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## **Minimum capital requirements to achieve selected net farm income levels from alternative systems of farrow-to-finish swine production on Tennessee farms**

William D. McBride

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To the Graduate Council:

I am submitting herewith a thesis written by William D. McBride entitled "Minimum capital requirements to achieve selected net farm income levels from alternative systems of farrow-to-finish swine production on Tennessee farms." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

S. Darrell Mundy, Major Professor

We have read this thesis and recommend its acceptance:

Luther H. Keller, Robert M. Ray

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

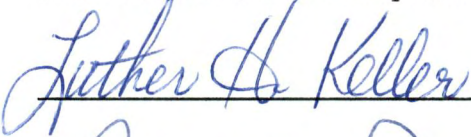
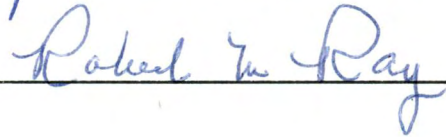
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MINIMUM CAPITAL REQUIREMENTS TO ACHIEVE SELECTED NET FARM INCOME  
LEVELS FROM ALTERNATIVE SYSTEMS OF FARROW-TO-FINISH SWINE  
PRODUCTION ON TENNESSEE FARMS

A Thesis  
Presented for the  
Master of Science  
Degree  
The University of Tennessee

William D. McBride

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## ABSTRACT

This study was an investigation of the minimum capital requirements, exclusive of land investments, for returning selected net farm income levels in a variety of swine farm situations in Tennessee. Representative resource situations and swine production systems were developed using data obtained from a 1984 survey of farrow-to-finish swine producers in a 10-county area of West Tennessee. These data provided information pertaining to swine production facilities and practices and a description of overall farm structure and organization.

The principle objective was to determine the minimum amount of required capital and the associated enterprise organization to return selected net farm income levels in various Tennessee swine farm situations. Other objectives included analyzing the effects on the farm plans of variations in selected resource availabilities and economic environments. These consisted of variations in hog prices, purchased corn prices, labor supplies, feeder pig prices and capital costs, factors which influence the income potential of any swine enterprise. In addition, minimum capital requirements to achieve selected net farm income levels were determined for a part-time farmer and for a farm situation in which no land base for cropping enterprises was available.

Minimum capital requirements were determined using linear programming procedures. The constructed programming models were designed to minimize total capital requirements subject to a minimum net income constraint. In addition to the survey reports, data used in this analysis included cost and price information on the various types of

available resources, production alternatives, and produced commodities. These data were developed using estimates obtained from the Ames Plantation Experiment Station in Tennessee, Tennessee Farm Planning Manuals and Tennessee Agricultural Statistics, as well as numerous other sources.

Four farm size situations were analyzed, each at two income levels. The examined net farm income levels included \$15,000 and \$30,000 on the small, medium, and large farms, and \$30,000 and \$50,000 on the extra-large farm. Potential farm enterprises consisted of four systems of farrow-to-finish swine production along with four corresponding systems of farrow-to-feeder pig and feeder pig-to-finish production. Also considered were 10 other enterprises commonly found on Tennessee swine farms.

The base situations used five-year weighted average prices, cost estimates based on 1984 levels, and yields consistent with the levels of input use and an above average level of management. Under these assumptions, among others, the lower income goals could be achieved on each farm size. However, available resources were insufficient for generating the higher income goals on the small and medium farm sizes.

Three enterprises--farrow-to-finish swine production, corn, and double-cropping wheat and soybeans--were employed in the majority of the optimum solutions. Two systems of farrow-to-finish swine production were included in the various analyzed farm situations. The low-investment confinement system, used in many of the plans for achieving the lower income levels, yielded the highest returns to the required investments. In situations where the labor supply became a highly

limiting resource, the more labor-efficient, high-investment, high-intensity confinement system was optimal. This occurred in many of the farm plans for achieving the higher income goals where the large required number of sows used much of the available labor supply. This system compared much more favorably with the low-investment confinement system when returns were considered after labor had been charged as an expense. Corn production was used in all situations and provided the major source of feed for the swine enterprise. Double-cropping wheat and soybeans, used in many of the farm plans, showed high relative returns and labor requirements not so directly competitive with those of corn production.

Results of the variations in selected factors indicated that prices received for hogs and prices paid for purchased corn and capital have a major influence on the minimum capital requirements. Required capital investments were markedly lower than base levels when hog prices were varied upward. In situations where hog prices were lowered and situations in which the purchased corn price was increased, the results were sharply higher total capital requirements. Analysis of all farm sizes showed total capital requirements that were highly responsive to changes in capital costs. When interest rates charged on investment and operating capital were higher than the base levels, total capital requirements were greatly increased.

Reducing the available labor supply resulted in increased capital requirements in situations where large amounts of hired labor were necessary. With a reduction in the supply of labor, much of the higher capital requirements were due to the required use of the labor-

efficient, high-investment, high-intensity swine production system. In addition, the results of this analysis suggest that if family labor is available, capital requirements can be greatly reduced.

The analysis which allowed feeder pig prices to vary indicated that feeder pig production did not compare favorably with farrow-to-finish production. Feeder pig prices were required to be at levels much higher than the base price before a system of feeder pig production was used in these farm plans. Only occasionally have average annual feeder pig prices at Tennessee organized sales been as high as the price necessary in this analysis.

The other examined situations included a part-time farmer and a specialized hog farm situation. Low amounts of required capital and labor in the part-time farmer situation made farrow-to-finish swine production appear attractive for the part-time farmer. However, income potential was limited to the lower level examined. The specialized hog farm situation required extremely high total capital requirements primarily in operating capital. These plans compared favorably to the other alternatives only in situations where operating capital was not restricted and sources were readily available.

Overall, no solutions were found in any of the analyzed situations that did not include a system of swine production. Additionally, the solutions showed that swine production provided the major source of income in all situations. These factors suggest that swine production may be considered as a potential farm enterprise when achieving a minimum net income level is an important goal of the farmer. Capital requirements are highly variable and depend heavily on the individual

farm situation. When quality management is available and the operator is willing to make a long-term commitment to swine production, achieving levels of earnings similar to those specified in this study is possible.

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## CHAPTER I

### INTRODUCTION

The Tennessee swine industry, along with the U. S. swine industry, has undergone significant changes over the past several years in the way hogs are produced. In the 1950's, many small farms, all producing hogs in much the same way, characterized the swine industry. With the introduction of capital intensive, labor saving technologies in the 1960's came drastic changes in the way hogs are produced. Fewer and larger operations utilizing these new technologies are becoming more characteristic of the swine industry today. Because of the cost advantages and increased labor efficiency provided by modern production systems, the trend toward fewer and larger operations will likely continue into the future.

This trend has been very evident in the Tennessee swine industry. During the period from 1974 to 1982, the percentage of all hog producers in Tennessee selling 500 or more hogs and pigs annually more than doubled from 2.6 percent to 5.6 percent (23). Also during this period, the percentage of total swine sales from these producers increased from 28.5 percent to 51.4 percent. While these changes show a clear trend toward larger production units in Tennessee, the concentration of production among larger producers in Tennessee were well below the U. S. swine industry as a whole. In 1982, 16.4 percent of the hogs and pigs sold in the U. S. came from operations selling 500 or more head annually. These operations accounted for nearly 70 percent of the total sales in the U. S.



Reasons for structural differences between the Tennessee and U. S. swine-producing industries are likely to include the following: 1) Tennessee swine farmers may lack information on resource requirements and production technologies that have made large-scale hog production economically efficient; or 2) Tennessee swine farmers are faced with resource situations that have limited the implementation of modern hog production technologies on many farms. Some combination of these two factors is likely to be the underlying cause of the smaller proportion of large-scale producers in the Tennessee swine industry.

#### I. PROBLEM STATEMENT

Consistently low levels of realized net farm income have characterized Tennessee farmers for many years. In 1982, average net income per farm was \$4,274 for Tennessee compared to \$9,188 for the U. S. (22). Low levels of farm income indicate that 1) Tennessee farmers lack the resources to generate a higher level of net income and/or 2) Tennessee farmers are not combining their resources in the most efficient ways. Either of these two suggests that adjustments in resource use are absolutely necessary for incomes to be increased in the future.

Changes in U. S. agricultural policy in recent years are of increasing concern to Tennessee farmers. Economic prospects for many Tennessee farm products, such as tobacco, corn and soybeans, have been reduced both by a movement toward a phasing out of government support programs and increased foreign competition. With expectations of reduced net returns from current enterprises, many farmers are seeking alternative enterprises for supplementing their income.

Ongoing research at the Ames Plantation Experiment Station in West Tennessee (14) has shown several systems of hog production to be profitable in most years. Studies in other states (8, 10, 13, 18, 20) have also suggested that under above average levels of management, alternative systems of swine production can be profitable. While findings from these studies are based on a budgetary analysis of the hog enterprise, more research needs to be done to determine how these alternative systems fit into the overall farm organization. This information would be useful to current and potential hog producers by providing the minimum levels of required resources which offer a reasonable chance of achieving a specified income. In addition, extension personnel, lending agencies and others involved with advising farmers need to know the minimum investment requirements to achieve acceptable net income levels from swine production on Tennessee farms.

## II. REVIEW OF RELATED LITERATURE

Van Arsdall and Nelson, in reporting findings obtained from a 1981 survey of the U. S. hog industry (24), characterized the current structure of the U. S. swine-producing industry as follows:

Now there is a mix of small and large operations with old and new ways of producing hogs. Change has been especially rapid in recent years. Fewer and larger operations draw more heavily on capital intensive technologies in the production of hogs. Greater specialization has altered the economic relationships and patterns of supply response in hog production. Economies of size are becoming increasingly important in determining costs and returns.

These changes and their effects on the hog-producing industry have led to significant research over the past several years concerning various methods of hog production.

Research by Lidvall, Ray, Dixon and Wyatt (14) compared three systems of farrow-to-finish pork production over the years, 1976-78. This research concluded that while small differences existed between systems in farrowing performance and carcass desirability, feed efficiency is superior in a system where pigs are finished in confinement as compared to pasture. Also, dollar return to labor and management per sow above variable expenses is greater for the total confinement system, but the pasture and partial confinement systems produce greater returns per sow above all expenses. In another study of Tennessee swine production, Ray (16) concluded that farrow-to-finish and feeder pig-to-finish enterprises were profitable in relation to other livestock alternatives if the price of hogs is \$35.00 per hundredweight (cwt) and above. The results of the analysis indicated that swine production appears to be a relatively profitable enterprise in the study areas examined; however, areas in West Tennessee have an advantage over the eastern areas because of a large acreage of continuous cropland and lower purchased grain prices.

Johnson, Saunders and Martin (12) and Martin, Saunders, Querin and Lovett (15) analyzed the potential of swine production on farms in the Georgia Coastal Plain and Piedmont areas, respectively. Both studies indicated that swine enterprises were potentially profitable and that farrow-to-finish and feeder pig-to-finish were the most profitable.

Both studies concluded that changes in corn prices had less of an impact on farm organization than changes in hog prices, and at higher corn prices the farrow-to-finish enterprises were more profitable. In another study of swine production in the Georgia Piedmont, Reid, Musser and Martin (17) showed that tremendous farm firm growth potential existed with hog production when debt is not highly restricted by internal or external rationing.

Kliebenstein and Sleper (13) compared total confinement, partial confinement and pasture systems of swine production under different cost and price scenarios. Their work showed that with farrow-to-finish enterprises, total confinement provided the highest income above variable costs per sow at relatively high market hog and feed prices. Comparatively, when hog and feed prices were relatively low, partial confinement provided the highest income above variable costs. In farrow-to-feeder pig enterprises, the pasture system provided the highest return per sow above all costs in all the analyzed cost-price situations. In feeder pig-to-finish enterprises, the partial confinement system provided the highest return per pig above all costs.

Research by Bullock and Beals (8) concluded that cost advantages of complete farrow-to-finish operations over specialized production units provide an incentive to combine the feeder pig production and topping-out operations into a single production unit. These economies arise because of the ability to better coordinate farrowing and feeding operations and because expenses of selling and purchasing feeder pigs, transporting feeder pigs and getting pigs resettled are not incurred by the complete farrow-to-finish operation. Also, the existence of econo-

mies of size provides incentives for operations to become large scale with at least 200-400 sows. In a similar study, Schupp and Elitzak (19) indicated that expansion can materially reduce costs of production. Larger operations achieve cost levels which will permit recovery of a greater percentage of fixed costs on an annual basis than small operations. They also concluded that, with other things being equal, larger operations have a greater chance of surviving the low prices of the liquidation phase of a major hog cycle than smaller operations.

In a series of publications, Bache and Foster (3) presented a guide concerning the compatibility of alternative pork production systems to given resource situations. This guide showed that not only are levels of available resources--land, labor, capital--important determinants in deciding what system fits best in the farm organization, but also the skill level and goals of the manager. Another publication in this series (2) developed guides for determining capital requirements of alternative systems. This illustration provided a rigorous development of each of the components of the capital necessary in financing various production systems. Other publications in this series (4, 5, 6, 7) were devoted to analyzing individual pork production systems with respect to factors that need consideration before implementing a particular system.

From the preceding citations, one can see that swine production is potentially a viable alternative for farmers throughout the Midwest and Southeast. Selection of the appropriate size and particular system of production is highly dependent on the resource situation of a particular farm. Before choosing swine production as an enterprise,

many considerations on the part of the individual farmer are necessary if the goals of the farmer and his/her business are to be met.

### III. OBJECTIVES

The general objectives of this study were to determine the resources required and the optimal farm organization to return selected net income levels in specified Tennessee swine farm situations. Specific objectives included:

1. Developing resource situations characteristic of Tennessee farrow-to-finish swine farms.
2. Developing enterprise budgets for selected farrow-to-finish swine production systems and other enterprises currently found on Tennessee hog farms.
3. Estimating the minimum investment and operating capital requirements and the associated enterprise organizations on representative Tennessee swine farms to return specified net farm income levels.
4. Analyzing the effects of variations from the base situations in hog prices, purchased corn prices, labor supplies, feeder pig prices and capital costs on the minimum capital requirements which achieve the specified net income goals.
5. Estimating the minimum capital requirements to achieve specified net income levels for part-time farmers and for situations with no land base for producing any type of crop.

#### IV. SCOPE OF THE STUDY

The inability to cover every aspect or variation of a problem places limitations on any economic analysis. This study concentrates on the complex hog enterprise and its place in the overall farm organization of various Tennessee farm situations. This makes greater depth and analytical detail possible about the income potential of swine production on Tennessee farms.

Three types of hog enterprises (farrow-to-feeder pig, feeder pig-to-finish and farrow-to-finish) are commonly found on farms in various parts of the state. While all three were candidates for analysis, the farrow-to-finish enterprise was determined to be the most predominant in the state and is the major focus of this study. In the farrow-to-finish enterprise, all phases of swine production can be analyzed as opposed to selected segments as in the case of the split-phase enterprises.

This study considers swine production as a competitive enterprise among other production alternatives in the total farm organization and thus allocates resources to uses providing the highest rate of return. The resource situations used in this study represent situations currently found on Tennessee farrow-to-finish swine farms. Much diversity exists in the resource situations faced by farmers statewide. This makes for a tremendous number of possible resource combinations and capabilities that could have been considered. While the results here do apply to the specific hog farm situations stated, these results should

provide guides suitable for estimating requirements for alternative farrow-to-finish swine systems for many farm operations.

Much of Tennessee was considered to be relevant in this analysis. Most of the data used came from the Plateau Slope areas west of the Tennessee River because of their relative importance in the overall production of slaughter hogs in the state. Therefore, the assumptions in this study were made to represent farm situations in West Tennessee where farrow-to-finish swine production is prevalent. Due to the nature of the assumptions, farmers in other areas of the state would need to carefully evaluate their particular situation in terms of the assumptions used in this study when comparing their situations with the results obtained here. While this does limit the relevance of this analysis to primarily West Tennessee areas, farmers in other areas of the state may find guides useful for evaluating the potential of farrow-to-finish swine production in their situations.

## V. DATA AND PROCEDURES

Most of the data included in this study were obtained through a survey of farrow-to-finish swine producers in a 10-county area of West Tennessee.<sup>1</sup> These data contained general information on the swine enterprise, descriptions of the facilities used in each phase of production and overall farm enterprise and resource organization. In addition, answers to other questions provided insight into the importance of

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<sup>1</sup>Unpublished survey data.



swine production on these farms and the factors that were limiting size of the swine enterprise.

Enterprise budgets for the selected swine systems were developed using data from the swine systems project on the Ames Plantation in West Tennessee<sup>2</sup> as well as sources in other states. In cases where current costs for a specific item were not available, estimates were obtained by inflating dated costs by an appropriate price index. Input use rates and costs used in the budgets for the other enterprises considered were derived from the Tennessee Farm Planning Manual (25). Price and yield data used in the study were based on historical Tennessee statistics on the crops and livestock considered (21).

Linear programming techniques were used to obtain the estimated minimum capital requirements to realize the specified net farm income levels for various resource situations. Postoptimal procedures were utilized to examine the effects on the required resources and on farm organizations of changes in selected factors. These factors were selected because of the influence they have in determining the income potential of swine production and the type and size of system required. More detailed discussions of procedures are presented in Chapters II and III.

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<sup>2</sup>The systems project is an ongoing study begun in 1975 to compare three systems of farrow-to-finish pork production.

## CHAPTER II

### RESOURCE ASSUMPTIONS AND SPECIFICATION OF THE MODEL

#### I. INTRODUCTION

A mail survey of farrow-to-finish swine producers in a 10-county area of West Tennessee was conducted by the Department of Agricultural Economics and Rural Sociology at the University of Tennessee in October of 1984. Farrow-to-finish swine producers in the counties of Obion, Weakley, Gibson, Crockett, Tipton, Fayette, Henry, Carroll, Henderson and McNairy were asked to participate. Each farmer surveyed received an initial mailing which included the questionnaire (Appendix B-19) and a cover letter explaining the purpose and goals of the survey. Nonrespondents were reminded periodically by a postcard one week after the initial mailing, followed by a second mailing of the original questionnaire and a modified cover letter two weeks later. Just over 60 percent of the farmers that were asked to participate completed and returned the questionnaire. Obtained information included detailed reports concerning the types and sizes of swine production systems used, descriptions of the general swine herd, resource availabilities and use, and overall farm characteristics and organization.

Data used in developing the resource assumptions included farm survey reports on 124 farrow-to-finish swine farms in West Tennessee. Statistical methods used in analyzing these data first included a univariate analysis of the various types of land acreages available on these farms. The farms were divided into four separate groups for each

land type (e.g., row crop, forage and pasture) considered to be available based on the results of the statistical analysis. Land-type acreage means for each of these groups provided the land base assumptions used in the study. Another univariate analysis of the total available row crop acreage divided the farms into four groups based upon the size of their productive land base. Means and frequencies of the specific types of labor, machinery and general overhead items that were available within these groups determined the other resource assumptions of the farms. The results of the statistical analysis of the survey data led to the designation of the base resource situations as small, medium, large and extra-large farms. These four base situations were used throughout this study.

## II. LAND AVAILABILITIES

Wide variation in the acreage of both owned and rented land was found to exist on the survey farms (Table 1). For the smallest size group acres of owned row cropland averaged 47.4, as compared to 571.3 acres for the extra-large farm group. Acreage of rented row cropland averaged 53.3 and 853.3 acres for the smallest and largest size groups, respectively. Farrow-to-finish swine production was found on a wide range of farm sizes.

In the programming analysis, owned land was considered as a fixed resource and net returns were determined without including a charge for owned land. Available acreage of owned and rented land were limited to the quantities indicated by the survey on each farm size situation.

TABLE 1

AVAILABLE OWNED AND RENTED LAND BY LAND CLASSIFICATION FOR  
THE FOUR FARM SIZES

Land Classification	Farm Size			
	Small	Medium	Large	Extra-Large
	-----number of acres-----			
<u>Owned -</u>				
Row cropland	47.4	103.3	201.3	571.3
Forage land	9.5	23.9	53.9	199.9
Permanent pasture	9.9	23.7	46.5	117.7
Woodland	13.6	32.2	72.6	294.1
Total available owned land	80.4	183.1	374.5	1,183.0
<u>Rented -</u>				
Row cropland	53.3	164.3	396.9	853.3
Forage land	10.7	22.8	45.0	146.7
Pasture	15.0	44.3	101.7	306.7
Total available rented land	79.0	231.4	543.6	1,306.7

Rates charged on rented land were \$60.00 per acre per year for row crop and forage land and \$45.00 per acre per year for pastureland (21).

One of the resource situations considered was the absence of a productive cropland and pasture land base on the farm. In this case, the only enterprises considered were the alternative systems of swine production and the only source of corn for hog feed was through purchasing. This represented a farm situation that is highly specialized in swine production. With the emergence of modern large-scale production units, greater specialization in hog production on many farm operations has resulted. Also, in many areas of Tennessee, the productive land base available to farmers is quite small. In the survey, 15 of the swine farmers reported no available acreages for row crop production.

### III. LABOR AVAILABILITIES

The amount of labor required for alternative systems of swine production vary greatly. Thus, the amount of available labor and cost of labor are important determinants of the most profitable system for a particular farm situation. Surveyed swine farmers considered labor as one of the resources most limiting with respect to size of operation.

In the analysis, the small and medium farms were assumed to have a one-person (owner-operator) labor supply with the ability to hire seasonal labor of one-half laborer units on the small farm and one laborer on the medium farm. The labor supply on the large and extra-large farms was assumed to be an owner-operator plus one and two full-time hired hands, respectively. Constraints on the hiring of seasonal

labor were set at one and one-half laborers on the large farm and two laborers on the extra-large farm.

Each full-time worker was assumed to provide 2,520 hours per year. This is based upon 50 weeks at 50 hours per week with one-week vacation in July and three days in November and December for the holidays. Seasonal workers could provide up to 2,520 hours per worker with the hours spread evenly over the year. Operator labor was reduced 10 percent for supervision on farms that employed hired labor. Full-time and seasonal labor availabilities by period and size of the labor force of the four farm sizes are shown in Table 2.

Full-time hired labor was charged as an overhead item at the rate of \$12,000 per laborer per year. Seasonal labor could be acquired on an hourly basis at the rate of \$4.00 per hour.

Because of the importance the on-farm labor supply plays in selecting a swine production system, an alternative labor situation was considered in the postoptimal analysis. Most of the smaller farms in the state are sole proprietorships, and in many cases the owner-operator is the only source of farm labor. Also, because of the specialized managerial skills required in many modern swine production operations, sources of skilled labor can be limited. For these reasons, an alternative labor situation was analyzed in which the labor force was restricted to only the amount of available full-time labor. In cases where this labor force was insufficient in generating the selected income goals, the available amount of labor was increased by 40 hours per period until the income level was reached. These additions to the labor force were not charged to the solution and were considered to be

TABLE 2

LABOR AVAILABILITY BY PERIOD AND SIZE OF THE LABOR FORCE,  
FOUR FARM SIZES

Labor Period	Farm Size			
	Small	Medium	Large	Extra-Large
	-----hours of labor-----			
<u>Full-time labor -</u>				
January-February	433.5	433.5	823.7	1,213.8
March-April	433.5	433.5	823.7	1,213.8
May-June	433.5	433.5	823.7	1,213.8
July-August	383.0	383.0	727.7	1,072.4
September-October	433.5	433.5	823.7	1,213.8
November-December	403.0	403.0	765.7	1,128.4
Total hours available	2,520.0	2,520.0	4,788.2	7,056.0
<u>Seasonal labor -</u>				
January-February	210.0	420.0	630.0	840.0
March-April	210.0	420.0	630.0	840.0
May-June	210.0	420.0	630.0	840.0
July-August	210.0	420.0	630.0	840.0
September-October	210.0	420.0	630.0	840.0
November-December	210.0	420.0	630.0	840.0
Total hours available	1,260.0	2,520.0	3,780.0	5,040.0

provided by available family members. Available family members in at least part of the year were an important source of labor on the swine farms in the survey. Over 50 percent of the survey respondents reported other family members available year-round while nearly 22 percent reported other family members available seasonally.

#### IV. MACHINERY AVAILABILITIES

Each farm size was assumed to have a given complement of machinery available for use. Use of each machine was restricted to a specified total number of hours of annual use based upon Tennessee estimates of annual use rates (25). The machinery complements were composed from the survey mean levels of available machinery for each of the farm size categories. The complements of machinery and annual use restrictions for each farm size are shown in Table 3.

Each item of machinery was charged to a particular enterprise at the rate it was used by the enterprise. The sources of machinery costs used in the study were published budgetary data on the machinery use in various enterprises in Tennessee for 1984 (25). More detailed information on the annual costs of owning and operating the various types of machinery appear in Appendix A-1.

The small farm was assumed to use custom harvesting of all considered grain and forage crops. The medium farm was considered to use custom harvesting only in the considered forage production alternatives. The custom rates were based upon those commonly charged Tennessee farmers and are presented in Table 4 (11).



TABLE 3

MACHINERY COMPLEMENTS AND RESTRICTED MAXIMUM ANNUAL HOURS OF  
USE, FOUR FARM SIZES

Machine	Size	Farm Size			
		Small	Medium	Large	Extra-Large
		-----hours of use-----			
Tractor #1	80 hp	600	600	600	600
Tractor #2	100 hp		600	600	600
Tractor #3	150 hp			600	600
Tractor #4	175 hp				600
Plow #1	4"-14"	100	100	200	100
Plow #2	6"-16"				100
Chisel plow #1	5 shank	80	80		
Chisel plow #2	9 shank			80	160
Disk #1	12'	70	70	140	70
Disk #2	21'				140
Cultimulcher #1	12'		70		
Cultimulcher #2	20'			70	70
Harrow #1	10'	70	70		70
Harrow #2	14'			70	70
Planter #1	4 row	70	70		70
Planter #2	6 row			70	70
Grain drill #1	11" x 7"	40	40		
Grain drill #2	21" x 7"			40	40
Sprayer	w/boom	40	40	80	120
Cultivator #1	4 row	60	60		60
Cultivator #2	6 row			60	60
Combine #1	13'	a	175		
Combine #2	15'			175	175
Corn header #1	4 row	a	100		
Corn header #2	6 row	a		100	100
Cotton picker	2 row	a	200	200	400
Pickup baler	PTO	a	a	210	210
Hay rake	side delivery	120	120	120	120
Haybine	7'	180	180	180	180
Grain auger	6", 42'	80	80	120	160
Hay conveyor	24'	70	70	70	70
Rotary mower	5'	60	60	60	60

<sup>a</sup>Farm is assumed to use custom harvesting.

TABLE 4  
CUSTOM HARVESTING RATES USED IN THE ANALYSIS

Operation	Dollars Per Acre	Dollars Per Hour
Corn harvesting	26.00	78.00
Cotton picking	60.00	85.74
Soybean combining	24.00	72.00
Small grain combining	21.00	63.00
Baling alfalfa	49.30	17.75
Baling hay	40.81	28.98

Source: D. L. Hunter and L. H. Keller, Farm Machinery Custom Rates by Crop Reporting Districts in Tennessee: 1982, Agricultural Extension Service, Publication 1085, University of Tennessee, 1982.

## V. CAPITAL AVAILABILITIES AND COSTS

Both operating and investment capital requirements of the enterprises were included in this study. Swine farmers in the survey reported that investment capital was the most limiting resource in expanding the size of the swine operation. For this reason, total required capital was chosen as the value to be minimized in the programming analysis to achieve the selected income goals. Total amounts of either operating or investment capital were not limited but instead their sum was minimized in the analysis.

Operating and investment capital were charged in the enterprise budgets on the basis of estimated requirements per unit of production. In the base situations, investment capital was charged at an annual rate of 12.5 percent. Operating capital was charged at an annual rate of 14 percent (1). Operating capital was assumed to be utilized for six months in the cropping enterprises and for three months in the swine enterprises. Charges for the use of operating capital were made only for the proportion of the year such capital would be required for a particular use.

Because of the large amount of capital required in many modern swine production systems, the cost of capital is important in determining which type and size of operation best fits into a particular farm situation. The postoptimal analysis included variations in capital costs of three percentage point intervals in both investment and operating capital. This analysis included investment capital charges at 9, 12, 15 and 18 percent and corresponding operating capital charges of

10.5, 13.5, 16.5 and 19.5 percent. The actual cost of capital can vary significantly depending upon sources of funds available to the farmer.

## VI. OVERHEAD SITUATIONS

Certain joint-use resource items were designated as overhead items and their associated costs were not charged to specific enterprises but rather to the farm as a whole. These items included such things as machine sheds, grain bins, trucks, trailers and full-time hired labor. Given the other resource assumptions of the farms, the assumption was that these items would exist on the farms regardless of the enterprises chosen.

These items were determined from the joint-use resources of the survey farms comprising each of the size categories. Annual overhead costs were developed and were based primarily upon the average investment requirement of the particular item. The annual overhead costs were \$3,489.88, \$3,940.26, \$18,456.54 and \$31,228.30 for the small, medium, large and extra-large farms, respectively. The breakdown of total overhead costs by item for each farm size is presented in Appendix A-2.

## VII. LEVEL OF MANAGEMENT

Above-average levels of management were assumed in the study. This is consistent with data from publications of Agricultural Experiment Stations and the Extension Service. Operators or managers were expected to make maximum use of all enterprise combinations to most efficiently use the given set of resources and restrictions.

The quality of available management is an important determinant in the type and size of swine production system that will work best on a farm. With the more modern large-scale, technically advanced systems, skills such as mechanical aptitude and supervising labor have become important managerial requirements. In the survey of swine farmers, the farmers rated their managerial skills as being higher in husbandry and production scheduling and lower in buying and selling and supervising labor.

#### VIII. INCOME GOALS

Net farm income in this study was defined as the residual return to the fixed factors of owned land, operator labor, risk and management. This return is for the period of one year that represents the average year in the life of the farm. The average year is determined from the point when all initial investments are made to when they are all paid. In actual practice, farm investments are usually made over a period of many years as net worth is accumulated and sources of investment funds become available. Therefore, this average year as strictly defined in the model is never actually experienced. When comparing the results here with actual situations, the amounts of resources required to achieve the income goals will vary depending upon the present point in time in the life of the firm (or the point in time in the planning span of the manager).

The income goals chosen in this study were \$15,000 and \$30,000 on the small, medium and large farms. The \$15,000 income goal was chosen because it represents approximate earnings of comparably skilled workers

in the nonfarm sector. Many young and beginning farmers who have made investments in the amounts of land assumed available here need to generate sufficient incomes to pay back the debt incurred on the real estate and other investments. The \$30,000 income goal was analyzed for this purpose and also because of higher income reservations held by some farmers. The large amounts of available resources on the extra-large farm suggested that higher income targets needed to be analyzed. The income goals analyzed on the extra-large farm were \$30,000 and \$50,000.

#### IX. PRICES AND YIELDS

The prices used in developing the budgets for the considered production alternatives were based upon five-year weighted average prices for the commodities produced. The estimates were from 1979-83 Tennessee farm prices (21) and were weighted by the total production for the given years. Purchasing corn for swine feed was an alternative considered in meeting system feed requirements. In the base situations, the charge for purchased corn was based upon average corn prices received for the period of 1979-83 in the months of March through September. An assumption was that the majority of corn purchases for swine feed occurred in this period due to dwindling supplies of farm-grown corn. In addition, a fixed hauling charge per bushel was added to this price to reflect transportation charges.

Economical and readily available supplies of corn are important factors in evaluating the profit potential of any swine operation. In many areas of Tennessee acreage for corn production is quite limited. The limited supplies, coupled with corn transporting costs, have made

purchased corn prices higher in these areas and so have reduced profit margins in swine production. In the postoptimal analysis purchased corn prices were varied upward from a \$3.12 per bushel base to \$3.25, \$3.35 and \$3.50 per bushel.

The postoptimal analysis also included variations in both hog and feeder pig prices. Hog prices vary widely depending upon the stage of the hog cycle. In this study, analyzed hog price situations included a high price of \$53.00 per cwt for market hogs and an equal percentage, upward variation in the other swine prices (e.g., cull sows, nonbreeders and boars). The price of all hogs was also varied downward to the point where either hogs exited the linear programming solution or where the income target could not be met. Feeder pig prices were varied upward while holding the price of market hogs constant to determine the price at which a system of feeder pig production entered the solution. Feeder pig production comprises a relatively large part of the total swine produced in the state. In many areas of Tennessee, resource situations faced by farmers seem more conducive to farrow-to-feeder pig enterprises than to farrow-to-finish enterprises.

The assumed yields for the various enterprises are consistent with the levels of inputs used in each while coupled with an above average level of management. Prices received and paid and yields for each of the considered enterprises appear in the budgets developed in Chapter III.

## CHAPTER III

### PRODUCTION ALTERNATIVES

#### I. INTRODUCTION

The production alternatives included four systems of farrow-to-finish swine production. The systems were separated by type and level of required investment. The alternative systems were determined from the cross-sectional data obtained from producer respondents in the mail survey of the 10 counties in West Tennessee. Farrow-to-feeder pig and feeder pig-to-finish operations were also considered to be possible production alternatives for the farms. These systems were determined by splitting the farrow-to-finish systems into split-phase operations. Analysis of the survey data showed that 26.6 percent of the farrow-to-finish swine farms were also engaged in farrow-to-feeder pig operations and 17.7 percent in feeder pig-to-finish operations.

The other enterprises considered to be production alternatives included enterprises commonly found on swine farms in the survey. Corn, soybeans and wheat, the three major crops of this area of Tennessee, were found on the majority of swine farms studied. The other enterprises considered in the analysis included cotton, grain sorghum, double-cropping (wheat-soybeans), alfalfa and clover hay. The only other livestock enterprise commonly found was a beef cow-calf operation which was reported on 35.5 percent of the farms.



## II. SWINE SYSTEMS

In addition to general information about the swine herd, farmers in the survey were asked to categorize their system based upon a description of the facilities used in each phase of production. These categories provided the framework from which the four representative swine systems were developed. Frequencies of the specific equipment used in each production phase were then utilized in building the representative swine systems. The four systems analyzed in this study were:

1. A 25-sow pasture system in which sows are farrowed twice a year.
2. A 50-sow low-investment confinement system in which sows are farrowed four times a year.
3. A 100-sow high-investment confinement system in which sows are farrowed six times a year.
4. A 200-sow high-investment, high-intensity confinement system in which sows are farrowed 12 times a year.

These represent the types and associated sizes of systems commonly found on the swine farms in the survey.

The concept of economies of size required that each system be limited as to size of operation in the programming analysis. These limits were placed at a doubling of the budgeted size of a particular system. No statistical relationship was found to exist between the productive land base of the farm and the type and size of swine system utilized. For this reason, all systems were considered as potential production alternatives on each farm size.

#### A. STRUCTURE AND SCHEDULING OF PRODUCTION

In the 25-sow pasture system, 30 females were assumed to be maintained to insure 25 sows were farrowed twice a year. Pigs are farrowed in April and October and are weaned at about eight weeks of age. At this time sows are rebred. Marketings take place twice annually in March-April and September-October. Building and equipment investments are relatively small and most are salable items not tied to the farm. The low capital requirements and relative liquidity of resources allow ease of entry and exit from swine production. A three-year pasture rotation is usually considered necessary to prevent disease and maintain quality pasture.

Two sow herds are maintained in the 50-sow low-investment confinement system--one herd farrowing in January and July and the other herd in April and October. Pigs are weaned at about eight weeks of age and remain in the farrowing pens for an additional two weeks. All but the breeding and gestating phases of production take place in confinement facilities. The breeding and gestating of sows and gilts occur in dirt lots where 60 females are maintained to insure four farrowings of 25 sows each per year. The buildings used in production are relatively simple in design with few automatic devices. This makes facilities investment per animal relatively low compared to the more intensive confinement systems. On many farms, systems of this type often employ abandoned facilities that otherwise have no alternative use. Such "free" resources can give this production system a considerable economic advantage over other systems requiring new and specialized buildings and equipment.

The 100-sow high-investment confinement system involves the use of an environment-controlled central farrowing house and open-fronted, partially slatted buildings in the nursery and finishing phases of production. Breeding and gestating of sows and gilts occur on permanent dirt lots. In this system 120 females are maintained in three groups to insure that 32 sows are farrowed every other month. Pigs are weaned at four to five weeks of age and moved to the nursery. The use of slatted floors and automatic devices greatly reduces labor requirements over the lower investment systems and increases labor productivity. Because the system permits more hogs to be produced with a given amount of labor, the potential for profit (or loss) per laborer equivalent is greater.

The 200-sow high-investment, high-intensity confinement system represents one of the most modern, technologically advanced systems of pork production in use today. The breeding phase occurs in dirt lots after which bred sows are moved to an open-fronted partially slatted gestating facility. The sow herd consists of 240 females in six groups to insure 32 farrowings each month. The farrowing facilities are totally environment-controlled with farrowings occurring in two separate rooms, each with a 32-sow capacity. Pigs are weaned at three to four weeks of age and moved to a totally environment-controlled nursery. The finishing facilities consist of two partially slatted open-fronted buildings with each having a 550-head capacity. The feeding system is a self-contained feed center with a pneumatic delivery system. Investment requirements per sow are relatively high while labor requirements per sow are low and spread uniformly throughout the year. This system lends itself to providing full-time employment for labor. A productive system

of this type will likely be selling market hogs weekly. This weekly income helps avoid cash flow problems, and weekly sales also eliminate the danger of selling a significant portion of annual production on a depressed market.

#### B. PERFORMANCE STANDARDS

A fixed set of performance standards was assumed across all systems. This is consistent with other studies (14) which have shown small differences to exist among systems in the majority of performance factors. The standards used here represent those possible where above average levels of management are available. The selected performance standards and the annual results for each of the analyzed systems are shown in Table 5.

#### C. FEED REQUIREMENTS

The basic feed requirements for the hog operations were corn and fortified supplements of 40 percent protein. The recommended amount of protein in the ration depends on the feeding stage of the animal. Unweaned pigs should receive a ration of 16-18 percent protein; nursery pigs a 14-16 percent protein ration; and market hogs, gestating-lactating sows and boars a 12-14 percent ration. From a technical point of view, these levels fall within the range of most recommendations. From an economic viewpoint, the least-cost combination of corn and protein within these ranges depends upon the corn-protein price ratio which changes frequently.

TABLE 5  
SELECTED PERFORMANCE STANDARDS AND ANNUAL RESULTS FOR THE FARROW-TO-FINISH SWINE SYSTEMS

Item	Standard	Annual Results			
		25-Sow Pasture	50-Sow Low- Investment Confinement	100-Sow High- Investment Confinement	200-Sow High- Investment Confinement
Conception rate	Gilts - 85% Sows - 90%	50 litters	100 litters	200 litters	400 litters
Live pigs farrowed/ litter	10	500 pigs farrowed	1,000 pigs farrowed	2,000 pigs farrowed	4,000 pigs farrowed
Pigs weaned/litter	7.6	380 pigs weaned	760 pigs weaned	1,520 pigs weaned	3,040 pigs weaned
Mortality rate	4%				
Feeder pigs	2%	373 feeder pigs	745 feeder pigs	1,490 feeder pigs	2,980 feeder pigs
Market hogs	2%	366 market hogs	730 market hogs	1,460 market hogs	2,920 market hogs
Gilts kept for replacement	1/3 of sow herd replaced annually	9 gilts	17 gilts	34 gilts	67 gilts
Market hogs sold annually	---	357 hogs	713 hogs	1,426 hogs	2,853 hogs
Boars needed	---	3 boars	5 boars	7 boars	10 boars
Rate of gain <sup>a</sup>	220-lb. market hog @ 6 mos.	844.8 cwt total gain	1,681.1 cwt total gain	3,420.0 cwt total gain	6,702 cwt total gain
Feed conversion (including sow herd)	400 lbs. feed/ cwt gain	169 tons total feed	366 tons total feed	684 tons total feed	1,340 tons total feed

<sup>a</sup> Gross weight produced = total poundage sold - purchase weight of boars. Purchase weight of boars = 2.2 cwt.

Annual feed requirements per sow varied only slightly between the systems. The methods of feeding were directly related to the type of system. The more capital intensive a system was, the more capital intensive the feeding system assumed for that system. Feed was assumed to be ground and mixed on the farm except for creep feed which was assumed to be purchased. This is consistent with the survey information which showed nearly 85 percent of the farms to have grinder-mixer capabilities. The annual feed requirements for the swine operations appear in Table 6.

#### D. LABOR REQUIREMENTS

Much variation exists among systems of swine production in the amounts and qualities of labor required. One important consequence of high-investment technology in swine production has been that labor needs are greatly reduced through the use of slatted floors and mechanical devices for environmental control and materials handling. In addition, high-intensity production schedules have smoothed out labor requirements to a more even flow throughout the year. Lower intensity and pasture systems require greater amounts of total labor per animal with peak labor demand periods occurring at farrowing.

The skill level of the labor force is also an important determinant in selecting the swine enterprise and the system type. Farrow-to-finish operations require a broad range of production skills. In farrow-to-feeder pig enterprises, husbandry and farrowing skills are the more important requirements. Feeder pig-to-finish enterprises require more skill in buying and selling hogs and pigs. In higher investment,

TABLE 6  
ANNUAL FEED REQUIREMENTS FOR THE SWINE OPERATIONS

Type of Feed	Feed Grain (corn equivalent)		Purchased Feed <sup>a</sup> (supplement or creep)		Complete Ration	
	Bushels	Pounds	Pounds	Tons	Pounds	Tons
<b>Part A. Farrow-to-Finish Operations (per sow; market hog sold @ 220 pounds)</b>						
Breeding herd	46.39	2,597.8	569.44	0.28	3,167.24	1.58
Creep	---	---	236.11	0.12	236.11	0.12
Starter-grower	13.83	774.7	322.22	0.16	1,096.92	0.55
Finishing ration	132.80	7,437.0	1,485.12	0.74	8,922.12	4.46
Total (per sow)	193.02	10,809.5	2,612.89	1.30	13,422.39	6.71
<b>Part B. Farrow-to-Feeder Pig Operations (per sow; feeder pigs sold @ 50 pounds)</b>						
Breeding herd	49.66	2,781.0	605.94	0.30	3,386.94	1.69
Creep	---	---	236.11	0.12	236.11	0.12
Starter-grower	13.83	774.5	322.22	0.16	1,096.72	0.55
Total (per sow)	63.49	3,555.5	1,164.27	0.58	4,719.77	2.36
<b>Part C. Feeder Pig-to-Finish Operations (per market hog sold; pig purchased @ 50 pounds; sold @ 220 pounds)</b>						
Finishing ration	9.07	508.0	101.40	0.051	609.40	0.305
Total (per market hog sold)	9.07	508.0	101.40	0.051	609.40	0.305

<sup>a</sup>For the pasture system, an assumption is that good quality pasture is utilized; therefore, reducing the amount of purchased required feed. Purchased feed is reduced by 10 percent in the pasture system for all operations.

higher intensity systems, skill in mechanical work, production scheduling and supervising labor become more important. Monthly labor requirements for the swine systems in each enterprise are presented in Table 7.

#### E. INVESTMENTS AND ANNUAL OWNERSHIP COSTS

Investments in the facilities used in swine production represent a major portion of the total investment requirement. This is especially true for many of the modern high-investment confinement systems. Detailed descriptions of the facilities investments for the systems are presented in Tables 8-11. Costs appearing here are based upon 1984 estimates of the purchase price of the specific items. In cases where the 1984 price of a specific item was not available, estimates were obtained from previous cost studies (4, 5, 6, 7) by inflating with an appropriate price index. For the split-phase systems the cost estimates were made from dividing the farrow-to-finish enterprises into the phases of production and adding the required supporting facilities. These are also reported in Tables 8-11.

In developing a budget, facilities should be classified for estimating overhead expenses. While separate categories for each depreciable item would give the greatest accuracy, an acceptable degree of precision was achieved by dividing facilities into two groups--items of a 15-year and 8-year life. For items with a high initial investment cost depreciation comprises a substantial annual ownership cost. Facilities investment costs for the farrow-to-finish swine systems by major depreciation classification appear in Table 12.



# DUCTION SYSTEMS

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					Total
<u>ust</u>	<u>September</u>	<u>October</u>	<u>November</u>	<u>December</u>	<u>Hours</u>
63	105	129	95	74	1,052
96	192	160	90	160	1,600
98	233	198	213	198	2,506
34	333	334	333	334	4,002
45	75	83	67	60	750
68	134	112	68	112	1,121
54	166	154	166	154	1,950
49	248	249	248	249	2,982
40	42	45	45	33	490
67	73	67	67	73	828
13	113	113	113	113	1,356
75	175	176	176	176	2,107

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TABLE 8  
FACILITIES INVESTMENTS FOR THE FARROW-TO-FINISH, 25-SOW PASTURE SYSTEM  
(25 FEMALES FARROWING TWICE A YEAR)

Item	Size and Description	Units Needed	Cost Per Unit	Total Investment
-----dollars-----				
<u>Part A.</u> Breeding Herd Facilities - Portable buildings for 30 females (22 sows, 8 gilts)				
Sow shelters	10' x 14' portable	3	532.00	1,596.00
Feeding fence	Wooden panels	75 ft.	3.00	225.00
Waterers	80-gal. with heater	1	120.00	120.00
Fencing	Temporary	50 rods	4.75	<u>237.50</u>
Total				2,178.50
<u>Part B.</u> Farrowing-Nursery Facilities - Individual houses with outside pens for 25 sows and litters				
Individual houses	6' x 7' portable	25	220.00	5,500.00
Feed pans	Individual	25	5.50	137.50
Wooden panels	10'	50	30.00	1,500.00
Heat lamps	250 watt bulb	25	3.00	75.00
Creep feeders	All-weather	3	100.00	<u>300.00</u>
Total				7,512.50
<u>Part C.</u> Growing-Finishing Facilities - Portable houses on three pasture lots for 200 hogs				
Pull-together houses	20' x 30' portable	3	2,200.00	6,600.00
Feeders	60-bu. round	3	200.00	600.00
Waterers	80-gal. with heater	3	120.00	360.00
Field fencing <sup>a</sup>	Permanent	400 rods	13.25	<u>5,300.00</u>
Total				12,860.00
<u>Part D.</u> Supporting Equipment				
Feed handling, manure handling and miscellaneous equipment <sup>b</sup>				3,500.00
<u>Part E.</u> Facilities Investment Summary				
Total facilities investment				
Farrow-to-finish operation				26,051.00
Investment per sow				1,042.00
Farrow-to-feeder pig operation (Parts A, B and D <sup>C</sup> )				13,191.00
Investment per sow				527.64
Feeder pig-to-finish operation (Parts C and D <sup>C</sup> )				16,360.00
Investment per hog marketed				43.86

TABLE 8 (continued)

<sup>a</sup> Permanent fencing provided for three fields to permit a three-year rotation.

<sup>b</sup> Equipment needed will vary from farm to farm but will likely include: water hydrants, feed (auger) wagon or pickup truck, high-pressure pump, front-end loader, dry manure spreader, loading chute and hog holders.

<sup>c</sup> One hundred percent of the supporting equipment is charged to each of the split-phase operations. An assumption is that the equipment would be required for both operations if they are separate.

TABLE 9  
FACILITIES INVESTMENTS FOR THE FARROW-TO-FINISH, 50-SOW LOW-INVESTMENT  
CONFINEMENT SYSTEM (25 FEMALES FARROWING IN JANUARY AND JULY, 25  
FARROWING IN APRIL AND OCTOBER)

<u>Item</u>	<u>Size and Description</u>	<u>Units Needed</u>	<u>Cost Per Unit</u>	<u>Total Investment</u>
-----dollars-----				
<u>Part A. Breeding Herd Facilities - Portable buildings; in permanent dirt lots for 60 females (45 sows, 15 gilts)</u>				
Sow shelters	10' x 14' portable	5	532.00	2,660.00
Feeding fence	Wooden panels	100 ft.	3.00	300.00
Waterers	2 hole, winter proof	2	133.00	266.00
Concrete feeding slab	7' x 100'	700 sq. ft.	1.50	1,050.00
Fencing	Woven wire	120 rods	13.25	<u>1,590.00</u>
Total				5,866.00
<u>Part B. Farrowing-Nursery Facilities - 25 litter capacity, central farrowing house with flush gutter</u>				
Building	32' x 72' pole	2,304 sq. ft.	86.65	15,320.00
Concrete slab	32' x 72'	2,304 sq. ft.	1.50	3,456.00
Concrete flush gutter	2 (2' x 80')	320 sq. ft.	1.50	480.00
Farrowing pens	Wooden panels	500 ft.	3.00	1,500.00
Feed pans	Individual	25	5.50	137.50
Heating devices	Space heater and lamps	---	---	410.00
Creep feeders	Individual	13	12.75	<u>165.75</u>
Total				21,469.25
<u>Part C. Growing-Finishing Facilities - 200-hog capacity, open-fronted building with exposed concrete slab</u>				
Building	20' x 72' pole	1,440 sq. ft.	3.85	5,544.00
Exposed concrete slab	20' x 72'	1,440 sq. ft.	1.50	2,160.00
Waterers	4 hole, winter proof	2	218.25	437.00
Feeders	20 hole, 75 bu.	2	477.50	955.00
Partitions and gates	Wooden panels	235 ft.	3.00	<u>705.00</u>
Total				9,801.00
<u>Part D. Supporting Equipment - Feed and manure handling</u>				
Grinder-mixer	75 bu. portable	1	6,500.00	6,500.00
Bulk supplement storage	7 ton tank	1	850.00	850.00
Miscellaneous <sup>a</sup>		---	---	<u>4,500.00</u>
Total				11,850.00

TABLE 9 (continued)

Item	Size and Description	Units Needed	Cost Per Unit	Total Investment
-----dollars-----				
<u>Part E. Facilities Investment Summary</u>				
Total facilities investment				
	Farrow-to-finish operation			48,986.25
	Investment per sow			979.25
	Farrow-to-feeder pig operation (Parts A, B and D <sup>b</sup> )			39,185.25
	Investment per sow			783.71
	Feeder pig-to-finishing operation (Parts C and D <sup>b</sup> )			21,651.00
	Investment per hog marketed			29.06

<sup>a</sup> A hog enterprise of the type described here is likely to be found on a multienterprise farm and thus shares equipment with other enterprises. Therefore, this system has been charged 60 percent of the investment in a front-end loader, high-pressure pump and dry manure spreader and 100 percent of a loading chute, hog holders and scales.

<sup>b</sup> One hundred percent of the supporting equipment is charged to each of the split-phase operations. An assumption is that this equipment will be required for both operations if they are separate.

TABLE 10  
FACILITIES INVESTMENTS FOR THE FARROW-TO-FINISH, 100-SOW HIGH-INVESTMENT  
CONFINEMENT SYSTEM (32 FEMALES FARROWING EVERY OTHER MONTH)

<u>Item</u>	<u>Size and Description</u>	<u>Units Needed</u>	<u>Cost Per Unit</u>	<u>Total Investment</u>
-----dollars-----				
<u>Part A.</u> Breeding Herd Facilities - Portable buildings in permanent dirt lots for 120 females (90 sows, 30 gilts)				
Sow shelters	20' x 30' portable	3	2,200.00	6,600.00
Feeding fence	Wooden panels	150 ft.	3.00	450.00
Waterers	4 hole, winter proof	2	218.25	436.50
Concrete feeding slab	7' x 150'	1,050 sq. ft.	1.50	1,575.00
Fencing	Woven wire	200 rods	13.25	<u>2,650.00</u>
Total				11,711.50
<u>Part B.</u> Farrowing Facilities - 32-sow capacity, partially slatted floor unit over underfloor manure storage				
Building (including plumbing, wiring, ventilation fans, heating, slatted floor, 4' deep under-floor manure tank)	23' x 90'	2,070 sq. ft.	20.75	42,952.50
Farrowing crates (including individual sow feeders, waterers and creep feeders)		32	315.25	10,088.00
Bulk feed holding bin	2 ton, hopper bottom	1	650.00	<u>650.00</u>
Total				53,690.50
<u>Part C.</u> Nursery Facilities - 270 weaned pig capacity, open-fronted building with manure flush system				
Building (including plumbing, wiring, ventilation fans, heating, partially slatted concrete floor over sloped flush gutter, wire mesh curtain)	24' x 44'	1,056 sq. ft.	11.50	12,144.00
Bulk feed holding bins	3 ton, hopper bottom	1	750.00	750.00
Feeders and feed distribution equipment	5 bu., round	8	91.50	732.00
Waterers	Nipple	8	14.00	112.00
Pen partitions	Wood	175 ft.	3.00	525.00
Flush system	Equipment	1	250.00	<u>250.00</u>
Total				14,513.00

TABLE 10 (continued)

Item	Size and Description	Units Needed	Cost Per Unit	Total Investment
-----dollars-----				
<u>Part D. Growing-Finishing Facilities - 550-hog capacity open-fronted building with manure flush system</u>				
Building (including plumbing, wiring, ventilation fans, partially slatted concrete floor over sloped flush gutter, wire mesh curtain)	32' x 130'	4,160 sq. ft.	11.00	45,760.00
Bulk feed holding bins	6 ton, hopper bottom	1	835.00	835.00
Feeders and feed distribution equipment	10 bu., round	12	103.00	1,236.00
Waterers	Nipple	12	14.00	168.00
Pen partitions	Wood	500 ft.	3.00	1,500.00
Flush system	Equipment	1	500.00	500.00
Cooling sprinklers	Spray fogger nozzle	12	6.25	75.00
Total				50,074.00
<u>Part E. Supporting Equipment</u>				
Grinder-mixer	85 bu., portable	1	7,000.00	7,000.00
Bulk supplement storage	12-ton tank	1	1,000.00	1,000.00
Sprayer-washer	High pressure, 500 PSI	1	1,025.00	1,025.00
Liquid manure spreader	750 gal.	1	3,000.00	3,000.00
Manure handling equipment	Lagoon and piping	---	8,500.00	8,500.00
Miscellaneous <sup>a</sup>		---	---	2,000.00
Total				22,525.00
<u>Part F. Facilities Investment Summary</u>				
Total facilities investment				
Farrow-to-finish operation				152,514.00
Investment per sow				1,525.14
Farrow-to-feeder pig operation (Parts A, B, C and E <sup>b</sup> )				102,440.00
Investment per sow				1,024.40
Feeder pig-to-finish operation (Parts D and E <sup>b</sup> )				72,599.00
Investment per hog marketed				48.72

<sup>a</sup> Items included are: charged at 100 percent of investment - loading chute, hog holders and scales; charged at 50 percent of investment - front-end loader.

<sup>b</sup> One hundred percent of the supporting equipment is charged to each of the split-phase operations. An assumption is that this equipment will be required for both operations if they are separate.

TABLE 11  
FACILITIES INVESTMENTS FOR THE FARROW-TO-FINISH, 200-SOW HIGH-INVESTMENT,  
HIGH-INTENSITY CONFINEMENT SYSTEM (32 FEMALES FARROWING EACH MONTH)

<u>Item</u>	<u>Size and Description</u>	<u>Units Needed</u>	<u>Cost Per Unit</u>	<u>Total Investment</u>
-----dollars-----				
<u>Part A.</u> Breeding Facilities - Portable buildings in permanent dirt lots for 40 females (30 sows, 10 gilts)				
Sow shelters	10' x 14'	4	532.00	2,128.00
Feeding fence	Wooden	100 ft.	3.00	300.00
Waterers	2 holes, winter proof	2	122.75	245.50
Concrete feeding slab	7' x 100'	750 sq. ft.	1.50	1,125.00
Fencing	Woven wire	100 rods	13.25	<u>1,325.00</u>
Total				5,123.50
<u>Part B.</u> Gestating Facilities - 200-sow capacity, partially slatted open-fronted building with underfloor manure storage				
Building (including plumbing, wiring, venti- lation fans, 10' wide slatted section with 6' underfloor manure tank, wire mesh curtain)	30' x 120'	3,600 sq. ft.	12.50	45,000.00
Bulk feed holding bin	3 ton, hopper bottom	1	750.00	750.00
Feeding system	Auger distribution with automatic floor drop	12	54.50	654.00
Waterers	Nipple	12	14.00	168.00
Pen partitions	Wood	400 ft.	3.00	1,200.00
Cooling sprinklers	Spray fogger nozzle	12	6.25	<u>75.00</u>
Total				47,847.00
<u>Part C.</u> Farrowing Facilities - 64-sow capacity with two rooms of 32 sows each, slatted floor unit with underfloor manure storage				
Building (including plumb- ing, wiring, ventilation fans, heating, slatted floor over 4' underfloor manure tank)	23' x 200'	4,600 sq. ft.	20.75	95,450.00
Farrowing crates (includ- ing individual waterers, sow and creep feeders)		64	315.25	20,176.00
Bulk feed holding bin	3 ton, hopper bottom	1	750.00	<u>750.00</u>
Total				116,376.00



TABLE 11 (continued)

Item	Size and Description	Units Needed	Cost Per Unit	Total Investment
-----dollars-----				
<u>Part D. Nursery Facilities - 550-weaned pig capacity, controlled environment building</u>				
Building (including plumbing, wiring, ventilation fans, heating, fully slatted floor over 4' manure tank)	32' x 60'	1,920 sq. ft.	13.75	26,400.00
Bulk feed holding bin	3 ton, hopper bottom	2	750.00	1,500.00
Feeders and feed distribution equipment	5 bu., round	12	91.50	1,098.00
Waterers	Nipple	12	14.00	168.00
Pen partitions	Steel pipe	300 ft.	2.00	600.00
Total				29,766.00
<u>Part E. Growing-Finishing Facilities - 1,100-hog capacity in two 550-capacity open-fronted, partially slatted buildings</u>				
Buildings (including plumbing, wiring, ventilation fans, 15' wide slatted section over 5' underfloor manure tank, wire mesh curtain)	2 (32' x 130')	8,320 sq. ft.	13.00	108,160.00
Bulk feed holding bins	6 ton, hopper bottom	2	835.00	1,670.00
Feeders and feed distribution equipment	10 bu., round	24	103.00	2,472.00
Waterers	Nipple	24	14.00	336.00
Pen partitions	Steel pipe	600 ft.	2.00	1,200.00
Cooling sprinklers	Spray fogger nozzle	24	6.25	150.00
Total				113,988.00
<u>Part F. Supporting Equipment</u>				
Self-contained feed center	20-ton storage and automatic electric mill	1	9,550.00	9,550.00
Feed delivery system	Pneumatic	1	4,100.00	4,100.00
Sprayer-washer	High pressure, 500 PSI	1	1,025.00	1,025.00
Dead pig incinerator		1	1,300.00	1,300.00
Stand-by generator	25 kilowatt	1	2,750.00	2,750.00
Liquid manure spreader	1,500 gal. with plow down attachment	1	5,200.00	5,200.00
Miscellaneous <sup>a</sup>		---	---	250.00
Total				24,175.00

TABLE 11 (continued)

<u>Item</u>	<u>Size and Description</u>	<u>Units Needed</u>	<u>Cost Per Unit</u>	<u>Total Investment</u>
			-----dollars-----	

Part G. Facilities Investment Summary

Total facilities investment				
Farrow-to-finish operation				337,275.50
Investment per sow				1,686.50
Farrow-to-feeder pig operation (Parts A, B, C and F <sup>b</sup> )				212,287.50
Investment per sow				1,061.44
Feeder pig-to-finish operation (Parts E and F <sup>b</sup> )				127,163.00
Investment per hog marketed				42.67

<sup>a</sup> Items included here are such things as loading chute, hog holders and scales.

<sup>b</sup> One hundred percent of the supporting equipment is charged to the split-phase operations except for the feeding system shown. An assumption is that if only one of the two split-phase operations is used, feed will be handled by a portable grinder-mixer and bulk tank supplement storage.

TABLE 12  
FACILITY INVESTMENT COSTS FOR THE FARROW-TO-FINISH SWINE  
SYSTEMS BY TWO DEPRECIATION LIFE CLASSIFICATIONS

<u>Depreciation Life</u>	<u>Total Sows</u>	<u>Per Sow</u>
	-----dollars-----	
<u>Part A. Pasture System - 25 sows</u>		
15 years	5,300.00 <sup>a</sup>	212.00
8 years	<u>20,751.00</u>	<u>830.04</u>
Total	26,051.00	1,042.04
<u>Part B. Low-Investment Confinement System - 50 sows</u>		
15 years	28,010.00 <sup>b</sup>	560.20
8 years	<u>20,976.25</u>	<u>419.53</u>
Total	48,986.25	979.73
<u>Part C. High-Investment Confinement System - 100 sows</u>		
15 years	62,088.90 <sup>c</sup>	620.89
8 years	<u>90,425.10</u>	<u>904.25</u>
Total	152,514.00	1,525.14
<u>Part D. High-Investment Confinement System - 200 sows</u>		
15 years	166,131.00 <sup>c</sup>	830.66
8 years	<u>171,144.00</u>	<u>855.72</u>
Total	337,275.50	1,686.38

<sup>a</sup>Includes field fencing.

<sup>b</sup>Includes concrete feeding slab, farrowing building slab and gutter and finishing building and slab.

<sup>c</sup>Includes concrete feeding slabs and 60 percent of the building investments. With the buildings used here, the manure pits and building shell make up approximately 60 percent of the total investments which have a longer life than the other equipment used.

Annual ownership costs generally include such items as payment of property taxes and insurance, provisions for maintenance, payment of a competitive interest rate on invested capital and the setting aside of funds for depreciation so that at the end of the useful life of a depreciable item capital will be intact. The annual ownership costs for the farrow-to-finish swine systems are shown in Table 13. For the split-phase operations, annual ownership costs appear in Appendix A, Tables A-3 and A-4. Totals of these categories provide the estimates of overhead expenses used in the budgets that were developed for the swine systems.

#### F. BUDGETS

For planning purposes in farm management, a budget represents a forecast of the expected returns from a given action, among other things, under specified technical and economic conditions. The estimated returns and expenses for the average year in the life of the farrow-to-finish swine systems are shown in Tables 14-17. Budgets for the split-phase swine systems appear in Appendix B, Tables B-1 through B-8. The costs presented here represent figures characteristic of 1984. A corn price of \$2.93 per bushel was used in developing the swine budgets. In the model, corn was assumed to be provided from two sources --farm grown and purchased corn. These sources have different associated costs and were charged these costs as the amounts of each used were brought into the linear programming solution.

The overhead expenses were determined from the previous section on annual ownership costs. In the model, overhead expenses for the

TABLE 13  
INVESTMENT AND ANNUAL OWNERSHIP COSTS FOR FOUR FARROW-TO-FINISH SWINE SYSTEMS

Item	Investment		Annual Ownership Costs			
	New	Average	Depreciation	Interest	Maintenance	Insurance and Taxes Total
-----dollars-----						
<b>Part A. 25-Sow Pasture System</b>						
1. Buildings and equipment						
a. 15-year depreciable facilities	5,300.00	2,650.00	353.33	331.25	53.00	777.33
b. 8-year depreciable facilities	20,751.00	10,375.50	2,593.88	1,296.94	363.14	4,357.71
2. Breeding stock <sup>a</sup>						
a. Sows/gilts	4,751.89	4,751.89	---	332.63	---	71.28
b. Boars	879.00	879.00	942.00 <sup>b</sup>	61.53	---	13.19
3. Operating inventory	24,258.12	24,258.12	---	849.03	---	363.87
4. Total	55,940.01	42,914.51	3,889.21	2,871.38	416.14	643.72
5. Total per sow	2,237.60	1,716.58	155.57	114.86	16.65	25.75
<b>Part B. 50-Sow Low-Investment Confinement System</b>						
1. Buildings and equipment						
a. 15-year depreciable facilities	28,010.00	14,005.00	1,867.33	1,750.63	280.10	210.08
b. 8-year depreciable facilities	20,976.25	10,488.13	2,622.03	1,311.02	367.08	157.32
2. Breeding stock <sup>a</sup>						
a. Sows/gilts	9,503.78	9,503.78	---	665.26	---	142.56
b. Boars	1,465.00	1,465.00	1,570.00 <sup>b</sup>	102.55	---	21.98
3. Operating inventory	48,569.27	48,569.27	---	1,699.92	---	728.54
4. Total	108,524.30	84,031.18	6,059.36	5,529.38	647.18	1,260.48
5. Total per sow	2,170.49	1,680.62	121.19	110.59	12.94	25.21

TABLE 13 (continued)

Item	Investment		Annual Ownership Costs			
	New	Average	Depreciation	Interest	Maintenance	Insurance and Taxes Total
-----dollars-----						
<b>Part C. 100-Sow High-Investment Confinement System</b>						
1. Buildings and equipment						
a. 15-year depreciable facilities	62,088.90	31,044.45	4,139.26	3,880.56	620.89	465.67
b. 8-year depreciable facilities	90,425.10	45,212.55	11,303.14	5,651.57	1,582.44	678.19
2. Breeding stock <sup>a</sup>						
a. Sows/gilts	19,007.55	19,007.55	---	1,330.53	---	285.11
b. Boars	1,963.50	1,963.50	2,023.00 <sup>b</sup>	137.45	---	29.45
3. Operating inventory	96,395.86	96,395.86	---	3,373.86	---	1,445.94
4. Total	269,880.91	193,623.91	17,465.40	14,373.97	2,203.33	2,904.36
5. Total per sow	2,698.81	1,936.24	174.65	143.74	22.03	29.04
<b>Part D. 200-Sow High-Investment, High-Intensity Confinement System</b>						
1. Buildings and equipment						
a. 15-year depreciable facilities	166,131.00	83,065.50	11,075.40	10,383.19	1,661.31	1,245.98
b. 8-year depreciable facilities	171,144.00	85,572.00	21,393.00	10,696.50	2,995.02	1,283.58
2. Breeding stock <sup>a</sup>						
a. Sows/gilts	38,015.10	38,015.10	---	2,661.06	---	570.23
b. Boars	2,680.00	2,680.00	2,640.00 <sup>b</sup>	187.60	---	40.20
3. Operating inventory	188,275.52	188,275.52	---	6,589.64	---	2,824.13
4. Total	560,245.62	397,608.12	35,108.40	30,330.39	4,656.33	5,964.12
5. Total per sow	2,831.23	1,988.04	175.54	151.65	23.28	29.82

<sup>a</sup> For the breeding stock, investments are based on boar values at the average of buying and selling prices while females are valued at their market price.

<sup>b</sup> Boar depreciation = (purchase price - selling price)/one year useful life.

TABLE 14  
ESTIMATED ANNUAL COSTS AND RETURNS BUDGET FOR THE FARROW-TO-FINISH, 25-SOW PASTURE SYSTEM

Item	One Sow			25 Sows		
	Quantity	Unit	Amount (dollars)	Quantity	Unit	Amount (dollars)
<b>A. Income</b>						
1. Market hogs (220 lbs. @ \$46.01/cwt)			1,445.45	357	head	36,136.25
2. Culled sows (425 lbs. @ \$39.34/cwt)			60.19	9	head	1,504.76
3. Nonbreeders (300 lbs. @ \$44.00/cwt)			26.14	5	head	660.00
4. Boars (425 lbs. @ \$32.00/cwt)			16.32	3	head	408.00
5. Gross income			<u>1,548.10</u>			<u>38,709.01</u>
<b>B. Direct Costs</b>						
1. Feed						
a. Corn equivalent (\$2.93/bu.)	193.02	bu.	565.55	4,825.5	bu.	14,138.72
b. Pasture (\$48.24/acre)	0.60	acres	28.94	15	acres	723.60
c. Purchased feed (\$0.12/lb.)	2,351.6	lbs.	282.19	58,790.0	lbs.	7,054.80
d. Total feed			<u>876.68</u>			<u>21,917.12</u>
2. Veterinary and medicine			37.54			938.50
3. Boar purchase (@ \$450.00)			54.00	3	head	1,350.00
4. Marketing			22.10			552.50
5. Power and fuel			8.00			200.00
6. Miscellaneous (bedding, supplies)			<u>26.00</u>			<u>650.00</u>
7. Total direct costs			<u>1,024.32</u>			<u>25,608.12</u>
8. Income over direct costs (A.5 - B.7)			523.78			13,100.89

TABLE 14 (continued)

Item	One Sow			25 Sows		
	Quantity	Unit	Amount (dollars)	Quantity	Unit	Amount (dollars)
<b>C. Overhead Expenses</b>						
1. Investment overhead						
a. 15-year depreciable facilities	212.00 <sup>a</sup>		31.09	5,300.00 <sup>b</sup>		777.33
b. 8-year depreciable facilities	830.04 <sup>a</sup>		171.31	20,751.00 <sup>b</sup>		4,357.71
c. Breeding stock			56.83			1,420.63
d. Operating inventory			48.52			1,212.90
e. Total investment overhead			310.75			7,768.57
2. Labor (\$4.00/hr.)	42.1	hrs.	168.40	1,050	hrs.	4,200.00
3. Total overhead expenses			479.15			11,968.57
<b>D. Summary</b>						
1. Net return to land, labor, risk and management (B.8 - C.1)			213.03			5,332.32
2. Net return to land, risk and management (B.8 - C.3)			44.63			1,132.32

<sup>a</sup>Total investment per sow.<sup>b</sup>Total investment per 25-sow unit.



TABLE 15  
ESTIMATED ANNUAL COST AND RETURNS BUDGET FOR THE FARROW-TO-FINISH, 50-SOW LOW-INVESTMENT  
CONFINEMENT SYSTEM

Item	One Sow			50 Sows		
	Quantity	Unit	Amount (dollars)	Quantity	Unit	Amount (dollars)
<b>A. Income</b>						
1. Market hogs (220 lbs. @ \$46.01/cwt)			1,443.43	713	head	72,171.29
2. Culled sows (425 lbs. @ \$39.34/cwt)			56.85	17	head	2,842.32
3. Nonbreeders (300 lbs. @ \$44.00/cwt)			26.40	10	head	1,320.00
4. Boars (425 lbs. @ \$32.00/cwt)			13.60	5	head	680.00
5. Gross income			1,540.28			77,013.61
<b>B. Direct Costs</b>						
1. Feed						
a. Corn equivalent (\$2.93/bu.)	193.02	bu.	565.55	9,651.0	bu.	28,277.43
b. Purchased feed (\$0.12/lb.)	2,612.89	lbs.	313.55	130,644.5	lbs.	15,677.34
c. Total feed			879.10			43,954.77
2. Veterinary and medicine			37.54			1,877.00
3. Boar purchase (@ \$450.00)			45.00	5	head	2,250.00
4. Marketing			21.75			1,087.50
5. Power and fuel			10.00			500.00
6. Miscellaneous (bedding, supplies)			23.00			1,150.00
7. Total direct costs			1,016.39			50,819.27
8. Income over direct costs (A.5 - B.7)			523.89			26,194.34

TABLE 15 (continued)

Item	One Sow		50 Sows	
	Quantity	Unit (dollars)	Quantity	Unit (dollars)
<b>C. Overhead Expenses</b>				
1. Investment overhead				
a. 15-year depreciable facilities	560.20 <sup>a</sup>	82.16	28,010.00 <sup>b</sup>	4,108.14
b. 8-year depreciable facilities	419.53 <sup>a</sup>	89.15	20,976.25 <sup>b</sup>	4,457.45
c. Breeding stock		50.05		2,502.35
d. Operating inventory		48.57		2,428.46
e. Total investment overhead		269.93		13,496.40
2. Labor (\$4.00/hr.)	32	hrs.	1,600	hrs.
3. Total overhead expenses		397.93		6,400.00
				19,896.40
<b>D. Summary</b>				
1. Net return to land, labor, risk and management (B.8 - C.1)		253.96		12,697.94
2. Net return to land, risk and management (B.8 - C.3)		125.96		6,297.94

<sup>a</sup>Total investment per sow.<sup>b</sup>Total investment per 50-sow unit.

TABLE 16  
ESTIMATED ANNUAL COST AND RETURNS BUDGET FOR THE FARROW-TO-FINISH, 100-SOW HIGH-INVESTMENT  
CONFINEMENT SYSTEM

Item	One Sow		100 Sows	
	Quantity	Unit Amount (dollars)	Quantity	Unit Amount (dollars)
<b>A. Income</b>				
1. Market hogs (220 lbs. @ \$46.01/cwt)		1,443.43	1,426	head 144,342.57
2. Culled sows (425 lbs. @ \$39.34/cwt)		56.84	34	head 5,684.63
3. Nonbreeders (300 lbs. @ \$44.00/cwt)		26.40	20	head 2,640.00
4. Boars (425 lbs. @ \$32.00/cwt)		9.52	7	head 952.00
5. Gross income		1,536.19		153,619.20
<b>B. Direct Costs</b>				
1. Feed				
a. Corn equivalent (\$2.93/bu.)	193.02	bu. 565.55	19,302	bu. 56,544.86
b. Purchased feed (\$0.11/lb.)	2,612.89	lbs. 287.42	261,289	lbs. 28,742.00
c. Total feed		852.97		85,296.86
2. Veterinary and medicine		37.54		3,754.00
3. Boar purchase (@ \$425.00)		29.75	7	head 2,975.00
4. Marketing		21.25		2,125.00
5. Heating fuel		25.00		2,500.00
6. Electricity		5.00		500.00
7. Truck and tractor use		7.20		720.00
8. Miscellaneous (bedding, supplies)		15.00		1,500.00
9. Total direct costs		993.71		99,370.86
10. Income over direct costs (A.5 - B.9)		542.48		54,248.34

TABLE 16 (continued)

Item	One Sow			100 Sows		
	Quantity	Unit	Amount (dollars)	Quantity	Unit	Amount (dollars)
<b>C. Overhead Expenses</b>						
1. Investment overhead						
a. 15-year depreciable facilities	620.89 <sup>a</sup>		91.60	62,088.90 <sup>b</sup>		9,106.38
b. 8-year depreciable facilities	904.25 <sup>a</sup>		192.15	90,425.10 <sup>b</sup>		19,215.34
c. Breeding stock			38.06			3,805.54
d. Operating inventory			48.20			4,819.80
e. Total investment overhead			370.01			36,947.06
2. Labor (\$4.00/hr.)	25.1	hrs.	100.40	2,506	hrs.	10,024.00
3. Total overhead expenses			470.41			46,971.06
<b>D. Summary</b>						
1. Net return to land, labor, risk and management (B.10 - C.1)			172.47			17,301.28
2. Net return to land, risk and management (B.10 - C.3)			72.07			7,277.28

<sup>a</sup>Total investment per sow.<sup>b</sup>Total investment per 100-sow unit.

TABLE 17

## ESTIMATED ANNUAL COST AND RETURNS BUDGET FOR THE FARROW-TO-FINISH, 200-SOW HIGH-INVESTMENT CONFINEMENT SYSTEM

Item	One Sow			200 Sows		
	Quantity	Unit	Amount (dollars)	Quantity	Unit	Amount (dollars)
<u>A. Income</u>						
1. Market hogs (220 lbs. @ \$46.01/cwt.)			1,443.93	2,853	head	288,786.37
2. Culled sows (425 lbs. @ \$39.34/cwt.)			56.01	67	head	11,202.07
3. Nonbreeders (300 lbs. @ \$44.00/cwt.)			26.40	40	head	5,280.00
4. Boars (425 lbs. @ \$32.00/cwt.)			6.80	10	head	1,360.00
5. Gross income			1,533.14			306,628.44
<u>B. Direct Costs</u>						
1. Feed						
a. Corn equivalent (\$2.93/bu.)	193.02	bu.	565.55	38,604	bu.	113,109.72
b. Purchased feed (\$0.10/lb.)	2,612.89	lbs.	261.29	522,578	lbs.	52,257.80
c. Total feed			826.84			165,367.52
2. Veterinary and medicine			37.54			7,508.00
3. Boar purchase (@ \$400.00)			20.00	10	head	4,000.00
4. Marketing			21.00			4,200.00
5. Heating fuel			25.00			5,000.00
6. Electricity			12.00			2,400.00
7. Truck and tractor use			7.00			1,400.00
8. Miscellaneous (bedding, supplies)			12.00			2,400.00
9. Total direct costs			961.38			192,275.52
10. Income over direct costs (A.5 - B.9)			571.76			114,352.92

TABLE 17 (continued)

Item	One Sow		200 Sows	
	Quantity	Unit (dollars)	Quantity	Unit (dollars)
<b>C. Overhead Expenses</b>				
1. Investment overhead				
a. 15-year depreciable facilities	830.66 <sup>a</sup>	121.83	166,131.00 <sup>b</sup>	24,365.88
b. 8-year depreciable facilities	855.72 <sup>a</sup>	181.84	171,144.00 <sup>b</sup>	36,368.10
c. Breeding stock		30.50		6,099.09
d. Operating inventory		47.07		9,413.77
e. Total investment overhead		381.24		76,246.84
2. Labor (\$4.00/hr.)	20	hrs.	4,002	hrs.
3. Total overhead expenses		461.24		16,008.00
				92,254.84
<b>D. Summary</b>				
1. Net return to land, labor, risk and management (B.10 - C.1)		190.52		38,106.08
2. Net return to land, risk and management (B.10 - C.3)		110.52		22,098.08

<sup>a</sup>Total investment per sow.<sup>b</sup>Total investment per 200-sow unit.

swine systems were charged in proportion to the number of sows in each solution. Two types of net returns are shown in the budget summaries. Net returns to land, labor, risk and management provided the values that the individual systems contributed to meeting the income goals.

Comparison of the alternative systems shows income over direct costs increasing as the level of investment and intensity increased. On a per sow basis, returns over direct costs were nearly identical for the pasture and low-investment confinement systems at \$523.78 and \$523.89, respectively. The returns over direct costs for the two high-investment confinement systems were much higher at \$542.48 and \$571.76 per sow for the 100-sow and 200-sow systems, respectively. Much of the higher returns over direct costs can be attributed to lower per unit costs incurred by the larger systems due to the annual input purchasing economies of the large-volume systems.

In comparing net returns to land, labor, risk and management, the pasture and low-investment confinement systems provided much higher levels at \$213.03 and \$253.96 per sow, respectively, than either the 100-sow or 200-sow high-investment confinement systems at \$172.47 and \$190.52 per sow, respectively. The higher costs associated with maintaining the larger capital stock of the high-investment confinement systems is the main reason that returns to land, labor, risk and management were much lower than those for the low-investment and pasture systems.

Net returns were more favorable in the higher investment confinement systems and less favorable in the labor-intensive pasture system once labor was charged as an overhead expense. The 100-sow and 200-sow

high-investment confinement systems yielded net returns to land, risk and management at \$72.07 and \$110.52 per sow, respectively, compared to only \$44.63 per sow for the pasture system. Overall, the low-investment confinement system provided the highest returns to the required resources with net returns to land, risk and management of \$125.96 per sow.

### III. OTHER ENTERPRISES CONSIDERED

Ten other enterprises were considered in the linear programming models as production alternatives for the selected farm situations. These enterprises were in direct competition with the swine systems for the resources required in meeting the income goals. These enterprises included the majority of cropping systems found on the swine farms in the survey plus a beef cow-calf livestock enterprise. An enterprise such as beef cow-calf production is commonly found on swine farms because the beef enterprise tends to utilize resources not required in swine production for the most part. Corn production was the most commonly found enterprise on the swine farms in the survey. Nearly 80 percent of the farms produced corn in 1984. This is typical on swine farms because corn provides the major feed input in meeting swine production requirements. While there has been an increase in the number of highly specialized swine farms, the majority of hogs produced today still come from multienterprise farming operations.

Certain agronomic restrictions were imposed upon the corn and cotton enterprises. Corn and cotton production on owned row cropland was limited to 50 percent of the land available on each farm. Crops



such as these require intensive cultivation and need to be rotated to promote sound cultural practices, including soil conservation. Because of the need to rotate these crops, this restriction in the model represented the amount of each that could be grown in any one year.

#### A. LABOR REQUIREMENTS

Labor requirements vary from enterprise to enterprise in the amounts required and in the time of year they are required. This variability influences the compatibility of various enterprises with different systems of swine production. Swine systems, with peak labor demand periods, usually fit well with enterprises that have low labor requirements during these same periods. Monthly labor requirements for the other enterprises appear in Table 18. These are based upon Tennessee estimates (25) as well as estimates used in other studies (9 and 16).

#### B. INVESTMENTS AND ANNUAL OWNERSHIP COSTS

Investments in the cropping enterprises included the machinery requirements and direct expenses used in the production alternatives. Operating capital is the estimated amount of funds needed to meet expenses during the year and is prorated on an annual basis. Investment capital is an estimate of the pro rata share of machinery investment requirements of that particular crop. Costs of crop storage facilities were not charged to either livestock or crop enterprises but instead were included as overhead items on each farm size situation. Investments in the beef cow-calf livestock enterprise were developed similarly

TABLE 18  
MONTHLY LABOR REQUIREMENTS FOR SELECTED ALTERNATIVE ENTERPRISES ON SWINE FARMS

Enterprise	January	February	March	April	May	June	July	August	September	October	November	December	Total Hours/ Unit
-----hours per acre-----													
<u>Part A. Crop Enterprises</u>													
1. Corn	--	--	.11	1.07	.33	.29	.29	--	--	.44	.23	--	2.76
2. Soybeans	--	--	.09	.35	.70	.46	.45	.19	--	.29	.29	--	2.82
3. Wheat	--	.25	--	--	--	.76	--	--	.52	.52	--	--	2.05
4. Cotton	--	--	.39	.62	.62	.84	.91	--	--	.10	--	--	3.48
5. Wheat - soybeans	--	.19	--	--	--	1.30	.25	.25	--	1.16	.68	--	3.83
6. Grain sorghum	--	--	.10	.94	.51	.44	--	--	.78	.41	--	--	3.18
7. Alfalfa hay	--	.20	--	.25	2.38	2.63	2.48	.16	2.40	--	--	--	10.50
8. Clover - Timothy hay	--	--	.01	.15	.15	1.69	1.66	1.67	1.67	--	--	--	7.00
9. Permanent pasture	--	.33	--	--	--	.52	--	.41	.02	--	--	--	1.26
-----hours per head-----													
<u>Part B. Livestock Enterprise</u>													
1. Beef cow-calf	1.00	1.00	1.13	.71	.57	.47	.47	.47	.57	.71	.90	1.00	9.00

Source: Synthesized from other studies (9, 16, 25).

to those in the swine alternatives. A summary of investment requirements of each enterprise are presented in Table 19. More detail about the annual ownership costs of the various types of machinery that were assumed to be available on the farms appears in Appendix A-1.

### C. BUDGETS

The budgets developed for the alternative enterprises served as bases for indicating the potential contributions of the enterprises in meeting the income goals as well as the per unit costs incurred by each enterprise. The budgets show returns and expenses that could be expected during a good year with the given set of assumed resource capabilities common to West Tennessee. Farmers in other areas would need to make appropriate adjustments in resource capabilities to fit their situations in evaluating the income potential of these enterprises as well as the possible addition of other enterprises.

A summary of the net returns for each enterprise used in the analysis are included in Table 19. The net returns are to land, labor, risk and management, which are those per unit values that each enterprise contributed to meeting the income goals in the programming model. The specific budgets used for each enterprise appear in Appendix B, Tables B-9 through B-18.

TABLE 19  
ESTIMATED ANNUAL CAPITAL REQUIREMENTS AND NET RETURNS FOR  
SELECTED ALTERNATIVE ENTERPRISES ON SWINE FARMS

<u>Enterprise</u>	<u>Operating Capital</u>	<u>Investment Capital</u>	<u>Net Returns<sup>a</sup></u>
<u>Part A. Crop Enterprises</u>	-----dollars per acre-----		
1. Corn	98.82	60.89	74.69
2. Soybeans	89.14	57.04	41.14
3. Wheat	61.95	41.72	38.33
4. Cotton	147.77	116.15	66.08
5. Wheat - soybeans	141.74	91.45	69.37
6. Grain sorghum	76.31	56.03	38.46
7. Alfalfa hay	118.17	154.79	-40.87
8. Clover - Timothy hay	58.02	90.80	-33.87
9. Permanent pasture	28.69	24.52	-53.21 <sup>b</sup>
<u>Part B. Livestock Enterprise</u>	-----dollars per head-----		
1. Beef cow-calf	213.38	80.98	-19.28

<sup>a</sup>Includes returns to land, labor, risk and management.

<sup>b</sup>Permanent pasture generates zero gross returns and is used solely as an intermediate input for the swine pasture system and the beef cow-calf operation. Therefore, the figure presented here represents the per acre cost of permanent pasture to each of these enterprises.

## CHAPTER IV

### DISCUSSION OF RESULTS

#### I. INTRODUCTION

Linear programming procedures were used to estimate the minimum capital requirements, exclusive of land investment, to return selected net farm incomes on four farm sizes. The selected income goals were \$15,000 and \$30,000 on the small, medium and large farms, and \$30,000 and \$50,000 on the extra-large farm. Four systems of farrow-to-finish swine production, along with four associated systems of farrow-to-feeder pig and feeder pig-to-finish operations and 10 other enterprises, were considered to compete for the resources of each farm size. In cases where two separate systems of a swine enterprise entered the optimal solution, each system was examined individually regarding the required resources for the farm. That is, in such cases the model was run two additional times, each time considering only one of the systems that appeared in the original solution. Results are reported as to which system provided an optimal solution with the least amount of total investment. Because two different systems of swine production are not typically found on the same farm, the results using a single swine system are more representative of actual farm situations.

The postoptimal analysis examined the effects of variations from the base situations in crucial factors for evaluating the economic

potential of any swine production operation. These factors included hog prices, purchased corn prices, labor supplies, costs of capital and feeder pig prices. In addition, two special situations were analyzed--one where the owner-operator was a part-time farmer, and the other where swine production was the only means of generating the selected net income levels.

In this chapter, comparisons are made of the minimum capital requirements for each farm size. Particular attention was given to comparing the types and sizes of swine production systems which were used in the farm situations. Additional criteria for comparison included, among other things, which resources proved to be most limiting in the analyzed farm situations.

## II. MINIMUM CAPITAL REQUIREMENTS FOR THE BASE SITUATIONS

The minimum capital requirements reported for the base situations were determined under economic conditions assumed to be static in nature. That is, no consideration was given to the realities of farming such as variability of prices and yields, among other things, and the accompanying risks which are ever present. Conditions assumed in the base situations were based on averages. Each farm was assumed to be operating during the mean year of the useful life for the investments. All farms faced costs representative of 1984 and prices representative of an average year during the early to mid 1980's.

Under these and other conditions assumed in the base situations, three enterprises were included in the solutions for all farm sizes.

The enterprises were corn, double-cropped wheat-soybeans and farrow-to-finish swine production. More detailed results of the base situations are shown in Table 20.

#### A. THE LOWER INCOME GOALS

The plan for the small farm included 66 sows in the farrow-to-finish, low-investment confinement system. This hog operation was accompanied by corn and double-cropped wheat and soybeans. Corn production was in the solution at its maximum amount including 50 percent of owned row cropland and the entire available rental acreage. The total amount of required capital for the \$15,000 income goal was \$93,593 with more than two-thirds of this in operating capital. Most of the operating capital requirements were for 275 hours of hired labor and 6,550 bushels of purchased corn.

Minimum capital requirements for the \$15,000 net income level were lower on the medium farm than on the small farm. This cost reduction was attributed mostly to lower operating capital requirements arising from more available land for corn production. Land for corn production was not limiting as it was on the small farm and enough corn was produced to meet the feed requirement of the swine system. The optimal farm plan included 45 sows in the farrow-to-finish, low-investment confinement system along with corn, wheat and double-cropping. Only a small amount of seasonal labor was required above that which the owner-operator was assumed to provide. This made

TABLE 20  
MINIMUM CAPITAL REQUIREMENTS UNDER BASE SITUATIONS FOR FOUR FARM SIZE ORGANIZATIONS AT SELECTED INCOME LEVELS

Item	Unit	Net Income in Dollars <sup>a</sup>							
		Small Farm		Medium Farm		Large Farm		Extra-Large Farm	
		15,000	30,000	15,000	30,000	15,000	30,000	30,000	50,000
<u>Resources Used:</u>									
Total capital -	dollars	93,593	—	69,178	—	129,064	338,037	207,545	456,547
Operating	dollars	67,895	—	42,001	—	71,685	217,542	116,172	280,144
Investment	dollars	25,698	—	27,177	—	57,379	120,495	91,373	176,403
Total owned land -	acre	57	—	110	—	213	210	503	473
Cropland	acre	47	—	103	—	202	202	487	461
Land for hog system	acre	10	—	7	—	11	8	16	12
Rented cropland	acre	53	—	57	—	82	48	16	17
Total labor -	hour	2,438	—	2,252	—	3,354	5,261	5,051	7,515
Full-time	hour	2,163	—	2,158	—	3,331	4,648	4,944	6,681
Part-time (seasonal)	hour	275	—	94	—	23	613	107	834
<u>Enterprises Used:</u>									
Corn	acre	77	I	109	I	183	149	286	303
Soybeans	acre	—	N	—	N	17	—	—	—
Wheat	acre	—	F	6	F	50	16	68	55
Wheat-soybeans	acre	24	E	46	E	33	85	66	79
Cotton	acre	—	A	—	A	—	17	23	27
Grain sorghum	acre	—	S	—	S	—	—	46	15
Farrow-to-finish -	acre	—	I	—	I	—	—	—	—
Low-investment confinement	sow	66	B	45	B	80	—	100	—
High-investment, high-intensity confinement	sow	—	L	—	L	—	222	—	302
Feeder pig-to-finish -	sow	—	E	—	E	—	—	—	—
Low-investment confinement	hog	—	—	—	—	—	—	389	—



TABLE 20 (continued)

Item	Unit	Net Income in Dollars <sup>a</sup>							
		Small Farm		Medium Farm		Large Farm		Extra-Large Farm	
		15,000	30,000	15,000	30,000	15,000	30,000	30,000	50,000
<u>Other Activities Used:</u>									
Corn -									
Bought	bushel								
Sold	bushel	6,550				866	30,939		34,096
Feeder pig purchased	pig							24	
Custom harvest -								397	
Corn	hour		25						
Wheat	hour		8						
Soybeans	hour		8						

<sup>a</sup> Net income = net returns to owned land and operator labor used, risk and management.

the medium farm plan conducive to similar farm situations where sources of hired labor are limited.

Even though the large farm had much larger amounts of available resources than the previous two farm sizes discussed, capital requirements were higher to achieve the \$15,000 income target. This higher requirement, \$129,064, was reflected in higher investment capital requirements due to additional costs of maintaining a much larger farm overhead. The optimal farm plan was a diversified organization including 80 sows in the farrow-to-finish, low-investment confinement system. In addition to the swine enterprise, corn, soybeans, wheat and double-cropped wheat-soybeans were used in the plan. Neither the labor supply nor available land for corn production were limiting factors on the large farm.

To achieve the \$30,000 net income goal on the extra-large farm, \$207,545 in capital investments were required. Nearly one man-equivalent in the full-time labor supply went unused in this solution. Significant capital savings would have resulted had not a second hired laborer been available and charged to the farm situation. Part of these savings, though, would have been offset by much higher seasonal labor requirements. Seasonal labor was required only in small amounts during the fall and spring. The optimal farm plan was a highly diversified organization including two swine enterprises and five different cropping systems. Farrow-to-finish swine production in the low-investment confinement system was in the solution at 100 sows, the maximum size allowed. An additional 389 market hogs were required for feeding out in

the feeder pig-to-finish, low-investment confinement system. Only a small percentage of the available cropland was used and no rented land was required. Systems of corn, wheat, double-cropped wheat-soybeans, cotton and grain sorghum were also included in the solution. Corn production was sufficient to meet feed requirements of the swine systems with a small amount remaining for sale.

#### B. THE HIGHER INCOME GOALS

Solutions for achieving \$30,000 in net income in the base situations for the small and medium farms were infeasible. Insufficient available labor supplies were the main reason a solution could not be obtained for either farm.

In achieving \$30,000 in net income on the large farm, \$338,037 in total capital was required. The optimum farm plan included 222 sows in the farrow-to-finish, high-investment, high-intensity confinement system. Increased labor requirements prompted the shift to this more labor-efficient system from the low-investment system used at the lower income level. Nearly all of the full-time labor supply was exhausted and an additional 613 hours of seasonal labor was required. This large amount of seasonal labor plus 30,939 bushels of corn purchased for swine feed made operating capital requirements extremely high in this plan. Smaller amounts of total row crop acreage were used here as compared to the optimal plan at the lower income goal. This reduction was through less rented acreage. A shift in the amounts of each of the cropping enterprises used also occurred. Single-crop soybean production was eliminated while corn and wheat production were reduced. More acres

were devoted to the higher returning enterprises of double-cropped wheat-soybeans and cotton. Overall, this farm plan was characterized by a high degree of specialization in farrow-to-finish swine production.

To return \$50,000 in net income on the extra-large farm, \$456,547 in capital was required. As with the large farm plan, the full-time labor supply was nearly exhausted, and an additional 834 hours of seasonal labor were required. Farrow-to-finish in the high-investment, high-intensity confinement system was in the solution at 302 sows. More farm-grown corn was available for swine feed in this plan than for the extra-large farm plan at the lower income goal; however, 34,096 bushels still had to be purchased. This purchased corn requirement, coupled with the required seasonal labor, again made operating investments extremely high. Row crop acreage was nearly the same as that used at the lower income goal. Besides corn production, other cropping systems used in the base solution included wheat, double-cropped wheat-soybeans, cotton and grain sorghum.

### III. EFFECTS OF VARIATIONS FROM THE BASE SITUATIONS

Variations from the base situations were made in selected factors important for evaluating the potential for any swine enterprise or system type. These included variations in hog prices, purchased corn prices, labor supplies, capital costs and feeder pig prices. Hog prices can vary widely depending upon the phase of the hog cycle. Higher purchased corn prices due to lower supplies and higher transporting costs are characteristic of many areas of Tennessee in contrast to other areas with greater comparative advantages in swine production. Small

farms with restricted resource situations, also characteristic of many areas of the state, typically have labor supplies limited to the owner-operator and any available family labor. Capital investments represent a major portion of the resource requirements in many swine production systems. Feeder pig production is prevalent in certain areas of the state. Reported results include the minimum capital requirements for each income level and corresponding farm plans, among other things, for variations in these factors on each farm size.

#### A. HOG PRICE VARIATIONS

Two alternative hog price situations were analyzed at both income levels on each farm size. From the base price of \$46.01/cwt for market hogs, a high price of \$53.00/cwt and a low price of \$40.00/cwt were examined. These hog price extremes were chosen because they represent approximately the extreme prices observed during the period of 1979-83 (21). The price of all other hogs sold within a system were correspondingly varied by an equal proportion. At the low price of \$40.00/cwt, no feasible solutions were found for any income level on any farm size. Hog prices were then varied upward by one dollar intervals from \$40.00/cwt to the point where a feasible solution existed on each farm size to achieve each income goal. Results of the hog price variations for the four farm sizes appear in Tables 21 and 22.

##### Small Farm

At the \$15,000 income goal, less than half of the total capital required in the base situation was required on the small farm when hog

TABLE 21  
EFFECTS OF HOG PRICE VARIATIONS ON THE SMALL AND MEDIUM FARM SIZES AT TWO INCOME LEVELS

Item	Unit	Small Farm			Medium Farm				
		Hog Price (\$/cwt)			Hog Price (\$/cwt)				
		45 <sup>a</sup>	53	48 <sup>a</sup>	53	45 <sup>a</sup>	53	47 <sup>a</sup>	
Net Income in Dollars <sup>b</sup>									
		15,000	15,000	30,000	30,000	15,000	30,000	30,000	
Resources Used:									
Total capital -									
Operating	dollars	166,491	43,598	203,167	91,743	82,619	39,010	231,632	79,698
Investment	dollars	114,273	28,051	141,626	66,511	52,033	22,381	155,673	49,986
Total owned land -	dollars	52,218	15,547	61,541	25,231	30,586	16,629	75,959	29,712
Cropland	acre	52	52	53	57	111	56	110	60
Land for hog system	acre	47	47	47	47	103	52	103	52
Rented cropland	acre	5	5	6	10	8	4	7	8
Total labor -	hour	53	51	47	53	72	22	72	98
Full-time	hour	2,646	1,252	3,175	2,424	2,325	1,177	3,812	2,417
Part-time (seasonal)	hour	2,431	1,252	2,520	2,147	2,084	1,177	2,520	2,140
	hour	215		655	277	241		1,292	277
Enterprises Used:									
Corn	acre	77	75	70	77	123	73	123	149
Soybeans	acre								
Wheat	acre					13		13	
Wheat-soybeans	acre	24	24	24	24	38		38	
Cotton	acre								
Grain sorghum	acre								
Farrow-to-finish -									
Low-investment confinement	sow		31		67	56	30		62
High-investment, high-intensity confinement	sow	116		141				159	

TABLE 21 (continued)

Item	Unit	Small Farm			Medium Farm		
		Hog Price (\$/cwt)			Hog Price (\$/cwt)		
		45 <sup>a</sup>	53	48 <sup>a</sup>	53	45 <sup>a</sup>	53
		45 <sup>a</sup>	53	48 <sup>a</sup>	53	45 <sup>a</sup>	53
		Net Income in Dollars <sup>b</sup>					
		15,000	15,000	30,000	30,000	15,000	30,000
<u>Other Activities Used:</u>							
Corn -							
Bought	bushel	16,266		21,670	6,718	911	20,736
Sold	bushel						
Custom harvest -							
Corn	hour	25	25	24	25		
Wheat	hour	8	8	8	8		
Soybeans	hour	8	8	8	8		

<sup>a</sup> Minimum market hog price for which a solution was attained that yielded the specified net income level.

<sup>b</sup> Net income = net returns to owned land and operator labor used, risk and management.

TABLE 22  
EFFECTS OF HOG PRICE VARIATIONS ON THE LARGE AND EXTRA-LARGE FARM SIZES AT SELECTED INCOME LEVELS

Item	Large Farm				Extra-Large Farm			
	Hog Price (\$/cwt)				Hog Price (\$/cwt)			
	44 <sup>a</sup>	53	45 <sup>a</sup>	53	44 <sup>a</sup>	53	46 <sup>a</sup>	53
Unit	15,000	15,000	30,000	30,000	30,000	30,000	50,000	50,000
Net Income in Dollars <sup>b</sup>								
Resources Used:								
Total capital -	dollars	326,271	78,294	272,104	115,708	455,542	127,275	462,890
Operating	dollars	209,359	37,919	167,682	63,019	280,333	61,097	284,788
Investment	dollars	116,912	40,375	104,422	52,689	175,209	66,178	178,102
Total owned land -	acre	210	108	209	112	499	226	474
Cropland	acre	202	101	202	101	487	214	461
Land for hog system	acre	8	7	7	11	12	12	14
Rented cropland	acre	32	26	82	97		17	
Total labor -	hour	5,015	2,033	4,404	3,179	7,486	3,427	7,609
Full-time	hour	4,552	2,033	4,219	3,138	6,691	3,427	6,726
Part-time (seasonal)	hour	463		185	41	795	883	24
Enterprises Used:								
Corn	acre	133	127	183	198	286	214	303
Soybeans	acre			17				99
Wheat	acre			50		68		55
Wheat-soybeans	acre	78		33		66		79
Cotton	acre	22				23		27
Grain sorghum	acre					46		15
Farrow-to-finish -								
Low-investment confinement	sow		53		82		89	100
High-investment, high-intensity confinement	sow	211		180		300		307



TABLE 22 (continued)

[illegible]

<sup>a</sup>Minimum market hog price for which a solution was attained that yielded the specified net income level.

<sup>b</sup>Net income = net returns to owned land and operator labor used, risk and management.

prices went to \$53.00/cwt. The major cost savings were attributed to the large reduction of operating capital because of the elimination of purchased corn and seasonal labor. Labor requirements were reduced to approximately half of the owner-operator supply. The optimal farm plan included little change in the cropping systems used, but a reduction from 66 sows in the base situation to 31 sows in the farrow-to-finish, low-investment confinement system. Hog prices could only fall to \$45.00/cwt before a solution to achieve this income level was unattainable. At these low hog prices, capital requirements were nearly four times those at the high hog prices. An increase in the demand for labor prompted a switch to the farrow-to-finish, high-investment, high-intensity confinement system where 116 sows were used. A large amount of required purchased corn made the operating capital requirement very high in this plan.

To achieve the \$30,000 income goal when hog prices varied, again very little changes occurred in the cropping systems while major changes occurred in the swine systems used. The solution went from 67 sows in the farrow-to-finish, low-investment confinement system at the high hog prices to 141 sows in the high-investment, high-intensity confinement system at the low hog prices. At this market hog price (\$48.00/cwt), the entire amount of operator labor was exhausted and an additional 675 hours of seasonal labor were required. This seasonal labor, coupled with the required 21,670 bushels of purchased corn, made operating investments very high. At the high market hog price of \$53.00/cwt, only small amounts of purchased corn and seasonal labor were required.

Medium Farm

At the high hog prices, the medium farm required \$39,010 in total capital to achieve the \$15,000 income target. This large reduction in investments was caused primarily by much lower operating capital requirements. Only about half of the operator labor supply was used and enough corn could be grown to supply the hog enterprise. The enterprises in the optimal solution included 30 sows in the farrow-to-finish, low-investment confinement system along with 73 acres of corn. Market hog prices could fall to \$45.00/cwt before the solution went infeasible at the \$15,000 income level. The major changes in the farm plan occurred in the cropping systems as hog prices varied from \$45.00 to \$53.00/cwt. Corn production was increased by 50 acres and systems of wheat and double-cropped wheat-soybeans were also used in the solution. The swine enterprise increased to 56 sows in the farrow-to-finish, low-investment confinement system. Higher rented acreage, seasonal labor and purchased corn requirements at the low hog prices made operating investments much higher than at the high hog prices.

To achieve \$30,000 in net income at the high hog prices, the farm plan resembled that used at the low income goal, except, as with the income level, resources required and enterprise usage roughly doubled. Corn production was 149 acres, enough to fulfill the feed requirement of the 62 sows used in the farrow-to-finish, low-investment confinement system. Increased acreage in corn production was provided by an increase in the rented acreage used. Seasonal labor was required mainly during the fall and spring. Market hog prices could fall to only \$47.00/cwt before the solution went infeasible. At this hog price,

capital needed to achieve \$30,000 in net income was much higher at \$231,632. Most of this high capital requirement came from a switch to the farrow-to-finish, high-investment, high-intensity confinement system where 159 sows were used. In addition, operating investments were greatly increased because of the 1,292 hours of seasonal labor and 20,736 bushels of purchased corn that were required. Cropping systems were exactly the same as those used in meeting the lower income goal when hog prices were low.

#### Large Farm

When hog prices were high on the large farm, \$78,294 in total capital was required to achieve \$15,000 in net income. As with the medium farm plans, when hog prices were high, the farm plan on the large farm consisted of only two enterprises--the farrow-to-finish, low-investment confinement system was used at 53 sows along with the production of 127 acres of corn to meet the feed requirement of this system. Less than half of the full-time labor supply was required in this situation. Because of high annual overhead costs, this solution was one of the few where required investment capital exceeded operating capital requirements. Hog prices could fall to \$44.00/cwt before the \$15,000 income level was unattainable. In contrast, a minimum of 211 sows were necessary in the farrow-to-finish, high-investment, high-intensity confinement system to generate \$15,000 in net income. This enterprise was accompanied by corn production and the two higher returning crop enterprises of double-cropped wheat-soybeans and cotton. Available full-time labor was nearly exhausted with an additional 463 hours of

seasonal labor being required. This solution also included 30,208 bushels of purchased corn, which helped make operating investments very high.

To achieve \$30,000 in net income when hog prices were high required well less than half of the total capital needed at the base hog prices. Much of this saving was incurred because only 82 sows were required in the farrow-to-finish, low-investment confinement system. Also, the 198 acres of produced corn was sufficient in meeting the feed requirement for the swine system. Nearly one-third of the available full-time labor went unused in this plan. The price of market hogs could fall to \$45.00/cwt before a solution achieving the \$30,000 net income goal could not be found. Cropping enterprises included the exact same mix of corn, soybeans, double-cropped wheat-soybeans and cotton found in the base situation. The farrow-to-finish, high-investment, high-intensity confinement system was used at 180 sows. This level of swine production required the purchase of 20,160 bushels of corn in addition to that produced on the farm for swine feed. Most of the available full-time labor was used with 185 hours of seasonal labor required primarily during the fall and spring.

#### Extra-Large Farm

Achieving the \$30,000 income goal when hog prices were at \$53.00/cwt on the extra-large farm required \$127,275 in total capital. This situation was again one of the rare instances where required investment capital exceeded operating capital requirements. Less than half of the full-time labor supply and only a small fraction of the

available row crop acreage was used. The optimal farm plan included 89 sows in the farrow-to-finish, low-investment confinement system. Corn was the only crop produced and the 214 acres were sufficient in providing feed for the swine enterprise. Market hog prices could fall to \$44.00/cwt before the solution went infeasible. This farm plan included 300 sows in the farrow-to-finish, high-investment, high-intensity confinement system for which 35,138 bushels of purchased corn were required. The cropping systems included the same mix of the five enterprises used in the base situation. Labor requirements included most of the available full-time supply plus 795 additional hours of seasonal labor.

To achieve the \$50,000 income target when hog prices were high required maximum use of the farrow-to-finish, low-investment confinement system at 100 sows. Again, the majority of land and labor resources went unused. Cropping systems included corn, soybean and wheat production. Enough corn was produced to meet the swine feed requirement with an additional 3,550 bushels being sold. The market hog price could fall to \$46.00/cwt before a solution was unattainable. This price was only one cent below the base price; consequently, the farm plan closely resembled the base situation. However, the one-cent drop in hog prices caused an increase in required total capital of more than \$6,000. Cropping systems were exactly the same as those in the base situation. The only major difference between this plan and the base plan was that the number of sows used in the farrow-to-finish, high-investment, high-intensity confinement system increased to 307. This prompted slightly higher requirements of both labor and purchased corn.

## B. PURCHASED CORN PRICE VARIATIONS

Three alternative prices of purchased corn were considered at both income levels on each farm size. From a base price of \$3.12 per bushel, variations were made upward to \$3.25, \$3.35 and \$3.50 per bushel. This makes the hog-corn price ratios used in this study range from nearly 15 in the base situation to a low of 13 at the \$3.50 per bushel corn price. In the period from 1980 to 1983 Tennessee farmers faced average annual hog-corn price ratios ranging from 13 to nearly 21 (21). Therefore, the price ratios used in the analysis represent the lower end of the range actually faced by Tennessee producers in the early 1980's.

Results reported here include only the situations in which the upward variation in the price of purchased corn would have an effect. That is, in base situations (Table 20) where purchased corn was not required or infeasible solutions were found, raising purchased corn prices would have no effect on the optimal solution. The extreme case of this in the analysis was seen on the medium farm in Table 20. In the base situation, no purchased corn was required at the \$15,000 income level and the solution for \$30,000 in net income was infeasible. For these reasons the medium farm situation was eliminated in this analysis. Results of the farm situations where this analysis was relevant are reported in Table 23.

### Small Farm

The effects of varying purchased corn prices could only be examined at the lower income level on the small farm. The base solution

TABLE 23

EFFECTS OF PURCHASED CORN PRICE VARIATIONS ON THREE FARM SITUATIONS, EACH AT SELECTED INCOME LEVELS

Item	Unit	Small Farm					Large Farm					Extra-Large Farm				
		Corn Price (\$/bu.)					Corn Price (\$/bu.)					Corn Price (\$/bu.)				
		3.25	3.35	3.50	3.25	3.35	3.50	3.25	3.35	3.50	3.25	3.35	3.50	3.25	3.35	3.50
		Net Income in Dollars <sup>a</sup>														
15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	30,000	30,000	30,000	50,000	50,000	50,000		
<b>Resources Used:</b>																
Total capital -	dollars	106,376	168,577				129,791	129,938	130,249	468,523					562,476	
Operating	dollars	78,438	116,787				71,800	71,921	72,177	315,581					359,716	
Investment	dollars	27,938	51,790				57,991	58,017	58,072	152,942					202,760	
Total owned land -	acre	58	52				187	187	187	214					466	
Cropland	acre	47	47				176	176	176	202					451	
Land for hog system	acre	11	5				11	11	11	12					15	
Rented cropland	acre	53	53				99	99	99	48					17	
Total labor -	hour	2,722	2,622				3,446	3,449	3,455	7,135					8,985	
Full-time	hour	2,261	2,421				3,394	3,396	3,401	4,788					7,056	
Part-time (seasonal)	hour	461	201				52	53	54	2,347					1,929	
<b>Enterprises Used:</b>																
Corn	acre	77	77				200	200	200	149					303	
Soybeans	acre															
Wheat	acre						42	42	42	16					49	
Wheat-soybeans	acre	24	24				33	33	33	85					84	
Cotton	acre														32	
Grain sorghum	acre															
Farrow-to-finish -																
Low-investment confinement	sow	74					84	84	84							
High-investment, high-intensity confinement	sow		115							307					371	



TABLE 23 (continued)

Item	Unit	Small Farm				Large Farm				Extra-Large Farm			
		Corn Price (\$/bu.)				Corn Price (\$/bu.)				Corn Price (\$/bu.)			
		3.25	3.35	3.50	3.25	3.35	3.50	3.25	3.35	3.25	3.35	3.25	3.35
		Net Income in Dollars <sup>a</sup>											
		15,000	15,000	15,000	15,000	15,000	15,000	15,000	30,000	30,000	30,000	50,000	50,000
<u>Other Activities Used:</u>													
Corn -													
Bought	bushel	8,152	16,049		139	158	197	47,367				47,446	
Sold	bushel												
Custom harvest -													
Corn	hour	25	25										
Wheat	hour	8	8										
Soybeans	hour	8	8										

<sup>a</sup> Net income = net returns to owned land and operator labor used, risk and management.

at the higher income level was infeasible so that upward variation of this price would have no effect on the solution. To achieve \$15,000 in net income when purchased corn prices varied upward necessitated an increase in capital requirements. Because corn production was already at its maximum in the base situation, no shift could be made to greater farm production. The cropping systems remained constant as the purchased corn price rose.

At \$3.25 per bushel, the increase in required capital was from more sows produced in the farrow-to-finish, low-investment confinement system. The required 74 sows resulted in higher purchased corn requirements and an increase in the demand for full-time labor. When this price increased to \$3.35 per bushel, the solution switched to 115 sows in the farrow-to-finish, high-investment, high-intensity confinement system. This, along with a nearly doubling of the purchased corn needs, caused a sharp increase in total required capital. A feasible solution was unattainable when the purchased corn price went to \$3.50 per bushel.

#### Large Farm

In the base situation for \$15,000 in net income on the large farm, only a small amount of purchased corn was required. This caused only slight changes in the optimal solution when the purchased corn price varied upward. The major changes that occurred were in the cropping systems used. As purchased corn became relatively more expensive, more acres were devoted to corn production to meet the swine feed requirement. At \$3.25 per bushel, purchased corn fell from 866 to 139 bushels while the number of sows required in the farrow-to-finish,

low-investment confinement system increased from 80 to 84. Capital requirements increased only slightly as the purchased corn price rose with the optimal solution remaining stable in the analyzed price situations. In addition to the swine enterprise, other enterprises included 200 acres of corn along with wheat and double-cropped wheat-soybeans.

To reach the \$30,000 income goal when the purchased corn price was \$3.25 per bushel, the major shift was to more sows in the farrow-to-finish, high-investment, high-intensity confinement system. The number of required sows increased from 222 in the base situation to 307 sows. This increase in the sow herd completely exhausted the full-time labor supply and required part-time labor at a level nearly equivalent to one full-time worker. These factors, along with an increase in the amount of purchased corn, made capital requirements much higher in this price situation than in the base situation. Solutions to attain the \$30,000 income goal when purchased corn prices were \$3.35 and \$3.50 per bushel were infeasible.

#### Extra-Large Farm

The base situation for \$30,000 in net income on the extra-large farm used no purchased corn and, therefore, was not relevant in this analysis. At the \$50,000 income level, the base situation used a large amount of purchased corn so that changes in this price greatly affected the solution. At a price of \$3.25 per bushel, the number of sows in the farrow-to-finish, high-investment, high-intensity confinement system increased to 371. The optimal solution also included a switch to more production of the higher returning enterprises of double-cropped wheat-

soybeans and cotton. Corn production remained stable while purchased corn needs increased. The full-time labor supply was completely exhausted, and an additional 1,929 hours of seasonal labor were needed. These factors led to a much higher level of total capital than that required in the base situation. The \$50,000 net income goal could not be reached when purchased corn prices were \$3.35 and \$3.50 per bushel.

### C. LABOR SUPPLY VARIATIONS

Two alternative labor supply situations were examined at both income levels on each farm size. The first situation limited each farm to only the assumed amount of available full-time labor in the base situation. Because this labor force was insufficient for generating the higher income goals on each farm, a second situation was also considered. The labor supply was increased by increments of 40 hours per month until an optimal solution existed at the higher income goal for each farm. These increases were not charged as a cost in the solution but instead were assumed to be supplied as "free" labor from available family members. Results in Tables 24 and 25 include both the above-mentioned situations. The amount of family labor required to achieve the higher income goal is reported along with the corresponding solution at the lower income goal when this amount of family labor is available.

#### Small Farm

When the labor supply on the small farm was restricted to only the owner-operator, a sharp increase in capital requirements occurred at the \$15,000 income level. This solution required a shift from the base

TABLE 24  
EFFECTS OF LABOR SUPPLY VARIATIONS ON THE SMALL AND MEDIUM FARM SIZES AT TWO INCOME LEVELS

Item	Unit	Small Farm			Medium Farm				
		Operator Labor		Plus 160 <sup>a</sup> Hrs./Mo.	Operator Labor		Plus 160 <sup>a</sup> Hrs./Mo.		
		Only			Only				
		Net Income in Dollars <sup>b</sup>							
	15,000	30,000	15,000	30,000	15,000	30,000	15,000	30,000	
<u>Resources Used:</u>									
Total capital -	dollars	126,644		85,793	262,020	94,062		67,085	229,076
Operating	dollars	85,752		61,462	183,882	55,720		40,463	153,595
Investment	dollars	40,892		24,331	78,138	38,342		26,622	75,481
Total owned land -	acre	51		56	55	106		109	110
Cropland	acre	47		47	47	103		103	103
Land for hog system	acre	4		9	8	3		6	7
Rented cropland	acre	42		53	38	55		54	52
Total labor -	hour	2,024		2,248	3,974	1,711		1,875	3,658
Full-time	hour	2,024		2,096	2,520	1,711		1,809	2,520
Family members	hour			152	1,454			66	1,138
<u>Enterprises Used:</u>									
Corn	acre				62	107		105	104
Soybeans	acre	66		77					
Wheat	acre							4	3
Wheat-soybeans	acre					5			
Cotton	acre	24		24	24	47		47	48
Grain sorghum	acre								
Farrow-to-finish -	acre								
Low-investment confinement	sow			61				44	
High-investment, high-intensity confinement	sow	88			186	61			159

TABLE 24 (continued)

Item	Unit	Small Farm				Medium Farm			
		Operator Labor		Operator Labor		Operator Labor		Operator Labor	
		Plus 160 <sup>a</sup>		Plus 160 <sup>a</sup>		Plus 160 <sup>a</sup>		Plus 160 <sup>a</sup>	
		Only	Hrs./Mo.	Only	Hrs./Mo.	Only	Hrs./Mo.	Only	Hrs./Mo.
		Net Income in Dollars <sup>b</sup>							
		15,000	30,000	15,000	30,000	15,000	30,000	15,000	30,000
<u>Other Activities Used:</u>									
Corn -									
Bought	bushel	11,676		5,572	30,892	3,332			
Sold	bushel								
Custom harvest -									
Corn	hour	22		25	21				
Wheat	hour	8		8	8				
Soybeans	hour	8		8	8				

<sup>a</sup> Minimum amount of monthly available family labor to achieve the higher income level and the associated solution at the lower income level.

<sup>b</sup> Net income = net returns to owned land and operator labor used, risk and management.

TABLE 25

EFFECTS OF LABOR SUPPLY VARIATIONS ON THE LARGE AND EXTRA-LARGE FARM SIZES AT SELECTED INCOME LEVELS

Item	Unit	Large Farm				Extra-Large Farm			
		Full-Time Labor		Full-Time Labor Plus 80 Hrs./Mo. <sup>a</sup>		Full-Time Labor		Full-Time Labor Plus 200 Hrs./Mo. <sup>a</sup>	
		Only		Only		Only		Only	
		15,000	30,000	15,000	30,000	30,000	50,000	30,000	50,000
Net Income in Dollars <sup>b</sup>									
<b>Resources Used:</b>									
Total capital -	dollars	129,456		128,198	326,658	244,004		202,715	424,963
Investment	dollars	72,431		70,522	211,086	125,426		111,976	256,687
Operating	dollars	57,025		57,676	115,572	118,577		90,739	168,276
Total owned land -	acre	213		189	210	467		502	457
Cropland	acre	202		178	202	461		487	445
Land for hog system	acre	11		11	8	6		15	12
Rented cropland	acre	69		98	5	17			14
Total labor -	hour	3,295		3,402	4,919	4,401		4,966	6,991
Full-time	hour	3,295		3,363	4,569	4,401		4,888	6,430
Family members	hour		I	39	350		I	78	561
<b>Enterprises Used:</b>									
Corn	acre	170	F	199	106	303	F	286	299
Soybeans	acre	11	A	1	18		A		
Wheat	acre	37	S	42		55	S	68	36
Wheat-soybeans	acre	53	I	33	58	79	I	66	98
Cotton	acre		B		26	27	B	23	26
Grain sorghum	acre		L			15	L	46	
Farrow-to-finish -			E				E		
Low-investment confinement	sow	79		82				100	
High-investment, high-intensity confinement									
Feeder pig-to-finish -	sow				214	151			282
Low-investment confinement	hog								322

TABLE 25 (continued)

Item	Unit	Large Farm		Extra-Large Farm				
		Full-Time Labor		Full-Time Labor		Full-Time Labor		
		Full-Time Labor	Plus 80	Full-Time Labor	Full-Time Labor	Plus 200		
		Only	Hrs./Mo. <sup>a</sup>	Only	Only	Hrs./Mo. <sup>a</sup>		
		Net Income in Dollars <sup>b</sup>						
		15,000	30,000	15,000	30,000	30,000	50,000	50,000
<u>Other Activities Used:</u>								
Corn -		-	-	-	-	-	-	-
Bought	bushel		1,605		32,774	4,819		
Sold	bushel							626
Feeder pigs purchased	pig							329

<sup>a</sup> Minimum amount of monthly available family labor to achieve the higher income level and the associated solution at the lower income level.

<sup>b</sup> Net income = net returns to owned land and operator labor used, risk and management.



situation (in Table 20) to the more labor efficient farrow-to-finish, high-investment, high-intensity confinement system. This, along with 11,676 bushels of required purchased corn, accounted for most of the increase in total capital.

To achieve \$30,000 in net income, an increase of 160 hours per month in the labor supply was needed. This solution required 1,454 hours of family labor above the owner-operator supply. This farm plan included 186 sows in the farrow-to-finish, high-investment, high-intensity confinement system where 30,892 bushels of purchased corn were required. These factors made capital requirements extremely high in this farm plan. When this amount of family labor was assumed available, the solution at the lower income goal resembled that of the base situation. Total capital was lower here than in the base situation mainly because of a reduction in the number of sows used in the farrow-to-finish, low-investment confinement system and lower purchased corn requirements.

#### Medium Farm

When the labor force was restricted to the owner-operator on the medium farm, achieving \$15,000 in net income required a much higher level of total capital. While the cropping systems remained relatively stable, a shift to the use of the farrow-to-finish, high-investment, high-intensity confinement system accounted for much of this increase. This solution also required that corn be purchased and that just over two-thirds of the operator labor be used.

To achieve \$30,000 in net income, the owner-operator supply had to be increased by 160 hours per month. From this increase, 1,138 hours of family labor were required above the owner-operator supply. The cropping systems remained relatively unchanged while 159 sows were used in the farrow-to-finish, high-investment, high-intensity confinement system. Purchased corn requirements were very high at 22,425 bushels, adding to an extremely high capital requirement. When family labor was available, capital requirements at the \$15,000 net income level were just below those in the base situation. This slightly lower investment requirement can be attributed to slightly lower acreage and number of sows used along with the availability of free labor.

#### Large Farm

Because much of the full-time labor went unused at the \$15,000 income level in the base situation, limiting the large farm to only the full-time supply increased required capital only slightly. The major changes that occurred were in the cropping systems. More emphasis was put on the higher returning enterprise of cotton and less on corn production. This, along with the 79 sows used in the farrow-to-finish, low-investment confinement system, caused higher purchased corn requirements than in the base situation.

The full-time labor supply had to be increased by 80 hours per month to attain the \$30,000 net income goal. This solution required 350 hours of family labor, mainly during seasonal peak labor demand periods. This solution yielded a lower level of total capital than in the base situation. The lower investment was due mostly to a reduction in the

number of sows in the farrow-to-finish, high-investment, high-intensity confinement system and lower rented acreage requirements. The cropping systems included 26 acres of cotton, which was not in the base plan, and less corn production. This made purchased corn requirements very high at 32,774 bushels. The solution at the \$15,000 income level closely resembled the base situation but with slightly lower capital requirements. Enough corn, 199 acres, could be grown to meet the swine feed requirement for the 82 sows used in the farrow-to-finish, low-investment confinement system and was a major attributing factor to the lower capital requirement.

#### Extra-Large Farm

The solution for \$30,000 in net income on the extra-large farm with only the full-time labor force being available shows the importance of seasonal labor in a farm situation that relies heavily on crop production. Even though in the base situation nearly one man-equivalent of full-time labor went unused, an elimination of available seasonal labor increased total capital markedly. The swine enterprise shifted to 151 sows in the farrow-to-finish, high-investment, high-intensity confinement system. Even as corn production increased in this situation, still 4,819 bushels of purchased corn were required. This solution again left much of the full-time labor force unused.

To achieve the \$50,000 net income goal, the full-time labor supply in the base situation (Table 20) had to be increased by 200 hours per month. Of the added 2,400 hours of available family labor, only 561 hours were used primarily during the seasonal peak labor demand periods

of the crop enterprises. This again points out the importance of available labor during peak demand periods on a farm engaged in intensive crop production. The solution had lower capital requirements than the base solution mainly due to the availability of free labor and because fewer sows, 282, were used in the farrow-to-finish, high investment, high-intensity confinement system. Cropping systems differed only slightly from the base plan and included more emphasis on the higher returning enterprise of double-cropped wheat-soybeans. When this amount of family labor was available, the solution to return \$30,000 in net income highly resembled the base solution. Cropping systems were exactly the same as those in the base situation and 100 sows were again used in the farrow-to-finish, low-investment confinement system. The only difference was that in this plan fewer market hogs were needed in the feeder pig-to-finish, low-investment confinement system. Finishing fewer market hogs made more corn available for sale and attributed to the lower capital requirements than in the base situation.

#### D. VARIATIONS IN THE COST OF CAPITAL

Four levels of interest rates for investment and operating capital were examined at both income levels for each farm size. In this analysis, the interest rate charged investment capital was varied upward from 9 percent, in intervals of three percentage points, to 18 percent. Corresponding, operating capital charges were made at 12.5 percent and varied upward at intervals of three percentage points to 19.5 percent. In this way, the same 1.5 percent differential was maintained between the prices of investment and operating capital as in the base situation.

Investment capital was charged at 12.5 percent in the base situation while operating capital was charged at 14 percent. Hence, the variations considered in this analysis were two intervals above and two below the base situation. Methods of charging the interest expenses were consistent with those used in the base situation. Results of this analysis appear in Tables 26 and 27.

#### Small Farm

Solutions to yield the \$15,000 income level could be attained at all interest rates except the highest level. Cropping systems remained stable at all cost levels and were unchanged from the base plan. As interest rates increased, the shifts in enterprise usage were through increased production in the farrow-to-finish operation. The low-investment confinement system was used at the lower levels of capital cost, but the high-investment, high-intensity confinement system was required as interest rates rose to the 15 and 16.5 percent rate combination. The 118 sows in this system along with 16,650 bushels of purchased corn made total capital high at this cost level. Even as interest rates were lowered to 9 and 10.5 percent, the \$30,000 income goal could not be reached.

#### Medium Farm

Solutions could be attained to achieve the \$15,000 income level at all analyzed interest rates on the medium farm. As interest rates rose up to the 15 and 16.5 percent rate combination, the major changes in the farm plan were in greater amounts of rented acreage mainly for increased corn production for swine feed. The farrow-to-finish, low-



## ES AT SELECTED INCOME LEVELS

Extra-Large Farm					
Interest Rates (Investment/Operating)					
12%/13.5%	15%/16.5%	18%/19.5%	9%/10.5%	12%/13.5%	All Other Levels
30,000	30,000	30,000	50,000	50,000	50,000
193,876	332,295		310,881	428,641	
105,367	183,472		182,392	261,214	
88,509	148,823		128,489	167,427	
502	470		470	473	
487	461		461	461	
15	9		9	12	
	17		17	17	
4,837	5,566		5,544	7,133	
4,768	5,453		5,437	6,489	
69	113		107	644	
		I			I
		N			N
286	303	F	303	303	F
		E			E
68	55	A	55	55	A
66	79	S	79	79	S
23	27	I	27	27	I
46	15	B	15	15	B
		L			L
		E			E
100					
	208		207	284	
201					
	15,955		15,757	30,582	
1,726					
206					

investment confinement system was employed in all solutions at the \$15,000 income level. While the number of sows used in this system increased from 35 to 57 at the 15 and 16.5 percent interest rate combination, the largest increase in this system was incurred as interest charges rose to the 18 and 19.5 percent combination. The solution required 92 sows, a decrease in rented acreage and corn production, and a shift to more purchased corn at 9,945 bushels. In addition, 1,086 hours of part-time labor added to the large amount of total operating capital in this solution. Labor requirements were greatly increased as interest rates rose. Nearly 1,000 hours of operator labor went unused at the lowest interest rates, while at the highest interest rates, a large amount of part-time labor was required in addition to the operator. Overall, as interest rates were increased by a constant amount with no shift occurring in the swine system used, capital requirements increased at an increasing rate.

The \$30,000 income goal could only be reached at the lowest level of capital charges. This farm plan required the use of 134 sows in the farrow-to-finish, high-investment, high-intensity confinement system. The 15,916 bushels of purchased corn and 737 hours of part-time labor contributed to the high level of operating capital necessary in this plan.

#### Large Farm

Solutions for \$15,000 in net income were obtained on the large farm for all but the 18 and 19.5 percent rate combination. At the lowest combination of interest rates, capital requirements were rela-



tively low with much less labor and rented acreage and fewer sows than the other solutions. The farrow-to-finish, low-investment confinement system, used in all three solutions, increased in size from 60 to 77 to 99 sows, respectively, as capital costs rose. As the number of sows increased, corn production on rented acreage increased at the 12 and 13.5 percent combination and greater amounts of purchased corn were required as capital costs went to the 15 and 16.5 percent combination. The full-time labor supply was not exhausted in any solution and only small amounts of seasonal labor were required at the higher capital charges.

Only when capital costs were at the two lowest levels were feasible solutions found for the \$30,000 income goal. Both solutions required the farrow-to-finish, high-investment, high-intensity confinement system with large amounts of purchased corn. The number of sows increased from 158 to 208, and corn production declined as capital charges rose. In general, the cropping systems shifted to a greater use of the higher returning enterprises of double-cropped wheat-soybeans and cotton. The full-time labor supply was nearly exhausted at the 12 and 13.5 percent interest rate combination with an additional 434 hours of seasonal labor being needed.

#### Extra-Large Farm

Solutions for \$30,000 in net income could only be reached at the three lowest levels of interest charges on the extra-large farm. The optimal solution for each combination of interest rates differed markedly. At the two lowest levels, both farm plans included 100 sows in

the farrow-to-finish, low-investment confinement system. When interest rates went to the 12 and 13.5 percent combination, an additional 201 market hogs were produced in the low-investment confinement system. At this cost level, the farm plan became a more diversified organization with five different cropping systems being employed. Both plans at the lowest capital cost levels were able to produce enough corn for swine feed with some additional corn available for sale. As interest rates rose to the 15 and 16.5 percent combination, the solution included 208 sows in the farrow-to-finish, high-investment, high-intensity confinement system. Even as corn production increased, 15,955 bushels of purchased corn were needed and added to sharply increased total capital requirements. The full-time labor supply was sufficient in all solutions with large amounts of labor going unused.

At the \$50,000 income goal, solutions could only be attained at the two lowest combinations of interest charges. Farm plans at these two combinations were very similar. More sows were used in the farrow-to-finish, high-investment, high-intensity confinement system as the cost of capital rose. The 284 sows along with 30,582 bushels of purchased corn accounted for most of the cost increase over the lower combination at the 12 and 13.5 percent rate combination. Neither farm plan exhausted the full-time labor supply, but the higher interest rates required more part-time labor.

#### E. VARIATIONS IN FEEDER PIG PRICES

Variations in the price of feeder pigs were examined at both income levels for each farm size. Because feeder pig production was

absent in the base situations, feeder pig prices were varied upward, holding all other hog prices constant, to the point where a system of producing feeder pigs entered the solution. This point was found by rounding the base price of \$79.13/cwt for feeder pigs to the nearest dollar and increasing the price by one-dollar increments. Results of this analysis are reported in Table 28. The feeder pig price quoted at the top of the column for each solution is that minimum price in which a system of feeder pig production was first used in the solution.

Typically market hog and feeder pig prices move together with lagged adjustments occurring in the price of feeder pigs in response to changes in the market hog price. In the period from 1980 to 1983 this price relationship, expressed as the ratio of average annual market hog to feeder pig prices, ranged from .49 to .70 in Tennessee (21).

#### Small Farm

At the \$15,000 income level, feeder pigs were first in the solution at a price of \$95.00/cwt on the small farm. This farm plan included 36 sows in the farrow-to-finish, low-investment confinement system, along with 57 sows producing feeder pigs in this system. The same cropping enterprises were used, less purchased corn was needed and more labor was required in this plan as compared to the base plan (Table 20).

Feeder pig prices had to rise to \$103.00/cwt before feeder pigs were used at the \$30,000 income level. This farm plan was highly specialized in feeder pig production using 205 sows in the high-investment, high-intensity confinement system. Compared to the previous

TABLE 28  
EFFECTS OF FEEDER PIG PRICE VARIATIONS FOR FOUR FARM SIZES AT SELECTED INCOME LEVELS

Item	Unit	Feeder Pig Price (\$/cwt) <sup>a</sup>								Net Income in Dollars <sup>b</sup>							
		Small Farm		Medium Farm		Large Farm		Extra-Large Farm		Small Farm		Medium Farm		Large Farm		Extra-Large Farm	
		95	103	95	99	93	95	92	95	15,000	30,000	15,000	30,000	15,000	30,000	30,000	50,000
<b>Resources Used:</b>																	
Total capital -	dollars	92,141	149,467	67,673	190,322	128,711	323,478	189,897	419,839								
Operating	dollars	62,655	92,724	37,783	115,215	69,841	199,721	98,644	234,612								
Investment	dollars	29,486	56,743	29,890	75,107	58,870	123,757	91,253	185,227								
Total owned land -	acre	59	55	113	112	214	212	541	468								
Cropland	acre	47	47	103	103	202	202	524	451								
Land for hog system	acre	12	8	10	9	12	10	17	17								
Rented cropland	acre	53	27	23	30	82	32										
Total labor -	hour	2,772	3,385	2,231	4,378	3,483	5,814	5,221	8,862								
Full-time	hour	2,281	2,520	2,072	2,520	3,439	4,788	5,114	7,056								
Part-time (seasonal)	hour	491	865	159	1,858	44	1,026	107	1,806								
<b>Enterprises Used:</b>																	
Corn	acre	77	51	74	81	183	133	286	303								
Soybeans	acre					17		105									
Wheat	acre					50		133	49								
Wheat-soybeans	acre	24	24	52	46	33	101		84								
Cotton	acre				5				32								
Grain sorghum	acre																
Farrow-to-finish -																	
Low-investment confinement	sow	36		8		69		100									
High-investment, high-intensity confinement	sow						130		91								

TABLE 28 (continued)

Item	Unit	Feeder Pig Price (\$/cwt) <sup>a</sup>							
		Small Farm		Medium Farm		Large Farm		Extra-Large Farm	
		95	103	95	99	93	95	92	95
Net Income in Dollars <sup>b</sup>									
		15,000	30,000	15,000	30,000	15,000	30,000	30,000	50,000
Farrow-to-feeder pig -									
Low-investment confinement	sow	57		69		21		29	
High-investment, high-intensity confinement	sow		205		252		158		367
Other Activities Used:									
Corn -									
Bought	bushel	4,364	8,949		9,531	117	24,568		16,694
Sold	bushel							1,701	
Custom harvest -									
Corn	hour	25	16						
Wheat	hour	8	8						
Soybeans	hour	8	8						

<sup>a</sup> Minimum feeder pig price in which feeder pigs entered the solution to achieve the specified net income level.

<sup>b</sup> Net income = net returns to owned land and operator labor used, risk and management.

solution, corn production was much lower and purchased corn requirements were nearly twice as high. Operator labor was completely exhausted with 865 hours of part-time labor being needed. These factors added to high total capital requirements.

#### Medium Farm

Feeder pigs were in the solution for \$15,000 in net income on the medium farm when the feeder pig price increased to \$95.00/cwt. This farm plan included 69 sows producing feeder pigs in the low-investment confinement system with eight sows producing farrow-to-finish in this same system. Crop acreage was relatively small and enough corn was produced to meet the swine feed requirements. Labor requirements were also low in this farm plan.

Feeder pig prices needed to be at \$99.00/cwt before feeder pigs were in the solution for \$30,000 in net income. This solution used 252 sows producing feeder pigs in the high-investment, high-intensity confinement system. In addition to the 81 acres of produced corn, this system required 9,531 bushels of purchased corn. The entire operator labor supply was used with an additional 1,858 hours of part-time labor being needed. These factors resulted in a high total capital requirement.

#### Large Farm

An optimal solution using feeder pig production at the \$15,000 income goal was attained on the large farm when feeder pig prices were at \$93.00/cwt. This farm plan was very similar to the base plan in terms of required capital and labor and in the cropping systems. Feeder

pig production was in the low-investment confinement system at 21 sows. An additional 69 sows were used in this same plan in a farrow-to-finish enterprise.

For \$30,000 in net income, feeder pig prices needed to be \$95.00/cwt. The farm plan included the high-investment, high-intensity confinement system with 158 sows producing feeder pigs and 130 sows producing market hogs farrow-to-finish. Such large volume hog production required 24,568 bushels of purchased corn and a large amount of labor. Full-time labor was completely exhausted, and an additional 1,026 hours of part-time labor were needed.

#### Extra-Large Farm

Feeder pig prices needed to rise to \$92.00/cwt for feeder pigs to be produced at the \$30,000 income level on the extra-large farm. The farm plan included 100 sows in the farrow-to-finish, low-investment confinement system along with 29 sows producing feeder pigs. Crop production was intensified over the base plan with large amounts of corn, soybeans and wheat being produced. Enough corn was produced for the swine feed requirement and an additional small amount was available for sale. A large amount of full-time labor went unused in this plan.

At the \$50,000 income goal, feeder pigs were not in the solution until they were priced at \$95.00/cwt. The plan used the high-investment, high-intensity confinement system in which 367 sows produced feeder pigs and 91 sows produced market hogs farrow-to-finish. A large amount of corn was needed from production as well as 16,694 bushels of additional purchased corn. Available full-time labor was completely exhausted with a part-time labor requirement of 1,806 hours.

#### IV. PROGRAMMING OF SPECIAL FARM SITUATIONS

Apart from the four farm size situations examined in the preceding analysis, two special farm situations were considered and provide the topic of this section. The first situation was where the owner-operator is a part-time farmer. Because of the increased availability of higher paying off-farm employment over the past several years in Tennessee, this alternative has seemed very attractive to many individuals. This is especially true for many people with a farm background, but who lack the resource base to generate an acceptable level of earnings. This lack of a sufficient resource base has characterized many areas of Tennessee and makes this analysis particularly relevant for these areas. These considerations also form part of the reasoning for examining the second special situation. In this situation, no available land base is assumed for cropping enterprises and the only source of generating the income goals is through swine production. Such highly specialized swine farms have been increasing in number and will likely be even more characteristic of the swine industry in the future.

##### A. PART-TIME FARMER

To simulate the part-time farmer situation, alterations were made in certain resource assumptions on the small farm base situation. These included reducing the selected income goals and the owner-operator labor supply in each time period by one-half. Analyzed income levels were \$7,500 and \$15,000. Other aspects of this situation, such as land availabilities and enterprises considered, were consistent with those of



the small farm situation. Results of this analysis are reported in Table 29.

The solution for \$7,500 in net income included 30 sows in the farrow-to-finish, low-investment confinement system. Cropping enterprises used were double-cropped wheat-soybeans and corn production where the 73 acres of corn were enough to meet the swine feed requirement. The part-time farmer in this plan was able to supply most of the necessary labor with some seasonal labor during the busy seasons. Overall, the low capital and labor requirements make this farm plan conducive to the part-time farmer.

A feasible solution could not be attained at the \$15,000 net income level. The limited labor supply of the part-time farmer was the reason that no enterprise combination was available that would achieve this income goal.

#### B. SWINE PRODUCTION ONLY

The land base for crop production was eliminated in this situation so that the only means of generating the specified net income levels was through swine production. This made purchasing corn the only way to meet the swine feed requirements. Available full-time labor consisted of the owner-operator. Any additional required labor could be purchased as needed. No limitation was placed upon the amount of additional labor that could be used in the solution. Income goals analyzed in this situation were \$15,000 and \$30,000. Results of this analysis also appear in Table 29.

TABLE 29  
MINIMUM CAPITAL REQUIREMENTS FOR TWO FARM ORGANIZATIONS--  
PART-TIME AND SWINE PRODUCTION ONLY--AT SELECTED  
INCOME LEVELS

Item	Unit	Part-Time Farmer		Swine Production Only	
		Net Income in Dollars <sup>a</sup>			
		7,500	15,000	15,000	30,000
<u>Resources Used:</u>					
Total capital -	dollars	46,150		132,064	475,445
Operating	dollars	30,255		103,647	347,113
Investment	dollars	15,895		28,417	128,332
Total owned land -	acre	52			
Cropland	acre	47			
Land for hog system	acre	5		13	13
Rented cropland	acre	49			
Total labor -	hour	1,276		3,017	7,039
Full-time	hour	1,090		2,357	2,520
Part-time (seasonal)	hour	186		660	4,519
<u>Enterprises Used:</u>					
Corn	acre	73			
Soybeans	acre				
Wheat	acre				
Wheat-soybeans	acre	24			
Cotton	acre				
Grain sorghum	acre				
Farrow-to-finish -					
Low-investment con-					
finement	sow	30		95	
High-investment, high-					
intensity confine-					
ment	sow				330
<u>Other Activities Used:</u>					
Corn -					
Bought	bushel			18,429	63,635
Sold	bushel				
Custom harvest -					
Corn	hour	24			
Wheat	hour	8			
Soybeans	hour	8			

<sup>a</sup>Net income = net returns to owned land and operator labor used, risk and management.

The farm plan for \$15,000 in net income included 95 sows in the farrow-to-finish, low-investment confinement system. This system required 18,429 bushels of purchased corn which made the operating capital requirement very high. The majority of the owner-operator labor was used in this plan. An additional 660 hours of labor was also required mainly during the farrowing seasons with this system.

The \$30,000 net income solution employed 330 sows in the farrow-to-finish, high-investment, high-intensity confinement system. This system required the purchase of 63,635 bushels of corn. The entire operator labor supply was exhausted with 4,519 additional hours of hired labor being needed. This extra amount of hired labor was equivalent to nearly two full-time man-equivalents. Overall, total capital requirements were extremely high with a large majority being in operating capital.

## CHAPTER V

### SUMMARY, CONCLUSIONS AND IMPLICATIONS

#### I. SUMMARY

The major source of data used in this study was a mail survey of farrow-to-finish swine producers in a 10-county area of West Tennessee. Approximately 60 percent of the surveyed farmers responded by completing and returning the questionnaire. Of the responding farmers, 124 were currently engaged in farrow-to-finish swine production. Responses from these producers formed the data set used in the analysis. The data provided information pertaining to swine production facilities and practices and a description of the overall farm structure and organization. In addition, responses to other questions provided considerable insight about specific farm characteristics and factors which influenced the viability of the farm firm.

The general objective of this study was to determine the minimum amount of required capital and the optimal enterprise organization to return selected net income levels in various Tennessee swine farm situations. To accomplish this objective, guidelines were developed for determining resource situations and enterprise budgets that were characteristic of Tennessee swine farms. The chosen resource situations and production alternatives were analyzed by using a linear programming model designed to minimize total capital requirements for achieving

selected net income levels. Postoptimal procedures were used to examine the effect on the solutions of variations in selected resource availabilities and economic environments. Finally, two special farm situations were analyzed regarding their capital requirements in achieving selected net income levels.

Four farm situations were analyzed, each at two income levels. The net income levels included \$15,000 and \$30,000 on the small, medium and large farms and \$30,000 and \$50,000 on the extra-large farm. Enterprises considered included four systems of farrow-to-finish swine production along with four corresponding systems of farrow-to-feeder pig and feeder pig-to-finish production. Also considered were 10 other enterprises commonly found on Tennessee swine farms. Solutions yielding minimum capital requirements and optimum enterprise organizations could be found in 39 of the programmed situations for the lower income goals and 22 of the situations considered at the higher income goals. In addition to the base situations, other situations, each examined one at a time, included variations in hog prices, purchased corn prices, labor supplies, capital costs and feeder pig prices. Also, a part-time farmer and a specialized hog farm situation were considered. A summary of the minimum capital requirements for each of these situations is reported in Table 30.

The results of the study indicated that three enterprises were employed in the majority of the optimum solutions. The enterprises were farrow-to-finish swine production, corn production and double-cropping wheat and soybeans. Two systems of farrow-to-finish swine production were employed in the various analyzed farm situations. The low-

TABLE 30  
SUMMARY OF RESULTS: THE PROGRAMMING ANALYSIS TO DETERMINE MINIMUM TOTAL CAPITAL REQUIREMENTS<sup>a</sup>  
TO ACHIEVE SELECTED NET FARM INCOME LEVELS

Income Level <sup>b</sup>	Farm Size						
	Small Farm 15,000	30,000	Medium Farm 15,000	30,000	Large Farm 15,000	30,000	Extra-Large Farm 30,000 50,000
	-----dollars-----						
Farm situation							
Base	93,593	---	69,178	---	129,064	338,037	207,545 456,547
Hog price variations							
High price (\$53.00/cwt)	43,598	91,743	39,010	79,698	78,294	115,708	127,275 175,344
Low prices <sup>c</sup>	166,491	203,167	32,619	231,632	326,271	272,104	455,542 462,890
Purchased corn price variations							
\$3.25/bu.	106,376				129,791	468,523	562,476
\$3.35/bu.	168,577	n.a. <sup>d</sup>	n.a.	n.a.	129,938	---	n.a. <sup>d</sup> ---
\$3.50/bu.	---				130,249	---	---
Labor supply variations							
Operator only	126,644	---	94,062	---	129,456	---	224,004 ---
Operator plus family members <sup>e</sup>	85,793	262,020	67,085	229,076	128,198	326,658	202,715 424,963
Variations in the cost of capital (investment/operating)							
9%/10.5%	71,717	---	55,163	188,289	105,572	233,099	162,041 310,881
12%/13.5%	89,386	---	66,351	---	124,444	317,810	193,876 428,641
15%/16.5%	173,346	---	86,558	---	157,842	---	332,295 ---
18%/19.5%	---	---	141,722	---	---	---	---
Feeder pig price variations <sup>f</sup>							
Varying prices	92,141	149,467	67,673	190,322	128,711	323,478	189,897 419,839
Special farm situations							
Part-time farmer <sup>g</sup>	46,150	---					
Swine production only <sup>h</sup>	132,064	475,445					

TABLE 30 (continued)

<sup>a</sup> Capital less owned land, operator labor, risk and management.

<sup>b</sup> Net income = net returns to land and operator labor used, risk and management.

<sup>c</sup> Low hog prices were the minimum prices in which a solution could be found that achieved the selected net income level. These were as follows:

Farm Size	Income Level		Farm Size	Income Level	
	Low	High		Low	High
	----\$/cwt----			----\$/cwt----	
Small	45.00	48.00	Large	44.00	45.00
Medium	45.00	47.00	Extra-large	44.00	46.00

<sup>d</sup> n.a. - Analysis was not applicable in this situation.

<sup>e</sup> Minimum number of hours of family labor required per month to achieve the higher income level on each farm size. These were as follows:

Farm Size	Hours Per		Farm Size	Hours Per	
	Month	Month		Month	Month
Small	160		Large	80	
Medium	160		Extra-large	200	

<sup>f</sup> Minimum feeder pig price in which feeder pigs were in the solution to achieve the specified net income level. These were as follows:

Farm Size	Income Level		Farm Size	Income Level	
	Low	High		Low	High
	----\$/cwt----			----\$/cwt----	
Small	95.00	103.00	Large	93.00	95.00
Medium	95.00	99.00	Extra-large	92.00	95.00

<sup>g</sup> Income levels and the owner-operator labor supply were reduced by one-half in the part-time farmer situation. Income levels analyzed in this situation included \$7,500 and \$15,000.

<sup>h</sup> The land base for producing crops was eliminated in the swine-production-only situation. Income levels analyzed in this situation included \$15,000 and \$30,000.

investment confinement system, used in many of the plans for achieving the lower income levels, yielded the highest returns to the required investments. In situations where the labor supply became a highly limiting resource, the more labor efficient high-investment, high-intensity confinement system was optimal. This occurred in many of the farm plans in achieving the higher income goals where the large required number of sows used much of the available labor supply. This system compared much more favorably with the low-investment confinement system when returns were considered after labor had been charged as an expense. Corn production was used in all situations and provided the major source of feed for the swine enterprise. In many cases, the agronomic and machinery restrictions limited the amount of corn that could be grown. Many of these situations used large amounts of purchased corn which greatly increased operating capital requirements. Double-cropping wheat and soybeans was used in many of the farm plans. This enterprise showed high relative returns and labor requirements not so directly competitive with those of corn production. Overall, the farm plans showed a higher degree of diversification in enterprise usage as farm size increased and more resources became available.

The base situations used five-year weighted average prices and yields consistent with the levels of input use and an above average level of management. Under these assumptions, the low income goals could be achieved on each farm size, but available fixed resources (land and operator labor) were insufficient for generating the high income goals on the small and medium farms. Total capital requirements varied



widely among the analyzed farm situations. Capital requirements declined markedly from the small to the medium farm size mainly because of the increased available acreage for corn production. This extra corn acreage eliminated the need for purchasing corn and thus greatly reduced operating capital requirements. The much larger farm overheads assumed to be present on the large and extra-large farm sizes made capital requirements higher in these plans. At the lower income goals both plans failed to employ much of the available labor. When the higher income goals were examined, the demand for labor was increased considerably and the solutions switched to the use of the more labor efficient swine system. Overall, both farm plans used much less cropping acreage than was available and concentrated more heavily in farrow-to-finish swine production.

The hog price variations examined in this study had a drastic effect on the optimal solutions for each farm size. When hog prices were high, many of the situations had total capital investments of less than half of those required at the base hog prices. Large amounts of resources went unused in many of these low and high income farm plans. As hog prices were varied downward, no solution could be found on any farm size that did not include a system of swine production. That is, as hog prices were lowered, the solution went infeasible before swine production exited the optimal plan. The minimum hog prices for which an optimal solution existed showed that prices could fall lower on farms with larger amounts of available zero-cost resources. Capital requirements at the low hog prices were much higher than those at the base hog prices. Labor supplies were completely utilized in the plans with large

part-time labor and purchased corn requirements accounting for much of the increased total capital requirements when hog prices were low.

The effects of purchased corn price variations could only be examined on the small, large and extra-large farm sizes. These were limited to the low income goal on the small farm and high income goal on the extra-large farm. Both income goals were relevant on the large farm. The small farm showed a sharp increase in total capital as the purchased corn price rose, especially when the price was \$3.35 per bushel because of a switch to the higher investment production system. The large farm experienced little change in the optimal plan at the lower income goal when purchased corn prices were increased. The small amounts of purchased corn used caused total capital requirements to increase only slightly. At the higher income goals capital requirements increased markedly on both the large and extra-large farm sizes. The higher requirements were due primarily to many more sows needed in the high investment production system.

Reducing the available labor supply to the owner-operator only caused greatly increased capital requirements on the small and medium farm sizes. With limited labor, both solutions required the more labor efficient high-investment production system. The solutions yielding \$30,000 in net income on these farms could only be achieved when 160 hours per month were available from family members. Much of this extra labor was employed by the large number of sows required in the high-investment production system. Solutions at the low income goal required a lower total capital requirement than the base situations due primarily to the availability of "free" labor. Because of the large amount of

full-time labor unused in the base plan of the large farm, restricting this situation to only the full-time labor supply had only a slight effect on the total capital required at the low income goal. However, this amount of labor was insufficient for generating the high income goal on the large farm. Family members were required to be available at the rate of 80 hours per month for achieving \$30,000 in net income. This requirement was much lower here than on any other farm size. The availability of this "free" labor produced lower capital requirements than in the base situation. The solution at the low income goal when family labor was available required much the same level of total capital as in the base plan. While much of the full-time labor went unused in the base plan of the extra-large farm at the low income goal, restricting the labor supply to only the full-time labor force increased required capital sharply. Also, 200 hours per month of family labor were required to achieve the high income goal with much of this labor going unused. These factors point out the importance of available labor during the busy seasons on a farm relying heavily on crop production. When this amount of family labor was available, the solution at the low income goal highly resembled that of the base situation.

Variations in the cost of capital showed that interest rates paid by farmers for operating and investment capital highly influence total capital requirements. Analysis of all farm sizes showed greatly increased total capital requirements as the cost of capital rose. The largest increases in total capital occurred when the solution required the use of the high-investment production system. Shifts to this system occurred as the number of sows increased, thus, utilizing larger amounts

of labor and making this labor-efficient system necessary. Higher purchased corn requirements with these larger production sizes also added significantly to the higher capital requirements. These results also showed that the larger the farm size the more capital costs could rise and still achieve the income goals. Comparing the farm sizes at the \$30,000 income level showed that the greater the amount of zero-cost resources available on a farm, the more capable the farm was in achieving the income level at higher capital costs.

The analysis which allowed feeder pig price variations indicated that feeder pig production did not compare very well with farrow-to-finish production in the analyzed situations. Feeder pig prices had to rise above \$90.00/cwt before a feeder pig production system would be used any of the optimal solutions. These prices were well above the base price. In only one of the last five years have average feeder pig prices at Tennessee organized feeder pig sales been this high. Many of the farm plans at the higher feeder pig prices included both feeder pig and farrow-to-finish production. These results also showed feeder pig production used in the farm plans at lower prices on the larger farm sizes. With larger supplies of available labor on these farms, the relatively labor-intensive enterprise of feeder pig production could be used at lower pig prices.

The low amounts of capital and labor required in the part-time farm situation made this plan look like an attractive alternative for the part-time farmer. A solution here could only be attained at the low-income goal where at the high-income level the labor supply of the part-time farmer was insufficient.

An extremely high level of total capital was required in the specialized hog farm situation. Most of these investments were in the large amounts of operating capital needed to hire labor and purchase corn. These plans look good only in situations where operating capital is not limited and sources are readily available.

## II. CONCLUSIONS

This analysis of the potential of swine production on Tennessee farms suggests the following conclusions:

1. The linear programming analysis suggested that enterprise combinations which included farrow-to-finish swine production provided a minimum net income with the least amount of required capital, excluding land investment, on all farm sizes. The low-investment confinement system was best suited for farms where labor is not a highly limited resource. In cases where a large volume of production is necessary to achieve an acceptable income, unless labor is essentially unrestricted, production in the labor-efficient, high-investment, high-intensity confinement system was suggested.
2. Corn production complemented farrow-to-finish swine production on all farm sizes whenever on-farm production was possible. This enterprise provided the major source of swine feed with purchased corn used when acreage was insufficient. Double-cropping wheat and soybeans was suggested as a high returns alternative. This enterprise worked well

in these plans because of labor requirements not so directly competitive with those of corn production.

3. Farmers faced with situations similar to the small and medium farms will find it very difficult to achieve a \$30,000 minimum net income constraint. If land payments or income reservations require this level of earnings, farmers would likely look to enterprises not considered here or off-farm employment. Farmers facing situations not unlike those of the large or extra-large farms may consider the high-income goals as targets. In the farm plans at the low-income goals many resources went unused, while at the high-income goals, the large amounts of available resources were used more effectively.
4. Both the large and extra-large farms failed to utilize much of the large amounts of available land acreage. Farmers in these situations might decide whether to concentrate more heavily in swine or crop production. The results here suggest farrow-to-finish swine production.
5. The price farmers can receive for their hogs is an important factor in determining total capital requirements. This situation suggests that hog farmers need to be aware of and able to use marketing strategies which reduce price variability and avoid the risk of selling the majority of annual total production in a depressed market. The results of the hog price variations also indicate that farms with larger amounts of available zero-cost resources are able to with-

stand lower prices while still generating acceptable incomes.

6. Upward variation of the purchased corn price sharply increased capital requirements in situations where corn production was limited and a large amount of purchased corn was required. This suggests that farmers in corn-deficit areas carefully examine their alternative sources of operating funds and corn suppliers. In addition, on-farm corn production may be viewed in general as a much less capital-intensive swine feed source even when rented acres are used.
7. In farm situations where the labor supply is highly restricting, farrow-to-finish with labor-efficient high-investment confinement systems may be considered as an enterprise providing high returns to the limited labor supply. These results showed capital investments as being highly substitutable for labor and total investments which were much higher when labor was in short supply. In cases where labor was in short supply, income potential was limited to the lower income targets.
8. If family members are available as a source of farm labor, capital requirements can be reduced substantially. In the analysis, family labor, which was required mainly during peak demand periods of crop production, allowed more full-time labor to be devoted to swine production and, thus, reduced required investment in the swine system. This situation was especially true for large crop-producing farms

which required large amounts of labor during seasonal demand periods.

9. The analysis in which the cost of capital was varied indicated that capital requirements were highly sensitive to the price farmers pay for operating and investment capital. This suggests that farmers carefully evaluate alternative sources of borrowed funds and the interest rates charged by each source. The results also showed that in situations where larger amounts of zero-cost resources were available, higher income goals were attainable even at much higher capital costs.
10. Feeder pig production did not compare well with farrow-to-finish production. Results of the analysis of feeder price variations showed that only at very high pig prices were feeder pigs in the optimal solutions. Farrow-to-feeder pig enterprises are relatively more labor intensive and do not yield the returns to labor that are achieved in farrow-to-finish operations.
11. Farrow-to-finish swine production can be an attractive alternative for the part-time farmer when income goals are not set too high. The labor supply of the part-time farmer severely limited the income potential of swine production in the analyzed farm situations.
12. Highly specialized swine farms look attractive only in situations where large amounts of purchased corn and labor



are available. These situations required large operating investments and sources for these funds must be available.

13. Results in nearly all analyzed situations showed that a higher degree of diversification was more relevant the larger the farm size. Results of this analysis suggests smaller farm plans be highly concentrated in corn and swine production.
14. No solutions were found in any of the analyzed situations that did not include a system of swine production. Swine production provided the major source of income in all situations. These factors suggest that swine production should be strongly considered as a potential farm enterprise when minimizing capital requirements subject to achieving a minimum net income level is an important goal of the farmer. Capital requirements are highly variable and depend heavily on the individual farm situation. When quality management is available and the operator is willing to make a long-term commitment to swine production, achieving an acceptable level of earnings is possible.

### III. IMPLICATIONS

#### For Tennessee

Results of this study suggest certain implications for swine farms in the various areas of Tennessee. Farmers with land acreage suitable for corn production of amounts filling most of the feed requirement for hogs will find nonland capital requirements much lower than in

situations where corn production is limited. This is the comparative advantage that West Tennessee producers generally have over producers in other areas of the state. In areas where corn production is limited, swine production with purchased corn can generate an acceptable income. These cases generally require much higher investments and capital requirements that are highly dependent on the price paid by farmers for corn. Forward contracting or large volume buying may provide for cheaper sources of corn and, thus, much lower investment requirements.

Highly specialized hog farms require large amounts of operating capital. Such situations should only be considered where operating capital is essentially unrestricted and large supplies of purchased corn and labor are available. These factors make this situation more conducive to West Tennessee where readily available supplies of lower priced corn are present as compared to other areas of the state.

The potential for swine production to generate specified income levels is highly dependent on the amounts and sources of available labor. Swine production is a labor-intensive enterprise. Resource situations that are highly restricted in the amounts of available labor will be highly limited in expected net returns. Capital requirements become much higher the more limited that labor becomes.

The availability of family labor can greatly reduce investment requirements. For smaller farms with available family labor, swine production can provide reasonable incomes at a much lower investment by utilizing this labor.

Hog prices and capital costs are other factors which have a major impact on the income potential of a swine enterprise. This suggests

that farmers be highly concerned with prices received and paid in hog production. Alternative marketing and leveraging strategies need to be closely examined to increase returns and reduce costs.

Overall, farrow-to-finish swine production provides a means for achieving reasonable levels of farm income on many different farm situations. Minimum capital requirements are highly variable and dependent on many factors influencing the profit potential of the swine enterprise. In general, while the potential for generating acceptable incomes in resource situations present in many areas of the state exists, West Tennessee generally has a considerable cost advantage because of corn availability.

#### For the Survey Farms

The four base situations developed in this study were determined from the resource situations and characteristics of 124 farrow-to-finish swine farms in West Tennessee. Comparisons of the base plans with these actual farm situations should provide some insight as to the efficiency of resource use and potential adjustments of West Tennessee swine farms.

The 29 swine farms which formed the small farm situation were basically using two enterprises, hog and corn production. Their use of these enterprises, on the average, was much lower than the levels of hog and corn production in the base plan. These results suggest that incomes may be increased on these farms through greater production from current enterprises by using available resources more efficiently.

Enterprises commonly used on the 26 farms comprising the medium farm situation included hogs, corn, soybeans, wheat and grain sorghum.

Level of enterprise usage was very similar to the base plan in hog production but significant differences existed in crop production. The majority of the farms produced much less corn and much more soybeans than the base plan suggested. Based on the analysis, corn production should be intensified and soybean production reduced and limited to a double-cropping system if income generated from the resources currently used is to be increased. Grain sorghum production was found on 50 percent of the farms in this group and may provide a source of swine feed. This feed source was not considered in the analysis and may account for the small amount of corn acreage actually used.

The 27 farms for the large farm situation commonly used four enterprises--hogs, corn, soybeans and wheat. The number of sows used was much lower than the base plan suggested. Corn production on the average for the 27 survey farms was approximately equal to the suggested levels in the base plan but the other crops were produced highly in excess of the base plan. These results imply that returns to resources may be increased by focusing more on the swine enterprise and reducing emphasis on crop production, especially if higher income goals are to be reached.

These same four enterprises were the ones commonly used on the 27 farms comprising the extra-large farm situation. Again, actual enterprise usage was more intensively devoted to crop production than in the base plans. Corn production levels in the base plans were very similar to actual levels, but soybean and wheat production greatly exceeded base levels. Hog production on the survey farms, on the average, was between the levels suggested by the base plan at each of the income goals. An

implication is that for the lower income level, much less acreage is needed for soybean and wheat production, and soybeans need to be utilized only in a double-cropping system. When higher incomes are the target, more emphasis needs to be placed on large-scale hog production and less on the cropping enterprises.

#### For the Use of This Study and Future Research

The potential use of this study lies not so much in the specific results obtained but more in the general guide it provides to farmers for planning and operating a successful swine operation. When analyzing the income potential for their swine operation, farmers may be able to compare their specific situation to ones considered here and estimate approximately what resources will be required and what incomes can be expected. Also, the study should prove helpful to producers in recognizing factors which may limit the profit potential of their farm and suggest ways of alleviating these problems.

Of course, many factors influence resource requirements and profit potential of swine production which were not considered here. The concept of economies of size, the one-year time dimension of this analysis and risks are three prime examples. While these limitations are conceded to exist, this study does provide a general overview of the potential of swine production in Tennessee. It should prove useful as a guide to current and potential farm operators with interests in swine production.

Addressing the limitations of this study offers suggestions for further research into the potential of swine production on Tennessee

farms. Growth and viability of the farm over time are major objectives for many farm operators. Determining costs incurred at various relative prices of inputs and outputs, and various sizes of production systems and at different points of time in the planning span of the farmer would provide insight into economical sizes of production. An examination of how to effectively deal with the ever present risks involved in farming would serve as a useful guide for farm survival in the future. Extensions such as these could provide a better understanding of the potential of swine production as an enterprise on Tennessee farms presently and in the future.

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## APPENDICES

APPENDIX A  
ANNUAL OWNERSHIP COSTS

ED AVAILABLE ON THE FOUR FARM SIZES

<u>Depreciation</u> <u>Per Year</u>	<u>Depreciation</u> <u>Per Hour</u>	<u>Repairs</u> <u>Per Hour</u>	<u>Interest</u> <u>Per Hour</u>	<u>Total Fixed</u> <u>Cost Per Hour</u>
1,872	3.12	2.08	2.17	7.37
2,429	4.05	2.70	2.81	9.56
3,510	5.85	3.90	4.06	13.81
4,095	6.83	4.55	4.74	16.12
171	1.71	1.41	1.19	4.31
343	3.43	2.28	2.38	8.09
79	0.99	0.66	0.69	2.34
163	2.03	1.36	1.41	4.80
306	4.37	1.94	3.04	9.35
617	8.81	3.91	6.11	18.83
330	4.72	2.10	3.28	10.10
447	6.39	2.84	4.44	13.67
65	0.93	0.31	0.64	1.88
98	1.40	0.47	0.97	2.84
495	7.07	3.14	4.91	15.12
747	10.67	4.74	7.41	22.82
198	4.96	2.21	3.45	10.62
315	7.88	3.50	5.48	16.86
58	1.45	0.97	0.80	3.22
222	3.70	2.47	2.57	8.74
345	5.75	3.83	4.00	13.58

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<u>preciation</u> <u>er Year</u>	<u>Depreciation</u> <u>Per Hour</u>	<u>Repairs</u> <u>Per Hour</u>	<u>Interest</u> <u>Per Hour</u>	<u>Total Fixed</u> <u>Cost Per Hour</u>
5,006	28.61	12.71	15.89	57.21
6,075	34.71	15.43	19.29	69.43
1,125	11.25	7.50	6.25	25.00
1,688	16.88	11.25	9.38	37.51
6,581	32.91	14.63	18.28	65.82
533	2.54	1.98	1.41	5.93
158	1.31	0.88	0.91	3.10
833	4.63	4.11	2.57	11.31
182	2.27	1.52	1.26	5.05
45	0.65	0.29	0.46	1.40
87	1.44	1.28	0.80	3.52

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## D OFFICE EXPENSES, FOUR FARM SIZES

Annual Repairs	Interest	Taxes and Insurance	Total Annual Cost
-----dollars-----			
22.50	157.50	16.88	204.88
75.00	231.00	24.75	550.75
15.00	105.00	11.25	231.25
00.00	665.00	71.25	2,091.25
10.00	35.00	3.75	78.75
8.00	28.00	3.00	63.00
---	---	---	75.00
90.00	105.00	---	<u>195.00</u>
			3,489.88
24.00	199.50	21.38	434.88
90.91	280.00	30.00	667.58
17.50	122.50	13.13	269.80
00.00	665.00	71.25	2,091.25
10.00	35.00	3.75	78.75
8.00	28.00	3.00	63.00
---	---	---	75.00
20.00	140.00	---	<u>260.00</u>
			3,940.26
32.42	269.50	28.88	587.47
70.46	525.00	56.25	1,251.71
21.00	147.00	15.75	323.75
00.00	1,131.90	121.28	3,608.48
16.80	58.80	6.30	132.30
15.00	52.50	5.63	118.13
---	---	---	110.00
50.00	175.00	---	325.00
---	---	---	<u>12,000.00</u>
			18,456.84
42.10	350.00	37.50	762.93
25.00	700.00	75.00	1,666.67
25.00	175.00	18.75	385.42
00.00	1,131.90	121.28	3,608.48
16.80	58.80	6.30	132.30
20.00	70.00	7.50	157.50
---	---	---	125.00
80.00	210.00	---	390.00
---	---	---	<u>24,000.00</u>
			31,228.30

TABLE A-3  
INVESTMENT AND ANNUAL OWNERSHIP COSTS FOR THE FARROW-TO-FEEDER PIG SWINE SYSTEMS

Item	Investment		Annual Ownership Costs			
	New	Average	Depreciation	Interest	Maintenance	Insurance and Taxes Total
-----dollars-----						
<b>Part A. 25-Sow Pasture System</b>						
1. Buildings and equipment						
a. 8-year depreciable facilities	13,191.00	6,595.50	1,648.88	824.44	230.84	98.93 2,803.09
2. Breeding stock <sup>a</sup>						
a. Sows/gilts	4,751.89	4,751.89	---	332.62	---	71.28 403.91
b. Boars	879.00	879.00	942.00 <sup>b</sup>	61.53	---	13.19 1,016.72
3. Operating inventory	10,010.42	10,010.42	---	350.63	---	150.16 500.31
4. Total	28,832.31	22,236.81	2,590.00	1,568.96	230.84	333.56 4,724.03
5. Total per sow	1,153.29	889.47	103.60	62.76	9.23	13.34 188.96
<b>Part B. 50-Sow Low-Investment Confinement System</b>						
1. Buildings and equipment						
a. 15-year depreciable facilities	20,306.00	10,153.00	1,353.73	1,269.13	203.06	152.30 2,978.22
b. 8-year depreciable facilities	18,879.25	9,439.63	2,359.91	1,179.95	330.39	141.59 4,011.84
2. Breeding stock <sup>a</sup>						
a. Sows/gilts	9,503.78	9,503.78	---	665.26	---	142.56 807.82
b. Boars	1,465.00	1,465.00	1,570.00 <sup>b</sup>	102.55	---	21.98 1,694.53
3. Operating inventory	19,594.41	19,594.41	---	685.80	---	293.92 979.72
4. Total	69,748.44	50,155.82	5,283.64	3,902.69	533.45	752.35 10,472.13
5. Total per sow	1,394.97	1,003.12	105.67	78.05	10.67	15.05 209.44



TABLE A-3 (continued)

Item	Investment		Annual Ownership Costs				
	New	Average	Depreciation	Interest	Maintenance	Insurance and Taxes	Total
-----dollars-----							
<b>Part C. 100-Sow High-Investment Confinement System</b>							
1. Buildings and equipment							
a. 15-year depreciable facilities	34,632.90	17,316.45	2,308.86	2,164.56	346.33	259.75	5,079.50
b. 8-year depreciable facilities	67,807.10	33,903.55	8,475.89	4,237.94	1,186.62	508.55	14,409.00
2. Breeding stock <sup>a</sup>							
a. Sows/gilts	19,007.55	19,007.55	---	1,330.53	£--	285.11	1,615.64
b. Boars	1,963.50	1,963.50	2,023.00 <sup>b</sup>	137.45	---	29.45	2,189.90
3. Operating inventory	41,063.81	42,063.81	---	1,437.23	---	615.96	2,053.19
4. Total	164,474.86	113,254.86	12,807.75	9,307.71	1,532.95	1,698.82	25,347.23
5. Total per sow	1,644.75	1,132.55	128.08	93.08	15.33	16.99	253.47
<b>Part D. 200-Sow High-Investment, High-Intensity Confinement System</b>							
1. Buildings and equipment							
a. 15-year depreciable facilities	101,235.00	50,617.50	6,749.00	6,327.19	1,012.35	759.26	14,847.80
b. 8-year depreciable facilities	111,052.50	55,526.25	13,881.56	6,940.78	1,943.42	832.89	23,598.65
2. Breeding stock <sup>a</sup>							
a. Sows/gilts	38,015.10	38,015.10	---	2,661.06	---	570.23	3,231.29
b. Boars	2,680.00	2,680.00	2,640.00 <sup>b</sup>	187.60	---	40.20	2,867.80
3. Operating inventory	81,339.08	81,339.08	---	2,846.87	---	1,220.09	4,066.96
4. Total	334,321.68	228,177.93	23,270.56	18,963.50	2,955.77	3,422.67	48,612.50
5. Total per sow	1,671.61	1,140.89	116.35	94.82	14.78	17.11	243.06

<sup>a</sup>For the breeding stock, investments are based on boar values at the average of buying and selling prices while females are valued at their market price.

<sup>b</sup>Boar depreciation = (purchase price - selling price)/one year useful life.

TABLE A-4  
INVESTMENT AND ANNUAL OWNERSHIP COSTS FOR THE FEEDER PIG-TO-FINISH SWINE SYSTEMS

Item	Investment		Annual Ownership Costs			
	New	Average	Depreciation	Interest	Maintenance and Taxes	Total
-----dollars-----						
<b>Part A. 380 Purchased Pigs/Pasture System</b>						
1. Buildings and equipment						
a. 15-year depreciable facilities	5,300.00	2,650.00	353.33	331.25	53.00	777.33
b. 8-year depreciable facilities	11,060.00	5,530.00	1,382.50	691.25	193.55	2,350.25
2. Operating inventory	31,497.53	31,497.53	---	1,102.41	---	1,574.87
3. Total	47,857.53	39,497.53	1,735.83	2,124.91	246.55	4,702.45
4. Total per hog	125.94	104.41	4.57	5.59	0.65	12.37
<b>Part B. 760 Purchased Pigs/Low-Investment Confinement System</b>						
1. Buildings and equipment						
a. 15-year depreciable facilities	7,704.00	3,852.00	513.60	481.50	77.04	1,077.94
b. 8-year depreciable facilities	13,947.00	6,973.50	1,743.38	871.69	244.07	2,963.74
2. Operating inventory	63,023.59	63,023.59	---	2,205.83	---	3,151.18
3. Total	84,674.59	73,849.09	2,256.98	3,559.02	321.11	7,192.86
4. Total per hog	111.41	97.17	2.97	4.68	0.42	9.46
<b>Part C. 1,520 Purchased Pigs/High-Investment Confinement System</b>						
1. Buildings and equipment						
a. 15-year depreciable facilities	30,044.40	15,022.20	2,002.96	1,877.78	300.44	4,406.51
b. 8-year depreciable facilities	42,554.60	21,277.30	5,319.33	2,659.66	744.71	9,042.86
2. Operating inventory	125,971.17	125,971.17	---	4,408.99	---	6,298.56
3. Total	198,570.17	162,270.67	7,322.29	8,946.43	1,045.15	19,747.93
4. Total per hog	130.64	106.76	4.82	5.89	0.69	12.99

TABLE A-4 (continued)

Item	Investment		Annual Ownership Costs				
	New	Average	Depreciation	Interest	Maintenance	Insurance and Taxes	Total
-----dollars-----							
<b>Part D. 3,040 Purchased Pigs/High-Investment Confinement System</b>							
1. Buildings and equipment							
a. 15-year depreciable facilities	64,896.00	32,448.00	4,326.40	4,056.00	648.96	486.72	9,518.08
b. 8-year depreciable facilities	62,267.00	31,133.50	7,783.38	3,891.09	1,089.67	467.00	13,231.74
2. Operating inventory	249,240.01	249,240.01	---	8,723.40	---	3,738.60	12,462.00
3. Total	376,403.01	312,821.51	12,109.78	16,671.09	1,738.63	4,692.32	35,211.82
4. Total per hog	123.82	102.90	3.98	5.48	0.57	1.54	11.58

APPENDIX B  
ENTERPRISE BUDGETS

TABLE B-1  
ANNUAL COSTS AND RETURNS BUDGET FOR THE FARROW-TO-FEEDER PIG, 25-SOW PASTURE SYSTEM

Item	One Sow			25 Sows		
	Quantity	Unit	Amount (dollars)	Quantity	Unit	Amount (dollars)
<b>A. Income</b>						
1. Feeder pigs (50 lbs. @ \$79.13/cwt)			576.07	364	head	14,401.66
2. Culled sows (425 lbs. @ \$38.34/cwt)			60.19	9	head	1,504.76
3. Nonbreeders (300 lbs. @ \$44.00/cwt)			26.40	5	head	660.00
4. Boars (425 lbs. @ \$32.00/cwt)			16.32	3	head	408.00
5. Gross income			678.98			16,974.42
<b>B. Direct Costs</b>						
1. Feed						
a. Corn equivalent (\$2.93/bu.)	63.49	bu.	186.03	1,587.25	bu.	4,650.64
b. Pasture (\$48.24/acre)	0.48	acres	23.16	12	acres	578.88
c. Purchased feed (\$0.12/lb.)	1,047.8	lbs.	125.74	26,198.08	lbs.	3,143.40
d. Total feed			334.93			8,372.92
2. Veterinary and medicine			22.90			572.50
3. Boar purchase (@ \$450.00)			54.00	3	head	1,350.00
4. Marketing			16.60			415.00
5. Power and fuel			6.00			150.00
6. Miscellaneous (bedding, supplies)			20.00			500.00
7. Total direct costs			454.43			11,360.42
8. Income over direct costs (A.5 - B.7)			244.55			5,614.00

TABLE B-1 (continued)

Item	One Sow			25 Sows		
	Quantity	Unit	Amount (dollars)	Quantity	Unit	Amount (dollars)
<b>C. Overhead Expenses</b>						
1. Investment overhead						
a. 8-year depreciable facilities	527.64 <sup>a</sup>		112.12	13,191.00 <sup>b</sup>		2,803.09
b. Breeding stock			56.83			1,420.63
c. Operating inventory			20.01			500.31
d. Total investment overhead			188.96			4,724.03
2. Labor (\$4.00/hour)	30	hours	120.00	750	hours	3,000.00
3. Total overhead expenses			308.96			7,724.03
<b>D. Summary</b>						
1. Net return to land, labor, risk and management (B.8 - C.1)			35.59			889.97
2. Net return to land, risk and management (B.8 - C.3)			-84.41			-2,110.03

<sup>a</sup>Total investment per sow.<sup>b</sup>Total investment per 25-sow unit.

TABLE B-2  
ANNUAL COSTS AND RETURNS BUDGET FOR THE FARROW-TO-FEEDER PIG, 50-SOW LOW-INVESTMENT  
CONFINEMENT SYSTEM

Item	One Sow		50 Sows	
	Quantity	Unit Amount (dollars)	Quantity	Unit Amount (dollars)
<u>A. Income</u>				
1. Feeder pigs (50 lbs. @ \$79.13/cwt)		576.07	728	head 28,803.32
2. Culled sows (425 lbs. @ \$39.34/cwt)		56.85	17	head 2,842.32
3. Nonbreeders (300 lbs. @ \$44.00/cwt)		26.40	10	head 1,320.00
4. Boars (425 lbs. @ \$32.00/cwt)		13.60	5	head 680.00
5. Gross income		672.92		33,645.64
<u>B. Direct Costs</u>				
1. Feed				
a. Corn equivalent (\$2.93/bu.)	63.49	bu. 186.03	3,174.5	bu. 9,301.29
b. Purchased feed (\$0.12/lb.)	1,064.27	lbs. 139.71	58,213.5	lbs. 6,985.62
c. Total feed		325.74		16,286.91
2. Veterinary and medicine		22.90		1,145.00
3. Boar purchase (@ \$450.00)		45.00	5	head 2,250.00
4. Marketing		16.25		812.50
5. Power and fuel		9.00		450.00
6. Miscellaneous (bedding, supplies)		18.00		900.00
7. Total direct costs		436.89		21,844.41
8. Income over direct costs (A.5 - B.7)		236.03		11,801.23

TABLE B-2 (continued)

Item	One Sow		50 Sows	
	Quantity	Unit	Quantity	Unit
				Amount
				(dollars)
				(dollars)
C. Overhead Expenses				
1. Investment overhead				
a. 15-year depreciable facilities	406.12 <sup>a</sup>		20,306.00 <sup>b</sup>	2,978.22
b. 8-year depreciable facilities	377.59 <sup>a</sup>		18,979.25 <sup>b</sup>	4,011.84
c. Breeding stock				2,502.35
d. Operating inventory				979.72
e. Total investment overhead				10,472.13
2. Labor (\$4.00/hour)	22.4	hours	1,121	hours
3. Total overhead expenses				4,484.00
				14,956.13
D. Summary				
1. Net return to land, labor, risk and management (B.8 - C.1)				1,329.10
2. Net return to land, risk and management (B.8 - C.3)				-3,154.90

<sup>a</sup>Total investment per sow.<sup>b</sup>Total investment per 50-sow unit.



TABLE B-3  
ANNUAL COSTS AND RETURNS BUDGET FOR THE FARROW-TO-FEEDER PIG, 100-SOW HIGH-INVESTMENT  
CONFINEMENT SYSTEM

Item	One Sow			100 Sows		
	Quantity	Unit	Amount (dollars)	Quantity	Unit	Amount (dollars)
<b>A. Income</b>						
1. Feeder pigs (50 lbs. @ \$79.13/cwt)			576.07	1,456	head	57,606.64
2. Culled sows (425 lbs. @ \$39.34/cwt)			56.85	34	head	5,684.63
3. Nonbreeders (300 lbs. @ \$44.00/cwt)			26.40	20	head	2,640.00
4. Boars (425 lbs. @ \$32.00/cwt)			9.52	7	head	952.00
5. Gross income			668.84			66,883.27
<b>B. Direct Costs</b>						
1. Feed						
a. Corn equivalent (\$2.93/bu.)	63.49	bu.	186.03	6,349	bu.	18,602.57
b. Purchased feed (\$0.12/lb.)	1,164.27	lbs.	139.71	116,427	lbs.	13,971.24
c. Total feed			325.74			32,573.81
2. Veterinary and medicine			22.90			2,290.00
3. Boar purchase (@ \$425.00)			29.75	7	head	2,975.00
4. Marketing			16.00			1,600.00
5. Heating fuel			22.00			2,200.00
6. Electricity			5.00			500.00
7. Truck and tractor use			7.00			700.00
8. Miscellaneous (bedding, supplies)			12.00			1,200.00
9. Total direct costs			440.39			44,038.81
10. Income over direct costs (A.5 - B.9)			228.45			22,844.46

TABLE B-3 (continued)

Item	One Sow		100 Sows	
	Quantity	Unit Amount (dollars)	Quantity	Unit Amount (dollars)
<u>C. Overhead Expenses</u>				
1. Investment overhead				
a. 15-year depreciable facilities	343.63 <sup>a</sup>	50.80	34,632.90 <sup>b</sup>	5,079.50
b. 8-year depreciable facilities	678.07 <sup>a</sup>	144.09	67,807.10 <sup>b</sup>	14,409.00
c. Breeding stock		38.06		3,805.54
d. Operating inventory		20.53		2,053.19
e. Total investment overhead		253.48		25,347.23
2. Labor (\$4.00/hour)	19.5	hours	1,950	hours
3. Total overhead expenses		78.00		7,800.00
		331.48		33,147.23
<u>D. Summary</u>				
1. Net return to land, labor, risk and management (B.10 - C.1)		-25.03		-2,502.77
2. Net return to land, risk and management (B.10 - C.3)		-103.03		-10,302.87

<sup>a</sup>Total investment per sow.<sup>b</sup>Total investment per 100-sow unit.

TABLE B-4  
ANNUAL COSTS AND RETURNS BUDGET FOR THE FARROW-TO-FEEDER PIG, 200-SOW HIGH-INVESTMENT,  
HIGH-INTENSITY CONFINEMENT SYSTEM

Item	One Sow			200 Sows		
	Quantity	Unit	Amount (dollars)	Quantity	Unit	Amount (dollars)
<b>A. Income</b>						
1. Feeder pigs (50 lbs. @ \$79.13/cwt)			576.26	2,913	head	115,252.85
2. Culled sows (425 lbs. @ \$39.34/cwt)			56.01	67	head	11,202.07
3. Nonbreeders (300 lbs. @ \$44.00/cwt)			26.40	40	head	5,280.00
4. Boars (425 lbs. @ \$32.00/cwt)			6.80	10	head	1,360.00
5. Gross income			665.47			133,094.92
<b>B. Direct Costs</b>						
1. Feed						
a. Corn equivalent (\$2.93/bu.)	63.49	bu.	186.03	12,698	bu.	37,205.14
b. Purchased feed (\$0.11/lb.)	1,164.27	lbs.	128.07	232,854	lbs.	25,613.94
c. Total feed			314.10			62,819.08
2. Veterinary and medicine			22.90			4,580.00
3. Boar purchase (@ \$400.00)			20.00	10	head	4,000.00
4. Marketing			15.80			3,160.00
5. Heating fuel			20.00			4,000.00
6. Electricity			15.00			3,000.00
7. Truck and tractor use			6.90			1,300.00
8. Miscellaneous (bedding, supplies)			12.00			2,400.00
9. Total direct costs			426.70			85,339.08
10. Income over direct costs (A.5 - B.9)			238.77			47,755.84

TABLE B-4 (continued)

Item	One Sow			200 Sows		
	Quantity	Unit	Amount (dollars)	Quantity	Unit	Amount (dollars)
<b>C. Overhead Expenses</b>						
1. Investment overhead						
a. 15-year depreciable facilities	506.18 <sup>a</sup>		74.24	101,235.00 <sup>b</sup>		14,847.80
b. 8-year depreciable facilities	555.26 <sup>a</sup>		117.99	111,052.50 <sup>b</sup>		23,598.65
c. Breeding stock			30.50			6,099.09
d. Operating inventory			20.33			4,066.96
e. Total investment overhead			243.06			48,612.50
2. Labor (\$4.00/hour)	14.9	hours	59.60	2,982	hours	11,928.00
3. Total overhead expenses			302.66			60,540.50
<b>D. Summary</b>						
1. Net return to land, labor, risk and management (B.10 - C.1)			-4.29			-856.66
2. Net return to land, risk and management (B.10 - C.3)			-63.89			-12,784.66

<sup>a</sup>Total investment per sow.<sup>b</sup>Total investment per 200-sow unit.

TABLE B-5  
ANNUAL COSTS AND RETURNS BUDGET FOR THE FEEDER PIG-TO-FINISH, 380 PURCHASED PIGS, PASTURE SYSTEM

Item	One Sow		380 Hogs	
	Quantity	Unit Amount (dollars)	Quantity	Unit Amount (dollars)
<u>A. Income</u>				
1. Market hogs (220 lbs. @ \$46.01/cwt)		99.36	373	head
2. Gross income		99.36		
<u>B. Direct Costs</u>				
1. Feed				
a. Corn equivalent (\$2.93/bu.)	9.07	bu.	3,414.86	bu.
b. Pasture (\$48.24/acre)	0.02413	acres	9	acres
c. Purchased feed (\$0.12/lb.)	91.26	lbs.	34,359.4	lbs.
d. Total feed		38.69		14,562.83
2. Veterinary and medicine		1.69		627.00
3. Purchased 50-lb. feeders (@ \$79.13/cwt)		39.57	380	head
4. Marketing		2.00		760.00
5. Power and fuel		0.35		133.00
6. Miscellaneous (bedding, supplies)		1.00		380.00
7. Total direct costs		83.26		31,497.53
8. Income over direct costs (A.2 - B.7)		16.10		6,258.28

TABLE B-5 (continued)

Item	One Sow		380 Hogs	
	Quantity	Unit	Quantity	Unit
				Amount (dollars)
<b>C. Overhead Expenses</b>				
1. Investment overhead				
a. 15-year depreciable facilities	13.95 <sup>a</sup>		5,300.00 <sup>b</sup>	777.33
b. 8-year depreciable facilities	29.11 <sup>a</sup>		11,060.00 <sup>b</sup>	2,350.25
c. Operating inventory				1,574.87
d. Total investment overhead				4,702.45
2. Labor (\$4.00/hour)	1.3	hours	490	1,960.00
3. Total overhead expenses				6,662.45
<b>D. Summary</b>				
1. Net return to land, labor, risk and management (B.8 - C.1)				1,555.83
2. Net return to land, risk and management (B.8 - C.3)				-404.17

<sup>a</sup>Total investment per hog.<sup>b</sup>Total investment per 380-hog unit.

TABLE B-6  
ANNUAL COSTS AND RETURNS BUDGET FOR THE FEEDER PIG-TO-FINISH, 760 PURCHASED PIGS, LOW-INVESTMENT  
CONFINEMENT SYSTEM

Item	One Hog		760 Hogs	
	Quantity	Unit Amount (dollars)	Quantity	Unit Amount (dollars)
<u>A. Income</u>				
1. Market hogs (220 lbs. @ \$46.01/cwt)		99.22	745	head 75,410.39
2. Gross income		99.22		75,410.39
<u>B. Direct Costs</u>				
1. Feed				
a. Corn equivalent (\$2.93/bu.)	9.07	bu. 26.58	6,825.18	bu. 19,997.77
b. Purchased feed (\$0.12/lb.)	101.40	lbs. 12.17	76,303.5	lbs. 9,156.42
c. Total feed		38.75		29,154.19
2. Veterinary and medicine		1.65		1,254.00
3. Purchased 50-lb. feeders (@ \$79.13/cwt)		39.57	760	head 30,069.40
4. Marketing		1.90		1,444.00
5. Power and fuel		0.55		418.00
6. Miscellaneous (bedding, supplies)		0.90		684.00
7. Total direct costs		83.32		63,023.59
8. Income over direct costs (A.2 - B.7)		15.90		12,386.80

TABLE B-6 (continued)

Item	One Hog		760 Hogs	
	Quantity	Unit (dollars)	Quantity	Unit (dollars)
<b>C. Overhead Expenses</b>				
1. Investment overhead				
a. 15-year depreciable facilities	10.14 <sup>a</sup>	1.41	7,704.00 <sup>b</sup>	1,077.94
b. 8-year depreciable facilities	18.35 <sup>a</sup>	3.90	13,947.00 <sup>b</sup>	2,963.74
c. Operating inventory		4.15		3,151.18
d. Total investment overhead		9.46		7,192.86
2. Labor (\$4.00/hour)	1.1	hours	828	hours
3. Total overhead expenses		13.86		3,312.00
				10,504.86
<b>D. Summary</b>				
1. Net return to land, labor, risk and management (B.8 - C.1)		6.44		5,193.94
2. Net return to land, risk and management (B.8 - C.3)		2.04		1,881.94

<sup>a</sup>Total investment per hog.<sup>b</sup>Total investment per 760-hog unit.



TABLE B-7  
ANNUAL COSTS AND RETURNS BUDGET FOR THE FEEDER PIG-TO-FINISH, 1,520 PURCHASED PIGS, HIGH-INVESTMENT CONFINEMENT SYSTEM

Item	One Hog		1,520 Hogs	
	Quantity	Unit Amount (dollars)	Quantity	Unit Amount (dollars)
<b>A. Income</b>				
1. Market hogs (220 lbs. @ \$46.01/cwt)		99.22		head 150,820.78
2. Gross income		<u>99.22</u>	1,490	<u>150,820.78</u>
<b>B. Direct Costs</b>				
1. Feed				
a. Corn equivalent (\$2.93/bu.)	9.07	bu. 26.58	13,650.35	bu. 39,995.53
b. Purchased feed (\$0.12/lb.)	101.4	lbs. 12.17	152,607	lbs. 18,312.84
c. Total feed		<u>38.75</u>		<u>58,308.37</u>
2. Veterinary and medicine		1.65		2,508.00
3. Purchased 50-lb. feeders (@ \$79.13/cwt)		39.57	1,520	head 60,138.80
4. Marketing		1.85		2,812.00
5. Power and fuel		0.65		988.00
6. Miscellaneous (bedding, supplies)		<u>0.80</u>		<u>1,216.00</u>
7. Total direct costs		<u>83.27</u>		<u>125,971.17</u>
8. Income over direct costs (A.2 - B.7)		15.95		24,849.61

TABLE B-7 (continued)

Item	One Hog		1,520 Hogs	
	Quantity	Unit	Quantity	Unit
				Amount (dollars)
<b>C. Overhead Expenses</b>				
1. Investment overhead				
a. 15-year depreciable facilities	19.77 <sup>a</sup>		30,044.40 <sup>b</sup>	4,406.51
b. 8-year depreciable facilities	28.00 <sup>a</sup>		42,554.60 <sup>b</sup>	9,042.86
c. Operating inventory				6,298.56
d. Total investment overhead				19,747.93
2. Labor (\$4.00/hour)	0.9	hours	1,355	5,420.00
3. Total overhead expenses				25,167.93
<b>D. Summary</b>				
1. Net return to land, labor, risk and management (B.8 - C.1)				5,101.68
2. Net return to land, risk and management (B.8 - C.3)				-318.32

<sup>a</sup>Total investment per hog.<sup>b</sup>Total investment per 1,520-hog unit.

TABLE B-8  
ANNUAL COSTS AND RETURNS BUDGET FOR THE FEEDER PIG-TO-FINISH, 3,040 PURCHASED PIGS, HIGH-INVESTMENT CONFINEMENT SYSTEM

Item	One Hog		3,040 Hogs	
	Quantity	Unit	Quantity	Unit
	Amount (dollars)		Amount (dollars)	
<b>A. Income</b>				
1. Market hogs (220 lbs. @ \$46.01/cwt)	99.22		2,980	head
2. Gross income	99.22			
<b>B. Direct Costs</b>				
1. Feed				
a. Corn equivalent (\$2.93/bu.)	9.07	bu.	27,300.7	bu.
b. Purchased feed (\$0.11/lb.)	101.4	lbs.	308,256	lbs.
c. Total feed	37.73			
2. Veterinary and medicine	1.65			
3. Purchased 50-lb. feeders (@ \$79.13/cwt)	39.57		3,040	head
4. Marketing	1.80			
5. Power and fuel	0.80			
6. Miscellaneous (bedding, supplies)	0.70			
7. Total direct costs	82.25			
8. Income over direct costs (A.2 - B.7)	16.97			
				52,401.55

TABLE B-8 (continued)

Item	One Hog		3,040 Hogs	
	Quantity	Unit	Quantity	Unit
	Amount (dollars)		Amount (dollars)	
<b>C. Overhead Expenses</b>				
1. Investment overhead				
a. 15-year depreciable facilities	21.35 <sup>a</sup>		64,896.00 <sup>b</sup>	9,518.08
b. 8-year depreciable facilities	20.48 <sup>a</sup>		62,267.00 <sup>b</sup>	13,231.74
c. Operating inventory				12,462.00
d. Total investment overhead				35,211.82
2. Labor (\$4.00/hour)	0.7	hours	2,107	8,428.00
3. Total overhead expenses				43,639.82
<b>D. Summary</b>				
1. Net return to land, labor, risk and management (B.8 - C.1)				17,189.73
2. Net return to land, risk and management (B.8 - C.3)				8,761.73

<sup>a</sup>Total investment per hog.<sup>b</sup>Total investment per 3,040-hog unit.

TABLE B-9  
CORN - RETURNS AND EXPENSES PER ACRE

Item	Unit	Quantity	Price	Amount
				----dollars---
<u>A. Income</u>				
1. Corn grain	bu.	80.00	2.93	<u>234.40</u>
2. Gross income				234.40
<u>B. Direct Costs</u>				
1. Seed	bu.	0.20	74.00	14.80
2. Fertilizer - N	lb.	90.00	0.23	20.70
- P205	lb.	60.00	0.24	14.40
- K20	lb.	60.00	0.13	7.80
3. Boron	lb.	1.00	1.39	1.39
4. Lime	ton	0.40	12.00	4.80
5. Herbicide - Atrazine	quart	1.25	2.40	3.00
- Lasso	quart	1.75	5.04	8.82
6. Machinery				<u>23.11</u>
7. Total direct costs				98.82
8. Income over direct costs (A.2 - B.7)				135.58
<u>C. Overhead Expenses</u>				
1. Machinery				38.49
2. Interest				
a. Operating capital (14% for 6 months)				6.92
b. Fixed capital (12.5% for 12 months)				15.48
3. Labor	hour	2.76	4.00	<u>11.04</u>
4. Total overhead expenses				71.93
<u>D. Summary</u>				
1. Net return to land, labor, risk and management (B.8 - C.1 and 2)				74.69
2. Net return to land, risk and management (B.8 - C.4)				63.65

TABLE B-10  
SOYBEANS - RETURNS AND EXPENSES PER ACRE

Item	Unit	Quantity	Price	Amount
			----dollars---	
<u>A. Income</u>				
1. Soybeans	bu.	28.00	6.69	<u>187.32</u>
2. Gross income				187.32
<u>B. Direct Costs</u>				
1. Seed	lb.	40.00	0.17	6.80
2. Inoculation	pkg.	0.33	0.45	0.15
3. Fertilizer - P205	lb.	60.00	0.24	14.40
- K20	lb.	60.00	0.13	7.80
4. Lime	ton	0.75	12.00	9.00
5. Herbicide - Sencor	pint	0.75	10.90	8.17
- Treflan	pint	1.50	3.78	5.67
- Basagram	pint	1.50	9.32	13.98
6. Machinery				<u>23.17</u>
7. Total direct costs				89.14
8. Income over direct costs (A.2 - B.7)				98.18
<u>C. Overhead Expenses</u>				
1. Machinery				35.96
2. Interest				
a. Operating capital (14% for 6 months)				6.24
b. Fixed capital (12.5% for 12 months)				14.84
3. Labor	hour	2.82	4.00	<u>11.28</u>
4. Total overhead expenses				68.32
<u>D. Summary</u>				
1. Net return to land, labor, risk and management (B.8 - C.1 and 2)				41.14
2. Net return to land, risk and management (B.8 - C.4)				29.86

TABLE B-11  
WHEAT - RETURNS AND EXPENSES PER ACRE

Item	Unit	Quantity	Price	Amount
			----	-----dollars-----
<u>A. Income</u>				
1. Wheat	bu.	40.00	3.55	<u>142.00</u>
2. Gross income				142.00
<u>B. Direct Costs</u>				
1. Seed	bu.	1.50	7.75	11.63
2. Fertilizer - N	lb.	60.00	0.23	13.80
- P205	lb.	60.00	0.24	14.40
- K20	lb.	60.00	0.13	2.60
3. Lime	ton	0.40	12.00	4.80
4. Machinery				<u>14.72</u>
5. Total direct costs				61.95
6. Income over direct costs (A.2 - B.5)				80.05
<u>C. Overhead Expenses</u>				
1. Machinery				26.37
2. Interest				
a. Operating capital (14% for 6 months)				4.34
b. Fixed capital (12.5% for 12 months)				11.01
3. Labor	hour	2.05	4.00	<u>8.20</u>
4. Total overhead expenses				49.92
<u>D. Summary</u>				
1. Net return to land, labor, risk and management (B.6 - C.1 and 2)				38.33
2. Net return to land, risk and management (B.6 - C.4)				30.13

TABLE B-12  
COTTON - RETURNS AND EXPENSES PER ACRE

Item	Unit	Quantity	Price	Amount
			----dollars---	
<u>A. Income</u>				
1. Cotton lint	lb.	500.00	0.64	320.00
2. Cotton seed <sup>a</sup>		1.00	10.00	10.00
3. Gross income				330.00
<u>B. Direct Costs</u>				
1. Seed	lb.	20.00	0.33	6.60
2. Fungicide	lb.	10.00	0.76	7.60
3. Fertilizer - N	lb.	55.00	0.23	12.65
- P205	lb.	55.00	0.24	18.00
- K20	lb.	75.00	0.13	9.75
4. Boron	lb.	1.00	1.39	1.39
5. Lime	ton	0.50	12.00	6.00
6. Herbicide - Pre-emerge Treflan	pint	1.50	3.78	5.67
- Pre-emerge Cotoran	lb.	0.63	8.25	5.20
- Post-emerge	acre	1.00	4.01	4.01
7. Insecticide - Early	ounce	2.00	0.45	0.90
- Mid and late	acre	1.00	12.03	12.03
8. Defoliant	acre	1.00	6.76	6.76
9. Machinery				51.21
10. Total direct costs				147.77
11. Income over direct costs (A.3 - B.10)				182.23
<u>C. Overhead Expenses</u>				
1. Machinery				75.48
2. Interest				
a. Operating capital (14% for 6 months)				10.34
b. Fixed capital (12.5% for 12 months)				30.33
3. Labor	hour	3.48	4.00	13.92
4. Total overhead expenses				130.07
<u>D. Summary</u>				
1. Net return to land, labor, risk and management (B.11 - C.1 and 2)				66.08
2. Net return to land, risk and management (B.11 - C.4)				52.16

<sup>a</sup>Seed pays for the cost of ginning with an additional return of \$10.00 per bale.



TABLE B-13  
WHEAT-SOYBEANS (DOUBLE CROP) - RETURNS AND EXPENSES PER ACRE

Item	Unit	Quantity	Price	Amount
			----	dollars----
<u>A. Income</u>				
1. Wheat	bu.	40.00	3.55	142.00
2. Soybeans	bu.	24.00	6.69	<u>160.56</u>
3. Gross income				302.56
<u>B. Direct Costs</u>				
1. Seed - Wheat	bu.	1.50	7.75	11.63
- Soybeans	lb.	40.00	0.17	6.80
2. Fertilizer - N	lb.	60.00	0.23	13.80
- P205	lb.	100.00	0.24	24.00
- K20	lb.	60.00	0.13	7.80
3. Lime	ton	0.75	12.00	9.00
4. Herbicide - Paraquat	pint	1.00	5.02	5.02
- Lorox	pint	1.50	5.25	7.88
- Lasso	quart	2.25	5.04	11.34
- Surfactant	pint	0.16	1.89	0.30
- Basagram	pint	1.50	9.32	13.98
5. Machinery				<u>30.19</u>
6. Total direct costs				141.74
7. Income over direct costs (A.3 - B.6)				160.82
<u>C. Overhead Expenses</u>				
1. Machinery				50.79
2. Interest				
a. Operating capital (14% for 6 months)				19.84
b. Fixed capital (12.5% for 12 months)				20.82
3. Labor	hour	3.83	4.00	<u>15.32</u>
4. Total overhead expenses				106.77
<u>D. Summary</u>				
1. Net return to land, labor, risk and management (B.7 - C.1 and 2)				69.37
2. Net return to land, risk and management (B.7 - C.4)				54.05

TABLE B-14  
GRAIN SORGHUM - RETURNS AND EXPENSES PER ACRE

Item	Unit	Quantity	Price	Amount
			----dollars---	
<u>A. Income</u>				
1. Grain sorghum	bu.	70.00	2.44	170.80
2. Gross income				170.80
<u>B. Direct Costs</u>				
1. Seed	lb.	8.00	0.90	7.20
2. Fertilizer - N	lb.	60.00	0.23	13.80
- P205	lb.	45.00	0.24	10.80
- K20	lb.	45.00	0.13	5.85
3. Lime	ton	0.40	12.00	4.80
4. Herbicide - Milogard	quart	2.00	4.36	8.72
5. Insecticide		1.00	1.87	1.87
6. Machinery				23.27
7. Total direct costs				76.31
8. Income over direct costs (A.2 - B.7)				94.49
<u>C. Overhead Expenses</u>				
1. Machinery				35.85
2. Interest				
a. Operating capital (14% for 6 months)				5.34
b. Fixed capital (12.5% for 12 months)				14.84
3. Labor	hour	3.18	4.00	12.72
4. Total overhead expenses				68.75
<u>D. Summary</u>				
1. Net return to land, labor, risk and management (B.8 - C.1 and 2)				38.46
2. Net return to land, risk and management (B.8 - C.4)				25.74

TABLE B-15  
ALFALFA HAY - RETURNS AND EXPENSES PER ACRE

Item	Unit	Quantity	Price	Amount
			----	-----dollars----
<u>A. Income</u>				
1. Alfalfa	ton	3.50	66.31	<u>232.09</u>
2. Gross income				232.09
<u>B. Establishment Costs</u>				
1. Seed	lb.	20.00	2.55	51.00
2. Inoculation	pkg.	0.50	0.60	0.30
3. Fertilizer - N	lb.	8.00	0.23	1.84
- P205	lb.	105.00	0.24	25.20
- K20	lb.	165.00	0.13	21.45
4. Boron	lb.	2.00	1.39	2.78
5. Lime	ton	3.00	12.00	36.00
6. Tractor	hour	1.00	7.67	7.67
7. Disk	hour	0.60	4.13	2.48
8. Harrow	hour	0.60	1.43	0.86
9. Cultipacker seeder	hour	0.40	8.18	<u>3.27</u>
10. Total establishment cost				152.85
11. Prorated establishment cost (5 years)				30.57
<u>C. Direct Costs</u>				
1. Fertilizer (0-9-27B)	cwt	5.60	7.60	42.56
2. Insecticide - Furadan	quart	1.00	11.49	11.49
3. Twine	bale	140.00	0.05	7.00
4. Machinery				<u>57.12</u>
5. Total direct costs				118.17
6. Income over direct costs (A.2 - C.5)				113.92
<u>D. Overhead Expenses</u>				
1. Prorated establishment cost	acre	1.00	30.57	30.57
2. Machinery				83.28
3. Interest				
a. Operating capital (14% for 6 months)				8.27
b. Fixed capital (12.5% for 12 months)				32.67
4. Labor	hour	10.50	4.00	<u>42.00</u>
5. Total overhead expenses				196.79

TABLE B-15 (continued)

Item	Unit	Quantity	Price	Amount
			----dollars---	
<u>E. Summary</u>				
1. Net return to land, labor, risk and management (C.6 - D.1 and 3)				-40.87
2. Net return to land, risk and management (C.6 - D.5)				-82.87

TABLE B-16  
RED CLOVER-TIMOTHY HAY - RETURNS AND EXPENSES PER ACRE

Item	Unit	Quantity	Price	Amount
			----	dollars----
<u>A. Income</u>				
1. Hay (2 cuttings/year)	ton	2.50	45.98	<u>114.95</u>
2. Gross income				114.95
<u>B. Establishment Costs</u>				
1. Seed - Timothy	lb.	8.00	0.79	6.32
- Red clover	lb.	8.00	2.00	16.00
- Clover (overseeded)	lb.	8.00	2.00	16.00
2. Inoculation	pkg.	0.30	0.85	0.25
3. Fertilizer - N	lb.	30.00	0.23	6.90
- P205	lb.	90.00	0.24	21.60
- K20	lb.	90.00	0.13	11.70
4. Lime	ton	2.00	12.00	24.00
5. Tractor	hour	0.89	7.67	6.83
6. Disk	hour	0.69	4.13	2.85
7. Harrow	hour	0.69	1.43	0.99
8. Cultipacker seeder	hour	0.20	8.18	<u>1.04</u>
9. Total establishment cost				115.07
10. Prorated establishment cost (4 years)				28.77
<u>C. Direct Costs</u>				
1. Fertilizer - P205	lb.	45.00	0.24	10.80
- K20	lb.	45.00	0.13	5.85
2. Twine	bale	100.00	0.05	5.00
3. Machinery				<u>36.37</u>
4. Total direct costs				58.02
5. Income over direct costs (A.2 - C.4)				56.93
<u>D. Overhead Expenses</u>				
1. Prorated establishment cost	acre	1.00	28.77	28.77
2. Machinery				41.64
3. Interest				
a. Operating capital (14% for 6 months)				4.06
b. Fixed capital (12.5% for 12 months)				16.33
4. Labor	hour	7.00	4.00	<u>28.00</u>
5. Total overhead expenses				118.80

TABLE B-16 (continued)

<u>Item</u>	<u>Unit</u>	<u>Quantity</u>	<u>Price</u>	<u>Amount</u>
			----	dollars----
<u>E. Summary</u>				
1. Net return to land, labor, risk and management (C.5 - D.1-3)				-33.87
2. Net return to land, risk and management (C.5 - D.5)				-61.87

TABLE B-17  
PERMANENT PASTURE - RETURNS AND EXPENSES PER ACRE

Item	Unit	Quantity	Price	Amount
			----	dollars---
<u>A. Income</u>				
1. Gross income <sup>a</sup>				0.00
<u>B. Establishment Costs</u>				
1. Seed - Ladino clover	lb.	2.00	2.60	5.20
- Fescue	lb.	12.00	0.54	6.48
2. Inoculation	pkg.	0.10	0.85	0.08
3. Fertilizer - N	lb.	30.00	0.23	6.90
- P205	lb.	90.00	0.24	21.60
- K20	lb.	90.00	0.13	11.70
4. Lime	ton	2.00	12.00	24.00
5. Tractor	hour	2.05	7.67	15.72
6. Plow	hour	0.75	2.67	2.00
7. Disk	hour	0.90	4.13	3.72
8. Harrow	hour	0.90	1.43	1.29
9. Cultipacker	hour	0.40	8.18	3.27
9. Total establishment cost				101.97
11. Prorated establishment cost (10 years)				10.20
<u>C. Direct Costs</u>				
1. Fertilizer - N	lb.	15.00	0.23	3.45
- P205	lb.	45.00	0.24	10.80
- K20	lb.	45.00	0.13	5.85
2. Lime	ton	0.20	12.00	2.40
3. Machinery				6.19
4. Total direct costs				28.69
5. Income over direct costs (A.1 - C.4)				-28.69
<u>D. Overhead Expenses</u>				
1. Prorated establishment cost	acre	1.00	10.20	10.20
2. Overseeding cost	acre	1.00	2.07	2.07
3. Machinery				7.28
4. Interest				
a. Operating capital (14% for 6 months)				2.00
b. Fixed capital (12.5% for 12 months)				2.97
4. Labor	hour	1.26	4.00	5.04
5. Total overhead expenses				29.56

TABLE B-17 (continued)

Item	Unit	Quantity	Price	Amount
			----dollars---	
<u>E. Summary</u>				
1. Net return to land, labor, risk and management (C.5 - D.1-4)				-53.21
2. Net return to land, risk and management (C.5 - D.6)				-58.25

<sup>a</sup>No gross income because permanent pasture is an intermediate enterprise for beef and/or swine.



TABLE B-18  
BEEF COW-CALF FED HAY OVER WINTER 30-COW HERD, 35 ANIMAL UNITS<sup>a--</sup>  
RETURNS AND EXPENSES PER UNIT

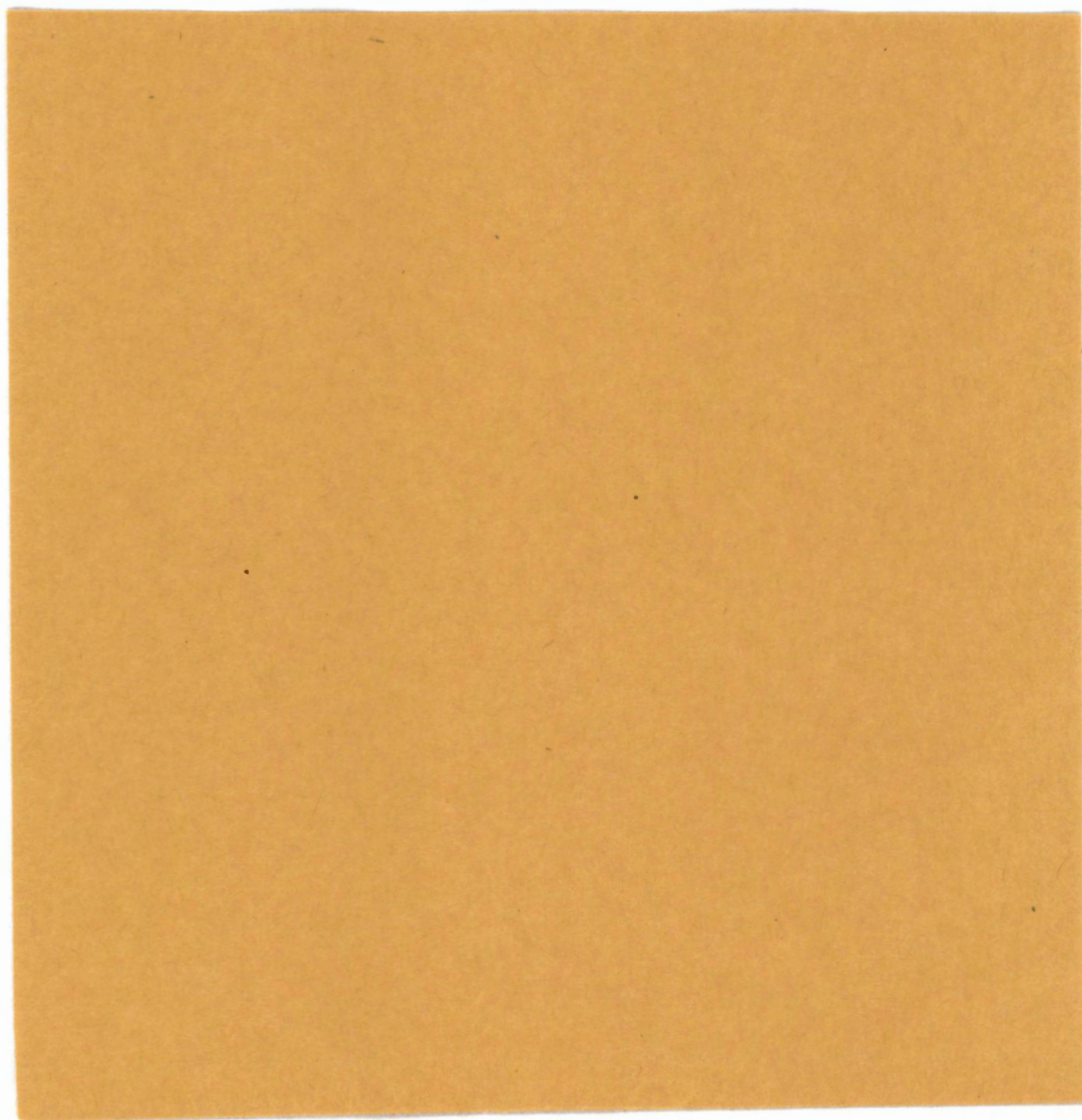
Item	Unit	Quantity	Price	Amount
			-----dollars-----	
<u>A. Income</u>				
1. Feeder heifers	cwt	41.85	54.00	2,259.90
2. Feeder steers	cwt	66.30	65.00	4,309.50
3. Cull cows	cwt	45.00	38.56	1,735.20
4. Death loss		1.00	-52.50	-52.50
5. Gross income				8,252.10
<u>B. Direct Costs</u>				
1. Feed hay	ton	39.90	75.00	2,992.50
2. Pasture	acre	52.50	53.21	2,793.53
3. Minerals, salt	animal unit	35.00	1.75	61.25
4. Veterinary medicine	head	30.00	9.40	282.00
5. Marketing - Cows	head	5.00	10.00	50.00
- Calves	head	22.00	7.50	165.00
6. Machinery				57.00
7. Total direct costs				6,401.28
8. Income over direct costs (A.5 - B.7)				1,850.82
<u>C. Overhead Expenses</u>				
1. Buildings, equipment depreciation	head	30.00	7.30	219.00
2. Buildings, equipment repairs	head	30.00	2.19	65.70
3. Bull depreciation	head	30.00	3.33	99.90
4. Fence depreciation and repairs	head	30.00	3.68	110.40
5. Machinery				31.40
6. Interest				
a. Cows and replacements (14% for \$383/cow)				1,608.60
b. Buildings and equipment (12.5% for \$73/cow)				273.75
c. Machinery				20.60
7. Labor	hour	270.00	4.00	1,080.00
8. Total overhead expenses				3,509.35

TABLE B-18 (continued)

Item	Unit	Quantity	Price	Amount
			-----dollars----	
<u>D. Summary</u>				
1. Net return to land, labor, risk and management (B.8 - C.1-6)				-578.53
2. Return per cow				-19.28
3. Net return to land, risk and management (B.8 - C.8)				-1,658.53
4. Return per cow				-55.28

<sup>a</sup>Animal units were assumed as follows: 30 cows = 30 animal units; 1 bull = 1 animal unit; 5 heifers = 4 animal units.

## QUESTIONNAIRE USED IN THE SURVEY OF WEST TENNESSEE SWINE FARMS



## VITA

William D. McBride was born in Greencastle, Indiana, on June 30, 1960. He was raised on a hog-crop farm in Montgomery County, Indiana, and attended North Montgomery High School, graduating in May, 1978.

In September, 1978, he entered Purdue University as a student in the School of Agriculture. He majored in Farm and Business Management and was awarded a Bachelor of Science degree in May, 1982.

Since September, 1982, he has been employed as a Graduate Research Assistant by the Department of Agricultural Economics and Rural Sociology at the University of Tennessee. The author completed the requirements for a Master of Science degree in Agricultural Economics in August, 1986. He is currently working on a Doctor of Philosophy degree at the University of Tennessee with a major in Production Economics-Farm Management.

