty hours of full-time hired labor. In the case of seasonal hired labor, one hour of operator supervisory labor was required for each ten hours of seasonal hired labor.

Labor availability and distribution by months for a one and two man labor supply are shown in Table IV. Total operator labor available was based on an average of 50 hours per week times the appropriate number of weeks in each month. The two man labor supply could represent a partnership or an operator plus a full-time hired man.

IV. AVAILABILITY AND COSTS OF CAPITAL

No restrictions were placed on the amounts of operating capital available for use in either livestock or crop production. For the base situation investment capital and operating capital were charged at 6 percent and 7 percent, respectively. Charges for use of operating capital were made only for the proportion of the year such capital would be required for a particular use.

V. PRICES

Prices and costs used in the analysis appear in Table V. It includes prices received for crop enterprises and base livestock prices received. Prices paid include custom work, seed, feed, fertilizer and

TABLE IV

ESTIMATED LABOR AVAILABILITY BY LABOR PERIODS AND BY LABOR SITUATIONS

Labor Period	Full-time Operator	Operator and One Hired Man Adjusted for Supervisory Labor
January	221.00	410.00
February	200.00	371.00
March	221.00	410.00
April	213.25	395.40
May	221.00	410.00
June	213.25	395.40
July	221.00	410.00
August	221.00	410.00
September	213.25	395.40
October	221.00	410.00
November	213.25	395.40
December	221.00	410.00
Totals	2,600.00	4,822.60

Source: Procedural Guide for S-67.

TABLE V

ASSUMED PRODUCT PRICES AND INPUT COSTS USED IN THE STUDY

	Unit	Price
Prices Received		
Cotton lint	Pound	.24
Cotton seed	Ton	50.00
Corn	Bushel	1.20
Soybeans	Bushel	2.75
Wheat	Bushel	1.30
Feeder steers (500 lbs.)	Cwt.	32.50
Feeder heifers (450 lbs.)	Cwt.	30.25
Cull cows	Cwt.	22.00
Slaughter steers (1000 lbs.)	Cwt.	29.00
Slaughter heifers (850 lbs.)	Cwt.	27.50
Stocker steers (783 lbs.)	Cwt.	29.50
Stocker heifers (734 lbs.)	Cwt.	27.00
Market hogs (220 lbs.)	Cwt.	21.00
Feeder Pigs (45 lbs.)	Cwt.	37.00
Cull sows	Cwt.	17.00
Prices Paid—Custom Work		
Cotton picking	Pound	.06
Silage harvesting	Ton	2.59
Sprigging Bermuda	Acre	15.00
Prices Paid—Seed		
Alfalfa	Pound	.90
Corn	Pound	.30
Cotton	Pound	.12
Soybeans	Pound	.085
Wheat	Pound	.05
Fescue	Pound	.20
Ladino Clover	Pound	.90
Orchard grass	Pound	.20
Lespedeza	Pound	.20
Red Clover	Pound	.50
Bermuda Grass	Sprigs	1.00
Prices Paid—Feed		
Corn	Bushel	1.35
Salt and minerals	Cwt.	3.90
Creep feed	Cwt.	5.50
Protein supplement (hog)	Cwt.	4.75
Salt	Pound	.015
Dicalcium Phosphate	Pound	.04
Urea	Pound	.044
Cottonseed Meal	Pound	.05

TABLE V (continued)

	Unit	Price
Prices Paid—Fertilizer and Lime		
Nitrogen	Pound	.10
P_2O_5	Pound	.10
K_2O	Pound	.06
Borax	Pound	.06
Lime (spread)	Ton	6.00

lime prices. Many of the prices were provided by Regional Project S-67. Others were derived from budget publications and consultation with people in the area.

VI. OVERHEAD COSTS

Certain costs were designated as overhead costs and were not charged to specific enterprises. Such items as a farm truck, a farm wagon, a manure spreader, an elevator, farm tools, utilities, insurance, legal fees, and a machine shed were included in this overhead. Items not used exclusively by the farm were shared by the farm and the household or family. The overhead costs totaled $1,779 per year (Table VI).

VII. MACHINERY RESOURCES

Machinery costs were included in the enterprise budgets on the basis of assumed performance rates and a charge per hour of estimated use. Costs considered were fuel, oil, lubrication, repairs, depreciation, and interest on investment. These costs were determined on the basis of an estimated annual cost of owning the machine, given the assumption of initial cost, salvage value, depreciation, years of life, and estimated hours of use for a particular machine during the year. If the likely use of a particular machine was too small to justify ownership, it was assumed that custom work was available at specific rates. Estimated costs of owning and operating various types of farm machinery are shown in Appendix A.

TABLE VI

ESTIMATED ANNUAL OVERHEAD COST, DELTA AND BROWN SOIL AREAS OF WEST TENNESSEE

Item	Cost New	Cost Average[a]	Salvage Value	Years Life	Annual Deprec.	Annual Repair	Interest @ 6 Percent	Taxes[b] and Insurance	Fuel and Other	Annual Total Cost
Machine Shed	$1500	$ 750			$ 75.00	$ 7.50	$ 45.00	$10.00		$ 137.50
Wagon	480	216	$ 48	15	28.80	21.60	12.96	1.94		65.30
Manure Spreader	1000	450	100	15	60.00	30.00	27.00	4.05		121.05
Truck (one ton)	4000	1800	400	10	360.00	150.00	108.00	90.00	$250.00	958.00
Auto (farm share)[c]									192.00	192.00
Telephone									48.00	48.00
Electricity[d]									36.00	36.00
Liability Insurance								45.00		45.00
Bookkeeping, Legal Fees, Miscellaneous									50.00	50.00
Elevator	300	135.00	30.00	15	18.00	9.00	8.10	.75		35.85
Farm Tools		500.00				60.00	30.00			90.00
Total										$1778.70

[a]The average cost is computed by subtracting salvage value from initial cost and dividing by two.

[b]May be property tax, truck insurance, license fee, etc.

[c]Farm share, 1,600 miles at $0.12 per mile.

[d]Monthly rate assumed to be $3.00. Charges for electricity were included in both swine and beef budgets.

Source: Synthesized from numerous publications and personal communications.

VIII. INCOME TARGETS

Income targets of $7,000 and $10,000 return to operator's labor and management were chosen for this study. If the working ability of the farmer is equal to that of workers in nonfarm employment, then farmers would likely expect to receive incomes consistent with nonfarm employment. In addition to returns to operator labor and management, the operator would also expect to receive an investment return on his equity in the farm business. Seven thousand dollars was the desired target of 1972. The alternative $10,000 income target was also used because many people have higher income reservations and income requirements have risen from 1972 to 1975.

IX. LEVEL OF TECHNOLOGY AND YIELDS

In developing the input-output coefficients, it was assumed that the advanced technology used by the more progressive farmers in the area in 1972 will portray the practices of the average farmer in 1975. This assumption implies, also, yields consistent with the use of advanced technology and farm managers who can attain such yields. Agronomists and soil conservation technicians were consulted in developing specific crop yields for each class of soil under the above assumptions of management skills and technology levels. These assumed yields are shown in Table VII by soil groups for each of the crop alternatives included in the analysis.

TABLE VII

CROP ENTERPRISE BUDGETS AND YIELD LEVELS BY SOIL GROUPS, DELTA AND BROWN SOIL AREAS OF WEST TENNESSEE

Enterprise Budget		Estimated Yield Per Acre for Soil Group: I	II	III	IV
Alfalfa	(tons)	3.0	2.3	2.8	-
Corn	(bushels)	90	75	60	-
Corn Silage	(tons)	17.5	14.8	11.9	-
Cotton	(lbs. lint)	750	675	550	-
Cotton	(lbs. seed)	1250	1000	900	-
Lespedeza	(tons)	1.8	1.6	1.3	1.0
Midland Bermuda Hay	(tons)	5.5	5.0	4.1	3.3
Midland Bermuda Pasture	(CAD)	200	178	148	119
Permanent Pasture, Hay	(tons)	1.0	0.9	0.75	0.6
	(CAD)	120	107	94	74
Permanent Pasture	(CAD)	180	160	140	110
Soybeans	(bushels)	36	32	27	-
Soybeans-Wheat	(bu. soybean)	27	24	20	
	(bu. wheat)	40	35	30	
Wheat	(bushel)	40	35	30	
Wheat-Red Clover	(bu. wheat)	20	17.5	15	
	(tons hay)	1.85	1.5	1.65	

Source: Developed in consultation with Agronomists and Soil Conservation Technicians of the University of Tennessee Agricultural Experiment Station in Knoxville.

X. LAND BUYING

Because the objective was to determine the minimum capital necessary to achieve a given net income level, a land buying activity was included in the programming model. Thus farm size for each optimal solution was a part of the solution and varied with the assumed conditions. Land pattern was determined on the basis of average situations in the study area and included 74 percent openland and 26 percent woodland, waste and other land. The distribution of the land among the four productive soil groups is shown in Table III on page 17. Each acre of openland contained these percentages of each soil group. Percentages of cropland and percentages of land which could be used for alfalfa for each soil group were also included.

The 1972 cotton allotment, wheat allotment, and feed grain base were also included in the land purchasing activity. The percentage of cotton allotment for each acre of total land was 9.8 percent; wheat allotment was 0.3 percent; and feed grain base was 13.8 percent. The allotments for corn, wheat, and cotton were found by dividing the total allotment available in 1972 for each crop in the twelve counties by the total farmland in the area.[2] Thus for each acre of land purchased, .098 acres of cotton allotment, .003 acres of wheat allotment, and .138 acres of feed grain allotment were also purchased. Total land in farms in the

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[2]U.S., Department of Agriculture, Agricultural Stabilization and Conservation Service, 1972 Annual Report, Tennessee (1973).

twelve counties was 3,047,676 acres.[3] Total cotton allotment was 298,213 acres, wheat allotment 8,239 acres and the feed grain base was 421,684 acres.[4]

Annual charges for purchases of land included interest on investment and a property tax. A base land value of $335.60 (1972) and a 1974 land value of $482.00 were used in the study. Interest was charged on land at 6 percent and the annual property tax was assumed to be $2.00 per acre of land for the base value and $3.00 for the 1974 value.

XI. ENTERPRISES CONSIDERED

Crop Enterprises

Enterprise production coefficients were developed for 13 crops with variations for the various soil groups. A total of 53 crop enterprise budgets were developed for the representative farm.

In determining costs or returns for enterprises, no charges were made for operator labor, land or overhead costs in the enterprise budgets. Estimated capital requirements and net costs or returns for specified crops are shown in Table VIII.

Operating capital is the estimated amount of funds needed to meet expenses during the year and is prorated on an annual basis. Investment

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[3]United States Bureau of the Census, United States Census of Agriculture:1969, Tennessee, Section 2, Vol. 1 County Data (Washington, D.C.: U.S. Government Printing Office, 1972).

[4]U.S., Department of Agriculture, Agricultural Stabilization and Conservation Service, 1972 Annual Report, Tennessee (1973).

TABLE VIII

ESTIMATED ANNUAL CAPITAL REQUIREMENTS AND NET COSTS
OR NET RETURNS PER ACRE FOR CROP ENTERPRISES

Crop Enterprises	Operating Capital	Investment Capital[a]	Net Cost or Net Return[b]
Alfalfa Hay			
Soil I	$18.12	$101.70	-$82.44
Soil II	15.47	101.70	-76.58
Soil III	17.27	101.70	-80.58
Corn (no government program)			
Soil I	18.65	47.86	-48.08
Soil II	16.56	47.86	-44.28
Soil III	13.95	47.86	-38.68
Corn (government program)			
Soil I	19.06	48.90	-31.07
Soil II	16.97	48.90	-30.27
Soil III	14.36	48.90	-27.67
Corn Silage			
Soil I	23.36	26.14	-95.99
Soil II	21.26	26.14	-84.80
Soil III	18.37	26.14	-71.49
Cotton (no government program)			
Soil I	26.42	33.43	75.69
Soil II	25.11	33.43	64.79
Soil III	22.50	33.43	47.49
Cotton (government program)			
Soil I	26.75	34.26	187.40
Soil II	25.44	34.26	165.25
Soil III	22.83	34.26	129.20
Lespedeza Hay			
Soil I	7.22	40.43	-29.47
Soil II	6.82	40.43	-28.15
Soil III	6.42	40.43	-27.47
Soil IV	6.02	40.43	-26.43
Midland Bermuda Hay			
Soil I	22.73	120.29	-100.36
Soil II	20.93	120.29	-96.36
Soil III	18.58	120.29	-90.94
Soil IV	15.48	120.29	-84.10

TABLE VIII (continued)

Crop Enterprises	Operating Capital	Investment Capital[a]	Net Cost or Net Return[b]
Midland Bermuda Pasture			
Soil I	16.90	8.29	-35.19
Soil II	15.60	8.29	-32.59
Soil III	13.40	8.29	-28.19
Soil IV	11.70	8.29	-24.79
Permanent Pasture[c]			
Soil I	8.90	8.00	-19.03
Soil II	8.02	8.00	-17.27
Soil III	7.22	8.00	-15.67
Soil IV	6.33	8.00	-13.91
Permanent Pasture[c]-Hay			
Soil I	8.92	36.86	-33.07
Soil II	8.02	36.86	-31.23
Soil III	7.24	36.86	-29.51
Soil IV	6.36	36.86	-27.63
Soybeans			
Soil I	13.92	42.15	62.02
Soil II	13.92	42.15	51.02
Soil III	13.92	42.15	37.27
Soybeans-Wheat			
Soil I	23.52	71.44	62.80
Soil II	21.47	71.44	52.17
Soil III	19.41	71.44	38.77
Wheat (no government program)			
Soil I	12.84	30.14	18.96
Soil II	10.80	30.14	16.56
Soil III	8.75	30.14	14.16
Wheat (government program)			
Soil I	14.19	33.58	84.09
Soil II	12.15	33.58	73.14
Soil III	10.10	33.58	62.19
Wheat-Red Clover Hay			
Soil I	12.03	58.57	-25.49
Soil II	10.18	58.57	-24.76
Soil III	11.23	58.57	-30.23

TABLE VIII (continued)

[a]These figures were computed using the same procedure as described on page 32 and represent the associated machine investment cost per acre for crops.

[b]Net costs or net returns, as shown here, do not include deductions for interest on operating or investment capital. Negative values indicate a net cost of production and that the activity is handled as an intermediate product while positive values indicate a net return obtainable from sale of the product exclusive of charges for land, labor, overhead costs, and intermediate products.

[c]Permanent pasture consists of Orchard grass-Ladino clover mixture or Fescue-Ladino clover mixture.

Source: Derived from unpublished budgets by Robert Burney and Luther Keller, developed for each production activity. Department of Agricultural Economics, The University of Tennessee Agricultural Experiment Station.

capital is an estimate of the prorata share of machinery investment requirements for production of that particular crop. Costs of crop storage facilities were included in livestock investment. In the column labeled "net cost or return" the negative figures indicate cost of production of an acre of feed crops on an annual basis. Cost of production includes annual expense for seed, fertilizer, chemicals, and so forth, and the annual prorated machinery costs for a particular crop. The positive figures for cotton, soybeans, soybeans-wheat double-cropped, and wheat indicate net returns per acre or the difference between gross income and allocated production expenses in an average year.

Yield estimates for all crop enterprises by soil groups are shown in Table VII, page 26. These estimates were considered reasonable averages for the study area when good management practices were applied.

Labor requirements were estimated from engineering data based on operations assumed in each of the crop enterprises. Estimates included actual field time, refueling time, time to and from the fields, and time lost due to breakdown and repair. Estimated labor requirements for crop enterprises appear in Table IX.

Row crops. Row crop budgets were developed using the format established for use in Regional Project S-67. Preharvest and harvest costs were considered separately in the budgets so interest charges could be made on operating capital only for the length of time the capital was used; about six months from planting to harvest in most cases.

TABLE IX

LABOR REQUIREMENTS FOR SPECIFIC CROPS BY MONTHS

Enterprise	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Alfalfa	-	.26	-	.32	3.06	3.38	3.18	.20	3.09	-	-	-	13.49
Conserving Base	-	-	-	-	.03	.03	-	.38	.03	-	-	-	.47
Corn	-	-	.17	1.67	.51	.45	.45	-	-	.69	.36	-	4.30
Corn WGP[a]	-	-	.17	1.67	.51	.46	.45	.34	.02	.69	.36	-	4.67
Corn Silage	-	-	.17	1.67	.51	.54	.54	-	-	-	-	-	3.43
Cotton	-	-	.80	1.26	1.25	1.71	1.85	-	-	.20	-	-	7.07
Cotton WGP	-	-	.80	1.26	1.25	1.71	1.85	.27	.015	.20	-	-	7.36
Lespedeza	-	-	.87	.09	-	.32	-	3.80	-	-	-	-	5.08
Midland Bermuda Hay	-	-	.02	.35	.35	4.04	3.98	3.98	3.98	-	-	-	16.70
Midland Bermuda Pasture	-	-	.02	.35	.35	.06	.32	-	-	-	-	-	1.10
Permanent Pasture	-	.29	-	-	-	.45	-	.36	.02	-	-	-	1.12
Permanent Pasture with Hay	-	.29	-	-	3.98	.45	-	.36	.02	-	-	-	5.10
Soybeans	-	-	.17	.63	1.25	.84	.81	.35	-	.53	.53	-	5.10
Soybeans-Wheat	-	.32	-	-	-	2.15	.41	.42	-	1.92	1.11	-	6.33
Wheat	-	.32	-	-	-	.98	-	-	.68	.68	-	-	2.66
Wheat WGP	-	.32	-	-	-	1.01	-	1.12	.75	.68	-	-	3.88
Wheat-Red Clover	-	.24	-	-	-	2.12	-	3.23	.29	.29	-	-	6.17

[a]WGP—With Government Programs.

Source: Ray, Robert M., and Walch, Herbert N. Farm Planning Manual. The University of Tennessee Agricultural Experiment Station, May, 1973, and other budget publications.

No interest costs were charged on operating capital required for harvesting operations.

Forage crops. Estimates of the capital requirements and net costs of forage crops which appear in Table VIII, page 29, are annual averages. These annual averages were determined by prorating total preharvest and harvest costs over the number of years which a crop could be harvested following a single establishment.

Monthly distribution of grazing nutrients from pasture enterprises are presented in Table X in terms of total digestible nutrients, digestible protein, and dry matter.

Feed wastage for hay and silage were subtracted from the total yields using 5 percent wastage for silage and 15 percent wastage for hay. Hays were converted to alfalfa equivalents using factors of .85 for Red Clover hay, .8 for lespedeza hay, .65 for Midland Bermuda hay, and .75 for hay cut off permanent pasture.[5]

A brief description of practices and assumptions involved in the various crop enterprises is presented here for further clarification.

Alfalfa. Alfalfa was an alternative on Soil Groups I, II, and III. The budget included four cuttings, one each in May, June, July, and September with aftermath grazing following the last cutting. Chemical control of the alfalfa weevil was part of the management practices involved.

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[5]James A. Atchison, "A Study of Optimum Resource Use on Part-Time Farms in the Brown Soil and Delta Areas of Tennessee" (unpublished Master's thesis, The University of Tennessee, Knoxville, August, 1972).

TABLE X

DISTRIBUTION OF TDN,[a] DP,[b] and DM[c] IN POUNDS FOR PASTURE ENTERPRISES

Enterprise		Jan.-Feb.	Mar.-Apr.	May-June	July-Aug.	Sept.-Oct.	Nov.-Dec.	Total
Alfalfa	TDN					190	48	238
	DP					50	13	63
Soil I	DM					317	79	396
Alfalfa	TDN					146	37	183
	DP					39	10	49
Soil II	DM					244	61	305
Alfalfa	TDN					178	45	223
	DP					48	12	60
Soil III	DM					298	74	372
Bermuda Hay	TDN					614		614
	DP					125		125
Soil I	DM					959		959
Bermuda Hay	TDN					558		558
	DP					113		113
Soil II	DM					872		872
Bermuda Hay	TDN					458		458
	DP					93		93
Soil III	DM					715		715
Bermuda Hay	TDN					401		401
	DP					81		81
Soil IV	DM					626		626
Bermuda	TDN		145	875	1312	582		2915
Pasture	DP		30	177	266	120		592
Soil I	DM		228	1366	2050	911		4555
Bermuda	TDN		130	780	1170	520		2595
Pasture	DP		26	159	238	105		527
Soil II	DM		203	1215	1823	811		4054
Bermuda	TDN		108	648	972	432		2157
Pasture	DP		22	132	198	88		438
Soil III	DM		168	1011	1517	672		3371
Bermuda	TDN		86	519	779	345		1734
Pasture	DP		17	105	158	69		352
Soil IV	DM		135	813	1219	541		2710
Permanent	TDN	72	601	556	198	287	81	1795
Pasture Hay	DP	11	102	93	34	48	13	305
Soil I	DM	107	898	831	294	429	120	2679
Permanent	TDN	64	536	496	176	256	72	1600
Pasture Hay	DP	11	91	84	30	43	12	272
Soil II	DM	96	800	740	262	382	108	2389

TABLE X (continued)

Enterprise		Jan.-Feb.	Mar.-Apr.	May-June	July-Aug.	Sept.-Oct.	Nov.-Dec.	Total
Permanent	TDN	56	471	436	154	225	63	1406
Pasture Hay	DP	10	80	74	26	38	11	239
Soil III	DM	83	703	650	230	335	94	2099
Permanent	TDN	45	371	343	122	177	50	1106
Pasture Hay	DP	8	63	58	20	30	9	188
Soil IV	DM	66	552	511	182	264	75	1650
Permanent	TDN	107	902	835	296	431	121	2693
Pasture	DP	18	153	142	50	73	21	458
Soil I	DM	160	1346	1246	442	643	181	4019
Permanent	TDN	96	801	741	264	382	108	2393
Pasture	DP	16	137	127	44	66	18	407
Soil II	DM	143	1197	1108	392	572	161	3572
Permanent	TDN	83	701	649	230	335	94	2094
Pasture	DP	14	119	110	40	57	16	356
Soil III	DM	125	1047	969	344	500	142	3125
Permanent	TDN	66	551	510	181	263	74	1646
Pasture	DP	11	94	85	30	45	12	277
Soil IV	DM	98	823	762	270	393	111	2456
Red	TDN					234	35	269
Clover	DP					51	7	58
Soil I	DM					334	50	384
Red	TDN					190	28	218
Clover	DP					41	6	47
Soil II	DM					270	40	310
Red	TDN					208	31	239
Clover	DP					45	7	52
Soil III	DM					297	44	342

[a]TDN—Total Digestible Nutrients.

[b]DP—Digestible Protein.

[c]DM—Dry Matter.

Source: Derived from unpublished data from the Plant Science Department, The University of Tennessee Agricultural Experiment Station.

Corn. Corn budgets were developed for Soils I, II, and III and included chemical weed control supplemented by cultivation. It was assumed that corn could be bought at $1.35 per bushel and sold at $1.20 per bushel. Corn could also be produced under government program provisions.

Corn silage. Estimates were based on custom harvesting and a combination of cultivation and chemical weed control. Silage was included as an alternative on Soils I, II and III.

Cotton. Cotton was included as an alternative on Soils I, II, and III. Production assumptions included custom harvesting and a combination of cultivation and weed control. A cotton price of 24 cents per pound of lint was used. Cotton produced under government programs with the proper allotment and set-aside would receive an additional payment of 15 cents per pound of lint for the projected yield.

Lespedeza hay. Hay would be cut in August. The life of stand was two years and the weeds would be clipped in June. Lespedeza was an alternative on all four soils.

Midland Bermuda hay. The life of the stand was 15 years. The budget included four cuttings, one each in June, July, August, and September. Custom sprigging was used to establish the stand. Aftermath grazing would be available in September and October. Budgets were developed for all four soil groups.

Midland Bermuda pasture. Production practices would be similar to the hay budget. Custom sprigging was used for establishment with a life of 15 years. Clipping would be done in July.

Permanent pasture with hay. The pasture mixture included ladino clover and fescue or orchard grass. The primary output of this crop is pasture with one cutting of hay in May during the surplus growth period. The weeds would be clipped in August. A ten year life of stand was assumed.

Permanent pasture. No hay would be harvested. The mixture included ladino clover and fescue or orchard grass. Clipping for weeds would be done in August. A ten year life of stand was also assumed.

Soybeans. Weed control would include both chemicals and cultivation. Soybeans was included as an alternative on Soils I, II, and III. An assumed price of $2.75 per bushel was based on price relationships in the period 1965-72.

Double-cropping of soybeans and wheat. Estimated soybean yields were lower with double-cropping than with traditional single crop production. It was an alternative of Soil Groups I, II, and III. An assumed price of $1.30 per bushel for wheat was used.

Wheat. This single crop alternative was included for Soils I, II, and III. Wheat straw was not baled since the market for straw is very limited in the study area. An option for producing wheat under government program was also included.

Wheat-red clover. The cost of establishing wheat-red clover was prorated over two years. Wheat and red clover were planted together in the Fall and the wheat was harvested in the Spring. Hay was harvested in August of the first year and in June and August of the second year. Aftermath grazing was available in September, October and November.

Crops produced under government programs were altered to include the additional payment and the costs of the required set-aside acreage. Operating capital, investment capital and labor required for the prescribed set-aside acreage were included in the applicable crop budget. The set-aside requirements were: corn 25 percent; wheat 83 percent; and cotton 20 percent. The payment for cotton was 15 cents per pound times the projected yield for each allotted acre. For each acre of wheat produced under the government program, the operator received payment of $1.71 per bushel times the projected yield. Corn payment was 80 cents per bushel times the projected yield.

Livestock Enterprises

Coefficients from a series of unpublished budgets developed for Regional Project S-67 by Keller and Williams were used for livestock enterprises. Two beef cow-calf operations, 12 finishing cattle operations, two stocker operations, and two swine operations were included in the research model.

Capital requirements and net returns above allocated cost for each of the livestock enterprises are shown in Table XI. Items such as interest on operating and investment capital and charges for farm-grown feeds and labor were not deducted from the net returns as shown in Table XI. Estimates of grain, hay, silage and pasture requirements for each livestock system are shown in Table XII. Labor requirements by months for the various livestock systems are shown in Table XIII. Labor requirements per head were developed for the assumed facilities for each

TABLE XI

ESTIMATED ANNUAL CAPITAL REQUIREMENTS AND NET RETURNS FOR LIVESTOCK ENTERPRISES

Livestock Enterprises[a]	Operating Capital	Investment Capital	Net Returns[b]
Cow-Calf I	68.03	372.40	115.65
Cow-Calf II	50.81	382.80	112.89
Stocker Steer	136.40	39.00	42.89
Stocker Heifer	118.30	39.00	37.09
Finishing Steer I	159.26	45.12	91.59
Finishing Steer II	127.14	45.12	91.89
Finishing Steer III	114.30	45.12	92.77
Finishing Steer IV	189.86	45.12	87.40
Finishing Steer V	193.97	45.12	84.61
Finishing Steer VI[c]	308.27	76.98	180.43
Finishing Heifer I	106.79	45.12	65.17
Finishing Heifer II	84.96	45.12	64.73
Finishing Heifer III	84.58	45.12	65.61
Finishing Heifer IV	141.95	45.12	61.34
Finishing Heifer V	145.15	45.12	57.89
Finishing Heifer VI[c]	229.73	76.98	126.56
Sow-Feeder Pigs	55.81	160.63	195.47
Sow-Finished Hogs	170.88	658.69	442.30

Source: Adapted from unpublished budgets developed for each production activity. Department of Agricultural Economics, The University of Tennessee Agricultural Experiment Station.

[a]One unit is one animal unless otherwise indicated.

[b]Net returns do not include deductions for land, labor, farm produced feeds or interest on operating and investment capital.

[c]One unit is two animals.

TABLE XII

ESTIMATED FEED REQUIREMENTS FOR LIVESTOCK ENTERPRISES

Livestock Enterprise[a]	Feed Requirements per Unit			
	Corn (Bushels)	Hay (Lbs. Alfalfa Equivalent)	Silage (Tons)	Pasture (CAD)
Cow-Calf I	--	2,800	--	280
Cow-Calf II	--	--	2.8	280
Stocker Steer	--	--	2.9	101
Stocker Heifer	--	--	2.85	94
Finishing Steer I	11.43	540	6.18	--
Finishing Steer II	20.36	456	4.18	--
Finishing Steer III	57.82	416	--	--
Finishing Steer IV	26.0	140	2.9	94
Finishing Steer V	50.5	826	--	80
Finishing Steer VI[b]	108.32	1,262	--	80
Finishing Heifer I	12.91	612	4.46	--
Finishing Heifer II	16.96	380	3.03	--
Finishing Heifer III	44.88	546	--	--
Finishing Heifer IV	13.12	82	2.85	101
Finishing Heifer V	39.57	800	--	68
Finishing Heifer VI[b]	84.45	1,346	--	68
Sow-Feeder Pigs	40.63	--	--	--
Sow-Finished Hogs	193.75	--	--	--

[a]One unit is one animal unless otherwise indicated.

[b]One unit is two animals.

Source: Estimated using standards of The National Academy of Sciences, Nutrient Requirements of Swine and Nutrient Requirements of Beef Cattle for the specified rate of return and management.

TABLE XIII

LABOR REQUIREMENTS FOR LIVESTOCK SYSTEMS PER HEAD BY MONTHS

Enterprise	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Beef													
Cow and calf fed hay	1.06	1.06	1.2	.75	.6	.5	.5	.5	.6	.75	.95	1.06	9.53
Cow and calf fed silage	1.0	1.0	1.16	.75	.6	.5	.5	.5	.6	.75	.9	1.0	9.01
Stocker	.62	.56	.37	.31	.28	.38				.48	.48	.62	4.10
Finishing systems:													
Steers I	.62	.56	.83	.7	.61	.84	.36			.48	.48	.62	6.10
II	.62	.56	.83	.7	.61	.05				.48	.48	.62	4.95
III	.62	.56	.83	.68	.28					.48	.48	.62	4.55
IV	.62	.56	.37	.31	.28	.38	.54	.65	.16	.48	.48	.62	5.45
V	.62	.56	.37	.37	.41	.36	.37	.58	.23	.48	.48	.62	5.45
VI	1.24	1.12	1.2	1.05	.69	.36	.37	.58	.23	.96	.96	1.24	10.0
Heifers I	.62	.56	.83	.7	.43					.48	.48	.62	4.72
II	.62	.56	.83	.59						.48	.48	.62	4.18
III	.62	.56	.83	.4						.48	.48	.62	3.99
IV	.62	.56	.37	.31	.28	.3	.58	.36		.48	.48	.62	4.96
V	.62	.56	.37	.37	.41	.44	.58			.48	.48	.62	4.93
VI	1.24	1.12	1.2	.77	.41	.44	.58			.96	.96	1.24	8.92
Swine													
Finishing hogs	.24	.21	.24	.22	.24	.24	.23	.24	.22	.24	.23	.24	2.79
Farrow to finish													
Labor/sow	5.3	4.62	6.3	5.14	4.92	6.14	5.3	4.92	6.14	5.3	4.78	6.3	65.16
2 sows	10.6	9.24	12.6	10.28	9.84	12.28	10.6	9.84	12.28	10.6	9.56	12.6	130.32
Feeder pig													
Labor/sow	3.38	2.94	4.38	3.34	3.0	4.34	3.38	3.0	4.34	3.38	2.98	4.38	42.84
2 sows	6.76	5.88	8.76	6.68	6.0	8.68	6.76	6.0	8.68	6.76	5.96	8.76	85.68

TABLE XIII (continued)

Source: Ray, Robert M., and Walch, Herbert N. Farm Planning Manual. The University of Tennessee Agricultural Experiment Station, May, 1973, and other budget publications.

system. Prices paid and received for livestock are shown in Table IX, page 33.

Investment and annual fixed cost for the livestock enterprises are shown in Appendix B. Tables were included for a stocker system, a cow-calf system, a 250 head feedlot, a 500 head feedlot, a sow and market hog system and a feeder pig system.

Cow-calf and stocker.

Stocker steer. Steers weighing an average of 500 pounds grading high good-low choice would be purchased in mid-October. These animals would be fed limited corn silage for 150 days and grazed for 105 days before being sold in early July. The expected sale weight would be 808 pounds with a grade of high good-low choice. Daily gain on limited feeding corn silage was one pound and on pasture was 1.5 pounds.[6]

Stocker heifer. Heifers weighing an average of 450 pounds and grading high good-low choice would be purchased in the middle of October. The animals would be fed limited corn silage for 150 days and then grazed 112 days before being sold around July 13. The expected average sale weight would be 757 pounds at a grade of high good-low choice. Daily gain on limited feeding corn silage was one pound and on pasture was 1.4 pounds. Estimates of investment required were also based on a 50 head unit.

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[6]National Academy of Sciences, Nutrient Requirements of Beef Cattle, No. 4, Fourth Revised Edition (National Academy of Sciences, 1970).

Beef cow-calf system. Calves were assumed to be born in February or March with an 88 percent calving rate (weaned). The cow death loss was assumed to be 2 percent. The average weight at weaning was 475 pounds. Animals would be sold around the middle of October. Alternatives were provided for winter feeding of cows on either silage or hay. Estimates of investment required were based on a 25 cow unit. This particular system of beef production is the most common method used in Tennessee.

Beef finishing systems. For the purpose of this study, a beef cattle finishing system was defined as a feeding method or combination of feeding methods which would result in a 500 pound steer weaned in the Fall attaining a slaughter weight of 1,000 pounds and grading USDA high good-low choice or a 450 pound heifer weaned in the Fall attaining a slaughter weight of 850 pounds and grading USDA high good-low choice.

A total of twelve beef feeding systems were included as potential activities. Cattle for all systems were assumed to be purchased October 16 and placed on an adjustment ration for two weeks. The systems included in the analysis are described in Table XIV. System 6 is a combination of Systems 3 and 5, utilizing the feeding facility in alternate periods.

Feeding rations for all systems except the pasture phase of System 4 and 5 included two pounds per head per day of alfalfa hay or its equivalent. Urea was added in sufficient quantities to balance the protein needs in all systems, except in the limited feeding phase of Systems 4 and 5. Cottonseed meal was used to balance the rations in

TABLE XIV

LENGTH OF FEEDING PERIODS AND DAILY GAINS ASSUMED FOR BEEF CATTLE FINISHING SYSTEMS

System	Ration Description by Feeding Period	Steers		Heifers	
		Length of Feeding Period, Days	Daily Gain, Pounds	Length of Feeding Period, Days	Daily Gain, Pounds
1	Full feeding corn silage	234	1.75	177	1.75
	Full feeding corn grain	36	2.50	40	2.25
2	Full Feeding corn silage, plus 5 lb. corn grain per head per day	228	2.20	190	2.10
3	Full feeding corn grain	208	2.40	182	2.20
4	Limited feeding corn silage	150	1.00	150	1.00
	Pasture only	105	1.50	112	1.40
	Full feeding corn grain	70	2.75	41	2.25
5	Limited feeding corn grain	150	1.00	150	1.00
	Pasture with supplemental grain	146	1.85	120	1.75
	Full feeding corn grain	32	2.50	18	2.25
6	Combination of systems 3 and 5 feeding two animals				

Source: James Anderson and Luther Keller, Beef Feeding Systems and Optimum Farm Organizations for Three Areas of Tennessee, Bulletin 480, The University of Tennessee, 1971.

these two instances because the relatively low energy level of the rations prevents efficient conversion of urea to a usable form. Coefficients for the feeding systems were based on a 250 head feedlot.

Hog enterprises.

Sows and feeder pig production (Hog I). Feeder pigs would be weaned at six weeks weighing an average of 45 pounds. Requirements for sows were based on a weighted average of sows farrowing in March and September or June and December. The number of pigs weaned would average eight pigs per litter. Replacement rate for the sows was 50 percent. One boar would service 20 sows.

Sows and finished hog production (Hog II). This alternative was similar to feeder pig production but the pigs would be finished to 220 pounds on the average. During the finishing phase about 2.8 pounds of TDN would be required per pound of gain.[7]

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[7]National Academy of Sciences, Nutrient Requirements of Swine, No. 2, Sixth Revised Edition (National Academy of Sciences, 1968).

CHAPTER IV

PROGRAMMING RESULTS

The optimal solutions obtained from the linear programming analysis are presented in this chapter. The minimum capital requirements and other requisites for a $7,000 farm income with all feasible enterprises considered are presented in the following section. The effects of variations in livestock prices, land values, wage rates, government programs, equity levels, income level, and labor supply on the optimal solutions are compared. The result of excluding grain purchase as an alternative was also discussed. The effects of restricting enterprises to beef and beef feed only on the minimum capital requirements for a specific income are presented in the second section of this chapter. Variations from the base situation were also made for beef and beef feed only.

I. ALL FEASIBLE ENTERPRISES

Results including all feasible enterprises with various changes are shown in this section. First the five equity levels were compared with and without an option to buy corn. Then effects of a high and low beef price were discussed. Then wages were increased from $1.75 to $2.65, land values were increased from $335.60 per acre to $482.00, government program options were excluded, and the desired income target was increased from $7,000 to $10,000. Finally, a labor situation which consists of a

full-time operator plus optional seasonal hired labor was compared with one which has a full-time operator plus a full-time hired man. Each of the above solutions that included the option to buy corn was also discussed without the option to buy corn.

Variations in Equity Levels, All Feasible Enterprises

Estimates of minimum capital requirements and associated enterprise organizations for a $7,000 net return were made for equity levels of 0, 25, 75, and 100 percent with all feasible enterprises considered and other variables at the base level. The base situation consisted of base beef prices as shown in Table IX, page 33, an average land value per acre of $335.60, a wage rate of $1.75 per hour, 1972 government program for corn, cotton and wheat, an allowance for hired seasonal labor up to the equivalent of two men, 0 percent equity, and $7,000 net return.

A minimum of $44,779 capital was required to achieve the $7,000 income target at the 0 percent equity level. Seventy acres of land were required with feeder pig production as the main source of income. The enterprise organization and resource requirements for the various equity levels are shown in Table XV.

The enterprise organizations for the five equity levels were very similar. Corn and cotton were included at their maximum under government programs. Additional acreage of corn without government program was also included in the five solutions. Approximately 69 percent of the corn required for the hogs would be purchased in each case. Acreages of total land, corn, and cotton, bushels of corn bought, and number of sows necessary to produce the desired income level decreased as the farmer's

TABLE XV

EFFECTS OF VARIATIONS IN EQUITY LEVEL ON MINIMUM CAPITAL REQUIREMENTS AND OTHER REQUISITES FOR $7,000 RETURN WITH ALL FEASIBLE ENTERPRISES CONSIDERED

Item	Unit	Equity Level 0%	25%	50%	75%	100%
Total Capital	Dollar	44,779	36,265	32,938	30,563	28,612
Total Acres	Acre	70.5	57.7	52.7	49.0	45.9
Total Acres Openland	Acre	52.1	42.7	39.0	36.2	34
Crops:						
Corn—Soil I	Acre	2.1	1.7	1.6	1.5	1.4
Cotton—Soil I (Gov. Prog.)	Acre	6.9	5.7	5.2	4.8	4.5
Corn—Soil I (Gov. Prog.)	Acre	8.0	6.6	6.0	5.6	5.2
Corn—Soil II (Gov. Prog.)	Acre	1.7	1.4	1.3	1.2	1.1
Hog Pasture	Acre	20.6	16.9	15.3	14.2	13.4
Set Aside	Acre	3.8	3.1	2.9	2.7	2.5
Idle Land:						
Soil I	Acre	4.9	4.0	3.7	3.4	3.2
Soil II	Acre	3.5	2.9	2.6	2.4	2.3
Soil IV	Acre	.6	.5	.4	.4	.4
Livestock:						
Hog I	Sow	82.2	67.4	61.4	57.1	53.6
Buy Corn	Bushel	2,300	1,885	1,719	1,599	1,499
Labor:						
Operator Labor Available	Hour	2,600	2,600	2,600	2,600	2,600
Operator Labor Used	Hour	2,500	2,567	2,475	2,376	2,282
Labor Hired	Hour	1,240	449	261	161	91
Capital:						
Operating Capital	Dollar	7,116	5,404	4,796	4,389	4,064
Investment Capital						
Land	Dollar	23,646	19,378	17,669	16,431	15,411
Machinery and Equipment	Dollar	813	663	607	566	530
Livestock and Livestock Equipment	Dollar	13,204	10,820	9,866	9,177	8,607
Total	Dollar	37,663	30,862	28,142	26,174	24,548
Return to Operator Labor and Management	Dollar	7,000	7,000	7,000	7,000	7,000

equity increased. Increasing the equity level had the effect of increasing the returns to be derived from a crop or livestock activity.

The capital required declined from $44,779 for 0 percent equity to $28,612 for the 100 percent equity level. The openland not used was 13 percent of total land for 0, 25, 50, 75, and 100 percent equity.

Operator labor was completely utilized at 0 percent equity and additional hired labor was necessary to allow for a vacation for the operator (100 hours at $1.75 plus appropriate capital charges). Seasonal labor hired declined from 1,240 hours for the 0 percent equity level to 91 hours for the 100 percent equity level. Slack hours of operator labor increased from 0 hours to 318 hours as the level of equity was increased from 0 to 100.

The solutions described in Table XV contain small acreages of corn and cotton. Coefficients used in estimating costs of crop production were based on a larger unit. For such small acreages, the operator cannot justify the purchase of certain equipment and must rely on custom work. It might be more practical to consider purchasing all the necessary corn.

Variations in Equity Levels, All Feasible Enterprises Option to Buy Corn Eliminated

In the optimum systems discussed in the previous section, the $7,000 income was generated primarily from the production of feeder pigs using purchased corn. In the systems discussed below, corn purchase was eliminated as an alternative and all feed used for livestock was required to be produced on the farm.

The minimum capital requirements and associated enterprise organization for $7,000 net return at the five equity levels, with all feasible enterprises considered and without an option to buy corn, are shown in Table XVI. These five solutions were compared with their counterparts (at the same equity) with the corn buying option present.

In each case, the minimum capital requirement and the size of the farm increased with the removal of the corn buying option. Capital requirements ranged from $62,046 for 0 percent equity to $36,648 for the 100 percent equity level as shown in Table XVI. Sow numbers for each equity level were only slightly smaller than when corn buying was permitted except at the 0 percent equity level. The increased acreage was used primarily to produce corn for use in the production of feeder pigs. Cotton was not included in the optimal solution at 50, 75, and 100 percent equity without the option to buy corn. All five solutions included idle land in each soil group. Land was purchased to provide sufficient row crop land for the corn required to feed the sows.

Corn was not grown under government programs apparently because of the 25 percent set-aside requirement. To produce corn under provisions of government programs would require additional capital for the purchase of more land.

Low, Base and High Livestock Prices

Prices used in this study are those adopted by members of Regional Project S-67. They were based on historical data; however, trends and changing relationships were considered. Beef and pork prices used in the

TABLE XVI

EFFECTS OF VARIATIONS IN EQUITY LEVEL ON MINIMUM CAPITAL REQUIREMENTS AND OTHER REQUISITES FOR $7,000 RETURN WITH ALL FEASIBLE ENTERPRISES EXCEPT OPTION TO BUY CORN

Item	Unit	Equity Level 0%	25%	50%	75%	100%
Total Capital	Dollar	62,046	51,184	44,531	40,102	36,648
Total Acres	Acre	130.5	100.8	84.8	76.6	70.2
Total Acres Openland	Acre	96.6	74.6	62.8	56.7	52
Crops:						
Corn—Soil I	Acre	30.6	29.2	24.6	22.2	20.4
Corn—Soil II	Acre	--	1.1	2.5	2.3	2.1
Corn—Soil III	Acre	--	--	2.5	2.3	2.1
Cotton—Soil I (Gov. Prog.)	Acre	6.0	--	--	--	--
Cotton—Soil II (Gov. Prog.)	Acre	3.3	1.6	--	--	--
Cotton—Soil III (Gov. Prog.)	Acre	3.2	2.5	--	--	--
Hog Pasture	Acre	17.0	16.7	15.8	14.2	13.0
Set Aside	Acre	2.5	.8	--	--	--
Idle Land:						
Soil I	Acre	9.1	7.0	5.9	5.4	4.9
Soil II	Acre	6.5	5.0	4.2	3.8	3.5
Soil III	Acre	6.2	3.1	1.8	1.6	1.5
Soil IV	Acre	12.0	7.4	5.4	4.9	4.5
Livestock:						
Hog I	Sows	67.9	66.8	63.0	56.9	52.1
Labor:						
Operator Labor Available	Hour	2,600	2,600	2,600	2,600	2,600
Operator Labor Used	Hour	2,585.5	2,574	2,513	2,390	2,280
Labor Hired	Hour	605.5	498.2	346.4	179	63.1
Capital:						
Operating Capital	Dollar	5,470	5,030	4,525	3,969	3,547
Investment Capital						
Land	Dollar	43,796	33,828	28,459	25,707	23,559
Machinery and Equipment	Dollar	1,873	1,596	1,427	1,286	1,173
Livestock and Livestock Equipment	Dollar	10,907	10,730	10,120	9,140	8,369
Total	Dollar	56,576	46,154	40,006	36,133	33,101
Returns to Operator Labor and Management	Dollar	7,000	7,000	7,000	7,000	7,000

study are presented in Table XVII. Prices per hundredweight for feeder and slaughter cattle represent animals that grade high good-low choice. Market hogs and feeder pigs prices are for animals grading U.S. 1-3. Prices were developed for a base situation and a low and high price situation. Because of the substitutability and correlation in price movements of beef and pork, prices for both were varied simultaneously.

The effects of changes in livestock prices on capital, other resources, and enterprise combinations are shown in Table XVIII. With high livestock prices, the enterprise combination was very similar to the system developed for base prices. Both include the same production activities—corn, cotton, and feeder pigs. Additional corn was purchased in each case. At the higher livestock price, the minimum capital required to achieve $7,000 net returns to the operator was only $24,671 as compared to $44,779 with the base price. The decrease in production activities was proportional with the higher price model requiring approximately 44 percent less land, crop production and livestock production to achieve the desired income level than for the base price situation.

Slack operator labor in the high price situation was 556 hours and no seasonal labor was hired since the solution required fewer acres of crops and fewer sows. The base price model had no slack labor and 1,240 additional hours of seasonal labor were hired. Unused land in the high price situation was approximately 46 percent of the unused land in the base price situation or roughly proportional to the acreage.

Feeder pig production was the only livestock activity for both the base and high price situations. The assumed price for feeder pigs was

TABLE XVII

BEEF AND PORK PRICES PER HUNDREDWEIGHT
USED IN THE STUDY

	Low Price	Base Price	High Price
Slaughter Steer	$26.00	$29.00	$32.00
Slaughter Heifer	24.50	27.50	30.50
Cull Cow	18.00	22.00	26.00
Feeder Steer	27.50	32.50	37.50
Feeder Heifer	24.25	30.25	36.25
Stocker Steer	25.50	29.50	33.50
Stocker Heifer	23.00	27.00	31.00
Market Hogs	15.00	21.00	27.00
Cull Sows	11.00	17.00	23.00
Feeder Pigs	26.00	37.00	43.00

Source: Procedural Guide for S-67.

TABLE XVIII

EFFECTS OF VARIATIONS IN BEEF AND PORK PRICES ON MINIMUM CAPITAL REQUIREMENTS AND OTHER REQUISITES FOR $7,000 RETURN WITH ALL FEASIBLE ENTERPRISES CONSIDERED, 0 PERCENT EQUITY LEVEL

Item	Unit	Beef and Pork Prices		
		Low	Base	High
Total Capital	Dollar	352,544	44,779	24,671
Total Acres	Acre	971.3	70.5	39.7
Total Acres Openland	Acre	718.8	52.1	29.4
Crops:				
Corn—Soil I	Acre	--	2.1	1.2
Corn Silage—Soil III	Acre	10.0	--	--
Cotton—Soil I	Acre	167.5	--	--
Cotton—Soil II	Acre	29.1	--	--
Cotton—Soil I (Gov. Prog.)	Acre	95.2	6.9	3.9
Corn—Soil I (Gov. Prog.)	Acre	--	8.0	4.5
Corn—Soil II (Gov. Prog.)	Acre	--	1.7	1.0
Corn—Soil III (Gov. Prog.)	Acre	11.0	--	--
Wheat—Soil III (Gov. Prog.)	Acre	2.9	--	--
Lespedeza Hay—Soil I	Acre	5.2	--	--
Hog Pasture	Acre	--	20.6	11.6
Set Aside	Acre	24.2	3.8	2.2
Idle Land:				
Soil I	Acre	62.8	4.9	2.8
Soil II	Acre	48.6	3.5	2.0
Soil III	Acre	106.4	--	--
Soil IV	Acre	155.4	.6	.3
Livestock:				
Hog I	Sows	--	82.2	46.3
Finishing Heifer II	Heifers	39.2	--	--
Buy Corn	Bushel	--	2,300	1,296
Labor:				
Operator Labor Available	Hour	2,600	2,600	2,600
Operator Labor Used	Hour	1,325	2,500	2,044
Labor Hired	Hour	1,162	1,240	--
Capital:				
Operating Capital	Dollar	13,876	7,116	3,444
Investment Capital				
Land	Dollar	325,968	23,646	13,323

TABLE XVIII (continued)

Item	Unit	Beef and Pork Prices Low	Base	High
Investment Capital (continued)				
Machinery and Equipment	Dollar	10,942	813	467
Livestock and Livestock Equipment	Dollar	1,769	13,204	7,437
Total	Dollar	338,679	37,663	21,227
Return to Operator Labor and Management	Dollar	7,000	7,000	7,000

$37.00 per hundredweight for the base situation and $43.00 per hundredweight for the high price situation. Thus, under the conditions specified for the study, increasing the price of beef and hogs had little or no effect on the basic organization, but reduced greatly the amount of resources required to return $7,000 net to operator's labor.

Minimum capital requirement increased from $44,779 at base prices to $352,554 at low livestock prices. With lower livestock prices, the optimal enterprise combination changed considerably. At the base price, the farm organization included a relatively small sow and feeder pig operation and 70 acres of land. At the lower livestock price a farm of approximately 971 acres would be required and principal enterprises included cotton and finishing heifers. Cotton acreage in the base price system was only seven acres as compared to almost 292 acres for the low livestock prices situation. Finishing heifers became a relatively more profitable system with the lowering of livestock prices and the optimal system included 39 head finished on corn silage and limited corn grain. All the livestock feeds would be produced on the farm in the low price situation, while in the base and high price situation, some corn would be purchased. No hogs were included in the optimal system for the low price situation but 82 sows were included at base livestock prices. Cotton and wheat allotments were exhausted under the low price situation while only the cotton allotment was completely used in the base price model.

In the low price situation, 971 acres were purchased to provide sufficient row cropland and cotton allotment. The desired income could

be achieved with less land and capital requirement if cotton allotment or land with a higher proportion of row crop soils could be purchased.

The labor requirements for cotton production were more seasonal than feeder pig production since cotton has no labor requirement in January, February, November and December. The optimal system included 1,275 hours or unused operator labor in the low price situation even though 1,162 hours of seasonal labor would be hired. In the base price situation, operator labor was completely exhausted and 1,240 hours of hired seasonal labor were included. Under these conditions, a fall in the price of livestock from the base level to the lower level of prices used would require substantial adjustment in both capital level and enterprise organization to attain the same level of income.

Variations in Livestock Prices without Buying Corn

If the corn buying option is eliminated, the solution is the same for the low livestock price since purchased corn was not included. However, the two solutions with base and high livestock prices without the option to buy corn shown in Table XIX required more capital, land, and corn production to achieve the desired income target than did the base and high livestock price solutions with the option to buy corn.

Income in the base and high price situations was predominantly from the sale of feeder pigs. In the base price model, 12.5 acres of cotton were included in the solution while the high price model did not include cotton production as an activity. Land was purchased to provide sufficient row crop acreage for the production of corn. The absence of an option to buy corn resulted in higher capital and land requirements. Only 5.8 hours

TABLE XIX

EFFECTS OF VARIATIONS IN BEEF AND PORK PRICES ON MINIMUM CAPITAL REQUIREMENTS AND OTHER REQUISITES FOR $7,000 RETURN WITH ALL FEASIBLE ENTERPRISES CONSIDERED, 0 PERCENT EQUITY LEVEL, WITHOUT OPTION TO BUY CORN

Item	Unit	Beef and Pork Prices		
		Low	Base	High
Total Capital	Dollar	352,544	62,046	33,710
Total Acres	Acre	971.3	130.5	64.7
Total Acres Openland	Acre	718.8	96.6	47.9
Crops:				
Corn—Soil I	Acre	--	30.6	18.8
Corn—Soil II	Acre	--	--	1.9
Corn—Soil III	Acre	--	--	1.9
Corn Silage—Soil III	Acre	10.0	--	--
Cotton—Soil I	Acre	167.5	--	--
Cotton—Soil II	Acre	29.1	--	--
Corn—Soil III (Gov. Prog.)	Acre	11.0	--	--
Cotton—Soil I (Gov. Prog.)	Acre	95.2	6.0	--
Cotton—Soil II (Gov. Prog.)	Acre	--	3.3	--
Cotton—Soil III (Gov. Prog.)	Acre	--	3.2	--
Wheat—Soil III (Gov. Prog.)	Acre	2.9	--	--
Lespedeza Hay—Soil I	Acre	5.2	--	--
Hog Pasture	Acre	--	17.0	12.0
Set Aside	Acre	24.2	2.5	--
Idle Land:				
Soil I	Acre	62.8	9.1	4.5
Soil II	Acre	48.6	6.5	3.2
Soil III	Acre	106.4	6.2	1.4
Soil IV	Acre	155.4	12.0	4.1
Livestock:				
Hog I	Sows	--	67.9	48.0
Finishing Heifer II	Heifers	39.2	--	--
Labor:				
Operator Labor Available	Hour	2,600	2,600	2,600
Operator Labor Used	Hour	1,325	2,585.5	2,148
Labor Hired	Hour	1,162	605.5	5.8

TABLE XIX (continued)

Item	Unit	Beef and Pork Prices		
		Low	Base	High
Capital:				
Operating Capital	Dollar	13,876	5,470	3,221
Investment Capital				
Land	Dollar	325,968	43,796	21,713
Machinery and Equipment	Dollar	10,942	1,873	1,066
Livestock and Livestock Equipment	Dollar	1,769	10,907	7,710
Total	Dollar	338,679	56,576	30,489
Returns to Operator Labor and Management	Dollar	7,000	7,000	7,000

of hired seasonal labor were necessary with the high price model. Unless the specific operation required two men, the operator would probably work longer hours during that period rather than hire someone for so short a time.

Other Variations with All Enterprises Considered

In addition to variations in equity level and beef and pork prices, wage rates, land values, government programs, and income levels were also varied. The results of these variations from the base at 0 percent equity are shown in Table XX. As described in the procedures section, wage rates were increased from $1.75 to $2.65 per hour; land values were changed from $335.60 to $482.00 per acre; government program options were deleted; and the income target was increased from $7,000 to $10,000. The following discussion compares the base situation to each of the variations.

Ten thousand dollar income. The change which has the largest effect on capital requirements was a shift from a $7,000 income target used in the base situation in Table XX to a $10,000 income target. Capital requirements increased from $44,779 in the base solution to $153,867, and total land increased from 70.5 to 344.6 acres. The optimum solution included 25 more sows and no corn would be purchased. In addition to 107 sows producing feeder pigs, almost 30 steers would be finished on corn silage and limited corn grain. Government program cotton increased from 6.9 to 33.8 acres. Several acres of land were idle but row cropland and allotments for cotton, feed grain, and wheat

TABLE XX

EFFECTS OF VARIATIONS IN WAGE RATE, LAND VALUE, GOVERNMENT PROGRAMS AND INCOME LEVEL ON MINIMUM CAPITAL REQUIREMENTS AND OTHER REQUISITES NECESSARY FOR A SPECIFIED RETURN AT 0 PERCENT EQUITY WITH ALL FEASIBLE ENTERPRISES CONSIDERED

Item	Unit	Base	High Wage	High Land Value	No Govt. Prog.	$10,000 Return
Total Capital	Dollar	44,779	110,686	68,379	54,532	153,867
Total Acres	Acre	70.5	266	86.6	85.2	344.6
Total Acres Openland	Acre	52.1	196.8	64.0	63	255
Crops:						
Corn—Soil I	Acre	2.1	--	2.6	24.7	8.7
Corn—Soil II	Acre	--	--	--	2.6	--
Cotton—Soil I	Acre	--	11.9	--	--	--
Cotton—Soil II	Acre	--	8.0	--	--	--
Corn—Soil I (Gov. Prog.)	Acre	8.0	27.2	9.9	--	40.5
Corn—Soil II (Gov. Prog.)	Acre	1.7	--	2.1	--	7.0
Corn—Soil III (Gov. Prog.)	Acre	--	5.2	--	--	--
Cotton—Soil I (Gov. Prog.)	Acre	6.9	26.1	8.5	--	33.8
Corn Silage—Soil II	Acre	--	--	--	--	1.6
Corn Silage—Soil III	Acre	--	--	--	--	8.4
Wheat—Soil III (Gov. Prog.)	Acre	--	.8	--	--	1.0
Lespedeza Hay—Soil I	Acre	--	--	--	--	4.7
Permanent Pasture—Soil I	Acre	--	--	--	--	.3
Hog Pasture	Acre	20.6	17.0	25.3	24.9	26.8
Set Aside	Acre	3.8	14.0	4.7	--	19.5
Idle Land:						
Soil I	Acre	4.9	18.6	6.1	6.0	19.1
Soil II	Acre	3.5	13.3	4.3	4.3	17.2

TABLE XX (continued)

Item	Unit	Base	High Wage	High Land Value	No Govt. Prog.	$10,000 Return
Idle Land (continued):						
Soil III	Acre	--	21.1	--	--	24.7
Soil IV	Acre	.6	33.7	.7	.7	41.2
Livestock:						
Hog I	Sows	82.2	67.9	101.0	99.4	107.2
Finishing Steer II	Steers	--	--	--	--	29.7
Buy Corn	Bushel	2,300	--	2,827	1,623	--
Labor:						
Operator Labor Available	Hours	2,600	2,600	2,600	2,600	2,600
Operator Labor Used	Hours	2,500	2,500	2,500	2,500	2,500
Labor Hired	Hours	1,240	985	2,163	2,074	3,110
Capital:						
Operating Capital	Dollar	7,116	7,309	9,414	8,651	15,286
Investment Capital						
Land	Dollar	23,646	89,270	41,741	28,593	115,648
Machinery and Equipment	Dollar	813	3,199	1,000	1,321	4,372
Livestock and Livestock Equipment	Dollar	13,204	10,907	16,224	15,967	18,561
Total	Dollar	37,663	103,376	58,965	45,881	138,581
Return to Operator Labor and Management	Dollar	7,000	7,000	7,000	7,000	10,000

were exhausted. These results indicate that higher levels of income were possible but they require substantially greater investment, larger farms, and additional hired labor.

High wages. As wage rates for hired seasonal labor were increased from $1.75 to $2.65 per hour, capital requirements to achieve the $7,000 income target increased from $44,779 to $110,686 and total acres increased from 70.5 to 266. The number of sows declined by 12 while cotton acreage increased from 6.9 to 46 acres. Each sow requires almost 43 hours of labor while an acre of cotton requires a little over seven hours of annual labor.

Increased wage rate resulted in relative shifts from sows and feeder pigs to cotton production since the return per hour of labor for sows and feeder pigs is considerably less than the average return per hour of labor for cotton. Land investment was 63 percent of total investment capital at the base situation and increased to 86 percent with the higher wage rate. This indicates a substitution of land for labor as labor became relatively more expensive. Total acres increased from 70.5 to 266 and seasonal labor hired decreased from 1,240 hours to 985 hours.

High land values. Increasing the land value by 44 percent from $335.60 to $482.00 per acre also increased capital requirements by 53 percent from $44,779 in the base to $68,379 with high land values. Total land increased 15.1 acres (from 70.5 to 86.6). The number of sows included in the optimal solution increased by 19 while seasonal

labor hired increased from 1,240 to 2,163 hours. A proportional increase of approximately 24 percent occurred in each production activity. Thus, an increase in land value would change the magnitude of the activities but not the basic form of organization under these specified conditions.

No government programs. The base situation for this study included 1972 government support programs for cotton, wheat and feed grains. Farmers would receive payments based upon projected yields if the various participation requirements were met. To determine the effect of government programs on capital requirements, a situation in which participation in government programs is not possible will be presented here.

Eliminating government program options increased minimum capital requirements by approximately 22 percent. An additional 17 sows were included in the optimum organization and row crops were shifted from government program crops to corn production without government programs. Hired seasonal labor increased by 834 hours. Without government programs, the optimal farm organization included the sale of feeder pigs as the only source of revenue. Part of the required corn would be farm produced and part purchased.

Other Variations Without Buy Corn

In the situations discussed in the preceding section, corn was purchased only in the base situation and for the variations with high land values and no government programs. Further analysis was conducted

to determine the effect of the elimination of the corn buying option in these situations.

An increase in land value greatly increased the capital and land requirements over the base situation (Table XXI). In the higher land value situation, capital increased 105 percent from $62,046 to $127,157 due both to larger acreage and higher value per acre. Corn acreage increased from 30.6 to 47 acres. Government program cotton increased from 12.5 to 19.8 acres. The number of sows increased from 68 to 104.

With the removal of government programs, total acres actually declined from 130.5 to 127.3. No cotton was produced and corn production was expanded from 30.6 to 44.5. Capital required increased almost $6,000 over the base situation. However, the major change was in the number of sows included in the solution. Almost 27 more sows were required to meet the income target in the situation without government programs.

Variation in Labor Supply

The situations discussed in the previous sections included a one man resident labor supply with allowance for hiring seasonal labor as needed. In this section, a labor supply consisting of two full-time men (operator plus one full-time hired man) was considered. The monthly distribution of labor for both the operator and the two man situation is presented in Table IV, page 20. The full-time hired laborer would receive $4,500 per year. An equity level of 25 percent was required to achieve a feasible solution with two full-time men. The situation with two full-time men will be compared to the one man plus seasonal labor situation at the same equity level.

TABLE XXI

EFFECTS OF VARIATIONS IN LAND VALUE AND GOVERNMENT PROGRAMS ON MINIMUM CAPITAL REQUIREMENTS AND OTHER REQUISITES FOR $7,000 RETURN WITH ALL FEASIBLE ENTERPRISES EXCEPT OPTION TO BUY CORN AT 0 PERCENT EQUITY LEVEL

Item	Unit	Base	High Land Value	No Government Program
Total Capital	Dollar	62,046	127,157	67,985
Total Acres	Acre	130.5	202.3	127.3
Total Acres Openland	Acre	96.6	149.7	94.2
Crops:				
Corn—Soil I	Acre	30.6	47.0	36.9
Corn—Soil II	Acre	--	--	3.8
Corn—Soil III	Acre	--	--	3.8
Cotton—Soil I (Gov. Prog.)	Acre	6.0	9.7	--
Cotton—Soil II (Gov. Prog.)	Acre	3.3	5.1	--
Cotton—Soil III (Gov. Prog.)	Acre	3.2	5.0	--
Hog Pasture	Acre	17.0	26.1	23.6
Set Aside	Acre	2.5	4.0	--
Idle Land:				
Soil I	Acre	9.1	14.2	8.9
Soil II	Acre	6.5	10.1	6.4
Soil III	Acre	6.2	9.8	2.7
Soil IV	Acre	12.0	18.8	8.1
Livestock:				
Hog I	Sows	67.9	104.2	94.5
Labor:				
Operator Labor Available	Hour	2,600	2,600	2,600
Operator Labor Used	Hour	2,585.5	2,600	2,600
Labor Hired	Hour	605.5	2,455.8	1,821.9
Capital:				
Operating Capital	Dollar	5,470	9,963	7,938
Investment Capital				
Land	Dollar	43,796	97,509	42,722
Machinery and Equipment	Dollar	1,873	2,947	2,145
Livestock and Livestock Equipment	Dollar	10,907	16,738	15,180
Total	Dollar	56,576	117,194	60,047
Returns to Operator Labor and Management	Dollar	7,000	7,000	7,000

Results comparing the two labor supplies with all feasible enterprises considered and with and without an option to buy corn are shown in Table XXII. First the two situations with an option to buy corn will be discussed. The situation with two full-time men required more than twice the capital ($78,591) necessary for the operator plus seasonally hired labor situation ($36,265). Farm size increased from almost 58 acres to over 148 acres when a full-time hired laborer was included. Livestock production increased substantially with the two full-time men labor situation. Almost 14 more sows were included and 40 steers would be finished on corn silage and limited corn grain. Nine more acres of cotton grown under the provisions of government program were included in the optimal system with a two man labor supply. Corn silage and hay would also be produced for finishing the steers.

About 900 hours of resident labor were unused with the full-time hired man present. In the operator plus seasonally hired labor situation, the optimal system included only 32.6 hours of unused operator labor and 450 hours of hired seasonal labor. Including a full-time hired man in the labor supply required more capital, land and production activities to achieve the specified operator income level. Certainly the operator plus hired seasonal labor option is preferred to the two full-time men option where adequate seasonal labor is available.

The second part of this discussion is concerned with the situations without the option to purchase corn as shown in the last two columns of Table XXII. The two full-time men situation without the option to buy

TABLE XXII

EFFECTS OF VARIATIONS IN LABOR SUPPLY ON MINIMUM CAPITAL REQUIREMENTS AND OTHER REQUISITES FOR $7,000 RETURN WITH ALL FEASIBLE ENTERPRISES WITH AND WITHOUT AN OPTION TO BUY CORN, AT 25 PERCENT EQUITY

Item	Unit	Buy Corn		No Buy Corn	
		Operator Plus Seasonally Hired Labor	Two Full-Time Men	Operator Plus Seasonally Hired Labor	Two Full-Time Men
Total Capital	Dollar	32,265	78,591	51,184	80,952
Total Acres	Acre	57.7	148.7	100.8	177.7
Total Acres Openland	Acre	42.7	110.0	74.6	131.5
Crops:					
Corn—Soil I	Acre	1.7	--	29.2	26.6
Corn—Soil II	Acre	--	--	1.1	--
Corn—Soil I (Gov. Prog.)	Acre	6.6	16.0	--	3.2
Corn—Soil II (Gov. Prog.)	Acre	1.4	--	--	4.3
Corn—Soil III (Gov. Prog.)	Acre	--	3.6	--	4.3
Corn Silage—Soil I	Acre	--	5.6	--	--
Corn Silage—Soil II	Acre	--	4.5	--	--
Corn Silage—Soil III	Acre	--	--	--	--
Cotton—Soil I (Gov. Prog.)	Acre	5.7	14.6	--	17.4
Cotton—Soil II (Gov. Prog.)	Acre	--	--	1.6	--
Cotton—Soil III (Gov. Prog.)	Acre	--	--	2.5	--
Bermuda Pasture—Soil I	Acre	--	.3	--	--
Lespedeza Hay—Soil I	Acre	--	6.3	--	--
Hog Pasture	Acre	16.9	20.3	16.7	20.0
Set Aside	Acre	3.2	7.8	.8	6.4

TABLE XXII (continued)

Item	Unit	Buy Corn		No Buy Corn	
		Operator Plus Seasonally Hired Labor	Two Full-Time Men	Operator Plus Seasonally Hired Labor	Two Full-Time Men
Idle Land:					
Soil I	Acre	4.0	--	7.0	12.4
Soil II	Acre	2.9	--	5.0	8.9
Soil III	Acre	--	--	3.1	9.9
Soil IV	Acre	.5	44.8	7.4	18.0
Livestock:					
Hog I	Sow	67.4	81.1	66.8	80.2
Finishing Steer II	Steer	--	39.5	--	--
Buy Corn	Bushel	1,885	2,446	--	--
Labor					
Resident Labor Available	Hour	2,600	4,823	2,600	4,823
Resident Labor Used	Hour	2,567.4	3,935.4	2,574	3,734.3
Seasonal Labor Hired	Hour	449.3	--	498.2	--
Capital:					
Operating Capital	Dollar	5,403	11,906	5,030	5,991
Investment Capital					
Land	Dollar	19,364	49,904	33,828	59,636
Machinery and Equipment	Dollar	672	1,972	1,596	2,442
Livestock and Livestock Equipment	Dollar	10,826	14,809	10,730	12,883
Total	Dollar	30,862	66,685	46,154	74,961
Return to Operator Labor and Management	Dollar	7,000	7,000	7,000	7,000

corn required 58 percent more capital and almost 77 more acres of land to achieve the desired income than did the operator plus seasonally hired labor situation without the option to buy corn. Production activities were increased with the two men situation without corn buying. Cotton produced under the provisions of government programs was increased by 13.3 acres (4.1 to 17.4), government program corn would be included at a level of 11.8 acres and sow numbers increased from almost 67 to 80. Only 26 hours of operator labor were unused with the operator plus seasonally hired labor situation without the option to buy corn and almost 500 hours of additional labor would be hired. Almost 1,089 hours of resident labor were unused in the two men labor situation without corn buying. These results again indicate that if sufficient seasonal labor is available the operator plus seasonally hired labor is the preferred situation.

Finally, situations with corn buying were compared to situations without corn buying. In the situations with an operator plus seasonally hired labor, the situation without buy corn required 41 percent more capital and 75 percent more land. Sow numbers and labor utilization varied only slightly. The operator plus seasonally hired labor situation without the option to buy corn included almost 20 acres more corn than the operator plus seasonal hired labor situation with corn buying.

The situation with two full-time men and no corn buying required almost $2,500 more capital and almost 30 more acres of land than did the situation with two full-time men and the option to buy corn. Sow numbers were approximately the same for the two men labor situations, but the

situation without corn buying included no cattle at all. Labor utilizations were similar, with the situation without corn buying and beef cattle using 200 less hours of labor. Removing the option to buy corn for these specific conditions resulted in increased farm size and greater capital requirements.

II. BEEF AND BEEF FEED ONLY

The regional project of which this study is a part was concerned with an evaluation of the economic potential of beef production in the study area. Beef was included in the optimal solution when all feasible enterprises were considered in only two cases: low livestock prices and $10,000 income target. To study further the role of beef on farms in the area, the analysis was extended to situations in which only beef and associated feed enterprises were considered as alternatives. Results from this analysis should indicate which beef system or organization will generate a given income level with minimum investment under the given set of constraints.

In discussing the results from this phase of the analysis, particular attention was given to choices from among production and finishing systems, to comparisons of steer versus heifer feeding, and to least cost forage combinations that were included in the optimal systems. The conditions specified for beef and associated feed enterprises analysis were the same as all feasible enterprises analysis. The base variables were operator labor plus available seasonal labor at $1.75 per hour, average land values at $335.60 per acre, a $7,000 income

target, 1972 government programs, 0 percent equity, base beef prices and an option to buy corn. The basic difference was that only beef and beef feed enterprises were considered.

Variations in Equity Level

Several programming situations were so restrictive that a solution was infeasible under the conditions specified. Solutions for 0 percent and 25 percent equity were infeasible when enterprises were limited to beef and potential sources of feed for beef. Among the alternatives considered, the lowest equity level at which an optimal solution could be achieved was 50 percent. Table XXIII presents the results for equity levels of 50, 75 and 100 percent with other variables at their base level.

Minimum capital requirements, at 50 percent equity, were $227,436. Nearly 87 percent of the investment capital would be required for the 454.5 acres of land which were necessary for the crop and livestock system planned. Of the 16 possible production and finishing systems considered, only Finishing Steer II was included in the optimal systems. Approximately 356 head would be finished on full feeding corn silage plus five pounds of corn grain per head per day for 228 days. The total set of beef alternatives considered included twelve finishing systems with a variety of feeding periods and rates of gain, and full or limited feeding of corn, corn silage, pasture, and hay. Two cow-calf production systems were included as well as the production of stocker steers and heifers on pasture and limited corn silage.

The optimum system for the 50 percent equity level contained over 91 acres of corn silage as the major feed source for the steers. Corn

TABLE XXIII

EFFECTS OF VARIATIONS IN EQUITY LEVEL ON MINIMUM CAPITAL REQUIREMENTS AND OTHER REQUISITES FOR $7,000 RETURN WITH ONLY BEEF AND BEEF FEED ENTERPRISES

Item	Unit	Equity Level 0%	25%	50%	75%	100%
Total Capital	Dollar			227,436	153,293	116,482
Total Acres	Acre			454.5	246.0	187.0
Total Acres Openland	Acre			336.3	182.0	138.4
Crops:						
Corn—Soil I	Acre			17.0	--	--
Corn Silage—Soil I	Acre			64.2	71.3	54.3
Corn Silage—Soil II	Acre			13.6	7.4	5.6
Corn Silage—Soil III	Acre			13.6	7.4	5.6
Corn—Soil I (Gov. Prog.)	Acre			40.3	--	--
Alfalfa Hay—Soil III	Acre			--	3.5	2.7
Bermuda Hay—Soil I	Acre			3.1	3.8	2.9
Lespedeza Hay—Soil I	Acre	INFEASIBLE	INFEASIBLE	28.7	13.4	10.2
Lespedeza Hay—Soil II	Acre			22.5	12.3	9.4
Lespedeza Hay—Soil III	Acre			--	19.5	14.9
Permanent Pasture—Soil II	Acre			.2	--	--
Permanent Pasture—Soil III	Acre			1.2	--	--
Set Aside	Acre			10.0	--	--
Idle Land:						
Soil III	Acre			44.7	--	--
Soil IV	Acre			72.7	39.4	29.9
Livestock:						
Finishing Steer II	Steers			356.4	346.2	263.3
Buy Corn	Bushels			2,083	7,048	5,361
Labor:						
Operator Labor Available	Hour			2,600	2,600	2,600
Operator Labor Used	Hour			2,144.5	2,003.5	1,656
Labor Hired	Hour			564	372.5	137
Capital:						
Operating Capital	Dollar			51,179	50,237	38.087
Investment Capital						
Land	Dollar			152,530	82,558	62,787
Machinery and Equipment	Dollar			7,641	4,877	3,727

TABLE XXIII (continued)

Item	Unit	Equity Level 0%	25%	50%	75%	100%
Investment Capital (continued)		INFEASIBLE	INFEASIBLE			
Livestock and Livestock Equipment	Dollar			16,086	15,621	11,881
Total	Dollar			176,257	103,056	78,395
Return to Operator Labor and Management	Dollar			7,000	7,000	7,000

was supplied by 17 acres of corn without government program and 40.3 acres under government program. In addition, 2,083 bushels of purchased corn were included in the optimal solution.

Hay production alternatives included alfalfa, bermuda, lespedeza, orchard grass-fescue-ladino clover, and red clover. The 50 percent equity solution contained 51.2 acres of lespedeza hay and 3.1 acres of bermuda hay. Most of Soil III and all of Soil IV would be idle. Seasonal labor would need to be hired (564 hours) even though total hours of operator labor were not exhausted.

Increasing the equity level to 75 percent reduced both capital and land requirements necessary to obtain a $7,000 net return to operator. The number of steers to be finished was 10 less (346) and the quantity of purchased corn increased from 2,083 to 7,048 bushels. Over 86 acres of corn silage were included. Hays consisted of 42.5 acres of lespedeza, 3.8 acres of bermuda, and 3.5 acres of alfalfa.

All of Soil IV was idle and 372.5 hours of seasonal labor were necessary to fulfill additional labor requirements. Land investment, as a percent of total investment capital, declined from almost 87 percent at 50 percent equity to 81 percent at 75 percent equity.

At the 100 percent equity level, minimum capital requirements were $116,482. Total acres of land declined to 187. The beef activity was again Finishing Steer II, but only 263 head were required to achieve the desired income. All corn was to be purchased. Approximately 65.5 acres of corn silage were a part of the optimal system. Hay was predominantly lespedeza with some alfalfa and bermuda. Less hired labor

was included and land investment was 80 percent of total investment capital.

The basic differences in the solution for the three equity levels discussed were the number of finishing steers and the source of corn. At higher equity levels, fewer steers were included and more corn was to be purchased.

Variations in Assumed Beef Prices

Beef prices used in the above analysis were base prices as shown in Table XVII, page 55. High and low beef prices presented in Table XVII were included as variations from the base to determine their effect on minimum capital requirement. Since finishing steers was the predominant beef enterprise, feeder calf and slaughter steer prices were of specific interest. Feeder calf prices used were $27.50, $32.50, and $37.50 per hundredweight and slaughter prices were $26.00, $29.00, and $32.00 per hundredweight. Results showing the effect of variations in beef prices are shown in Table XXIV at equity levels of 50 and 75 percent.

The introduction of higher beef prices had a similar effect to a shift to a higher equity level, since both were less restricting variations. The minimum capital and land requirement necessary to achieve the desired operator income was less with higher beef prices. Farm size declined over 102 acres from 454.5 acres at base beef prices to 352 acres with high beef prices. The number of finishing steers included in the optimal solution had only slight variation but the percentage of corn to be purchased or produced had a significant variation when a solution achieved at base beef prices was compared

TABLE XXIV

EFFECTS OF VARIATIONS IN BEEF PRICES ON MINIMUM CAPITAL REQUIREMENTS AND OTHER REQUISITES FOR $7,000 RETURN AT 50 PERCENT AND 75 PERCENT EQUITY WITH ONLY BEEF AND BEEF FEED ENTERPRISES

Item	Unit	Base Beef Price 50% Equity	High Beef Price 50% Equity	Low Beef Price 50% Equity	Base Beef Price 75% Equity	Low Beef Price 75% Equity
Total Capital	Dollar	227,436	197,634		153,293	169,405
Total Acres	Acre	454.5	352.0		246.0	354.9
Total Acres Openland	Acre	336.3	260.5		182.0	262.6
Crops:						
Corn—Soil I	Acre	17.2	--		--	58
Corn—Soil I (Gov. Prog.)	Acre	40.3	26.4		--	--
Corn Silage—Soil I	Acre	64.2	69.1		71.3	45
Corn Silage—Soil II	Acre	13.6	10.6		7.4	10.7
Corn Silage—Soil III	Acre	13.7	10.6		7.4	10.7
Alfalfa Hay—Soil III	Acre	--	--		3.5	--
Bermuda Hay—Soil I	Acre	3.1	4.4		3.8	--
Lespedeza Hay—Soil I	Acre	28.7	20.2		13.4	24.8
Lespedeza Hay—Soil II	Acre	22.5	17.6		12.3	17.8
Lespedeza Hay—Soil III	Acre	--	13.4		19.5	--
Permanent Pasture—Soil II	Acre	0.2	--		--	--
Permanent Pasture--Soil III	Acre	1.2	--		--	3.7
Set Aside	Acre	10.1	6.6		--	--
Idle Land:						
Soil III	Acre	44.7	21.2		--	32.7
Soil IV	Acre	72.7	56.3		39.4	56.8
Livestock:						
Finishing Steer II	Steers	356.4	357.1		346.2	256.5

INFEASIBLE

TABLE XXIV (continued)

Item	Unit	Base Beef Price 50% Equity	High Beef Price 50% Equity	Low Beef Price 50% Equity	Base Beef Price 75% Equity	Low Beef Price 75% Equity
Buy Corn	Bushels	2,083	4,897		7,048	6.3
Labor:						
Operator Labor Available	Hour	2,600	2,600		2,600	2,600
Operator Labor Used	Hour	2,144.5	2,097.8		2,003.5	1,738.6
Labor Hired	Hour	564	483.5		372.5	251.7
Capital:						
Operating Capital	Dollar	51,179	57,140		50,237	32,454
Investment Capital						
Land	Dollar	152,530	118,131		82,558	119,104
Machinery and Equipment	Dollar	7,641	6,251		4,877	6,263
Livestock and Livestock Equipment	Dollar	16,086	16,112		15,621	11,585
Total	Dollar	176,257	140,494		103,056	136,952
Return to Operator Labor and Management	Dollar	7,000	7,000		7,000	7,000

INFEASIBLE

to a solution with high beef prices. With base beef prices and 50 percent equity, 7,258 bushels of corn were required of which 29 percent was to be purchased and 71 percent would be raised on the representative farm. The optimal solution with the high beef price option required 7,264 bushels of corn of which 67 percent would be purchased and only 33 percent would be farm produced. The necessary complement of corn silage and hay were also included. Lespedeza was the major source of hay. With high beef prices, less seasonal labor was required and unused operator labor was greater than in the base price situation. Investment in land as a percent of total investment was 86.5 percent with base beef prices and 84 percent with high beef prices.

The lowest equity level at which a feasible solution could be achieved using low beef prices was 75 percent. Both land and capital requirements were higher in the model with low beef prices. The number of finishing steers included in the optimal solution with low beef prices was 90 head less than that necessary to achieve the desired income target with base beef prices. All the corn would be purchased at base beef prices and 75 percent equity while almost all the corn would be produced in the situation with low beef prices. Lespedeza was the major source of hay in both models. Investment in land as a percent of total investment capital was 81 percent with base beef prices as compared to 87 percent with low beef prices at 75 percent equity.

Farm size in the four situations in Table XXIV well exceed the 210 acre average for the study area. A change to high beef prices from

base prices resulted in a 23 percent decline in farm size from 454.5 acres to 352. A change from base beef prices at 75 percent equity to low beef prices at the same equity level resulted in a 44 percent increase in farm size.

High Wage and No Government Program

Programming situations which included an increase in the wage rate and discontinuance of government programs were feasible at a minimum of 50 percent equity. Results showing both these variations are presented in Table XXV.

An increase in the wage rate from $1.75 per hour to $2.65 per hour resulted in an increase in capital requirements from $227,436 to $245,172. Farm size increased from 454.5 acres to 517.3 acres in the high wage situation. Also, the high wage situation required 21 less finishing steers. Practically all the corn would be produced on the farm at the high wage rate as opposed to 71 percent of the corn produced on the farm at the base situation.

Discontinuance of government programs had only a slight effect on the optimum organization. Capital requirements increased $169 and land remained practically the same. Finishing steers remained the same. Corn production included an additional 10 acres but the entire acreage would be produced on Soil I without government programs. The set aside requirement of 25 percent on 40.3 acres of government program corn accounted for the 10 additional acres of corn. Other crop activities varied no more than 0.3 acres.

TABLE XXV

EFFECTS OF A WAGE RATE INCREASE AND DELETION OF GOVERNMENT PROGRAMS ON MINIMUM CAPITAL REQUIREMENTS AND OTHER REQUISITES FOR $7,000 RETURN AT 50 PERCENT EQUITY WITH ONLY BEEF AND BEEF FEED ENTERPRISES

Item	Unit	Base	High	No Government Program
Total Capital	Dollar	227,436	245,172	227,605
Total Acres	Acre	454.5	517.3	454.3
Total Acres Openland	Acre	336.3	382.8	336.2
Crops:				
Corn—Soil I	Acre	17.2	4.5	67.5
Corn—Soil I (Gov. Prog.)	Acre	40.3	71.4	--
Corn Silage—Soil I	Acre	64.2	56.3	64.2
Corn Silage—Soil II	Acre	13.6	15.5	13.6
Corn Silage—Soil III	Acre	13.7	15.5	13.7
Bermuda Hay—Soil I	Acre	3.1	2.2	3.0
Lespedeza Hay—Soil I	Acre	28.7	34.0	28.8
Lespedeza Hay—Soil II	Acre	22.5	15.4	22.7
Permanent Pasture—Soil II	Acre	0.2	1.8	--
Permanent Pasture—Soil III	Acre	1.2	--	1.5
Set Aside	Acre	10.1	17.9	--
Idle Land:				
Soil II	Acre	--	8.7	--
Soil III	Acre	44.7	53.0	44.4
Soil IV	Acre	72.7	82.8	72.7
Livestock:				
Finishing Steer II	Steer	356.4	335.3	356.4
Buy Corn	Bushels	2,083	4.5	1,183
Labor:				
Operator Labor Available	Hour	2,600	2,600	2,600
Operator Labor Used	Hour	2,144.5	2,106.3	2,148.5
Labor Hired	Hour	564	584.3	590.2
Capital:				
Operating Capital	Dollar	51,179	48,179	50,989

TABLE XXV (continued)

Item	Unit	Base	High	No Government Program
Investment Capital				
Land	Dollar	152,530	173,606	152,463
Machinery and Equipment	Dollar	7,641	8,251	8,067
Livestock and Livestock Equipment	Dollar	16,086	15,136	16,086
Total	Dollar	176,257	196,993	176,616
Return to Operator Labor and Management	Dollar	7,000	7,000	7,000

High Land Value and $10,000 Return

A minimum of 75 percent equity was required to achieve feasible solutions for programming situations with high land value and $10,000 return with beef and beef feed sources only. Results for both these situations plus the base situation at 75 percent equity are presented in Table XXVI.

An increase in land value of 44 percent from $335.60 to $482 resulted in an increase in total capital requirement of 41 percent. Total capital required was $153,293 in the base situation and $215,818 with high land values. In the base situation, land investment represented 80 percent of total investment capital with base land values. In the high land value situation, the cost of land represented 85 percent of total investment capital. All production activities, buy corn and land were approximately 14 percent greater with high land values. In both situations, all the corn would be purchased. The general farming organization was the same with slightly higher activity levels required in the high land value situation.

Minimum capital requirements were $153,293 in the base situation and $215,883 with a $10,000 income target. In the base situation 246 acres were included while 421 acres were required to achieve $10,000 net return. The $10,000 income target would be generated through the finishing of 356.5 steers using Feeding System II. A much larger proportion of the corn would be home produced. Approximately 53 acres of hay and 91 acres of silage would be produced to provide the roughage for the beef steers. Nearly 35 percent of the 312 acres of openland would be idle.

TABLE XXVI

EFFECTS OF VARIATIONS IN LAND VALUE AND INCOME LEVEL ON THE MINIMUM CAPITAL REQUIREMENTS AND OTHER REQUISITES FOR A SPECIFIED RETURN AT 75 PERCENT EQUITY WITH ONLY BEEF AND BEEF FEED ENTERPRISES

Item	Unit	Base	High Land Value	$10,000 Return
Total Capital	Dollar	153,293	215,818	215,883
Total Acres	Acre	246.0	279.8	421.3
Total Acres Openland	Acre	182.0	207.0	311.8
Crops:				
Corn—Soil I (Gov. Prog.)	Acre	--	--	45.2
Corn Silage—Soil I	Acre	71.3	81.2	65.8
Corn Silage—Soil II	Acre	7.4	8.4	12.6
Corn Silage—Soil III	Acre	7.4	8.4	12.6
Alfalfa Hay—Soil III	Acre	3.5	4.0	--
Bermuda Hay—Soil I	Acre	3.8	4.4	4.4
Lespedeza Hay—Soil I	Acre	13.4	15.2	25.1
Lespedeza Hay—Soil II	Acre	12.3	14.0	21.0
Lespedeza Hay—Soil III	Acre	19.5	22.2	2.4
Set Aside	Acre	--	--	11.3
Idle Land:				
Soil III	Acre	--	--	39.9
Soil IV	Acre	39.4	44.7	67.4
Livestock:				
Finishing Steer II	Steer	346.2	393.9	356.5
Buy Corn	Bushel	7,048	8,019	3,194
Labor:				
Operator Labor Available	Hour	2,600	2,600	2,600
Operator Labor Used	Hour	2,003.5	2,121.5	2,129.7
Labor Hired	Hour	372.5	599.6	529
Capital:				
Operating Capital	Dollar	50,327	57,594	51,332
Investment Capital				
Land	Dollar	82,558	134,864	141,388
Machinery and Equipment	Dollar	4,877	5,587	7,078
Livestock and Livestock Equipment	Dollar	15,621	17,773	16,085
Total	Dollar	103,056	158,224	164,551
Return to Operator Labor and Management	Dollar	7,000	7,000	10,000

Variation in Labor Supply (Beef Only)

The effect of variations in labor supply on capital requirements when only beef activities are considered is shown in Table XXVII. Total capital required was $116,482 with one man and the option to hire seasonal labor and $178,440 with the operator plus a full-time hired man and no option to hire seasonal labor. Total labor available with a full-time hired man was 4,823 hours but only 2,129 hours were required in the optimal system. This was less than the total operator labor available. Distribution of labor requirements showed that in only three months, March, April, and May, was the labor required more than the monthly operator labor supply. Labor in those periods was necessary for preparation of the seed bed and planting the crops. April labor was a limiting factor because all available labor was utilized. The full-time hired man labor situation could be interpreted in terms of partnership farms with two owners or a farm in which the owner works off the farm and the majority of the labor is supplied by the hired man. Availability of seasonally hired labor may be a problem for some areas and hiring someone full-time is a possible solution. These results do not justify a full-time worker if the operator plans to devote his time to the farm.

Enterprise combinations were similar for the two labor supplies. Finishing Steer II was included in both situations with 26 more steers included in the two man labor supply situation. The situation with the two man labor supply included government program corn with additional purchased corn while in the operator plus seasonal labor situation all

TABLE XXVII

EFFECTS OF VARIATION IN LABOR SUPPLY ON MINIMUM CAPITAL REQUIREMENTS AND OTHER REQUISITES FOR $7,000 RETURN AT 100 PERCENT EQUITY WITH ONLY BEEF AND BEEF FEED ENTERPRISES

Item	Unit	Operator Plus Option to Hire Seasonal Labor	Two Full-Time Men
Total Capital	Dollar	116,482	178,440
Total Acres	Acre	187.1	352.2
Total Acres Openland	Acre	138.4	260.6
Crops:			
Corn—Soil I (Gov. Prog.)	Acre	--	33.6
Corn—Soil III (Gov. Prog.)	Acre	--	8.5
Corn Silage—Soil I	Acre	54.3	60.2
Corn Silage—Soil II	Acre	5.6	10.6
Corn Silage—Soil III	Acre	5.6	--
Alfalfa Hay—Soil III	Acre	2.7	--
Bermuda Hay—Soil I	Acre	2.9	3.6
Lespedeza Hay—Soil I	Acre	10.2	21.1
Lespedeza Hay—Soil II	Acre	9.4	17.6
Lespedeza Hay—Soil III	Acre	14.9	.3
Set Aside	Acre	--	10.5
Idle Land:			
Soil III	Acre	--	35.1
Soil IV	Acre	29.9	56.3
Livestock:			
Finishing Steer II	Steer	263.3	289.6
Buy Corn	Bushel	5,361	2,367
Labor:			
Resident Labor Available	Hour	2,600	4,823
Resident Labor Used	Hour	1,656	2,129
Seasonal Labor Hired	Hour	137	--
Capital:			
Operating Capital	Dollar	38,087	41,276
Investment Capital			
Land	Dollar	62,787	118,198
Machinery and Equipment	Dollar	3,727	5,899

TABLE XXVII (continued)

Item	Unit	Operator Plus Option to Hire Seasonal Labor	Two Full-Time Men
Investment Capital (continued)			
Livestock and Livestock Equipment	Dollar	11,881	13,067
Total	Dollar	78,395	137,164
Return to Operator Labor and Management	Dollar	7,000	7,000

corn would be purchased. With a full-time hired worker, most of the corn would be homegrown and capital and land requirement would be much higher. These results are consistent with findings discussed in earlier sections. Land was purchased to provide sufficient row crop acreage and to provide feed grain base. Land requirement would be almost doubled to carry the full-time laborer. Investment in land accounted for 80 percent of total investment capital with the operator plus hired seasonal labor option and 86 percent when a full-time hired man was included in the resident labor supply.

CHAPTER V

SUMMARY AND CONCLUSIONS

I. SUMMARY

The objectives of this study were: (A) to determine the minimum capital requirements which would return net farm operator incomes of $7,000 and $10,000 respectively, under specified technical and price conditions in the Delta and Brown Soil areas of Tennessee when (1) all feasible crop and livestock alternatives are included; and (2) alternatives are restricted to beef enterprises plus crop enterprises which are potential feed supplies for beef. Particular attention was given to (a) the most profitable system for finishing beef, (b) the relative profitability of heifer and steer feeding, and (c) the least cost feed combination associated with a given beef production system; and (B) to analyze the effect of variations from the base situation in equity levels, wage rates, land values, livestock prices, labor supply, and government programs on the minimum capital requirements which achieve the specified $7,000 and $10,000 income targets.

Linear programming techniques were used to determine the minimum capital requirements and optimum enterprise organization in each situation. A land buying activity allowed land to enter the optimum solution in any quantity necessary to satisfy the model constraints. Total capital requirement was the quantity minimized in the objective function of the linear model.

Minimum capital requirements and optimum enterprise organizations were computed for thirty-one situations with variations in equity level, wage rate, income level, government programs, land value, labor supply, option to buy corn and enterprises considered. The enterprise alternatives were limited to those most commonly found in the area.

The results of the study showed wide variations in minimum capital requirements to return a $7,000 farm income. Minimum capital requirements ranged from $24,671 for the situation with all feasible enterprises considered and high livestock prices to $352,544 for the situation with all feasible enterprises considered and low livestock prices. Farm size for these two situations ranged from almost 40 acres with high livestock prices to over 971 acres with the low beef and pork prices.

Optimal solutions for situations with all feasible enterprises considered consisted mainly of sows and feeder pigs and cotton production. The necessary corn would be either purchased or produced on the representative farm. When the corn buying option was removed, both capital and land requirements increased.

Total land requirement for most of the situations with all enterprises considered was well under the 210 acre average for the study area. The three exceptions were (1) the situation with low livestock prices which required 971 acres; (2) the situation with a $10,000 income target which required almost 345 acres; and (3) the situation with a high wage rate which required 266 acres.

Only three of the situations with all feasible enterprises considered included beef cattle. The 971 acre farm with low livestock prices had

39 finishing heifers but the main income producer was cotton. The second situation which included beef was the one with a $10,000 income target which included almost 30 finishing steers. A third solution with beef was the two man labor supply with almost 40 finishing steers.

A higher equity level would generally have a lower capital and land requirement. Higher livestock prices did not change the optimum organization but resulted in less capital and land required to achieve the desired income target. However, lower livestock prices had a pronounced effect on the optimum organization. As mentioned above, land and capital requirements were much higher with low livestock prices and income resulted mainly from cotton production. This was one of the few instances where nongovernment program cotton was included in the optimum farm organization.

Other variations which were considered for all feasible enterprises were the inclusion of a higher income target, wage rate, and land value and the deletion of government programs. These variations were more restrictive and therefore the optimal solution for these situations had a higher capital and land requirement. The situation with a higher income target, $10,000, had the most pronounced effect on capital requirement. The operator would have to invest considerably more money and farm more land to achieve the desired income.

Including an increase in the wage rate to $2.65 per hour resulted in more cotton and corn production with less sows. The crop production required less labor and hours of labor hired decreased. This was a substitution of land for labor.

An increase in land value had the opposite effect. Labor was substituted for land. The hours of hired labor and number of sows increased while total acres and acres of crop production declined. The majority of the corn would be purchased.

Deletion of government programs eliminated cotton production and resulted in an optimal solution with only corn and hogs.

A final variation for all feasible activities was in the labor supply. The inclusion of a two man labor supply in the programming model resulted in a solution with more capital and land requirements. Production activities were increased and finishing steers plus corn silage and hay were additional activities.

The elimination of the buy corn alternative for the nine situations with all feasible enterprises generally resulted in larger capital and land requirements. The enterprise organizations were quite similar. The number of sows did not change greatly; however, corn production was increased to meet the corn requirements.

From the standpoint of capital requirements, a farm operator must have a high preference for beef production to choose this as an alternative. For this study, limiting production to beef raised capital and land requirements considerably. Solutions were infeasible at equity levels below 50 percent. All but one of the solutions had land requirements in excess of the average farm size for the study area of 210 acres. The exception was the 100 percent equity situation which required only 187 acres. Capital requirements ranged from a high of $245,172 with high wages and 50 percent equity to a low of $116,482 with

100 percent equity. Finishing Steer II was the major source of revenue with animal numbers ranging from 257 to 394 head for the various situations.

As was the case with all feasible enterprises, an increase in equity resulted in a decline in capital and land requirements. Also the amount of corn purchased or produced and the number of steers finished would vary.

A rise in beef prices had a similar effect to an increase in equity level, since it was a less restricting variation. As the price of beef declined, practically all the corn was produced and the number of steers declined.

Increasing the wage rate resulted in higher capital and land requirements. As was the case with a decline in beef price, fewer animals were included in the optimal solution and very little corn would be purchased. Elimination of government programs had practically no effect on capital, land, or livestock requirements. Set aside acreage for government program corn was shifted to corn production and purchased corn declined.

A shift to higher land values resulted in a solution with the largest number of finishing steers and all purchased corn. The situation with the $10,000 income target had a similar capital requirement to the situation with high land values. However, fewer steers and more land were required and over half the corn would be produced on the representative farm.

The final programming situation was one with a variation in labor supply with only beef alternatives. A two man labor supply was certainly

not justified. Hours of resident labor used were less than that supplied by the operator and capital and land requirements were significantly higher with the two man labor supply.

How do the results obtained compare with agriculture for the area? Acreages of principal crops in the study area for 1969 were presented in Table II, page 11. Soybeans ranked as the largest crop by acres with cotton second and corn third. The trend toward increased production of soybeans has continued in recent years. However, when minimizing capital in this study, soybean production did not appear in a single solution. Government program cotton proved to be a better income producer per dollar of capital invested for the conditions specified in the study.

The first choice as far as livestock was easily sows and feeder pigs. To achieve the assumptions of birth rate, death loss and rate of gain, good sound management is necessary. Beef cattle production in Tennessee as reported by CusKaden is predominantly the cow-calf type. The major beef production included in the results of this study was finishing steers on silage and corn grain.

Situations where government support programs were removed had little change. The majority of cotton allotment was produced but these farms were rather small with small allotments. Programming situations, which had only beef, included some government program corn but its removal had only a minor effect. Government support programs required additional capital investment in land for the set aside acreage and were not particularly favorable when minimizing capital.

Variations which were more restrictive on income resulted in higher capital requirements of varying degree. Land values had a greater effect than changes in wage rate. Lowering livestock prices, increasing the income target, and increasing the labor supply also raised capital requirements. Those variations which were less restrictive were increases in equity levels and livestock prices.

II. CONCLUSIONS

This study presents some guidelines for choosing farming systems with relatively low capital requirements and for judging the effect of a variety of factors on the amount of capital required. The $7,000 income target chosen for this study was not intended as a goal for all low income farmers. However, higher income targets would require larger capital investments and intensify the problem of acquiring the necessary resources for a commercial farm.

Clearly indicated by the results of the study are needed adjustments in farm size and an increase in gross farm receipts if the operator wishes to increase his income. Farm size is a more critical factor with beef production since predominantly beef operations require substantial acreages of land for forage production. In 1969, only about 20 percent of all farms in the study area had sales greater than $10,000. For all farms in the U.S. in 1969, realized net income was 29.6 percent of gross sales including government payments.[1] Using this percentage,

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[1]U.S., Department of Agriculture, Economic Research Service, Farm Income Situation, FIS 216 (Washington, D.C.: U.S. Government Printing Office, July, 1970), p. 44.

gross sales of approximately $23,650 would be required to return $7,000 net income.

The consistent choice for a livestock enterprise was feeder pig production and the preferred cash crop was cotton. The absence of soybean production as a part of the optimum organization was surprising. Soybeans was approximately 50 percent of the harvested cropland in the area as shown in Table II, page 11. The results indicate that cattle production would be a difficult activity for improving income while minimizing capital. An equity level of 50 percent was required to achieve a feasible solution when forcing beef into the optimum organization. Various specialty enterprises were not included such as poultry, dairy, hog finishing, vegetable crops, or orchards.

Allowances were not made for appreciation of land value through time. There was no provision for excess capacity of land or machinery. Many of the results included idle land and labor. Land was purchased in many instances to provide sufficient row cropland. In addition, the operator labor supply was assumed available and utilized to the extent that was necessary. Once the $7,000 income target was met, no further effort would be made toward utilizing the idle resources.

The results of this study show capital requirements and farm organizations which would be considered optimal for the conditions set forth in this study. Changes in interest rates, price relationships, and technology would certainly need to be considered before attempting to apply these results to an actual situation. Economic size units which justify the investment of time, machinery, and money must also be considered. The results shown here are applicable to farms with similar

soil characteristics or land pattern. Farms with substantially different proportions of soil classes would have limited application to these results. It is possible to purchase a farm with a greater percentage of Class I soil, a larger than average cotton allotment, or 50 percent or more woodland. Each situation must be compared individually.

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APPENDIXES

APPENDIX A

ESTIMATED COST OF OWNING AND OPERATING FARM MACHINERY

TABLE XXVIII

ESTIMATED PER HOUR COST OF OWNING AND OPERATING VARIOUS TYPES OF FARM MACHINERY

Machine	Cost New	Cost Average	Salvage Value	Useful Life in Years	Annual Use in Hours	Repair Costs for Life of Machine as a Percentage of Purchase Price	Repairs per Life-time	Interest per Year	Total Depreciation	Depreciation per Hour	Repairs per Hour	Interest per Hour
Wheel Tractor												
42 db. hp.	5062	2784	506	12	700	125	6328	167.04	4556	.54	.75	.24
65 db. hp.	7400	4070	740	12	700	125	9250	244.20	6660	.79	1.10	.35
Mold Board Plow												
3-bottom	600	330	60	12	100	75	450	19.80	540	.45	.38	.20
4-bottom (Semimounted)	1200	660	120	12	100	75	900	39.60	1080	.90	.75	.40
Disks, tandem												
6'-8'	570	314	57	12	125	30	171	18.84	513	.34	.11	.15
10'-15'	1040	572	104	12	125	30	312	34.32	936	.62	.21	.27
Harrows-Spike Tooth												
6'-8' (2 sect.)	150	88	15	12	125	30	45	5.28	135	.09	.03	.04
10'-15' (4 sect.)	275	152	28	12	125	30	83	9.12	247	.16	.06	.07
Stalk Shredder (Rotary Mower)												
4'-6'	550	303	55	8	75	75	413	18.18	495	.83	.69	.24
10'-12'	1300	715	130	8	75	75	975	42.90	1170	1.95	1.63	.57
Cultipacker-Double Gang												
6'-8'	380	209	38	12	125	15	57	12.54	342	.23	.04	.10
10'-14'	632	348	63	12	125	15	95	20.88	569	.38	.06	.17
Chisel Plow												
6'-10'	647	356	65	20	100	50	324	21.36	582	.29	.16	.21
10'-14'	971	534	97	20	100	50	486	32.04	874	.44	.24	.32
Grain Drill												
12'	760	418	76	12	60	40	304	25.08	684	.95	.42	.42

TABLE XXVIII (continued)

Machine	Cost New	Cost Average	Salvage Value	Useful Life in Years	Annual Use in Hours	Repair Costs for Life of Machine as a Percentage of Purchase Price	Repairs per Life-time	Interest per Year	Total Depreciation	Depreciation per Hour	Repairs per Hour	Interest per Hour
Fertilizer Applicators (Conventional)												
6'-8'	350	193	35	10	75	50	175	11.58	315	.42	.23	.15
10'-14'	600	330	60	10	75	50	300	19.80	540	.72	.40	.26
2 row	150	88	15	10	75	50	75	5.28	135	.18	.10	.07
4 row	275	152	28	10	75	50	138	9.12	247	.33	.18	.12
Planter, corn, cotton, soybean drill w/fertilizer attachments												
2 Row	620	341	62	12	125	40	248	20.46	558	.37	.17	.16
4 Row	1250	687	125	12	125	40	500	41.22	1125	.75	.33	.33
2 Row (no till)	1025	564	103	12	125	40	410	33.84	922	.61	.27	.27
4 Row (no till)	2050	1128	205	12	125	40	820	67.68	1845	1.23	.55	.54
Cultivator												
2 Row	506	279	51	12	100	50	253	16.74	455	.38	.21	.17
4 Row	1045	575	104	12	100	50	523	34.50	941	.78	.44	.35
Spray Rig												
21' boom	425	234	43	8	60	60	255	14.04	382	.80	.53	.23
Herbicide App Applicator												
2 Row 4'-10'	226	124	23	10	75	40	90	7.44	203	.27	.12	.10
4 Row 10'-20'	323	178	32	10	75	40	129	10.68	291	.39	.17	.14
Mower and Conditioner												
7'	1650	908	165	9	75	75	1238	54.48	1485	2.20	1.83	.73

TABLE XXVIII (continued)

Machine	Cost New	Cost Average	Salvage Value	Useful Life in Years	Annual Use in Hours	Repair Costs for Life of Machine as a Percentage of Purchase Price	Repairs per Life-time	Interest per Year	Total Depreciation	Depreciation per Hour	Repairs per Hour	Interest per Hour
Side-delivery Rake	1000	550	100	10	60	40	400	33.00	900	1.50	.67	.55
Hay Baler (Pick-up) PTO	2500	1375	250	8	125	50	1250	82.50	2250	2.25	1.25	.66
Combine 10' SP	10600	5830	1060	10	150	60	6360	349.80	9540	6.36	4.24	2.33
Corn-Header 2 Row	2100	1155	210	10	80	60	1260	69.30	1890	2.36	1.58	.87

Source: Derived from various budget publications.

APPENDIX B

ESTIMATED LIVESTOCK INVESTMENT AND ANNUAL FIXED COST

TABLE XXIX

INVESTMENT AND ANNUAL FIXED COST FOR A 50 HEAD STOCKER SYSTEM

Item	Initial Investment	Average Investment	Annual Fixed Cost			
			Depreciation	Repair	Taxes and Insurance[a]	Interest[b]
Barn[c]	$1500	$ 750	75	32.50	6.75	45.00
Fencing[d]	1000	500	50	10.00	4.50	30.00
Equipment	200	100	20	5.00	.90	6.00
Trench silo[e]	1200	600	60	12.00	5.40	36.00
Total	3900	1950	205	59.50	17.55	117.00
Per head	78	39	4.10	1.19	.35	2.34

[a]Computed at a rate of 0.4 percent of average investment for insurance and 0.5 percent of average investment for taxes.

[b]Computed at 6 percent.

[c]One thousand square feet pole barn.

[d]Forty acres of pasture divided in 20 acre fields fencing cost is $2.50 per rod with approximately 400 rods.

[e]Two hundred ton capacity trench silo.

TABLE XXX

INVESTMENT AND ANNUAL FIXED COST FOR A BEEF COW-CALF SYSTEM (25 BROOD COWS)

Item	Initial Investment	Average Investment	Annual Fixed Cost			
			Depreciation	Repairs	Taxes and Insurance[a]	Interest[b]
25 Cows	$ 6,250	$6,250	--	--	$56.25	$375.00
4 Yearling Heifers	800	800	--	--	7.20	48.00
1 Bull[c]	500	410	$ 60.00	--	3.69	24.60
Barn	1,500	750	75.00	$32.50	6.75	45.00
Fencing	2,000	1,000	100.00	20.00	9.00	60.00
Equipment	200	100	20.00	5.00	.90	6.00
Total	11,250	9,310	255.00	57.50	83.79	558.60

[a]Computed at a rate of .4 percent of average investment for insurance and .5 percent of average investment for taxes.

[b]Computed at 6 percent.

[c]Bull kept 3 years and sold for $320.

TABLE XXXI

INVESTMENT AND ANNUAL FIXED COST FOR A 250 HEAD FARM FEEDLOT

Item	Initial Investment	Average Investment	Annual Fixed Cost			
			Depreciation	Repair	Taxes and Insurance[a]	Interest[b]
Feed storage[c]	$15,100	$ 7,550	$ 888	$154	$ 67.95	$453.00
Feed handling equipment[d]	2,080	1,040	195	69	9.36	62.40
Manure equipment[e]	1,100	550	110	55	4.95	33.00
Feed bunks	500	250	33	25	2.25	15.00
Feed grinder	550	275	55	20	2.48	16.50
Concrete aprons	1,750	875	70	10	7.88	52.50
Water facilities	430	215	17	20	1.94	12.90
Fence facilities	400	200	20	10	1.80	12.00
Other equipment	650	325	48	13	2.93	19.50
Total	$22,560	$11,280	$1,436	$376	$101.54	$676.80
Per head	90.24	45.12	5.74	1.50	0.41	2.71

[a]Computed at a rate of 0.4 percent of average investment for insurance and 0.5 percent of average investment for taxes.

[b]Computed at 6 percent.

[c]Including grain, hay, silage, and supplement feed storage facilities.

[d]Including elevator, auger, silage blower, and wagon with power box.

[e]Excluding tractor.

TABLE XXXI (continued)

Sources: McCoy, J. H., and Wakefield, H. D. Economies of Scale in Farm Cattle Feed Lots in Kansas—An Analysis of Nonfeed Costs, Kansas Agricultural Experiment Station Technical Bulletin 145, 1966.

Saunders, Fred B., and others, Costs and Returns for Alternative Cattle Feeding Systems in Georgia, Georgia Agricultural Experiment Station Bulletin N.S. 163, June 1966.

Heady, E. O., and Gibbons, James R., Cost Economies in Cattle Feeding and Combination for Maximization of Profit and Stability, Iowa Experiment Station Research Bulletin 562, June 1968.

TABLE XXXII

INVESTMENT AND ANNUAL FIXED COST FOR A 500 HEAD FARM FEEDLOT

Item	Initial Investment	Average Investment	Annual Fixed Cost			
			Depreciation	Repair	Taxes and Insurance[a]	Interest[b]
Feed storage[c]	$30,200	$15,100	$1,776	$308	$135.90	$ 906.00
Feed handling equipment[d]	2,080	1,040	195	69	9.36	62.40
Manure equipment[e]	1,100	550	110	55	4.95	33.00
Feed bunks	500	250	33	25	2.25	15.00
Feed grinder	550	275	55	20	2.48	16.50
Concrete apron	1,750	875	70	10	7.88	52.50
Water facilities	860	430	34	40	3.87	25.80
Fence	800	400	20	10	3.60	24.00
Other equipment	650	325	48	13	2.93	19.50
Total	$38,490	$19,245	$2,341	$550	$173.22	$1,154.70
Per head	76.98	38.49	4.68	1.10	0.35	2.31

[a]Computed at a rate of 0.4 percent of average investment for insurance and 0.5 percent of average investment for taxes.

[b]Computed at 6 percent.

[c]Including grain, hay, silage, and supplement feed storage facilities.

[d]Including elevator, auger, silage blower, and wagon with power box.

[e]Excluding tractor.

TABLE XXXII (continued)

Sources: McCoy, J. H., and Wakefield, H. D., Economies of Scale in Farm Cattle Feed Lots in Kansas—An Analysis of Nonfeed Costs, Kansas Agricultural Experiment Station Technical Bulletin 145, 1966.

Saunders, Fred B., and others, Costs and Returns for Alternative Cattle Feeding Systems in Georgia, Georgia Agricultural Experiment Station Bulletin, N.S. 163, June 1966.

Heady, E. O., and Gibbons, James R., Cost Economies in Cattle Feeding and Combination for Maximization of Profit and Stability, Iowa Experiment Station Research Bulletin 562, June 1968.

TABLE XXXIII

INVESTMENT AND ANNUAL FIXED COST FOR SOWS AND MARKET HOGS (8 SOW UNIT)[a]

Item	Quantity	Life (Yrs.)	Investment		Annual Fixed Cost				
			New	Ave.	Deprec.	Ins. and taxes	Repairs	Interest	Total
Feeding pens[b]	--	15	$2,278	$1,139	$151.87	$10.25	$ 22.78	$ 68.34	$ 253.24
Water system[b]	--	15	435	218	29.00	1.96	4.35	13.08	48.39
Grain storage	(bu. 3500)[b]	20	1,355	668	66.80	6.01	13.55	40.08	126.44
Supplement bin[b]	--	20	348	174	17.40	1.57	3.48	10.44	32.89
Loading chute	--	15	25	12.50	1.67	.11	.25	.75	2.78
Sprayer	--	10	14	7.00	1.40	.06	.14	.42	2.02
Lagoon	--	20	400	200	20.00	1.80	4.00	12.00	37.80
Feed handling equip.	--	8	3,400	1,700	425.00	15.30	34.00	102.00	576.30
Sows	8	2	612	612	--	--	--	36.72	36.72
Boar	.4	1	30	30	--	--	--	1.80	1.80
Houses	--	15	600	300	40.00	2.70	15.00	18.00	75.70
Lamps	3	5	12	6	2.40	.05	--	.36	2.81
Waterers	4	10	72	36	7.20	.32	.72	2.16	10.40
Feeders	--	10	83	42	8.30	.38	.83	2.52	12.03
Fence (Acres)	2	20	200	100	10.00	.90	10.00	6.00	26.90
Misc.	--	10	50	25	5.00	.23	.50	1.50	7.23
Total 8 sow unit			$9,914	$5,269.50	$786.04	$41.64	$109.60	$316.17	$1,253.45
Total per sow			1,239.25	658.69	98.25	5.20	13.70	39.52	156.68

[a]Combination of feeder pig and hog finishing operation with exceptions noted.

[b]Investment assumed to be 2/3 of investment shown in finishing budget plus allowance for sow requirements.

TABLE XXXIV

INVESTMENT AND ANNUAL FIXED COST FOR FEEDER PIG PRODUCTION (8 SOW UNIT)[a]

Item	Quantity	Life (Years)	Investment		Annual Fixed Cost				
			New	Ave.	Depreciation	Ins. and Taxes[b]	Repairs	Interest[c]	Total
Sows	8	2	612	612	--	--	--	36.72	36.72
Boar	.4	1	30	30	--	--	--	1.80	1.80
Houses		20	600	300	30.00	2.70	15.00	18.00	65.70
Lamps	3	5	12	6	2.40	.05	--	.36	2.81
Waterers	4	10	72	36	7.20	.32	.72	2.16	10.40
Feeders[d]		10	83	42	8.30	.38	.83	2.52	12.03
Grain storage[e]		20	162	81.50	8.15	1.47	1.63	4.89	16.14
Supplement bin		20	80	40	4.00	.72	.80	2.40	7.92
Fence (acres)	2	20	200	100	10.00	.90	10.00	6.00	26.90
Loading chute		10	25	12.50	2.50	.11	.25	.75	3.61
Miscellaneous		10	50	25	5.00	.23	.50	1.50	7.23
Total 8 sow unit			1926	1285	77.55	6.88	29.73	77.10	191.26
Total per sow			240.75	160.63	9.69	.86	3.72	9.64	23.91

[a]With four farrowing dates during the year.

[b]Insurance computed at .4 percent and taxes at .5 percent of average investment.

[c]Computed at 6 percent of average investment.

[d]Including four farrowing pens, 4 creep feeders and 1 range feeder.

[e]Assumed storage of 325 bushels of corn and $.50/bushel new investment cost in grain storage facility.

VITA

Robert Wesley Burney was born November 6, 1950 in Clarksville, Tennessee. He attended elementary school in Montgomery County and graduated from Clarksville High School in 1968. He began undergraduate school at Austin Peay State University in September, 1968 and received the Bachelor of Science degree in June 1972 with a commercial agriculture major. While at Austin Peay, he was a member and officer in the Laurel Wreath Society, Delta Tau Alpha, Agriculture Club, and Collegiate Civitan Club. In September, 1972, he entered graduate school at The University of Tennessee as a graduate research assistant. At The University of Tennessee he became a member of Phi Kappa Phi and Gamma Sigma Delta. He received the Master of Science degree in Agricultural Economics in March, 1976. He is married to the former Elizabeth Buchanan and they have two children Robert John and Anne Katherine.