

AGRICULTURAL EXPERIMENT STATION

ELMER R. KIEHL, *Director*

# Farm Plans for a 200-Acre Central Missouri Farm

*A Comparative Analysis of the Economic Potential for  
Alternative Farming Systems*

WILLIAM H. HUTCHERSON, ALBERT R. HAGAN, JOHN P. DOLL



Missouri Agricultural Experiment Station in cooperation  
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## CONTENTS

Introduction .....	3
Objective .....	4
Farm Situation .....	4
Capital .....	6
Management .....	7
Buildings and Machinery .....	7
Crop Enterprises .....	7
Livestock Enterprises .....	8
Presentation and Assumptions of Analysis .....	8
Livestock Plans—Extensive Land Use .....	8
Budget and Linear Programming Solutions .....	8
Programming with Variable Capital .....	14
Livestock Plans—Intermediate Land Use .....	17
Budget and Linear Programming Solutions .....	17
Programming with Variable Capital .....	21
Livestock Plans—Intensive Land Use .....	24
Budget and Linear Programming Solutions .....	24
Programming with Variable Capital .....	29
Summary .....	31
Appendix .....	35

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## INTRODUCTION

Farming has become a complex business and requires careful planning for successful operation. The adoption of a single new practice may change the whole farming program. A change in the cropping system, for example, may require adjustments in the livestock system, which in turn may require additional capital, machinery, buildings, or labor.

Each year the farmer operates his business under conditions different from the year before. The cost of inputs, price of products, and the amount of resources available for use in production are all different from one year to another. Adjustment to these changing conditions must be made in a farm business to maintain net income.

The Department of Agricultural Economics and the Extension Service of the University of Missouri are cooperating on a farm adjustment study of Blackwater and Lamine townships in Cooper County, Missouri. One of the primary concerns of this study is to determine the effect of changing economic conditions on the size and types of farming operations in the area.

One phase of the farm adjustment study involved an appraisal of several "typical" farms in that area. These farms ranged in size from a small part-time farm to a large 1,000-acre operation. The farm selected for this study has 200 acres. Farms of this size, with rather limited land resources for present conditions, are numerous in many parts of Missouri. Their earnings are often too low, compared with the high costs of production, to return a suitable income.

Thus, from a practical farm management standpoint, problems of farm size often pose these questions to the operator: Should I expand my farming operations by adding more livestock, buildings, fertilizer, and other intensive forms of capital on the present acreage? Or, should I add more acres for crops and cash sales without any attempt at intensification?

For many farmers the question of how to expand size narrows down to a single choice. Some established owners who can get more capital find no additional land to be rented or purchased near them. If they are to continue on their present units, they must intensify by using more capital to improve methods of production and to expand output through livestock and crop enterprises.

Block budgets for farm planning were used to select several feasible plans for a farm of this size. Linear programming was used to determine the maximum net income with a given amount of resources available.

## OBJECTIVE

The purpose of this study was to develop livestock systems that would maximize income for each of three "typical" cropping systems on a 200-acre farm in west central Missouri. The more specific objectives were (1) to select three cropping systems, each having different capital, labor, and land use requirements; and (2) to determine the combination of livestock enterprises which will maximize returns to each of the cropping systems selected.

The resulting plans should serve as useful guides to individual farmers, extension workers, and others concerned with adjustment problems on individual farms.

## FARM SITUATION

The farm selected for this study is located in Cooper County, in central Missouri. The owner-operated farm is 200 acres in size. Of the 200 acres, 170 consist of cropland, 14 acres are permanent pasture land unsuitable for tillage, and the remaining 16 acres are in farmstead, roads, and woodlots.

### Land

The predominant soil types on this farm are Pershing, Weldon, and Bodine. Pershing, the largest of these three soil types, comprises some 85 percent of total acres. Twelve percent of the soil is Weldon and the rough wooded areas of Bodine cover 3 percent of the total farm acres. The soil survey map in Figure 1 illustrates the farm layout and soil resources.

Pershing, a grayish brown soil, has developed from loess on gently sloping topography. Its surface is 8 to 10 inches thick on uneroded areas. The subsoil is a gray silty clay which is slowly permeable to air and water. Pershing is located on 3 to 10 percent slopes below Ladoga ridgetops, making erosion a problem. The soil when uneroded is of moderate fertility and, with good management and adequate fertilization, good yields of corn, small grains, and pasture can be obtained.

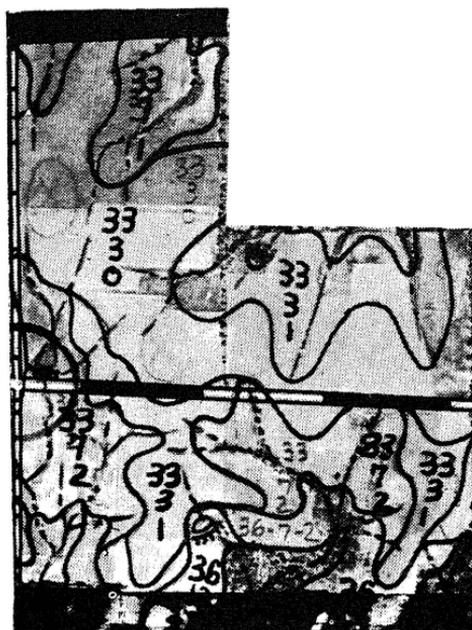
Weldon is a grayish brown, moderately aerated river hills soil with a gray silty clay subsoil. The fertility is low and complete fertilization is required. Slopes are generally less than 10 percent, making terracing possible. The predominant uses for this soil are pasture and small grains.

Bodine is characterized by its steep slopes, shallow soil, and many rock outcroppings. In some places a subsoil of red cherty clay appears while in others ledges of limestone are apparent. Forest and woodland pasture are its best use.

### Labor

The total hours of labor available by months are given in Table 1, and include the time of the operator and two sons, who comprise the total family labor supply. All the activities considered in these farm plans compete for the labor supply. The hours of labor required to perform a certain task are changed from an hourly basis to a per-man-work-unit basis. A man work unit is the amount of

**Fig. 1**  
**Layout and Soils of Study Farm**



LEGEND

Soil Types

33	Pershing	Good, Grundy type soil. Slight gray layer, usually acid.
36	Weldon	Grundy type soil. Acid, less fertile than Pershing.
40	Bodine	Clarksville-type soil, steep and stoney. Red, cherty clay subsoil.

Slope Classes

Avg. Slope

1 . . . . .	0 to 2%	12 . . . . .	10 to 15%
3 . . . . .	2 to 5%	20 . . . . .	15 to 25%
7 . . . . .	5 to 10%	30 . . . . .	25 to 35%
	50 . . . . .		Over 35% slopes

Erosion Classes

Class 0 . . . .	Deposition; more than 10 inches of top soil.
Class 1 . . . .	Slight erosion; over 6 inches surface remaining.
Class 2 . . . .	Moderate erosion; 2 to 6 inches surface remaining.
Class 3 . . . .	Severe erosion; subsoil exposed, small gullies.
Class 4 . . . .	Very severe erosion; badly gullied, cultivation difficult.

TABLE 1--HOURS OF AVAILABLE FAMILY LABOR PER MONTH

Month	Operator	Other Family Labor	Total Family Labor
January	270		270
February	240		240
March	260		260
April	260		260
May	270	110	380
June	250	250	500
July	270	270	540
August	270	270	540
September	250		250
October	270		270
November	260		260
December	260		260

work that a man should be able to do in a 10-hour day, with average work methods and average equipment.

For the purpose of this study, it was assumed that the total labor supply was composed of 12 months of operator labor and 4 months of family labor. In addition, a maximum of two extra men per month could be employed in any month needed. A labor charge of \$200 per month for each worker is assumed.

### Capital

Capital is a limiting resource on most farms in this area. The amount of capital a farmer has or can obtain directly influences the crop and livestock alternatives available in the farm organization. The plans presented in this study are long run, the type a manager would work and strive for over a long period of time. While capital often is not immediately available in a short time period, the assumption made for the study was that capital could be secured for an enterprise that appeared profitable. Thus, capital was assumed not to be limiting.

A distinction must be made between capital required for operating the farm and investment capital. Investment capital includes the purchase of items such as land, breeding livestock, buildings, machinery, equipment, fencing, and soil conserving practices. The costs incurred during the year for such items as seed, fertilizer, fuel, machine repair, taxes, are considered as operating capital items. All the capital used in the farm business, both operating and investment, is charged a five percent interest rate.

## Management

Management is one of the most important factors in the farm business production process. The function of management is to combine land, labor, and capital into a workable program. The manager's reward for decision-making and risk-bearing is net farm income. Just as interest must be paid on capital, wages paid to labor, and rent paid on land, the excess returns left after deducting the cost of production in the farm business is considered as wage or profit to management.

Management ability is difficult to evaluate, and mistakes in appraisal of this resource often result in failure of the farm business. In this study, the expected management ability of the operator, based on past performance, is expressed in the yields expected from crops and the type and size of livestock enterprises included in this program.

## Buildings and Machinery

A large amount of capital is invested in buildings and fences on most farms, but the amount varies widely from farm to farm, depending upon the size of the farm, the system of farming followed, and the design and condition of the buildings. In this study, buildings were considered nonexistent for all classes of livestock because of a recent move in farmstead location. Thus, building investments had to be estimated for each livestock enterprise considered. The annual costs of investment capital required for buildings and other improvements were deducted from the net income of each livestock alternative. The annual charge on these investments included: 10 percent for repairs, depreciation, and insurance on improvements; 5 percent interest on the total capital investment; and a 1 percent charge on the total real estate investment for taxes.

Machinery represents one of the most important capital inputs on farms today. The ability to get things done depends upon the farmer's supply and use of labor and machinery. The amount of machinery a farm requires is based on the kind and amount of crops and livestock grown. The farm in this study has adequate machinery for the present farming situation. However, the farm plans proposed require additional purchases of machinery. An estimated \$2,000 for extra equipment will be needed in the extensive and intermediate land use systems and the intensive land use plans require \$3,000 for additional machinery.

## CROP ENTERPRISES

Three cropping systems were set up for this study, each requiring varying amounts of land, labor, and capital. The data on labor requirements and crop income over cost are included in Appendix Tables 1 and 2. The cropping systems range from an extensive grass system to a very intensive row crop system which includes 142 acres of row crops, 14 acres of small grain, and 14 acres of hay.

With each cropping system fixed at its maximum possible intensity, subject to minimizing soil loss, the livestock alternatives which gave the highest net return were selected by comparative budgeting and linear programming.

## LIVESTOCK ENTERPRISES

The input-output coefficients for livestock are included in Appendix Tables 3 and 4. These data were taken from the *Farm Business Planning Guide*.<sup>1</sup> The coefficients provide the basic data for both comparative budgeting and linear programming. A total of 23 livestock enterprises were allowed to compete for the available farm resources: two dairy enterprises, two beef cow enterprises, eight feeder cattle systems, ten hog systems, and a ewe and lamb enterprise.

### PRESENTATION AND ASSUMPTIONS OF ANALYSIS

In the next three sections, livestock plans are presented to examine the income opportunities available for the various classes of livestock under the three land use systems. In addition, livestock plans have been selected by linear programming to obtain the optimum net income for each fixed cropping system.

The livestock alternatives in these plans are dependent upon the crop production in each land use system. All plans are restricted to roughage produced on the farm and no provision is made to buy or sell forage. If needed, grain can be purchased to expand livestock production beyond the grain produced on the farm. The purchase of grain or labor is included as livestock enterprise costs and has been deducted from net income.

### LIVESTOCK PLANS: EXTENSIVE LAND USE

#### Budget and Linear Programming Solutions

The extensive cropping system produces a large quantity of roughage and a small amount of grain. It would be appropriate for farms with soils not suited for intensive row crop production. Or, a manager might select such a system because of personal preference.

The cropping plan for the extensive land use program, including the field layout and acreages, is depicted in Figure 2. Resources required for this system, along with physical outputs and expected returns, are presented in the top part of Table 2.

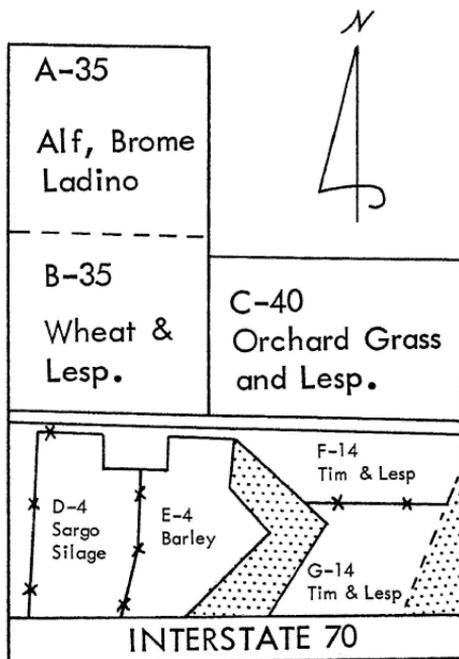
The crop rotations in this plan include: continuous alfalfa, continuous permanent pasture, a one year wheat-lespedeza rotation, orchard grass-lespedeza pasture and a four-year rotation of sorgo, barley, timothy-lespedeza, and timothy-lespedeza. The roughage production consists of: 119 tons of hay, 240 tons of silage, 224 tons of hay equivalent from pasture, a total of 423 hay equivalent<sup>2</sup> tons

<sup>1</sup>University of Missouri College of Agriculture and the United States Department of Agriculture Cooperating, B.F. 6103, January, 1961.

<sup>2</sup>The total roughage produced was converted to a hay equivalent basis, at the following ratio:

1 pound hay  
3 pound silage = 1 pound hay equivalent  
4 pound grass

**Fig. 2**  
**Cropping Plan**  
**Extensive Land Use System**



production for the farm. Roughage production is assumed fixed; it cannot be purchased or sold.

The grain production is limited to 640 bushels of corn equivalent.<sup>3</sup> However, provision was made to purchase additional corn at \$1.00 per bushel if required by any of the livestock enterprises in this study. This cropping system requires seven months of the farm labor supply. The total and monthly labor requirements of the various crops are given in Appendix Table 1.

The crop costs are \$3,017 for 170 acres, an average of \$17.75 per tillable acre. An income over cost of \$2,993 is expected from the crops, excluding charges for

<sup>3</sup>A corn equivalent unit is calculated by taking corn as the basis and assuming that 1 bushel of corn equals 1 corn equivalent unit. The other grain crops are connected to corn equivalents on the basis of total digestible nutrients. A bushel of oats is equal to  $\frac{1}{2}$  bushel of corn on this basis and, therefore, is equal to  $\frac{1}{2}$  bushel corn equivalent. A bushel of barley is equivalent to 0.8 bushels of corn and a bushel of wheat is equivalent to 1.1 bushels of corn.

TABLE 2--RESOURCE REQUIREMENTS AND RETURNS FOR CROP AND LIVESTOCK ENTERPRISES,  
EXTENSIVE LAND USE

Crop	Use	Acres	Yield	Cropping System					
				Total Production	Price (Unit)	Total Value	Corn Equiv.	Hay Equiv.	Labor PMWU
Barley (bu.)	Grain	16	50	800	\$ 0.85	\$ 680	640	---	9.6
Sargo (t.)	Silage	16	15	240	5.00	1,200	---	80	25.6
Alfalfa, Brome, Ladino (t.)	Hay	35	3	105	18.00	1,890	---	105	84.0
Timothy, Lespedeza (t.)	Hay	14	1	14	16.00	224	---	14	14.0
Wheat, Lespedeza (t.)	Pasture	35	2	70	9.00	630	---	70	10.5
Orchard Grass, Lespedeza (t.)	Pasture	40	2	80	9.00	720	---	80	12.0
Timothy, Lespedeza (t.)	Pasture	14	1	14	9.00	126	---	14	4.2
Barley (t.)	Pasture	16*	1	16	9.00	144	---	16	4.8
Timothy, Lespedeza (t.)	Pasture	16*	1	16	9.00	144	---	16	4.8
Improved Permanent Pasture (t.)	Pasture	14	2	28	9.00	252	---	28	2.8
Farmstead, Etc.	---	16	---	---	---	---	---	---	---
Totals	---	200	---	---	---	\$6,010	640	423	172.3
Crop Costs (Till A. 170 x \$17.75 per A.)						\$3,017			
Cost of Extra Fertilizer						---			
Crop Income Over Cost						\$2,993			

Livestock System

TABLE 2 (Cont'd)

Livestock Enterprise	Plan 1	Plan 2	Plan 3	Plan 4	Plan 5	Plan 6
Dairy-10,000 lbs, Production (Head) . . . . .	50					28
Beef-Cow Calf Sold (Head) . . . . .		80			.75	
Beef-Cow Calf Fed (Head) . . . . .			75			
Steer Calf-Winter, Graze, Fed (Head) . . . . .				200		.46
Two Litter-Feeder Pigs (Head) . . . . .					560	
Five Litter System (Head) . . . . .						525
Requirements:						
Corn Equivalent (bu.)	3,100	160	2,400	9,000	2,950	11,681
Hay Equivalent (t.)	375	400	412	400	395	321
Labor (PMWU)	450	240	375	260	285	537
Capital	\$29,500	\$18,000	\$20,250	\$31,800	\$23,675	\$34,005
Livestock Income Over Costs	\$11,950	\$ 2,560	\$ 3,375	\$ 7,800	\$ 5,520	\$ 7,334

Summary: Livestock Enterprises and Cropping System

Total Months Labor Required	25	17	22	17	18	28
Added Improvements Needed	\$16,808	\$ 8,075	\$ 9,717	\$16,319	\$14,599	\$17,990
Total Capital Required	81,308	61,075	64,967	83,119	73,274	86,995
Total Farm Income Over Cost	14,943	5,553	6,368	10,793	8,513	10,327
Total Undistributed Costs	9,014	5,443	6,817	7,451	6,970	4,091
Income to Labor & Management	5,929	110	-449	3,342	1,543	6,236

\*Double-cropped Land

labor or the use of capital. Crop income over cost estimates used in this study are given in Appendix Table 2.

Five livestock systems, labeled Plans 1 through 5 in Table 2, were budgeted for the extensive land use cropping system. Plan 6 in Table 2 is the linear programming solution. Given the assumptions of the study, the programming solutions determine the combination of livestock enterprises which maximize income from the extensive cropping system.

Estimated labor requirements for livestock enterprises are presented in Appendix Table 3; livestock income over costs is given in Appendix Table 4. The study farm did not have usable buildings and equipment because of a recent relocation of the farmstead. Therefore, capital investments in buildings and equipment were necessary for each of the livestock systems planned. Because of the numerous systems presented, investment details for each system are not given. However, the type of building or other improvement deemed necessary for each type of enterprise can be determined from Appendix Table 5. For example, in the dairy enterprise production of 10,000 pounds of milk per cow requires construction of milking parlor, loafing shed, paved lot, horizontal silo, and some grain storage. Cost of these improvements is estimated to be \$228.05 per head for the extensive system (Appendix Table 6). A dairy cow and equipment requires an average annual investment of \$590 (*Farm Business Planning Guide* and Appendix Table 5) so that total investments per unit for the extensive system is \$818.05. Average annual investment for the dairy herd is \$29,500 ( $\$590 \times 50$ ). The land is valued at \$20,000, present improvements at \$10,000, and present farm machinery at \$3,000. Total capital for the dairy enterprise is \$81,308 (summary of Table 2). By subtracting land value, value of present improvements and machinery, and investment in dairy cow and equipment from the total capital figure, it can be seen that investment in added farm improvements and added machinery amounts to \$18,808 for this alternative. In this way, the *Farm Business Planning Guide* and the Appendix Table 5 can be used to divide total capital into its major components.

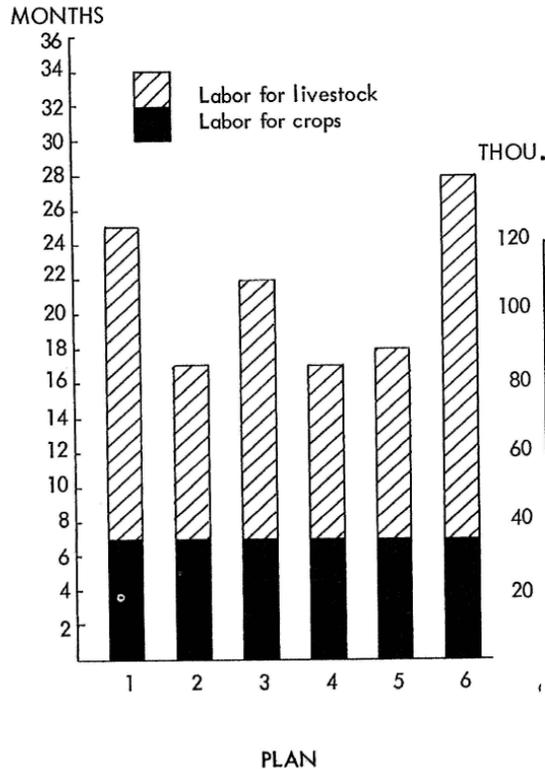
Figure 3 summarizes the findings for the extensive land use system. The data presented represent totals of each livestock enterprise and the extensive land use system. Income to labor and management is income remaining after a five percent interest charge is subtracted for total capital. For example, the dairy enterprise (Plan 1) requires a total capital of \$81,308; five percent of this is \$4,065. If the operator owns all the capital invested, this \$4,065 is income to him or, more exactly, to his capital. If part of the capital is borrowed, a part of the \$4,065 would be used to pay interest charges to the lender.

The family can supply 16 months of labor. Plan 1, dairy; Plan 3, beef cow-calf fed; and Plan 6, the programming solution, require the most labor and, therefore, the hiring of labor. All alternatives except Plan 2 require the purchase of corn equivalents. Plan 4, steer calves, and Plan 6 require the purchase of 8,360 and 11,041 bushels of corn equivalent, respectively.

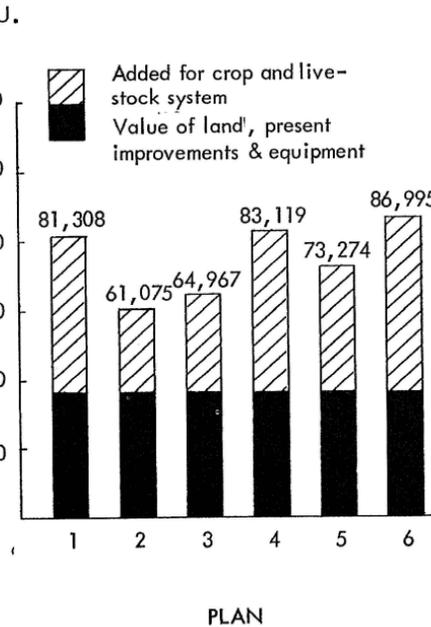
**Fig. 3**  
**Labor, Capital, and Income Estimates**  
**Extensive Land Use System**

EXTENSIVE LAND USE SYSTEM

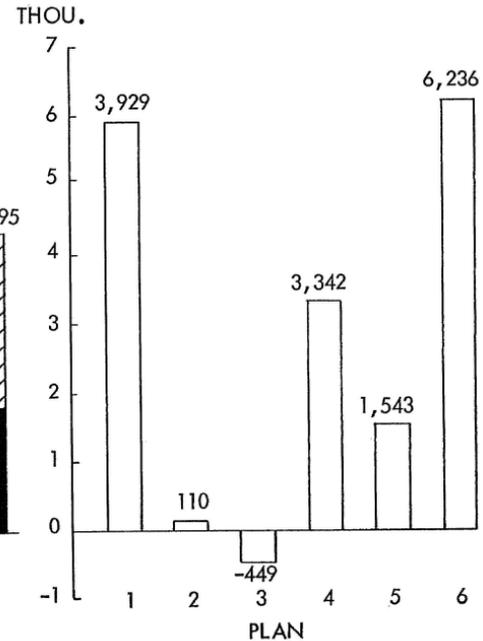
Total Months Labor Required



Total Capital Required



Income to Operator's Labor and Management



Total capital requirements are highest for dairy, steer calves, and the programming solution. Income to labor and management is also the highest for these three alternatives. Plans 2 and 3, beef cows with calf fed or sold, are not profitable on this farm even though they have the lowest capital requirements. When calves are fed, labor requirements are quite high.<sup>4</sup> The high price of land (\$150 per acre) coupled with the low returns from the system will not pay the undistributed costs of the system (undistributed costs are explained in the *Farm Business Planning Guide*).

Plan 4, steer calves, returns only \$3,342 for labor and management but makes good use of the family labor supply. This plan requires the second highest capital investment of all alternatives, \$83,119, exceeding the Grade A dairy and exceeded only by Plan 6.

The linear programming results, Plan 6, indicate that farm operators who have resources similar to those of the extensive land use system would maximize returns by establishing a 28-cow grade "A" dairy herd, producing 75 litters of market hogs, and adding 46 steer calves that are wintered, grazed, and fed out. This program is not the most practical; in Missouri, swine ordinarily are not fed out on a small Grade A dairy. While the programming model could have been set up to prevent this type of diversity, to do so would have circumvented one purpose of the study. Specialized plans can be budgeted directly; the programming solution indicates the amount by which incomes from the specialized budgeted solutions differ from the income possible if management and capital were available to carry out a diversified plan such as Plan 6. In this case the answer is clear: a 50-cow Grade A dairy herd returns practically the same income as Plan 6 and requires less capital, labor, and purchased feed. In addition, only one set of buildings and perhaps a less arduous contribution from management is needed.

### Programming with Variable Capital

The livestock systems described above were determined under the assumption that capital was not limited. That is, in the long run or the period for which the plans are derived, the manager would be able to obtain reasonable amounts of capital. However, a question of importance to the farm operator is: How should the livestock system be changed (to maximize profits) as total capital increases? Linear programming with variable amounts of capital was used to indicate answers to that question (Table 3).

For each amount of capital, all livestock enterprises considered for the extensive land use system "competed" for the available capital. The plans presented represent the profit-maximizing combination of livestock for each capital level.

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<sup>4</sup>Recent research results indicate the labor requirements for beef cattle used in this study are high. See Harry Lanpher and Albert R. Hagan, Labor Requirements for Beef Cows, University of Missouri Agricultural Experiment Station Bulletin 838. Labor requirements were not regarded as limiting in the study so that appropriate adjustments can be made by referring to Station Bulletin 838 without otherwise changing the solutions.

TABLE 3--HOW LIVESTOCK SYSTEMS CHANGE AS TOTAL CAPITAL INCREASES--EXTENSIVE LAND USE SYSTEM

Plan	Total Capital	Livestock Enterprises	Roughage	Roughage	Total	Total
			Surplus or Deficit**	Surplus or Deficit	Labor (Months)	Income Labor & Management
			(Ton H. E.)	(Bu. C. E.)		
6-1	\$40,726	7-Dairy Cows (10,000 lb. production)	+371	+206	9	176
6-2	45,635	13-Dairy Cows (10,000 lb. production)	+326	-166	12	1,125
6-3	52,179	21-Dairy Cows (10,000 lb. production)	+266	-662	14	2,408
6-4	56,269	26-Dairy Cows (10,000 lb. production)	+228	-972	16	3,132
6-5	59,541	30-Dairy Cows (10,000 lb. production)	+198	-1,220	18	3,590
6-6	66,027	30-Dairy Cows (10,000 lb. production) 23-Litters Hogs (one litter system)*	+192	-3,635	20	4,420
6-7	69,378	31-Dairy Cows (10,000 lb. production) 8-Litters Hogs (one litter system)* 42-Litters Hogs (six litter system)*	+182	-3,635	22	4,802
6-8	72,311	30-Dairy cows (10,000 lb. production) 8-Litters Hogs (one litter system)* 42-Litters Hogs (six litter system)*	+186	-6,470	24	5,225
6-9	74,561	30-Dairy Cows (10,000 lb. production) 60-Litters Hogs (six litter system)*	+183	-7,520	25	5,421
6-10	86,995	28-Dairy Cows (10,000 lb. production) 75-Litters Hogs (five litter system)* 46 Steer Calves (Winter, graze, fed)	+102	-11,041	28	6,236

\* Enterprise described in Appendix Table 7

\*\* An explanation of the unused roughage is presented in the text, p. 23.

By reading down Table 3, the effects of increasing capital upon livestock enterprise combinations can be determined. Plan 6-10 is the profit-maximizing plan for the farm and is identical to Plan 6 in Table 2. That is, Plan 6-10 represents the point at which capital is no longer limiting. Further increase in capital (over \$86,995) would have no effect on income or enterprise organization; it could not increase profits.

In Table 3, the columns labeled "roughage surplus or deficit" or "grain surplus or deficit" indicate the feed supply produced on the farm but not used (signified by a plus sign) or the amount of grain purchased (signified by a minus sign). As before, grain can be purchased but roughage cannot. The labor, capital, and income-to-labor-and-management columns include resource requirements and returns from the extensive cropping system as well as the livestock enterprises listed. The capital figure includes land value.

As capital increases from its low level in Table 3, \$40,726 for Plan 6-1, to about \$60,000, Plan 6-5, a dairy cow herd would be started and expanded to 30 cows. For further increases in capital, hogs come into the livestock system. At the high capital level, \$86,995 for plan 6-10, steer calves are introduced in the system while the dairy cow herd is reduced slightly. Apparently, factors other than capital availability are preventing the livestock feeding enterprises from "competing" effectively with the dairy enterprise.

Table 3 has to be interpreted with care. A seven-cow Grade A dairy herd is not feasible nor, as mentioned above, would swine usually be found on a Grade A dairy. The conclusion from Table 3 is that the dairy enterprise is dominant at all capital levels for the extensive land use system and changes in land use would be necessary if comparable amounts are to be earned by a livestock feeding program.

The linear programming solutions in Table 3 utilize large amounts of purchased corn while allowing roughage to go unused. All livestock enterprises, including intensive feeding operations, were included in the programming model. As capital is increased, the linear programming technique selects those enterprises which return the maximum to capital rather than those which utilize roughage. By buying corn and feeding livestock, the programming solutions disregard the type of land use.

Thus, rather than demonstrate how to maximize returns from systems which utilize *all* the roughage and corn grown on a land use system, the programming solutions suggest an alternative method of increasing income, i.e., by purchasing corn and undertaking intensive livestock enterprises. The expected income resulting from livestock enterprises of the type which would utilize the roughage grown on this extensive land use system can be determined from Plans 2, 3, and 4 in Table 2.

## LIVESTOCK PLANS—INTERMEDIATE LAND USE SYSTEM

### Budget and Linear Programming Solutions

The cropping plan for the intermediate land use program is presented in Figure 4. Resources required, physical outputs, and expected returns for this system are presented in the top section of Table 4.

The crop rotations in this land use system are: corn-corn-barley, sweet clover rotation; corn-sudan-alfalfa-alfalfa rotation; and continuous permanent pasture. Soil erosion is minimized in the three-year rotations by the use of terraces and terrace outlets while in the four-year rotation it is controlled by keeping a high percentage of land in hay and pasture crops.

The total crop production (Table 4) consists of 2,450 corn equivalent bushels of grain and 436 hay equivalent tons of roughage. This land use system requires seven months of labor, 170 acres of tillable land, and \$10,000 capital (crop and machinery costs). The total value of crops is \$9,172. The use of high cost row crops in the rotation contributes to the high cost of production (\$4,999), leaving an expected crop income over cost of \$4,173.

**Fig. 4**  
**Cropping Plan**  
**Intermediate Land Use System**

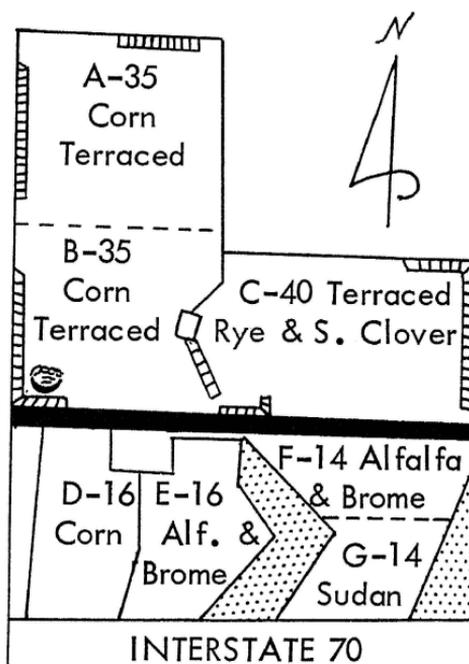


TABLE 4--RESOURCE REQUIREMENTS AND RETURNS FOR CROP AND LIVESTOCK ENTERPRISES,  
INTERMEDIATE LAND USE

<u>Cropping System</u>									
Crop	Use	Acres	Yield	Total Production	Price (Unit)	Total Value	Corn Equiv.	Hay Equiv.	Labor PMWU
Corn (bu.)	Grain	35	70	2,450	\$ 1.00	\$2,450	2,450	---	35.0
Corn (t.)	Silage	51	12	612	7.00	4,284	---	204	81.6
Alfalfa, Brome (t.)	Hay	14	3	42	18.00	756	---	42	33.6
Barley, Sweet Clover (t.)	Pasture	40	1.5	60	9.00	540	---	60	12.0
Alfalfa, Brome (t.)	Pasture	16	2	32	9.00	288	---	32	4.8
Sudan (t.)	Pasture	14	2	28	9.00	252	---	28	4.2
Barley (t.)	Pasture	35*	1	35	9.00	315	---	35	10.5
Corn Stalks (t.)	Pasture	35*	0.2	7	5.00	35	---	7	---
Improved Permanent Pasture (t.)	Pasture	14	2	28	9.00	252	---	28	2.8
Farmstead, Etc.		16	----	---	----	---	---	---	---
Totals	-----	200	----	---	----	\$9,172	2,450	436	184.5
Crop Costs (Till. Acres 170 x \$24.35 per A.)						\$4,139			
Cost of Extra Fertilizer (86 A. x \$10 per A.)						860			
Crop Income Over Cost						4,173			

TABLE 4 (Cont'd)

Livestock System

Livestock Enterprise	Plan 1	Plan 2	Plan 3	Plan 4	Plan 5	Plan 6
Heifer Calf-Winter, Graze, Fed (Head) . . . . .	225					
Dairy-10,000 lbs. Production (Head) . . . . .		50				11
Steer Calf-Winter, Graze, Fed (Head) . . . . .			210			
Yearling Steer-Winter, Graze, Fed (Head) . . . . .				190		
Plain Steer-Winter, Fed (Head) . . . . .					190	
Yearling Steer-Drylot (Head) . . . . .						108
Two-Litter Feeder Pigs (Head) . . . . .						56
Five-Litter System (Head) . . . . .						154
Six-Litter System (Head) . . . . .						238
Requirements:						
Corn Equivalent (bu.)	6,750	3,100	9,450	7,600	2,850	14,243
Hay Equivalent (t.)	405	375	420	428	285	341
Labor (PMWU)	248	450	273	304	152	491
Capital	\$29,250	\$29,500	\$33,600	\$39,900	\$19,000	\$36,594
Livestock Income Over Costs	\$ 6,300	\$11,950	\$ 8,190	\$ 6,840	\$ 3,800	\$ 5,813

Summary: Livestock Enterprises and Cropping System

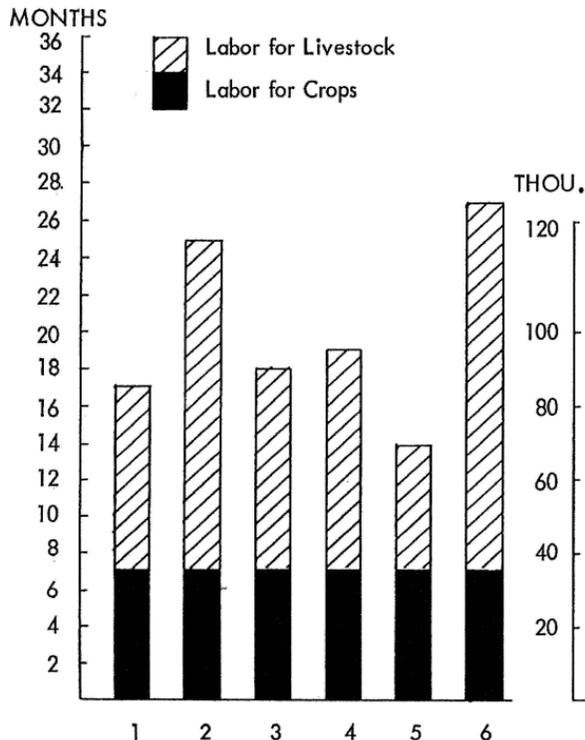
Total Months Labor Required	17	25	18	19	13	27
Added Improvements Needed	\$21,861	\$23,545	\$22,510	\$22,757	\$15,632	\$ 19,326
Total Capital Required	86,111	88,045	91,110	97,657	69,632	100,290
Total Farm Income Over Costs	10,473	16,123	12,363	11,013	7,973	9,986
Total Undistributed Costs	7,771	9,651	8,292	8,847	6,061	4,429
Income to Labor & Management	2,702	6,472	4,071	2,166	1,912	5,557

\*Double-cropped Land

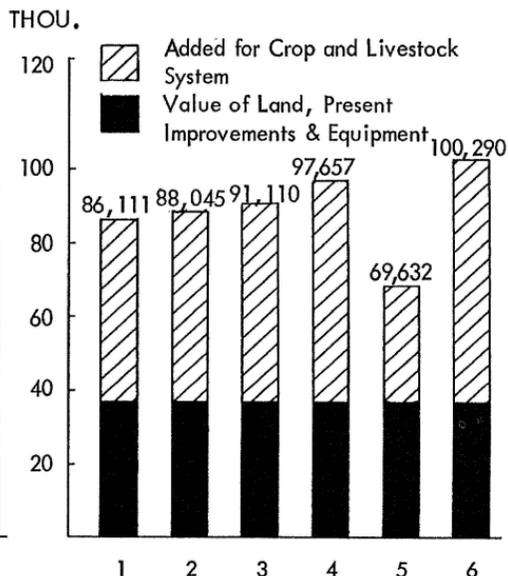
**Fig. 5**  
**Labor, Capital, and Income Estimates**  
**Intermediate Land Use System**

INTERMEDIATE LAND USE SYSTEM

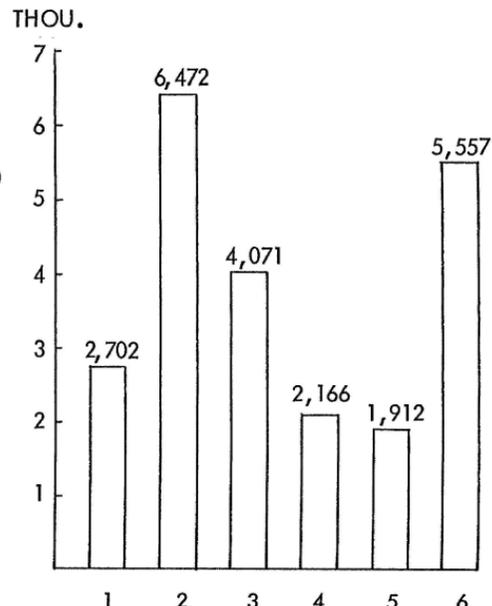
Total Months Labor Required



Total Capital Required



Income to Operator's  
 Labor and Management



Estimated labor requirements for the crops used in this system are presented in Appendix Table 1. Cost and income estimates are in Appendix Table 2.

Five budgeted livestock systems and a system determined by linear programming (Plan 6) are presented in Table 4 for the *intermediate* land use system. Estimated labor requirements for livestock enterprises are given in Appendix Table 3 and livestock income over costs in Appendix Table 4. As described before, the capital investment figures in Appendix Table 5 can be used to determine a breakdown in total capital investment. Income to labor and management is the net above a five percent interest charge for total capital.

The findings for the intermediate land use system are summarized in Figure 5. The data presented are totals for the crop and livestock system. Plan 2, the dairy enterprise, and Plan 6, the programming solution, require the most hired labor. Plain steers, wintered and fed (Plan 5) require the least labor. In fact, they do not fully utilize family labor. All plans except plain steers (5) required about the same amount of capital. Yearling steers, wintered, grazed and fed, required the highest amount, \$97,657, while the plain steer enterprise required \$69,632, one-third less.

The high income plan was the specialized Grade A dairy with 50 cows. The linear programming solution, at \$5,557, was about \$1,000 less.<sup>5</sup> Steer calves, wintered, grazed and fed, produced expected earnings of \$4,071 while Plans 1, 4, and 5 were considerably lower.

Only the dairy system (2) and the programming solution (6) required the purchase of much labor. The purchase of corn equivalent was necessary for all plans but Plans 3, 4, and 6 required the largest purchases. Plain steers underutilize farm grown roughage.

### Programming with Variable Capital

The purpose of linear programming with variable capital was explained above. The results of variable capital programming for the intermediate land use system are presented in Table 5. Plan 6-1 is the profit-maximizing livestock system for a low capital level (recall that the sum of \$23,000 is invested in land and present equipment) while Plan 6-10 is the profit maximizing plan for the capital amount at which capital is no longer a limiting resource. Plan 6-10 is the same system labelled Plan 6 in Table 4.

Dairy cows compete most effectively for capital at low capital levels. As capital increases, first hogs and then feeder pigs come into the system (Plans 6-4 and 6-5). Further increases in capital bring steer calves (6-6) and fed yearling steers

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<sup>5</sup>Given the same assumptions, the linear programming solution should return the highest income. In this case, it was determined that the pasture distribution used in budgeting was less restrictive than that used in the programming model. To actually carry 50 cows, the farmer would have to revise either his cropping or feeding program. As a result of these findings, the pasture balance system used in budgeting has been revised for future use.

TABLE 5--HOW LIVESTOCK SYSTEMS CHANGE AS TOTAL CAPITAL INCREASES--INTERMEDIATE LAND USE SYSTEM

Plan	Total Capital	Livestock Enterprises	Roughage	Grain	Total	Total
			Surplus or Deficit**	Surplus or Deficit	Labor (Months)	Income Labor & Management
			(Ton H. E.)	(Bu. C. E.)		
6-1	\$39,070	5-Dairy Cows (10,000 lb. production)	+399	+2,140	9	\$ 630
6-2	46,397	14-Dairy Cows (10,000 lb. production)	+331	+1,582	12	2,048
6-3	49,653	18-Dairy Cows (10,000 lb. production)	+300	+1,334	14	2,693
6-4	55,095	21-Dairy Cows (10,000 lb production)	+276	-112	16	3,593
		12-Litters Hogs (six litter system)*				
6-5	62,877	24-Dairy Cows (10,000 lb. production)	+241	-1,138	20	4,309
		60-Litters Feeder Pigs (2 litter system)*				
6-6	67,024	24-Dairy Cows (10,000 lb. production)	+203	-1,993	21	4,564
		60-Litters Feeder Pigs (2 litter system)*				
		19-Steer Calves (winter, graze, fed)				
6-7	78,760	24-Dairy Cows (10,000 lb. production)	+120	-4,783	24	5,093
		60-Litters Feeder Pigs (2 litter system)*				
		27-Steer Calves (winter, graze, fed)				
6-8	88,783	54-Fed Yearling Steers (drylot)	+85	-9,379	27	5,457
		17-Dairy Cows (10,000 lb. production)				
		34-Litters Feeder Pigs (2 litter system)*				
		38-Steer Calves (winter, graze, fed)				
		105-Fed Yearling Steers (drylot)				
		30-Litters Hogs (6 litter system)*				

TABLE 5 (Continued)

Plan	Total Capital	Livestock Enterprises	Roughage Surplus or Deficit**	Grain Surplus or Deficit	Total Labor (Months)	Total Income Labor & Management
			(Ton H. E.)	(Bu. C. E.)		
6-9	92,376	11-Dairy Cows (10,000 lb. production) 15-Litters Feeder Pigs (2 litter system)* 46-Steer Calves (winter, graze, fed) 115-Fed Yearling Steers (drylot) 55-Litters Hogs (5 litter system)* 102-Feeder Pigs (purchased)*	+102	-12,354	24	5,515
6-10	100,290	11-Dairy Cows (10,000 lb. production) 8 Litters Feeder Pigs (2 litter system)* 54-Steer Calves (winter, graze, fed) 108-Fed Yearling Steers (drylot) 22-Litters Hogs (5 litter system) 34-Litters Hogs (6 litter system)*	+95	-11,682	27	5,557

\* Description of enterprise in Appendix Table 7.

\*\* An explanation of the unused roughage is presented in the text, p. 23.

(6-7) into the system. The dairy enterprise reaches a maximum of 24 cows in Plan 6-5, a total capital amount of \$62,877. It stays constant at 24 cows until a capital level of \$88,783 when cow numbers are reduced to 17. The next capital jump decreases cow numbers to 11 and increases further the livestock feeding operations.

An 11-cow Grade A dairy is not feasible, as mentioned, on a farm with hog feeding operations. Thus, the interpretation of Table 5 is that at low capital levels a Grade A dairy enterprise is the best alternative on this intermediate land use system but at high capital levels livestock feeding operations compete effectively with dairy as income generating alternatives. The livestock feeding operation, involving both cattle and hogs, requires considerable management skill and involves more risk than the dairy.

### LIVESTOCK PLANS—INTENSIVE LAND USE SYSTEM

#### Budget and Linear Programming Solutions

The cropping plan for the intensive land use program is depicted in Figure 6. Resource requirements, prices used, costs, and expected returns are contained in the top section of Table 6.

**Fig. 6**  
**Cropping Plan**  
**Intensive Land Use System**

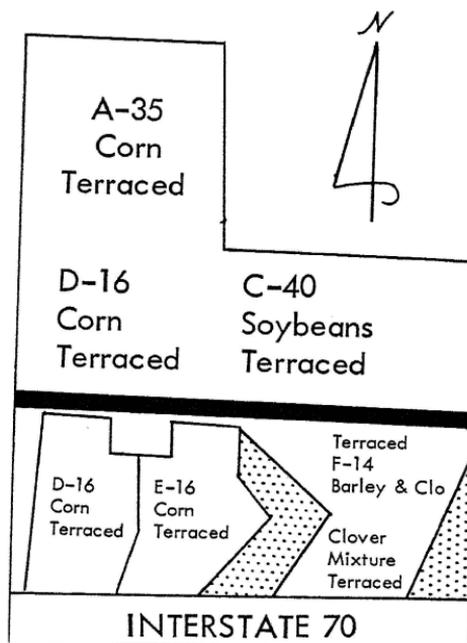


TABLE 6--RESOURCE REQUIREMENTS AND RETURNS FOR CROP AND LIVESTOCK ENTERPRISES  
INTENSIVE LAND USE

Cropping System

Crop	Use	Acres	Yield	Total Production	Price (Unit)	Total Value	Corn Equiv.	Hay Equiv.	Labor PMWU
Soybean (bu.)	Cash	40	30	1,200	\$ 2.00	\$2,400	---	---	24
Corn (bu.)	Grain	86	70	6,020	1.00	6,020	6,020	---	86
Barley (bu.)	Grain	14	50	700	0.85	595	560	---	8.4
Corn (t.)	Silage	16	12	192	7.00	1,344	---	64	25.6
Clover (t.)	Hay	14	1	14	16.00	224	---	14	14
Rye (t.)	Pasture	56*	1	56	9.00	504	---	56	16.8
Barley (t.)	Pasture	16*	1	16	9.00	144	---	16	4.8
Red Clover (t.)	Pasture	28*	1	28	9.00	252	---	28	8.4
Stalk Fields (t.)	Pasture	70*	1	14	5.00	70	---	14	---
Improved Permanent Pasture (t.)	Pasture	14	2	28	9.00	252	---	28	2.8
Farmstead Etc.	-----	16	---	---	-----	---	---	---	---
Totals	-----	200	---	---	-----	\$11,805	6,580	220	191.0
Crop Costs (Till. Acres 170 x \$30 Per A.)						5,100			
Cost of Extra Fertilizer (102 A. x \$10 A.)						1,020			
Crop Income Over Cost						5,685			

TABLE 6 (Cont'd.)

Livestock System

Livestock Enterprise	Plan 1	Plan 2	Plan 3	Plan 4	Plan 5	Plan 6
Plain Steer-Winter, Fed, (Head) . . . . .	50					
Yearling Steer-Winter, Graze, Fed (Head) . . . . .		60				
Steer Calf-Winter, Graze, Fed (Head) . . . . .			65			
Heifer Calf-Winter, Graze, Fed (Head) . . . . .				70		
Steer Calf-Winter, Graze (Head) . . . . .					75	
Yearling Steer-Drylot (Head) . . . . .						102
Two Litter System (Head) . . . . .	630	560	560	630	700	
Four Litter-Feeder Pigs (Head) . . . . .						392
Five Litter System (Head) . . . . .						490
Six Litter System (Head) . . . . .						588
Requirements:						
Corn Equivalent (bu.)	10,200	10,800	11,320	11,550	10,500	36,640
Hay Equivalent (t.)	97	155	150	148	175	180
Labor (PMWU)	310	336	324	347	368	700
Capital	\$17,150	\$23,400	\$21,200	\$21,250	\$23,250	\$38,344
Livestock Income Over Cost	\$ 7,885	\$ 8,280	\$ 8,655	\$ 8,845	\$ 9,300	\$ 4,960

Summary: Livestock Enterprises and Cropping System

Total Months Labor Required	20	21	21	21	22	36
Added Improvements Needed	\$31,895	\$31,433	\$31,462	\$33,047	\$33,844	\$38,988
Total Capital Required	86,045	91,833	89,662	91,297	94,094	114,332
Total Farm Income Over Cost	13,576	13,971	14,346	14,536	14,991	10,651
Total Undistributed Costs	9,231	9,669	9,564	9,820	10,247	4,839
Income to Labor & Management	4,345	4,302	4,782	4,716	4,744	5,812

\*Double-cropped Land

This land use system is characterized by intensive use of the land for high profit grain and roughage crops. The crop rotations considered feasible for this plan include: corn-corn-soybean three-year rotation; a corn-corn-barley and clover-clover four-year rotation; and continuous permanent pasture. These rotations are facilitated by a complete water management plan to control soil erosion. Soil fertility is assumed maintained in the following ways: (1) application of commercial fertilizer, (2) legumes in the crop rotation, and (3) the use of small grain, after the row crops are harvested, for fall pasture which is then plowed down as a green manure crop in the spring.

The crop production consists of 6,580 corn equivalent bushels of grain and 220 hay equivalent tons of roughage (Table 6). The combined value of these crops is \$11,805. The resources required to obtain this production include: 186 acres of land, eight months of labor and \$6,114 capital. The crops are expected to return an income over cost of \$5,685 excluding any charge for labor or the use of capital.

Estimated labor requirements for the crops are given in Appendix Table 1. Cost and income estimates are in Appendix Table 2.

The five budgeted livestock systems (Plans 1 to 5) and the linear programming solution (Plan 6) are presented in the center portion of Table 6. Estimated labor requirements for livestock are given in Appendix Table 3 and livestock income over cost in Appendix Table 4. As described under the extensive land use system, the total capital investment figure can be divided using Appendix Table 5. A five percent interest charge for capital investment is subtracted from total income to determine income to operator's labor and management.

Figure 7 contains a summary of labor and capital requirements as well as income resulting from each of the six plans. Each of the five budgeted plans require about the same amount of labor, approximately 21 months; each uses about the same amount of capital, \$90,000; and each plan returns about \$4,500 a year to labor and management. In addition to this, \$4,500 is earned by his capital (5 percent of \$90,000). Each budgeted plan uses about 11,000 bushels of corn, necessitating a purchase of approximately 5,000 bushels.

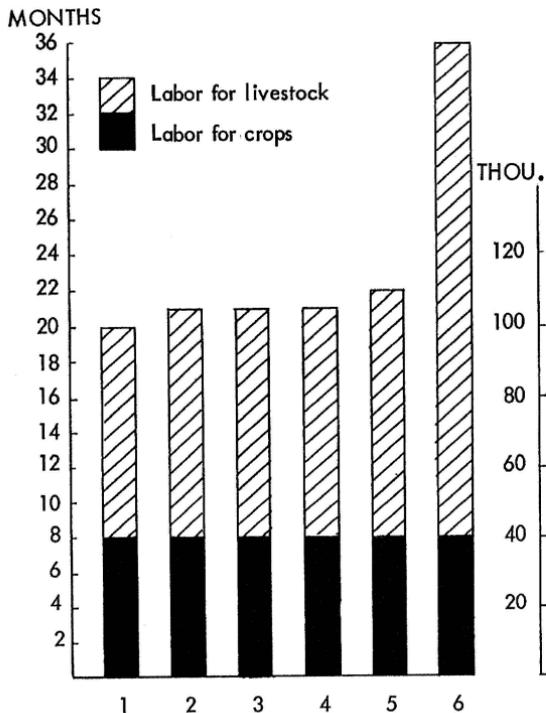
Plan 1, with 50 head of plain steers and 630 head of hogs produced in a two-litter system, does use slightly less capital, \$86,000, than the other budgeted plans but also returns one of the lowest incomes, \$4,345. Plan 2, 60 head of yearling steers and 560 head of hogs produced in a two-litter system, requires the second largest capital investment, \$91,833, and returns the lowest income, \$4,302. All of these figures and estimates and the small differences in Table 6 can be easily outweighed by buying and selling practices or efficiencies in management.

Plan 6 is the linear programming solution. Swine, both feeder pigs and sows with litters, are the major enterprises. Yearling steers in drylot were introduced, apparently to utilize the roughage production. This plan requires the purchase of large amounts of corn (30,000 bushels), uses more capital (\$114,332) than any of the budgeted plans, and earns \$5,812 return to operator's labor and manage-

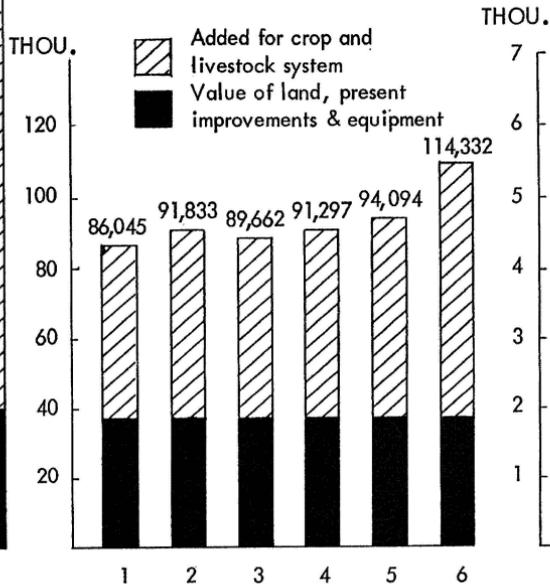
**Fig. 7**  
**Labor, Capital, and Income Estimates**  
**Intensive Land Use System**

INTENSIVE LAND USE SYSTEM

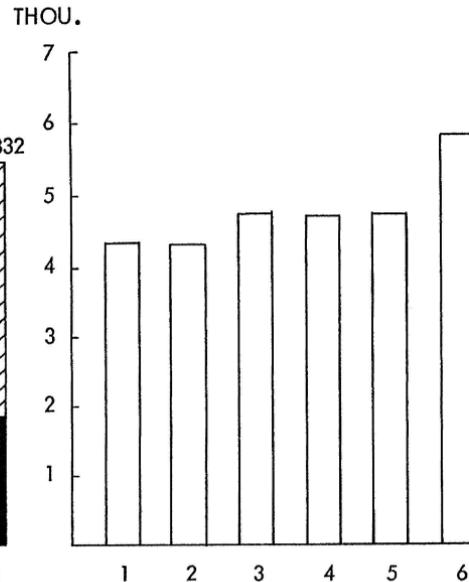
Total Months Labor Required



Total Capital Required



Income to Operator's  
 Labor and Management



ment, which is \$1,000 more than the best budgeted plan. Adding the 5 percent interest charge for capital, this plan returns \$11,500 to operator's capital, labor, and management. This large swine operation, involving substantial purchases of corn, large amounts of capital, and considerable management ability, returns the most income of any plan presented in this study.

### **Programming with Variable Capital**

Using linear programming, the amount of capital "available" to the farm business can be increased and the resulting effect on the livestock system determined. For each level of capital, the programming solution represents the maximum possible profit obtainable from any combination of livestock enterprises imposed on the land use system. Results of the variable capital programming for the intensive system are shown in Table 7. Plan 6-8 is the same as Plan 6 in Table 6; further increases in capital will not change Plan 6-8. Beyond \$114,432 of capital some other resource becomes limiting.

At low levels of capital, the Grade A dairy cow system is the profit-maximizing system. As capital increases, hogs enter the system and when the investment reaches \$70,000 the operator specializes in hogs and earns almost as much income as in any of the budgeted alternatives (Table 6). Further increases bring yearling steers in drylot into the system and income climbs above that earned by the budgeted systems. The increase in estimated profits from Plan 6-5 to Plan 6-8 is small (\$650) when compared to the increase in complexity of the feeding program, the increase in capital required (\$45,000) and increase in purchased corn. For practical purposes, Plan 6-8 would appear to have no advantage over Plan 6-7.

An 11-cow dairy system would not be feasible. The meaning of the variable capital solution is: Given the intensive land use system, a dairy system is not as profitable as intensive feeding systems. The farmer who intends to follow an intensive cropping plan should start with a swine enterprise and increase its magnitude as he obtains added capital. At high capital levels, yearling steers on drylot may be added to utilize roughage and other resources not used in swine production.

TABLE 7--HOW LIVESTOCK SYSTEMS CHANGE AS TOTAL CAPITAL INCREASES--INTENSIVE LAND USE SYSTEM

Plan	Total Capital	Livestock Enterprises	Roughage Surplus or Deficit**	Grain Surplus or Deficit	Total Labor (Months)	Income Labor & Management
			(Ton H. E.)	(Bu. C. E.)		
6-1	\$46,318	11-Dairy Cows (10,000 lb. production)	+138	+5,898	12	\$2,595
6-2	59,093	5-Dairy Cows (10,000 lb. production) 60-Litters Hogs (4 litter system)*	+168	-30	17	3,306
6-3	63,008	4-Dairy Cows (10,000 lb. production) 76-Litters Hogs (4 litter system)*	+171	-1,648	18	3,727
6-4	70,334	112-Litters Hogs (4 litter system)*	+192	-5,180	21	4,331
6-5	91,424	112-Litters Hogs (4 litter system)* 114-Yearling Steers (drylot)	+50	-10,310	27	5,150
6-6	101,548	48-Litters Hogs (4 litter system)* 96-Litters Hogs (6 litter system)* 110-Yearling Steers (drylot)	+47	-13,490	31	5,187
6-7	109,326	168-Litters Hogs (6 litter system)* 108-Yearling Steers (drylot)	+43	-15,920	34	5,739
6-8	114,432	84-Litters Hogs (6 litter system)* 70-Litters Hogs (5 litter system)* 56-Litters Feeder Pigs (4 litter system) 102-Yearling Steers (drylot)	+40	-20,060	36	5,812

\* Description of enterprise in Appendix Table 7.

\*\* An explanation of the unused roughage is presented in the text, page 23.

## SUMMARY

The purpose of this study was to determine livestock systems that maximize income for each of three "typical" cropping systems on a 200-acre farm in west central Missouri. The three cropping systems selected were: (1) an *extensive* system consisting of continuous alfalfa; continuous permanent pasture; a one-year wheat-lespedeza rotation; and a four-year sorgo, barley, timothy-lespedeza, timothy-lespedeza rotation; (2) an *intermediate* system consisting of a corn-corn-barley and sweet clover rotation, corn-sudan-alfalfa-alfalfa rotation and continuous permanent pasture; and (3) an *intensive* rotation consisting of a corn-corn-soybean rotation, a corn-corn-barley and clover, clover rotation imposed on a complete water management system. Five livestock plans were then budgeted for each of these land use systems. In addition, linear programming was used to determine the most profitable livestock program for each cropping system at various levels of capital.

The three cropping systems were predetermined in this study to illustrate the manner in which livestock enterprises (as well as income) vary with land use. In general, it is known that crop income increases with intensity of land use. For farm operators who can not or do not want to intensify land use, this study describes possible alternatives.

Plans developed were long run in nature. Capital, management, and labor were assumed to not limit production. In the long run, if an enterprise is profitable the operator will be able to secure necessary financing and labor. A further assumption was that grain could be purchased but roughage was limited to farm production.

## Extensive Land Use System

Following are the livestock enterprises budgeted for the extensive land use system (income to labor and management is the net above a 5 percent charge on total capital):

<u>Livestock Enterprise</u>	<u>Capital Investment</u>	<u>Income to Labor and Management</u>
50 Dairy cows - 10,000	\$81,308	\$5,929
80 Beef cows - calf sold	61,075	110
75 Beef cows - calf fed	64,967	-449
200 Steer calves - winter, graze, fed	83,119	3,342
75 Beef cows-calves fed and 560 two-litter feeder pigs	73,274	1,543

The linear programming results indicated that \$6,236 income to labor and management could be earned by establishing a 28-cow Grade "A" dairy, producing 75 litters of market hogs and adding 46 steer calves that are wintered, grazed, and fed out. An estimated \$86,995 capital would be needed. However, nearly the

same level of income can be earned from a 50-cow dairy herd. Specializing in dairy would require only one set of buildings, less capital and labor, and perhaps a lower level of management.

Variable capital programming indicated that the dairy enterprise would be a major enterprise at all capital levels. At high capital levels, hog and steer feeding operations entered the profit maximizing solutions but not to the extent necessary to eliminate dairy.

### Intermediate Land Use System

The following livestock enterprises were budgeted for this land use system:

<u>Livestock Enterprise</u>	<u>Capital Investment</u>	<u>Income to Labor and Management</u>
225 Heifer calves - winter, graze, fed	\$86,111	\$2,702
50 Dairy cows - 10,000	88,045	6,472
210 Steer calves - winter, graze, fed	91,110	4,071
190 Yearling Steers - winter, graze, fed	97,657	2,166
190 Plain Steers - winter, fed	69,632	1,912

Linear programming determined that \$5,557 income to labor and management would result from 11 dairy cows, 108 yearling steers in drylot, 56 two-litter feeder pigs, 154 head of the five-litter system and 238 head of the six-litter system. this complex system required \$100,290 capital investment.

For this land use system a 50-cow dairy herd apparently earned more income than the linear programming solution. An investigation of the two techniques determined that the budgeting pasture balance was not sufficiently restrictive. To actually carry 50 dairy cows, more summer pasture is needed than is provided by the intermediate land use system. Thus, the income figure for the dairy system is probably over-estimated. As a result of these findings, the pasture balance used in the budgeting technique has been revised.

Variable capital programming indicated that the dairy enterprise would be started at low capital levels and increased with increases in capital. However, as total capital increases above \$80,000, livestock feeding operations become more competitive with dairy until cow numbers are reduced to the low level of 11 when capital becomes nonrestrictive (\$100,290).

### Intensive Land Use System

The following livestock enterprises were budgeted for the intensive land use system:

<u>Livestock Enterprise</u>	<u>Capital Investment</u>	<u>Income to Labor and Management</u>
50 Plain Steer - winter, fed and 630 two-litter hogs	\$86,045	\$4,345
60 Yearling Steer - winter, graze, fed and 560 two-litter hogs	91,833	4,302
65 Steer Calf - winter, graze, fed and 560 two-litter hogs	89,662	4,782
70 Heifer Calf - winter, graze, fed and 630 two-litter hogs	91,297	4,716
75 Steer Calf - winter, graze and 700 two-litter hogs	94,094	4,744

All the budgeted plans required about the same amount of capital and earned the same income to labor and management. The linear programming solution included 102 yearling steers on drylot, 392 head of four-litter feeder pigs, 490 head of market hogs on a five-litter system and 588 head on a six-litter system. This system needed \$114,332 capital investment and returned \$5,812 in income to labor and management. Thus, the programming solution included more hogs than did the budgeted alternatives.

Variable capital programming indicated that at low capital levels dairy cows would be most profitable. As total capital increased to \$70,000, swine enterprises forced dairy out completely. Above \$70,000, yearling steers on drylot were added to the swine enterprises. Dairy was not the most profitable alternative at high capital levels on this intensive land use system.

# APPENDIX

APPENDIX TABLE 1--TOTAL AND MONTHLY DISTRIBUTION OF LABOR - CROPPING SYSTEMS

Crop	Hours of Labor Required Per Acre by Months												Hours Req. per Acre per Year
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
<u>Grain</u>													
Corn	--	--	0.50	1.00	3.00	1.50	0.50	--	0.50	1.50	1.20	0.30	10
Barley	--	--	--	--	--	1.50	1.50	0.90	1.80	0.30	--	--	6
Soybeans	--	--	--	0.30	2.10	1.50	0.78	--	0.30	0.72	0.30	--	6
Oats	--	0.60	1.80	0.42	--	0.18	3.00	--	--	--	--	--	6
Wheat	--	--	--	--	--	0.30	2.40	0.60	1.20	1.20	0.30	--	6
<u>Silage</u>													
Corn	--	--	0.80	1.60	3.20	1.28	0.32	--	6.40	2.40	--	--	16
Sorgo	--	--	0.80	1.60	3.20	1.28	0.32	--	3.20	4.80	0.80	--	16
<u>Hay</u>													
Alfalfa	--	--	0.40	0.40	0.80	2.00	1.60	1.60	0.80	0.40	--	--	8
Clover or Mixed Hay	--	0.20	0.20	--	0.20	1.80	0.40	0.80	0.20	0.20	--	--	4
Lespedeza	--	0.15	0.30	0.15	--	--	1.80	0.60	--	--	--	--	3
<u>Pasture</u>													
Alfalfa & Brome	--	--	--	0.10	0.10	0.30	--	0.60	0.60	0.30	--	--	2
Clover & Grass	--	--	0.30	0.30	--	0.20	--	--	0.40	0.60	0.20	--	2
Lespedeza & Timothy	--	--	0.30	0.30	--	0.20	--	--	0.40	0.60	0.20	--	2
Lespedeza & Small Grain	--	--	0.20	0.20	--	0.20	--	0.40	0.80	0.20	--	--	2
Sweet Clover	--	0.40	1.40	0.20	--	--	--	--	--	--	--	--	2
Rye	--	--	--	--	--	--	--	--	1.20	1.80	--	--	3
Barley	--	--	--	--	--	--	--	0.30	1.80	0.90	--	--	3
Wheat	--	--	--	--	--	--	--	0.30	1.80	0.90	--	--	3
Sudan	--	--	--	--	--	--	--	0.30	1.80	0.90	--	--	3

APPENDIX TABLE 2--CROP INCOME OVER COST

Crop	Yield per Acre	Corn Equi.	Hay Equi.	PMWU	Price	Value	*Cost per Acre	**Income over Cost
Corn (bu.)	70	70		1.0	\$1.00	\$70.00	\$30.00	\$40.00
Barley (bu.)	50	40		0.6	0.85	42.50	22.00	20.50
Soybeans (bu.)	30			0.6	2.00	60.00	25.00	35.00
Oats (bu.)	40	20		0.6	0.65	26.00	18.00	8.00
Wheat (bu.)	30			0.6	1.60	48.00	26.00	22.00
Corn Silage (T.)	12		4	1.6	7.00	84.00	36.00	48.00
Sorgo Silage (T.)	15		5	1.6	5.00	75.00	34.00	41.00
Alfalfa Hay (T.)	3		3	2.4	18.00	54.00	28.00	26.00
Mixed Hay (T.)	2		2	1.0	16.00	32.00	21.00	11.00
Lespedeza Hay (T.)	1		1	0.8	16.00	16.00	10.00	6.00
Sudan Pasture (T.)	3		3	0.3	9.00	27.00	16.00	11.00
Improved Permanent Pasture (T.)	2		2	0.2	9.00	18.00	7.00	11.00
Permanent Pasture (T.)	1		1	0.1	6.00	6.00	2.00	4.00

\* Exclusive of labor costs, and interest charges on land.

\*\* Taken from Farm Business Planning Guide

APPENDIX TABLE 3--TOTAL AND MONTHLY DISTRIBUTION OF LABOR - LIVESTOCK

Livestock	Hours of Labor Required Per Animal by Month												Hrs. Req. per Animal Yearly
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Dairy Cow	9.00	9.00	9.00	9.00	5.40	5.40	5.40	5.40	7.2	8.10	8.10	9.00	90
Beef Cow (Stocker Calf)	6.00	6.00	3.00	3.00	0.60	0.60	0.60	0.60	0.60	1.50	3.00	4.50	30
Beef Cow (Calf Fed)	5.00	5.00	5.00	7.50	7.50	1.25	1.25	1.25	1.25	5.00	5.00	5.00	50
Steer Calf (W., Gr., F.)	1.56	1.56	1.56	0.91	0.26	0.26	1.17	1.17	1.17	1.56	0.65	1.17	13
Steer Yrlg. (W., Gr., F.)	1.92	1.92	1.92	1.12	0.32	0.32	1.44	1.44	1.44	1.92	0.80	1.44	16
Heifer Calf (W., Gr., F.)	1.65	1.65	1.65	0.77	0.55	1.10	1.00	--	--	1.10	0.55	0.88	11
Steer Calf (W. Gr.)	1.35	1.35	1.35	0.90	0.18	0.18	0.18	0.18	0.45	1.08	0.72	1.08	9
Heifer Calf (W. Fatten)	1.40	1.40	1.40	1.00	1.00	1.00	0.50	--	--	1.00	0.50	0.80	10
Plain Steer (W. F.)	1.20	1.20	1.20	1.20	0.80	--	--	--	--	0.96	0.48	0.96	8
Steer Yrlg. (F., drylot)	2.10	2.10	2.10	1.40	0.70	0.70	0.70	--	--	--	2.10	2.10	14
Steer Calf (Winter)	1.20	1.20	1.20	1.20	--	--	--	--	--	0.80	1.20	1.20	8
Ewe (100% Lamb Crop)	1.00	1.00	0.75	0.50	0.50	0.50	0.10	0.10	0.10	0.10	0.10	0.25	5
Feeder Lamb	0.45	--	--	--	--	--	--	--	--	0.45	1.05	1.05	3
Sow & 1 Litter	--	--	--	--	--	7.80	6.00	4.50	4.50	3.60	3.60	--	30
Sow & 2 Litters	3.60	3.60	7.80	6.00	4.50	4.50	3.60	3.60	7.80	6.00	4.50	4.50	60
2 Sows & 3 Litters	3.60	3.60	7.80	6.00	4.50	12.30	9.60	8.10	12.30	9.60	8.10	4.50	90
2 Sows & 4 Litters	9.60	12.30	10.50	8.10	8.10	11.40	9.60	12.30	10.50	8.10	8.10	11.40	120
3 Sows & 5 Litters	17.40	18.30	15.00	12.60	11.70	7.20	11.40	13.80	10.50	9.00	8.10	15.00	150
3 Sows & 6 Litters	14.10	15.90	14.10	15.90	14.10	15.90	14.10	15.90	14.10	15.90	14.10	15.90	180
Sow & 1 Litter (Feeder Pigs)	--	--	--	--	--	7.50	3.75	1.50	0.75	0.75	0.75	--	15
Sow & 2 Litters (Feeder Pigs)	0.75	0.75	7.50	3.75	1.50	0.75	0.75	0.75	7.50	3.75	1.50	0.75	30
2 Sows & 4 Litters (Feeder Pigs)	4.50	9.00	4.50	2.25	1.50	8.25	4.50	9.00	4.50	2.25	1.50	8.25	60
Feeder Pigs (Bought) 1 Unit - 4	3.20	2.80	2.80										8.8

## APPENDIX TABLE 4--LIVESTOCK INCOME OVER COST

Livestock	Price cwt.	Gross Receipts	Corn Equiv. (bu.)	Hay Equiv. (T.)	**Total Enterprise Costs	*Income Over Cost
Dairy--8,000 lb. Prod. . . . .	\$ 2.90	\$ 278.40	54	7.0	\$ 177.23	\$101.00
Dairy--10,000 lb. Prod. . . . .	3.90	468.00	62	7.5	288.87	179.00
Beef Cow--Calf Sold . . . . .	22.00	97.24	2	5.0	65.29	32.00
Beef Cow--Calf Fed Out . . . . .	22.00	155.46	32	5.5	110.73	45.00
Steer Calf--Winter, Graze, Fed . . . . .	23.00	236.67	45	2.0	197.63	39.00
Heifer Calf--Winter, Graze, Fed . . . . .	22.00	183.26	30	1.8	155.36	28.00
Yearling--Winter, Graze, Fed . . . . .	23.00	260.54	40	2.25	224.51	36.00
Steer Calf --Winter . . . . .	24.00	141.12	6	1.0	127.52	14.00
Steer Calf--Winter, Graze . . . . .	20.00	161.70	--	2.0	139.92	22.00
Heifer--Winter, Fatten . . . . .	22.00	172.48	30	1.2	152.10	20.00
Plain Steer--Winter, Fed . . . . .	17.00	170.00	15	1.5	149.65	20.00
Fed Yearling Steer--Drylot . . . . .	23.00	260.53	45	1.25	223.69	37.00
Sow & Litter . . . . .	15.00	245.37	105	0.25	169.08	76.00
Sow & 2 Litters . . . . .	15.00	490.75	210	0.50	337.41	153.00
2 Sows & 3 Litters . . . . .	15.00	736.11	315	0.75	507.24	229.00
2 Sows & 4 Litters . . . . .	15.00	981.48	420	1.0	676.32	306.00
3 Sows & 5 Litters . . . . .	15.00	1,226.85	525	1.25	845.40	382.00
3 Sows & 6 Litters . . . . .	15.00	1,472.22	630	1.5	1,014.48	459.00
Sow & 1 Litter (Feeder Pigs) . . . . .	13/hd	110.50	35	0.25	71.48	39.00
Sow & 2 Litters (Feeder Pigs) . . . . .	13/hd	221.00	70	0.50	142.96	78.00
2 Sows & 4 Litters (Feeder Pigs) . . . . .	13/hd	442.00	140	1.00	285.92	156.00
Feeder Pig--Bought . . . . .	15.00	33.75	10.8	--	29.61	4.00
Ewe & Lamb . . . . .	21.00	26.79	2.5	.66	19.14	8.00

\*\* Includes Corn, Hay Equiv., Protein, Salt & Mineral, Breeding Charge, Veterinary, Taxes, Insurance, Depreciation and Miscellaneous Expense.

\* Return Capital & Labor Even Dollars.

APPENDIX TABLE 7--DESCRIPTION OF SELECTED SYSTEMS  
OF HANDLING MARKET HOGS AND FEEDER PIGSOne-Litter System

In this enterprise the sow farrows in early June and the litter is marketed in November. On an average 6.5 market hogs are raised per litter, with one-half cull sow being sold as pork, and one-half gilt saved for replacement. The sow and litter remain on a clean-ground pasture system throughout the period. An average 1,662 pounds of pork, including the one-half cull sow, are marketed per litter.

Two-Litter System

Two litters of hogs are marketed annually for each sow. One litter is farrowed in early March and sold in August; the other litter is farrowed in September and sold in February. One gilt is saved for replacement and one cull sow sold for pork, with this enterprise. In addition to one cull sow sold for pork, 13 pigs are also sold, totaling 3,325 pounds.

Three-Litter System

This enterprise requires two groups of sows. One group farrows in March and is marketed in August, the same group farrows again in September and is marketed in February. Gilts from the September litters are saved and farrowed in June, both sow and litter are sold in November. The total amount of pork sold, including two sows, is 5,088 pounds.

Four-Litter System

This multiple farrowing system requires two groups of sows, both farrowing twice a year. Farrowings take place in December, February, June and August. Each litter is marketed five to six months after farrowing and includes 6.5 market hogs and .5 cull sow sold. Two gilts are saved for replacement for every four litters produced in this system. Farrowings are arranged for a time that doesn't compete with the crops.

Five-Litter System

This hog enterprise is a modification of the two-litter system. Three groups are farrowed a few weeks apart in December, January and February using the same farrowing facilities for all three. Two of these three groups are farrowed again in July and August. This system works quite well where corn fields are available for gleaning in the fall. An average of 35 pigs are weaned for each five litters, with one-half gilt per litter saved for replacement stock.

Six-Litter System

This is a very intensive and virtually continuous hog enterprise. Farrowings take place every other month, requiring a rigid program with good management ability. The hogs are marketed every one to two months, hitting both the high and low yearly markets. With this system an even supply of labor is required throughout the year. Three groups of sows are farrowed twice a year, and three replacement gilts are saved for each six litters. Thirty-nine hogs and three cull sows are sold annually.

## APPENDIX TABLE 7 (Continued)

One-Litter Feeder Pigs

This system includes pigs farrowed in June, and sold in August weighing 60 pounds each. Each sow farrows in an individual house on clean ground pasture, where she remains throughout the year; the pigs also are on pasture until sold as feeders. Seven pigs are raised per litter, with one-half gilt saved for replacement, and one-half cull sow sold for pork.

Two-Litter Feeder Pigs

Each sow in this system farrows twice a year. Farrowings are in March and September, with litters being sold in May and November as feeder pigs.

The sow is handled the same as in the one litter system. For each two litters thirteen feeder pigs are sold for \$13.00 each.

Four-Litter Feeder Pigs

Four litters of hogs are sold annually for each two sows in this system. Farrowings are spread evenly throughout the year, occurring in December, February, June and August. Twenty-six feeder pigs and 2 cull sows are sold, with 2 gilts saved for replacements. All sows farrow in same farrowing house, then are moved out to pasture in individual houses until pigs are sold and sow is due to farrow again.

Feeder Pigs Bought

In this pig enterprise feeder pigs were purchased in every month at a weight of about 60 pounds. Both confinement and feeding out on pasture were considered in this study. The pigs were kept about three months, then sold as market hogs weighing 225 pounds. The purchase cost was \$13.00/head; fifty cents of this was deducted as death loss.

APPENDIX TABLE 5--TOTAL CAPITAL INVESTMENT OF LIVESTOCK ENTERPRISES FOR LINEAR PROGRAMMING  
ON A 200-ACRE CENTRAL MISSOURI FARM

Livestock Enterprise	CAPITAL INVESTMENT IN IMPROVEMENTS PER UNIT														Total Capital Investment					
	Milking Parlor			Loafing Shed	Paved Lot	Horizontal Silo	Grain Storage	Individual Hog House	Farrowing House	Finishing Floor			Total Investment			Average Annual Capital Investment	Per Unit			
	Extensive System	Intermediate System	Intensive System							Extensive System	Intermediate System	Intensive System	Extensive System	Intermediate System	Intensive System		Extensive System	Intermediate System	Intensive System	Extensive System
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	
1 Dairy - 8,000 lb. Production	\$125.00	\$122.00	\$152.00	\$37.50	\$18.75	\$15.00	\$21.60						\$217.85	\$214.85	\$244.85	\$390.00	\$607.85	\$604.85	\$634.85	
2 Dairy - 10,000 lb. Production	\$132.00	\$128.00	\$161.00	\$37.50	\$18.75	\$15.00	\$24.80						\$228.05	\$224.05	\$257.05	\$590.00	\$818.05	\$814.05	\$847.05	
3 Beef-Cow Calf Sold							\$ 0.80						\$ 0.80	\$ 0.80	\$ 0.80	\$225.00	\$225.80	\$225.80	\$225.80	
4 Beef-Cow Calf Fed				\$22.50	\$12.50	\$15.00	\$12.80						\$ 62.80	\$ 62.80	\$ 62.80	\$270.00	\$332.80	\$332.80	\$332.80	
5 Steer Calf Winter Graze & Fed				\$18.75	\$12.50	\$10.00	\$18.00						\$ 59.25	\$ 59.25	\$ 59.25	\$159.00	\$218.25	\$218.25	\$218.25	
6 Heifer Calf Winter Graze & Fed				\$18.75	\$12.50	\$10.00	\$12.00						\$ 53.25	\$53.25	\$ 53.25	\$131.00	\$184.25	\$184.25	\$184.25	
7 Yearling Winter Graze & Fed				\$22.50	\$12.50	\$15.00	\$16.00						\$ 66.00	\$ 66.00	\$ 66.00	\$210.00	\$276.00	\$276.00	\$276.00	
8 Steer Calf - Wintered				\$18.75	\$12.50	\$ 5.00	\$ 2.40						\$ 38.65	\$ 38.65	\$ 38.65	\$ 63.00	\$101.65	\$101.65	\$101.65	
9 Steer Calf - Winter & Graze				\$18.75	\$12.50	\$ 7.50							\$ 38.75	\$ 38.75	\$ 38.75	\$130.00	\$168.75	\$168.75	\$168.75	
10 Heifer - Winter & Fatten				\$18.75	\$12.50	\$10.00	\$12.00						\$ 53.25	\$ 53.25	\$ 53.25	\$107.00	\$160.25	\$160.25	\$160.25	
11 Plain Steer Winter & Fed					\$12.50	\$15.00	\$ 6.00						\$ 33.50	\$ 33.50	\$ 33.50	\$ 97.00	\$130.50	\$130.50	\$130.50	
12 Yearling Steer - Dry Lot				\$22.50	\$12.50	\$10.00	\$18.00						\$ 63.00	\$ 63.00	\$ 63.00	\$122.00	\$185.00	\$185.00	\$185.00	
13 One Litter System							\$42.00	\$80.00				122.50	\$122.00	\$122.00	\$244.50	\$160.00	\$282.00	\$282.00	\$404.50	
14 Two Litter System							\$84.00	\$80.00	200.00				122.50	\$364.00	\$364.00	\$486.50	\$270.00	\$634.00	\$634.00	\$756.50
15 Three Litter System							126.00	160.00	200.00				122.50	\$486.00	\$486.00	\$608.50	\$430.00	\$916.00	\$916.00	1038.50
16 Four Litter System							168.00	160.00	200.00				122.50	\$528.00	\$528.00	\$650.50	\$540.00	1068.00	1068.00	1190.50
17 Five Litter System							210.00	160.00	200.00				367.50	\$570.00	\$570.00	\$937.50	\$700.00	1270.00	1270.00	1637.50
18 Six Litter System							252.00	240.00	200.00				367.50	\$692.00	\$692.00	1059.50	\$810.00	1502.00	1502.00	1869.50
19 One Litter - Feeder Pigs							\$14.00	\$80.00					\$ 94.00	\$ 94.00	\$ 94.00	\$101.00	\$195.00	\$195.00	\$195.00	
20 Two Litter - Feeder Pigs							\$28.00	\$80.00	200.00				\$108.00	\$108.00	\$108.00	\$170.00	\$278.00	\$278.00	\$278.00	
21 Four Litter - Feeder Pigs							\$56.00	\$80.00					\$336.00	\$336.00	\$336.00	\$340.00	\$676.00	\$676.00	\$676.00	
22 Feeder Pigs Bought (Pasture)							\$17.28	\$11.58					\$ 28.86	\$ 28.86	\$ 28.86	\$ 60.00	\$ 88.86	\$ 88.86	\$ 88.86	
23 Feeder Pigs Bought (Confinement)							\$17.28			\$17.50	\$17.50	\$17.50	\$ 34.78	\$ 34.78	\$ 34.78	\$ 60.00	\$ 94.78	\$ 94.78	\$ 94.78	
24 Ewe and Lamb				\$15.00	\$ 8.75	\$ 1.25	\$ 1.00						\$ 26.00	\$ 26.00	\$ 26.00	\$ 36.00	\$ 62.00	\$ 62.00	\$ 62.00	

APPENDIX TABLE 6--TOTAL UNDISTRIBUTED COSTS AND NEW INCOME OVER COST FOR THE  
VARIOUS LIVESTOCK ENTERPRISES USING LINEAR PROGRAMMING

		Dairy 8,000 lbs. Production	Dairy 10,000 lbs. Production	Beef Cow Calf Sold	Beef Cow Calf Fed	Steer, Calf Wintered & Graze Fed	Heifer Calf Wintered & Graze Fed	Yearling Wintered & Graze Fed	Steer, Calf- Wintered	Steer, Calf Winter & Graze	Heifer, Calf Winter & Fatten	Plain Steer Winter & Fed	Yearling Steer (Dry/lot)	One Litter System	Two Litter System	Three Litter System	Four Litter System	Five Litter System	Six Litter System	One Litter (Feeder Pigs)	Two Litter (Feeder Pigs)	Four Litter (Feeder Pigs)	Feeder Pigs Bought (Pasture)	Feeder Pigs Bought (Confinement)	Ewe & Lamb
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Extensive System	1 Repairs, Depreciation, Insurance on Added Improvements (10%)	\$21.78	\$22.80	\$ 0.08	\$ 6.28	\$ 5.92	\$ 5.32	\$ 6.60	\$ 3.86	\$ 3.87	\$ 5.32	\$ 3.35	\$ 6.30	\$12.20	\$36.40	\$48.60	\$52.80	\$57.00	\$69.20	\$ 9.40	\$10.80	\$33.60	\$ 2.89	\$ 3.48	\$ 2.60
	2 Interest on Investment (5%)	10.89	11.40	0.04	3.14	2.96	2.66	3.30	1.93	1.94	2.66	1.68	3.15	6.10	18.20	24.30	26.40	28.50	34.60	4.70	5.40	16.80	1.44	1.74	1.30
	3 Real Estate Taxes (1%)	2.18	2.28	0.01	0.63	0.59	0.53	0.66	0.39	0.39	0.53	0.34	0.63	1.22	3.64	4.86	5.28	5.70	6.92	0.94	1.08	3.36	0.29	0.35	0.26
	4 Interest on Average Annual Livestock Investment (5%)	19.50	29.50	11.25	13.50	7.95	6.55	10.50	3.15	6.50	5.35	4.85	6.10	8.00	13.50	21.50	27.00	35.00	40.50	5.05	8.50	17.00	3.00	3.00	1.80
	5 Undistributed Costs for Added Improvements	54.35	65.98	11.38	23.55	17.42	15.06	21.06	9.33	12.70	13.86	10.22	16.18	27.52	71.74	99.26	111.48	126.20	151.22	20.09	25.78	70.76	7.62	8.57	5.96
	6 Livestock Income Over Cost (Budgets)	101.00	239.00	32.00	45.00	39.00	28.00	36.00	14.00	22.00	20.00	20.00	37.00	76.00	153.00	229.00	306.00	382.00	459.00	39.00	78.00	156.00	20.00	16.00	8.00
	7 New Livestock Income Over Cost - For Linear Programming	46.65	173.00	20.62	21.45	21.58	12.94	14.94	4.67	9.30	6.14	9.78	20.82	48.48	81.26	129.74	194.52	255.80	307.78	18.91	52.22	85.24	12.38	7.43	2.04
Intermediate System	8 Repairs, Depreciation, Insurance on Added Improvements (10%)	\$21.48	\$22.40											\$12.20	\$36.40	\$48.60	\$52.80	\$57.00	\$69.20						
	9 Interest on Investment (5%)	10.74	11.20											6.10	18.20	24.30	26.40	28.50	34.60						
	10 Real Estate Taxes (1%)	2.15	2.24											1.22	3.64	4.86	5.28	5.70	6.92						
	11 Interest on Average Annual Livestock Investment (5%)	19.50	29.50											8.00	13.50	21.50	27.00	35.00	40.50						
	12 Undistributed Costs for Added Improvements	53.87	65.34											27.52	71.74	99.26	111.48	126.20	151.22						
	13 Livestock Income Over Cost (Budgets)	101.00	239.00											76.00	153.00	229.00	306.00	382.00	459.00						
	14 New Livestock Income Cost - For Linear Programming	47.13	173.66											48.48	81.26	129.74	194.52	255.80	307.78						
Intensive System	15 Repairs, Depreciation, Insurance on Added Improvements (10%)	\$24.48	\$25.70											\$24.45	\$48.65	\$60.85	\$65.05	\$93.75	105.95						
	16 Interest on Investment (5%)	12.24	12.85											12.22	24.32	30.42	32.52	46.88	52.98						
	17 Real Estate Taxes (1%)	2.45	2.57											2.44	4.86	6.08	6.50	9.38	10.60						
	18 Interest on Average Annual Livestock Investment (5%)	19.50	29.50											8.00	13.50	21.50	27.00	35.00	40.50						
	19 Undistributed Costs for Added Improvements	58.67	70.62											47.11	91.33	118.85	131.07	185.01	210.03						
	20 Livestock Income Over Cost (Budgets)	101.00	239.00											76.00	153.00	229.00	306.00	382.00	459.00						
	21 New Livestock Income Cost - For Linear Programming	42.33	168.38											28.89	61.67	110.15	174.93	196.99	248.97						

NOTE: In budgeting undistributed costs are not allocated (distributed) among cropping and livestock enterprises but rather subtracted from total farm income. This is infeasible for linear programming. For programming, undistributed costs had to be divided among enterprises considered. This table gives the method used to allocate undistributed costs and the resulting new income over cost used in the linear programming models.