Costs, Returns and Capital Requirements For Soil-Conserving Farming on Rented Farms In Western Iowa

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CONTENTS

SUMMARY

1. Most farm management studies have approached the study of adjustments to soil conservation farming from the standpoint of the owner-operator. This study seeks to determine the conditions under which tenant and landlord net incomes can be increased by shifting from a soil-exploitive cash-grain farming system to soil-conserving farming systems involving different degrees of adjustment in terms of capital and cost outlays. Net incomes from the different farming systems are estimated under different leasing systems. Net incomes are compared not only in terms of the effect of different farming systems but also under different leasing systems. Tenant net incomes have been computed both with and without labor costs. Landlord net incomes are calculated with and without a commercial farm manager's fee to determine whether a landlord can profitably adjust to soil conservation farming even when a commercial farm manager is hired.

2. The estimates of this study are based on alternative complete budgets for each of 40 farms. These budgets estimate the physical production, capital requirements, costs, gross and net incomes for each farm in the sample under five different farming systems (one soil-exploitive and four soil-conserving, one of which is cash-crop and the other three include different livestock programs). The 40 farms were a subsample representative from a larger sample of 140 farms. The analysis shows: (a) The tenant's net income is increased by adjusting to soil conservation farming, irrespective of the leasing system. (b) The tenant's net income from a soil-conserving farming system including a dairy-hog program was larger under a crop-share-cash lease than under a livestock-share lease. (c) The landlord's net income was increased by adjusting to soil-conserving farming systems under a livestock-share lease (even after a commercial farm manager's fee had been paid) but not under a crop-share-cash lease. In other words, a landlord may realize less from a soil-conserving farming system if a crop-share lease is retained on the farm. The leasing system affected the average net income of the landlord.

3. Since the customs and traditions that grow up around leasing systems prevent farmers from making economic adjustment to soil conservation farming, these customs or practices were analyzed and modifications suggested to promote economic efficiency. The modifications include: (a) Increase length of lease and security of tenure where feasible and in line with both tenant and landlord interests. (b) Encourage the tenant to invest in fertilizer and other semi-durable resources by including compensation provisions for portions of resources unexhausted upon termination of tenure on the farm. (c) Encourage investment in long-lived resources like buildings, terraces and tile by means of the landlord collecting improvement rent, or increasing his share of the product, or by sharing with the tenant the added costs and added returns. (d) Encourage optimum intensity of production in the short run by landlord-tenant sharing of variable costs in the same proportions as receipts and in the long run by tenant and landlord furnishing some of both fixed and variable resources and then sharing receipts in proportions similar to resources furnished. (e) Discourage cost transfers within the business by relating rental charges for the services of specialized resources directly to their productivity.

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THE SOIL CONSERVATION PROBLEM IN WESTERN IOWA

Soil can be conserved at any degree or level between zero and approximately 100 percent. Also, in conserving soil at a given level (say at a level that permits an average soil loss of 7 tons per acre annually), various methods or combinations of methods are usually available. Intertilled, small grain and forage crops can be combined in varying proportions. The mechanical practices of contouring, strip cropping or terracing can be substituted for years of legumes and grasses in the crop rotation. Since there is a choice in level of soil conservation and in methods by which a given level can be achieved, these questions arise: What is the most profitable level of soil conservation over time? What is the least-cost or most profitable method of attaining this level?

One of the major farm management problems in western Iowa is that of adjusting farming systems to control erosion. The erosive nature of Ida-Monona soils arises out of their vertical structure and their steep and long slopes. Past farming practices have given rise to a large amount of gullying. Three to four large gullies per farm are not uncommon in the area. The soils are inherently productive, but the problem is the extent to which they can be maintained through the use of erosion control systems of farming. Our questions are these: Will shifting from soil-exploitive to soil-conserving farming systems increase farm income for tenants and for landlords? What are the costs, capital requirements and returns for tenants and landlords? Are conventional lease arrangements obstacles to either tenants or landlords in making the shift? Are some lease arrangements obstacles while others are not? How can leases be altered to facilitate shifts to soil-conserving farming systems?

To date, farm management studies on costs and capital requirements for and returns to soil-conserving farming systems have been directed primarily to the tenure position of the owner-operator. Such analyses overlook or by-pass the soil conservation adjustment problems of tenure arrangements used on approximately one-half of the farm land in western Iowa.

[1]Project 1085, Iowa Agricultural Experiment Station. This is a third study in a series on the economics of soil conservation in western Iowa. For others in the series see: Heady, Earl O. and Allen, C. W., Returns from and capital required for soil conservation farming systems. Iowa Agr. Exp. Sta. Res. Bul. 381; and Baumann, Ross V., Heady, Earl O., and Aandahl, A. R., Costs and returns for soil-conservation systems of farming on Ida-Monona soils in Iowa. Iowa Agr. Exp. Sta. Res. Bul. to be published. ARS, USDA, cooperating.

RELATIONSHIP OF LEASE ARRANGEMENTS TO SOIL CONSERVING FARMING SYSTEMS

In 1949, 50.8[2] percent of the total acreage in farms in Iowa was rented by farm operators. Table 1 shows the proportion of farms and farm land operated by various tenure groups in western Iowa counties where soils are predominantly of the Ida-Monona series. As of 1950, 44 percent of the farms but 48 percent of the farm land was operated by tenants. These figures show that leasing systems play an important role in helping farmers get control of resources and in channeling resources into various agricultural uses.

Farm land is rented under a number of different leasing systems. Data in table 2 show that about 55 percent of the rented land in western Iowa is operated under a crop-share-cash lease; 22 percent is operated under a livestock-share lease while 10 and 9 percent respectively are managed under cash and crop-share leasing.

As lease arrangements vary, so also do the kinds and quantities of resources furnished by the landlords and tenants. This situation, together with the relatively short-term tenure and limited capital position of many tenants, points out that choices of soil-conserving

[2] Iowa yearbook of agriculture. State of Iowa, Des Moines. 1950.

TABLE 1. PROPORTION OF FARMS AND FARM LAND OPERATED BY VARIOUS TENURE GROUPS IN WESTERN IOWA, 1950.*

Tenure	Percent	
	Farms	Farm land
Full owners	41.1	31.2
Part owners	14.5	20.0
Tenants	44.1	48.1
Managers	0.3	0.7

*Source: U. S. Census of Agriculture, 1950. Figures are based on data from Crawford, Harrison, Ida, Monona, Plymouth, Pottawattamie, Shelby and Woodbury counties.

TABLE 2. PROPORTION OF TENANT FARMS AND RENTED FARM LAND OPERATED UNDER VARIOUS LEASING SYSTEMS IN WESTERN IOWA, 1950.*

Leasing systems	Percent	
	Tenant farms	Rented farm land
Cash	12.8	10.2
Share-cash	53.4	54.8
Crop-share	10.5	9.4
Livestock-share	18.6	22.1
Other	4.7	3.5

*Source: U. S. Census of Agriculture, 1950. Same counties are included as in table 1.

farming systems economically feasible for landlords and tenants might well differ from choices which are economic for the owner-operator. In fact, if soil conservation recommendations are to be economically expedient, they must be related not only to varying levels of soil conservation, different methods of attaining a given level, and tenure and capital positions; they must also be related to labor supply, managerial skill and willingness to assume risk.

On many rented farms, the most profitable long-run farm organization and level of soil conservation are not attained because too much land is devoted to corn and soybeans. Table 3 shows that in 1949, about 60 percent of the total harvested crop acres on rented farms in western Iowa was devoted to intertilled crops.

In the area studied, this land-use pattern is estimated[3] to result in an average soil loss of at least 20 tons per acre annually. Such loss is far greater than that which agronomists consider permissible to maintain present crop yields over the long run and to prevent complete loss of soils through gullying. This relatively heavy emphasis on intertilled crops on rented farms is undoubtedly the result of a number of factors.[4] The limited capital position of beginning farmers, who often start as tenants, is likely to push such farmers into short-run planning and production with little or no emphasis on forage-consuming livestock and forage crops. Short-run or insecure tenure tends to reflect itself in a high proportion of intertilled crops since, within any 1 year, corn in the Corn Belt will nearly always bring a higher return than other crops. Another contributing factor is the belief of some landlords that each acre of forage must bring as high a return to them as each acre of grain. Adherence to this belief often results in hay and pasture rents so high that forage acreage is reduced below that which is most profitable in the long run. Accordingly, resources are prevented from moving into their most productive uses, thus defeating one of the primary functions of leasing systems.

THE SAMPLE AND METHOD OF ANALYSIS

This study is based on a sample of 40 farms for which alternative budgets have been computed. The farms are drawn from a homogeneous soil area to assure differences due to variables other than soil. To determine the soil and farm population, soil scientists outlined the township areas in each county[5] where soils were primarily of the Ida-Monona association. Areas with both the steep Hamburg and bottomland soils were excluded from the study area, unless these occurred in association with Ida-Monona soils. To increase further the homogeneity of the soil situation and to restrict the study basically to upland soils, enumerators in their initial survey eliminated from the original sample unit farms that had 15 or more acres of bottomland and level ridgetops. Any farms thus eliminated were replaced with substitute farms (drawn at random) which met the previously prescribed soil characteristics and which were selected for such use when the original sample of 140 farms was drawn. In view of the resources and time available for the study, only 160-acre farms (actually ranging from 150 to 170 acres) were included in the sample study.[6] Not only do most of the farms in the area fall within this size group, but in terms of the problems under analysis in this study, inferences can be more accurately made from one size-group to another within a homogeneous soils area than from farms of various sizes within one soils area to farms of varying sizes in different soils areas.[7]

Although this study and the more comprehensive one indicated elsewhere are similar with respect to sample selection and stratification of farms, the comparative analyses differ. As indicated earlier, in the larger study the comparison on costs, returns and capital requirements was between those of the present farming systems (based on 1947-48 average crop acreages and yields) and those of soil-conserving farming systems. In the current study, the comparison is between a soil-exploitive system of cash-grain farming on the one hand and soil-conserving systems of farming on the other hand. The first study relates to the farm as a whole; it is applicable to owner-operator farms. The study reported here refers to tenant returns and landlord returns on rented farms.

Crop and Livestock Systems

Because farm management is concerned with returns to the farm as a whole from the combined use of land, labor and other resources, the analysis following is based largely on budgetary procedure which allows comparisons of different uses of resources. The sample of 40 farms was used for these budgetary purposes. Prices and costs used in the budgetary analysis were the 1940-44 averages. Although these prices and costs are well below present levels, they may reflect fairly accurately long-run price relationships. To show the returns (costs, capital and labor requirements were also computed) that would be expected in the long run from a highly soil-exploitive system of farming, budgets were drawn up for each of the 40 farms on a

TABLE 3. HARVESTED CROP ACRES OF VARIOUS CROPS AS A PERCENT OF TOTAL HARVESTED CROP ACRES ON RENTED FARMS UNDER VARIOUS LEASE ARRANGEMENTS IN WESTERN IOWA, 1949.*

Crop	Percent			
	Leasing arrangement			
	Cash	Share-cash	Crop-share	Livestock-share
Intertilled-				
Corn and soybeans	59.4	63.4	64.9	61.7
Oats	27.8	26.3	24.7	24.2
Hay	12.8	10.3	10.4	14.1

*Source: U. S. Census of Agriculture, 1950. These data include the counties of Audubon, Cass, Crawford, Fremont, Harrison, Mills, Monona, Montgomery, Page, Pottawattamie, Shelby and Woodbury; census data did not permit a county breakdown that corresponds exactly to the counties included in the subsequent sample analysis, but there is no reason for believing that this distorts the actual cropping pattern in the area under study.

[3]See Baumann, Ross V., Heady, Earl O. and Aandahl, Andrew R. Costs and returns for soil-conservation systems of farming on Ida-Monona soils in Iowa. Iowa Agr. Exp. Sta. Res. Bul. to be published.

[4]For a fuller discussion see Heady, Earl O. and Jensen, Harald R. The economics of crop rotations and land use. Iowa Agr. Exp. Sta. Res. Bul. 383.

[5]The counties included were Crawford, Harrison, Ida, Monona Plymouth, Pottawattamie, Shelby and Woodbury.

[6]The overall project encompases plans for study of economic adjustments to soil conserving farming systems on model sized farms in each of the major soils areas of the state.

[7]For a more detailed account of sampling method and procedure see Baumann, Ross V., Heady, Earl O. and Aandahl, Andrew R. Costs and returns for soil-conservation systems of farming on Ida-Monona soils in Iowa. Iowa Agr. Exp. Sta. Res. Bul. to be published.

cash-grain farming basis with a crop rotation of C-C-Os and no mechanical erosion control methods or supplemental cropping practices. Alternative budgets were then made up for cropping and livestock systems which control erosion.

In estimating returns for the soil-conserving farming systems, the problem of the level of conservation had to be considered. Agronomists tentatively estimate that soil losses in the area should be restricted to from 5 to 7 tons per acre annually, if crop yields are to be maintained over a period of years and if the soil is not to be permanently impaired for farming purposes. Therefore, budgets are based on a level of soil conservation which will restrict soil loss to 7 tons per acre annually.

A given level of soil conservation can be attained by use of alternative erosion control methods. Different combinations of cropping systems and mechanical erosion control systems can be used. Accordingly, alternative farming systems, all of which are predicted to restrict soil loss to 7 tons per acre per year, have been used in the analysis. First, commercial fertilizers and, then, mechanical practices (contouring and terracing) with various combinations of corn, oats and hay crops were examined to find combinations which would permit as much grain as possible and still restrict annual soil loss to 7 tons per acre. This then gives two basic cropping systems for comparison: (1) An exploitive system based entirely on grain and employing a corn-corn-oats (with clover for green manure) rotation; mechanical erosion control practices are not included with the cropping system. (2) Contouring and terracing along with rotations including an amount of meadow adapted to the slope of the soil; a maximum of grain is included in each rotation but some forage is used to restrict soil loss to 7 tons when contouring and terracing are used.

To make the findings applicable to as many different resource situations as possible, several different methods of disposing of crops were considered. They are as follows (each requiring varying amounts of resources and giving different returns to resources): (1) crops sold directly on the market for cash; and (2) crops processed on the farm through three different livestock systems including (a) feeder cattle and hogs, (b) beef cows and hogs and (c) dairy cows and hogs. For the latter systems, the number of forage-consuming livestock has been based on the forage supply; enough animals are employed to consume the forage produced. Then, the costs, incomes and capital requirements have been computed for tenants and landlords under these several crop and livestock systems. The number of hogs has been determined as that necessary to use the grain remaining after the grain requirement of forage-consuming livestock has been met.

Lease Systems

Costs, returns, and labor and capital requirements for both tenant and landlord also were computed for each of the 40 farms. The computations were made on the basis of crop-share-cash and livestock-share leasing arrangements under the several soil-exploitive and soil-conserving farming systems indicated above. These leasing systems were selected because of the extent of use. Approximately 77 percent of the rented farm land in the area under study was operated under these two leasing systems. Also, the resources furnished by the tenant and landlord differ under these leasing systems. In turn, the extent of soil conservation adjustment required and the level of returns differ between tenants and landlords for the two leasing systems.

THE BUDGETARY AND COMPARATIVE ANALYSIS

Crop Acreages and Crop Production

On some farms, a more profitable (or the most profitable) level of soil conservation over time can be attained by merely supplementing the present cropping plan with mechanical practices such as contouring, strip cropping or terracing. However, where cash-crop farming is followed and soil erosion is severe, not only is the addition of mechanical practices required but also a shift from grain acres to forage crops is necessary. Table 4 shows the average acreage shift required if farms in the study were to shift from a C-C-Os rotation, or its approximation, to rotations and cropping practices which reduce soil loss to 7 tons per acre per year. C-C-Os is about the rotation followed on typical rented farms in western Iowa. To reduce soil loss to 7 tons per acre annually involved the use of the following rotations: C-Os-C-O-M-M, C-C-O-M-M, C-O-M-M, C-O-M-M-M and C-O-M-M-M-M. In addition, these rotations were supplemented with contouring, terracing and the use of commercial fertilizer. Type of soil, steepness and length of slope determined the particular cropping system and practices estimated to be necessary on any one farm to reduce soil loss to 7 tons per acre per year. The quantities of fertilizer assumed in this study do not represent the economic optimum level of fertilization. The fertilizer rates used are extremely conservative and include the quantities of nutrients "necessary" for establishing and maintaining rotations or for obtaining moderate increases in grain yields. Experiments in the area show that even higher fertilization rates are profitable under current price ratios.

Grain acreage must be decreased by approximately 40 percent and corn acreage by about 30 percent to permit the required increase in hay acreage under the soil-conserving farming system. These acreage shifts represent one of the major problems in adjusting farming systems to a higher level of soil conservation.[8] In the initial years of the transition period, in shifting

[8]For discussion of this problem see also Heady, Earl O. and Allen, C. W. Returns from and capital required for soil conservation farming systems. Iowa Agr. Exp. Sta. Res. Bul. 381.

TABLE 4. CROP ACRES PER FARM UNDER VARIOUS CROPPING PATTERNS AND SYSTEMS OF FARMING.

Cropping pattern and systems of farming	Crop acreage per farm		
	Corn	Oats	Hay
Cash-grain, soil-exploitive system	99.7	49.8	. . .
Soil-conserving with:			
Crops sold for cash	56.8	34.5	58.1
Crops fed through steers and hogs	56.8	34.5	58.1
Crops fed through beef cows and hogs	56.8	34.5	58.1
Crops fed through dairy cows and hogs	56.8	34.5	58.1

from grain to hay, total grain (particularly corn) production is less and net income to the farm as a whole is lower than previously. After the first year, if grass and legume stands are successfully established, the increased forage output necessitates capital outlays for the purchasing of forage-consuming livestock. After a complete cycle of the crop rotation, the yield-increasing effects[9] of legumes on grain production may offset the decrease in grain acreage; more grain may be produced from a smaller grain acreage. Compared to the exploitive farming system, forage output also is greater. However, the grain-to-forage acreage shift may be so extensive that it results in less total grain (when compared to that of the cropping system prior to adjustment) even after sufficient time has elapsed to permit the yield-increasing effect of forages to be fully reflected in grain yields. In such instances, the forage gained must have a net value at least equal to that of the grain sacrificed to prevent a loss in farm profits.

For the sample area farms with the grain-to-forage acreage shift indicated in table 4, total average grain production (in terms of corn equivalent) from soil-conserving crop rotations in combination with the use of contouring, terracing, commercial fertilizer and barn-yard manure from a livestock program was estimated to practically equal that from an all-grain rotation of C-C-Os with no supplemental practices. In addition, 113 tons of forage would be available for direct sale or for livestock feed. These crop production comparisons, as well as those for per-acre crop yields, are shown in table 5.

The increase in per-acre grain yields, which practically offsets the decrease in grain acres, may be noted. It must be remembered that the comparisons set forth in table 5 reflect the differences in the effects of the various cropping systems and practices over the long run. Also, it may be pointed out that the crop production as estimated from the soil-conserving farming systems is contingent upon cost and capital outlays for fertilizer and terrace construction and maintenance. The net effect on farm returns of these differences in crop production, capital investment and costs will be shown later.

Livestock Numbers

When adjustment to soil conservation farming involves grain-to-forage acre shifts and changes in feed supply as outlined in tables 4 and 5, another major problem arises in initiating or adjusting a livestock program to the make-up of the new feed supply. Large capital outlays not only for livestock but also for building space, equipment and fencing to handle the livestock are often required. The problem is usually more acute on rented than on owned farms because some landlords have no long-run interests in the farm, others have little or no understanding of farming, and some are limited on capital or operate under a lease that gives no direct return on capital invested in livestock facilities. Also, difficulties may be encountered because the tenant has limited capital and managerial experience with different kinds of livestock. Table 6 shows the livestock numbers required to process the feed from the soil-conserving farming systems in table 5. Livestock numbers are further related to leasing systems.

As evidenced by the figures in table 5, sizeable capital outlays would be required for forage-consuming livestock alone under any of the farming systems. It is true, of course, that for beef and dairy cows the size of herds indicated would not have to be established at once; they could be built up over time thus reducing considerably the initial capital outlay for livestock and facilities. However, if this approach is followed, the transition period leading to a higher volume of output and returns is also extended. As shown in table 6, hog numbers vary considerably between livestock leasing systems. The relatively large number of hogs in combination with beef cows under crop-share leasing reflects the small grain requirements of beef cows; since the calves are not fed out, a large amount of grain remains available for hogs. The larger hog numbers under livestock-share than under crop-share leasing reflects a more than doubling of the grain input for hog production. Under crop-share leasing, one-half of the total grain is assumed to be sold off the farm as the landlord's share of the grain; whereas under livestock-share leasing, all the grain is available for livestock production on the farm. Since cattle numbers are geared to the forage supply, which is the same under both lease arrangements, the grain requirements for cattle remain similar under both kinds of leases. The effect then is a more than doubling of the grain supply available for hogs. This brief outline of livestock as related to conservation farming adjustments may help in understanding the fuller economic implications set forth at later points.

[9]See Heady, Earl O. and Jensen, Harald R. Economics of crop rotations and land use. Iowa Agr. Exp. Sta. Res. Bul. 383.

TABLE 5. AVERAGE PER-ACRE YIELDS AND AVERAGE TOTAL CROP PRODUCTION PER FARM UNDER VARIOUS SYSTEMS OF FARMING, SOIL-EXPLOITIVE AND SOIL CONSERVING, WESTERN IOWA

Systems of farming	Crop production per farm					
	Per-acre yields			Total crop production		
	Corn	Oats	Hay	Corn	Oats	Hay
	(bu.)	(bu.)	(ton)	(bu.)	(bu.)	(ton)
Cash-grain with crop rotation of C-C-Os	34.5	23.7	...	3,436	1,180	...
Soil-conserving with:						
Crops sold for cash	56.3	37.2	1.8	3,196	1,284	105
Crops fed through steers and hogs	57.5	38.6	1.9	3,267	1,332	113
Crops fed through beef cows and hogs	57.5	38.6	1.9	3,267	1,332	113
Crops fed through dairy cows and hogs	57.5	38.6	1.9	3,267	1,332	113

TABLE 6. AVERAGE NUMBER OF CATTLE AND HOGS PER FARM UNDER DIFFERENT LEASE ARRANGEMENTS AND SOIL-CONSERVING SYSTEMS OF FARMING, WESTERN IOWA

Systems of farming	Average livestock numbers			
	Crop-share lease*		Livestock-share lease	
	Cattle	Hogs†	Cattle	Hogs†
Soil-conserving with feed processed through:				
Steers and hogs	31‡	43	31	150
Beef cows and hogs	28	102	28	211
Dairy cows and hogs	21	59	21	167

*In this table and throughout the remaining discussion, a crop-share lease will denote crop-share-cash lease where grain rent is paid in shares and hay and pasture rent in cash.
†Butcher hogs.
‡Yearling steers.

Labor Requirements

When one of the soil conservation adjustments is an initiation or expansion of livestock production, an increase in labor demands for farm production must necessarily follow. On some farms the family labor supply may not be sufficiently adequate to care for the size of livestock program which the feed supply can support and carry. The problem then is to determine whether the income from the livestock program expanded to the limits of the feed supply will more than offset the added cost of hired labor and perhaps additional livestock facilities. Returns may be higher by limiting the livestock program, selling some of the feed directly and restricting the labor input to that available from operator and family labor. On the other hand, the home labor supply on some farms may be sufficiently large to permit an expansion of the livestock program up to or even beyond the limits of the home feed supply. The fuller and more efficient use of labor thus obtained may mean larger farm profits. Table 7 summarizes the average total labor requirements for a soil-erosion, cash-grain system of farming based on a C-C-Os rotation and also the requirements for various soil-conserving systems.

To adjust to soil conservation farming with livestock programs, total labor requirements are almost doubled in some instances and more than doubled in others. For instance, shifting from a soil-exploitive to a soil-conserving farming system with dairy cows and hogs increases total labor requirements by about four times. Depending upon how labor requirements are distributed throughout the year, adjustment to most of the soil-conserving farming systems suggests a fuller and more efficient use of the operator and family labor already available on most farms. Little or no hired help would be needed except perhaps during peak seasons. The data suggest, however, that, in adjusting to soil-conserving farming with dairy and hogs, hired help is likely to be needed during some months of the year.

Capital Investment

Major emphasis to this point has been on some of the physical adjustments for soil conservation farming. Changes in land use, in make-up of the feed supply, in livestock programs and in labor requirements have been set forth. Most of these changes require more capital. Soil conservation farming entails the use of a larger quantity of funds for grass and legume seed, fertilizer, terrace construction, livestock, building space, fencing, and perhaps in hired labor costs. Table 8 shows the average amount of capital required for the tenant, the landlord and the farm as a whole under the highly exploitive, cash-grain system of farming and the several soil-conserving farming systems.

TABLE 7. HOURS OF LABOR REQUIRED PER FARM UNDER DIFFERENT LEASE ARRANGEMENTS AND VARIOUS SYSTEMS OF FARMING, SOIL-EXPLOITIVE AND SOIL-CONSERVING, WESTERN IOWA.

Systems of farming	Hours of labor					
	Crop-share lease			Livestock-share lease		
	Crops	Livestock	Total	Crops	Livestock	Total
Cash-grain with crop rotation of C-C-Os	947	....	947	....	....	....
Soil-conserving with:						
Crops sold for cash	1,093	....	1,093	....	....	....
Crops fed through steers and hogs	1,093	531	1,624	1,093	1,003	2,096
Crops fed through beef cows and hogs	1,093	676	1,769	1,093	1,155	2,248
Crops fed through dairy cows and hogs	1,093	2,678	3,771	1,093	3,156	4,249

CAPITAL REQUIREMENTS UNDER CROP-SHARE LEASES

The extent of soil conservation adjustment underlying these capital requirements is considerably greater than necessary for some farms. Some farms fall between our extremes in respect to current level of erosion control. For farms organized around a less exploitive cropping system than a C-C-Os rotation, or which have previously adopted some contouring and terracing and have livestock, a change to a more complete soil-conserving farming system would require smaller capital changes than those suggested in table 8.

On the basis of the comparisons made in this study, however, the average amount of capital required for soil-conserving adjustment varies from practically nothing to over $3,900 for a tenant with a crop-share lease. For the landlord, the minimum requirement is considerably higher but the maximum is very much lower. He would need to add around $1,000 in investment for a shift from the soil-exploitive farming system to the cash-crop soil-conserving system. He would need to add around $1,800 under the beef cow or dairy systems.

The shift from the cash-grain, erosive to the cash-crop soil-conserving system of farming can be accomplished with very little capital on the part of the tenant for these reasons. Since the landlord pays for all the legume seed, a shift from grain to forage crops reduces the tenant's seed costs for grain (shared 50-50 with the landlord); seed costs for the tenant are reduced to the extent that they practically offset his added outlay for fertilizer. Since the tenant customarily does not share in building expenditures, capital presents no obstacle to him in making the shift between the two cash-cropping systems. For the landlord, however, investment in additional building space may be required for hay storage as well as for fertilizer. The largest expenditures are, however, for grass and legume seed and for terrace construction—investments which pay for themselves only over a period of years. The investment, of course, need not be made in a single year. Terraces can be constructed and the shift from grain to forage crops can be made gradually over time. This procedure results in a longer transition period and more time must lapse before the full effects of the changes are reflected in income.

The change from a soil-exploitive system of farming to a soil-conserving system with livestock requires larger capital outlays for both the landlord and the tenant. The increase is particularly large for the tenant; beyond the relatively small outlay for fertilizer, his increase in capital expenditure is for breeding stock, including brood sows, dairy, beef cows or feeder cattle, depending on the livestock system. The tenant's total increase in capital expenditure ranges from about $2,400 with feeder steers to approximately $3,900 for

TABLE. 8 AVERAGE CAPITAL REQUIRED FOR SOIL-EROSIVE AND SOIL-CONSERVING FARMING SYSTEMS BY THE TENANT AND LANDLORD, INDIVIDUALLY AND IN COMBINATION, UNDER A CROP-SHARE-CASH LEASE AS ESTIMATED FOR A SAMPLE OF FARMS IN WESTERN IOWA AT 1940-44 PRICES.

Systems of farming		Power and machinery*	Buildings	Fertilizer‡	Terraces§	Additional fencing**	Purchased corn††	Livestock‡‡	Land§§	Seed***	Total
		($)	($)	($)	($)	($)	($)	($)	($)	($)	($)
Cash-grain, soil-exploitive system	Ten.	4,473	....†	....	....	....	....	....	....	99	4,572
	Lld.	....	6,833	....	....	....	....	....	9,682	153	16,668
	Farm	4,473	6,833	....	....	....	....	....	9,682	252	21,240
Soil-conserving with: Crops sold for cash	Ten.	4,473	....	47	....	....	....	....	....	61	4,581
	Lld.	....	6,968	47	741	....	....	....	9,682	301	17,739
	Farm	4,473	6,968	94	741	....	....	....	9,682	362	22,320
Crops fed through steers and hogs	Ten.	4,473	....	42	....	....	19	2,407	....	61	7,002
	Lld.	....	7,125	42	741	43	....	....	9,682	303	17,936
	Farm	4,473	7,125	84	741	43	19	2,407	9,682	364	24,938
Crops fed through beef cows and hogs	Ten.	4,473	..	42	....	....	....	3,912	....	61	8,488
	Lld.	....	7,666	42	741	43	....	....	9,682	303	18,477
	Farm	4,473	7,666	84	741	43	....	3,912	9,682	364	26,965
Crops fed through dairy cows and hogs	Ten.	4,473	....	42	....	....	1	3,735	....	61	8,312
	Lld.	....	7,582	42	741	43	....	....	9,682	303	18,393
	Farm	4,473	7,582	84	741	43	1	3,735	9,682	364	26,705

*Includes a full line of tractor and tractor drawn machinery except hay-harvesting equipment which is assumed to be hired.
†This includes an average building investment of $5,863 estimated to be actually available on farms studied through farmer interviews plus $970 additional as estimated needed on an average to store the grain from this farming system. Thus, on the basis of building investment estimated actually to exist on the farms studied, the succeeding farming systems in order would require additional building space to the extent of $1,105, $1,262, $1,803 and $1,719.
‡Reflects amounts as recommended by agronomists.
§Figures in this column represent the custom-cost of building an average of 46,319 feet of terraces per farm.
**Includes additional fencing materials needed for land shifted into permanent pasture and for rotation pasture.
††This reflects the farms where an insufficient quantity of home-grown grain was available for the forage-consuming livestock, the number of which was determined by the farm-raised forage.
‡‡Includes breeding livestock—milk cows, beef cows, brood sows and feeder cattle—where indicated.
§§Value of bare land as estimated from secondary sources.
***Reflects one-half of the grain seed for the tenant, and, for the landlord, the remaining one-half of the grain seed plus all of the legume and grass seed.

beef cows. The beef cow-hog combination requires the most capital since the cow herd consumes very little of the grain. A relatively large amount of grain is left for pork production. If hogs are to consume the available grain, more brood sows are needed with beef cows than with other livestock systems.

For a tenant short on capital, the size of these outlays poses a problem. If he is to maximize profits, he invests his limited resources where he thinks they will bring the highest returns. Perhaps he thinks the funds will bring more if invested in machinery, fertilizer or cash crops rather than in livestock for a soil-conserving farming system. He is interested in investing to get a rapid turnover on capital, particularly if his tenure is insecure. Cash-grain farming gives a quick turnover but does not result in soil conservation. A steer feeding-hog program gives a quick turn-over, but the capital position of many tenants makes this a risky enterprise. There is always the chance that prices may take an adverse turn before the steers have been fed out. For beef or dairy cows, more capital is needed and the time required to regain the investment is longer. More than a year elapses between the time beef cows are bred and calves are sold; if the calves are fed out, 2 years may elapse before any return is obtained. Returns from dairy are also relatively slow but some money comes in each month—an important consideration where capital is short. The entire beef or dairy cow herd need not, of course, be purchased at one time. A few cows can be purchased at first with the rest of the herd built up with heifers raised on the farm.

However, even though these time adjustments are possible and give the tenant a profitable use of his capital, they tend to be discouraged where the tenant has only a short stay or is highly uncertain of his tenure. If the shift from grain to forage crops has taken place at one time, some of the forage can not be utilized by livestock; it must either be sold directly or plowed under as green manure. Over time this latter practice will be reflected in higher grain production. The tenant shares in this increased grain production if he remains on the farm long enough.

In addition to this problem of waiting for his return, another problem looms up for a tenant under a crop-share-cash lease: He customarily pays a cash rent for each acre in forage. In the short-run he pays rent and gets little or no return for the forage plowed under; forage increases grain production from a given acreage only over a period of years. While a complementary acreage of forage can increase grain production in the long-run, a share of which goes to the tenant, he will gain nothing from shifting to more hay if he does not remain on the farm.

For the landlord changing from a soil-exploitive to a soil-conserving system with livestock, the increase in capital outlay is mainly for additional buildings, terrace construction, and legume and grass seed. The increase in building investment alone ranges from an average of $135 for the steer-hog program to $833 for the beef cow-hog system.[10] Under customary crop-share leases, the landlord gets no direct return for building investment. Under these circumstances, it is often difficult to get landlords to provide additional building space for the tenant's livestock program.

CAPITAL REQUIREMENTS UNDER LIVESTOCK-SHARE LEASES

Table 9 sets forth the average capital requirements for tenants and landlords under soil-conserving farming systems. These figures include the livestock outlined in table 8 but the capital outlays assume a livestock-share lease. Compared to table 8, the combined capital requirements for the tenant and landlord have now increased. More resources are being used in the farm business. This increase occurs since the landlord, instead of selling his share of the grain for cash, now diverts it into livestock production. Hog numbers are increased and buildings therefore are added. The

[10]It has already been pointed out that the relatively large increase in additional building space for this program evolves from the grain available to support a larger hog program. The beef cow herd consumes less grain than the steers or dairy cows.

TABLE 9. AVERAGE CAPITAL REQUIRED FOR SOIL-CONSERVING FARMING SYSTEMS BY THE TENANT AND LANDLORD, INDIVIDUALLY AND IN COMBINATION, UNDER A LIVESTOCK-SHARE LEASE AS ESTIMATED FOR A SAMPLE OF FARMS IN WESTERN IOWA AT 1940-44 PRICES*

Systems of farming		Power and machinery	Buildings	Fertilizer	Terraces	Additional fencing	Purchased corn‡	Livestock§	Land	Seed**	Total
Soil-conserving with feed processed through:		($)	($)	($)	($)	($)	($)	($)	($)	($)	($)
Steers and hogs	Ten.	4,473	....	42	....	....	10	1,464	....	181	6,170
	Lld.	....	7,729†	42	741	43	10	1,463	9,682	181	19,891
	Farm	4,473	7,729	84	741	43	20	2,927	9,682	362	26,061
Beef cows and hogs	Ten.	4,473	....	42	....	....	....	2,220	....	181	6,916
	Lld.	....	8,426	42	741	43	....	2,219	9,682	181	21,334
	Farm	4,473	8,426	84	741	43	....	4,439	9,682	362	28,250
Dairy cows and hogs	Ten.	4,473	....	42	....	....	1	2,131	....	181	6,828
	Lld.	....	8,138	42	741	43	1	2,130	9,682	181	20,958
	Farm	4,473	8,138	84	741	43	2	4,261	9,682	362	27,786

*Footnotes are the same as for table 8 except as indicated below.
†This figure includes the average building investment for livestock and crops of $5,863 estimated for the sample farms from farmer interviews plus $1,866 new investment; succeeding building figures, in order, reflect the same base plus $2,563 and $2,275 new respectively.
‡Value of purchased corn as described in footnote ††, table 8 shared 50:50 between landlord and tenant.
§Livestock investment for breeding stock and for feeder cattle where indicated is shared equally between tenant and landlord.
**All seed, grain, grass and legume is shared equally by tenant and landlord.

figures in table 8 suppose that under a crop-share lease the tenant uses cattle to consume forage, and hogs to use the grain remaining after requirements for cattle have been met; the landlord's share of the grain (the tenant gets all the forage for cash rent under the share lease) is considered to be sold from the farm. Under the livestock-share lease of table 9, however, all hay and grain raised on the farm are considered to be used by livestock.

When the capital requirements are viewed individually, the landlord's increase in capital requirements ranges from $1,955 to $2,857 more than for the same farming systems under the crop-share lease. The larger amounts reflect the landlord's contribution to the livestock program; he now furnishes one-half of the breeding and feeding stock and the increased building space required for the larger hog program. When the landlord's capital requirements under a livestock-share lease are compared to the cash-grain soil-exploitive system of table 8, the increase in capital required ranges from $3,223 for the steer-hog system to $4,666 for the beef cow-hog system. Since the landlord gets a direct return on his entire investment (including buildings) under the livestock-share lease, he has a higher return under a soil-conserving system with livestock than under a crop-share lease, where his income is from crops or cash rent only. Under a crop-share lease, no direct returns are obtained from buildings except by attraction of more efficient tenants or through manure returned to the land from the tenant's livestock program. The proportional breakdown of the landlord's $3,223 increase for the soil conservation system, including steers and hogs, is approximately 25 percent for crop and land improvement and 75 percent for livestock and facilities. For the systems including dairy or beef cows, the proportions for buildings and livestock are somewhat larger.

For the tenant, on the other hand, the increase in capital expenditure for a soil-conserving farming system with livestock is considerably less under the livestock-share than under the crop-share lease. Under the livestock-share lease, the landlord furnishes one-half of the breeding or feeding livestock, which explains most of the differences. To adjust to soil conservation farming with livestock, the tenant needs from $832 to $1,572 (depending on the livestock program) less capital under a livestock-share than under a crop-share lease. In adjusting to soil conservation farming with livestock, these differences in capital requirements are important where tenants have limited funds.

The above data, as well as those from other studies, show that adjustment to soil conservation farming requires a sizable increase in capital investment. The foremost question in the minds of tenants and landlords, as well as owner-operators is this: What is the effect of these capital investments on gross incomes, operating costs and finally net returns? The next three sections analyze these aspects of adjusting from a soil-exploitive to a soil-conserving farming system on rented farms.

Gross Incomes

One means of increasing farm incomes is the use of more resources; a larger volume of output can then be obtained. A larger volume of business does not guarantee a higher net farm income, however. Whether or not net income will be increased from use of more resources depends on the costs of the added resources, how efficiently they are used and the prices of products. As has already been indicated, adjusting to soil-conserving farming entails the use of larger quantities of resources in the form of capital and labor. The use of these additional resources then gradually becomes reflected in a larger volume of output, increased sales and, if farm product prices hold constant, in higher gross income. We now examine whether the added resources add more to costs or gross income under the price base selected for the study.

Labor, capital and land resource requirements for soil-erosive and soil-conserving farming systems were outlined in tables 7, 8 and 9. The effects of employing these added resources as combinations of different crop and livestock systems and different leasing systems on gross income are shown in table 10.

TABLE 10. AVERAGE GROSS INCOMES PER TENANT, LANDLORD AND FARM UNDER VARIOUS ARRANGEMENTS AND SYSTEMS OF FARMING IN WESTERN IOWA AT 1940-44 PRICES.

Systems of farming	Average gross incomes					
	Crop-share lease			Livestock-share lease		
	Tenant	Landlord	Farm	Tenant	Landlord	Farm
	$	$	$	$	$	$
Cash-grain, soil-exploitive system	1,548	1,548	3,096	....	....	....
Soil-conserving with:						
Crops sold for cash	2,980	1,891	4,461	....	....	....
Crops fed through steers and hogs	4,075	1,935	5,593	3,364	3,364	6,728
Crops fed through beef cows and hogs	4,302	1,935	5,820	3,493	3,493	6,986
Crops fed through dairy cows and hogs	4,852	1,935	6,370	3,768	3,768	7,536

The gross incomes of both tenant and landlord increase with the adoption of a soil-conserving cash-crop farming system as compared to the cash-grain exploitive system of farming. The landlord's increase, however, is not as large as that of the tenant. The landlord's increase is $343 or 22 percent; the figures for the tenant are $1,432 or 90 percent. Previous tables showed that this type of adjustment to soil conservation results in less total grain. The cash-crop soil-conserving farming system thus yields a somewhat lower gross income from grain, both for the tenant and landlord. The landlord's cash rent for hay is sufficient, however, to result in a net increase in gross income. Since the tenant's computed forage sales have a larger value than the landlord's cash rent from the forage acreage, the tenant's gross income is increased by a larger net amount.

CROP-SHARE LEASES AND GROSS INCOME

In adjusting from a soil exploitive cash-grain farming system to the soil-conserving farming systems including livestock, landlord and tenant gross incomes are increased by larger amounts, as compared to soil conservation systems with no livestock. This is true under both crop- and livestock-share leases. Under the crop-share lease, the tenant's gross income increases by $2,527 from adoption of the conservation program including steers and hogs; it increases by $3,304 from the conservation adjustment including a dairy-hog program.

Under crop-share leasing, the landlord's gross is increased by much smaller amounts than is the tenant's gross by changing to soil-conserving farming systems with livestock. The reason is this: The tenant's capital outlay is increased by twice the amount for the landlord. The tenant shares in the increased output resulting from the landlord's investment in terrace construction, legume and grass seed, but the landlord does not share in the value of output from the tenant's livestock; the landlord invests capital for additional building space and fencing for the tenant's livestock program under the customary crop-share lease arrangement but obtains no direct return from it.

Gross incomes to the landlord from soil-conserving farming systems with and without livestock also can be compared. A gain of only $44, or 2 percent, occurs as a result of adding livestock. This gain reflects the value of one-half of the increased grain production resulting from the manure applied to the land under the livestock program and a crop-share lease.

LIVESTOCK-SHARE LEASES AND GROSS INCOME

In adjusting from a soil-exhaustive cash-grain farming system to a soil-conserving system which includes livestock, the tenant's gross income increases by less and the landlord's by more under the livestock-share lease, as compared to the crop-share lease. This difference is due to the livestock investment which is shared equally under a livestock-share lease. For the landlord to attain a gross income equal to that of the tenant under livestock-share leasing, the landlord must increase his total capital outlay by about twice the amount required for the tenant in order to attain a gross income equal to that of the tenant. Again, the explanation lies in the land improvements (terrace construction), added building and other livestock facilities in which the landlord must invest. A larger gross income for the farm as a whole under livestock-share as compared to the crop-share lease also is evident. It is due to a larger volume of production, obtained from the larger hog enterprise. An increase in the enterprise is made possible under livestock-share leasing because the landlord's share of the grain is fed instead of being sold as it is under the crop-share leasing.

In all cases of table 10, gross income increases between soil-exploitive and soil-conserving farming systems. In the final analysis, however, the effect of these adjustments on costs and net incomes must be considered. The sections which follow deal with cost and net income.

COSTS

Use of additional resources involves annual costs; costs are represented as fertilizer, feed and labor are transformed into crops or livestock or as durable capital items depreciate over time. An increase in costs is not "bad" *per se*. The important consideration is the relationship between increases in costs and gross income. If the latter increase by more than the former, farm profits must increase. The nature of the costs added from soil conservation practices is also important. Some costs are fixed and remain constant in amount irrespective of whether much or little is produced. Some of these fixed costs are "hidden"; they involve no direct cash outlay from year to year since the total expenditure is made when the capital asset is purchased. Other costs are variable and depend on the production of the years.

Tables 11 and 12 show landlord and tenant costs related to soil-exhaustive and soil-conserving farming systems with crop-share and livestock-share leases. Costs are at 1940-44 price levels.

CROP-SHARE LEASES AND CASH-CROP SYSTEMS

Under crop-share leases, tenant, landlord and total farm costs are increased by $729, $247 and $545 respectively in adjusting from a cash-crop soil-exploitive system to a soil-conserving cash-crop system. The total farm cost figure is lower than the combined total of tenant and landlord costs; the cash rent paid by the tenant is omitted as a farm cost. (Total farm costs therefore reflect the cost adjustment which might hold true for an owner-operator.) Adjustment to a soil-conserving cash-crop system of farming requires a very small capital investment on the part of a crop-share tenant. The landlord's capital expenditure increases slightly over $1,000.[11] Yet, the tenant's cost increase is almost three times that of the landlord.

A detailed examination of the cost items helps explain this difference. The reduction in grain acres decreases the tenant's seed costs, and while his outlay for fertilizer increases, the reduction in seed costs almost offsets his increase in fertilizer costs. His increase in total costs therefore is not explained in seed and fertilizer expenses. Examination of table 11 reveals that

[11]While we have not considered this addition of annual expenses as a capital investment for the tenant, he would need to have funds available each year to meet the greater expenses.

TABLE 11. AVERAGE ANNUAL COSTS (TENANT, LANDLORD AND FARM) FOR A SOIL-EXHAUSTIVE AND SOIL-CONSERVING FARMING SYSTEMS PER FARM UNDER CROP-SHARE-CASH LEASING IN WESTERN IOWA AT 1940-44 COST LEVELS.

Systems of farming		Power and machinery	Seed	Fertilizer	Crop labor	Other crop costs	Terracing	Building	Taxes	Fencing	Livestock expense other than labor	Livestock labor	Purchased corn	Sub-total of costs	5 percent of sub-total[u]	Total costs
		($)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)
Cash-grain soil-exploitive system	Ten.	876[a]	99[b]	....	379[c]	217[d]	....	...	...	...	...	...	...	1,571	78	1,649
	Lld.	....	153[j]	....	...	...	....	499[k]	182[l]	...	...	...	...	834	42	876
	Farm	876	252	....	379	217	....	499	182	...	...	...	...	2,405	120	2,525
Soil-conserving with Crops sold for cash	Ten.	1,103[e]	61[b]	47[f]	437[c]	617[g]	....	...	...	...	...	...	...	2,265	113	2,378
	Lld.	...	301[m]	47[f]	...	...	30[n]	509[o]	182[l]	...	...	...	...	1,069	54	1,123
	Farm	1,103	362	94	437	207	30	509	182	...	...	...	...	2,924	146	3,070
Crops fed through steers and hogs	Ten.	839[h]	61[b]	42[f]	437[c]	507[i]	....	...	...	...	633[p]	213[q]	19	2,751	138	2,889
	Lld.	....	303[m]	42[f]	...	...	30[n]	520[o]	182[l]	2[t]	...	...	...	1,079	54	1,133
	Farm	839	364	84	437	90	30	520	182	2	633	213	19	3,413	171	3,584
Crops fed through beef cows and hogs	Ten.	839	61[b]	42[f]	437[c]	507	....	...	...	...	835[r]	270[q]	...	2,991	150	3,141
	Lld.	..	303[m]	42[f]	...	...	30[n]	560	182	2	...	...	...	1,119	56	1,175
	Farm	839	364	84	487	90	30	560	182	2	835	270	...	3,693	185	3,878
Crops fed through dairy cows and hogs	Ten.	839	61[b]	42[f]	437[c]	507	....	...	...	...	731[s]	1,089[q]	1	3,707	185	3,892
	Lld.	...	303	42[f]	...	...	30[n]	554	182	2	...	...	...	1,113	56	1,169
	Farm	839	364	84	437	90	30	554	182	2	731	1,089	1	4,403	220	4,623

[a]Fixed costs on tractor and machinery and operating costs on tractor.
[b]One-half of corn and oat seed costs.
[c]Value of operator's labor on crops at 40 cents per hour.
[d]Costs of hauling grain from field to storage, elevating grain, shelling corn and hauling grain to town.
[e]Fixed costs on tractor and machinery, plus operating tractor costs, plus cost of custom baling.
[f]One-half the cost of fertilizer on corn and oats.
[g]Cost of hauling grain from field to storage, elevating grain, shelling corn, hauling grain to town, plus $410 cash rent on hayground.
[h]Tractor operating costs, plus fixed costs on tractor and machinery for corn, oats, hay and rotation pasture, plus cost of custom baling one-half of hayground.
[i]Cost of hauling grain from field to storage, elevating grain, shelling corn, plus cash rent for hay and rotation pasture and permanent pasture of $417.
[j]Cost of sweet clover seed plus one-half of corn and oats seed.
[k]Estimated annual cost on present buildings plus added building costs.
[l]Taxes at $1.22 per acre.
[m]Total seed costs for hay and sweet clover plus one-half of cost of corn and oat seed, plus some seed costs on permanent pasture where livestock systems are involved.
[n]Annual maintenance costs of terracing.
[o]Annual costs on present buildings plus annual cost on added building investment.
[p]Costs of supplement, tractor and horsepower, vet, insurance, property tax, interest on investment in livestock, equipment costs and miscellaneous.
[q]Value of operator's labor for livestock at 40 cents per hour.
[r]Costs of supplement, tractor and horsepower, vet, interest on investment in livestock, property tax and miscellaneous.
[s]Costs of supplement, property taxes, vet, insurance, interest on investment in livestock and equipment, depreciation on equipment, tractors and horsepower, and miscellaneous costs.
[t]Equals added fencing investment depreciated out in 20 years.
[u]Five percent is added to include any miscellaneous costs that may have been omitted in the cost computations.

TABLE 12. AVERAGE ANNUAL COSTS (TENANT, LANDLORD AND FARM) FOR SOIL-CONSERVING FARMING SYSTEMS PER FARM UNDER LIVESTOCK-SHARE LEASING IN WESTERN IOWA AT 1940-44 COST LEVELS.

Systems of farming		Power and Machinery	Seed	Fertilizer	Crop labor	Other crop costs	Terracing	Building	Taxes	Fencing	Livestock expense other than labor	Livestock labor	Purchase of corn	Sub-total of costs	5 percent of Sub-total[q]	Total costs
Soil-conserving with feed processed through:		($)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)
Steers and hogs	Ten.	643[a]	181[c]	42[d]	437[e]	59[f]	....	....	...	...	576[l]	401[o]	10[p]	2,349	117	2,466
	Lld.	192[b]	181[c]	42[d]	...	38[g]	30[h]	564[i]	182[j]	2[k]	576	...	10	1,817	91	1,908
	Farm	835	362	84	437	97	30	564	182	2	1,152	401	20	4,166	208	4,374
Beef cows and hogs	Ten.	643	181	42	437	59	....	....	...	...	678[m]	462[o]	..	2,502	125	2,627
	Lld.	192	181	42	...	38	30	615[i]	182	2	678	...	..	1,960	98	2,058
	Farm	835	362	84	437	97	30	615	182	2	1,356	462	.	4,462	223	4,685
Dairy cows and hogs	Ten.	643	181	42	437	59	....	....	...	...	531[n]	1,263[o]	1[p]	3,157	156	3,313
	Lld.	192	181	42	..	38	30	594[i]	182	2	531	...	1	1,793	90	1,883
	Farm	835	362	84	437	97	30	594	182	2	1,062	1,263	2	4,950	246	5,196

[a]Fixed costs on tractor and machinery, one-half cost of tractor operating, and one-half the cost of custom-baling one-half of hay acreage.
[b]One-half of tractor operating costs, and one-half the cost of custom baling one-half of the hay acreage.
[c]One-half of all seed costs.
[d]One-half of fertilizer costs on corn and oats.
[e]Value of operator's labor on crops at 40 cents per hour.
[f]Cost of hauling grain from field to storage, and costs of elevating grain, and one-half the costs of shelling corn.
[g]One-half the costs of shelling corn.
[h]Annual maintenance cost of terracing.
[i]Estimated annual costs on present buildings plus annual costs on added building investment.
[j]Taxes on $1.22 per acre.
[k]Annual cost on added fencing.
[l]One-half of costs on supplement, tractor and horse power, vet, insurance, property tax, interest on investment in livestock, equipment costs and miscellaneous.
[m]One-half of costs of tractor and horse power, interest on investment in livestock, property tax and miscellaneous.
[n]One-half of costs of supplement, property tax, insurance, interest on investment in livestock and equipment, depreciation on equipment, tractor and horse power, and miscellaneous costs.
[o]Value of operator's labor at 40 cents per hour.
[p]One-half the cost of purchased corn.
[q]Five percent is added to include any miscellaneous costs that may have been omitted in the cost computations.

power and machinery costs, crop labor costs and other crop costs account for the increase. The higher power and machinery costs result not from an increase in the fixed costs of owning power and machinery but from the custom cost of baling additional hay. Crop labor costs also increase. (They represent the value of the operator's labor in crop production estimated at the average farm wage rate per hour for 1940-44 levels.) The increased labor costs come about with the shift from grain to forage. Total labor requirements increase since the labor for growing and harvesting an acre of forage is greater than for an acre of grain.

The other main item in the increase in crop costs is cash rent amounting to $410. It is paid by the tenant for hay ground, which he would not be paying for under an all-grain farming system. Both custom baling costs and cash rent for hay ground are cash expenses that must be met each year by the tenant. (Baling costs will vary from year to year with the amount of hay produced.) But because of the magnitude and "fixity" of hay baling and cash rental costs, these annual expenses may be difficult to meet for tenants limited on funds, particularly in years when crop yields are low. Crop labor costs on the other hand are not a cash expense unless the labor is hired. On many farms crop work is performed by operator and family labor; this labor is present on the farm, whether used or not, and involves no cash outlay.

The increase in landlord costs following a change from a soil-exhaustive cash-grain system of farming to a cash-crop soil-conserving system comes mainly from added expenditures for grass and legume seed, fertilizer, terrace maintenance and annual costs of additional building space. The annual charge for depreciation on the added building space is a fixed or overhead cost involving no actual out-of-pocket expense. Interest on investment for the increased housing falls in the same category. Repairs and insurance are the only cash expenses attached to the additional buildings. Terrace maintenance may or may not be a cash expense. If the terraces are maintained through the regular routine of crop operations, no cash expenses are involved. But if this is not the case, the landlord must hire the tenant, or someone else, to perform the maintenance work. Some tenants may do this work in exchange for concessions from the landlord in lower rents. The use of fertilizer also involves a cash outlay by the landlord. In summary, the landlord must pay out annual cash costs for repair and insurance (and perhaps interest) on added building space, fertilizer and perhaps for terrace maintenance. But the most important single cash item increase is for grass and legume seed. This cost is about 60 percent of the total cost increase for the landlord.

CROP-SHARE LEASE AND LIVESTOCK SYSTEMS

In adjusting from a cash-grain soil-exploitive farming system to a soil-conserving one with livestock, the tenant's costs under a crop-share lease are increased by considerably larger amounts than where no livestock is added. The tenant's cost-increases, with the cash-grain soil-exploitive system as the base of comparison, ranges from $1,240 for the steer-hog to $2,243 for the dairy-hog system. For the tenant, minor cost decreases take place (between cash-crop and livestock farming) in seed, power and machinery since one-half of the hay ground is now in rotation pasture; it is used directly by cattle and hence only growing costs are incurred on this portion of the hay ground. This change brings about a minor reduction in the total power and machinery costs. Cost increases occur for fertilizer, crop labor,[12] "other crop costs," livestock expense other than labor, livestock labor and purchased grain. Of these, the most important are "other crop costs" (cash rent for hay ground included), livestock expense other than labor (includes cost of protein supplement, veterinary, property tax, equipment costs, etc.) and labor for livestock, especially where dairying is involved. "Other crop costs" and "livestock expense other than labor" involve mostly out-of-pocket expenditures. The labor for livestock can be omitted as a cost where it is available from operator or family time.

In changing from the soil-exploitive to the soil-conserving farming systems with livestock, the landlord's cost-increases under a crop-share lease are small in comparison to those of the tenant. The landlord's cost increase runs from $257 to $299, depending upon the livestock program. Included in the increase are the annual costs for the added building space, fences, maintenance of terraces, fertilizer and legume and grass seed. The latter two items involve the main annual cash outlay.

Some tenants and landlords have already made changes in crop rotations and supplemental practices necessary for a higher degree of erosion control. This gives them a cash-crop soil-conserving farming system. If they now desire to complete the adjustment by adding livestock, they are interested in the cost increases accompanying a shift from a cash-crop soil-conserving farming system to soil-conserving farming with livestock. When labor is included as a cost, this shift increases the tenant's total costs under a crop-share lease from $511 to $1,514, depending on which livestock program is adopted. If the labor charge is omitted, the total increase varies from about $287 to $480. However, some of the tenant's individual expense items are lowered by the shift. This is true for power and machinery, fertilizer and grain-hauling. Power and machinery costs are lower because one-half the hay acreage now is pastured instead of harvested. The presence of livestock and manure allows use of less fertilizer, and since the tenant's share of the grain now is fed on the farm, grain hauling costs are less. The reductions in these individual expense items, however, are not large enough to offset the increase in livestock expenses. Hence, the tenant's total costs increase when he adds livestock to a soil-conserving farming system.

In shifting from cash-grain soil-conserving farming to soil-conserving farming with livestock under a crop-share lease, the landlord's costs increase only by $10 to $46, the amount depending on the livestock pro-

[12]In terms of crop labor alone these costs would be expected to be somewhat lower where livestock is involved than where soil-conserving farming is performed on a cash-crop basis. The reason is this: Where livestock are included,, hay harvesting costs are assumed for only one-half of the hay (the remainder of the hay is assumed to be pastured off), but the reduction in labor here is assumed to be offset by odd jobs, such as fence and building repair.

gram. This increase reflects the annual cost on added buildings and fences and some expenditures for grass seed in renovating permanent pasture.

LIVESTOCK-SHARE LEASE AND LIVESTOCK SYSTEMS

In shifting from a cash-grain soil-conserving system of farming to a soil-conserving farming system with livestock, the tenant's total costs under a livestock-share lease increase from $88 to $935 if labor is included as a cost. The $88 increase reflects the steer-hog program, while the $935 increase is for the dairy cow-hog program. The increase for beef cows and hogs is in between the above figures. But if labor costs are omitted, the tenant's total costs are $200 to $400 less under soil-conserving farming with livestock. Changes in the following cost items explain most of this cost decrease: (1) Power and machinery costs are lower because, with the shift under a livestock-share lease, the landlord pays one-half of the tractor operating costs and one-half of the baling costs. Further, since one-half of the hay is assumed to be in rotation pasture when livestock is added, hay harvesting costs are increased on only one-half of the hay acreage. (2) The shift under a livestock-share lease eliminates the cash rental payment for hay and pasture. Hence on farms where labor costs can be ignored, the tenant's annual farm expenses are lower with a livestock-share lease and soil-conserving farming including livestock than with cash-crop soil-conserving farming and a crop-share lease. However, if labor is hired and has a cash cost, the shift from cash-crop soil-conserving farming under a crop-share lease to soil-conserving farming with livestock under a livestock-share lease increases the tenant's annual expenses from $88 to $935, depending on the livestock system. This increase is less than when the shift to soil-conserving farming and livestock is made under the crop-share lease. Thus, when livestock production attends adjustment to soil conservation farming, the tenant can more easily meet his operating expenses under a livestock-share than under a crop-share lease. This is true not only because of the difference in annual expenses under the two leases, but because credit is more easily obtained when both landlord and tenant can furnish security.

In shifting from cash-crop soil-conserving farming to soil-conserving farming with livestock, the landlord's annual expenses increase by a larger amount under livestock-share than under crop-share leasing. The reason for the larger increase under the livestock-share lease is because the landlord, under this lease, shares most of the operating expenses with the tenant; in addition, annual building costs are higher because more building space is required for the larger livestock program.

In the beginning of the section on costs, it was mentioned that an increase in costs *per se* is not necessarily bad. The important consideration is the increase in costs relative to the increase in gross income. This relationship is shown by the net incomes from soil conservation adjustments in the following section.

NET INCOMES

Table 13 shows net incomes for tenant, landlord and

TABLE 13. AVERAGE NET INCOMES (TENANT, LANDLORD AND FARM) FROM A SOIL-EXPLOITIVE AND FROM SOIL-CONSERVING FARMING SYSTEMS UNDER DIFFERENT LEASE ARRANGEMENTS IN WESTERN IOWA AT 1940-44 PRICE AND COST LEVELS.

Systems of farming	Average tenant net income				Average landlord net income				Average farm net income			
	Labor free		Labor as a cost		Excluding 10 percent of landlord's gross as farm manager's fee		Including 10 percent of landlord's gross as farm manager's fee		Labor free		Labor as a cost	
	Crop-share lease	Livestock-share lease	Crop-share lease	Livestock-share lease	Crop-share lease	Livestock-share lease	Crop-share lease	Livestock-share lease	Crop-share lease	Livestock-share lease	Crop-share lease	Livestock-share lease
	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)
Cash-grain, soil-exploitive system	297**	. . .	-101	. . .	672*	. . .	. . .	. . .	969	. . .	571	. . .
Soil-conserving with:												
Crops sold for cash	1,061**	. . .	602	. . .	768*	. . .	578*	. . .	1,849	. . .	1,390	. . .
Crops fed through steers and hogs	1,868**	1,777**	1,191	898	801*	1,458	607*	1,121**	2,692	3,233	2,009	2,354
Crops fed through beef cows and hogs	1,904**	1,808**	1,161	866	759*	1,435	566*	1,086**	2,685	3,245	1,942	2,301
Crops fed through dairy cows and hogs	2,561**	2,238**	977	452	766*	1,886	572*	1,509**	3,349	4,123	1,747	2,340

*Differences among systems not significant at 5-percent level of probability.

**Differences among systems significant at 5-percent level of probability. (Net incomes under the livestock-share lease are compared with net incomes from cash-crop farming systems under the crop-share lease).

farm under soil-erosive and soil-conserving farming systems and under different lease arrangements. Also shown in the table are tenant net incomes with and without labor costs. Operator and family labor is available whether fully used or not. For this reason, such labor is often regarded as an overhead cost involving no cash outlay. Accordingly, most tenants will perhaps be primarily interested in the tenant net incomes without labor costs. However, some tenants will no doubt want to know what returns are left over after having paid themselves, their hired and family help the going wage rate. Therefore, tenant net incomes for the various farming systems are also computed with labor as a cost.

Making and carrying through decisions that underlie adjustments to and operation of soil-conserving farming systems often requires a good deal of managerial skill and know-how. Sometimes tenants and landlords do not possess this skill. Some beginning tenants are inexperienced and some landlords have little or no farm background or management experience. Other landlords are hindered from actively entering into the decision-making because their place of residence is remotely located from the farm. Also, some landlords are busy with activities other than farming. Ill-health or age may prevent others from active managerial participation. Such landlords will be interested in exploring the possibility of whether it pays to shift to a soil-conserving farming system if a professional farm manager is hired to make the decisions. Accordingly, landlord net incomes are calculated with a commercial farm manager fee of 10 percent of the landlord's gross income. For many landlords, managerial skills and the situation generally are such that net incomes will be higher from relying on their own and the tenant's managerial resources rather than hiring them. Hence, landlord net incomes have also been computed without a commercial farm manager's fee.

The basic questions to be answered from an analysis of the data in table 13 are: (1) Do the various farming systems significantly affect tenant and landlord net incomes? Are net incomes between soil-conserving farming systems and the soil-exhaustive system significantly different? Is the net income under one soil-conserving farming system significantly different from that of another? (2) Do leasing systems significantly affect the net income from a particular farming system?

For the tenant, the net incomes (without labor costs) for the various farming systems differed significantly[13] when the five systems were compared as a group. This was also true when paired comparisons were made—except for the income difference between the steer-hog soil-conserving farming system and the beef cow-hog soil-conserving system of farming. These findings hold for both the crop-share and livestock-share leases. Under the conditions set up for this study, it can therefore be said that not only are net incomes for the tenant increased by shifting from soil-exhaustive to soil-conserving farming systems but that some soil-conserving farming systems yield larger returns than others. All the soil-conserving farming systems with livestock net higher returns to the tenant than the soil-conserving farming system without livestock. Also the soil-conserving system with dairy cows and hogs brings in a higher return than the other two soil-conserving systems with livestock. This would not be true for the dairy-hog system, however, were labor included as a cost. In other words, the system including dairying shows up as highly favorable if little or no value is attached to labor.

The length of time it would take for a particular tenant to attain these income increases from soil conservation farming would depend on the extent of the adjustment required. For some, perhaps, only one or two rotation cycles will be required. For others, several rotation cycles will be necessary.

Before these income increases are attained, many tenants can expect to go through a transition period where their returns are lower than under the old farming system for reasons already explained. The length of time it takes to attain these income increases also hinges on what happens to the price level after the investment for soil conservation has been made. If prices fall immediately after the adjustment is made, it will obviously take much longer to regain the investment. Thus, to attain long-run income increases from soil conservation adjustments, the tenant is likely to experience some short-run sacrifices. To be interested in taking the necessary steps for attaining these long-run gains, the tenant will either have to have tenure security or be assured of getting back the unused portion of resources invested in soil conservation. To be able to take the necessary steps he will either have to have the capital resources himself or be in a position to make long-run and short-term credit arrangements without endangering his equity.

For the soil-conserving farming systems with livestock, table 13 shows the tenant's net incomes to be lower under livestock-share than under crop-share leasing. Are these income differences large enough to be significantly different? If so, then leasing systems can be said to influence the tenant's returns from a given system of farming. When tests were applied, the leasing systems showed no significant effect on the returns from steer-hog and beef cow-hog soil-conserving farming systems. But the incomes from the dairy-hog conservation program were significantly different as a result of the leasing systems. Hence, the tenant's net income from the dairy-hog conservation farming system is higher under crop-share than under livestock-share leasing.

An explanation of this difference is set forth in table 14. This table shows the effect of leasing systems on tenant gross incomes, costs and net incomes for the three soil-conserving farming systems including livestock. As may be noted, under all three farming systems the tenant's gross income from hogs is higher under the livestock-share than under the crop-share lease. The difference is relatively less for the farming system with beef cows, because under the crop-share lease nearly all the grain goes into hog production; thus when the landlord's share of the grain under the livestock-share lease is added, the hog enterprise is little more than doubled. But with the other two live-

[13]The F test with 5-percent probability level was used.

TABLE 14. DIFFERENCE* RESULTING FROM LEASING SYSTEMS IN TENANT GROSS INCOMES, COSTS AND NET INCOMES FOR THREE SOIL-CONSERVING FARMING SYSTEMS INCLUDING LIVESTOCK

Items	Differences in tenant gross incomes, costs and net incomes for farming systems of:		
	Steer-hog soil-conserving	Beef cow-hog soil-conserving	Dairy-hog soil-conserving
	($)	($)	($)
Differences in gross incomes from hogs—livestock-share vs. crop-share lease	+ 780	+ 83	+ 618
Differences in gross incomes from forage-consuming livestock—livestock-share vs. crop-share lease	−1,492	−894	−1,702
Net differences in gross incomes—livestock-share vs. crop-share lease	− 712	−811	−1,084
Differences in costs—livestock-share vs. crop-share lease	− 621	−715	− 761
Differences in net incomes—livestock-share vs. crop-share lease	− 91	− 96	− 323

*The figures in the table indicate the effects of operating under a livestock-share lease rather than a crop-share.

stock programs, the hog enterprise is two to three times larger under livestock-share leasing than crop-share leasing. On the other hand, tenant gross incomes from forage-consuming livestock is lower under livestock-share than under crop-share leasing for all three livestock systems. Since the number of forage-consuming livestock is determined by the quantity of forage produced and since lease arrangements had no effect on cropping pattern, the number of forage-consuming livestock remains the same irrespective of leasing system. Under the crop-share lease, the tenant receives all the income from the forage-consuming livestock whereas under the livestock-share lease he shares this equally with the landlord.

Since dairy cows gross proportionately more than beef cows or steers under crop-share than under livestock-share leasing, the tenant's gross income from dairy cows is lowered more than from steers or beef cows as a result of livestock-share leasing. Neither the higher gross income from hogs nor the lower costs under the livestock-share lease are sufficient to offset the relatively lower tenant returns from dairy cows. Hence, the tenant's net income is considerably lower for the dairy-hog soil-conserving program than for the other farm systems in table 14 as a result of leasing under a livestock-share rather than a crop-share lease.

Thus far it has been shown that adjusting to soil-conserving farming systems does increase the net income of the tenant. Further, except for the dairy-hog soil-conserving system, the conventional leasing arrangements have no effect on tenant net incomes. But the decision to change from a soil-exploitive to soil-conserving farming systems is not the tenant's alone. The landlord is also a party to that decision, and unless his net income also is increased, the decision is not likely to be made. Therefore, when the inquiry turns to an analysis of landlord net incomes, we need to ask questions similar to those raised at the beginning of the examination and study of tenant net incomes. First, under a given leasing arrangement, do the different farming systems significantly affect landlord net incomes? Under the crop-share lease, landlord net incomes for the five farming systems do not differ significantly when tested as a group. With one exception, the conclusion is the same when paired comparisons of farming systems are made; in comparing the net incomes from the soil-exploitive cash-grain farming system and from the steer-hog soil-conserving system with no commercial farm manager's fee, tests showed a significant difference. From these findings, the general statement cannot be made that the landlord's net income under conventional crop-share leasing is increased by changing from a soil-exploitive to a soil-conserving farming system. Changes in gross income relative to costs as a result of the adjustment were not large enough to generally establish any significant difference between the landlord's net returns from soil-exploitive and soil-conserving farming systems.

On the other hand, under the livestock-share lease, the farming systems do affect the net incomes of the landlord. Tests show incomes to differ significantly when comparisons are made between various farming systems. The landlord's net income is increased by shifting from a soil-exploitive cash-grain farming system or from a soil-conserving cash-crop farming system (both under crop-share leasing) to soil-conserving farming systems with livestock under livestock-share leasing. Also, the soil-conserving farming system with a dairy-hog program increases the landlord's net income by more than the soil-conserving farming systems with either steers or beef cows. The incomes between these latter two systems are not significantly different.

Do leasing systems have any effect on the landlord's net income under a given farming system? Tests show that the landlord's net incomes from each of the three soil-conserving systems with livestock under crop-share leasing are significantly different from each of the same systems under livestock-share leasing. Thus, leasing systems do affect the landlord's net returns from a given farm organization. The landlord's returns from a particular farm organization are higher under a livestock-share lease than under a crop-share-cash lease.

The analysis of net incomes then leads to the following conclusions: (1) Shifting from soil-exploitive to soil-conserving farming systems does increase the net income of the tenant under both crop-share and livestock-share leasing. (2) The same shift or adjustment increases the landlord's net return under a livestock-share lease. (3) The tenant's net returns from a specific farm organization are not influenced by leasing systems except for the soil-conserving farming plan including dairy and hogs. (4) Leasing systems do affect the landlord's net income from a particular farming system. His net income from a given farming system is higher under a livestock-share lease than under a crop-share lease.

Table 15 summarizes for tenant, landlord and farm the average increases in capital and net incomes. It also shows the percent return on the added capital by shifting from soil-exploitive to soil-conserving farming systems under different lease arrangements.

On the basis of data in table 15, capital investment in soil conservation farming by the tenant is a very profitable venture, irrespective of the leasing system under which he operates. Even when labor costs are included, returns are extremely high.

Relative to other long-term investments, capital investment in soil conservation farming is also highly

TABLE 15. AVERAGE INCREASE IN CAPITAL, NET INCOME AND PERCENT RETURN ON ADDED CAPITAL FOR TENANT, LANDLORD AND FARM AS A RESULT OF CHANGING FROM A SOIL-EXPLOITIVE, CASH-GRAIN FARMING SYSTEM TO VARIOUS SOIL-CONSERVING FARMING SYSTEMS UNDER DIFFERENT LEASE ARRANGEMENTS IN WESTERN IOWA AT 1940-44 PRICE AND COST LEVELS.

Change in farming system—from cash-grain, soil-exploitive to:		Increases in capital requirements		Increase in net income				Percent return on added capital			
				Labor free*		Labor as a cost†		Labor free*		Labor as a cost†	
		Crop-share lease	Livestock-share lease	Crop-share lease	Livestock-share lease	Crop-share lease	Livestock-share lease	Crop-share lease	Livestock-share lease	Crop-share lease	Livestock-share lease
		($)	($)	($)	($)	($)	($)	(%)	(%)	(%)	(%)
Soil-conserving with:											
Crops sold for cash	Ten.	9	....	764	....	703	....	8,488.88	....	7,811.11	....
	Lld.	1,071	....	96	....	61	....	8.96	....	5.70	....
	Farm	1,080	....	880	....	819	....	81.48	....	75.83	....
Crops fed through steers and hogs	Ten.	2,430	1,598	1,571	1,480	1,292	909	64.65	92.62	53.17	56.88
	Lld.	1,268	3,223	129	786	90	604	10.17	24.39	7.10	18.74
	Farm	3,698	4,821	1,723	2,264	1,438	1,783	46.59	46.96	38.89	36.98
Crops fed through beef cows and hogs	Ten.	3,916	2,344	1,607	1,511	1,262	967	41.04	64.46	32.23	41.25
	Lld.	1,809	4,666	87	763	49	569	4.81	16.35	2.71	12.19
	Farm	5,725	7,010	1,716	2,276	1,371	1,730	29.97	32.47	23.25	24.68
Crops fed through dairy cows and hogs	Ten.	3,740	2,256	2,264	1,941	1,078	553	60.53	86.04	28.82	24.51
	Lld.	1,725	4,290	94	1,214	55	992	5.45	28.30	3.19	23.12
	Farm	5,465	6,546	2,380	3,154	1,176	1,769	43.55	48.18	21.52	27.02

*For the landlord, 10 percent of his gross income is excluded as a farm manager's fee.
†For the landlord, 10 percent of his gross income is included as a farm manager's fee.

profitable for the landlord when he operates with the tenant on a livestock-share lease basis. Returns are high even when the landlord pays a commercial farm manager 10 percent of his gross income to perform the management function or to make the decisions necessary to soil conservation farming. However, the returns on the landlord's capital invested in soil conservation farming do not average as high as those of the tenant. This difference may be due to a lower return on that portion of the capital invested in soil amendments, such as terracing, than from that invested in fertilizer and livestock, resulting in a lower overall average investment return for the landlord. On the other hand, it may also indicate that the rent the landlord receives fails to reflect accurately the real productivity of some of the capital invested in soil conservation farming and consequently yields a return somewhat less than that which is fair or equitable.

The returns on investment in soil conservation farming that are outlined in table 15 assume farming conditions as profitable as those in existence during the period 1940-44. These relationships are also used in table 16. This table shows tenant, landlord and farm returns as percentages of the total resource investments under the different farming and leasing systems. With price relationships less favorable than these, returns on resource investment in soil conservation, as well as in the whole farm enterprise, would be lowered. Like most other investments, soil conservation investment must be planned and the plans initiated under conditions of price risks. To determine the opportune time for making the investment and thus assure an efficient and successful adjustment, farmers need to keep abreast of the farm outlook and use other means to reduce risks.

So far, adjustments or changes in crop acreages and crop production, numbers of livestock, capital requirements, gross incomes, costs and net incomes have been presented primarily in terms of averages for the 40 farms making up the sample for budgetary analysis. These adjustments or changes were those required, on an average, by the 40 farms in shifting from an exploitive cash-grain farming system to farming systems in which soil-conserving systems were designed to reduce annual soil losses to 7 tons per acre. In planning the crop rotation and cropping practices on each of the 40 farms (to attain this degree of erosion control), the degree of slope and erosion of soil was found to vary considerably. Consequently, the extent of adjustment in soil management practices required to reduce annual soil losses to the 7-ton limit also varied greatly. As the grain-to-forage acreage shift and amount of terrace construction varied from farm to farm, so also did the changes in feed supply, numbers of forage and grain-consuming livestock, capital requirements, costs and incomes.

The following section shows the variation in extent of adjustment required for the 40 farms in changing from the single soil-exploitive system of cash-grain farming to various soil-conserving systems. The differences shown are figured starting from the single soil-exploitive, cash-grain system outlined earlier. Variations would be even greater were the adjustments measured from the original farming programs followed on many of the 40 farms.

TABLE 16. PERCENT RETURN ON AVERAGE TOTAL INVESTMENT (LAND AND CAPITAL) FOR TENANT, LANDLORD AND FARM FROM A SOIL-EXPLOITIVE AND FROM VARIOUS SOIL-CONSERVING FARMING SYSTEMS UNDER DIFFERENT LEASING SYSTEMS IN WESTERN IOWA AT 1940-44 PRICE AND COST LEVELS.

Systems of farming	Tenant's percent return on investment				Landlord's percent return on investment				Farm's percent return on investment			
	Labor free		Labor as a cost		Excluding 10 percent of landlord's gross as farm manager's fee		Including 10 percent of landlord's gross as farm manager's fee		Labor free		Labor as a cost	
	Crop-share lease	Livestock-share lease	Crop-share lease	Livestock-share lease	Crop-share lease	Livestock-share lease	Crop-share lease	Livestock-share lease	Crop-share lease	Livestock-share lease	Crop-share lease	Livestock-share lease
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Cash-grain, soil-exploitive system	6.50	....	-2.21	....	4.03	....	3.10	....	4.56	....	2.69	....
Soil-conserving with: Crops sold for cash	23.16	....	13.14	....	4.33	....	3.26	....	8.28	....	6.23	....
Crops fed through steers and hogs	26.68	28.80	17.01	14.55	4.47	7.33	3.38	5.64	10.79	12.41	8.06	9.03
Crops fed through beef cows and hogs	22.43	26.14	13.68	12.52	4.11	6.73	3.06	5.09	9.96	11.49	7.20	8.15
Crops fed through dairy cows and hogs	30.81	32.78	11.75	6.62	4.16	9.00	3.11	7.20	12.54	14.84	6.54	8.42

VARIATIONS IN ADJUSTMENTS TO SOIL-CONSERVING FARMING SYSTEMS

Table 17 shows the frequency distribution of the 40 farms in terms of the given number of feet of terracing necessary to bring soil losses to 7 tons per acre annually. These figures assume the use of contouring and rotations to bring soil loss down to the stated amount. Five farms require from 45,000 to 49,999 feet of terraces; the average requirement for the 40 farms is 46,319 feet. Seventeen farms require less and 18 farms more than the average. The wide variation in terracing requirements results in wide differences in the capital outlay required for terrace construction. Capital expenditure for terracing ranged from $300 to $1,300, with the average falling at $741.

Table 18 includes frequency distributions of crop acreages under the soil-exploitive farming system and under the system of soil management calculated to reduce annual soil losses to 7 tons per acre. Under the soil-exhaustive farming system, 27 have from 95 to 104 acres of corn and 34 have from 45 to 54 acres of oats; the average corn and oats acreage for all 40 farms is 100 and 50 acres respectively. Under a soil-conserving cropping system (rotations with the aid of other cropping practices to reduce soil loss to 7 tons

TABLE 17. FREQUENCY DISTRIBUTION OF FEET OF TERRACING REQUIRED FOR SOIL-CONSERVING FARMING SYSTEMS IN THE IDA-MONONA SOILS AREA IN WESTERN IOWA.

Feet of terracing	Frequency
20,000 to 24,999	8
25,000 to 29,999	2
30,000 to 34,999	. .
35,000 to 39,999	5
40,000 to 44,999	2
45,000 to 49,999	5
50,000 to 54,999	6
55,000 to 59,999	2
60,000 to 64,999	5
65,000 to 69,999	1
70,000 to 74,999	1
75,000 to 79,999	2
80,000 to 84,999	1
Average feet	46,319

TABLE 18. FREQUENCY DISTRIBUTION OF VARIOUS CROP ACRES UNDER DIFFERENT FARMING SYSTEMS IN THE IDA-MONONA SOILS AREA OF WESTERN IOWA

Acres	Frequency				
	Non-conserving soil management system*		Soil-conserving system†		
	Corn	Oats	Corn	Oats	Hay
20 to 24				1	
25 to 29				3	
30 to 34				16	2
35 to 39		2	2	18	
40 to 44		3	3	2	6
45 to 49		7	6		3
50 to 54		27	8		6
55 to 59		1	5		5
60 to 64			7		6
65 to 69			6		3
70 to 74	1		2		3
75 to 79	1				4
80 to 84	1		1		1
85 to 89	1				1
90 to 94	4				
95 to 99	4				
100 to 104	23				
105 to 109	4				
110 to 114	1				
Average acres	99.7	49.8	56.8	34.5	58.1

*This soil management system is based on a cropping rotation of C-C-Os (s=sweet clover seeded with oats and plowed under as green manure) on each farm, and the crop rotation is not supplemented with any additional cropping practices.

†This soil management system involves the use of crop rotations in combination with contouring and terracing, and commercial fertilizer application that is estimated to control annual soil loss at a level of 7 tons per acre.

TABLE 19. FREQUENCY DISTRIBUTION OF TENANT NET INCOMES (EXCLUDING LABOR COSTS) UNDER DIFFERENT FARMING SYSTEMS AND LEASE ARRANGEMENTS IN THE IDA-MONONA SOIL ASSOCIATION OF WESTERN IOWA (1940-44 PRICE AND COST LEVELS).

Income class	Frequency							
	Non-soil-conserving cash grain	Soil-conserving cash crop	Soil-conserving feeder cattle-hogs		Soil-conserving beef cows-hogs		Soil-conserving dairy-hogs	
$	Crop-share	Crop-share	Crop-share	Livestock-share	Crop-share	Livestock-share	Crop-share	Livestock-share
-300 to -101	2							
-100 to 99	7							
100 to 299	8	1						
300 to 499	17	1						
500 to 699	5	2						
700 to 899	1	8		1				
900 to 1,099		6	2	1	1	2		
1,100 to 1,299		14	1	3	3	2		
1,300 to 1,499		7	4	7	4	7	1	2
1,500 to 1,699		1	6	4	5	5	1	3
1,700 to 1,899			5	5	5	4	2	6
1,900 to 2,099			9	10	6	10	4	4
2,100 to 2,299			8	7	9	8	3	4
2,300 to 2,499			4	1	4	1	6	8
2,500 to 2,699			1	1	3	1	2	9
2,700 to 2,899							11	3
2,900 to 3,099							5	1
3,100 to 3,299							5	
Average amount	297	1,061	1,868	1,777	1,904	1,808	2,561	2,238

per acre annually), farms are planned to recognize the soil characteristics of each; they do not employ a single cropping plan, and acreages on individual farms are not grouped so closely around the mean. Under this soil management program, some farms have no more than 35 to 39 acres of corn while others have twice this number of acres. Hay acres vary in the same manner from farm to farm.

Tables 17 and 18 show wide variations from farm to farm in feet of terracing and in acres of grain and forage. These variations suggest large differences from farm to farm in the make-up of the feed supply, in the numbers of forage and grain-consuming livestock, in building space, in capital and cost outlays, and finally in net incomes.

Tables 19 and 20 show how tenant and landlord net incomes under different lease arrangements vary from farm to farm for the soil-exploitive and soil-conserving farming systems.

So far, average comparisons of crop acreages and production, livestock numbers, capital and cost requirements, and incomes have been made between a soil-exhaustive and various soil-conserving systems of farming. These averages have been outlined for the farm and for the tenant and landlord under different lease arrangements. The extent to which an individual farm or tenant and landlord adjustment to soil conservation farming varies from the average and how this variation results in wide differences in capital and cost outlays and in incomes has also been noted. But whether the adjustment required is large or small, it is not likely to be made if conventional lease arrangements make it unprofitable for either the tenant or landlord. Previous analysis showed that it was not profitable for the landlord to shift from a soil-exploitive, cash-grain system of farming to soil-conserving farming systems under a conventional crop-share lease. If the customs and traditions that grow up around a leasing system prevent a more efficient use of resources, then these customs need to be altered, because the leasing system then fails to perform one of its primary functions—to channel resources into their most profitable uses. Accordingly, the following section explores possible adjustments in conventional lease arrangements (particularly in the crop-share-cash lease) so that leasing systems may facilitate adjustment to soil-conservation farming systems that reflect greater efficiency in resource use.

RENTAL ADJUSTMENTS

Functions of Leasing Systems

Leasing is one of the more important means whereby farm operators obtain control of resources.

TABLE 20. FREQUENCY DISTRIBUTION OF LANDLORD NET INCOMES (EXCLUDING MANAGEMENT FEE) UNDER DIFFERENT FARMING SYSTEMS AND LEASE ARRANGEMENTS IN THE IDA-MONONA SOIL ASSOCIATION OF WESTERN IOWA (1940-44 PRICE AND COST LEVELS).

Income class	Frequency							
	Non-soil conserving cash grains	Soil conserving cash crop	Soil-conserving feeder cattle-hogs		Soil conserving beef cows-hogs		Soil conserving dairy-hogs	
($)	Crop-share	Crop-share	Crop-share	Livestock-share	Crop-share	Livestock-share	Crop-share	Livestock-share
100 to 299	4	1					1	
300 to 499	5	4	5		5		5	
500 to 699	12	14	10	1	15		12	
700 to 899	12	9	10	1	8	3	9	
900 to 1,099	5	8	9	6	8	5	7	
1,100 to 1,299	2	4	6	7	4	9	6	3
1,300 to 1,499				3		5		4
1,500 to 1,699				13		8		6
1,700 to 1,899				4		6		7
1,900 to 2,099				3		3		8
2,100 to 2,299				2		1		7
2,300 to 2,499								1
2,500 to 2,699								4
2,700 to 2,899								
Average amount	672	768	801	1,458	759	1,435	766	1,886

Through various rental payments the tenant buys the services of land, buildings and sometimes other resources. Leasing might also be viewed as an arrangement through which the landlord buys, for a share of the product, the services of labor, power and machinery from the tenant.

Aside from enabling tenants and landlords to buy the services of resources instead of the resources themselves, leasing systems must perform the function of channeling resources into their most productive uses if efficiency is to be attained. If, for example, leasing systems prevent a given amount of resources —labor and capital—from being invested where it will bring the highest return within the farm business, they have failed in fulfilling their production efficiency role. The efficiency of any leasing system must be measured largely in terms of how well it performs this function.

The extent to which a leasing system is efficient can be determined by the size of the total farm income over the long run.[14] This relationship holds true where prices reflect with some degree of accuracy the wishes of consumers and the relative scarcity and, hence, values of resources. If consumers place a higher value on some products than on others, market prices will generally reflect this order of values. For highest returns, farmers must then combine their crop and livestock enterprises to correspond with consumer wants and purchases. Likewise, the consuming public indicates how it desires to have the services of capital, labor and other resources used through the cost or market price of these resource services. Accordingly, a leasing system will be efficient if it results in a farm business that is organized in line with market prices for products and resource services, and consequently brings about the maximization of total farm income in the long run.[15] Total net farm income will be at a maximum if the last unit of resources—a given quantity of land, labor, capital and management—nets as high a return in one segment of the farm business as in any other.

To attain this maximum, each unit of resources must be invested in that segment of the farm business which will net highest returns over time. Accordingly, wherever capital is limited, the relative profitability of a given investment in soil conservation must be measured in terms of returns in alternative investment opportunities. If a fixed quantity of resources will bring a higher return in soil conservation then elsewhere in the farm business, farm profits will be maximized by investing in soil conservation. But highest returns will be obtained by investing in alternative investment opportunities when these are the most profitable. Hence, leasing systems are efficient when they channel successive quantities of resources into their most profitable uses and thereby succeed in maximizing total net farm income over the long run. When leasing systems prevent resources from being invested in soil-conserving practices and farming systems when such investment reflects the most profitable resource use, leasing systems must be termed as inefficient.

Adjustments in Investments of Semi-Durable and Durable Resources

Some tenants or landlords are willing to make the full investment in the semi-durable resources of fertilizer, lime, grass and legume seed provided that the return is greater than the cost.[16] In the foregoing study of adjusting from cash-grain soil-exploitive to soil-conserving farming in western Iowa, landlord net incomes would have been higher under a crop-share lease had the tenant made the full investment in fertilizer, grass and legume seed. But whether the investment is fully made in semi-durable resources by the tenant or is shared by tenant and landlord, the tenant should be compensated for the unused portion of his investment to attain increased efficiency in the use of resources.

When used for fertilizer, the provision requires the landlord to pay the tenant, upon leaving, the unused portion of the tenant's investment in fertilizer. A schedule based on experimental data may show that 50 percent of a given fertilizer is transformed into crop product during the first year, and during the second and third years 35 percent and 15 percent respectively. If this schedule is used and the tenant buys a ton of fertilizer costing $40 per ton, the value of the unexhausted portion at the end of the first year will then be $20, at the end of the second year $6 and at the end of the third year $0. If the tenant moves off at the close of the first year he will get $20, and if at the close of the second year, $6. If the tenant pays only for one-half of the fertilizer, the above amounts will be reduced by the same proportion.

However, regaining only the original cost of an investment at the end of 1 or more years does not afford the tenant profit possibilities similar to those existing in absence of the lease; without the lease, alternative investments will be ordered so that some returns over and above the original investment cost are likely to occur. Otherwise, the investment is not apt to be made. Under a compensation plan where the tenant recovers only the unused portion of the original outlay for fertilizer or some other semi-durable resource, the tenant is not likely to invest in fertilizer. Other investment opportunities will appear more attractive, particularly investments like hogs or chickens, where the tenant may easily recover the original investment plus normal profits within the same year. Accordingly, if compensation provisions are really to be effective in promoting resource efficiency, the expected rate of return, discounted to the present, on the unused portion of the resource should be added to the original cost of the unrecovered portion of the resource. As a practical measure, compensation provisions should at least give the tenant the unused portion of the investment plus interest.

Compensation provisions for lime, similar to those

[14]For a more detailed discussion see Heady, Earl O., and Kehrberg, E. W. Relationship of crop-share and cash leasing systems to farming efficiency. Iowa Agr. Exp. Sta. Res. Bul. 386.

[15]Long run is here defined as a period sufficiently long to reflect efficient farm production. This suggests that it is not the year-to-year returns of the landlord and of the tenant that are significant; rather it is the combined income of the two over a long time period that is important. This need not imply that a single tenant must remain on a given farm for this time period.

[16]This still reflects an inefficient use of resources if higher net returns can be obtained from investing in alternative opportunities. A possible means of correcting this distortion is a sharing of the variable costs in the same proportion as the product, which will be discussed at a later point.

for fertilizer, can be set up to assure an efficient use of lime and other resources. The time period required to recover the investment is longer than that for most fertilizers, except perhaps for rock phosphate, but the principle is the same.

Working out compensation provisions for investment in grass and legume seeding is more difficult than for fertilizer and lime because of the nature of some portions of the investment to be recovered. If the tenant invests $100 in alfalfa seed and moves off the farm at the end of the year, he is entitled compensation not only for his original investment but he should also receive some rate of return on next year's forage crop. If he stays on the farm through the second year, he may have harvested an alfalfa crop, plowed under the sod, and put in a new seeding. If his lease is terminated at the end of the second year, the tenant should be compensated for the original cost of the new seeding, plus the value of the plowing, plus some rate of return on next year's forage crop and on the increase in next year's grain crop, which may be expected as a result of the complementary effects of legumes and grasses on grain yields. Again the tenant needs to recover something more than the original investment, otherwise alternative investment opporunities will take precedence and the seeding investment is not likely to be made. Yet without the lease, the seeding investment may be the most profitable or reflect the most efficient use of resources. As indicated earlier, increasing the efficiency with which farm resources are used is one of the primary functions of leases.

Compensation to the tenant for making capital outlays in durable resources, such as terraces, tile and buildings, can also be provided in the lease arrangement. Such improvements are fully transformed into farm products usually only over a long period of years. Accordingly, a much longer recovery schedule has to be worked out between the tenant and landlord than is necessary for semi-durable resources. Despite the fact that it normally takes a long period to recover the investment, tenants may find such investments profitable if they are properly compensated. For the western Iowa farms in this study, proper compensation provisions may induce the tenant to make the full investment in terraces and buildings. Such provisions may make adjustment from soil-exhaustive cash-grain farming to soil-conserving systems under a crop-share lease a profitable venture not only for the tenant but also for the landlord.

However, the tenant's compensation would have to include more than the unexhausted portion of the investment. It would have to include some rate of return on the investment. This compensation rate would have to be at least as high as the returns that could be obtained in the most profitable of alternative investment opportunities. For a tenant severely limited on capital, this would imply a relatively high rate, since his most profitable alternative investment opportunity is likely to lie with resources that bring full returns within the year, such as hogs, nitrate fertilizer or poultry. Because of the limited capital position of many tenants and the relatively large capital outlays required for durable resources, compensation provisions for these resources are considered less expedient than the procedure by which the landlord makes the improvement and then charges a direct rent for the use of it or obtains a larger share of the product. A tenant with limited capital, although he has compensation provisions in the lease, is not likely to put his money into the construction of a barn and then be deficient in funds for buying the steers, dairy or beef cows to put into it. Nevertheless, a barn may be the most profitable investment on a given farm. To guide resources into this, their most efficient use, an arrangement that may be more satisfactory than compensation provisions for durable resources is for the landlord to invest his funds in the barn and charge the tenant a direct rent for the use of it. Another arrangement having merit is for the landlord and tenant to sit down and budget through the added costs on and the added returns from the barn investment and then agree to share these costs and returns in a way mutually satisfactory.

Since compensation provisions also may not be practicable for terrace investment, a more feasible arrangement may be for the landlord to invest his funds in the terraces and in return receive a larger share of the crop production. This rental adjustment may be economically justifiable. Terraces are installed to make the land more productive. But there is no incentive for the landlord to invest in terraces if each 100 feet of terrace costs him $3.20 and the value of the crop production resulting from this installation is worth $5.00, which, according to the lease terms, must be shared equally with the tenant. To increase resource efficiency in this instance, the lease terms must be adjusted by increasing the landlord's share of the product so that he will receive at least as high a rate of return on terrace investment as elsewhere.

APPENDIX A

F TABLES*

TABLE 1-A. EFFECT OF FARMING SYSTEMS ON TENANT AVERAGE NET INCOME, CROP-SHARE LEASE (LABOR FREE).

Source of variation	d.f.	S.S.	M.S. or S.S./d.f.
Total	199		
Between	4	122,330,609	30,582,652
Within	195	26,554,197	136,175

$$F = \frac{\text{Between M.S.}}{\text{Within M.S.}} = \frac{30,582,652}{136,175} \text{ or } 224.58$$

TABLE 2-A. EFFECT OF FARMING SYSTEMS ON TENANT AVERAGE NET INCOME, LIVESTOCK-SHARE LEASE (LABOR FREE).

Source of variation	d.f.	S.S.	M.S. or S.S./d.f.
Total	199		
Between	4	93,476,972	23,369,243
Within	195	23,910,491	122,618

$$F = \frac{\text{Between M.S.}}{\text{Within M.S.}} = \frac{23,369,243}{122,618} \text{ or } 190.59$$

TABLE 3-A. EFFECT OF FARMING SYSTEMS ON LANDLORD AVERAGE NET INCOME, CROP-SHARE LEASE (FARM MANAGER'S FEE DEDUCTED).

Source of variation	d.f.	S.S.	M.S. or S.S./d.f.
Total	199		
Between	4	317,329	79,332
Within	195	11,365,559	58,285

$$F = \frac{\text{Between M.S.}}{\text{Within M.S.}} = \frac{79,332}{58,285} \text{ or } 1.36$$

TABLE 4-A. EFFECT OF FARMING SYSTEMS ON LANDLORD AVERAGE NET INCOME, LIVESTOCK-SHARE LEASE (FARM MANAGER'S FEE DEDUCTED).

Source of variation	d.f.	S.S.	M.S. or S.S./d.f.
Total	199		
Between	4	22,633,754	5,658,438
Within	195	17,082,618	87,603

$$F = \frac{\text{Between M.S.}}{\text{Within M.S.}} = \frac{5,658,438}{87,603} \text{ or } 64.59183$$

TABLE 5-A. EFFECT OF LEASING SYSTEMS ON TENANT AVERAGE NET INCOME FROM A STEER-HOG SOIL-CONSERVING FARMING SYSTEM (LABOR FREE).

Source of variation	d.f.	S.S.	M.S. or S.S./d.f.
Total	79		
Between	1	164,348.5	164,348.5
Within	78	12,158,479.5	155,877.9423

$$F = \frac{\text{Between M.S.}}{\text{Within M.S.}} = \frac{164,348.5}{155,877.9423} \text{ or } 1.054340964$$

*An F value of 2.41 is significantly different from 0 at the 5-percent probability level where the effect of farming systems is measured, and of 3.96 where the effect of the leasing system is measured. F tests were also applied to paired farming systems but because of space are omitted.

TABLE 6-A. EFFECT OF LEASING SYSTEMS ON TENANT AVERAGE NET INCOME FROM A BEEF COW-HOG SOIL-CONSERVING FARMING SYSTEM (LABOR FREE).

Source of variation	d.f.	S.S.	M.S. or S.S./d.f.
Total	79		
Between	1	185,473.8	185,473.8
Within	78	12,373,962.2	158,640.5410

$$F = \frac{\text{Between M.S.}}{\text{Within M.S.}} = \frac{185,473.8}{158,640.5410} \text{ or } 1.169145030$$

TABLE 7-A. EFFECT OF LEASING SYSTEM ON TENANT AVERAGE NET INCOME FROM A DAIRY-HOG SOIL-CONSERVING FARMING SYSTEM (LABOR FREE).

Source of variation	d.f.	S.S.	M.S. or S.S./d.f.
Total	79		
Between	1	2,086,903.0	2,086,903.0
Within	78	14,894,290.7	190,952.4449

$$F = \frac{\text{Between M.S.}}{\text{Within M.S.}} = \frac{2,086,903.0}{190,952.4449} \text{ or } 10.92891479$$

TABLE 8-A. EFFECT OF LEASING SYSTEM ON LANDLORD AVERAGE NET INCOME FROM A STEER-HOG SOIL-CONSERVING FARMING SYSTEM (FARM MANAGER'S FEE DEDUCTED).

Source of variation	d.f.	S.S.	M.S. or S.S./d.f.
Total	79		
Between	1	5,334,412.05	5,334,412.05
Within	78	6,330,169.50	81,156.01923

$$F = \frac{\text{Between M.S.}}{\text{Within M.S.}} = \frac{5,334,412.05}{81,156.01923} \text{ or } 65.73033153$$

TABLE 9-A. EFFECT OF LEASING SYSTEM ON LANDLORD AVERAGE NET INCOME FROM A BEEF COW-HOG SOIL-CONSERVING FARMING SYSTEM (FARM MANAGER'S FEE DEDUCTED).

Source of variation	d.f.	S.S.	M.S. or S.S./d.f.
Total	79		
Between	1	5,462,215.20	5,462,215.20
Within	78	5,587,629.80	71,636.27949

$$F = \frac{\text{Between M.S.}}{\text{Within M.S.}} = \frac{5,462,215.20}{71,636.27949} \text{ or } 76.24928652$$

TABLE 10-A. EFFECT OF LEASING SYSTEM ON LANDLORD AVERAGE NET INCOME FROM A DAIRY COW-HOG SOIL-CONSERVING FARMING SYSTEM (FARM MANAGER'S FEE DEDUCTED).

Source of variation	d.f.	S.S.	M.S. or S.S./d.f.
Total	79		
Between	1	17,632,542.05	17,632,542.05
Within	78	6,536,894.95	83,806.34551

$$F = \frac{\text{Between M.S.}}{\text{Within M.S.}} = \frac{17,632,542.05}{83,806.34551} \text{ or } 210.3962647$$