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An Economic Analysis of Alternative Beef Cattle Systems for a Large Farm in Central Missouri

by

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INTRODUCTION

The average number of acres per farm has increased steadily in recent decades. Accompanying this increase in farm size has been an increase in the number of farms grossing over $10,000, indicating an increase in economic size as well as physical size. Thus, the large farm looms more and more important in the future of Missouri's commercial farming areas.

Many important questions on large farms remain to be resolved. Among these are: Will large farms be specialized or diversified? What economies or diseconomies of size exist for large farms? Should large farms be intensively or extensively farmed? What livestock and crop programs are most appropriate for large farms?

This bulletin deals with the last of these questions. The objective of the analysis presented was to determine costs and returns of alternative beef cattle systems on a thousand-acre farm in central Missouri. The size of the farm considered is much larger than the average farm in Missouri but it represents the type of farm toward which many livestock men aspire. Further, it is a size of farm that is occurring more and more frequently in northern Missouri.

A considerable difference of opinion about the organization of large farms exists among farmers and management men. Some believe large farms should be put to grass for supporting extensive beef cattle operations, while others believe that part or all of a farm should be put to a more intensive use. The system most appropriate for a single farm will depend upon the quality of the land and both quality and quantity of other resources. Different systems have different resource and management requirements, and earn different incomes.

The different plans presented in this bulletin permit a comparison of beef cattle systems commonly found on Missouri farms. It is presumed that managers normally select crop and livestock systems most compatible with their ability, experience, and preference. Regardless of the system preferred, a manager should be aware of the possible net farm income from other systems feasible for his farm.

THE METHOD OF ANALYSIS

This study uses the method of projected planning. Because of practical limitations, not all crop and livestock systems of interest could be tried on the study farm. Plans were formulated and expected costs and returns estimated for each system, using the most suitable production and price data available. Specific crop and livestock enterprises represented the personal preferences of the manager of the study farm, and the kinds usually found in the area. The plans described represent plans proposed for the farm rather than the results of actual operations.

Two techniques were used to study the relationships among crop and livestock enterprises. Both of these techniques, block budgeting and linear programming, used the same price and production data and were subject to the same assumptions. A discussion of the general assumptions of this study follows.

General Assumptions.—One assumption was that livestock enterprises rely largely upon farm grown feeds. Thus, livestock and crop enterprises would be limited by the intensity of land use. In some plans the purchase of corn was considered, but in all cases roughage usage was limited to that produced on the farm. Although large feeding operations relying upon purchased feeds are an important consideration in livestock production, such operations are independent of land use. Because the major objective of this analysis was to determine the effects of integrated livestock and cropping systems upon net farm income, no plans for large feeding operations were included.

The second assumption was that sufficient capital and labor could be obtained for the alternatives considered. Because the plans developed are long run, the manager probably could secure necessary financing if indications are that the plan would be profitable,. When budgeting, capital requirements were considered and an attempt was made to keep capital use within reasonable limits.

Labor requirements presented are only rough estimates of the labor needed by a given manager. Rather than place a restriction on labor by a monthly distribution, the assumption was made that new technologies or alternative production methods would be used in months when labor requirements were high. For example, wheel-track planting and weed sprays might be used to save labor in early summer when corn cultivation is usually done. Or, custom work might be hired. Managers can make these types of adjustments over a period of time. When labor was hired it was assumed to be of average quality.

The third general assumption of this analysis centers around management. The assumption was made that the manager would possess adequate ability to handle the large crop and livestock enterprises found on a 1000-acre farm. In practice, managers will differ greatly in their ability to manage this size of farm. Comparison of the different plans would be made more difficult if management were introduced as a variable.

Block Budgeting.—The block budgeting technique was used to estimate net farm income from alternative, long run, crop and livestock systems believed feasible for the study farm. Procedures for block budgeting, along with the appropriate forms, are presented in the *Farm Business Planning Guide* (5). Prices, costs, yields, capital investments, labor requirements and other data used were also taken in large part from the *Guide.* Differences between the figures from the *Guide* and those used in the study can be found by comparing the enterprise tables with figures from the *Guide* and observing the footnotes to the tables.

In block budgeting, each enterprise is set up on a per unit basis (acres or head of livestock) and total operating income. Resource requirements for an enterprise are determined by multiplying the per unit figures by the total number of units of the enterprise. Thus, block budgeting assumes that resource requirements and operating costs are constant per unit of output. If an enterprise with significant changes in efficiency (cost economies or diseconomies) is being planned, the per unit resource requirements are based on the level of production the budgeter expects to include in the farm plan. In this way satisfactory results can be obtained using the block budgeting procedure.

Linear Programming.—Linear programming was developed during World War II to determine the allocation of supplies and to choose the most efficient transportation routes (7). Since its development, it has had many other uses, including farm planning. The technical aspects of linear programming will not be discussed here; many references are available (3, 7, 8).

Linear programming requires the same data as budgeting techniques. Available resources, the amount of each resource required for one unit of production, and the net income from each unit of product must be known. Given this economic and technical data, the linear programming procedure will select, from those enterprises included for consideration, the most profitable crop and livestock system.

The same assumptions and budgeting data were used for linear programming as were used for block budgeting solutions in this study. Programming like budgeting, necessitates the assumption of constant per unit resource requirements, costs, and income, regardless of enterprise size. Again, this limitation can be overcome by developing per unit requirements based on the expected size of enterprise, as described above.

After the basic plan is chosen, whether by programming or budgeting, the farm manager must still develop an effective field layout, water management system, farmstead arrangement, and other facilities for efficient use of labor and resources.

DESCRIPTION OF THE FARM

A public road passes through the farm, by the farmstead, providing ready accessibility to the various fields. The farmstead can be reorganized for greater efficiency. Many of the buildings, old and outmoded, could be replaced with a more efficient arrangement for managing livestock and handling materials. Thus, the planned farming systems were not limited to existing buildings; it was assumed new buildings could be built if needed.

The farm selected for this study is located in central Missouri along the Blackwater River. It has both river bottom land and rolling upland. It consists of 9 percent bottom land, 59 percent tillable upland, 18 percent permanent pasture land, 8 percent woodland, and 6 percent farmstead.

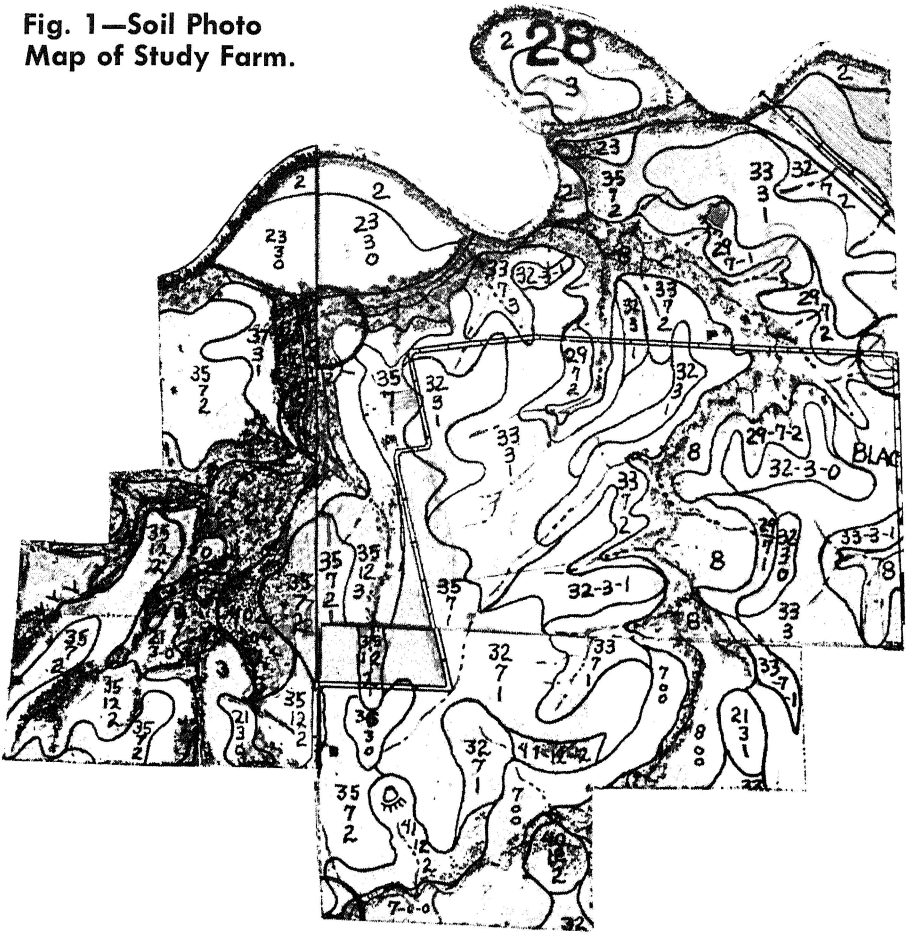
Nodaway, Westerville, Chequest, and Carlow (arranged in order of productivity) comprise the major low bottom land soils on the farm. Chariton silt loam and Sandy terrace soil types are the two high bottom or terrace soils. When provided with proper soil treatment, these soils are suitable for any degree of land use intensity.

Winfield, Pershing, and Ladoga are the major types of tillable upland soils. Winfield is a brown, well-drained river hill soil which requires protection from erosion and complete fertilization for intensive use. Pershing, a grayish-brown soil developed from loess and of sloping topography, requires protection from erosion and complete fertilization for good yields. Ladoga, a brown, well aerated, productive soil of moderately high fertility, requires applications of phosphorus, nitrogen and lime for high yields. For the most part, these upland soils could be farmed with intensive rotations when given proper erosion control and soil treatments.

The degree of roughness and amount of timber on the land accounted for the major difference between the remaining two classes of land: *permanent pasture* and *woodland.* These two sections of the farm consisted of Stony Land, Bewleyville, Baxter, and Winfield. Because of steep slopes, shallow soil, and rock outcroppings, this land is limited largely to either permanent pasture or forest use.

All of the soil types and their erosion class and slope are illustrated on the soil photo map of the study farm (Figure 1). The meaning of the erosion and slope class indexes is presented in Appendix Table 1 and Appendix Table 2. Appendix Table 3 gives the name and description of each soil type found on the farm.

Fig. 1—Soil Photo Map of Study Farm.



CONVENTIONAL SIGNS AND SYMBOLS

ROADS: Paved, Gravel, Dirt, Private
RAILROAD
PIPELINE
STORE
HOUSE
SCHOOL
CHURCH
CEMETERY
STREAMS: Large Perennial, Small Perennial, Large Intermittent, Small Intermittent
GULLIES: Large, Small
SECTION CORNER
POND OR LAKE
MINE OR QUARRY
LEVEE
ROCK OUTCROP

NOTE: top number is soil type, middle is erosion class, lower is slope (see Appendix Table 1-3

RESULTS OF THE BUDGETING ANALYSIS

Budgeting the Extensive Land Use System—Beef cow-stocker calf.
Beef cow-calf fed.
Deferred yearling steers.
Feeder pigs following fed cattle.

The extensive land use system was planned as an all-grass system without grain production; even the bottom land was put into grass. An all-grass system such as this might be useful to farmers whose land is not adaptable to more intensive cultivation or who prefer a less intensive system for other reasons. A comparison of this system with the more intensive crop and livestock systems will reveal the relative income to be expected from the different intensities as well as the inputs required to produce that income.

Crops used on extensive systems.—Income-over-cost figures for the crops considered in the extensive system are given in Table 1. The data are from the *Farm Business Planning Guide* but are adapted to local conditions.

All land was assumed to be unimproved except for an initial fertility application for pasture improvement. This initial fertilizer application was assumed to be applied to all land, including those fields on which row cropping would not be feasible.

The hypothetical fertility treatment for the tillable upland was 2 tons of lime per acre, 1,000 pounds of rock phosphate per acre, and 200 pounds of started fertilizer per acre, totaling $28.00 per acre. This charge was prorated over a 10-year period and included in the annual cost per acre figures of the rotation pastures.

For the permanent pasture land the fertility treatment was 2 tons of lime and 200 pounds of starter fertilizer per acre for a total cost of $12.00 per acre. This charge was prorated over a ten-year period and inserted in the annual costs of these permanent pastures.

The rotation pastures were top dressed every other year with 30 pounds of P_2O_5 and the permanent pasture with 15 pounds of P_2O_5. The cost of P_2O_5 was estimated at 10 cents per pound. In practice, a soil test would be necessary before actual soil treatments were made but these assumed amounts suffice for the purpose of analysis.

Alfalfa-brome supplied all the hay and some of the pasture needs of the livestock. Alfalfa-brome and fescue-ladino provided grass for the early and late pasture seasons. The other mixtures provided grass for the hot, dry summer months The proportion of each pasture mix included in the extensive land use system was varied depending upon the livestock enterprises.

Livestock Enterprises Used in the Extensive System

Costs and returns for livestock enterprises considered for the extensive land use system are listed in Table 2. Two beef cow enterprises were considered. One was a beef cow enterprise with calves sold as stockers. The calves were dropped during the November through February period and sold as stockers in the fall,

TABLE 1-ESTIMATED CROP PRODUCTION, INCOME, AND COST DATA FOR BLOCK BUDGETING AND LINEAR PROGRAMMING THE EXTENSIVE LAND USE SYSTEM

Item	Hay	Pastures					
		Rotation Pastures			Permanent Pastures		
	Alfalfa-Brome	Alfalfa-Brome	Fescue & Ladino	Orchard Grass, Timothy, & Lespedeza	Orchard Grass, Timothy, & Lespedeza	Bluegrass & Lespedeza	Woodland
Yield	3.5 tons	2.5 tons	2.5 tons	1.5 tons	1.5 tons	1.5 tons	0.2 tons
Price	$18.00	$ 9.00	$ 9.00	$ 9.00	$ 9.00	$ 9.00	$ 6.00
Value	$63.00	$22.50	$22.50	$13.50	$13.50	$13.50	$ 1.20
Labor (PMWU)[1]	$ 1.50	$ 0.20	$ 0.20	$ 0.20	$ 0.15	$ 0.15	$ 0.10
Cost/Acre	$28.00	$10.00	$10.00	$ 6.50	$ 6.50	$ 6.50	---
Income Over Cost[2]	$35.00	$12.50	$12.50	$ 7.00	$ 7.00	$ 7.00	$ 1.20

[1] Labor requirement per year. A productive man work unit (PMWU)is the amount of work a man should be able to do in a ten-hour day, with average work methods and average equipment.

[2] Exclusive of labor costs, interest, and other charges on land.

Source: Farm Business Planning Guide, University of Missouri, College of Agriculture and the United States Department of Agriculture cooperating, B. F. 6103, January, 1961.

TABLE 2-ESTIMATED LIVESTOCK PRODUCTION, INCOME, AND COST DATA FOR BLOCK BUDGETING AND LINEAR PROGRAMMING THE EXTENSIVE LAND USE SYSTEM

	Beef Cow Stocker Calf Sold (Per Head)	Beef Cow Calf Fed Out-- Started Before Weaning (Per Head)	Deferred Yearling Steers (Per Head)	Feeder Pigs Following Fed Cattle (Per Head)
Cross receipts[1]	$ 97.24	$155.46	$238.37	$33.75
Total enterprise costs	65.29	110.73	205.74	29.61
Income over costs	32.00	45.00	33.00	4.00
Requirements:				
Ave. Capital Investment	$220.00	$255.00	$203.00	$13.00
Corn (bu)	2.00	32.00	25.00	10.80
Hay (T)[2]	2.65	2.20	2.20	-
Pasture (T)	3.85	3.85	2.09	-
Labor (PMWU)[3]	2.00	3.00	1.30	0.15

[1]Includes sale of culls and death losses where appropriate. See the farm planning guide for details.

[2]Hay requirements figures of the farm planning guide have been modified by increasing them by ten percent in order to provide a more conservative estimate of the number of animals that could be carried on this study farm.

[3]Labor requirement per year. A productive man work unit (PMWU) is the amount of work a man should be able to do in a 10-hour day with average work methods and average equipment.

Source: Farm Business Planning Guide, University of Missouri, College of Agriculture and the United States Department of Agriculture cooperating, B. F. 6103, January, 1962.

August through October. The other was a beef cow enterprise with calves fed as baby beeves from weaning time and sold in February.

A third livestock enterprise was deferred yearling steers. These steers were purchased about September; then they were wintered, grazed, and sold the following October after being on concentrate feeds for 60 to 90 days.

The beef cow-calf fed and deferred steer enterprises included purchased feeder pigs to salvage wasted corn. A ratio of one pig for each two animal units was assumed for both enterprises. For the extensive land use system, the only feeder pigs considered were those following fed cattle; feeder pigs were not considered as a major enterprise.

Assumptions of the Extensive Analysis

1. *Livestock numbers are limited by the amount of roughage produced on the farm. In the area studied, as in many areas in north Missouri, the supply of roughage available for purchase is highly variable from year to year.*
2. *Grain for livestock feed can be purchased.*
3. *Sufficient capital and labor can be acquired to develop the alternative plans. The plans presented are the type a manager would work toward over a long time. Thus, over a period of years he would be able to obtain capital and labor for enterprises that were profitable.*
4. *The manager has sufficient ability to manage the crop and livestock enterprises on a scale appropriate for a 1000-acre farm.*

Budgets for the Extensive System

To demonstrate the earnings of different cattle enterprises, each of the three beef enterprises were budgeted for the extensive land use system. The results are given in Table 3.

The farm has 718 tillable acres divided among four upland fields of 100 acres each and two of 110 acres, and a bottomland field of 98 acres.

All the land was put into pasture under this system. The amount of hay and pasture production was varied among the three budgeted plans, depending upon the needs of the livestock enterprises. In general, the crop income over cost increased as the amount of alfalfa-brome, hay and pasture increased.

The beef cow-stocker calf enterprise (Extensive Plan A) returned the least net income, -$1,220, of the three systems. The beef cow-calf fed enterprise (Extensive Plan B) resulted in a net income of -$42 while the deferred yearling enterprise resulted in a net income of $5,695 (Extensive Plan C).

The assumptions of the analysis were that grain can be purchased but roughage cannot. Thus, of the three beef enterprises considered, the one which used the least hay and pasture should generate the most income. Deferred yearling steers have a lower requirement for both pasture and hay than the other two beef enterprises (Table 2). Hence, as more corn is purchased, a higher number of animal units can be carried and an increased volume of the supplementary en-

terprise, feeder pigs, is possible. All of this adds up to a higher net farm income for Plan C than for the other two plans.

It should be pointed out that further intensification of livestock enterprises, using more purchased inputs, would increase net farm income. Feed lot operations involving all purchased feeds and labor can be set up independently of a cropping system. However, the purpose of the analysis is to present comparative

TABLE 3-ALTERNATIVE FARM PLANS BUDGETED FOR THE EXTENSIVE LAND USE SYSTEM

Enterprises	Extensive Plan A	Extensive Plan B	Extensive Plan C
Crops	(Acres)	(Acres)	(Acres)
Hay:			
Alfalfa-Brome	172	220	219
Pastures:			
Alfalfa-Brome	100	116	187
Fescue-Ladino	198	198	242
Orchard Grass-Timothy-Lespedeza	248	184	70
Permanent Pasture	185	185	185
Woodland Pasture	40	40	40
Other:			
Woodland	87	87	87
Farmstead	10	10	10
Total	1,040	1,040	1,040
Livestock	(Head)	(Head)	(Head)
Beef Cow-Stocker Calf	365	-	-
Beef Cow-Calf Fed	-	350	-
Defd. Yelg. Steers	-	-	700
Feeder Pigs	-	175	350
Resources Required			
Labor	$ 7,750	$ 11,750	$ 10,750
Fixed Capital	163,362	181,991	192,897
Variable Capital	80,300	91,281	146,077
Total Capital	243,662	273,272	338,974
Hay Fed (tons)	602	770	770
Corn Fed (bu)	730	12,357	19,562
Income & Costs			
Crop Inc./Cost	$12,819	$15,281	$ 14,869
Livestock Inc./Cost	11,680	17,183	26,218
Total Inc./Cost	24,499	32,464	41,087
Total Undist. Costs	25,719	32,506	35,392
Cash Inc.	14,178	16,507	23,007
Net Farm Inc.	-1,220	-42	5,695

TABLE 4. ESTIMATED CROP PRODUCTION, INCOME AND COST DATA FOR BLOCK BUDGETING AND LINEAR PROGRAMMING THE INTERMEDIATE LAND USE SYSTEM.

Item	Crops					Pastures					
	Grain		Roughage		Hay	Rotation Pastures			Permanent Pastures		
	Corn	Barley	Corn Silage	Sorgo Silage	Alfalfa-Brome	Alfalfa-Brome	Fescue & Ladino	Orch. Grass, Timothy & Lespedeza	Orch. Grass, Timothy & Lespedeza	Bluegrass and Lespedeza	Woodland
Yield	80 bu.	50 bu.	14 t.	16 t.	3.5 t.	2.5 t.	2.5 t.	1.5 t.	1.5 t.	1.5 t.	0.2 t.
Price	$ 1.00	$ .85	$ 7.00	$ 5.00	$18.00	$ 9.00	$ 9.00	$ 9.00	$ 9.00	$ 9.00	$ 6.00
Value	80.00	42.50	98.00	80.00	63.00	22.50	22.50	13.50	13.50	13.50	1.20
Labor (PMWU)[1]	0.80	0.50	1.20	1.20	1.50	0.20	0.20	0.15	0.15	0.15	0.10
Cost/Acre	$30.00	$22.00	$36.00	$34.00	$28.00	$10.00	$10.00	$ 6.50	$ 6.50	$ 6.50	$ --
Income Over Cost[2]	50.00	20.50	62.00	46.00	35.00	12.50	12.50	7.00	7.00	7.00	7.20

1. Labor requirement per year. A productive man work unit (PMWU) is the amount of work a man should be able to do in a ten hour day, with average work methods and average equipment.

2. Exclusive of labor costs, interest, and other charges on land.

Source: Farm Business Planning Guide, University of Missouri, College of Agriculture and the United States Department of Agriculture cooperating, B.F. 6103, January, 1961.

costs and returns for livestock enterprises depending largely upon home-grown feeds.

Budgeting the Intermediate Land Use System—Beef cow-calf fed.
Deferred yearling steers.
Wintered and fed plain steers.
Wintered and fattened heifers.
Feeder pigs following fed cattle.

In this system all the tillable upland was planned for a six-year rotation, corn silage, barley, and four fields of pasture or hay. The 98-acre bottomland field was planned for continuous corn. The rest of the farm, not suited for cropping, was put into improved permanent pasture or left as woodland pasture.

In general, the intermediate land use system typifies one found on many Missouri farms. The bottomland is farmed as intensively as possible. Corn is grown on the upland but only in rotation with less intensive crops.

Crops Used on Intermediate System.—Income-over-cost figures for crops included in the intermediate land use system are given in Table 4. The data are from the *Farm Business Planning Guide* but are adapted to suit local conditions.

Fertility improvement for pasture in the intermediate land use system was the same as for the extensive system. An added charge of 10 dollars per acre annually was made to apply extra nitrogen (100 pounds per acre) to maintain basic fertility for fields with row crops.

Livestock Enterprises Used in the Intermediate System.—Costs and returns for the livestock enterprises considered for the intermediate land use system are presented in Table 5. Because the intermediate land use system was planned to produce large quantities of roughage, two livestock enterprises considered for the extensive land use system were also considered for the intermediate land use system. These enterprises, beef cow-calf fed and deferred yearling steers, were handled as described in the extensive land use section.

Wintered and fed plain steers were purchased in early fall (September-October) and used to glean fields and utilize fall pasture. When the pasture season was over, they were fed silage until January and then full-fed until sold the last of February.

The wintered and fattened heifers were purchased at the same time as the deferred yearling steers and plain steers, in early fall. They were handled in the same manner as plain steers but were on silage a month longer. They were put on concentrate feed in April and sold the latter part of June.

The only hog enterprise considered for the intermediate land use systems was an enterprise of purchased feeder pigs following fed cattle to salvage waste corn. A ratio of one feeder pig to two animal units was used.

Assumptions of the Intermediate Analysis.—Assumptions for the intermediate land use system are the same as those for the extensive system. The assumptions, which were discussed in more detail in the extensive system section, are:

TABLE 5-ESTIMATED LIVESTOCK PRODUCTION, AND COST DATA FOR BLOCK BUDGETING AND LINEAR PROGRAMMING THE INTERMEDIATE LAND USE SYSTEM

	Beef cow Stocker Calf Fed (Per Head)	Deferred Yearling Steers (Per Head)	Wintered and Fed Plain Steers (Per Head)	Wintered and Fattened Heifers (Per Head)	Feeder Pigs Following Fed Cattle (Per Head)
Gross receipts[1]	$155.46	$238.37	$170.00	$172.48	$33.75
Total Enterprise Costs	$110.73	$205.74	$149.65	$152.10	$29.61
Income Over Costs	$ 45.00	$ 33.00	$ 20.00	$ 20.00	$ 4.00
Requirements:					
Average Capital Invest.	$225.00	$203.00	$ 92.00	$102.00	$13.00
Corn (bu)	32.00	25.00	15.00	30.00	10.80
Hay (tons)[2]	2.20	1.10	1.65	1.32	-
Pasture (tons)	3.85	2.09	-	-	-
Labor (PMWU)[3]	3.00	1.30	1.20	1.00	0.13

[1]Includes sale of culls and death losses where appropriate. See the Farm Business Planning Guide for details.

[2]Hay requirement figures of the Farm Business Planning Guide have been modified by increasing them by ten percent in order to provide a more conservative estimate of the number of animals that could be carried on this study farm.

[3]Labor requirement per year. A productive man work unit (PMWU) is the amount of work a man should be able to do in a 10-hour day with average work methods and average equipment.

Source: Farm Business Planning Guide, University of Missouri, College of Agriculture and the United States Department of Agriculture cooperating, B. F. 6103, January, 1962.

1. Roughage is limited to home production.
2. Grain for livestock feed may be purchased.
3. Sufficient quantities of capital and labor are available.
4. The manager has the needed ability to manage the crop and livestock operations considered.

Budgets for the Intermediate System.—Three different livestock plans (A, B, and C in Table 6) were budgeted on the intermediate land use system.

Plan A, using beef cows with fed calf, is almost identical, from a cost and income standpoint, to the beef cow with fed calf plan used on the extensive land use system (Extensive Plan B). The increased intensity of land use had little effect on income when livestock enterprises were high forage users. In fact, fewer beef cow-calf fed units could be carried on the intermediate land use system because roughage production was reduced; livestock income over cost, over $17,000 for Extensive B, was reduced to $15,000 for Intermediate B. Only the crop income over cost for Intermediate A, $16,561 compared to $15,281 in the Extensive system using cows and fed calves, kept net farm income for this plan from dropping further.

Because under the assumptions of this study grain can be purchased and roughage cannot, livestock enterprises which use smaller amounts of roughage relative to corn than does the beef cow-calf fed enterprise should be more profitable. With this in mind, Intermediate B and Intermediate C were planned.

Intermediate Plan B utilizes 569 units of deferred yearling steers. The lower roughage requirements of deferred yearling steers compared to the beef cow-calf fed system permits an increase in the number of livestock units carried and a similar increase in feeder pigs following cattle. Thus, livestock income over costs increased $6,000 between Intermediate A and B and net farm income increased to $6,500.

Livestock income over cost for Intermediate B is still not as large as it is for Extensive C, which also utilizes deferred yearling steers. Thus, a beef cattle program which required less roughage and more grain was needed. To fulfill this requirement, Intermediate C was budgeted.

Intermediate C utilizes 500 head of deferred yearling steers, 100 wintered and fed plain steers and 120 wintered and fattened heifers. Three hundred and sixty feeder pigs following fed cattle were included to salvage corn. With this planned year-around livestock program, Intermediate C produced the highest net farm income budgeted so far. Crop income over cost increased and, because Intermediate C used more grain relative to hay and roughage than the other intermediate plans, higher livestock output and higher income were attained.

TABLE 6-ALTERNATIVE FARM PLANS BUDGETED FOR THE INTERMEDIATE LAND USE SYSTEM

Enterprises	Intermediate Plan A	Intermediate Plan B	Intermediate Plan C
Crops	(Acres)	(Acres)	(Acres)
Grains:			
Corn	85	95	98
Barley	100	100	100
Silages:			
Corn	-	103	100
Sorgo	113	-	-
Hay:			
Alfalfa-Brome	52	41	116
Pastures:			
Alfalfa-Brome	238	192	194
Fescue-Ladino	-	143	110
Orchard Grass-Timothy-Lespedeza	130	44	-
Permanent Pasture	185	185	185
Woodland Pasture	40	40	40
Other:			
Woodland, and idle	87	87	87
Farmstead	10	10	10
Total	1,040	1,040	1,040
Livestock	(Head)	(Head)	(Head)
Beef Cow-Calf Fed	306	-	-
Defd. Yrlg. Steers	-	569	500
Wtrd. & Fed Plain Strs.	-	-	100
Wtrd. & Fatd. Heifers	-	-	120
Feeder Pigs	153	284	360
Resources Required			
Labor	$ 10,250	$ 8,500	$ 11,000
Fixed Capital	199,423	204,906	209,826
Variable Capital	79,805	118,733	127,044
Total Capital	$279,228	$323,639	$336,870
Hay Fed (tons) (Includes silage)	673	626	873
Corn Fed (bu.)	10,803	15,895	19,760
Income & Costs			
Crop Inc./Cost	$ 16,561	$ 18,488	$ 20,368
Livestock Inc./Cost	15,023	21,310	24,068
Total Inc./Cost	31,584	39,798	44,436
Total Undist. Costs	32,406	33,292	36,926
Cash Inc.	16,868	24,519	25,757
Net Farm Inc.	-822	6,506	7,510

Budgeting The Intensive
Land Use System—Non-deferred yearling steers.
Wintered and fed plain steers.
Wintered and fattened heifers.
Sow and two litters.
Feeder pigs following fed cattle.
Feeder pigs not following fed cattle.

This system was planned for the most intensive land use possible on the study farm. The intensity of the rotation planned necessitated a complete water management system to control erosion on the tillable upland. The bottom land was planned for continuous corn. All but one field, approximately 100 acres of the tillable upland, was put in the corn, corn, corn, corn, and barley-sweet clover rotation. The remaining field was used to produce the roughage needs of the livestock enterprises. Variations in the proportion of corn used for grain or silage were made depending upon livestock needs. Land other than bottomland or tillable upland was left unchanged, as described for the other systems.

Crops used on the Intensive Land Use System.—Cost and return data for crops used on the intensive land use system are given in Table 7. The data are adapted from the *Farm Business Planning Guide.*

The fertility program for woodland and permanent pasture was the same as for other land use systems. For the rest of the farm an increased fertility program was used, compared to the other two systems. The annual fertility program for the row crops was increased to $12 per acre for extra nitrogen (120 pounds per acre).

A new farm field layout map and water management system is presented in Figure 2. This layout was necessary to have ready accessibility to each field from the farmstead. The water management system included 510 acres at a total cost of $20,400 or $40 per acre. This type of system was needed to permit the intensive rotation planned for the upland fields.

Livestock Enterprises Used in the Intensive System.—Costs, returns, and resource requirements for the livestock enterprises considered for the intensive land use system are listed in Table 8. Three intensive beef cattle enterprises—nondeferred yearling steers, wintered and fed plain steers, and wintered and fattened heifers—were considered with this system. All but the nondeferred steer system have been described in previous sections. The nondeferred yearling steer enterprise is different from the deferred in that the cattle are kept on silage a month less, are fed on pasture during the spring rather than put on pasture only to graze, are fed 30 days longer on full-feed, and are marketed 30-60 days sooner.

A feeder pig enterprise followed fed cattle to salvage waste corn. In addition, two swine enterprises, a sow with two litters and a purchased feeder pig enterprise, were included to demonstrate the comparative returns of intensive hog enterprises with those from intensive beef enterprises.

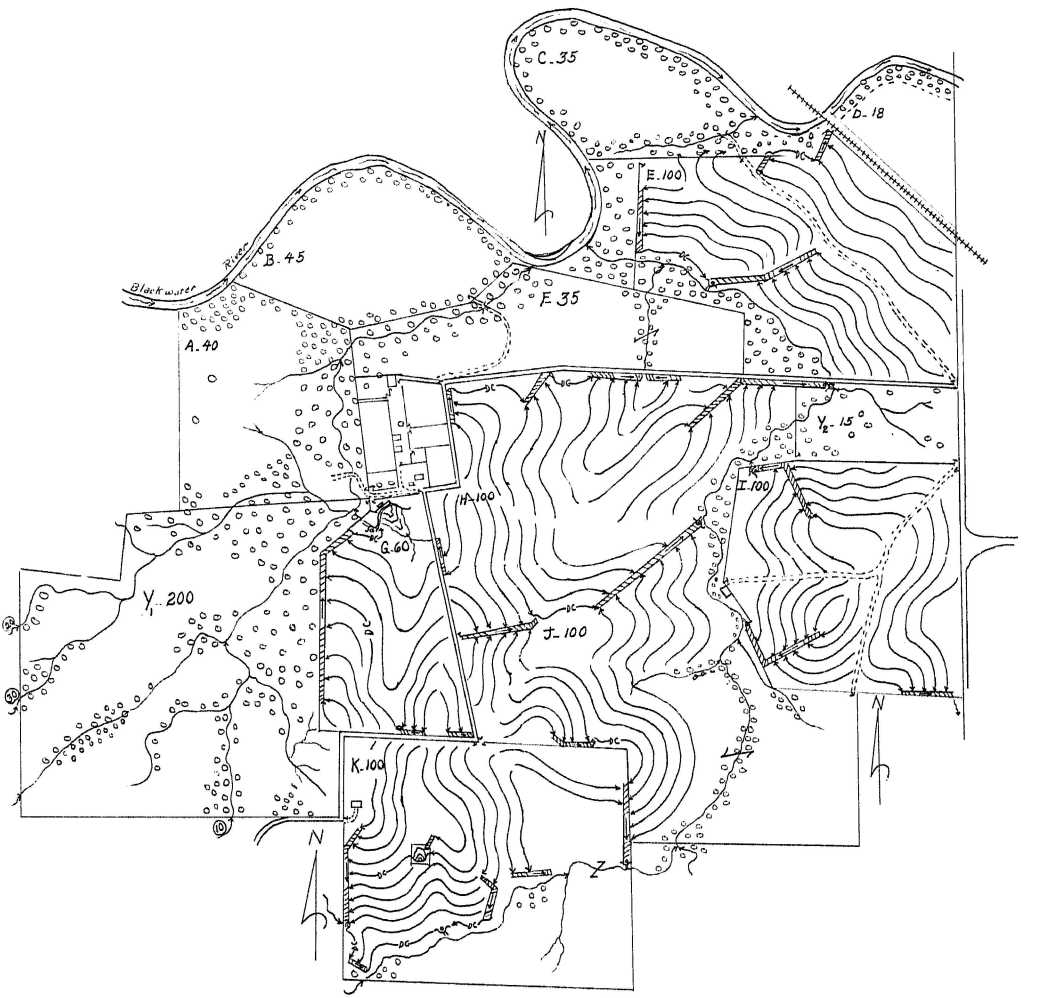


Figure 2. New Field Layout and Water Management System for Case-Study Farm.

TABLE 7-ESTIMATED CROP PRODUCTION, INCOME, AND COST DATA FOR BLOCK BUDGETING AND LINEAR PROGRAMMING THE INTENSIVE LAND USE SYSTEM

Item	Crops		Hay		Pastures					
	Grain		Roughage		Rotation Pasture			Permanent Pastures		
	Corn	Barley & Sweet Clover	Corn Silage	Alfalfa-Brome	Alfalfa-Brome	Fescue & Ladino	Barley & Sweet Clover	Orch. Grass, Timothy& Lespedeza	Bluegrass and Lespedeza	Woodland
Yield	80 bu	50 bu	14 t.	3.5 t.	2.5 t.	2.5 t.	0.75 t.	1.5 t.	1.5 t.	0.2 t.
Price	$1.00	$ .85	$ 7.00	$18.00	$ 9.00	$ 9.00	$ 9.00	$ 9.00	$ 9.00	$ 6.00
Value	80.00	42.50	98.00	63.00	22.50	22.50	6.75	13.50	13.50	1.20
Labor (PMWU)[1]	0.80	0.50	1.20	1.50	0.20	0.20	0.20	0.15	0.15	0.10
Cost/Acre	$30.00	$22.00	$36.00	$28.00	$10.00	$10.00	$ 4.00	$ 6.50	$ 6.50	$ -
Income Over Cost[2]	50.00	20.50	62.00	35.00	12.50	12.50	2.75	7.00	7.00	1.20

[1] Labor requirement per year. A productive man work unit (PMWU) is the amount of work a man should be able to do in a ten hour day, with average work methods and average equipment.

[2] Exclusive of labor costs, interest, and other charges on land.

Source: Farm Business Planning Guide, University of Missouri, College of Agriculture and the United States Department of Agriculture cooperating, B. F. 6103, January, 1961.

TABLE 8-ESTIMATED LIVESTOCK PRODUCTION, INCOME, AND COST DATA FOR BLOCK BUDGETING AND LINEAR PROGRAMMING THE INTENSIVE LAND USE SYSTEM

Item	Wintered, Grazed, & Fed Yearling, Nondefd. = 90 Days (Per Head)	Wintered & Fed Plain Steers (Per Head)	Wintered & Fattened Heifers (Per Head)	Feeder Pigs Bought (Per Head)	Sow & Two Litters To Market (Per Head)
Gross receipts[1]	$260.54	$170.00	$172.48	$ 33.75	$490.75
Total enterprise costs	224.51	149.65	152.10	29.61	337.41
Income over costs	36.00	20.00	20.00	4.00	153.00
Requirements:					
Average capital invest.	$205.00	$92.00	$102.00	$13.00	$220.00
Corn (bu.)	40.00	15.00	30.00	10.80	210.00
Hay (tons)[2]	1.375	1.65	1.32	--	---
Pasture (tons)	1.10	--	--	--	0.55
Labor (PMWU)[3]	1.10	1.20	1.00	0.15	4.50

[1]Includes sale of culls and death losses where appropriate. See the Farm Business Planning Guide for details.

[2]Hay requirement figures of the Farm Business Planning Guide have been modified by increasing them by 10 percent to provide a more conservative estimate of the number of animals that could be carried on this farm.

[3]Labor requirement per year. A productive-man-work-unit (PMWU) is the amount of work a man should be able to do in a 10-hour day with average work methods and average equipment.

Source: Farm Business Planning Guide, University of Missouri, College of Agriculture and the United States Department of Agriculture cooperating, B. F. 6103, January, 1962.

In the sow and two-litter enterprise, each sow farrowed twice and the sow numbers were divided so that farrowing occurred four times a year. Half the sows farrowed from December through January and the other half from February through March. The second farrowing period then occurred June through July and August through September. By this method af farrowing, four litters of pigs were fed per year and four groups of fat hogs were marketed per year. This averaged out prices received through the year. The purchased feeder pig enterprise was also divided into four groups per year.

Assumptions of the intensive analysis:

1. *Roughage is limited to home production.*
2. *Grain is limited to home production.*
3. *Sufficient quantities of labor and capital can be obtained.*
4. *The manager has sufficient ability to manage the large beef cattle and hog enterprises.*

Budgets for the Intensive System.—Three livestock plans (A, B, and C in Table 9) were budgeted for the intensive land use system. Plan A was budgeted to be as intensive a cattle feeding operation as possible, given the assumptions of no purchased roughage or grain. Plan B was budgeted to compare this intensive cattle program operation with a large purchased feeder pig operation, while Plan C illustrates the comparative earnings of a large sow and two-litter hog enterprise.

Intensive Plan A was budgeted using similar livestock enterprises as Intermediate Plan C. Because the intensive land use system produced more grain and less roughage than the intermediate system, a nondeferred steer enterprise requiring less roughage and more grain than the deferred steer enterprise was considered. Also, the number of wintered and fed plain steers and wintered and fattened heifers was increased in Intensive Plan A over Intermediate C. This plan resulted in the highest net farm income, $10,982, and the highest capital requirement, $378,498, budgeted thus far. Because both hay and grain were assumed limited to that grown on the farm, the livestock enterprises were selected to return the largest possible returns to roughage and grain.

Intensive Plan B included purchased feeder pigs as the major livestock enterprise. This plan gave nearly the same income as the intensive beef feeding plan, Intensive A. The cattle enterprises included in Intensive B, plain steers and deferred steers, had high roughage requirements relative to wintered and fattened heifers; therefore, these steer enterprises were used to utilize the roughage available while minimizing the amount of corn taken from feeder pigs.

Intensive Plan C had a sow and two-litter enterprise that consumed all grain except that needed by the roughage utilizing beef cattle enterprises. Because hogs returned more per unit of grain than any beef enterprise, the objective of the budgeting was to assign the maximum possible amount of corn to swine.

TABLE 9-ALTERNATIVE FARM PLANS BUDGETED FOR THE INTENSIVE LAND USE SYSTEM

Enterprises	Intensive Plan A	B	C
Crops	(Acres)	(Acres)	(Acres)
Grains:			
Corn	306	381	457
Barley & Sweet Clover	100	100	100
Silage:			
Corn	212	137	61
Hay:			
Alfalfa-Brome	97	68	84
Pastures:			
Alfalfa-Brome	--	32	--
Fescue-Ladino	3	--	16
Permanent Pasture	185	185	185
Woodland Pasture	40	40	40
Other:			
Woodland	87	87	87
Farmstead	10	10	10
Total	1,040	1,040	1,040
Livestock	(Head)	(Head)	(Head)
Nondefd. Yrlg. Steers	350	400	300
Wtrd. & Fed Pl. Strs.	300	200	100
Wtrd. & Fatd. Heifers	255	--	--
Sow & Two-Litters	--	--	135
Feeder Pigs	453	1,606	--
Resources Required			
Labor	$ 14,750	$ 12,500	$ 13,750
Fixed Capital	248,105	251,983	249,431
Variable Capital	130,393	120,656	99,075
Total Capital	$378,498	$372,639	$348,506
Hay Fed (tons) (Includes Silage)	1,313	880	578
Corn Fed (bu.)	28,475	34,480	40,525
Income & Costs			
Crop Inc./Cost	$29,337	$27,771	$27,219
Livestock Inc./Cost	28,079	26,689	34,780
Total Inc./Cost	57,416	54,460	61,999
Total Undist. Costs	46,434	44,273	44,146
Cash Inc.	30,235	29,620	37,123
Net Farm Inc.	10,982	10,187	17,853

Intensive Plan C would return a higher net farm income, $17,853, at a lower capital investment, $348,506, than the other two plans budgeted for the intensive land use system. However, it is an extremely large operation, having 135 sows, 100 plain steers, and 300 nondeferred steers. The management needs of an operation of this magnitude are sizable. In practice, significant economies or diseconomies not adequately reflected in the data may exist for operations of this size. The plan is included here only to suggest the type of returns that would be possible under the assumption of sufficient managerial ability.

RESULTS OF THE LINEAR PROGRAMMING ANALYSIS

Programming the *Extensive* Land Use System

The livestock enterprises, crop enterprises, and the initial fertility treatments used for the linear programming analysis of the extensive system were identical to those used earlier to budget the extensive system. Capital requirements used in the programming model were developed from data used in the budgeting models. When a livestock enterprise, such as deferred yearling steers, was considered as an alternative for two different budgets in the same land use system, the capital coefficients were derived for each and then averaged.

The objective of the linear programming analysis was to determine the combination of the three cattle enterprises which would maximize net farm income. At the same time, the best possible crop and pasture system for this livestock program was determined.

A secondary objective of the linear programming was to determine the effect of capital upon the farm plan. The question was asked: Does a capital limitation influence the basic structure (crop and livestock combination) of the farm plan?

Figure 4 depicts the relationship between net farm income and added capital. Added capital is defined to be the additional capital needed to operate and implement the farm plan over and above that money already invested in the farm—buildings, machinery, and improvements. For this study farm, $156,542 was the invested capital or "sunken" capital and this amount must be added to the capital listed on the graph to determine total capital at each net income level. Added capital includes the money necessary for such items as new improvements, machinery, livestock, and facilities.

Figure 3 depicts net income increases with added capital in the *extensive* land use system. There are three main segments to the graph: $0-$23,200; $23,200-$141,500; and $141,500 and above. For the $0-$23,200 capital interval, most of the enterprises found in the final solution came into the crop and livestock system: corn buying, cow-stocker calf, feeder pigs, alfalfa hay, alfalfa pasture, and permanent pasture. The cow-stocker calf enterprise reached a maximum at $26,200 added capital. From the $26,200 added capital level to $43,200, the cow-stocker calf enterprise was gradually phased out and the deferred yearling steer enterprise replaced it.

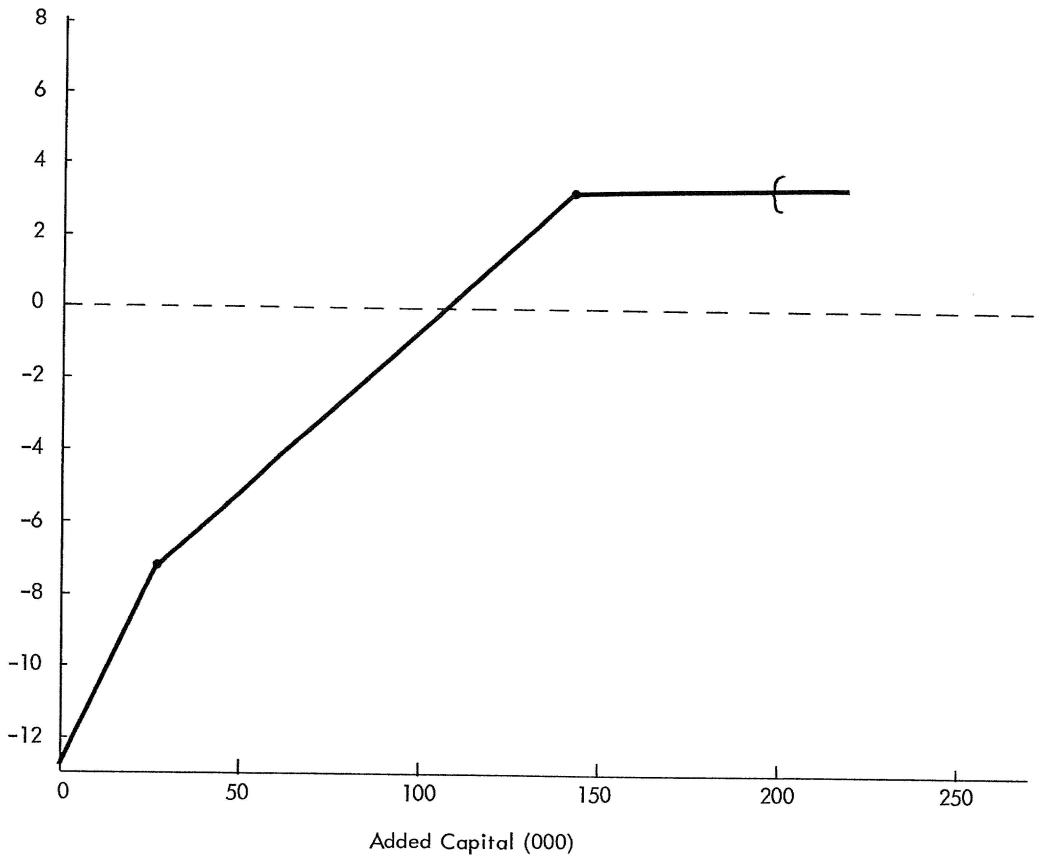


Figure 3 - Net Farm Income Increases With Added Capital - Extensive Land Use System

Between $26,200 and $43,200 additional capital, fescue-ladino pasture became feasible and at $43,200 purchased labor was needed. From $43,200 to $141,500 the enterprises already selected increased in size and the woodland pasture was utilized. Above $141,500, further increases in capital added nothing to net farm income; the land had become the limiting factor of production.

The conclusions concerning added capital for the *extensive* land use system are: At low capital levels, a cow-stocker calf enterprise is first introduced and produced on the best land. As capital becomes more plentiful a deferred yearling steer enterprise is added. At high capital levels, the cow-stocker calf enterprise is deleted and the least productive land is brought into use. At low capital levels, livestock numbers were too low to fully utilize the land production.

Table 10 shows the results of the programming solution of the extensive land use system for the highest capital level, $141,500 of added capital. This solution is represented by the point where the graph reaches a maximum.

The programming solution in Table 10 is most similar to budgeting Extensive Plan C. The livestock enterprises are the same, but the programming solution has fewer livestock and lower income. This difference occurred because the pasture distribution (the amount of pasture available during each period of the pasture season) was more restrictive in the linear programming model than in the budgeting model. Linear programming provides a method of considering such factors in farm planning.

Thus, to the extent that the pasture distribution used was representative of actual conditions, the programming model is more exact than the budgeting model and illustrates the need for careful consideration of pasture availability throughout the grazing season.

Neither the programming nor the budgeting pasture solution figures are immediately adaptable to the fields as they exist on the farm. A user of this solution would round off the amounts of each pasture to fit his particular field arrangement.

Programming the *Intermediate* Land Use System

Again the enterprises and initial fertility treatments are identical to those discussed under the budgeting of the intermediate land use system (page 19). As discussed previously, the deferred yearling steer capital coefficients are averages of two budgets.

The purpose of the linear programming model for the *intermediate* land use system is to determine whether roughage and grass should be grown on the farm while corn is purchased for the livestock activities, or whether the optimal plan is to maximize row-crop production while livestock consumes the roughage production. Also, should silage be produced for livestock enterprises such as wintered and fattened plain steers and heifers?

The intensity of land use was determined by letting pasture compete with row crops on that part of the farm suitable to row cropping.

TABLE 10-OPTIMAL FARM PLAN THROUGH LINEAR PROGRAMMING THE EXTENSIVE LAND USE SYSTEM

Enterprises	Linear Programming Results
Crops	(Acres)
Hay:	
Alfalfa-Brome	162
Pastures:	
Alfalfa-Brome	243
Fescue-Ladino	210
Orchard Grass-Timothy-Lespedeza	-
Permanent Pasture	288
Woodland Pasture	40
Other:	
Woodland	87
Farmstead	10
Total	1,040
Livestock	(Head)
Beef Cow-Stocker Calf	-
Beef Cow-Calf Fed	-
Defd. Yearling Steers	516
Feeder Pigs	258
Resources Required	
Labor	$ 7,449
Fixed Capital	190,303
Variable Capital	107,588
Total Capital	$297,891
Hay Fed (Tons) (Includes Silage)	568
Corn Fed (bu.)	14,408
Income and Capital	
Crop Inc./Cost	$ 13,398
Livestock Inc./Cost	19,155
Total Inc./Cost	32,553
Total Undist. Costs	29,451
Cash Inc.	20,339
Net Farm Inc.	3,102

Figure 5 depicts the increase in net farm income as a function of added capital. The definition of added captial is as defined in the extensive section.

Capital limitation had an interesting effect upon this model. For the $0-$18,900 range of added capital, the major enterprises for the land use system came into the optimum solution: corn, barley, alfalfa hay, feeder pigs, and the cow-calf fed enterprise. The cow enterprise was not included in the optimum solution at any added capital level.

In the next segment, $18,900-$29,600, alfalfa pasture was produced. At the $18,900 capital level, plain steers entered into the program and expanded up to the $29,600 level, where the solution contained heifers for the first time.

At $32,200 the plain steers were dropped while the heifer enterprise expanded. The deferred yearling steer enterprise came in at $29,600 of added capital and expanded up to the $115,200 level and decreased thereafter.

At $36,600 of added capital, the heifer enterprise was dropped but it was reintroduced into the optimum program at the $115,200 capital level and increased further as captial was added.

In the $29,500-$124,500 capital interval, orchard grass-timothy-lespedeza pasture entered the solution and was deleted; purchased labor entered; and fescue-ladino pasture entered. For the $124,500-$154,500 capital segment no enterprises were changed but income increased.

This discussion is meant to point out how one resource, capital, can affect a farm plan. Extensive livestock enterprises are utilized when capital is limited and more intensive livestock enterprises are used as capital increases.

This might be explained by income over cost and pasture requirements of the livestock enterprises. From high to low, rank of estimated income over cost for livestock enterprises is: cow-calf fed, deferred yearling steers, wintered and fattened heifers, and wintered and fed plain steers. Thus, the cow enterprise comes in first while grass is abundant. Then the deferred steers come in to utilize the grass more fully. The heifers support this system because they require no pasture but are more profitable than plain steers. The heifers are the only enterprise that does not depend upon pasture production but they do depend on hay and roughage.

Table 11 is the optimal farm program for the intermediate land use system; that is, further additions of capital will not increase net farm income or change the solution given in Table 11. This is also the farm plan that results in the highest income in Figure 4. This answer best compares to that of the budgeting Intermediate Plan C. Plain steers were not in the programming solution, probably because they had higher hay and labor requirements than heifers, though the capital requirement for steers was less. As with the extensive system, the programming solution for the intermediate system resulted in smaller net farm income than the best budgeting solution. Fewer cattle were produced because of the pasture distribution requirements mentioned before.

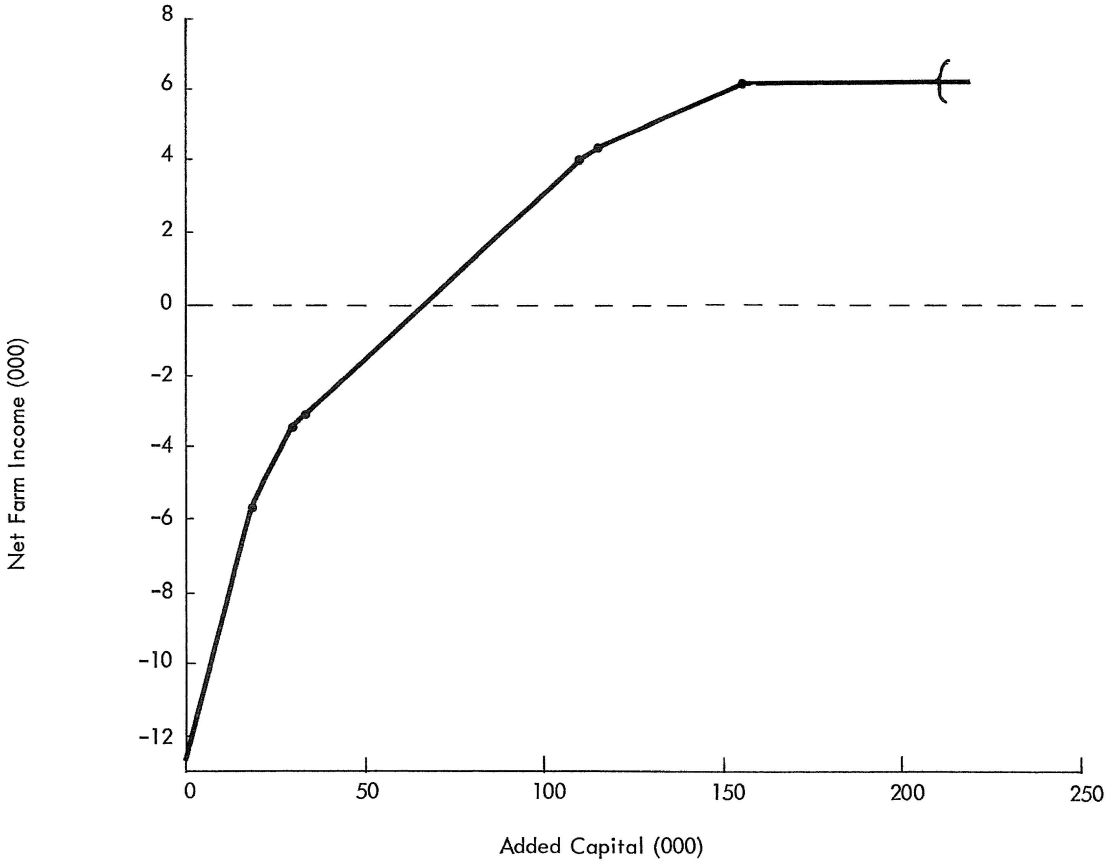


Figure 4 - Net Farm Income Increases With Added Capital - Intermediate Land Use System

TABLE 11-OPTIMAL FARM PLAN THROUGH LINEAR PROGRAMMING THE INTERMEDIATE LAND USE SYSTEM

Enterprises	Linear Programming Results
Crops	(Acres)
Grains:	
Corn	198
Barley	100
Silages:	
Corn	-
Sorgo	-
Hay:	
Alfalfa-Brome	228
Pastures:	
Alfalfa-Brome	132
Fescue-Ladino	61
Orchard Grass-Timothy-Lespedeza	-
Permanent Pasture	184
Woodland Pasture	-
Other:	
Woodland	127
Farmstead	10
Total	1,040
Livestock	(Head)
Beef Cow-Calf Fed	-
Defd. Yrlg. Strs.	236
Wtd. & Fed Plain Steers	-
Wtrg. & Fattening Heifers	408
Feeder Pigs	322
Resources Required	
Labor	$ 10,299
Fixed Capital	217,914
Variable Capital	93,128
Total Capital	$311,042
Hay Fed (Tons) (Includes Silage)	798
Corn Fed (bu.)	19,840
Income & Costs	
Crop Inc./Cost	$ 21,642
Livestock Inc./Cost	19,132
Total Inc./Cost	40,774
Total Undist. Costs	34,325
Cash Inc.	25,289
Net Farm Inc.	6,449

Given the cost and returns data used for this study, silage production is not profitable. Corn was produced as much as the intensity of land use assumptions allowed. Also, the land was used as intensively as possible; the optimum solution did not call for purchasing grain and producing roughage. Rather, the programming solution used roughage production required for soil conservation purposes and added heifers to utilize the corn production. Some differences in the cropping programs can be observed in Tables 6 and 11.

Programming the *Intensive* Land Use System

The livestock enterprises, crop enterprises, and the initial fertility treatment are identical to those discussed for the budgeting of the intensive land use system. The assumptions of the intensive land use system are the same as those for the other land use systems, except that available grain is limited to the farm production.

For this final level of land use intensity two programming models were used. One model considered hogs only as a supplementary enterprise as in the previous land use systems. In the second model, hogs were a major enterprise. A sow and two-litter enterprise and a feeder pig enterprise were included for possible selection in the optimum program. As before, when an activity was considered on two different budgets within a land use system, the capital requirement coefficients were developed from each budget and then averaged.

Figure 6 shows how net farm income increases as added capital is increased for the intensive land use system. The high curve results when swine are the major enterprise and the low curve when beef cattle are the major enterprise.

The capital and income data have the meanings defined previously. Swine production results in a higher net farm income at each level of capital. The two models are about the same at the breakeven point for added capital, but from that point on the sow and litter enterprise returns more per dollar of capital added and more total profit. From the \$0-\$50,000 added capital segment, the following enterprises (model with hogs) were selected; corn, corn silage, barley-sweetclover, alfalfa hay, alfalfa pasture, permanent pasture, nondeferred steers, sow and two litters. At the \$150,000 added capital level the corn silage activity left the solution, and at \$176,082, fescue-ladino pasture came in. The heifer enterprise never came into producion because the corn was needed for hogs. Probably the reason for the nondeferred steer enterprise was to utilize the pasture necessary for the rotation.

For the intensive land use model with purchased feeder pigs the first activities to come in were corn, alfalfa hay, corn silage, alfalfa pasture, permanent, pasture, fescue-ladino pasture, barley-sweetclover, nondeferred yearling steers, and feeder pigs. The only activity to come in with added capital was the heifer enterprise. The optimum solution was arrived at with \$220,500 of added capital.

Table 12 shows the final solution to both models as represented by the point where each income function first reached a maximum (Figure 5). The model including purchased feeder pigs will be discussed first. This solution is approxi-

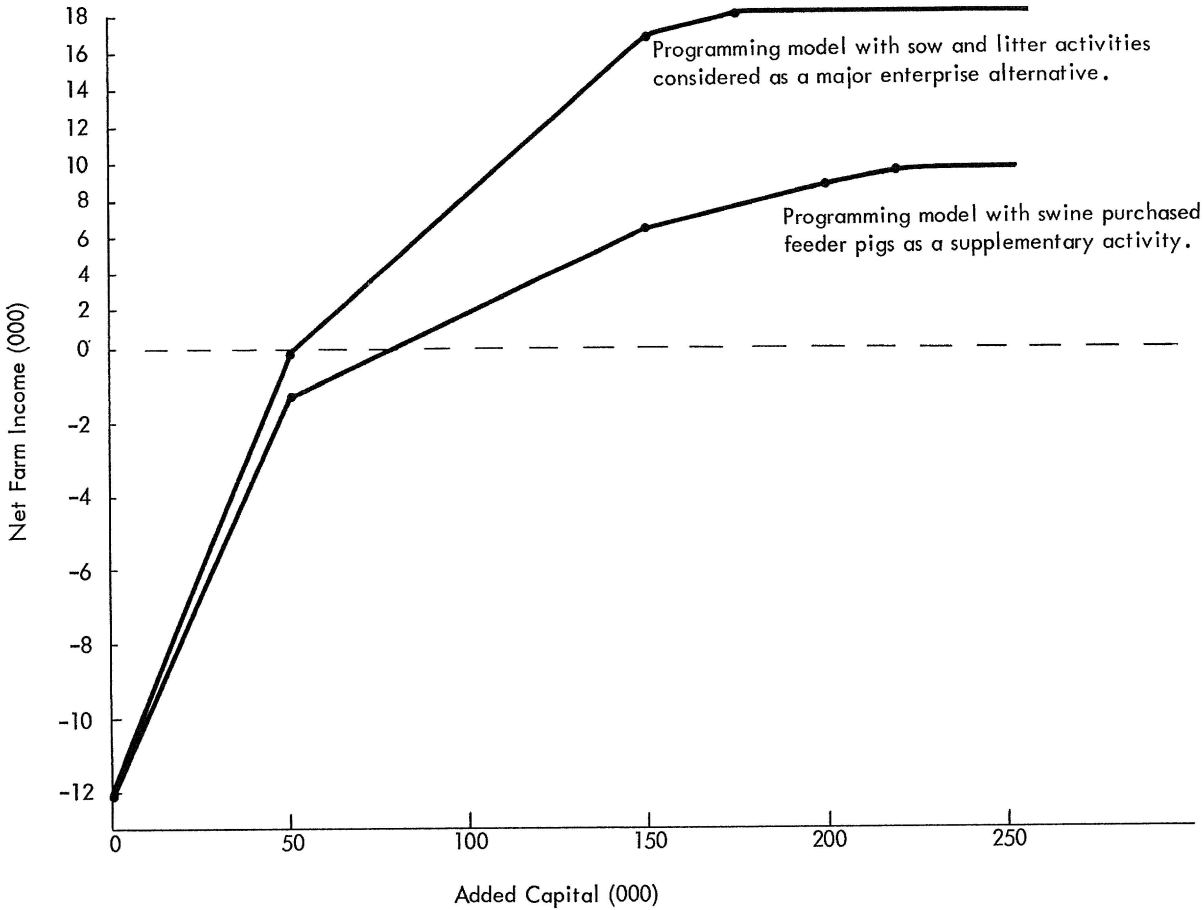


Figure 5 - Net Farm Income Increases With Added Capital - Intensive Land Use System

TABLE 12-OPTIMAL FARM PLAN THROUGH LINEAR PROGRAMMING THE INTENSIVE LAND USE SYSTEM

Enterprises	Supplementary Enterprises	
	Sow & Litter	Purchased Feeder Pigs
Crops	(Acres)	(Acres)
Grains:		
Corn	518	358
Barley & Sweet Clover	100	22
Silage:		
Corn	-	158
Hay:		
Alfalfa-Brome	56	103
Pastures:		
Alfalfa-Brome	44	77
Fescue-Ladino	63	90
Permanent Pasture	122	95
Woodland Pasture	40	40
Other:		
Woodland	87	87
Farmstead	10	10
Total	1,040	1,040
Livestock	(Head)	(Head)
Nondeferred Yearling Steers	142	334
Wintered & Fed Plain Steers	-	-
Wintering & Fattening Heifers	-	482
Sow & Two-Litters	192	-
Feeder Pigs	-	408
Resources Required		
Labor	$ 12,778	$ 12,577
Fixed Capital	261,878	254,975
Variable Capital	70,746	122,065
Total Capital	$332,624	$377,040
Hay & Fed (Tons) (Includes Silage)	195	1,095
Corn Fed (Bu.)	45,440	29,501
Income & Costs		
Crop Inc./Costs	$ 25,585	$ 27,200
Livestock Inc./Costs	35,106	26,275
Total Inc./Costs	60,691	53,475
Total Undist. Costs	42,568	43,664
Cash Inc.	38,176	29,443
Net Farm Inc.	18,123	9,811

mately $3,400 more profitable to the firm than the essentially same system under the Intermediate land use. Also, this is the first model where silage was produced. Apparently silage was needed to provide sufficient roughage so that enough cattle could be fed out to fully utilize the grain produced. This solution is also much like Intensive Plan A except, as was also shown by programming and budgeting of the intermediate land use system, plain steers are not a part of the plan. This programming answer for the intensive land use system is much closer to the Intensive Plan A than the programming answer for the intermediate land use system was to Intermediate Plan C.

For the intensive land use system model with the sow and litter enterprise, the net farm income is much higher than with the purchased feeder pigs. The income with the sows and litters is about double that resulting from the small purchased feeder pig enterprise combined with cattle. For this model, less cattle and more hogs were produced than budgeted for Intensive Plan C. Also, the total capital required was less with a higher income. Thus, given the data from the *Farm Business Plannning Guide,* hogs were more profitable than cattle.

SUMMARY

The objective of this study was to determine the most profitable combination of crop and livestock enterprises for a 1000-acre farm, assuming the manager was primarily interested in beef cattle production. Representative livestock systems were budgeted to determine expected net farm income from various alternatives. Linear programming was used to determine the most profitable farm plan using the same data.

General assumptions adhered to throughout the study were: (1) Livestock enterprises would rely upon farm grown feeds. In some plans purchase of corn was considered but roughage was always limited to farm production. (2) Because the farm plans were long range, no limitations were placed upon capital use as long as total amounts appeared reasonable for a farm of this size. (3) Labor was not restricted. In the long run, the manager can hire additional labor or use new techniques, alternative production methods or custom work when labor requirements appear unreasonably high. (4) The farm manager has sufficient ability to manage enterprises of the size required for this farm. While introduction of management as a variable would make a comparison of alternative plans difficult, this assumption undoubtedly obscures many important economies or diseconomies of size inherent in large-scale farming operations.

Three land use systems were considered. The first, an all-grass system, was called the *extensive* land use system. The second, called the *intermediate* land use system, included continuous corn on the bottom land and a six-year rotation on the tillable upland. The third, called the *intensive* land use system, included continuous corn on the bottom land and an intensive rotation on all tillable upland, which necessitated a complete water management system. Appropriate soil treatments were assumed to be applied in each land use system.

The following livestock enterprises were considered for the *extensive* system: beef cow-stocker calf, beef cow-calf fed, deferred yearling steers, feeder pigs following fed cattle. Of the budgeted extensive system alternatives, 700 head of deferred yearling steers followed by 350 head of feeder pigs resulted in the highest expected net farm income, $5,695 (cash income was $23,007). This plan required an estimated $388,974 of capital, of which $146,077 was variable capital. Linear programming determined the most profitable extensive system livestock enterprise to be 516 deferred yearling steers followed by 258 feeder pigs; the resulting expected net farm income was $3,102 (cash income was $20,339). The linear programming income was smaller than budgeted income because the programming model included a more restrictive expression of summer pasture requirements.

For the *intermediate* land use system, the livestock enterprises considered were: beef cow-calf fed, deferred yearling steers, wintered and fed plain steers, wintered and fattened heifers, feeder pigs following fed cattle. The most profitable budgeted plan for this land use system included 500 deferred yearling steers, 100 wintered and fed plain steers, 120 wintered and fattened heifers, and 360 feeder pigs. Ninety-eight acres of corn were grown for grain and 100 acres for silage. The cash income from this plan was $25,757 and net farm income $7,510. A total of $336,870 capital was required, of which $127,044 was variable capital. Linear programming selected 236 deferred yearling steers, 408 wintered and fattened heifers, and 322 feeder pigs as the most profitable intermediate livestock system. Cash income from this solution was $25,289 and net farm income $6,449. Variable capital requirements were $93,128 and total capital $311,042. Again, the programming solution was smaller than the budget solution because of the differences in pasture distribution.

The following livestock enterprises were considered for the *intensive* land use system: nondeferred yearling steers, wintered and fed plain steers, wintered and fattened heifers, sow and two litters, feeder pigs following fed cattle, feeder pigs not following fed cattle. Intensive Plan A was budgeted to be as intensive a cattle feeding operation as possible, given the assumption of no purchased roughage or grain. This plan included 350 head of nondeferred yearling steers, 300 head of wintered and fed plain steers, 255 head of wintered and fattened heifers, and 453 head of feeder pigs following fed cattle. This system required $378,498 of total capital, $130,393 of it variable capital. Estimated cash income was $30,235 and expected net farm income was $10,982.

Intensive Plan B included feeder pigs purchased as a major livestock enterprise. The plan included 400 head of nondeferred yearling steers, 200 head of wintered and fed plain steers, and 1,606 head of feeder pigs. Total capital investment was $372,639 and variable capital was $120,656. Estimated cash income was $29,620 and expected net farm income was $10,187.

Intensive Plan C included a sow and two-litter system as the major enterprise. This system was budgeted only for comparison with the other systems.

The plan included 300 head of nondeferred yearling steers, 100 head of wintered and fed plain steers, and 135 head of sows with two litters. This system required $348,506 of total capital and $99,075 of variable capital. Estimated cash income was $37,123 and expected net farm income was $17,853.

Intensive Plan C returns a higher net farm income at a lower capital investment than the other plans budgeted for the intensive land use system. However, extensive Plan C is a very large operation. In practice, significant economies or diseconomies of size may exist that are not reflected in the data. The plan is included here to illustrate what could be done if management were not limiting.

The linear programming model for the intensive land use system was set up two ways: one with beef cattle as the major enterprise and a second which also included a sow and two-litter enterprise and a feeder pig enterprise (not following fed cattle). The program solution without swine (except following fed cattle) included 334 head of nondeferred yearling steers, 482 head of wintered and fattened heifers, and 408 head of feeder pigs. Total capital needed was $377,040, of which $122,065 was variable capital. The resulting estimated cash income was $29,443 with an expected net farm income of $9,811. The programming solution with swine included 142 head of nondeferred yearling steers and 192 head of sows with two litters. This solution required $332,624 of total capital with $70,746 of variable capital included in this total. Cash income was estimated at $38,176 and expected net farm income was $18,123. When compared to the solution without hogs, the programming solution with hogs yielded twice the expected net farm income with only about 60 percent as much invested in variable capital. Again the management problems involved in large swine operations of this type should be noted.

Data used in this study were taken from the *Farm Business Planning Guide (5)* with changes made to fit the farm studied. Any use of the results presented herein should include a careful study of the input data to determine its applicability to the specific farm being studied.

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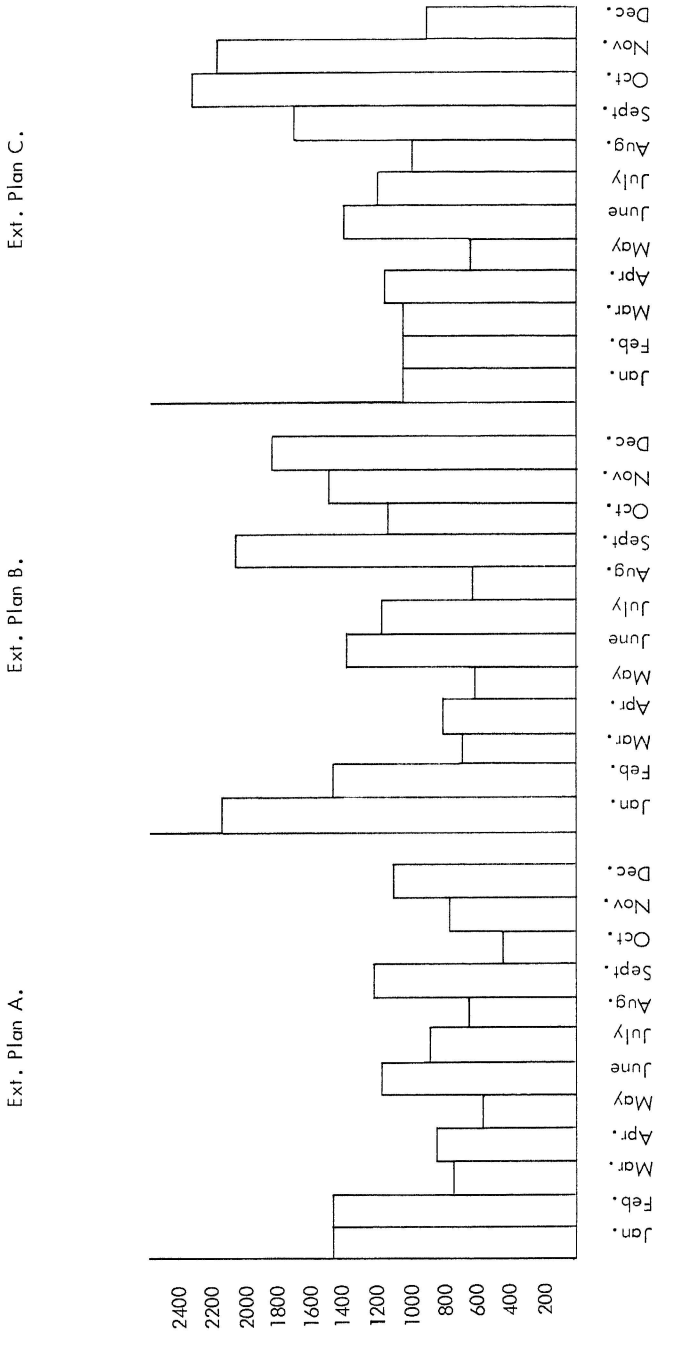
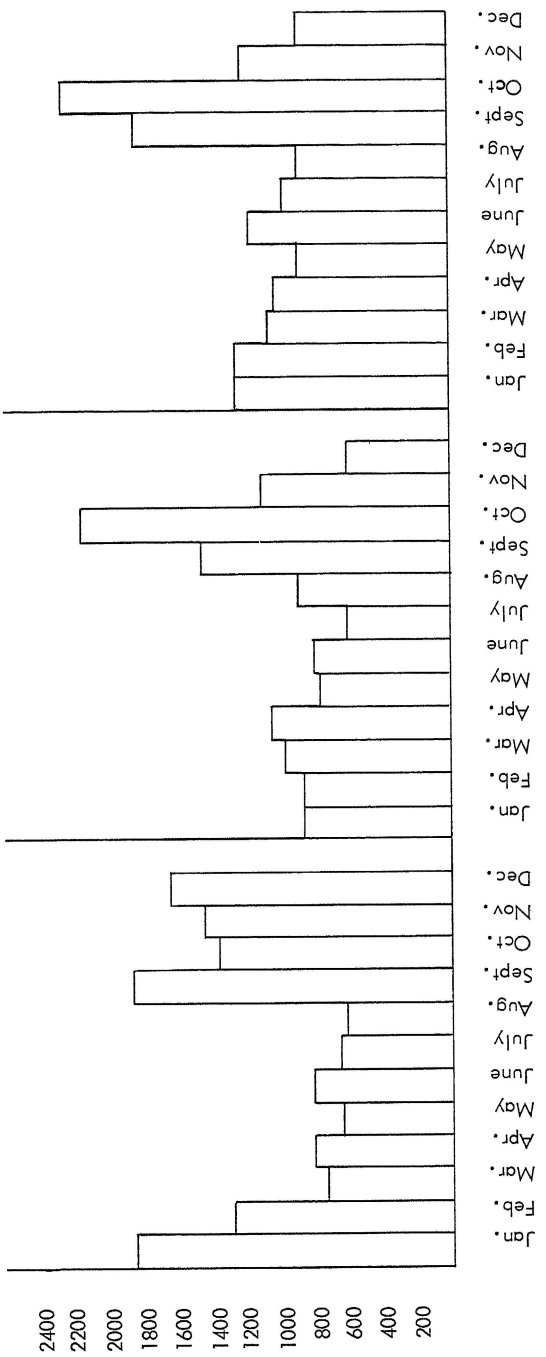
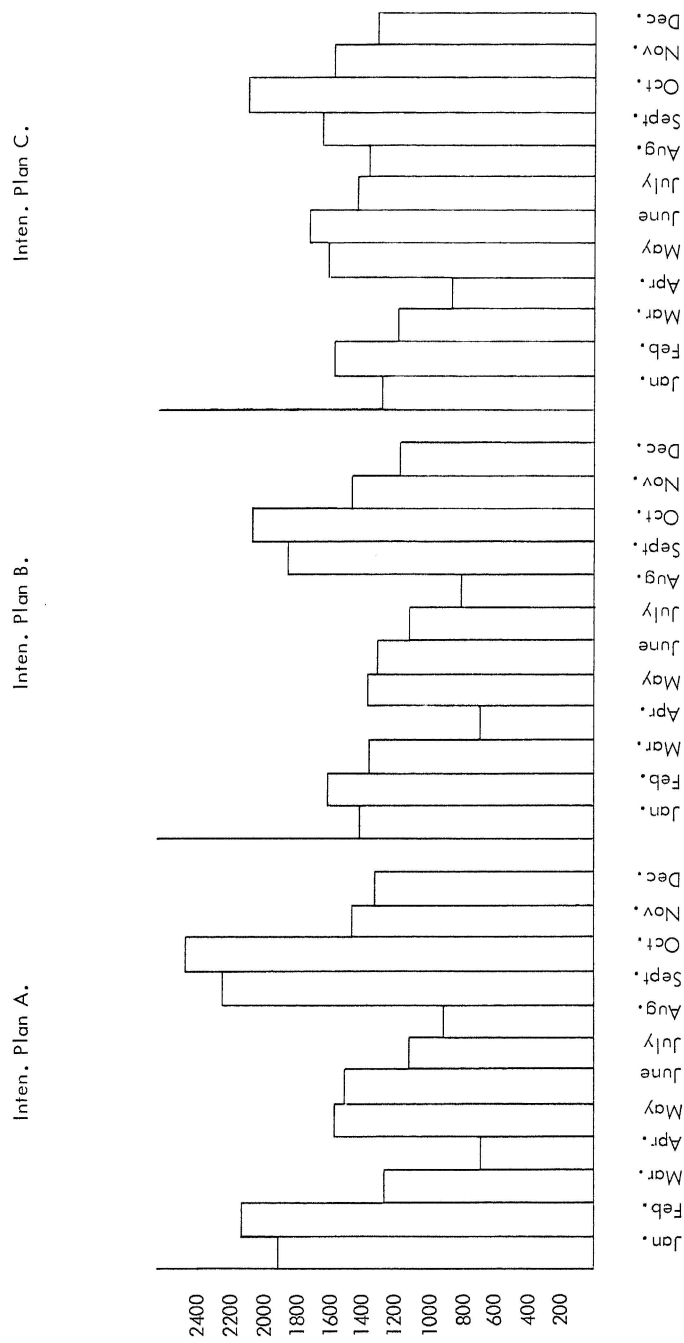
APPENDIX



Appendix Figure 1 Labor Distribution for the Extensive Land Use System



Appendix Figure 2 Labor Distribution for the Intermediate Land Use System



Appendix Figure 3 Labor Distribution for the Intensive Land Use System

TABLE I-EROSION CLASSES

Class 0 - Deposition; more than 10 inches of topsoil
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

Source: Soils of Blackwater and Lamine Townships, Cooper County, University of Missouri Agricultural Experiment Station, Bulletin 772, August 1961.

TABLE II-SLOPE CLASSES

Average Slope	Range	Average Slope	Range
1	1 to 2% slopes	12	10 to 15% slopes
3	2 to 5% slopes	20	15 to 25% slopes
7	5 to 10% slopes	30	25 to 35% slopes
		50	over 35% slopes

Source: Soils of Blackwater and Lamine Townships, Cooper County, University of Missouri Agricultural Experiment Station, Bulletin 772, August 1961.

TABLE III-SOIL TYPES

Number	Soil Name	Description
2	Westerville	A good, brown, bottom land soil which is slightly acid.
3	Nodaway	A deep well drained, productive, brown, first bottom soil.
7	Chequest	A good, very dark gray, small creek bottom soil with internal drainage programs which cause acid conditions, but of a moderately high fertility level.
8	Carlow	A dark colored bottom land soil of moderately high fertility.
23	Chariton	A dark gray, silty, poorly aerated acid soil with a dark gray, silty clay subsoil. Fertility is moderate and complete fertilization is required.
29	Sandy Terrace	A brown well aerated, sandy clay loam soil occupying the edges of high terraces. This soil should be managed the same as soils in association with it since areas of it are small.
32	Ladoga	A dark brown silt loam, well aerated, productive soil. It is responsive to soil treatments which are necessary for continuing high yields.
33	Pershing	A grayish brown soil developed from loess on gently sloping topography. A poorly aerated soil commonly situated on slopes below Ladoga ridge tops, making erosion a problem. It is of moderate fertility and complete fertilization is necessary.
35	Winfield	A good, brown, river hill soil similar to Memphis; a responsive soil with some restriction to internal drainage in the lower subsoil and complete fertilization necessary.
37	Steinmetz	A gray, silty, poorly drained, seepy, poorly aerated soil of low fertility located down the slope from better upland soils; needs tilling and soil treatments for best results.
40	Stony Land	A steep, shallow, stony land: red colored with a cherty clay subsoil.
41	Bewleyville and Baxter	A brown, well aerated soil with a yellowish brown or red silty clay subsoil underlain by red cherty clay. It is largely found on steep slopes at the base of a hill or on very narrow ridge tops.

TABLE IV-ESTIMATED INCOME OVER COSTS OF SEVERAL MISSOURI FARM CROPS FOR ESTIMATED YIELDS AND PRICES. LABOR, INTEREST, AND OTHER CHARGES ON THE LAND ARE NOT INCLUDED

Item	Corn	Barley	Corn Silage	Sorgo Silage	Sweet Clover Pasture With Barley	Alf-Brome Hay	Alf-Brome Pasture	Fescue-Ladino Pasture	O.G. Tim. & Lespd. Pasture	Woodland Pasture
Yield	80 Bu.	50 Bu.	14 T.	16 T.	3/4 T.	3.5 T.	2.5 T.	2.5 T.	1.5 T.	.2 T.
Price	$ 1.00	$ .85	$ 7.00	$ 5.00	$ 9.00	$18.00	$ 9.00	$ 9.00	$ 9.00	$ 6.00
Value	$80	$42.50	$98	$80	$ 6.75	$63	$22.50	$22.50	$13.50	$ 1.20
Cost Per Acre[1]	$30	$22	$36	$34	$ 4.00	$28	$10.00	$10.00	$ 6.50	-
Income Over Cost[2]	$50	$20.50	$62	$46	$ 2.75	$35	$12.50	$12.50	$ 7.00	$ 1.20

[1] Exclusive of labor costs, interest, and other charges on land.

[2] Extensive land use system: no extra fertilizer was needed in addition to that provided for in the budget cost figures, therefore. no additional expenses for cost of additional fertilizer was deducted from the total crop income over cost figure.

Intermediate land use system: extra fertilizer needed in addition to that provided for in the budget cost figures to maintain the row crop yield figures in the rotation, therefore an extra $10 per acre was estimated for cost of additional fertilizer to be deducted from the total crop income over cost figure.

Intensive land use system: extra fertilizer needed in addition to that provided for in the budget cost figures to maintain the row crop yield figures in the rotations, therefore an extra $12 per acre was estimated for cost of additional fertilizer to be deducted from the total crop income over cost figure.

Source: Farm Business Planning Guide, University of Missouri College of Agriculture and The United States Department of Agriculture cooperating, B.F. 6103, January, 1961.

TABLE V-ESTIMATED INCOME OVER COSTS OF SEVERAL MISSOURI LIVESTOCK ENTERPRISES FOR ESTIMATED PRODUCTION AND PRICES. LABOR AND CAPITAL CHARGES ARE NOT INCLUDED

Kind of Enterprise	Beef Cow (Stocker Calf Sold)		Beef Cow Calf Fed Out--Started Before Weaning		Wintered & Fattened Heifer		Wintered - Fed Plain Steer	
	(90% calf crop) (16% saved for replacement) 450 x $22 x 90% x 84% = Plus 16% of cows culled 1000 x $14 x 16% =	$74.84 22.40	(90% calf crop) (16% saved for replacement) 800 x $22 x 90% x 84% = Plus 16% of cows culled 1000 x $14 x 16% =	$133.06 22.40	800 @ $22 Less 2% death loss	$176.00 3.52	1000 @ $17	$170.00
1. Gross receipts per enterprise unit		$97.24		$155.46		$172.48		$170.00
Cost Items								
2. Purchase cost		None		None	400 x 21¢	$84.00	700 x 14¢	$98.00
3. Grain: Corn equiv. x $1 bu.	2 bushel	$ 2.00	32 bushel	$32.00	30 bushel	$30.00	15 bushel	$15.00
4. Hay equiv. $14-$18 ton Pasture $5-$9 ton	1.65 margin 1.5 T. at $16 3.85 margin 3.5 T. @ $6	24.00 21.00	2.2 margin 2 T. @ $16 3.85 margin 3.5 T. @ $6	32.00 21.00	1.32 margin 1.2 T. @ $16	19.20	1.65 margin 1.5 T. @ $16	24.00
5. Protein, salt and mineral		5.00		10.00		12.25		8.00
6. Breeding charge		5.00		5.00		None		None
7. Veterinary and drugs		3.00		3.00		2.00		.30

TABLE V (Continued)

Kind of Enterprise	Wintered, Grazed and Fed Yearling Nondefd. = 90 days		Sow and Two Litters To Market		Feeder Pigs Bought		Wintered, Grazed and Fed Yearling Defd. System	
8. Taxes and insurance 1.5% of livestock equipment investment	$225 x 1.5%	3.38	$270 x 1.5%	4.05	$107 x 1.5%	1.61	$97 x 1.5%	1.46
9. Depreciation & repairs on livestock equipment--9%	$5 x 9%	.45	$15 x 9%	1.35	$5 x 9%	.45	$5 x 9%	.45
10. Miscellaneous expense--1.5% of gross receipts	$97.24 x 1.5%	1.46	$155.46 x 1.5%	2.33	$172.48 x 1.5%	2.59	$170 x 1.5%	2.55
11. Total enterprise costs		$65.29		$110.73		$152.10		$149.76
12. Income over costs		$31.95		$ 44.73		$ 20.38		$ 20.24
(Return for capital & labor--even dollars)		$32.00		$ 45.00		$ 20.00		$ 20.00
	1150 at 23¢	$264.50	(14 pigs raised, 7 per litter)		225 x $15 per cwt.	$33.75	1100 x 22¢	$242.00
	Less 1.5% Death loss	3.96	13 market hogs x 225 x $15	$438.75			Less 1.5% Death loss	3.63
			1 gilt saved for replacement					
			1 cull sow x 400 x $13	52.00				
1. Gross receipts per enterprise unit		$260.54		$490.75		$ 33.75		$238.37
Cost Items					Trucking	.50		
2. Purchase cost	600 @ $22	$132.00		None	60 lb. pig	$ 13.00	600 @ 21¢	$126.00
					Death loss	.50		

TABLE V (Continued)

Kind of Enterprise	Wintered, Grazed and Fed Yearling Nondefd. = 90 days		Sow and Two Litters To Market		Feeder Pigs Bought		Wintered, Grazed and Fed Yearling Defd. System	
3. Grain: Corn equiv. x $1	40 bushel	$ 40.00	210 bushel	$210.00	10.8 bushel	$ 10.80	25 bushel	$ 25.00
4. Hay equiv. $14-$18 ton Pasture $5-$9 ton	1.375 margin 1.25 T. 1.1 margin 1 T.	20.00 9.00	.55-10% margin	4.50			1.1 margin 1.0 T. 2.09 margin 1.9 T.	16.00 17.10
5. Protein, salt and mineral		15.00	Creep feed	12.00 72.00	85 lbs.	3.40		13.50
6. Breeding charge		None		4.00				
7. Veterinary and drugs		1.00	Electric heat	16.00 3.00		.50		1.00
8. Taxes and insurance 1.5% of livestock equipment investment	$210 x 1.5%	3.15	$270 x 1.5%	4.05	$15 x 1.5%	.23	$185 x 1.5%	2.78
9. Depreciation & repairs on livestock equipment--9%	$5 x 9%	.45	$50 x 9%	4.50	$2 x 9%	.18	$5 x 9%	.45
10. Miscellaneous expense--1.5% of gross receipts	$260.54 x 1.5%	3.91	$490.75 x 1.5%	7.36	$33.75 x 1.5%	.50	$238.37 x 1.5%	3.58
11. Total enterprise costs		$224.51		$337.41		$ 29.61		$205.41
12. Income over costs		$ 36.03		$153.34		$ 4.14		$ 32.96
(Return for capital & labor--even dollars)		$ 36.00		$153.00		$ 4.00		$ 33.00

Source: Farm Business Planning Guide, University of Missouri College of Agriculture and The United States Department of Agriculture cooperating, B. F. 6103, January, 1961.

TABLE VI-STANDARDS FOR PRODUCTIVE-MAN WORK DAYS (P. M. W. U.)*

Crop	Small	Medium	Large	
Corn	1.2	1.0	0.8	
Wheat or Winter Barley	0.6	0.6	0.5	
Silage-Corn or Sorghum	1.8	1.6	1.2	
Hay-Per Acre Cutting	1.0	0.8	0.5	
Livestock				
Beef Cow (Stocker Calf)	4.0	3.0	2.0	(over 100)
Beef Cow (Calf Fed)	6.0	5.0	3.0	(over 75)
Steer Calf (Wtrd., Grazed, & Fed)	2.2	1.3	1.1	(over 150)
Wintering Yearlings	1.5	1.0	0.8	(over 100)
Summer Grazing	0.3	0.2	0.1	(over 100)
Cattle Full Fed (Per Mo.)	0.4	0.3	0.2	(over 100)
Each Litter to Market Weight	4.0	3.0	2.25	(over 30)
Each Litter (Farrowing to Weaning)	2.0	1.5	1.3	(over 60)
Feeder Pig to Market	0.4	0.22	0.15	(over 200)

*To obtain the Productive-man-work-days represented in a farm business multiply the number of acres, or livestock units on the farm by the standards (days) shown above. A man-work-day is the amount of work that a man should be able to do in a 10-hour day, with average work methods and average equipment.

Source: Farm Business Planning Guide, University of Missouri College of Agriculture and The United States Department of Agriculture cooperating, B. F. 6103, January 1961.

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CROPPING SYSTEM
(Form 1)

Total Farm Acres 1040

Present
Alternative V

Crop (a)	Acres (a) (1)	Yield (2)	Total Production (3)	Price (4)	Total Value (whole dollars) (5)	Corn Equivalent Factor (6)	Corn Equivalent Total (7)	Hay Equivalent(b) Factor (8)	Hay Equivalent(b) Total (9)	Labor: P.M.W.U. Factor (10)	Labor: P.M.W.U. Total (11)
1. COTTON				$	$					8.0	
GRAINS: 2. Soybeans										0.6	
3. Wheat						1.1				0.6	
4. Corn	457	80	36,560	1	36,560	1.0	36,560			~~0.9~~ 1.0	366
5. Oats						1/2				0.6	
6. Barley+Sw. Clover	100	50	5,000	.85	4,250	0.8	4,000			~~0.5~~ 0.8	50
SILAGES:(b) 7. Row Corn	61	14	854	7	5,978			1/3	285	~~1.8~~ 2 1.8	73
8. Small Grain								1/3		1.2	
9.								1/3			
HAYS: 10. Alfalfa – Brome	84	3.5	294	18	5,292			1.0	294	~~2.5~~ 1.5 1.5	126
11. Mixed Hay								1.0		1.0	
12.								1.0			
ROTATION 13. Past.: (b)								1.0		0.3	
14. Fesc.+Ladino	16	2.5	40	9	360			1.0	40	0.2	3
15. Barley+Sw. Clover	100	.75	75	9	675			1.0	75	0.2	20
16.								1.0			
17.								1.0			
18.								1.0			
TOTAL TILLABLE A. (c) 19.	718										
20. Perm. pastures:(b) Orchard Grass, Timothy, Lespedeza	150	1.5	225	9	2,025			1.0	225	0.15	22
21. Improved Permanent pasture Bluegrass+Lespedeza	35	1.5	52	9	468			1.0	52	~~0.15~~ 0.13	5
22. Woodlots Woodland Past.	40	1/5	8	6	48				8	0.1	4
23. Farmstead, etc. Woodland	87 10										
24. TOTALS	322				55,656		40,560		979		669

25. Crop Costs (Till. A 303 x $24.6 per A.) (c)		$ 22,221
26. Cost of Extra Fertilizer (12/A 618 A)		$ 6,216
27. TOTAL CROP COSTS (Add Lines 25 and 26)		28,437
28. CROP INCOME OVER COST (Line 27 from 24) (d)		27,219

(a) Col. 1: When land is double-or triple-cropped, list crops separately. Circle the acres of the second and third crops. But do not add the circled figures for the total on Line 19.

(b) Col. 8-9; Lines 7, 13, 20: Change pasture and silage to Hay Equivalent for pricing and value.

(c) Lines 19 and 25: Estimated crop costs vary from $20 to $30 per acre This does not include labor, charge for use of capital, or extra fertilizer.

(d) Line 28: Transfer to Form 3 "Summary", Line 17.

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LIVESTOCK SYSTEM
(Form 2)

Present
Alternative ✓

Livestock Enterprise Unit (a)	Requirements Per Unit: Corn Equivalent (1)	Hay Equivalent (2)	Labor P.M. W.U. (3)	Capital (4)	Per Unit Income over costs (5)	No. of Units (6)	Total Requirements: Corn Equivalent (7)	Hay Equivalent (8)	Labor P.M. W.U. (9)	Capital (10)	Total Income over Costs(b) (11)
1. Dairy Cow 10,000 lb.	63	9	10-14	$500							
(Grade A) 8,000 lb.	50	7.5	10-14	400							
2. Dairy Cow 7,000 lb.	40	7.0	14	270							
(Grade C)											
3. Beef Cow (stocker calf) 450 lb.	2	5.0	2-4	225							
calf fed 750 lb.	32	5.5	3-6	270							
4. Wintered, grazed, fed steer 1,050 lb.	45	2.0	1.3	160							
5 Wintered, grazed fed heifer 850 lb	30	1.8	1.1	130							
Wintered, fattened heifers 800 lb.	30	1.2	1.0	110							
6. Plain steer wintered 1,000 lb.	15	1.5	0.8	100							
Wtrd., Grazed, + Fed Non-Deferred Syst. 7. Other Cattle	40	2.475	1.1	205	36	300	12,000	742	330	61,500	10,800
Wtrd. + Fed Plain Strs.	15	1.65	1.2	92	20	100	1,500	165	120	9,200	2,000
8. Sow & Litter	110	.33	3.5	135							
7 market hogs											
7 feeder pigs	70	.5	1.5	85							
Sow + Two Litters	210	.55	4.5	220	153	135	28,350	74	608	29,700	20,655
Other Hogs											
10. Ewe (Lamb crop) 100% (90 lb. lambs)	2.5	.66	.5-.6	35							
11. Laying Hens (Per 100 hens)	100	0	10-20	280							
12. Other Livestock											
Corn credit from hogs following cattle						−	1,325			-1,325	+1,325
13. TOTAL FEED REQUIRED							40,525	981			
14. Raised Feed Available (From Form 1, Line 24, Col. 7, 9)							40,560	979			
15. Feed Excess (+) or Deficit(-)							+35	-2			
16. LIVESTOCK PRODUCTIVE MAN WORK UNITS (To Summary Form 3, Line 2)									1058		
17. CAPITAL REQUIRED FOR LIVESTOCK AND EQUIPMENT (To Summary Form 3, Line 13)										99,075	
18. LIVESTOCK INCOME OVER COSTS (To Summary Form 3, Line 18)											34,780

(a) Includes sire and replacement stock for all breeding units.

(b) All costs included except charge for labor and capital.

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SUMMARY
CAPITAL AND LABOR REQUIREMENTS
AND INCOME AND COSTS
(Form 3)

Present Alternative ✓

LABOR REQUIREMENTS		
1. P.M.W.U. on Crops. (From Form 1, Line 24)	669	
2. P.M.W.U. on Livestock. (From Form 2, Line 16)	1,058	
3. TOTAL P.M.W.U. ON FARM. (Add Lines 1 and 2)	1,727	
4. Months Labor Required. (Line 3 divided by 25)		69
5. Operator Labor Available, Months	12	
6. Family Labor Available, Months	2	
7. TOTAL LABOR AVAILABLE. (Add Lines 5 and 6)		14
8. MONTHS OF LABOR TO HIRE. (Line 4 less Line 7)		55

CAPITAL REQUIREMENTS		
9. Land (Present value)	$ 110,000	
10. Present Improvements (Present Value)	40,000	
11. Added Improvements Needed (Alternate Plan) $40 per Acre WATER MANAGEMENT SYSTEM, 510 ACRES, LAND IMPROVE. / Building Improve.	20,400 / 47,523	
12. TOTAL REAL ESTATE (Add Lines 9, 10, and 11)		$ 217,923
13. Livestock and Livestock Equipment (Form 2, Line 17)		99,075
14. Field Machinery and Equipment (From Farm Depreciation Record)		6,542
15. Added Machinery Needed (Alternate Plan)		24,966
16. TOTAL CAPITAL REQUIRED (Add Lines 12 through 15)		$348,506

INCOME AND COSTS		
17. Crop Income Over Costs (Form 1, Line 28)	$ 27,219	
18. Livestock Income Over Costs (Form 2, Line 18)	34,780	
19. TOTAL FARM INCOME OVER COST (Add Lines 17 and 18)		$ 61,999
20. Cost of Additional Labor (Line 8, - 55 x $ 250 per mo.)	$ 13,750	
21. Real Estate Taxes (1% of Line 12)	2,179	
22. Repairs, Depreciation, Insurance on Improvements (10% of Lines 10,11)	10,792	
23. Cash Rent (If tenant)		
24. Interest on Investment (5% of Line 16)	17,425	
25. TOTAL UNDISTRIBUTED COSTS (Add Lines 20 through 24)		$ 44,146
26. INCOME TO OPERATOR AND FAMILY (For Labor and Management) (Line 19 less 25)		17,853
27. *Equity in Total Capital ($ ____ at 5%)		
28. Depreciation on All Buildings, Machinery and Equipment (Account Book or Income Tax Return)		
29. NET CASH INCOME AVAILABLE FOR (Family Living Replacements Investments) (Add Lines 26, 27, 28) Carry to Form 4 "Distribution of Family New Cash Income"		$

*Line 16 minus total farm debt.

BF-5505

PASTURE BALANCE

Alternative (Year or Plan No.)

Line	Kind of Pasture	Acres	April Per A	April Total	May Per A	May Total	June Per A	June Total	July-Aug. Per A	July-Aug. Total	Sept Per A	Sept Total	Oct.-Nov. Per A	Oct.-Nov. Total
		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1	PERMANENT PASTURE: (1) Fescue & Ladino	16	1.5	24	2.0	32	1.8	32			1.5	24	1.0	16
2	Grass & Lespedeza	35			1.5	52	1.0	35	1.0	35	1.0	35		
3	Alfalfa & Brome		1.2		1.6		1.6						1.2	
4	Alfalfa & Brome	84			Hay	—			.8	—	1.2	—		
	Orchard Grass, Timothy, and Lespedza	150	—	—	1.5	225	1.0	150	1.0	150	1.0	150	—	—
	SMALL GRAINS													
6	Fall seeded & Pastured out		1.6		1.6								1.2	
7	Rye or Barley + Lesp.		1.2		1.2		.8		1.2		1.2			
8	Wheat + Lesp.		.8		1.6		1.2		1.2		1.2			
	LEGUMES: 1st year													
9	Sweet Clover 2nd year	100	1.6	—	3.2	—	3.2	—			1.5	150	1.5	150
10	Lesp. after small grain								1.2		1.2			
11	Meadow - 1st crop for Hay								.4		.4			
12	Sudan						.8		3.2		1.6			
13	TOTAL A.U. PASTURE AVAILABLE			24		311		217		185		359		166
14	ANIMAL UNITS (A.U.) PASTURE NEEDED = NUMBER OF EACH KIND OF LIVESTOCK X A. U. FACTOR GIVEN													
15	*KIND OF LIVESTOCK	A. U. Factor	No. A.U.		No. A.U.		No. A.U.		No. A.U.		No. A.U.		No. A.U.	
16	Mature Cattle and 2-year olds	1.0												
17	Yearling Cattle 300	.7		210		210		210		105		210		210
18	Calves	.3												
19	Ewes	.2												
20	TOTAL A.U. PASTURE NEEDED													
21	SURPLUS(+) OR SHORTAGE(-)		—	186	+	101	+	7	+	80	+	149	-	44

*Hogs not included. Allow one acre per sow and litter, if possible, in clean ground rotation; minimum one-half acre per sow in addition to sow pasture.

INSTRUCTION:

1. In Col. 1, substitute comparable crops in making computations.
2. In Col. 2, show number of acres of pasture available each month.
3. On each line multiply acres by factors and round results to nearest whole number.
4. Add "total" columns to get "Total A.U. Available" for each month on line 13.
5. Enter number of each kind of livestock to be grazed each month. Compute animal units needed.
6. Show surplus or shortage for each.

ADJUSTMENT OF PASTURE UNIT FACTORS TO DIFFERENT LEVELS OF FERTILITY

Above Units	.40	.80	1.20	1.60	3.20
Corn Yields	Change above to				
15 bu.	.15	.30	.45	.60	1.20
20 bu.	.20	.40	.60	.80	1.60
25 bu.	.25	.50	.75	1.00	2.00
30 bu.	.30	.60	.90	1.20	2.40
35 bu.	.35	.70	1.05	1.40	2.80
50 bu.	.50	1.00	1.50	2.00	4.00
60 bu.	.60	1.20	1.80	2.40	4.80