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To the Graduate Council:

I am submitting herewith a thesis written by Ronald Coons Atkinson entitled "Minimum Land Requirements for a $5,000 Farm Income in the Brown Soil Area of West Tennessee." I recommend that it be accepted for nine quarter hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

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MINIMUM LAND REQUIREMENTS FOR A $5,000 FARM INCOME IN THE BROWN SOIL AREA OF WEST TENNESSEE

A Thesis

Presented to

the Graduate Council of

The University of Tennessee

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

---

by

Ronald Coons Atkinson

August 1966

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TABLE OF CONTENTS

CHAPTER		PAGE
I.	NATURE OF THE STUDY	1
	Introduction	1
	Statement of the Problem	2
	Objectives	3
	Procedures	4
	Previous Research	5
II.	AREA DESCRIPTION	9
	Introduction	9
	Characteristics of the Study Area	9
	Soil type and topography	9
	Land use	11
	Farm numbers and size	14
	Land valuation	14
	Income	17
	Population and tenure	17
III.	DESCRIPTION OF RESEARCH PROCEDURES AND ASSUMPTIONS	21
	Introduction	21
	Land Resources	21
	Soil classification	22
	Land buying	26
	Labor Resources	27

CHAPTER PAGE

Capital Resources 27
Machinery Resources 29
Income Targets 31
Overhead 31
Enterprises Considered 32
Cotton 32
Corn 32
Soybeans 32
Oats 34
Swine 34
Beef 34
Dairy 35
Forage 36
Hay selling 36
IV. PROGRAMMING RESULTS 37
Effects of Variations in Cotton Price and Allotments on Minimum Land Requirements for $5,000 Farm Income . . . 37
55 percent of the 1963 allotment 38
85 percent of the 1963 allotment 42
100 percent of the 1963 allotment 45
115 percent of the 1963 allotment 50
No cotton allotment 55
Effects of Variations in Land Prices on Minimum Land Requirements for a $5,000 Farm Income 58

CHAPTER PAGE

With cotton allotments 58

Without cotton allotments 62

Effects of Variations in Labor Prices on Minimum Land Requirements for a $5,000 Farm Income 67

Influence of an Increase in Soybean Price on Minimum Land Requirements and Optimum Enterprise Organization for a $5,000 Farm Income 71

With cotton allotments 71

Without cotton allotments 72

V. SUMMARY AND CONCLUSIONS 73

Summary 73

Conclusions 78

SELECTED BIBLIOGRAPHY 81

APPENDIXES 84

APPENDIX A. Product and Input Prices 85

APPENDIX B. Estimated Annual Overhead Cost 88

APPENDIX C. Estimated Prorated Machinery Investment Per Acre for Selected Crops 90

APPENDIX D. Labor Requirements 92

APPENDIX E. Forage and Concentrate Requirements for Livestock and Forage Distribution by Periods 95

LIST OF TABLES

TABLE		PAGE
I.	Value of Farm Products Sold in the Brown Soil Area of West Tennessee, 1949 and 1959	12
II.	Distribution of Farms by Size, Brown Soil Area, West Tennessee, 1959	15
III.	Value of Farm Land Per Acre in the Brown Soil Area of West Tennessee, 1950 and 1959	16
IV.	Population Characteristics of the Counties in the Brown Soil Area of West Tennessee, 1950 and 1960	19
V.	Distribution of Farm Operators by Tenure Group, Brown Soil Area, West Tennessee, 1949 and 1959	20
VI.	Distribution of Openland by Soil Groups, Predominantly Upland Farms, Brown Soil Area, West Tennessee	23
VII.	Estimated Crop Yields by Soil Group, Brown Soil Area of West Tennessee	25
VIII.	Labor Distribution by Period for the Brown Soil Area of West Tennessee	28
IX.	Machinery Complement, Estimated Hours Used, and Cost Per Hour of Machines, Brown Soil Area of West Tennessee	30
X.	Cotton Price-Allotment Combinations Programmed, Brown Soil Area of West Tennessee	33

TABLE PAGE

XI. Estimated Minimum Land Requirements and Other Requisites for a $5,000 Return to Operator's Labor and Management with Cotton Allotment at 55 Percent of the 1963 Allotment, Brown Soil Area of West Tennessee 39

XII. Estimated Minimum Land Requirements and Other Requisites for a $5,000 Return to Operator's Labor and Management with Cotton Allotment at 85 Percent of the 1963 Allotment, Brown Soil Area of West Tennessee 43

XIII. Estimated Minimum Land Requirements and Other Requisites for a $5,000 Return to Operator's Labor and Management with Cotton Allotment at the 1963 Allotment Level, Brown Soil Area of West Tennessee 46

XIV. Estimated Minimum Land Requirements and Other Requisites for a $5,000 Return to Operator's Labor and Management with Cotton Allotment at 115 Percent of the 1963 Allotment, Brown Soil Area of West Tennessee 52

XV. Estimated Minimum Land Requirements and Other Requisites for a $5,000 Return to Operator's Labor and Management With No Cotton Allotment, Brown Soil Area of West Tennessee 56

XVI. Effects of Variations in Land Price on Minimum Land Requirements and Other Requisites for $5,000 Return to Operator's Labor and Management with 1963 Cotton Price-Allotment Levels, Brown Soil Area of West Tennessee 59

TABLE PAGE

XVII. Effects of Variations in Land Price on Minimum Land Requirements and Other Requisites for $5,000 Return to Operator's Labor and Management with no Cotton Allotment, Brown Soil Area of West Tennessee 64

XVIII. Effects of Variations in Labor Price on Minimum Land Requirements and Other Requisites for $5,000 Return to Operator's Labor and Management with 1963 Cotton Price-Allotment Levels, Brown Soil Area of West Tennessee 68

XIX. Selected Sample of Projected Prices Received and Paid by Farmers in the Brown Soil Area of West Tennessee . . . 86

XX. Estimated Annual Overhead Cost, Brown Soil Area of West Tennessee 87

XXI. Estimated Prorated Machinery Investment Per Acre for Selected Crops 91

XXII. Estimated Labor Requirements for Crop Enterprises by Labor Periods 93

XXIII. Estimated Labor Requirements for Livestock Enterprises by Labor Periods 94

XXIV. Estimated Forage Requirements for Livestock Enterprises . . 96

XXV. Estimated Grain and Supplement Requirements for Livestock Enterprises 97

XXVI. Distribution of Forage by Periods 98

CHAPTER I

NATURE OF THE STUDY

I. INTRODUCTION

Many farmers face the problem of "readjustment" in farm organization as a result of changes in technological and economical conditions. These "adjustments" are necessary if the farm business is to remain competitive and return a satisfactory income level.

Advances in technology have made the American agricultural economy the most efficient in the world. In many cases these technological developments have created economic pressures for expanding farm size. With an increasing number of people leaving the farm each year, opportunity for expansion and recombination of farms is facilitated. In Tennessee from 1954 to 1964, the number of farms decreased from 203,149 to 133,445, a decrease of 34 percent. During this same period the average size of farm increased from 86.9 acres to 114.4 acres, an increase of nearly 32 percent.[1] However, on many farms, farm size is still the most important factor limiting the possibility of increased farm income.

Certain economic changes have also made "adjustments" necessary. As the average size of farm continues to increase, investment in land and other facilities increases. In Tennessee from 1954 to 1964, the

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[1]United States Bureau of the Census, United States Census of Agriculture: 1964. Tennessee, Preliminary Report (Washington: Government Printing Office, June, 1966), p. 2.

average value of land and buildings per farm increased over 150 percent.[2]

Capital requirements for an efficient farm often exceed investments in nonfarm businesses and obtaining the necessary capital has become a major problem of established as well as beginning farmers.

Farmers are generally aware of income differences between farm and nonfarm employment and are actively searching for means of improving the economic well-being within the limits of their capital restrictions. Income improvements will almost invariably involve adjustments in farm resources and enterprise organization.

II. STATEMENT OF THE PROBLEM

Farm incomes have increased only slightly in recent years, while nonfarm incomes have increased rapidly. Research has shown that the working ability of farmers is comparable to that of semi-skilled or skilled workers in the rest of the economy.[3] But when farm and nonfarm incomes are compared, returns in agriculture to labor and capital are considerably lower, relative to nonfarm industries.

Investments per worker in agriculture exceed investment per worker in most types of nonfarm industries, but net returns to farmers are less than half the national median income of nonfarm workers. In 1963, the median income of employed males in nonfarm occupations in the United

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[2] Ibid.

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

States was $5,431, compared with $2,247 for farmers and farm managers.[4] Greater variations can be seen when the median income of farmers and farm managers is compared with the semi-skilled and skilled workers in nonfarm employment. The semi-skilled and skilled workers had median incomes ranging from $5,000 to $7,658.

In 1959, farmers and farm managers in the Brown Soil Area of West Tennessee had median incomes that were well below the national average. Median incomes for the nine counties ranged from a low of $811 in Fayette to a high of $1,707 in Dyer County. Median farm income in six of these counties was $1,000 or less, less than half the national average for farmers and farm managers and less than 20 percent of the median income of all nonfarm workers.

III. OBJECTIVES

The objectives of this study were:

1. To determine the minimum land requirements for a $5,000 return to operator's labor and management under alternative cotton price-allotment combinations in the Brown Soil Area of West Tennessee.
2. To determine the effect of changes in land and labor prices on minimum land requirements.
3. To determine the amounts of other resources needed in the optimum arrangements.

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[4]United States Department of Commerce, Statistical Abstract of the United States: 1965 (Washington: Government Printing Office, 1965), p. 348.

IV. PROCEDURES

The study was conducted in the following manner:

1. Most of the data included in this study were obtained from a regional research project presently being carried out in the Brown Soil Area of West Tennessee. These data were gathered for use in the Regional Resource study, "An Economic Appraisal of Farming Adjustment Opportunities in the Southern Region to Meet Changing Conditions--Revised."[5] These data contain representative resource situations, input requirements and output levels for crop and livestock enterprises. Data on cotton allotments in the area, projected factor and product prices, enterprise budgets and a summary of soil groups in the area were also available from an earlier phase of this regional project.

2. Minimum land requirements to achieve a $5,000 net return were determined for twelve cotton allotment-cotton price combinations, one situation with no allotment, four land prices and three labor prices.

The base situation assumed a cotton price of 31.2 cents, 1963 cotton allotment levels, 1963 land price and labor price of 75 cents per hour.

Minimum land requirements were then considered with variations in cotton allotments and cotton price. The cotton allotment levels were varied from 115 percent to 55 percent of the 1963 allotment and cotton price from 20.8 cents to 36.4 cents per pound of lint. Since about

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[5] A more detailed description of this project (S-42) will be found in the next section.

one-sixth of the farms in the Brown Soil Area have no cotton allotment, a situation was also considered with no cotton allotments.

Minimum land requirements were also determined for land values varying from 50 percent to 200 percent of the 1963 land value in the area. Since cotton allotments are likely to be capitalized into the land values, separate land value determinations were made for farms with and without allotments.

Labor price was also varied at 150 percent and 200 percent of the 1963 labor price of 75 cents per hour.

3. Linear programming techniques were used to determine the minimum land requirements and optimum combination of enterprises for a $5,000 return to operator's labor and management. Solutions obtained for each of the assumed situations included not only the minimum land requirements but also land use, livestock systems, labor utilization, and capital investment for the optimal system.

V. PREVIOUS RESEARCH

This study is part of objective (C) of the Southern Regional Project S-42, entitled, "An Economic Appraisal of Farming Adjustment Opportunities in the Southern Region to Meet Changing Conditions--Revised." The objectives of this study are "to extend research findings from data and analysis designed to provide guides to farmers when choosing among alternative production opportunities, especially as those

opportunities are affected by changes in factor prices and levels of allotments."[6] The Regional Project is anticipated to provide information to farm people and policy makers concerning needed adjustments and variations in minimum resource requirements for specified levels of income.

In a study by Amick and Allison to determine minimum land requirements for a specified level of income in the Piedmont area of Georgia, it was shown that definite adjustments are needed if farm operators desire to increase incomes.[7] It was shown that for a return of $5,000 most of the labor could be furnished by the operator, but when returns were increased to $10,000 and more labor was hired, the operator became a manager rather than a laborer and additional returns were counted as returns to operator's management rather than operator's labor and management.

An Oklahoma study indicated that if adjustments were made in the present farm numbers in order to obtain a minimum of $5,000 return for each farm, approximately 70 percent reduction in the number of farms would have to occur.[8] This would involve many people seeking nonfarm

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[6]A Guide to Procedures in Southern Research Project S-42, "An Economic Appraisal of Farming Adjustment Opportunities in the Southern Region to Meet Changing Conditions--Revised" (unpublished, The University of Tennessee, Knoxville, 1963), p. 1-6.

[7]R. J. Amick and J. R. Allison, Minimum Land Requirements for Specified Levels of Income for General Crop-Livestock Farms in the Piedmont of Georgia, Bulletin N. S. 146 (Athens, Georgia: Georgia Agricultural Experiment Station, September, 1965).

[8]William F. Lagrone, James S. Plaxico, and Percy L. Strickland, Jr., Minimum Land Requirements and Adjustments for Specified Income Levels, Southwestern Oklahoma, Bulletin B-608 (Stillwater, Oklahoma: Oklahoma State University Experiment Station, May, 1963).

employment; however, the results of the study did maintain that some former operators would be employed as hired workers in the newly adjusted system. This same study showed that the average total capital investment per worker in agriculture to obtain a $5,000 return in Oklahoma was much higher than average total capital investment in nonfarm industries, as indicated by the $193,506 average required in agriculture to a range of $3,679 to $40,822 required for nonfarm industries.

Walker, Kline, and Arnold found in Virginia that most farmers could make adjustments and definitely increase incomes.[9] It was shown that farm operators, with the assumed resources in the study, could have efficiently used more capital than they used. The marginal productivity of capital varied from $12 per $100 of additional capital when investment capital was limited to $10,000, to $74 per $100 when capital was limited to $1,000.

An Alabama study indicated that land was the major capital expense on most farms and that minimizing land had almost the same effect as minimizing capital.[10] Minimum land requirements ranged from 105 acres to 192 acres for a $5,000 net income in the area of study. The labor requirements were low enough on these farms that it was felt these farms

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[9]Carl J. Arnold, Ralph G. Kline, and Harold W. Walker, Farm Adjustment Opportunities, Southside Virginia, Technical Bulletin 150 (Blacksburg: Virginia Agricultural Experiment Station, May, 1961).

[10]Gary C. Jones, P. L. Strickland, Jr., and Earl Partenheimer, Minimum Open Land Requirements for $5,000 Farm Income, Wiregrass Area Lower Coastal Plain Alabama (Auburn, Alabama: Agricultural Experiment Station of Auburn University, Agricultural Economics Series 6, July, 1965).

could come under the family-farm heading and provide a $5,000 return to operator's labor and management.

It is evident from previous research work in this area that farm adjustments are needed and could be profitable to many farm operators. By helping to determine what adjustments are needed and what combination of enterprises and resources are optimum, this and similar studies should provide benchmarks for farm operators and policy makers when evaluating the problem of low incomes.

CHAPTER II

AREA DESCRIPTION

I. INTRODUCTION

The area of study includes all of Crockett, Fayette, Haywood, Gibson, and Madison Counties and portions of Dyer (62.4 percent), Lauderdale (59.0 percent), Tipton (91.0 percent), and Shelby (81.0 percent) Counties (Figure 1). This area is known as the Brown Soil Area of West Tennessee. The approximate land area in the study area is 2,557,909 acres. Of this amount 2,152,561 acres were in farms in 1959. Openland accounted for approximately 72 percent of the land in farms, woodland over 18 percent and wasteland and other accounted for 10 percent.[1]

II. CHARACTERISTICS OF THE STUDY AREA

Soil type and topography. The soils in the area consist primarily of the Memphis, Loring, Grenada, and Calloway series, with Falaya and Waverly soils included in the bottomlands. Most of the soils were derived from moderate deep to deep loess that overlies clay and sandy material.[2] The soils range from well-drained to some poorly drained bottomland

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[1] United States Bureau of the Census, United States Census of Agriculture: 1959, Tennessee, Vol. I (Washington: Government Printing Office, 1961), pp. 144-151.

[2] Joe A. Martin and B. H. Luebke, Types of Farming in Tennessee, Bulletin 311 (The University of Tennessee, Knoxville, March, 1960).

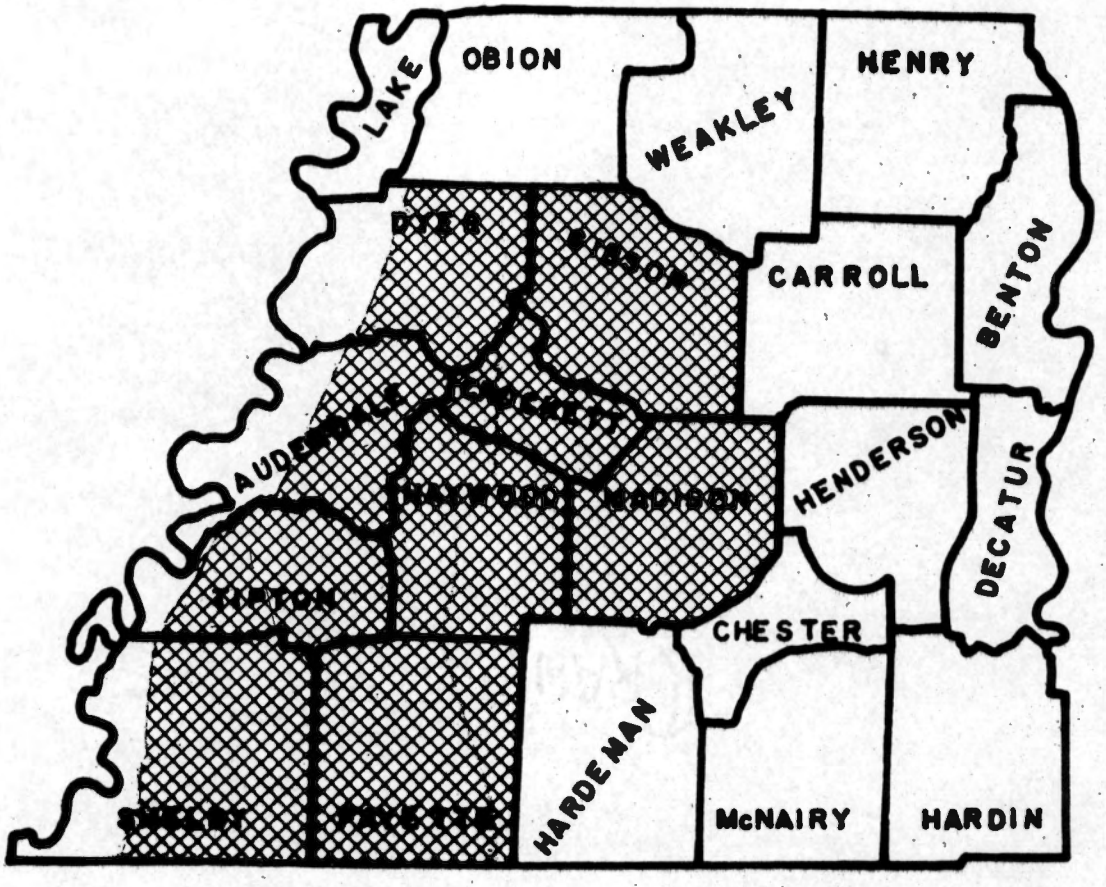

FIGURE 1

LOCATION OF STUDY AREA, BROWN SOIL AREA OF WEST TENNESSEE

soils with most of the soils being moderately well-drained. There are fragipans in the majority of the eastern section of the study area that does restrict cropping to some extent.

The topography of the area varies from fairly flat in the western section to gently rolling hilly land in the eastern section. The soils do erode easily and evidence of erosion can be seen.

Average precipitation for the area is 48 inches per year and the growing season ranges from about 200 days in the far northeastern section to about 220 days in the western section.

Land use. The climate, topography, and soil type in this area is favorable for the growing of many crops. Conditions are especially favorable for cotton, corn, and soybeans on the most productive soils and production of forage for livestock enterprises on less productive soils. The value of agricultural products sold by farmers in the area was nearly 106 million dollars in 1959 as compared to 73 million dollars in 1949 as shown in Table I. In 1959, 79.5 percent of the agricultural income came from crops, 18.6 percent from livestock, and 1.9 from sale of forest products.

Cotton is the main cash crop and accounted for approximately 67 percent of the agricultural sales in the area in 1959.[3] In 1959, over 61 percent of the farms in this area were classified as cotton farms by census classification. Cotton acreage has declined in recent

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[3]This estimate was based on cotton yields and cotton prices as reported by the Crop Reporting Service.

TABLE I

VALUE OF FARM PRODUCTS SOLD IN THE BROWN SOIL AREA OF WEST TENNESSEE, 1949 AND 1959

Types of Products Sold	1949		1959	
	Value (000)	Percent of Total	Value (000)	Percent of Total
Crops				
Field crops	$54,815	75.0	$ 79,601	75.2[a]
Vegetables	973	1.3	1,555	1.5
Fruits and nuts	1,190	1.6	1,019	0.9
Horticulture	1,133	1.6	1,995	1.9
Total	$58,111	79.5	$ 84,170	79.5
Livestock				
Dairy	$ 2,809	3.8	$ 2,697	2.5
Poultry and poultry products	924	1.3	1,911	1.8
Other livestock[b]	10,269	14.1	15,119	14.3
Total	$14,002	19.2	$ 19,727	18.6
Forest Products	$ 960	1.3	$ 2,001	1.9
Total Value of Products	$73,773	100.0	$105,898	100.0

Source: William Butler Cowan, Jr., "Variations in Land-Labor Resources and Optimum Enterprise Organizations of Farms in the Brown Soil Area of West Tennessee" (unpublished Master's thesis, The University of Tennessee, Knoxville, 1964), p. 12.

[a]Cotton was estimated to have accounted for 66.8 percent of total agricultural sales in 1959.

[b]Includes beef cattle, beef feeders, hogs, and so forth.

years but total production of lint has increased. From 1954 to 1959 cotton acreage decreased by 15 percent but bales of cotton produced increased by 29.7 percent.

Soybeans have made a very significant increase from 1954 to 1959, increasing from 104,986 acres in 1954 to 237,237 acres in 1959. It is estimated that the acreage of soybeans in this area in 1965 reached 470,600 acres, a fourfold increase in eleven years.[4] Higher soybean prices and use of acreage diverted from cotton have been the main factors in the rapid increase in soybean acreage.

Oat and corn acreage have decreased in recent years. Oat acreage decreased by 64 percent from 1954 to 1959 while acreage of corn decreased 27 percent. Hay production remained about steady but there was an increase in the amount of hay sold. Hay sales increased from 2,801 tons in 1954 to 9,016 tons in 1959, an increase of 222 percent. Lespedeza accounted for 73 percent of the total hay sold in 1959.

The number of cattle and calves on farms in the nine counties decreased by 9 percent from 1954 to 1959. A 46 percent decrease in dairy cows accounted for most of this decrease while beef cattle numbers showed only a slight decrease. The number of hogs and pigs in the nine county area increased from 176,844 to 232,022 during this period, an increase of over 31 percent.

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[4]Tennessee Department of Agriculture, Statistical Reporting Service, 1965 Soybean County Estimates (Nashville, Tennessee: Tennessee Crop Reporting Service, March 23, 1966).

Farm numbers and size. According to the 1954 Census of Agriculture, there were 34,635 farms in the nine counties in the study area averaging 73.5 acres per farm. By 1959, the number of farms had decreased to 25,471 but the average size had increased to 95.5 acres.[5] The distribution of farms by size for the study area in 1959 is shown in Table II. Over 75.3 percent of the farms were less than one hundred total acres and nearly 40 percent were less than thirty acres.

Land valuation. Increasing land values in the area can be largely attributed to price inflation and to increased competition among farmers for land as more operators seek to expand farm size. Among the nine counties, land prices ranged in value from $50.12 per acre to $167.47 per acre in 1950 and from $98.76 per acre to $400.28 per acre in 1959. The average value per acre for 1950 and 1959 and the percentage increase per acre is shown in Table III for each separate county. During this period, the average per acre value increased by more than 50 percent in all counties. As adjustments occur in the farming industry, land prices will play an important role by determining just how far some small farmers can expand their farm acreage. As land increases in value, some farmers will find it increasingly difficult to obtain the necessary capital and/or credit to make such expansions.

Capital investment in buildings and machinery has also increased. Throughout the study area the number of cotton pickers, tractors, hay

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[5]United States Bureau of the Census, United States Census of Agriculture: 1959. Tennessee, Vol. I (Washington: Government Printing Office, 1961), pp. 144-151.

TABLE II

DISTRIBUTION OF FARMS BY SIZE, BROWN SOIL AREA, WEST TENNESSEE, 1959

Farm Size (Acres)	Farms	
	Numbers	Percent
Less than 30	9,156	39.9
30 - 99	8,120	35.4
100 - 179	2,926	12.8
180 - 259	1,128	4.9
260 and over	1,606	7.0

Source: William Butler Cowan, Jr., "Variations in Land-Labor Resources and Optimum Enterprise Organizations of Farms in the Brown Soil Area of West Tennessee" (unpublished Master's thesis, The University of Tennessee, Knoxville, 1964), p. 16.

TABLE III

VALUE OF FARM LAND PER ACRE IN THE BROWN SOIL AREA OF WEST TENNESSEE, 1950 AND 1959

County	Average Value Per Acre		Increase Per Acre
	1950	1959	(percent)
Crockett	$109.68	$206.98	88.7
Dyer	119.56	184.52	54.3
Fayette	50.12	98.76	97.0
Gibson	101.06	152.72	51.1
Haywood	70.11	150.10	114.1
Lauderdale	106.51	168.71	58.4
Madison	85.26	128.91	51.2
Shelby	167.47	400.28	139.0
Tipton	96.85	204.60	111.2

Source: Tennessee Department of Agriculture, Excellence Attained, 45th Biennial Report, 1963-1964 (Nashville, Tennessee: Tennessee Department of Agriculture, 1964), p. 244.

balers, corn pickers and trucks have increased. The average value of farm land and buildings per farm increased 126 percent from 1950 to 1959.[6] The rising total capital investment required to operate an efficient farm has increased the difficulty of getting started in farming and intensified the problem of capital accumulation on existing farms.

Income. Farm incomes have increased slightly in recent years, but as previously mentioned nonfarm incomes have increased rapidly. The median income for farmers and farm managers in the study area ranged from $811 in Fayette County to $1,707 in Dyer County in 1959.[7] Workers in nonfarm employment that were classed as semi-skilled and skilled workers had median incomes ranging from $1,654 in Fayette County to $3,304 in Shelby County for operative and kindred workers and $3,500 in Fayette County to $6,364 in Shelby County for professional managers and kindred workers. If we assume farm operators possess labor skills that are equal to these groups, then certainly adjustments are needed in the agriculture industry to help solve this income differential.

Population and tenure. There were approximately 112,491 persons living on farms in the study area in 1959. This represents about 12.8 percent of the total population of the area. Madison and Shelby Counties

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[6]Tennessee Department of Agriculture, Excellence Attained, 45th Biennial Report, 1963-1964 (Nashville, Tennessee: Tennessee Department of Agriculture, 1964), p. 242.

[7]United States Bureau of the Census, United States Census of Population: 1960, Tennessee (Washington: Government Printing Office, 1961), pp. 238-245.

were classified as predominantly urban counties while the other counties were classified as predominantly rural or rural nonfarm. A breakdown of population change by county between 1950-1960 is presented in Table IV and shows a rather high rate of migration from this area to other areas. All counties, with the exception of Madison and Shelby, showed decreases in population from 1950 to 1960, ranging from 4.1 percent decrease in Tipton County to a 12.8 percent decrease in Lauderdale County. Shelby County recorded an increase of 30 percent during this period, part of which is due to farm people from the study area moving to nonfarm employment in Memphis.

Changes have also occurred in tenure arrangements, as can be seen in Table V. The number of total farm operators in the area declined from 35,602 to 22,936 from 1954 to 1959, a decrease of 35.6 percent. Full owners decreased by 31.9 percent but the most pronounced change occurred in the number of tenants, a decline of 55.8 percent. The number of cash tenants declined from 1,056 in 1954 to only 359 in 1959, a decrease of 66 percent, while share tenants and croppers declined by 56.5 percent and 34.2 percent, respectively. This decline in tenants was caused in part by the increased mechanization on cotton farms in the area. Part owners, the only group showing an increase, increased slightly from 3,633 to 3,775 or by 3.9 percent.

TABLE IV

POPULATION CHARACTERISTICS OF THE COUNTIES IN THE BROWN SOIL AREA OF WEST TENNESSEE, 1950 AND 1960

County	Urban	Rural Nonfarm	Rural	Change in Population 1950-1960
	Percent			
Crockett	0.0	43.5	56.5	-12.2
Dyer	42.3	29.1	28.5	-11.8
Fayette	0.0	33.2	66.8	-10.7
Gibson	40.1	26.1	33.8	-7.1
Haywood	23.2	11.4	65.4	-10.8
Lauderdale	17.3	35.8	46.9	-12.8
Madison	61.0	19.6	19.5	0.9
Shelby	87.8	10.0	2.2	30.0
Tipton	18.5	35.5	46.0	-4.1

Source: Charles L. Cleland, Selected Population and Agricultural Statistics for Tennessee Counties, Bulletin 359 (The University of Tennessee, Knoxville, January, 1963), pp. 8-10.

TABLE V

DISTRIBUTION OF FARM OPERATORS BY TENURE GROUP, BROWN SOIL AREA, WEST TENNESSEE, 1949 AND 1959

Tenure Group	Number of Farms		Percent of Farms		Change
	1949	1959	1949	1959	1949-1959
					(percent)
Full owner	10,586	7,125	29.7	31.4	-31.9
Part owners	3,633	3,775	10.2	16.5	3.9
Tenants (all)	21,383	11,946	60.1	52.1	-55.8
Cash	1,056	359	3.0	1.6	-66.0
Share cash	224	234	0.6	1.0	4.5
Share tenants	8,853	3,855	24.9	16.8	-56.5
Croppers	8,808	5,796	24.7	25.3	-34.2
Total	35,602	22,936	100.0	100.0	-35.6

Source: William Cowan, Jr., "Variations in Land-Labor Enterprise Organizations of Farmsin the Brown Soil Area of West Tennessee" (unpublished Master's thesis, The University of Tennessee, Knoxville, 1964), p. 19.

CHAPTER III

DESCRIPTION OF RESEARCH PROCEDURES AND ASSUMPTIONS

I. INTRODUCTION

Linear programming techniques were used to determine the minimum land requirements for a $5,000 return to operator's labor and management with variations in cotton allotment-price combinations, land price, and labor price. Total acres of land was the objective function to be minimized but since the soil pattern was assumed to be the same regardless of farm size, solutions obtained would also indicate minimum quantities of openland.

Land is one of the most limiting resources on many small farms and for most farms in the study area would constitute 75 to 85 percent of total farm value. Because of recent increases in land values, it is becoming even more difficult for small farmers to obtain additional land in competition with larger farmers, and in some cases with nonfarm land uses. Therefore, land was chosen as the resource or factor to minimize. Previous research has indicated that when land is minimized, this had almost the same effect as minimizing capital, since land represents a major portion of capital investment on many farms.

II. LAND RESOURCES

In an earlier phase of this study, farms in the Brown Soil Area were classified as predominantly upland or predominantly bottomland with

70 percent of the farms being classified upland and 30 percent being classified bottomland. This thesis deals only with the predominantly upland farms.

Soil classification. Soils in the area were classified into six groups according to production capabilities. Each of these soil groups contains soils of somewhat similar capabilities and was derived by combinations of management capability groups developed by the Soil Conservation Service.[1] Range of crop adaptability, potential yields, erosion hazard, internal and external drainage, slope and depth were some of the factors considered in making the classifications. A summary of the soil groupings is shown in Table VI.

Soil group I contained capability groups I-1, I-2, IIe-1, IIw-1, IIIw-2, and IIe-3. All of these were suitable for continuous row cropping, with the exception of IIe-1, which could not be cropped more often than one of every two years. Alfalfa production was limited to I-1, I-2, IIe-1, and IIe-3. This soil group contained 30.79 percent of the soils on the predominantly upland farms and 43 percent of the openland.

Soil II contained predominantly capability groups IIe-2 and IIs-1. It was assumed these soils could not be row cropped more than one of every three years. Alfalfa could be grown on these soils but yields would be low. This group contained 9.11 percent of the soils and 12.7 percent of the openland soils of the predominantly upland farms.

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[1]A description of the management capability units is shown in Fayette County, Tennessee Soil Survey, Series 1960, No. 13 (Washington: Government Printing Office, 1964), p. 22.

TABLE VI

DISTRIBUTION OF OPENLAND BY SOIL GROUPS, PREDOMINANTLY UPLAND FARMS, BROWN SOIL AREA, WEST TENNESSEE

Soil Group	Capability Group	Percent
Soil I	I-1, I-2, Ie-1, Iw-1, Iw-2 and IIe-2	30.79[a]
Soil II	IIe-2 and IIs-1	9.11[b]
Soil III	IIIe-4	8.13[c]
Soil IV	IIIe-2, IIIe-4, IIIw-1	8.13[d]
Soil V	IVe-1, IVe-2, IVe-3, IVs-1, IVw-1, and IVw-2	10.18
Soil VI	VIe-1, VIe-2, VIe-3, VIIe-1, and VIIs-1	5.04
Total openland		71.38
Woodland, waste, and other land		28.62
Total		100.00

[a]Row crops are restricted to 77.9 percent of Soil I and alfalfa is restricted to 49.5 percent of Soil I.

[b]Row crops are restricted to 33.3 percent of Soil II.

[c]Row crops are restricted to 25.0 percent of Soil III.

[d]Row crops are restricted to 21.75 percent of Soil IV.

Soil III contained 8.13 percent of the soils and 11.5 percent of the openland and could not be cropped more than one out of every four years.

Soil IV consisted of the capability group IIIe-2, IIIe-4, and IIIw-1 and accounted for 8.13 percent of the soils and 11.5 percent of the openland. Capability groups IIIe-2 and IIIe-4 could not be cropped more than one in every four years. Alfalfa could not be grown on IIIe-4 or IIIw-1.

Soil V consisted of capability groups IVe-1, IVe-2, IVe-3, IVs-1, IVw-1, and IVw-2. This group accounted for 10.18 percent of the soils and for 14.2 percent of the openland on the farm type being studied.

Soil VI contained capability groups VIe-1, VIe-2, VIe-3, VIIe-1, and VIIs-1, and represents 5.04 percent of the soils and 7.1 percent of the openland in the representative situation. This group was restricted to permanent pasture.

Woodland and wasteland accounted for the remaining 28.62 percent of the total acreage. This acreage was not considered to produce any income or to require any annual production inputs in the analysis. Its value was included in land price determinations.

The estimated yields of crop enterprises for the six soil groups are shown in Table VII. These yields were developed for an earlier phase of the study and were based on County Soil Conservation reports and consultation with production specialists. These were the expected yields under good management, using the recommended production practices.

TABLE VII

ESTIMATED CROP YIELDS BY SOIL GROUP, BROWN SOIL AREA OF WEST TENNESSEE

Crop	Unit	Soil Group					
		I	II	III	IV	V	VI[b]
Cotton	lbs.lint	700	650	575	600	a	a
Corn	bushel	80	65	65	46	a	a
Soybeans	bushel	33	28	28	22	a	a
Oats	bushel	58	52	52	40	a	a
O.G. Ladino pasture	CAD	175	155	145	125	103	72
O.G. Ladino pasture & hay	CAD	84	72	69	60	49	a
	Ton	1.4	1.3	1.2	1.05	0.8	a
Lespedeza past.	CAD	120	105	100	85	70	a
Lespedeza hay	Ton	1.7	1.6	1.6	1.2	1.2	a
Coastal Bermuda Ladino pasture	CAD	190	170	160	130	110	80
Red clover	Ton	2.2	1.5	2.2	a	a	a
Alfalfa	Ton	2.8	2.0	2.8	a	a	a

[a]Production considered not feasible for this soil.

[b]Only unimproved pasture could be grown on Soil VI.

Land buying. In programming, a land buying activity was included in the programming matrix. This allowed land to enter the optimum solution when needed in units of one acre of total land. For each acre of land entering the solution, 71.38 percent was openland and 28.62 percent was woodland, waste, and other land. The distribution of the land among the six productive soil groups is shown in Table VI, page 23. Each acre of land brought into the solution contained these percentages of each soil group. Row crop acreage was restricted to 77.9 percent of Soil I, 33.3 per cent of Soil II, 25 percent of Soil III and 21.75 percent of Soil IV.

Cotton allotment variations also were included in the land purchasing activity. The percentage of cotton allotment for each acre of land was 17.55 percent when the 1963 cotton allotment was considered, 20.18 percent with 115 percent of the 1963 allotment, 14.92 percent with 85 percent of the 1963 allotment and 9.65 percent with 55 percent of the 1963 allotment level.[2] Since about 16.8 percent of the farms have no cotton allotments, programming situations were also included with zero allotment level.

Annual charges for purchases of land included interest on land investment and a property tax. Land value, based on 1963 land price,

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[2]These percentages represent the maximum amount of cotton allotment that could enter the solution for each acre of land included. They were available from an earlier phase of S-42 and were derived by calculating total 1963 cotton acreage in the area and dividing by the acres of farm land on the 83.2 percent of the farms growing cotton in the study area in 1959. Cotton acreage was then increased to 115 percent of the 1963 allotment to determine the percentage of cotton allotment at this level and similar methods were used to calculate the percentages at 85 and 55 percent of the 1963 allotment.

was considered at $206 per acre for land with cotton allotments and $180 per acre without cotton allotments, with variations of 50 percent below and 50 and 100 percent above these prices. Interest was charged at 5 percent on investment and the property tax was assumed to be $1.00 annually per acre of land.

III. LABOR RESOURCES

A one-man supply of resident labor was assumed in the programming model. This consisted of 2,865 hours of operators labor distributed over six labor periods as shown in Table VIII. Labor periods were designed to insure an adequate seasonal as well as total labor supply for the optimum farming systems developed.

Hired labor was considered available as needed in each of the six labor periods and no restriction was placed on the amount that could be hired. Initially hired labor cost was set at $0.75 per hour with subsequent variations to $1.125 and $1.50 per hour, 50 and 100 percent, respectively, above the base price.

IV. CAPITAL RESOURCES

Operating and investment capital were assumed unlimited. Operating capital used to purchase items such as seed, fertilizer, insecticides, fuel, and so forth, was charged at the rate of 6 percent per year for the period utilized. Interest at 6 percent was charged for feed produced for livestock from the average time from harvest until sale of the livestock.

TABLE VIII

LABOR DISTRIBUTION BY PERIOD FOR THE BROWN SOIL AREA OF WEST TENNESSEE

	Period	Days in Period	Hours Available	Percent of Labor
I	December 1-February 28	90	616	21.5
II	March 1-April 14	45	351	12.3
III	April 15-May 31	47	390	13.6
IV	June 1-August 15	76	650	22.7
V	August 16-September 30	46	390	13.6
VI	October 1-November 30	61	468	16.3
	Total	365	2,865	100.0

Investment capital was charged at 6 percent per year for such items as tractors and machinery, buildings and long-life pasture. Investment capital for land was charged at 5 percent per year.

The programming model was designed to determine the amount of various forms of capital that was required for each situation.

V. MACHINERY RESOURCES

Machinery costs were included in the enterprise budgets on the basis of an assumed performance rate and charge per hour of estimated use. All costs were considered including fuel, oil, lubrication, repairs, insurance, depreciation and interest on investment. These costs were determined on the basis of estimated annual cost of owning the machine, given the assumptions of initial cost, salvage value, depreciation, years of life and estimated hours of use of a particular machine during the year. The machine costs per hour of use and estimated annual hours of use for various machines are shown in Table IX. If a machine was not used enough to justify owning the machine, custom hiring of machinery was assumed. The assumed custom rates are shown in Appendix A.

A prorata share of machine investment cost was associated with each hour used of a machine. For example, the 25 h.p. tractor referred to in Table IX had an expected life of 12 years and was assumed to be used 400 hours each year. The average investment over the expected life was $990 per year. Thus for each hour of assumed use, the associated investment cost per hour was $2.48. If a production enterprise required the use of this tractor 6 hours per acre, then the prorata tractor

TABLE IX

MACHINERY COMPLEMENT, ESTIMATED HOURS USED, AND COST PER HOUR OF MACHINES, BROWN SOIL AREA OF WEST TENNESSEE

Machine	Description	Annual Estimated Hours Used	Cost Per Hour
Tractor	25 h.p.	400	$1.09
Tractor	45 h.p.	500	1.74
Plow	2 bottom	100	.42
Disk	8 ft.	150	.30
Section harrow	2 section	75	.14
Planter fertilizer	2 row	50	.87
Cultivator	2 row	65	.74
Fertilizer spreader	12 ft.	80	.42
Sprayer	6 row	55	.65
Mower	7 ft.	50	1.13
Rotary mower	6 ft.	50	1.27
Side delivery rake	wheel driven	40	1.70

investment would be $14.88 per acre for this enterprise. Prorata investment cost for other machines in the study were computed in a similar manner.

The estimated prorated machinery investment per acre for crops considered in the study are presented in Appendix C.

VI. INCOME TARGETS

An income target of $5,000 return to operator's labor and management was chosen for this study. Since many people consider the working ability of the farmer equal to that of semi-skilled or skilled workers in nonfarm employment, then farmers should receive an income more in line with nonfarm employment. This figure represents approximately the average income of workers in nonfarm employment. In addition to the $5,000, the operator would also receive the investment return on his equity in the farm business.

VII. OVERHEAD

Certain items were considered to be overhead cost in the programming model and were not charged to a specific enterprise. A truck, farm wagon, a manure spreader, an elevator, farm tools and a machine shed were included in this overhead. Also items such as telephone, electricity, farm share of auto expense, liability insurance, and miscellaneous charges were included. The overhead items and costs are shown in Appendix B.

This overhead charge was estimated to be $1,073.24 for a typical farm and was added to the specified net income when programmed to include the cost of these items in the optimal solutions.

VIII. ENTERPRISES CONSIDERED

Cotton. Cotton could be grown on Soils I, II, III, and/or IV. The base price was 31.2 cents per pound of lint, with price variations ranging from 20.8 cents to 36.4 cents per pound of lint. Cotton allotments were based on the 1963 allotment level and total acres in the farm and were varied from 55 percent to 115 percent of this level. The cotton allotment-price combinations considered in the study are shown in Table X.

The cotton program authorized under the Food and Agriculture Act of 1965, designed to reduce cotton production, reduce Government costs, and keep cotton competitively priced without reducing farmer's income, was not considered in this study. However, this study should give farmers more information for decision-making when considering the alternatives under the new program.

Corn. Corn could be grown on Soils I, II, III, and/or IV. Corn could be utilized only by the livestock enterprises. It was assumed that corn could not be bought nor sold.

Soybeans. In line with the Regional Resource Study, the price of soybeans was assumed to be $2.00 per bushel. They could be grown on Soils I, II, III, and IV. Four additional situations were considered, three with cotton allotment and all other factors and products at

TABLE X

COTTON PRICE-ALLOTMENT COMBINATIONS PROGRAMMED, BROWN SOIL AREA OF WEST TENNESSEE

Price of Cotton per Pound (Cents)	Level of Allotment[a]			
	55	85	100	115
20.8			X	X
26.0		X	X	X
31.2	X	X	X	X
36.4	X	X	X	

[a]Percent of the 1963 Allotment. Allotment levels for 1963 for each county were taken from Federal Register of December 6, 1962.

current price with variations in cotton price and one without cotton allotments and all factors and products at current price. In these situations, soybeans were priced at $2.40, which was close to current price.

Oats. Oats could be grown on Soils I, II, III, and/or IV. They were followed by lespedeza hay and lespedeza pasture. In the programming model, 2.1 bushels of oats were considered to be equal to one bushel of corn and oats were shown in the optimal solution in terms of corn equivalents.

Swine. Each unit of the swine enterprise consisted of twelve sows. Two swine systems, designated as Swine I and Swine II were included as alternatives. Swine I was a slaughter hog operation. The pigs were assumed farrowed and kept until they reached 210 pounds and then sold as slaughter hogs. The price was assumed to be $14.50 per hundredweight for slaughter hogs. Swine II was a feeder pig operation. Pigs were farrowed and sold at weaning time as feeder pigs. The feeder pig price was assumed to be $10.50 per pig.

Orchardgrass-ladino pasture costs were included in the swine budgets. Six acres of pasture were required for each unit of Swine I and three acres of pasture were required for each unit of Swine II.

Beef. A total of three beef enterprises were considered. These will be designated as Beef I, Beef II, and Beef III. Each unit of beef consisted of a twenty-five brood cow herd. Beef I was a beef cow-calf enterprise with calves being sold as 500-pound feeders. The calves

would be dropped in February and sold in October. The calves were assumed to have gained 1.9 pounds per day for 240 days. The assumed price for feeder calves was $22.50 per hundredweight.

Beef II was also a beef cow-calf operation but included feeding and finishing the heifers and steers in confinement following weaning at 500 pounds with no pasture. Calves would be dropped in February and kept with cow for about 6 to 7 months. Both heifers and steers would be wintered on a limited grain ration until reaching a weight of about 710 pounds. Heifers would then be fed for 50 days in the spring on full feed and sold at 810 pounds in May. The steers were assumed full-fed for 116 days and sold in July at 1,000 pounds. The assumed price for both heifers and steers was $23.50 per hundredweight.

Beef III was a beef cow-calf enterprise similar to Beef II with the exception that steers were assumed pastured for 80 days following the wintering period and fed finishing ration for 76 days. The heifers would be sold in May and the steers in September. The assumed prices were the same as for Beef I and Beef II.

Dairy. A dairy operation which could produce milk for manufacturing purposes was also included as an alternative. The unit consisted of ten cows with a production rate of 7,500 pounds of 4 percent milk per cow. The milk price was $3.30 per hundredweight. Surplus heifers were assumed sold for $175 each and three-day-old calves were assumed sold for $7.50 each.

Forage. Pasture and hay could be grown on every soil group to obtain feed for livestock. Pasture could be obtained from orchardgrass-ladino, lespedeza, and coastal bermuda-ladino. Hay could be produced by alfalfa, lespedeza, orchardgrass-ladino, and red clover hay crops. Yields of each crop varied by soil group as shown earlier. The programming model required not only that adequate total pasture be available but also that the pasture production be properly distributed seasonally to meet the needs of the livestock system. Seasonal distribution of the forage growth for each pasture species and seasonal pasture requirement for the livestock alternatives is shown in Appendix E.

Hay selling. Hay could be grown on each soil group. Hay selling was included as an alternative. All hay was sold in terms of an alfalfa equivalent valued at $25.50 per ton. Lespedeza and red clover hay were considered to contain 90 percent of the feed equivalent of a ton of alfalfa and orchardgrass-ladino was assumed to contain 80 percent of the feed value of alfalfa. No restriction was placed on the hay selling activity.

CHAPTER IV

PROGRAMMING RESULTS

The optimal solutions obtained from the linear programming analysis are presented in this chapter. The first section presents the minimum land requirements and other requisites for a $5,000 farm income under the various cotton price-allotment combinations. The second section shows the effects of variations in land price on minimum land requirements. The third section presents the effect of variations in labor price on minimal land requirements. The last section compares the results obtained with soybeans priced at $2.40 per bushel and $2.00 per bushel.

I. EFFECTS OF VARIATIONS IN COTTON PRICE AND ALLOTMENTS ON MINIMUM LAND REQUIREMENTS FOR $5,000 FARM INCOME

Estimates of minimum land requirements and associated enterprise organization for $5,000 net return were made at allotment levels of 55, 85, 100, and 115 percent of 1963 allotment level and with cotton lint prices of 20.8, 26.0, 31.2, and 36.0 cents per pound. All of the points considered were presumed to lie above the free market demand curve for cotton and thus to represent varying levels of Governmental expenditures to support these cotton prices given the acreage allotment. Since over 16 percent of farms in the Brown Soil Area have no cotton allotment,

estimates of minimum land requirements were also made for situations with zero allotments. In the analysis land and labor price were considered at $206 per acre and $0.75 per hour with cotton allotments, while land price was considered at $180 per acre with no cotton allotment.

55 percent of the 1963 allotment. The initial situation was programmed with cotton allotment at 55 percent of the 1963 allotment level and with cotton price at 31.2 cents and 36.4 cents per pound of lint. At the 55 percent allotment level, the maximum acres of cotton was 9.65 percent of total acres.

A minimum of 260 acres of land were required when the price of cotton was considered at 31.2 cents. The enterprise organization and resource requirements for this system is shown in Table XI. The optimal system included 185.6 acres of openland. When cotton price was increased to 36.4 cents, an increase of 16.7 percent, minimum land requirements were reduced by 18.1 percent, to 212.9 acres. Thus, for every 1 percent increase in cotton price, the minimum land requirements were reduced by 1.08 percent.

The enterprise organization, at the two cotton price levels were very similar. Cotton, corn, orchardgrass-ladino pasture, oat-lespedeza hay enterprises, and pasture for hogs were included in both the optimal cropping systems. The acreage of these enterprises decreased almost proportionally as the price of cotton increased and the amount of land required decreased. Cotton was included in both solutions at the maximum

TABLE XI

ESTIMATED MINIMUM LAND REQUIREMENTS AND OTHER REQUISITES FOR A $5,000 RETURN TO OPERATOR'S LABOR AND MANAGEMENT WITH COTTON ALLOTMENT AT 55 PERCENT OF THE 1963 ALLOTMENT, BROWN SOIL AREA OF WEST TENNESSEE

Item	Unit	Cotton Price (Cents Per Pound)	
		31.2	36.4
Total acres	Acre	260.0	212.9
Total acres openland	Acre	185.6	152.0
Cotton allotment available	Acre	25.1	20.5
CROPS:			
Cotton	Acre	25.1	20.5
Corn	Acre	55.2	45.2
O.G.-ladino pasture	Acre	49.2	40.4
Oat-lespedeza hay	Acre	42.3	22.7
Oat-lespedeza pasture	Acre		12.2
Pasture for hogs	Acre	13.8	11.0
HAY SOLD:			
Total	Tons	19.7	3.8
LIVESTOCK:			
Dairy	Cows	8.0	13.7
Swine I	Sows	27.6	22.0
Beef III	Cows	5.7	
LABOR USED:			
Operator	Hour	2865	2865
Hired seasonal	Hour	420	293
Total	Hour	3285	3158
INVESTMENT CAPITAL:			
Land	Dollars	53560	43857
Machinery and equipment	Dollars	7104	6024
Livestock and livestock equipment	Dollars	9576	8509
Total	Dollars	70240	58390

TABLE XI (continued)

Item	Unit	Cotton Price (Cents Per Pound) 31.2	36.4
OPERATING CAPITAL:			
Total	Dollars	3860	3091
RETURNS:			
Gross receipts	Dollars	22573	19835
Operating and overhead expense	Dollars	14635	12429
Land charge	Dollars	2938	2406
Returns to operator's labor and management	Dollars	5000	5000

allowable acreage. At 36.4 cent cotton, oat-lespedeza pasture was included in the solution at a level of 12.2 acres to provide more forage for the larger dairy system.

Dairy, Swine I (market hogs), and Beef III (finished heifers and steers on pasture) were included in the solution at levels of 8 dairy cows, 27.6 sows, and 5.7 beef cows, respectively, when cotton was considered at 31.2 cents. When cotton price was increased to 36.4 cents per pound, only dairy (13.7 dairy cows) and Swine I (22.0 sows) were included in the livestock system. Hay, not utilized by the livestock enterprises, was assumed to be sold in both systems. The tonnage sold would decrease from 19.7 tons to 3.8 tons as cotton price increased from 31.2 cents to 36.4 cents per pound.

All the available operator labor was utilized at both cotton price levels. Hired seasonal labor at 75 cents per hour was included in both solutions but decreased from 420 to 293 hours as cotton price increased from 31.2 cents to 36.4 cents per pound.

The total capital investment required decreased from $70,240 to $58,390. The major portion of this reduction is due to less capital investment in land as cotton price increased.

Gross farm receipts of $22,573 and $19,835 necessary to return $5,000 to operator's labor and management were high enough to classify these situations as a Class II and a Class III farm as defined by the 1959 Census of Agriculture.

85 percent of the 1963 allotment. Three cotton prices were considered with cotton allotments at 85 percent of the 1963 allotment level to determine the influence on minimum land requirements. At the 85 percent level, maximum cotton acreage was 14.92 percent of the total acres. As shown in Table XII, minimum land required for a $5,000 farm income was 320.6 acres, 224.2 acres, and 179.5 acres with cotton price at 26.0 cents, 31.2 cents, and 36.4 cents per pound. When cotton price was increased from 26 cents to 31.2 cents per pound, an increase of 20 percent, minimum land required decreased by 30 percent and when cotton price was increased from 31.2 cents to 36.4 cents per pound, minimum land required was decreased by 20 percent.

The enterprise organization showed only a slight change as cotton price increased. Cotton was included in all three solutions at the maximum acreage allowable. Corn, orchardgrass-ladino pasture, oat-lespedeza hay, and pasture for hogs were included in each solution; however, with an increase in cotton price from 26.0 cents to 31.2 cents per pound, 16.5 acres of oats-lespedeza pasture were included and as cotton price increased to 36.4 cents per pound, 10.9 acres of orchardgrass-ladino pasture and hay were included. These additional forage enterprises were included to provide necessary feed for the dairy enterprise. Hay for sale was included in the first two situations, but when cotton price was increased to 36.4 cents per pound, no hay was to be sold. With cotton priced at 26 cents, 23.6 tons were assumed sold, while only 0.3 ton was to be sold with cotton at 31.2 cents.

TABLE XII

ESTIMATED MINIMUM LAND REQUIREMENTS AND OTHER REQUISITES FOR A $5,000 RETURN TO OPERATOR'S LABOR AND MANAGEMENT WITH COTTON ALLOTMENT AT 85 PERCENT OF THE 1963 ALLOTMENT, BROWN SOIL AREA OF WEST TENNESSEE

Item	Unit	Cotton Price (Cents Per Pound)		
		26.0	31.2	36.4
Total acres	Acre	320.6	224.2	179.5
Total acres openland	Acre	228.8	160.0	128.1
Cotton allotment available	Acre	47.8	33.5	26.8
CROPS:				
Cotton	Acre	47.8	33.5	26.8
Corn	Acre	51.2	35.9	28.6
O.G.-ladino pasture	Acre	62.4	43.9	35.6
O.G.-ladino pasture and hay	Acre			10.9
Oat-lespedeza hay	Acre	53.9	21.2	7.7
Oat-lespedeza pasture	Acre		16.5	12.2
Pasture for hogs	Acre	13.5	9.0	6.3
HAY SOLD:				
Total	Tons	23.6	0.3	
LIVESTOCK:				
Dairy	Cows	6.6	15.5	15.2
Swine I	Sows	27.0	18.0	12.6
Beef III	Cows	11.0		
LABOR USED:				
Operator	Hours	2865	2865	2865
Hired seasonal	Hours	713	363	30
Total	Hours	3578	3228	2895

TABLE XII (continued)

Item	Unit	Cotton Price (Cents Per Pound)		
		26.0	31.2	36.4
INVESTMENT CAPITAL:				
Land	Dollars	66043	46185	36977
Machinery and equipment	Dollars	8323	6301	5361
Livestock and livestock equipment	Dollars	10565	8296	7127
Total	Dollars	84931	60782	49465
OPERATING CAPITAL:				
Total	Dollars	4582	3075	2157
RETURNS:				
Gross receipts	Dollars	26719	20869	17602
Operating and overhead expenses	Dollars	18096	13336	10574
Land charge	Dollars	3623	2533	2028
Returns to operator's labor and management	Dollars	5000	5000	5000

Dairy Swine I and Beef III were included in the optimum system when cotton was priced at 26 cents, but when cotton price was increased to 31.2 and 36.4 cents only Swine I and Dairy were included in the optimum solution. Dairy cow numbers increased from 6.6 cows with cotton at 26.0 cents to a maximum of 15.5 cows with cotton price at 31.2 cents but decreased slightly as price increased to 36.4 cents per pound.

Capital investment decreased from $84,931 to $49,465 over the range of cotton prices for this allotment level. Investment in land decreased by 41.7 percent over the price range while investment in machinery and equipment and livestock and livestock equipment decreased by 35.5 percent and 32.5 percent, respectively.

Operator labor was fully utilized in all situations. The amount of hired labor included decreased as cotton prices increased and only 30 hours of seasonal labor were needed for the system at 36.4 cent cotton price.

Gross receipts from the first two situations were in excess of $20,000 which would classify these situations as Class II farms; however, the third situation with gross receipts of $17,602 would be classified as a Class III farm using Census classifications.

100 percent of the 1963 allotment. Four cotton price levels were considered with the cotton allotment at 100 percent of the 1963 level. Minimum land requirements varied inversely with the cotton price level (Table XIII). When cotton was priced at 20.8 cents per pound, 385.2 acres were required but as cotton price has increased to 26 cents, 31.2 cents

TABLE XIII

ESTIMATED MINIMUM LAND REQUIREMENTS AND OTHER REQUISITES FOR A $5,000 RETURN TO OPERATOR'S LABOR AND MANAGEMENT WITH COTTON ALLOTMENT AT THE 1963 ALLOTMENT LEVEL, BROWN SOIL AREA OF WEST TENNESSEE

Item	Unit	Cotton Price (Cents Per Pound)			
		20.8	26.0	31.2	36.4
Total acres	Acre	385.2	314.0	212.9	168.3
Total acres openland	Acre	274.9	224.1	160.0	120.1
Cotton allotment available	Acre	67.6	55.1	37.4	29.5
CROPS:					
Cotton	Acre		55.1	37.4	29.5
Corn	Acre	118.9	41.8	28.3	22.4
Alfalfa	Acre				6.4
O.G.-ladino pasture	Acre	69.4	62.1	43.7	46.0
O.G.-ladino pasture and hay	Acre			4.4	
Oat-lespedeza hay	Acre	59.2	53.7	16.9	
Oat-lespedeza pasture	Acre			14.4	11.4
Pasture for hogs	Acre	27.4	11.4	6.9	4.4
HAY SOLD:					
Total	Tons	23.1	24.8		
LIVESTOCK:					
Dairy	Cows		10.0	16.5	17.0
Swine I	Sows	54.9	22.8	13.8	8.3
Swine II	Sows				1.0
Beef III	Cows	19.1	7.5		
LABOR USED:					
Operator	Hour	2865	2865	2798	2600
Hired seasonal	Hour	1643	760	261	19
Total	Hour	4508	3625	3059	2619

TABLE XIII (continued)

Item	Unit	Cotton Price (Cents Per Pound)			
		20.8	26.0	31.2	36.4
INVESTMENT CAPITAL:					
Land	Dollar	79351	64684	43857	34670
Machinery and equipment	Dollar	8799	8311	6095	5190
Livestock and livestock equipment	Dollar	16501	9755	7738	6945
Total	Dollar	104651	82750	57690	46805
OPERATING CAPITAL:					
Total	Dollar	6636	4351	2689	1833
RETURNS:					
Gross receipts	Dollar	29686	26680	20113	17058
Operating and overhead expense	Dollar	20333	18132	12707	10156
Land charge	Dollar	4353	3548	2406	1902
Returns to operator's labor and management	Dollar	5000	5000	5000	5000

and 36.4 cents per pound, 314.0 acres, 212.9 acres and 168.3 acres of land were required to satisfy the requirements for a $5,000 farm income.

Minimum land required was reduced by 18.4 percent as cotton price was increased from 20.8 cents to 26 cents per pound, 32.1 percent when price increased from 26 cents to 31.2 cents per pound and 20.9 percent as price was increased from 31.2 cents to 36.4 cents per pound. Over the range of cotton prices considered, a 1 percent increase in cotton price was associated with a reduction of 0.75 percent in the minimum land required.

No cotton was included in the optimum system for the 20.8 cent price level. A total of 67.6 acres of cotton allotment was available but with this low price, cotton production was not profitable enough to be included in the optimal solution. When cotton price was increased to 26 cents and above, the maximum allowable acreage of cotton was grown.

Corn was included on Soils I, II, III, and IV in the solution at 20.8 cents with 118.9 acres grown but with cotton included in the solutions at 26 cents, 31.2 cents, and 36.4 cents, corn production was limited to a portion of Soil I and Soil III. Forage production decreased as the minimum acreage required decreased. Orchardgrass-ladino pasture was grown on 69.4 acres when cotton price was 20.8 cents, but was reduced to 46 acres when the maximum cotton price was considered. Oat-lespedeza hay was included in the first three solutions but was not included in the solution when cotton price was set at 36.4 cents. Oat-lespedeza pasture was included in solution when cotton price was increased to 31.2 cents to provide forage for the dairy enterprise. Alfalfa hay would be

produced on Soil III at the 36.4 cent cotton price. Orchardgrass-ladino pasture and hay were included in the solutions at 31.2 cents and 36.4 cent cotton.

Hay to be sold was included in the optimum system at the two lower cotton prices, but as price was increased to 31.2 cents and above, hay would be utilized by the dairy enterprise and none would be sold. The livestock arrangement changed from Swine I and Beef III at 20.8 cents to Swine I and Dairy at 31.2 cents and 36.4 cents cotton price. The main livestock enterprise in the first two situations was Swine I. This enterprise was at a level of 54.9 sows at 20.8 cent cotton and 22.8 sows at 26 cent cotton and would involve production of 828 and 344 market hogs, respectively, to be sold at 210 pounds each. With cotton priced at 26 cents, both the Dairy enterprise and Beef III were included in the solution; however, as cotton price was increased to 31.2 and 36.4 cents per pound, Beef III was not included. Dairy cow numbers varied from 10 cows at 26 cent cotton to 17 cows at 36.4 cent cotton. The number of sows decreased from 54.9 to 8.3 sows as the cotton price was increased from the lowest to the highest level. One sow, to produce feeder pigs, was included in the optimum solution when cotton price was at the 36.4 cent per pound level.

Total labor required decreased by 41.9 percent as cotton price was increased from 20.8 cents to 36.4 cents. A total of 4,508 hours were required when cotton was priced at 20.8 cents while only 2,619 hours would be needed at the 36.4 cent cotton price. Operator's labor would be fully utilized at the two lower cotton prices but a small

amount of operator labor would be idle at the two highest cotton prices. The solution at the 20.8 cent cotton price required 1,643 hours of hired seasonal labor or nearly six-tenths of one full-time man. For this system, hired labor would be required in all six labor periods. Hired labor required decreased as cotton price increased and only 19 hours would be required in labor period two at the highest cotton price considered.

A capital investment of $104,651 was required at the 20.8 cent cotton price level, while an investment of $46,805 was required at the maximum cotton price of 36.4 cents. Investment in livestock and livestock equipment decreased by 57.9 percent while machinery and equipment investment decreased by 41 percent. Operating capital requirements were reduced by approximately 72 percent as the minimum land required decreased. Crop acreage decreased as farm size decreased which required less operating capital and the size of the dairy enterprise increased with the reduction in farm size. In the model, no operating capital was required for the dairy operation.

Gross receipts for the solutions at 20.8 cents, 26 cents, and 31.2 cents were in excess of $20,000 and high enough to classify these farm sizes as Class II farms while the optimal system for 36.4 cent cotton would return $17,058 in gross receipts and could be classified as a Class III farm.

115 percent of the 1963 allotment. Cotton prices of 20.8 cents, 26 cents, and 31.2 cents per pound were considered with the cotton allotments at

115 percent of the 1963 levels. Maximum cotton acreage was 20.18 percent of the total acres. Optimal solutions for these situations are presented in Table XIV.

The solution obtained at the 20.8 cent cotton price at this allotment level was the same as the solution for the same cotton price at the 100 percent allotment level. Both systems required a minimum of 385.2 acres of land and neither included cotton in the optimum solution. At 20.8 cent cotton price, corn was included on Soils I, II, III, and IV at a level of 118.9 total acres but when cotton price was increased to 26 cents and 31.2 cents, cotton was included in the optimum solutions and replaced corn on Soils I, II, and IV. Cotton was included at the maximum allowable acreage at the two highest cotton prices. With cotton in the optimum solutions at 26 cents and 31.2 cents per pound, land requirements were reduced to 307.8 acres and 202.8 acres, respectively.

Orchardgrass-ladino pasture and lespedeza hay, 69.4 and 59.2 acres, respectively, were required to furnish needed forage for the livestock enterprises at the 20.8 and 26 cent cotton price levels. With an increase in cotton price to 31.2 cent per pound, orchardgrass-ladino pasture and hay (9.6 acres) and oat-lespedeza pasture (13.7 acres) were included to produce the necessary feed for the increase in the dairy enterprise.

Hay sales were included at cotton prices of 20.8 cents and 26 cents per pound but with cotton price at 31.2 cents, all the hay produced would be utilized by the dairy enterprise.

TABLE XIV

ESTIMATED MINIMUM LAND REQUIREMENTS AND OTHER REQUISITES FOR A $5,000 RETURN TO OPERATOR'S LABOR AND MANAGEMENT WITH COTTON ALLOTMENT AT 115 PERCENT OF THE 1963 ALLOTMENT, BROWN SOIL AREA OF WEST TENNESSEE

Item	Unit	Cotton Price (Cents Per Pound)		
		20.8	26.0	31.2
Total acres	Acre	385.2	307.8	202.8
Total acres openland	Acre	274.9	219.7	144.7
Cotton allotment available	Acre	77.7	62.1	40.9
CROPS:				
Cotton	Acre		62.1	40.9
Corn	Acre	118.9	32.9	21.7
O.G.-ladino pasture	Acre	69.4	61.7	42.0
O.G.-ladino pasture and hay	Acre			9.6
Oat-lespedeza hay	Acre	59.2	53.6	11.7
Oat-lespedeza pasture	Acre			13.7
Pasture for hogs	Acre	27.4	9.4	5.1
HAY SOLD:				
Total	Tons	23.1	26.0	
LIVESTOCK:				
Dairy	Cows		13.2	17.2
Swine I	Sows	54.9	18.8	10.1
Beef III	Cows	19.1	4.3	
LABOR USED:				
Operator	Hour	2865	2865	2781
Hired seasonal	Hour	1643	804	172
Total	Hour	4508	3669	2953

TABLE XIV (continued)

Item	Unit	Cotton Price (Cents Per Pound)		
		20.8	26.0	31.2
INVESTMENT CAPITAL:				
Land	Dollar	79351	63407	41777
Machinery and equipment	Dollar	8799	8870	5908
Livestock and livestock equipment	Dollar	16501	8377	7216
Total	Dollar	104651	80654	54901
OPERATING CAPITAL:				
Total	Dollar	6636	4130	2347
RETURNS:				
Gross receipts	Dollar	29686	26643	19443
Operating and overhead expense	Dollar	20333	18165	12151
Land charge	Dollar	4353	3478	2292
Returns to operator's labor and management	Dollar	5000	5000	5000

Swine I and Beef III were the only livestock enterprises included with cotton price at 20.8 cents, but as cotton price was increased, swine numbers decreased, beef cows decreased and the dairy enterprise entered the solutions and became increasingly competitive with Beef III. Cotton production required the use of Soils I, II, and IV and was competitive with the corn enterprise. Since corn buying was not permitted, as corn acreage was reduced, swine numbers were also reduced. When cotton was priced at 31.2 cents, the dairy enterprise replaced Beef III as compared to the 20.8 cent and 26 cent levels but Swine I remained at a level of 10.1 sows which would produce 152 market hogs per year.

All available operator's labor and 1,643 hours and 804 hours of hired seasonal labor were required with cotton prices at 20.8 and 26 cents per pound. A total of 2,953 hours were required when cotton price was increased to 31.2 cents. Of the total, 172 hours were hired seasonal labor.

Investment capital of $104,651, $80,654 and $54,901 were required for the optimum systems at the three cotton price levels. Investments in livestock and livestock equipment would be reduced by nearly one-half as cotton price increased from 20.8 cents to 31.2 cents. Investment in machinery and equipment was greater at the 26 and 31.2 cent price levels since the cotton acreage required the use of more machinery. Operating capital decreased as farm size decreased.

Gross farm receipts of $29,686, $26,643, and $19,443 were required to return a $5,000 farm income with cotton price at 20.8 cents, 26 cents, and 31.2 cents, respectively.

No cotton allotment. The optimum solution with no cotton allotment and land valued at $180 per acre, required a minimum of 340.9 acres, of which 243.3 acres were openland. Enterprises, investments and labor use for this optimal system are shown in Table XV.

Corn, orchardgrass-ladino pasture, oat-lespedeza hay, and pasture for hogs were the land use activities included. Corn was included at a level of 105.2 acres while orchardgrass-ladino pasture and oat-lespedeza hay were to utilize 61.4 acres and 52.4 acres, respectively. Pasture for hogs accounted for 24.3 acres. Twenty and one-half tons of lespedeza hay would be sold.

The livestock system included Swine I at a level of 48.6 sows and Beef III at a level of 16.9 cows. This would permit the sale of 733 market hogs and 12 heifers and steers.

A total of 3,990 hours of labor would be required in this system, of which 1,125 hours would be seasonal labor hired at 75 cents per hour.

Investment capital totaled $84,040 of which 73 percent was in land. Investment in livestock and livestock equipment was $14,607, largely for the swine operation. Operating capital required was $5,750.

This farm system would produce estimated gross receipts of $26,302. Nearly 90 percent of the gross income would result from the sale of market hogs.

TABLE XV

ESTIMATED MINIMUM LAND REQUIREMENTS AND OTHER REQUISITES FOR A $5,000 RETURN TO OPERATOR'S LABOR AND MANAGEMENT WITH NO COTTON ALLOTMENT, BROWN SOIL AREA OF WEST TENNESSEE

Item	Unit	Amount
Total acres	Acre	340.9
Total acres openland	Acre	243.3
CROPS:		
Corn	Acre	105.2
O.G.-ladino pasture	Acre	61.4
Oat-lespedeza hay	Acre	52.4
Pasture for hogs	Acre	24.3
HAY SOLD:		
Total	Tons	20.5
LIVESTOCK:		
Swine I	Sows	48.6
Beef III	Cows	16.9
LABOR USED:		
Operator	Hour	2865
Hired seasonal	Hour	1125
Total	Hour	3990
INVESTMENT CAPITAL:		
Land	Dollar	61362
Machinery and equipment	Dollar	8071
Livestock and livestock equipment	Dollar	14607
Total	Dollar	84040
OPERATING CAPITAL:		
Total	Dollar	5750

TABLE XV (continued)

Item	Unit	Amount
RETURNS:		
Gross receipts	Dollar	26302
Operating and overhead expense	Dollar	17893
Land charge	Dollar	3409
Returns to operator's labor and management	Dollar	5000

II. EFFECTS OF VARIATIONS IN LAND PRICES ON MINIMUM LAND REQUIREMENTS FOR A $5,000 FARM INCOME

With cotton allotments. Optimum systems for the land minimization model were determined with land prices at the estimated 1963 land price, with variations at 50 percent below and 50 and 100 percent above this level. For the cotton allotment situations assumed, cotton allotment value was included in the land price. Each acre of cotton allotment was valued at $150. Land prices of $103, $206, $309, and $412 per acre were used. The $206 per acre price was the estimated 1963 average land price in the area including $26 average per acre for the proportionate amount of cotton allotment associated with land acreage.[1] In the discussion below dealing with the effects of land price variations on minimum land requirements, cotton allotments were set at the 100 percent level and cotton price at 31.2 cents.

With land price at $206 per acre, the minimum land requirements to produce a $5,000 net return to operator's labor and management was 212.9 acres, as shown in Table XVI. A decrease of 50 percent in land value to $103 per acre in each case brought about a reduction of 18.2 percent in land required while increases of 50 and 100 percent in land values above the 1963 level (to $309 and $412 per acre, respectively) required increases of 35.8 percent and 120 percent in the minimum land requirements.

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[1] At the 100 percent cotton allotment (1963 levels) each acre of land was assumed to be associated with 0.1755 acre of cotton allotment.

TABLE XVI

EFFECTS OF VARIATIONS IN LAND PRICE ON MINIMUM LAND REQUIREMENTS AND OTHER REQUISITES FOR $5,000 RETURN TO OPERATOR'S LABOR AND MANAGEMENT WITH 1963 COTTON PRICE-ALLOTMENT LEVELS, BROWN SOIL AREA OF WEST TENNESSEE

Item	Unit	Value Per Acre			
		$103	$206	$309	$412
Total acres	Acre	174.0	212.9	289.3	468.1
Total acres openland	Acre	124.2	160.0	206.5	334.1
Cotton allotment available	Acre	30.5	37.4	50.8	82.2
CROPS:					
Cotton	Acre	30.5	37.4	50.7	82.1
Corn	Acre	23.2	28.3	38.5	62.4
Alfalfa	Acre	5.4			
O.G.-ladino pasture	Acre	42.8	43.8	57.3	92.3
O.G.-ladino pasture and hay	Acre	3.0	4.4		
Oat-lespedeza hay	Acre		16.8	49.5	79.9
Oat-lespedeza pasture	Acre	14.6	14.4		
Pasture for hogs	Acre	4.7	6.9	10.5	17.4
HAY SOLD:					
Total	Tons			24.1	31.0
LIVESTOCK:					
Dairy	Cows	16.8	16.5	12.2	
Swine I	Sows	9.4	13.8	20.9	34.7
Beef III	Cows			4.0	26.0
LABOR USED:					
Operator	Hour	2629	2798	2865	2865
Hired seasonal	Hour	23	261	563	1533
Total	Hour	2652	3059	3428	4398

TABLE XVI (continued)

Item	Unit	Value Per Acre			
		$103	$206	$309	$412
INVESTMENT CAPITAL:					
Land	Dollar	17922	43857	89394	192857
Machinery and equipment	Dollar	5297	6095	7850	11172
Livestock and livestock equipment	Dollar	6952	7738	8991	14509
Total	Dollar	30171	57690	106235	218538
OPERATING CAPITAL:					
Total	Dollar	1936	2689	3977	6746
RETURNS:					
Gross receipts	Dollar	16480	20113	26678	41186
Operating and overhead expense	Dollar	10410	12707	16919	26075
Land charge	Dollar	1070	2406	4759	10111
Returns to operator's labor and management	Dollar	5000	5000	5000	5000

Only small changes were recorded in the optimum enterprise organization as the price of land was varied. Cotton was included in all the optimum arrangements at the maximum acreage allowable. Both cotton and corn acreage increased in direct proportion to increases in land required. Forage requirements for the dairy enterprise were supplied by orchardgrass-ladino pasture and hay, oat-lespedeza hay, and oat-lespedeza pasture in the base situation ($206 land price). At a land price of $103, 50 percent of the 1963 land price, alfalfa hay was included at a level of 5.4 acres and oat-lespedeza hay production was not included. When land values were considered at 50 and 100 percent above the base, orchardgrass-ladino pasture and oat-lespedeza hay were included to supply forage necessary for the beef and dairy cows. The acreage of these crops increased as minimum land requirements increased.

All hay was utilized by the dairy enterprise in the base situation and with land valued at $103 per acre, but 24.1 tons and 31 tons of lespedeza would be sold when land values were increased by 50 and 100 percent above the base price.

The livestock system consisted of Dairy and Swine I for both the base and $103 land price. As land price was increased to $309 per acre, Beef III was included in the solution. With an increase in land value to $412 per acre, Dairy was not in the optimum solution and only Swine I and Beef III were included.

The base situation ($206 land price) required 3,059 hours of labor, of which 261 hours were seasonal hired labor. All operator's labor was completely utilized at land prices of $309 and $412 per acre but smaller

quantities were used at the two lower land prices. The amount of hired seasonal labor, valued at 75 cents per hour, varied from 23 hours with land valued at $103 to 1,533 hours with land valued at $412 per acre.

Capital investment decreased by 47 percent as land price decreased by 50 percent below the base situation but increased by 84 percent and 279 percent as land price increased by 50 percent and 100 percent above the base price. Investment in land accounted for 88 percent of the total investment with land valued at $412 per acre. Operating capital required increased as farm size and land values increased as a result of additional acreages of crops being produced.

Gross receipts of $16,480 were required with land valued at $103 to produce a $5,000 farm income. With land valued at $206 and $309 per acre, gross receipts of $20,113 and $26,678 were required to satisfy these requirements while gross receipts of $41,186 were required with land priced at $412 per acre. The first situation could be classified as Class III farm, gross receipts $10,000 to $19,999, the next two as Class II farms, gross receipts of $20,000 to $39,999, and the last a Class I farm with gross receipts of over $40,000.

Without cotton allotments. Land prices were also varied in situations with no cotton allotments to determine the minimum requirements necessary to return a $5,000 farm income. The 1963 value of land on farms without allotments was estimated to be $180 per acre. Additional situations were included with land priced at $90, $270, and $360 per acre to represent points of 50 percent, 150 percent, and 200 percent

of the 1963 land price level. The optimum systems derived at each of these land price levels is shown in Table XVII.

With land priced at $180 per acre, minimum land requirement was 340.9 acres. A 50 percent decrease in land price ($90 per acre) brought about a 28 percent reduction in land required to 244.2 acres, while increases of 50 percent ($270 per acre) and 100 percent ($360 per acre) in land price required an increase of 65 percent and 388 percent in land requirements, to 565.8 acres and 1,662.8 acres, respectively.

The optimum crop enterprise organization was the same for all four situations. Corn, orchardgrass-ladino pasture, oats-lespedeza hay, and pasture for hogs were included in all optimal solutions. The acreage of these crops increased in direct proportions to increases in land required, with the exception of orchardgrass-ladino pasture and oat-lespedeza hay in the situation with land valued at 100 percent above the base. In this situation, the increase was slightly higher for these two enterprises than the percentage increase in total acres. In all solutions corn and oats would be utilized mainly by the swine enterprise. Pasture requirements for the livestock would be supplied by orchardgrass-ladino and hay requirements from lespedeza.

Hay sales varied in direct proportion to increases in land required, with an exception of the situation for land valued at $90 per acre. In this situation, slightly less hay would be sold because the dairy enterprise would utilize more of the hay produced than beef cows in the other situations.

TABLE XVII

EFFECTS OF VARIATIONS IN LAND PRICE ON MINIMUM LAND REQUIREMENTS AND OTHER REQUISITES FOR $5,000 RETURN TO OPERATOR'S LABOR AND MANAGEMENT WITH NO COTTON ALLOTMENT, BROWN SOIL AREA OF WEST TENNESSEE

Item	Unit	Value Per Acre			
		$90	$180	$270	$360
Total acres	Acre	244.2	340.9	565.8	1662.8
Total acres openland	Acre	174.3	243.3	403.8	1186.9
CROPS:					
Corn	Acre	75.4	105.2	174.7	513.3
O.G.-ladino pasture	Acre	44.0	61.4	101.9	299.6
Oats-lespedeza hay	Acre	37.6	52.4	86.9	255.5
Pasture for hogs	Acre	17.3	24.3	40.3	118.5
HAY SOLD:					
Total	Tons	16.0	20.5	34.0	99.9
LIVESTOCK:					
Dairy	Cows	3.2			
Swine I	Sows	34.7	48.6	80.7	237.0
Beef III	Cows	9.0	16.9	28.0	82.5
LABOR USED:					
Operator	Hour	2865	2865	2865	2865
Hired seasonal	Hour	209	1125	3758	16598
Total	Hour	3074	3990	6623	19463
INVESTMENT CAPITAL:					
Land	Dollar	21978	61362	152766	598608
Machinery and equipment	Dollar	6481	8071	11773	29825
Livestock and livestock equipment	Dollar	10469	14607	24242	71235
Total	Dollar	38928	84040	188781	699668

TABLE XVII (continued)

Item	Unit	Value Per Acre			
		$90	$180	$270	$360
OPERATING CAPITAL:					
Total	Dollar	3871	5750	10253	32210
RETURNS:					
Gross receipts	Dollar	19159	26302	43674	128319
Operating and overhead expense	Dollar	12816	17893	30470	91726
Land charge	Dollar	1343	3409	8204	31593
Returns to operator's labor and management	Dollar	5000	5000	5000	5000

The optimum livestock organization included increased size of Swine I and Beef III enterprises, as farm acreage required increased. When land was valued at $90 per acre, 3.2 dairy cows were included but the dairy enterprise was omitted from the solution when the price of land was increased to $180 per acre and above. The swine enterprise increased from 34.7 sows with land valued at $90 per acre to 237 sows when land was considered at $360 per acre. The number of market hogs would increase from 521 to 3,555 as land price was increased from the lowest to the highest level. The number of sows and market hogs in the optimum solutions increased by 387 percent when land price was increased by 100 percent above the 1963 land price. The beef enterprise increased from 9 cows to 82.5 cows as land price increased from $90 to $360 per acre.

All operator's labor would be utilized in each of the situations and increasing amounts of hired seasonal labor would be required as land price and farm size increased. As land price increased to $360 per acre, a total of 19,463 hours of labor or the equivalent of nearly 7 full time laborers would be required. In the situation with land price at $270 per acre, 2.3 full time laborers would be required.

Capital investment ranged from $38,928 when land was priced at $90 per acre to $699,668 for land valued at $360 per acre. Investment in land ranged from 56 percent to over 83 percent of the total investment. Total investment, when land price was considered at $360 per acre, increased by over 732 percent when compared with the base situation.

Operating capital increased over the range of land prices from $3,871 to $32,210.

Gross receipts of $19,159, $26,302, $43,674, and $128,319 were required to return $5,000 to operator's labor and management for the four situations. These receipts would classify the farms as a Class III, a Class II, and two Class I farms.

III. EFFECTS OF VARIATIONS IN LABOR PRICES ON MINIMUM LAND REQUIREMENTS FOR A $5,000 FARM INCOME

Labor prices were programmed at the 1963 price and at 50 percent and 100 percent above this level to determine the effect on minimum land requirements. For this analysis, cotton allotment was set at the 100 percent level and cotton price was assumed to be 31.2 cents per pound of lint. The estimated 1963 land price, on farms with allotments, of $206 per acre was assumed.

When the estimated 1963 labor price of 75 cents per hour was used, minimum land required was 212.9 acres (Table XVIII). As labor price was increased to $1.125 and $1.50 per hour, only slight increases were needed in land requirements and optimum enterprise organization changed only slightly. A 50 percent increase in labor price required only 1.4 percent more land while an increase in labor price of 100 percent above the base price required only a 2.7 percent increase in land requirements.

Cotton was included at the maximum acreage allowable in all situations. Both cotton and corn acreage increased in direct proportion to the amount of land required. Forage would be supplied for the dairy

TABLE XVIII

EFFECTS OF VARIATIONS IN LABOR PRICE ON MINIMUM LAND REQUIREMENTS AND OTHER REQUISITES FOR $5,000 RETURN TO OPERATOR'S LABOR AND MANAGEMENT WITH 1963 COTTON PRICE-ALLOTMENT LEVELS, BROWN SOIL AREA OF WEST TENNESSEE

Item	Unit	Labor Price Per Hour		
		$0.75	$1.125	$1.50
Total acres	Acre	212.9	216.0	218.8
Total acres openland	Acre	160.0	154.2	156.2
Cotton allotment available	Acre	37.4	37.9	38.4
CROPS:				
Cotton	Acre	37.4	37.9	38.4
Corn	Acre	28.3	28.8	29.1
O.G.-ladino pasture	Acre	43.8	41.1	41.1
O.G.-ladino pasture and hay	Acre	4.4	9.9	9.5
Oats-lespedeza hay	Acre	16.8	29.4	30.8
Oats-lespedeza pasture	Acre	14.4		
Pasture for hogs	Acre	6.9	7.1	7.3
HAY SOLD:				
Total	Tons		19.9	20.8
LIVESTOCK:				
Dairy	Cows	16.5	14.0	13.7
Swine I	Sows	13.8	14.2	14.6
LABOR:				
Operator	Hour	2798	2785	2794
Hired seasonal	Hour	261	133	145
Total	Hour	3059	2918	2939

TABLE XVIII (continued)

Item	Unit	Labor Price Per Hour		
		$0.75	$1.125	$1.50
INVESTMENT CAPITAL:				
Land	Dollar	43857	44496	45073
Machinery and equipment	Dollar	6095	6375	6451
Livestock and livestock equipment	Dollar	7738	7031	7045
Total	Dollar	57690	57902	58569
OPERATING CAPITAL:				
Total	Dollar	2689	2683	2774
RETURNS:				
Gross receipts	Dollar	20113	20164	20431
Operating and overhead expense	Dollar	12707	12723	12958
Land charge	Dollar	2406	2441	2473
Returns to operator's labor and management	Dollar	5000	5000	5000

enterprise by orchardgrass-ladino pasture, orchardgrass-ladino pasture and hay, and oat-lespedeza hay. In the base situation (75 cent labor price) 14.4 acres of oat-lespedeza pasture were also included. Acreage of orchardgrass-ladino pasture decreased as land required increased while orchardgrass-ladino pasture and hay and oat-lespedeza hay increased. Pasture for hogs increased from 6.9 acres to 7.3 acres over the range of labor prices, in direct proportion to the size of the swine enterprise included.

All hay would be utilized for the dairy enterprise in the situation where labor was considered at 75 cents per hour but when labor price was increased to 50 and 100 percent above this price, 19.9 tons and 20.8 tons of hay to be sold were included.

The livestock system consisted of a dairy enterprise and Swine I. Dairy cow numbers decreased slightly as labor price was increased while the number of sows increased slightly. The amount of hired seasonal labor included in the optimal solutions was 261 hours at $0.75 an hour, 133 hours at $1.125 an hour, and 145 hours at $1.50 an hour. All of this hired labor would be required in labor periods II and IV, the planting and harvesting periods, with the exception of 60 hours that would be required in labor period I at the $0.75 an hour labor situation.

A 100 percent increase in labor price from the 75 cent per hour base, resulted in total capital investment increase of only $879. Investment in land and machinery and equipment, necessary for the increased crop acreage, increased but were nearly offset by a decrease in livestock and livestock equipment, as a result of a reduction in

dairy cow numbers. Operating capital requirements increased by only $85 as labor price increased by 100 percent.

Gross receipts, required to satisfy the requirements of a $5,000 net farm income, were slightly over $20,000 in each case or in the range of Class II farms.

IV. INFLUENCE OF AN INCREASE IN SOYBEAN PRICE ON MINIMUM LAND REQUIREMENTS AND OPTIMUM ENTERPRISE ORGANIZATION FOR A $5,000 FARM INCOME

Soybeans, in line with the assumptions of Regional Resource Study S-42, were priced at $2.00 per bushel; however, soybean price was increased to $2.40 per bushel, a price that more closely represents current price, to determine what effects this would have on the optimum enterprise organization and minimum land requirements. Four situations were programmed with soybean price at $2.40 per bushel, three with cotton allotments and one without cotton allotment. The situations with cotton allotments were programmed with 1963 allotment levels (100 percent) and with cotton prices of 20.8 cents, 26 cents, and 31.2 cents per pound. The land price used was the 1963 level of $206 per acre for farm situations with cotton allotments and $180 per acre for the farm situation without cotton allotments. Hired labor price of $0.75 per hour was used in all of the situations.

With cotton allotments. In the situations with cotton allotments, soybeans were included at only the 20.8 cent cotton price level. They were produced on Soil IV at a level of 6.8 acres. In this situation

they replaced 6.8 acres of corn production on Soil IV. The addition of 6.8 acres of soybeans reduced total land requirements by only 0.16 acres when compared with the situation with soybeans priced at $2.00 per bushel (Table XIII, page 46). As cotton price increased, the optimal solutions at 26 cents and 31.2 cents per pound were identical to those with soybeans priced at $2.00 and no change was recorded.

Without cotton allotments. The increase in soybean price to $2.40 per bushel as compared to $2.00 per bushel likewise had only slight effect on the minimum land requirements and enterprise organization for the situations without cotton allotments. At the $2.00 soybean price, no soybeans were included in the optimal solution and the minimum land requirements to achieve the $5,000 net income was 340.9 acres (Table XVII, page 56). At the $2.40 per bushel soybean price, 6 acres of soybeans were included and minimum land requirement was 340.8 acres, only 0.10 acre less than at the $2.00 soybean price.

Thus, it was noted that this increase in soybean price had only a slight effect, if any, on the optimum enterprise organization and minimum land requirements.

CHAPTER V

SUMMARY AND CONCLUSIONS

I. SUMMARY

The objectives of this study were: (1) to determine the minimum land requirements for a $5,000 return to operator's labor and management under alternative cotton price-allotment combinations in the Brown Soil Area of West Tennessee; (2) to determine the effects of change in land and labor prices on minimum land requirements; and (3) to determine the resource use and the enterprise organization which would be optimum under each of the situations considered.

Linear programming techniques were used to determine the minimum land requirements and optimum enterprise organization in each situation. Land was completely variable in all situations studied. A land buying activity allowed land to enter the optimum solution in any quantity necessary to satisfy the model constraints. Acres of total land was the quantity minimized in the objective function of the linear model.

Minimum land requirements and optimum enterprise organizations were computed for thirteen situations with variations in cotton price-allotment combination, eight situations with variations in land price with and without cotton allotments, three situations with variations in labor price, and four situations involving change in soybean price.

The enterprise alternatives were limited to those most commonly found in the area. Grade A dairy, horticulture crops, poultry, or

specialty crops or enterprises were not considered because adjustment opportunities involving these enterprises are not general in the area.

The results of the study showed wide variations in minimum land requirements to return a $5,000 farm income. Minimum land requirements ranged from 168.3 acres for the situation with the 1963 cotton allotment level and 36.4 cent cotton to 1,662.8 acres for the situation without cotton allotments and land price at 200 percent of the 1963 level.

As cotton-price allotment combinations were varied, minimum land requirements varied from 168.3 acres to 385.2 acres. With increases in cotton price or allotment level, the amount of land required to return $5,000 income decreased. No cotton was included in the optimal systems at 20.8 cent lint price while the maximum allowable cotton acreage was included in every case where cotton price was 26 cents per pound or above. When cotton price was set at 20.8 cents row crop acreage was used to produce corn to be used for production of slaughter hogs.

With cotton allotments at 55 percent of the 1963 allotment, 260.0 acres and 212.9 acres of land were required for the 31.2 cent and 36.4 cent cotton prices considered. When the cotton allotments were increased to 85 percent of the 1963 allotment level, 320.6 acres, 224.2 acres, and 179.5 acres of land were required for the 26.0 cent, 31.2 cent, and 36.4 cent cotton prices, respectively. Land requirements for the 100 percent allotment level were 385.2 acres, 314.0 acres, 212.9 acres, and 168.3 acres when cotton prices of 20.8 cents, 26 cents, 31.2 cents, and 36.4 cents, respectively, were considered. Minimum land requirements of 385.2 acres, 307.8 acres, and 202.8 acres were shown with cotton prices

of 20.8, 26.0, and 31.2 cents per pound and allotment levels at 115 percent of the 1963 levels.

As farm size decreased in response to changes in cotton prices or allotment levels, the farming operation became more intensive as shown by a decrease in the beef cattle and hog numbers and an increase in number of dairy cows. As farm size decreased the swine enterprise was replaced by dairy as the main livestock enterprise. Cotton was included in ten of the twelve situations and was the main cash crop. Corn, orchard grass-ladino pasture, and oat-lespedeza hay were the crops most often included along with cotton in the optimal solution. As farm size decreased, oat-lespedeza pasture and orchard grass-ladino pasture and hay were included to provide feed for livestock.

Total capital investment required varied from $46,805 to $104,651 for twelve cotton price-allotment level situations considered. Land required approximately 75 percent of the total investment, livestock and livestock equipment accounted for approximately 16 percent and machinery and equipment accounted for approximately 9 percent of the capital investment.

Labor requirements varied from 2,619 hours at the 36.4 cent cotton price and the 100 percent cotton allotment to 4,508 hours at the 20.8 cent cotton price at the same allotment level. Hired seasonal labor varied from 19 hours to 1,643 hours for the above situations.

Variations in the land prices had a direct effect on the minimum land requirements. A "base situation" using 31.2 cent cotton price and 1963 allotment levels, 1963 land price ($206 with cotton allotments and

$180 without) and 1963 labor ($0.75 per hour) was computed and used to compare the results of the variation in land price with and without cotton allotments. Minimum land requirements varied from 174 acres at 50 percent below the 1963 land price to 468 acres with land valued at 200 percent of the 1963 price for the situations with cotton allotments. A decrease in land value of 50 percent below the base to $103 brought about an 18.2 percent decrease in land requirements, while increases in land price of 50 percent ($309 per acre) and 100 percent ($412 per acre) required increases in minimum land requirements of 35.8 and 120 percent.

Land prices were also varied for situations without cotton allotments. Minimum land requirements ranged from 244.2 ($90 per acre) acres for the situation with land values at 50 percent of the 1963 price, to 1,662.8 acres with land valued at 200 percent of the 1963 land price ($360 per acre).

Variations in land price was also associated with rather large changes in total investment capital required. For the situations with cotton allotments, variations in land prices at levels of $103 per acre, $206 per acre, $309 per acre, and $412 per acre resulted in investment capital requirements of $30,171, $57,690, $106,234, and $218,538, respectively. For the situation without cotton allotments variations in land prices over the range of 50 percent to 200 percent of 1963 levels resulted in capital requirements ranging from $38,928 to $699,668. Land accounted for 56 percent of the capital investment with land valued at $90 an acre without cotton allotments and increased to 88 percent with land valued at $412 per acre with cotton allotments.

As land price increased, there was a shift to extensive farming operations. Dairy cow numbers decreased while beef cattle and hog numbers increased. The situation with land valued at $360 per acre and no cotton allotment required nearly three times as much land as any other situation studied and was considered to be an abnormal situation. In this situation, a $699,668 capital investment was required, of which 83 percent was in land. Total labor used was 19,463 hours or slightly less than seven full time men. Most of this labor was to be utilized in the swine operation of 237 sows producing 3,555 market hogs per year. Net return per acre of land was only $3.00.

Variations in labor price also had a direct but small effect on minimum land requirements. Increases in acreage of 1.4 percent and 2.7 percent were required when labor price was increased to 150 and 200 percent of the 1963 labor price. With increases in labor price, the amount of hired labor used was limited to labor periods II and IV, the planting and harvesting periods. Optimum enterprise organization varied only slightly as a result of labor price increases.

Increases in soybean price from $2.00 to $2.40 per bushel had a very small effect on the acreage of soybeans grown and minimum land required. Soybeans were not included in any of the solutions when priced at $2.00 per bushel. With a price of $2.40 per bushel, soybeans were included in the solution for the situation at the 20.8 cent cotton price and the solution for the situation with no cotton allotment. Acreage of soybeans was 6.8 and 6.0 acres, respectively. Land requirements were

reduced by only 0.16 acre for the situation with cotton priced at 20.8 cents and by only 0.1 acre for the situation with no cotton allotment.

II. CONCLUSIONS

This study does not infer that a $5,000 farm income should be a goal set for all low income farmers to reach but rather is intended to be used as a benchmark against which present farm income may be compared with semi-skilled and skilled workers in nonfarm employment. When present farm income and farm organizational situations are compared with the optimal systems obtained from this study, adjustments in the present farming systems may then be considered. Some of the needed adjustments are clearly indicated in the study but the magnitude of the change cannot be determined from these data.

Clearly indicated by the results of the study are needed adjustments in farm size and an increase in gross farm receipts if farm incomes are to be increased. At present, the average farm size in the study area is 95.5 acres, while the estimated minimum land required to return $5,000 to operator's labor and management under any of the alternative situations considered in the study was 168.3 acres. In 1959, 82.7 percent of the farms in the area were below 140 total acres of land. This research has indicated that a large reduction in the number of farms would have to occur in order that farmers might increase farm size and increase income.

In 1959, only 12.2 percent of the commercial farms in the study area had gross receipts of $10,000 to $19,999, necessary to be classified

as a Class III farm and only 4 percent had gross receipts of $20,000 to $39,999, a Class II farm as defined by the Census of Agriculture. Of the twenty-eight situations programmed in the study, only six had estimated gross farm receipts of less than $20,000 and these six were in excess of $16,000. Gross receipts for situations in the study ranged from $16,480 to $128,319 per farm.

Adjustments in the role of the farm operator are also indicated if incomes are to be increased. As farm size increases, the farm operator must become more efficient and assume a role of manager rather than a laborer. In the study, hired seasonal labor increased as farm size increased, giving the operator an increasing role as a manager. As farm size increases and hired labor becomes more important, new types of managerial skills are going to be necessary for efficient farm operation.

If the needed adjustments in farm size and changes in enterprise organization are made, then more capital would be required. Increases in farm size would require increased capital investment as would certain changes in enterprise organization. It is evident from data presented earlier in the thesis that land requirements constitute most of the capital investment in farming operations and with increasing land prices, capital problems are going to become more intense. Previous studies have indicated that many farmers can efficiently use more capital in their farming operation than they presently use but the magnitude of capital requirements are becoming so large that traditional methods of capital acquisition may not continue to give satisfactory results.

The results of this study are normative estimates of what could be considered profitable for the assumed conditions set forth in the study. The results were computed primarily for the study area but would have certain implications for other areas if adjustments were made in the assumptions.

SELECTED BIBLIOGRAPHY

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A Guide to Procedures in Southern Research Project S-42. "An Economic Appraisal of Farming Adjustment Opportunities in the Southern Region to Meet Changing Conditions--Revised." Knoxville, Tennessee: The University of Tennessee Agricultural Experiment Station, Unpublished, August, 1964.

Amick, R. J., and J. R. Allison. Minimum Land Requirements for Specified Levels of Income for General Crop-Livestock Farms in the Piedmont of Georgia. Bulletin N. S. 146. Athens, Georgia: Georgia Agricultural Experiment Station, September, 1965.

Arnold, Carl J., Ralph G. Kline, and Harold W. Walker. Farm Adjustment Opportunities, Southside Virginia. Technical Bulletin 150. Blacksburg, Virginia: Virginia Agricultural Experiment Station, May, 1961.

Cleland, Charles L. Selected Population and Agricultural Characteristics for Tennessee Counties. Bulletin 359. Knoxville, Tennessee: The University of Tennessee Agricultural Experiment Station, January, 1963.

Cowan, William Butler, Jr. "Variations in Land-Labor Resources and Optimum Enterprise Organization of Farms in the Brown Soil Area of West Tennessee. Unpublished Master's thesis, The University of Tennessee, Knoxville, December, 1964.

Johnson, D. Gale. "Comparability of Labor Capacities of Farm and Nonfarm Labor," The American Economic Review, XLIII, No. 3 (June, 1963).

Jones, G. C., P. L. Strickland, and E. J. Partenheimer. Minimum Open Land Requirements for a $5,000 Farm Income, Wiregrass Area, Lower Coastal Plains, Alabama. Agricultural Economic Series 6. Auburn, Alabama: Agricultural Experiment Station of Auburn University, July, 1965.

Lagrone, William F., James S. Plaxico, and Percy L. Strickland, Jr. Minimum Land Requirements and Adjustments for Specified Income Levels, Southwestern Oklahoma. Bulletin 608. Stillwater, Oklahoma: Oklahoma Agricultural Experiment Station, May, 1963.

Martin, Joe A., and B. H. Luebke. Types of Farming in Tennessee. Bulletin 311. Knoxville, Tennessee: The University of Tennessee Agricultural Experiment Station, March, 1960.

Tennessee Department of Agriculture. Excellence Attained, 45th Biennial Report, 1963-1964. Nashville, Tennessee: Tennessee Department of Agriculture, 1964.

Tennessee Department of Agriculture. Statistical Reporting Service, 1965 Soybean County Estimates. Nashville, Tennessee: Tennessee Crop Reporting Service, March 23, 1966.

United States Bureau of the Census. Fifteenth and Seventeenth Censuses of the United States: 1950 and 1960. Population and Agriculture. Washington: Government Printing Office.

United States Bureau of the Census. United States Census of Agriculture: 1964. Preliminary Report. Washington: Government Printing Office.

United States Department of Commerce. Statistical Abstract of the United States 1965. Washington: Government Printing Office.

APPENDIXES

APPENDIX A

PRODUCT AND INPUT PRICES

TABLE XIX

SELECTED SAMPLE OF PROJECTED PRICES RECEIVED AND PAID BY FARMERS IN THE BROWN SOIL AREA OF WEST TENNESSEE, 1963

Item	Unit	Price
PRICES RECEIVED		
Cotton lint	pound	$ .312
Cotton seed	ton	45.00
Corn	bushel	1.10
Soybeans	bushel	2.00
Hay (alfalfa equivalent)	ton	25.50
Oats	bushel	.70
Oat straw	ton	20.00
Feeder calves (500 lbs.)	cwt.	22.50
Cull beef cows (1,000 lbs.)	cwt.	15.00
Slaughter steers (1,000 lbs.)	cwt.	23.50
Slaughter heifers (810 lbs.)	cwt.	23.50
Milk (manufacturing 4%)	cwt.	3.30
Cull dairy cows	cwt.	13.45
Dairy heifers	head	175.00
Dairy calves (3 day old)	head	7.50
Market hogs (210 lbs.)	cwt.	14.50
Feeder pigs (40 lbs.)	head	10.50
Sows, cull	cwt.	11.00
PRICES PAID--CUSTOM WORK		
Cotton picking (machine)	cwt.	2.20
Corn picking	acre	6.00
Hay baling	ton	5.00
PRICES PAID--SEED		
Cotton	pound	.12
Corn	pound	.18
Soybean	bushel	4.25
Alfalfa	pound	.45
Orchardgrass	pound	.32
Lespedeza (Kobe)	pound	.22
Oats	bushel	1.40
Lespedeza (Korean)	pound	.20
Ladino clover	pound	.65

TABLE XIX (continued)

Item	Unit	Price
PRICES PAID--FEED		
Mineralized salt	cwt.	$ 2.00
Cottonseed oil meal	cwt.	3.70
Calf starter	cwt.	5.00
Sow and pig supplement	cwt.	4.30
Hog and boar supplement	cwt.	4.20
PRICES PAID--FERTILIZER		
Nitrogen	pound	.12
6-12-12	cwt.	2.60
0-20-30	cwt.	2.95
3-12-12	cwt.	1.93
0-9-27	cwt.	2.25
0-20-20	cwt.	2.45
Lime (spread)	ton	5.00

APPENDIX B

ESTIMATED ANNUAL OVERHEAD COST

TABLE XX

ESTIMATED ANNUAL OVERHEAD COST, BROWN SOIL AREA OF WEST TENNESSEE, 1963

Item	Cost		Salvage Value	Years Life	Annual Deprec.	Annual Repair	Interest @ 6%	Taxes and Insur.	Fuel and Other	Annual Total Cost
	New	Average[a]								
Machine shed	$1200.00	$ 600.00	$	20	$ 60.00	$ 6.00	$ 36.00	$ 7.20	$	$ 109.20
Wagon	450.00	202.50	45.00	15	27.00	20.25	12.15	1.01		60.41
Manure spreader	650.00	292.50	65.00	15	39.00	19.50	17.55	1.50		58.05
Truck (one ton)	2400.00	1080.00	240.00	10	216.00	72.00	64.80	50.00	130.00	532.80
Auto (farm share)[b]									128.00	128.00
Telephone									30.00	30.00
Electricity[c]									30.00	30.00
Liability Insurance								35.00		35.00
Service and miscellaneous									20.00	20.00
Elevator	300.00	135.00	30.00	15	18.00	9.00	8.10	.68		35.78
Farm tools		150.00				25.00	9.00			34.00
TOTAL		$2460.00			$360.00	$151.75	$147.60	$95.39	$338.00	$1073.24

[a]The average cost is computed by subtracting salvage value from initial cost and dividing by two. This represents the average value over the life of a machine.

[b]Farm share, 1,600 miles at $0.08 per mile.

[c]Monthly rate was assumed to be $2.50. The electrical charges for the service enterprises were included in the swine budgets.

APPENDIX C

ESTIMATED PRORATED MACHINERY INVESTMENT PER ACRE FOR SELECTED CROPS

TABLE XXI

ESTIMATED PRORATED MACHINERY INVESTMENT PER ACRE FOR SELECTED CROPS, 1963

Crop	Amount[a]
Cotton	$31.68
Corn	27.00
Soybeans	24.68
Alfalfa hay	52.82
Orchardgrass-ladino pasture	14.38
Orchardgrass-ladino pasture and hay	23.19
Oat-lespedeza hay	33.81
Oat-lespedeza pasture	21.64
Red clover hay	23.19

[a]These figures were computed using the same procedure as described on page 29 and represents the associated machine investment cost per acre for crops.

APPENDIX D

LABOR REQUIREMENTS

TABLE XXII

ESTIMATED PER ACRE LABOR REQUIREMENTS FOR CROP ENTERPRISES BY LABOR PERIODS

Crop Enterprise	Labor Period[a] (Hours)					
	I	II	III	IV	V	VI
Cotton	0.5	1.7	1.8	4.6	0.2	0.8
Corn	0.5	1.8	1.8	0.8		2.0
Soybeans		1.1	1.4	1.8	2.1	
Alfalfa		0.8	3.7	5.1	2.6	
Orchardgrass-ladino pasture	0.8		0.6	1.0	0.1	
Oat-lespedeza hay	0.6	0.5		5.2	5.3	
Oat-lespedeza pasture	0.6	0.5		5.2	1.6	
Orchardgrass-ladino pasture and hay	0.8		3.9	1.0	0.1	

[a]Labor period distribution is shown in Table VIII, page 28.

TABLE XXIII

ESTIMATED LABOR REQUIREMENTS FOR LIVESTOCK ENTERPRISES BY LABOR PERIODS

Livestock Enterprise	Labor Period (Hours)					
	I	II	III	IV	V	VI
Dairy	258.5	121.3	91.9	152.8	91.7	153.5
Swine I	139.2	82.2	66.3	110.3	68.3	86.1
Swine II	114.8	60.2	39.4	77.4	61.2	54.9
Beef I	140.0	88.0	17.0	25.0	18.0	60.0
Beef II	180.5	142.9	35.8	40.4	18.0	73.5
Beef III	180.5	139.6	19.6	39.3	26.5	73.5

APPENDIX E

FORAGE AND CONCENTRATE REQUIREMENTS FOR LIVESTOCK AND FORAGE DISTRIBUTION BY PERIODS

TABLE XXIV

ESTIMATED FORAGE REQUIREMENTS FOR LIVESTOCK ENTERPRISES BY FORAGE PERIOD

Enterprise	Forage Periods[a]				
	I	II	III	IV	97
	Tons	CAD	CAD	CAD	CAD
Dairy	15.98	936	741	741	559
Beef I	33.88	2128	1708	1708	1288
Beef II	52.20	2128	1708	1708	1288
Beef III	51.10	2664	1875	1708	1288

[a]Forage requirements are in terms of alfalfa hay equivalent for forage period I and in terms of cow acre days for forage periods II-V. One cow acre day was assumed equal to 25 pounds of hay equivalent. The forage periods are shown in Table XXVI, page 98.

TABLE XXV

ESTIMATED GRAIN AND SUPPLEMENT REQUIREMENTS FOR LIVESTOCK ENTERPRISES

Enterprise	Corn	Protein Supplement	Mineralized Salt
	(bushels)	(cwt.)	(cwt.)
Dairy	236.7	50.02	3.0
Beef I[a]			6.0
Beef II	579.5	59.5	9.0
Beef III	455.5	50.7	9.0
Swine I[b]	2224.3	221.4	
Swine II[b]	550.3	54.0	

[a]Calves sold as feeders and required no corn or supplement.

[b]Protein supplement included the required salt and minerals for the swine enterprises.

TABLE XXVI

PERCENTAGE DISTRIBUTION OF FORAGE BY PERIODS[a]

Forage Period	Orchardgrass-Ladino Clover	Lespedeza After Oats	Lespedeza Alone
I. Nov. 16 - Mar. 15	11	0	0
II. Mar. 16 - May 31	41	0	3
III. June 1 - July 31	26	47	47
IV. Aug. 1 - Sep. 30	13	42	42
V. Oct. 1 - Nov. 15	9	11	8

[a]These figures represent the percentage of cow acre days in each period of the total days furnished by the particular enterprise.