Plans for Beginning Farmers In Southwest Iowa With Comparison of Farm And Nonfarm Income Opportunities

by Earl O. Heady, Arthur B. Mackie and Everett G. Stoneberg

Department of Economics and Sociology

Tennessee Valley Authority
cooperating

AGRICULTURAL AND HOME ECONOMICS EXPERIMENT STATION, IOWA STATE COLLEGE

RESEARCH BULLETIN 456 JANUARY 1958 AMES, IOWA

CONTENTS

Plans for Beginning Farmers in Southwest Iowa With Comparison of Farm and Nonfarm Income Opportunities[1]

(An Application of Linear Programming)

BY EARL O. HEADY, ARTHUR B. MACKIE AND EVERETT G. STONEBERG

How scarce resources, especially capital, should be allocated among different crop and livestock enterprises to maximize returns is an ever present problem for all Iowa farmers. It is a problem of particular importance to beginning farmers in southwest Iowa. They not only have limited funds with which to become established in farming but also have been faced with drouth and declining prices in recent years.

Because of the magnitude of planning problems for young farmers, the Iowa Agricultural Extension Service initiated an educational program designed particularly to provide technical assistance and guidance in planning for this group. This research study had been designed to aid in these purposes and relates to problems of beginning farmers in southwest Iowa. Not only is guidance needed on the best organization of resources within the farm, but also an appraisal of income opportunities open to young farmers in farming and in nonfarm employment is needed to facilitate choice and adjustment. Information concerning optimum farm plans is needed to help farmers who wish to and should remain in agriculture to obtain greater profits. Information comparing farm and off-farm income is needed to facilitate choice by young farmers who may feel that income and welfare of their families might be increased by shifting to another occupation.

OBJECTIVES

The main objective of this study is to determine farm plans which (a) best fit the capital, labor and managerial resources of beginning farmers in southwest Iowa and (b) control soil erosion. A collateral objective is to compare income from farming and nonfarm employment open to young farmers in this area. Numerous young families may have chosen farming as an occupation based on the relatively high incomes in the immediate postwar years. With the decline in farm income relative to wage levels in other occupations, many now ask whether they should continue in farming or liquidate their capital holdings and transfer to nonfarm work. The severe drouth and low hog prices of recent years have forced some to take this step.

LOCATION AND FARM CHARACTERISTICS

The benchmark farm situation selected for study is in Mills County, Iowa. It was chosen by the Mills County Extension Service staff as typical of those managed by young tenant farmers in the area. Its predominant soil type is Marshall silt loam with 63 percent (97.8 acres) of the total tillable acres having a slope greater than 4 percent (table 1). The farm is considered to be typical in terms of soil type, farm size and quantity of building and machinery facilities. The farm is 160 acres in size, with 153.4 tillable acres in field crops and pasture and the remaining 6.6 acres used for farmstead buildings, roads and fences.

The service buildings of the farm consist of poultry housing, grain storage facilities, a small dairy barn and a hog house. The poultry housing is adequate for a laying flock of 78 hens. Grain and hay storage facilities are adequate to handle the production from the cropland. Dairy housing is adequate for a herd of three cows and care of replacements. (Dairying is limited for some plans because of lease considerations. See later discussion.) Hog housing consists of 1,692 square feet.

The labor supply includes the time of the operator, supplying 275 man-hours per month from March through October and 260 man-hours from November through February. In addition, the labor supply includes: 90 hours of family labor from April through August; 25 hours each in Sep-

TABLE 1. SOIL CHARACTERISTICS OF MODAL FARM, MILLS COUNTY, IOWA*

Soil type	Total acres	Acres with slope: Less than 4 percent	Acres with slope: Greater than 4 percent	Percent of total
Marshall silt loam	118.8	21.0	97.8	74
Wabash-Judson complex	34.6	34.6	0.0	22
Bldgs., lots and fences	6.6	—	—	4
TOTAL	160.0	55.6	97.8	100
Tillable acres	153.4	—	—	96

*Data obtained from Soil Conservation Service, Mills County, Iowa.

[1]Project 1220, Iowa Agricultural and Home Economics Experiment Station.

tember and October; 15 hours per month from November through February and 75 hours in March. The housewife's labor is assumed to be sufficient for a poultry enterprise. Therefore, poultry does not compete with other enterprises for other labor. The amount of housewife labor available for other enterprises amounts to 1 hour per day during the months of January, February, November and December; 1½ hours per day during March, April, September and October; and 2 hours per day for May, June, July and August.

DESCRIPTION OF ENTERPRISES CONSIDERED

The basic enterprises considered in this study are four crop rotations, a beef cow enterprise, eight feeder cattle enterprises, two dairy enterprises, two poultry enterprises and eight hog enterprises, with spring and fall farrowing considered in four ratios.[2] It is from these several enterprises that an optimum farm plan is to be specified. However, several different techniques are considered for each. The four hog farrowing systems are: spring litters only (1:0 ratio); equal spring and fall litters (1:1 ratio); two spring litters to one fall litter (2:1 ratio); and equal spring, summer and fall litters (1:1:1 ratio). While other crop and livestock enterprises also are available to beginning farmers in southwest Iowa, only those enterprises typical of the area are considered. All enterprises compete freely for the use of resources—except poultry, which competes only for capital. These basic enterprises represent the farm investment opportunities considered in this study.

Crop Enterprises

The rotations considered to be practical for tenants who are beginning farmers and to allow erosion control if used with appropriate mechanical practices, are: a corn-corn-oats-meadow rotation (CCOM), a corn-oats-meadow rotation (COM), a corn-oats-meadow-meadow rotation (COMM) and a corn-corn-oats-meadow-meadow rotation (CCOMM). The meadow mixture for these rotations includes alfalfa, red clover and bromegrass. Fertilization is considered only for those rotations with second-year corn. The rates of fertilization for the two rotations are: (1) no nitrogen fertilizer but P_2O_5 added according to the rotation and (2) 40 pounds of available nitrogen per acre applied on second-year corn for the CCOM rotation, and 30 pounds of available nitrogen per acre applied on the second-year corn for the CCOMM rotation, plus P_2O_5 according to the rotation. No nitrogen fertilization (a zero rate) is considered for the other two rotations.

In the remainder of this study fertilization levels for a given rotation are noted by subscripts. Hence, there are six crop alternatives: (1) $CCOM_O$, (2) $CCOM_N$, (3) COM_O, (4) $COMM_O$, (5) $CCOMM_O$ and (6) $CCOMM_N$. The nutrient combination for the two fertilization levels and the corresponding crop yields are given in tables 2 and 3, respectively. Input-output coefficients or resource requirements for crops are shown in table 4 in total amounts and by percentage distribution in months. In the description of resource requirements or input-output coefficients, a unit of rotation is 1 acre. Hence, a unit of $CCOM_O$ includes ½ acre of corn, ¼ acre of oats and ¼ acre of meadow; a unit of COM_O includes 1/3 acre each of corn, oats and meadow; etc. The inputs shown in table 4 represent the tenant's share.

TABLE 2. POUNDS PER ACRE OF AVAILABLE NUTRIENTS SUPPLIED BY COMMERCIAL FERTILIZER FOR DIFFERENT ROTATIONS AND FERTILIZATION LEVELS.

Rotation	Fertilization levels					
	No nitrogen (O)*			Nitrogen (N)†		
	N	P	K	N	P	K
Corn, first year	0	30	0	0	30	0
Corn, second year	0	30	0	40	30	0
Oats	0	20	0	0	20	0
Meadow	0	0	0	0	0	0
Corn, first year	0	30	0	—	—	—
Oats	0	30	0	—	—	—
Meadow	0	0	0	—	—	—
Corn, first year	0	40	0	—	—	—
Oats	0	40	0	—	—	—
Meadow	0	0	0	—	—	—
Meadow	0	0	0	—	—	—
Corn, first year	0	33	0	0	33	0
Corn, second year	0	33	0	30	33	0
Oats	0	33	0	0	33	0
Meadow	0	0	0	0	0	0
Meadow	0	0	0	0	0	0

*Subscript O in later tables refers to this fertlization practice without nitrogen.

†Subscript N in later tables refers to this fertilization practice with nitrogen.

Livestock Enterprises

Eleven livestock enterprises are considered to be alternatives for either average or above-aver-

TABLE 3. ESTIMATED CROP YIELDS FOR DIFFERENT FERTILIZATION LEVELS ON MARSHALL SILT LOAM SOILS.*

Rotation	Unit	Fertilization levels	
		No nitrogen (O)	Nitrogen (N)
Corn, first year	bu.	71.74	71.74
Corn, second year	bu.	61.28	71.28
Oats	bu.	29.54	29.54
Meadow	ton	2.18	2.18
Corn, first year	bu.	71.92	——
Oats	bu.	32.23	——
Meadow	ton	1.84	——
Corn, first year	bu.	70.85	——
Oats	bu.	31.69	——
Meadow	ton	2.41	——
Meadow	ton	2.26	——
Corn, first year	bu.	72.10	72.10
Corn, second year	bu.	65.14	70.18
Oats	bu.	29.42	29.42
Meadow	ton	2.07	2.07
Meadow	ton	2.50	2.50

*Ten-year (1945-54) average yields for experiment station farm, Clarinda, Iowa and adjusted downward by 20 percent for actual farm conditions.

[2]As pointed out later, only half of these numbers for cattle feeding, dairy cows, hogs and poultry are considered for average or above-average managers.

TABLE 4. TENANT'S SHARE, UNDER A LIVESTOCK-SHARE LEASE, OF BASIC INPUTS FOR VARIOUS CROP ROTATIONS IN MILLS COUNTY, IOWA.

Inputs	Unit	Crop rotations* (per acre unit)					
		$CCOM_O$	$CCOM_N$	$CCOMM_O$	$CCOMM_N$	COM_O	$COMM_N$
Constant costs†	dol.	9.88	9.88	8.54	8.54	8.72	7.34
Fertilizer costs	dol.	1.09	1.83	1.09	1.51	1.09	1.09
Harvest costs	dol.	5.88	6.21	4.81	4.95	5.22	3.88
Total tenant capital	dol.	16.85	17.92	14.44	15.00	15.03	12.31
Labor:							
January	hr.	—	—	—	—	—	—
February	hr.	—	—	—	—	—	—
March	hr.	0.09	0.09	0.07	0.07	0.12	0.09
April	hr	0.64	0.64	0.51	0.51	0.57	0.43
May	hr.	0.77	0.77	0.62	0.62	0.51	0.39
June	hr.	0.46	0.46	0.37	0.37	0.31	0.23
July	hr.	0.84	0.84	0.67	0.67	0.87	0.66
August	hr.	0.47	0.47	0.38	0.38	0.63	0.47
September	hr.	0.07	0.07	0.06	0.06	0.05	0.04
October	hr.	0.52	0.52	0.41	0.41	0.35	0.26
November	hr.	0.71	0.71	0.57	0.57	0.48	0.36
December	hr.	0.18	0.18	0.15	0.15	0.12	0.09

*Subscripts on each rotation indicate rate of fertilization for corn (see table 2). An acre unit is an average acre of the crops in the rotation. For example, an acre of CCOM would contain ½ acre corn and ¼ acre each of oats and meadow.

†Includes fuel, grease, repairs, maintenance of tractors and machinery, and seed costs involved in planting and growing crops.

age tenant managers who are beginning farmers. As part of the analysis considering the farm income under different management levels, input-output coefficients assuming both average management and above-average management are included for all types of livestock. Managerial ability is measured in a technical sense as the amount of output obtained per unit of resource input. A preferable measurement of management would include ability of the farmer to form accurate expectations, to devise plans consistent with these expectations and to adopt precautionary measures consistent with the family's personal circumstances. However, these additional aspects of management could not be measured and incorporated into the analysis.

The terms *average* and *above-average* in respect to management, do not represent estimates for the universe of beginning farmers in southwest Iowa. They are simply used as a basis of illustrating the need for different plans or occupational choices with differences in managerial ability. The livestock resource requirements for the tenant are summarized in tables 5 and 6. A brief summary of each livestock enterprise follows.

DAIRY WITH AVERAGE MANAGEMENT

This enterprise includes cows with an annual production of 228 pounds of butterfat, 4,569 pounds of skimmilk and beef sold from veal calves and cull cows. The productive life of each cow is 4 to 5 years. Annual replacement stock includes the equivalent of one-third of a calf, one-third of a yearling and one-fourth of a 2-year-old. Total feed, capital, labor and building requirements, as well as the net return above variable costs, are calculated on the unit basis of one cow and corresponding replacement stock.

DAIRY WITH ABOVE-AVERAGE MANAGEMENT

This enterprise is a small dairy herd with use of good management practices where total annual production includes 9,430 pounds of milk per cow and beef sold from veal calves and cull cows. The productive life of each cow is 5 years. Total feed, capital, labor and building requirements are based on one cow and corresponding replacements which include the equivalent of one-third of a calf, one-third of a yearling and one-fourth of a 2-year-old. Net return above variable costs for this enterprise is also calculated on the unit basis of one cow and replacement stock.

SPRING PIGS WITH AVERAGE MANAGEMENT (1:0 RATIO)

This hog system includes pigs farrowed in April, fed out on pasture and marketed in October at a weight of 225 pounds. Litters average 6.8 pigs weaned, with one gilt saved for farrowing in the following year. Pork sold per litter, including a 300-pound sow, averages 1,524 pounds. Death loss is estimated at 5 percent after weaning. Total feed, capital, labor and building requirements and net return above variable costs for this enterprise are calculated on the unit basis of one sow and litter.

SPRING PIGS WITH ABOVE-AVERAGE MANAGEMENT (1:0 RATIO)

This hog system includes pigs farrowed in March, fed out on pasture and marketed in September at a weight of 225 pounds. Litters average 7.3 pigs weaned per sow, but one gilt is saved for farrowing the following year. Pork sold per litter, including a 300-pound sow, averages 1,675 pounds. Death loss is estimated at 3 percent after weaning. Total feed, capital, labor and building

TABLE 5. BASIC INPUT-OUTPUT DATA FOR LIVESTOCK ENTERPRISES WITH AVERAGE MANAGEMENT UNDER A LIVESTOCK-SHARE LEASE.

Item	Unit	Hog litters				Dairy cows (per cow plus replac.)	Beef cows (per cow plus replac.)	Feeder calves deferred fed on pasture (per head)	Medium yearling steers (per head)	Poultry (per hen)
		1:0 ratio (per litter)	1:1 ratio (per 2 litters)	2:1 ratio (per 3 litters)	1:1:1 ratio (per 3 litters)					
Inputs:										
Tenants' capital*	dol.	64.46	109.94	173.84	198.44	222.89†	101.30	66.84	73.09	3.67†
Corn equivalent‡	bu.	118.90	250.00	368.90	368.90	44.70	4.77	40.00	15.00	1.60
Hay equivalent‡	ton	0.70	0.70	1.40	1.40	6.50	5.47	2.00	1.25	——
Housing‡	sq. ft.	38.60	63.50	77.30	63.50	84.00	——	——	——	4.12
Labor:‡										
January	hr.	20.50	4.48	6.98	6.77	13.64	2.04	0.23	1.00	——
February	hr.	2.05	4.48	6.17	6.37	13.02	2.04	0.23	0.75	——
March	hr.	2.47	4.48	5.47	5.68	13.64	2.27	0.23	1.50	——
April	hr.	2.60	11.62	16.35	10.81	11.78	1.53	0.23	1.50	——
May	hr.	2.37	5.61	3.76	4.25	9.30	0.77	0.11	1.25	——
June	hr.	2.16	3.60	3.53	9.56	15.88	2.84	2.16	——	——
July	hr.	2.16	3.48	6.03	4.86	7.44	2.54	1.86	——	——
August	hr.	2.16	3.48	5.97	4.80	15.25	0.77	0.11	——	——
September	hr.	2.05	3.48	6.09	6.55	7.44	2.26	3.65	——	——
October	hr.	2.05	6.08	10.63	9.62	15.36	0.77	3.10	——	——
November	hr.	2.03	4.78	7.06	7.26	10.54	1.01	2.98	1.00	——
December	hr.	1.85	3.95	6.98	8.46	12.40	1.53	2.86	1.00	——
Outputs:‡										
Meat	lbs.	1,524.00	3,052.00	4,575.00	4,550.00	387.30	438.00	550.00	300.00	4.87
Milk	lbs.	——	——	——	——	6,000.00	——	——	——	——
Eggs	doz.	——	——	——	——	——	——	——	——	15.00
Tenants' return*	dol.	16.25	26.33	42.61	30.26	112.04†	22.75	23.10	14.64	0.43†

*Based on 50-50 livestock-share lease.

†The tenant furnishes all inputs and gets all returns from dairy and poultry enterprises. Number cows limited to three, except where dairying is considered under a crop-share lease.

‡Total requirements per unit of enterprise.

TABLE 6. BASIC INPUT-OUTPUT DATA FOR LIVESTOCK ENTERPRISES WITH ABOVE-AVERAGE MANAGEMENT UNDER A LIVESTOCK-SHARE LEASE.

Item	Unit	Hog litters				Dairy cows (per cow plus replace.)	Medium yearling steers (per head)	Choice calves deferred fed on pasture (per head)	Choice calves drylot (per head)	Choice yearlings deferred fed on pasture (per head)	Poultry (per hen)
		1:0 ratio (per litter)	1:1 ratio (per 2 litters)	2:1 ratio (per 3 litters)	1:1:1 ratio (per 3 litters)						
Inputs:											
Tenants' capital*	dol.	70.91	120.21	190.57	215.15	284.87†	77.03	83.20	90.15	97.73	3.83†
Corn equivalent‡	bu.	96.50	202.90	299.40	299.40	66.00	33.00	50.00	61.00	50.50	1.70
Hay equivalent‡	ton	0.70	0.70	1.40	1.40	6.80	0.70	1.60	0.70	2.40	——
Housing	sq. ft.	42.70	70.10	85.30	70.10	84.00	——	——	——	——	4.12
Labor:‡											
January	hr.	1.48	4.48	6.17	6.77	14.19	2.10	1.08	1.00	0.51	——
February	hr.	1.48	4.48	5.47	6.37	13.55	2.10	1.06	0.99	0.51	——
March	hr.	5.98	11.62	16.35	10.81	14.19	2.10	1.06	0.99	0.51	——
April	hr.	1.51	5.61	3.76	4.25	12.26	2.10	1.49	1.39	0.51	——
May	hr.	1.51	3.60	3.53	4.86	9.68	1.05	2.42	2.51	2.49	——
June	hr.	2.16	3.48	6.03	9.56	17.39	1.34	9.03	3.92	4.48	——
July	hr.	2.16	3.48	5.97	5.63	7.74	——	2.42	2.51	2.49	——
August	hr.	1.69	3.48	6.09	4.80	16.60	1.14	8.77	3.71	4.18	——
September	hr.	3.12	6.08	10.63	9.62	7.74	——	1.07	——	2.49	——
October	hr.	1.69	4.78	7.06	6.55	16.61	0.97	2.34	2.97	1.62	——
November	hr.	1.69	3.95	6.98	7.26	10.97	2.10	1.06	0.99	0.31	——
December	hr.	1.48	4.48	6.98	8.46	12.90	2.10	1.08	1.00	0.31	——
Outputs:‡											
Meat	lbs.	1,675.00	3,352.00	5,027.00	5,002.00	387.30	287.00	560.00	550.00	487.00	4.87
Milk	lbs.	——	——	——	——	9,430.00	——	——	——	——	——
Eggs	doz.	——	——	——	——	——	——	——	——	——	19.20
Tenants' return*	dol.	48.81	84.22	132.42	112.30	205.53†	15.58	26.19	17.20	24.71	1.39†

*Based on 50-50 livestock-share lease.

†The tenant furnishes all inputs and gets all returns from dairy and poultry enterprises. Dairy cows limited to three, under livestock-share lease.

‡Total requirements per unit of enterprise.

requirements and returns for this enterprise are calculated on the unit basis of one sow and litter.

SPRING AND FALL PIGS WITH AVERAGE MANAGEMENT (1:1 RATIO)

This hog system includes equal spring and fall litters with farrowing in April and October. Spring pigs are fed out on pasture and marketed at a weight of 225 pounds in October; fall pigs are fed on drylot and marketed at a weight of 225 pounds in April. Sows farrow two litters and are sold after fall farrowings. Litters average 6.8 and 6.7 pigs weaned per sow for spring and fall farrowings, respectively. Pork sold for this system, including 400 pounds of sow, averages 3,052 pounds per sow for two litters. Death loss after weaning is estimated at 5 percent. Total feed, capital, labor and building requirements and returns for this enterprise are calculated on the unit basis of one sow and two litters.

SPRING AND FALL PIGS WITH ABOVE-AVERAGE MANAGEMENT (1:1 RATIO)

This hog system differs from the one immediately above only through above-average management. Litters are farrowed in March and September. Spring pigs are fed out on pasture and marketed at a weight of 225 pounds in September, while the fall pigs are fed on drylot and marketed at a weight of 225 pounds in March. Sows farrow two litters and are sold after fall farrowings. Litters average 7.3 and 7.2 pigs weaned per sow for spring and fall farrowings, respectively. Pork sold for this system, including 400 pounds of sow, averages 3,352 pounds per sow. The death loss after weaning is estimated at 3 percent. Total feed, capital, labor and building requirements and net return again are calculated on the unit basis of one sow and two litters.

SPRING AND FALL PIGS WITH AVERAGE MANAGEMENT (2:1 RATIO)

This hog system includes twice as many spring as fall litters. The spring pigs are farrowed in April, fed out on pasture and marketed at a weight of 225 pounds in October. Fall pigs are farrowed in October, fed on drylot and marketed at a weight of 225 pounds in April. Half of the sows farrow two litters a year and are sold after fall farrowings; the remainder farrow only one litter and are sold after spring farrowings. Litters average 6.8 and 6.7 pigs weaned per sow for spring and fall farrowings, respectively. Pork sold for this enterprise, including 700 pounds of sow, averages 4,575 pounds per unit of two sows and three litters. Death loss after weaning is estimated at 5 percent. Total feed, capital, labor and building requirements and returns for this enterprise are calculated on the unit basis of two sows and three litters.

SPRING AND FALL PIGS WITH ABOVE-AVERAGE MANAGEMENT (2:1 RATIO)

This system parallels the preceding one but includes above-average management. Spring pigs are farrowed in March, fed out on pasture and marketed at a weight of 225 pounds in September. Fall pigs are farrowed in September, fed on drylot and marketed at a weight of 225 pounds in March. Litters average 7.3 and 7.2 pigs weaned per sow for spring and fall farrowings, respectively. Total feed, capital, labor and building requirements and returns for this enterprise are calculated on this same unit basis. Pork sold, including 700 pounds of sow, averages 5,027 pounds per unit of two sows and three litters. Death loss after weaning is estimated at 3 percent.

SPRING, SUMMER AND FALL PIGS WITH AVERAGE MANAGEMENT (1:1:1 RATIO)

This hog system includes an equal ratio of spring, summer and fall litters with farrowings in April, June and October. Spring and summer pigs are fed out on pasture and marketed at a weight of 225 pounds in October and December, respectively. Fall pigs are fed on drylot and marketed at a weight of 225 pounds in April. Sows farrow one litter a year and are sold after each farrowing at a weight of 300 pounds. Litters average 6.8 pigs weaned per sow for spring and summer farrowings, with 6.7 pigs weaned per sow for fall farrowing. Pork sold for this system, including 900 pounds of sow, averages 4,550 pounds per unit of three litters. Total feed, capital, labor and building requirements and returns for this enterprise also are calculated on the unit basis of three sows and three litters. The death loss after weaning is estimated at 5 percent for all litters.

SPRING, SUMMER AND FALL PIGS WITH ABOVE-AVERAGE MANAGEMENT (1:1:1 RATIO)

This hog system is the same as the preceding one but includes above-average management practices, with litters farrowed in March, July and September. Spring and summer pigs, fed out on pasture, are marketed at a weight of 225 pounds in September and January, respectively. Fall pigs are fed on drylot and marketed at a weight of 225 pounds in March. Sows farrow one litter a year and are sold after farrowing at a weight of 300 pounds. Litters average 7.3 pigs weaned per sow for spring and summer farrowings, with 7.2 pigs weaned per sow for fall farrowings. Pork sold for this system, including 900 pounds of sow, averages 5,002 pounds per unit of three litters. Death loss after weaning is estimated at 3 percent for all litters Total feed, capital, labor and building requirements are on a unit basis of three litters.

POULTRY WITH AVERAGE MANAGEMENT

This laying flock is supplementary in use of labor and buildings and is replaced with new stock each year. It does not compete with other enterprises for limited resources except capital. Annual production is 180 eggs per hen. An average of 1.25 sexed chicks per hen is purchased each year to supply potential layers. Culling and mortality

rates for hens are estimated at 11 percent and 15 percent, respectively, of the total number of young chickens raised. Chick mortality is estimated at 10 percent of the total number purchased. Resource requirements and returns are based on a unit of one hen and 1.25 sexed chicks.

POULTRY WITH ABOVE-AVERAGE MANAGEMENT

This enterprise is the same as the preceding one except for management practices. Annual production is 230 eggs per hen. Resource requirements are on the same unit basis as the average-management plan.

MEDIUM YEARLING STEERS WITH AVERAGE MANAGEMENT

For this enterprise, medium yearling feeder steers are purchased at a weight of 670 pounds in November, wintered primarily on roughage and put on full feed in late winter. They are fed out in drylot to grade good and are marketed in April or May. Market weight averages 957 pounds per head sold. Death loss is 1.5 percent of purchase weight. Resource requirements and returns are calculated on the unit basis of one head.

MEDIUM YEARLING STEERS WITH ABOVE-AVERAGE MANAGEMENT

This enterprise is the same as the preceding one but assumes above-average management in feeding, buying and selling. This differential is expressed in a price differential at selling time of $1.25 per hundredweight.

FEEDER CALVES FED IN DRYLOT WITH AVERAGE MANAGEMENT

In this calf enterprise, good to choice feeders are bought in October at about 430 pounds, wintered on roughage and limited grain and put on full feed in drylot in early summer. They are fed out to grade choice and marketed in August. Market weight averages 980 pounds per head sold, and death loss is 2.5 percent of purchase weight. Resource requirements and returns are calculated on a unit basis of one head.

FEEDER CALVES FED IN DRYLOT WITH ABOVE-AVERAGE MANAGEMENT

With above-average management, this enterprise is the same as the preceding one except that a price differential of $1.50 per hundredweight is realized at marketing.

FEEDER CALVES WITH AVERAGE MANAGEMENT DEFERRED-FED ON PASTURE

Good to choice calves in this enterprise are purchased in October at weights of about 430 pounds. They are wintered on roughage and limited grain and are put on full feed on pasture the following spring. They are fed out to grade choice and marketed in September. Market weight averages 990 pounds per head sold, with a death loss of 2.5 percent of purchase weight. Resource requirements and returns are calculated on a unit basis of one head.

FEEDER CALVES WITH ABOVE-AVERAGE MANAGEMENT DEFERRED-FED ON PASTURE

With above-average management, this enterprise is the same as the preceding one except for a price differential of $1.50 at marketing.

CHOICE YEARLING STEERS WITH AVERAGE MANAGEMENT DEFERRED-FED ON PASTURE

Choice yearling feeder steers for this activity are purchased at a weight of 621 pounds in October. They are wintered on roughage and limited grain and are put on full feed on pasture the following spring. Steers are fed out to grade choice and marketed in August. Market weight averages 1,108 pounds per head sold, and death loss is 1.5 percent of purchase weight. Resource requirements and returns are calculated on a unit basis of one head.

CHOICE YEARLING STEERS WITH ABOVE-AVERAGE MANAGEMENT DEFERRED-FED ON PASTURE

With above-average management, this enterprise is the same as the preceding except for a price differential of $1.25 at marketing.

BEEF COWS

This particular enterprise is considered to be essentially the same under either above-average or average management and assumes a calf crop of 90 percent. Calves are marketed at 400 pounds. Unit prices and requirements are computed on a per-cow basis. Requirements include those for replacement stock. Prices include a representative proportion of cull cows separated from the herd and consider that some heifer calves are held back for replacement.

Input-output coefficients are shown in table 5 for all livestock enterprises under average management which come into feasible solutions during the programming process. Table 6 includes the same data for livestock enterprises under above-average management. (Labor requirements for crops are given in table 4 in total amounts and by percentage distribution in months.)

TECHNIQUE FOR PLANNING

The empirical technique used in this study is linear programming. The logic and technique of this method have been presented elsewhere and are not repeated.[3]

Particular Linear Programming Application

The objective of a farm, when viewed as a business unit, is not to maximize net returns to any

[3]Dorfman, Robert. Application of linear programming to the theory of the firm. University of California Press, Los Angeles. 1952; Bowlen, B. and Heady, Earl O. Optimum combination of competitive crops at particular locations. Iowa Agr. Exp. Sta. Res. Bul. 426. 1955; Heady, Earl O. and Gilson, J. C. Optimum combinations of livestock enterprises and management practices on farms including supplementary dairy and poultry enterprises. Iowa Agr. Exp. Sta. Res. Bul. 437. 1956; McKee, Dean E., Earl O. Heady and G. M. Scholl. Optimum allocation of resources between pasture improvement and other opportunities on southern Iowa farms. Iowa Agr. Exp. Sta. Res. Bul. 435. 1956.

particular enterprise but rather, to maximize income for the whole farm from a given stock of resources. Hence, some method is needed whereby an approximation can be made of the returns from the many alternative uses of these resources. Linear programming is a mathematical technique permitting the simultaneous consideration of many hundreds of possible plans, given the enterprise requirements, resource limitations and prices. By simultaneously selecting the most profitable combination of crops and livestock, the method allows approximation of actual planning conditions under which decisions are made.[4]

Activities or Investment Opportunities

This study considers a total of 20 separate activities each for the average and above-average management situations previously designated. The activities include the six crop activities and the 11 livestock activities outlined on earlier pages, grain buying, grain selling and a forage activity. Linear programming is used to select the one combination of activities, among hundreds of possible combinations, which will maximize returns under different soil, capital, labor, management and leasing restrictions.[5]

A rotation with no application of fertilizer is an activity differing from the same rotation with fertilization. Likewise, a rotation with one sequence of crops is a different activity than another rotation with a different sequence of the same crops. Since two rotations (CCOM and CCOMM) are considered at two levels of fertilization, each rotation gives rise to two crop activities. These four crop activities, together with the COM and COMM with no fertilization, constitute the total of six crop activities considered. Each crop activity, in turn, competes with all other activities for the use of available resources. The different livestock activities considered in this study compete both with each other and with crop activities for the use of resources. Two activities, corn buying and selling, are considered in order to allow tenants to expand livestock beyond the grain produced on the farm when sufficient capital, labor and building space are available. A forage activity is included to allow independent determination of optimum crop and livestock enterprises.

The problem in this study is that of function

(1) Maximize $f(X) = c' X$

(1) where we wish to maximize a linear function of X (i.e., maximize profit); c is a matrix of net prices for activities or enterprises while X is a matrix of activity levels (i.e., amounts of enterprises produced).

[4]As a planning technique, linear programming has been used in other studies dealing with the problems of beginning farmers. See: Heady, Earl O. and others. Optimum farm plans for beginning farmers on Tama-Muscatine soils. Iowa Agr. Exp. Sta. Res. Bul. 440. 1956; and Mackie, Arthur B., Heady, Earl O. and Howell, H. B. Optimum farm plans for beginning tenant farmers on Clarion-Webster soils. Iowa Agr. Exp. Sta. Res. Bul. 449. 1957.

[5]Dorfman, R. Application of linear programming to the theory of the firm, op. cit.

This function must be maximized, subject to the restrictions of equations (2) and (3).

(2) $AX \leqq S$

(3) $X \geqq 0$

In equation (2), A is the matrix of input-output coefficients, and S is the matrix of resource supplies available to the tenant. Equation (3) simply states that none of the activity levels can be negative. In terms of the 20 farm activities previously described and the 21 restrictions for the optimum plan, the set of equations defining the use of resources are those of equation (4), (i=1,2, ... 21) (j=1,2, . . . 20).

$$
(4) \quad \begin{array}{l}
a_{11} x_1 + a_{12} x_2 + \ldots\ldots a_{1j} x_j + \ldots\ldots + a_{1n} x_n = s_1 \\
a_{21} x_1 + a_{22} x_2 + \ldots\ldots a_{2j} x_j + \ldots\ldots + a_{2n} x_n = s_2 \\
a_{i1} x_1 + a_{i2} x_2 + \ldots\ldots a_{ij} x_j + \ldots\ldots + a_{in} x_n = s_i \\
a_{m1} x_1 + a_{m2} x_2 + \ldots\ldots a_{mj} x_j \ldots\ldots\ldots a_{mn} x_n = s_m
\end{array}
$$

In these equations the a_{ij} values refer to the tenant's share of input per unit of output produced. (See later discussion of leasing arrangements.) The net prices in the c matrix are computed from the tenant's share of the product and his contribution of costs per unit of activity. Restrictions refer to those relating to the tenant and his rental agreement. The 21 restrictions placed on the main program computed are, accordingly, those that follow. The amount of tenant capital, s_4, is not specified here because it is set at several levels in actual computations of programs. This procedure is followed to allow examination of how differences in capital availability affect the optimum plan for beginning farmers.

The capital quantities mentioned as programming restrictions do not include machinery investment. However, machinery investment, on a second-hand basis, is included in total capital requirements. If machinery is purchased new, the total capital would be increased by $5,720. The amount of forage, s_9, is not predetermined but will be equal to an amount consistent with the maximum profit plan. In other words, both crop and livestock systems are considered to be variable, and the amount of forage to be produced is that consistent with the best combination of rotations and livestock. Grain is the only resource for which requirements, including buying and selling, must just exactly equal the supply. Housewife labor in each month for handling poultry is not included in restrictions. The amount of housewife labor available allows a poultry enterprise exceeding that allowed by poultry housing. Poultry does not use other farm labor. In the list of restrictions following, a_{ij} refers to the input-output coefficient of the jth activity or enterprise for the ith resource restriction, These quantities are those indicated as input coefficients or resource requirements in tables 4, 5 and 6. The amounts of resources are those listed below:

Marshall silt loam, less 4 percent slope:

$$\sum_{j=1}^{20} a_{1j}x_j \leqq 118.8 \text{ acres}$$

Marshall silt loam, 4 percent slope or over:

$$\sum_{j=1}^{20} a_{2j}x_j \leqq 97.8 \text{ acres}$$

Wabash-Judson silt loam, less than 4 percent slope:

$$\sum_{j=1}^{20} a_{3j}x_j \leqq 34.6 \text{ acres}$$

Capital:

$$\sum_{j=1}^{20} a_{4j}x_j \leqq s_4$$

Poultry building space:

$$\sum_{j=1}^{20} a_{5j}x_j \leqq 321 \text{ sq. ft.}$$

Hog building space:

$$\sum_{j=1}^{20} a_{6j}x_j \leqq 1{,}692 \text{ sq. ft.}$$

Dairy cattle building space (for main situations):

$$\sum_{j=1}^{20} a_{7j}x_j \leqq 3 \text{ cows}$$

Forage:

$$\sum_{j=1}^{20} a_{8j}x_j \leqq s_9$$

Grain:

$$\sum_{j=1}^{20} a_{9j}x_j \leqq \text{Zero}$$

March labor:

$$\sum_{j=1}^{20} a_{10j}x_j \leqq 335 \text{ hr.}$$

April labor:

$$\sum_{j=1}^{20} a_{11j}x_j \leqq 350 \text{ hr.}$$

May labor:

$$\sum_{j=1}^{20} a_{12j}x_j \leqq 350 \text{ hr.}$$

June labor:

$$\sum_{j=1}^{20} a_{13j}x_j \leqq 350 \text{ hr.}$$

July labor:

$$\sum_{j=1}^{20} a_{14j}x_j \leqq 350 \text{ hr.}$$

August labor:

$$\sum_{j=1}^{20} a_{15j}x_j \leqq 350 \text{ hr.}$$

September labor:

$$\sum_{j=1}^{20} a_{16j}x_j \leqq 285 \text{ hr.}$$

October labor:

$$\sum_{j=1}^{20} a_{17j}x_j \leqq 285 \text{ hr.}$$

November labor:

$$\sum_{j=1}^{20} a_{18j}x_j \leqq 275 \text{ hr.}$$

December labor:

$$\sum_{j=1}^{20} a_{19j}x_j \leqq 275 \text{ hr.}$$

January labor:

$$\sum_{j=1}^{20} a_{20j}x_j \leqq 275 \text{ hr.}$$

February labor:

$$\sum_{j=1}^{20} a_{21j}x_j \leqq 275 \text{ hr.}$$

The resource restrictions shown are those for the main analysis of the study. However, as explained later, some variations are made in restrictions and activities—by changing leasing requirements, omitting cattle feeding under average management, lessening resource supplies for "variable enterprises," where dairy and poultry are forced in for "risk" precaution purposes, etc. However, changes in restrictions will not be restated at each point in this study. When corn and forage requirements for livestock are not in the same ratio as the production of corn and forage, any surplus forage will go unused while any surplus corn can be sold. Likewise, any deficit of corn can be purchased. Grain supplies are in terms of the tenant's share; he receives all the hay under crop-share leasing.

UNITS OF OUTPUT

The unit levels of output of all activities are chosen arbitrarily, with the outputs, inputs and unit prices stated in relation to the magnitude of the unit. The unit chosen for crops is 1 acre, with outputs expressed separately for grain and hay. The net price for crops includes only the sale of grain, since hay is assumed to have a zero market price. If not consumed by livestock, hay would go unused. The units chosen for livestock are the animals, birds or litters. Net prices and resource requirements per unit of output are shown in tables 4, 5, 6 and 7 for the various activities.

Prices and Input-Output Coefficients

Prices used in computing the optimum plans are included in table 7. The pricing method used in this study attempts to maintain the average historical price relationships among items purchased and sold by the farmer, while adjusting all prices relative to a $1.20 net price for corn (market price in the locality less costs of hauling and handling). This adjustment is accomplished by taking the ratio of the average price of each item to the average price of corn for each period and multiplying this ratio by a $1.20 price for corn. The period used for all items except hogs and feeder cattle is 1950-55. The periods used to compute hog and feeder cattle prices are 1947-55 and 1935-55, respectively. Prices per unit of product (but not per unit of activity) are shown in table 7.

Net prices are used for calculation of optimum farm plans. These are calculated on the basis of the share of inputs and outputs furnished or realized respectively by the tenant under the two types of leases for which programs are computed.

The net price is the gross price per unit of each activity minus the annual variable costs associated with production of one unit of the particular activity. The gross price for each activity is computed by multiplying the various products produced per unit (i.e., per acre or per head, etc.) of this activity by the individual product prices. The prices of all factors and products are held constant throughout this study.

TABLE 7. PRICES USED FOR PLANNING

Item	Unit	Purchase price ($)	Selling price ($)
Seed and fertilizer:			
Corn	bu.	11.50	——
Oats	bu.	1.00	——
Nitrogen (N)	lb.	0.14	——
Phosphorus (P_2O_5)	lb.	0.11	——
Potassium (K_2O)	lb.	0.06	——
Feed and grain:			
Corn	bu.	1.30	1.20
Oats	bu.	0.68	0.63
Cattle supplement	cwt.	4.42	——
Hog supplement	cwt.	5.50	——
Laying mash	cwt.	4.58	——
Livestock and livestock products:			
Medium yearlings*	cwt.	15.21	18.49
Choice feeder calves (drylot)*	cwt.	19.79	21.91
Choice feeder calves (pasture)*	cwt	19.79	22.10
Choice yearling steers (pasture)*	cwt.	18.85	21.91
Cull dairy cows	cwt.	——	15.42
Veal calves	cwt.	——	18.54
Medium dairy cows	head	——	153.90
Good dairy cows	head	——	200.00
Butterfat	lb.	——	0.61
Milk (3.7% grade A)	cwt.	——	3.67
Sows	cwt.	15.84	14.61
March-market hogs	cwt.	——	16.88
April-market hogs	cwt.	——	16.53
September-market hogs	cwt.	——	18.00
October-market hogs	cwt.	——	16.41
November-market hogs	cwt.	——	16.66
December-market hogs	cwt.	——	15.00
January-market hogs	cwt.	——	16.34
Eggs	doz.	——	0.28
Farm chickens	lb.	——	0.14
Broilers	lb.	——	0.22

*Prices shown are for above-average management. Prices for sales under average management are $1.25 per cwt. less than those shown here for yearlings and $1.50 for calves.

Capital coefficients and costs

The capital requirements (investment and operating expenses) for each enterprise are given in tables 4, 5 and 6 and relate to the tenant's share under the livestock-share lease outlined later. The requirements or coefficients are the same for crops under a crop-share lease, except for capital. In plans which assume a crop-share lease, capital coefficients are not shown but consider the fact that the tenant owns all livestock. Capital requirements are annual cash expense for crops and do not include the harvest cost for hay unless hay is actually harvested. Crop capital requirements (annual expenses) are given on the unit basis (1 acre) explained earlier. The machinery investment (not shown in the tables) for crop production has been treated as a fixed cost since a given amount must be owned by the tenant before the farm can be planted to any rotation. Items included in annual cash expense for crops are such items as seed, fertilizer, insecticides, seed treatments, feed and machinery repairs associated with crop production. Annual expense for livestock includes such items as fuel and repairs for livestock equipment, veterinary fees, insurance, replacement stock and other miscellaneous expenses. Investment in livestock equipment (but not in buildings since the tenant does not share these costs) is treated as a part of the capital investment, since it is not required unless livestock are included in a farm plan.

The capital coefficients in tables 5 and 6 are the tenant's share of total annual expenses, plus equipment and investment in livestock for the various livestock enterprises. They indicate the amount of capital for the tenant, necessary to produce one unit of each enterprise, with units of the magnitude described previously. While the plans shown later include the total numbers of animals or crop acres to be shared by the tenant and landlord, the inputs shown are only those furnished by the tenant per *farm unit* of output.

An interest charge has not been made for capital used in computing plans in this study. If the capital must be obtained from credit sources, income would be lowered by the corresponding interest charge. For example, if $5,000 of the capital used for a plan is borrowed and if the interest charge is 6 percent, then the profits indicated by the plan would be lowered by $300.

Lease Considerations

The two types of leasing arrangements considered in this study are livestock-share and crop-share. Since the livestock-share is a typical lease in southwestern Iowa, the major concern of this study deals with optimum farm plans under this leasing arrangement. Optimum plans are computed for crop-share rented farms to determine how income and farm organizations differ with

type of lease, since it is known that leasing arrangements affect efficiency of production.[6]

Under a livestock-share lease in the area, landlord and tenant each receive half of the total livestock and crop production and sales. Supplementary dairy and poultry enterprises are not shared but are allowed solely for the tenant. Typically, the livestock-share tenant furnishes all of the labor and machinery and pays for half of the cost for seed, fertilizer, livestock and livestock equipment. He pays for all of the machine operating expenses. A limit of three cows is placed on the tenant's dairy enterprise in this study.

Crop-share rental rates include half of the corn and two-fifths of the oats. A cash rent of $9 per acre is paid for meadow and hay land. The tenant receives all of the production from livestock and furnishes all of the inputs except permanent buildings. He furnishes all of the machinery and labor needed by the farm business. The cost of seed, fertilizer and custom harvesting of oats is shared equally by landlord and tenant. However, the tenant bears all of the harvest cost for corn and other operating expenses.

OPTIMUM FARM PLANS FOR LIVESTOCK-SHARE LEASE

Profit-maximizing plans for tenants with a livestock-share lease are presented in this section. Plans computed have the restriction that production cannot exceed the resource supplies outlined earlier. If needed, grain can be purchased to expand livestock production beyond the grain produced on the farm. In the following tables, the amount of corn sold or purchased for each plan is indicated in the column "corn surplus or deficit." A plus sign signifies corn sold, while a minus sign indicates the number of bushels purchased. Where grain must be purchased, 10 cents is charged above the market price to cover hauling and handling costs.

Returns for the plans presented in the following tables do not have a fixed cost subtracted. The return for each plan represents income to the tenant as owner of resources typically owned by the tenant. A list of the fixed costs is given in the Appendix (table A-4). These fixed costs may be subtracted from the indicated returns for each plan if figures of net profit are desired. Fixed costs, under the situation studied, will average about $800, with depreciation figured on used machinery. Hence, as an average, about $800 should be subtracted from the returns shown later, if net profit is to be computed. Also an additional amount should be subtracted to cover the interest on any borrowed capital, an item which varies among farms. While only net return is shown in the tables, differences in net profit will be the same as differences in returns as defined here. This is true since fixed or overhead costs do not vary with the plan selected.

Capital is treated as a variable quantity to determine how farm plans are related to capital availability. The resulting plans indicate that, for very small quantities of capital, similar farm organizations are optimum, regardless of the level of livestock management considered. As the quantity of capital is increased, and as land, labor, livestock housing, corn and hay become limitational, farm plans are related to managerial ability. Therefore, the manner in which resources should be allocated to maximize profits can be quite different for tenants with small amounts of capital than for those with larger amounts available. The capital quantities stated in tables which follow will, unless otherwise stated, assume use of second-hand machinery with a value of $5,360 (see Appendix). If new machinery is assumed, $5,720 should be added to these capital quantities.

Many alternative organizations are possible for a farm with given soil resources. The plans may include quite different enterprise combinations and give but little difference in income. Similarly, different organizations may have widely different capital requirements while returning similar incomes. On the other hand, incomes may change nearly in proportion to changes in organization and capital. The plans which follow for different quantities of capital have been computed from the continuous variable method. They simply show the *corner points* or amounts of capital at which plans change in composition. These several plans are included as illustrations of optimum organizations at *corner points* and to indicate alternative plans open to beginning tenants. The authors do not suggest that tenants would wish to make large additions to capital to obtain small additions to income (as illustrated between plans 4 and 5 in table 8).

Plans With Average Management for All Activities

Typically, beginning farmers have limited farming experience and, therefore, have not developed a high degree of managerial skills. Consequently, the plans summarized in table 8 consider tenants to have average managerial ability in all enterprises. These plans can be compared with plans in the subsequent section which consider above-average management.

With tenant capital, assuming second-hand machinery, limited to $12,238, the most profitable plan (Plan 1) includes a CCOM rotation fertilized with nitrogen (as well as with the elements indicated in table 2). Since rotations were not allowed which included less forage, a more intensive cropping system was not allowed in programming. One requirement of the programming situation was that erosion must be controlled. However, without this restriction, tenants with very re-

[6]See Heady, Earl O. and Kehrberg, Earl W. Relationship of crop-share and cash leasing systems to farming efficiency. Iowa Agr. Exp. Sta. Res. Bul. 386. 1952; and Heady, Earl O. et. al. Analysis of the efficiencies of alternative farm leasing arrangements. Iowa Agr. Exp. Sta. Res. Bul. 445. 1956.

TABLE 8. OPTIMUM FARM PLANS WITH AVERAGE MANAGEMENT AND A LIVESTOCK-SHARE LEASE.

Plan	Tenant return*	Tenant capital†	Enterprises included	Limiting resources	Corn surplus or deficit (bu.)
1	$2,167	$12,238	153 acres $CCOM_N$ 3 dairy cows 44 litters spring pigs 10 deferred-fed yearling steers	Dairy housing Forage Land Capital Hog housing	+ 316
2	$2,358	$13,644	153 acres $CCOM_N$ 3 dairy cows 44 litters spring pigs 2 litters fall pigs 27 medium yearlings	Same as Plan 1 plus grain	0
3	$2,392	$13,991	129 acres $CCOM_N$ 24 acres $CCOMM_N$ 3 dairy cows 44 litters spring pigs 34 medium yearlings	Same as Plan 2	0
4	$2,401	$14,088	139 acres $CCOM_N$ 14 acres $CCOMM_N$ 3 dairy cows 44 litters spring pigs 31 medium yearlings 78 hens	Same as Plan 3 plus poultry housing	0
5	$2,607	$15,257	153 acres $CCOMM_N$ 3 dairy cows 28 litters spring pigs 61 medium yearlings 78 hens	Same as Plan 4 but capital not limiting	—200

*Fixed costs have not been subtracted.

†Includes second-hand machinery; $5,720 should be added for new machinery. Tenant's share of purchased grain also is included.

stricted amounts of capital would make greater profit by producing even more corn than that shown in table 8.

With the forage restriction mentioned, the plan includes 3 dairy cows (up to the limit of the lease for the tenant), 10 deferred-fed yearling steers and 44 litters of pigs. At other capital levels, the plans are generally of a similar nature. A small amount of land is shifted to a CCOMM rotation to allow some more forage. Poultry does not come into the plan until capital is at the level of $14,088 under Plan 4.

Income to the tenant ranges from $2,167 to $2,607 under the plans shown. These figures assume average management, and many operators of this ability might not prefer an organization which includes cattle feeding. Steer feeding ordinarily is a "risky" enterprise for the manager who does not "stay close to the market." However, if cattle feeding is excluded from the plan under average management, with dairy cows allowed to increase to eight (and the returns shared by the landlord and tenant), the plan includes the following: (1) Under the lowest capital level, 153 acres of $CCOM_N$, 8 dairy cows, 32 litters of spring pigs and 16 litters of fall pigs. Income is $1,635. (2) Under the highest (unlimiting) capital level, 153 acres of $CCOM_N$, 8 dairy cows, 44 litters of spring pigs, 22 litters of fall pigs, 78 hens and 2,289 bushels of purchased grain. Income is $2,234. Many average managers select the "more conservative" plan—even with some sacrifice in average income over time.

Plans With Above-Average Management for Livestock Activities

The plans outlined above are for young farmers with average management abilities in all activities. The plans presented in table 9 consider tenants with above-average managerial ability. The resource restrictions are the same; only management is changed. The manner in which enterprises are combined to maximize profits with small quantities of capital under improved management is very similar to the farm organizations obtained when management is average.

Plan 6 with $13,501 of capital includes 153 acres of $CCOM_N$, 3 dairy cows, 40 litters of spring pigs and 9 litters of fall pigs. Because of superior management in feeding, choice calves fed on pasture are included to utilize forage most efficiently. Profits for this plan, before fixed costs are subtracted, are $4,330. Building limitations on the spring pig enterprise cause some fall pigs to be profitable.

With a slight increase in capital to $13,739 (Plan 7) the organization is the same as Plan 6, except that a poultry enterprise has been added, and fall pigs are decreased by two litters. For this amount of capital, which allows poultry (as a small supplementary flock) to come into the plan, it is more profitable to reallocate some of the supply of home-produced grain used by the fall pig enterprise to poultry than to purchase grain to expand the fall pig enterprise. Profits for Plan 7 are $4,395, or only $65 more than for Plan 6. Hence, young farmers not preferring to have a small farm

TABLE 9. OPTIMUM PLANS FOR ABOVE-AVERAGE LIVESTOCK MANAGEMENT AND A LIVESTOCK-SHARE LEASE.

Plan	Tenant return*	Tenant capital†	Enterprises included	Limiting resources	Corn surplus or deficit (bu.)
6	$4,330	$13,501	153 acres $CCOM_N$ 3 dairy cows 40 litters of spring pigs 9 litters of fall pigs 22 choice calves on pasture	Capital Land Dairy housing Corn Hog housing	0
7	$4,395	$13,739	153 acres $CCOM_N$ 3 dairy cows 40 litters of spring pigs 7 litters of fall pigs 22 choice calves on pasture 78 hens	Same as Plan 6 plus poultry housing	0
8	$4,714	$15,011	153 acres $CCOM_N$ 3 dairy cows 40 litters of spring pigs 18 litters of fall pigs 22 choice calves on pasture 78 hens	Same as Plan 7 plus labor for September, October and November	—1,147
9	$4,781	$15,919	94.3 acres $CCOM_N$ 58.7 acres $CCOMM_N$ 3 dairy cows 40 litters of spring pigs 14 litters of fall pigs 36 choice calves on pasture 78 hens	Same as Plan 8 plus labor for July and August Capital not limiting	—1,876

*Fixed costs have not been subtracted.
†Includes second-hand machinery; $5,720 should be added for new machinery. Tenant's share of purchased grain also included.

laying flock would sacrifice very little profit by having nine litters of fall pigs and no poultry. However, a small poultry flock would provide eggs for home use which would otherwise have to be purchased. Also, the small supplementary poultry flock would add some stability to income.[7] For these reasons, the present plan might be used by many beginning farmers.

Addition of more capital causes purchase of grain and expansion of fall hog and feeder cattle enterprises to be profitable, as illustrated by plans 8 and 9. Poultry and spring hog enterprises are unchanged. As capital is increased to $15,011, the most profitable use of purchased grain is to expand the fall hog enterprise to the limit of the September, October and November labor supply. Except for the 18 litters of fall pigs, the number and types of enterprises in Plan 8 are the same as Plan 7. The purchase of 1,147 bushels of corn and the subsequent expansion of the fall hog enterprise by 11 litters increases profits by $319 and the capital required by $1,272.

Increasing the capital supply beyond that used for Plan 8 makes profitable the purchase of more grain and further expansion of the feeder cattle enterprise (Plan 9). However, as capital becomes unlimiting at $15,919, some of the September, October and November labor used by fall pigs is reallocated to the beef enterprise. Consequently, the fall hog enterprise is reduced in Plan 9, as compared with Plan 8, by 4 litters; 14 choice calves fed on pasture are added. In other words, the "interaction" of added capital and limited labor supplies causes the shift in feed resources from hogs to cattle to be profitable. Since more hay is needed with an expanded cattle feeding operation, 58.7 acres of $CCOMM_N$ rotation are substituted for $CCOM_N$ rotation to supply the necessary forage. Substitution of feeder cattle for fall pigs and the $CCOMM_N$ rotation for the $CCOM_N$ rotation is continued until the supply of July and August labor is exhausted. Profits for Plan 9 are $4,781.

[7]Brown, William G. and Earl O. Heady. Economic instability and choices involving income and risk in livestock and poultry production. Iowa Agr. Exp. Sta. Res. Bul. 431. 1955.

INCOME FROM PLANS

Plans in tables 8 and 9 are those which, given the resource restrictions and prices used, will maximize income to the tenant. Profit-maximizing plans for a landlord or owner-operator need not be the same as for a tenant with a smaller amount of capital. This statement applies particularly to plans under crop-share renting. The general nature of the plan will be the same, though the specific details may differ, for a rented farm under a livestock-share lease as for an owner-operated farm. Hence, the general plans of tables 8 and 9, including a $CCOM_N$ rotation, hogs and cattle feeding, will generally be most profitable for an owner-operated farm as well as for the livestock-share situations shown. While cattle feeding entails more risk and some operators would prefer dairying or sale of some grain for cash, income would be lowered accordingly. Still, many families would select a plan which averages less income over time but allows them to stay in farming rather than to select a plan with high risks which might force bankruptcy in a year of unfavorable prices.

The outstanding feature of table 8, analyzed alone, is the generally low level of income under the average management conditions used in pro-

gramming. The incomes in table 8 do not include subtraction of fixed costs. Supposing second-hand machinery, fixed costs will average about $782. Hence, net profit under Plan 4 would be $1,619.[8] If he owns the capital, the tenant's labor return is less than if he works as a hired man and realizes no return on his capital.

The outstanding difference in the plans in tables 8 and 9 is the level of income under above-average management. With approximately the same amount of capital for a beginning tenant farmer, income averages around 90 percent more under the plans of above-average management. Another outstanding characteristic of the plans in tables 8 and 9 is that the rotation with the minimum amount of forage is most profitable, of those considered for planning, as a general rule. The only exception is use of a CCOMM$_N$ rotation to supply added forage for plans involving a large amount of capital and an expanded cattle feeding operation. Comparison of the plans in tables 8 and 9 again indicate that no one plan is best for all farms. Optimum plans for the same soil situation will vary with capital, managerial ability, labor supply and other resource restrictions.

OPTIMUM FARM PLANS FOR CROP-SHARE LEASE

Plans previously computed considered the leasing system to be livestock-share. Although this is the typical leasing arrangement for beginning farmers in this area, many young farmers in southwest Iowa rent farms on a crop-share arrangement. Since the type of lease may influence the best farm organization for the tenant, plans in this section are computed for a crop-share lease.

Under a crop-share lease, the tenant shares certain crop expenses and all grain crop production but bears all the livestock expense and receives the total livestock product. Consequently, more capital is required with a crop-share lease to operate the same farm with a given livestock organization. Or, with the same tenant capital, fewer head of livestock can be kept on the farm. Of course, the tenant realizes the full return from the smaller livestock enterprises, if capital is constant in both cases. If, however, the farm is stocked to the limit of resource restrictions, the tenant will require more capital under a crop-share lease than under a livestock-share lease. If the farm is stocked to the same level, with the tenant owning all livestock under a crop-share lease, the need for capital is increased. Often, the added capital would come from credit sources, with a consequent increase in risk and uncertainty. However, the opportunity of using more capital by the tenant on a rented farm makes higher incomes possible.

Plans With Average Management and Dairying as a Competitive Enterprise

Plans under a crop-share lease for average management suppose that the operator, since he must furnish all the capital and stand all of the risks, will not go into cattle feeding. Hence the programming process does not allow feeders to be considered in the plans presented in table 10. To allow use of forage produced in the rotation, beef cows and a dairy enterprise are included. The restriction used under the livestock-share lease, dairying held to three cows for the tenant, is lifted for the plans of table 10. Dairying is now considered to be an enterprise competing with other activities for all labor, capital and feed.

Markets in southwest Iowa are primarily for butterfat rather than for grade A milk. Hence,

[8]The fixed costs of $782 include depreciation on machinery and equipment. These would be out-of-pocket costs only in the year of machinery purchase. Fixed costs which would have to be paid each year (as cash, out-of-pocket expenses), and which determine income for consumption in the short-run, would amount to something over $100.

TABLE 10. OPTIMUM PLANS WITH COMPETITIVE DAIRY ENTERPRISE, AVERAGE MANAGEMENT AND CROP-SHARE LEASE.

Plan	Tenant return*	Tenant capital†	Enterprises included	Limiting resources	Corn surplus or deficit (bu.)
10	$2,460	$11,176	153 acres CCOM$_N$ 11 dairy cows 15 litters of spring pigs 7.5 litters of fall pigs	Capital Forage Land Grain	— 154
11	$2,673	$17,442	153 acres CCOM$_N$ 9 dairy cows 34 litters of spring pigs 17 litters of fall pigs	Same as Plan 10 plus labor for March and April	—3,583
12	$2,749	$18,511	153 acres CCOM$_N$ 9 dairy cows 38 litters of spring pigs 15 litters of fall pigs	Same as Plan 11 plus labor for September, October and November	—3,852
13	$2,799	$20,269 (unlimiting)	153 acres CCOM$_N$ 8 dairy cows 44 litters of spring pigs 12 litters of fall pigs 78 hens	Same as Plan 12 plus hog and poultry housing. Capital not limiting.	—4,204

*Includes payment of cash rent at $9.00 per acre of meadow but other fixed costs have not been subtracted.
†Includes second-hand machinery; $5,720 should be added for new machinery. Tenant's share of purchased feed also is included.

the opportunity for producing grade A milk is not considered.

With capital at $11,176, all cropland is planted to a CCOMN rotation to supply the necessary feed for the livestock enterprises. A small amount of grain is purchased. The dairy enterprise includes 12 cows, a number which utilizes forage remaining after pasture requirements for spring pigs have been met. A poultry enterprise is not able to compete for limited funds under this capital situation.

An increase in capital to $17,442 (Plan 11) makes profitable the purchase of grain and further expansion of a 2-litter hog enterprise. Purchase of grain at this capital level is continued until the 2-litter hog enterprise is limited by March and April labor. The supply of March and April labor, together with a fixed supply of land and dairy housing, makes the combination of 153 acres of CCOMN, 9 dairy cows, 34 litters of spring pigs and 17 litters of fall pigs the most profitable use of limited resources. However, the return on the added capital is small, and tenants borrowing funds would find use of the added capital to be unprofitable.

Even those with full equity in their capital could find other uses for funds which would return more than the 3.2 percent earned on the added $6,326 represented by Plan 11, as compared with Plan 10. This statement also applies to plans 12 and 13 in table 10. Hence, of the plans shown in table 10, Plan 10 appears as the organization to be recommended for a beginning tenant farmer with average management ability and the resource restrictions mentioned earlier. In table 10, the rotation with a minimum of forage, CCOMN, again represents the optimum cropping plan. The most profitable use of labor, land and livestock housing, with capital unlimiting at $20,269, is to allocate these resources to 153 acres of CCOMN, 8 dairy cows, 44 litters of spring pigs, 12 litters of fall pigs and 78 hens. Tenant returns, without fixed costs subtracted, are $2,799. Poultry is included in this plan since the capital level is high enough that enterprises do not have to compete for funds and because the laying hens use housewife labor, rather than the time of the operator.

The plans in table 10 return somewhat more for approximately the same amount of capital than the plans in table 8. This is because the tenant owns all of the livestock and realizes all of the return from livestock under the crop-share arrangement of table 10. The two sets of plans are not strictly comparable, however. Those of table 8 do not allow a competitive dairy enterprise while those of table 10 do not consider cattle feeding. With cattle feeding allowed as an alternative, profits in table 10 would exceed those of table 8 by an even greater amount for the same amount of capital. This is because cattle feeding, with a land-use system and soil productivity which allow a large ratio of grain relative to hay, is more profitable than dairying in a butterfat market.

Even under the crop-share arrangements of table 10, the average manager would realize somewhat less income that a year-around hired man.

Plans With Above-Average Management for All Livestock Activities

Plans with a crop-share lease in the previous section consider livestock management to be average. Plans presented in this section for a crop-share lease consider the level of management to be above-average in all livestock activities. Dairying is not included as a competitive enterprise. This step is taken since cattle feeding is more profitable than dairying in a butterfat market, and it is assumed that the above-average manager can predict the market sufficiently well to stand the risks of beef production. The resource restrictions are the same; only management and cattle activities are changed.

Plans in this section are compared with farm organizations obtained earlier with a comparable level of management with a livestock-share lease to show how plans vary with leasing arrangements. A summary of optimum plans with above-average management and a crop-share lease is given in table 11.

Capital required by the tenant for stocking the farm to particular limits of resource restrictions is greater for the plans in table 11 than for the comparable plans under a livestock-share lease in table 9. Capital requirements are greater under the crop-share lease since the landlord does not provide any of the investment capital. Neither does the tenant realize any of the return from the landlord's livestock investment under a livestock-share lease. Accordingly, for a good manager who can earn more than interest cost on capital in livestock, the crop-share lease is more profitable. The tenant now has a larger volume of business for himself. These facts are borne out by comparison of the plans in table 9 and table 11. For the differences between these two tables, the added return under crop-share renting would generally merit use of the added capital.

In a broad sense, the optimum farming program is the same under the crop-share and livestock-share situations in tables 9 and 11, respectively. The CCOMN rotation is still most profitable, except where capital is large and an intensive cattle feeding program is carried on the farm. Then some land is shifted to a CCOMMN rotation to allow more forage to complement the sizable corn purchases. Poultry does not come into the plan until capital approaches the unlimiting level. Dairy cows drop out of the plan entirely when capital becomes unlimiting.

Income opportunities are greater for the crop-share tenant with sufficient capital, but risks and uncertainty are also greater. Since most beginning farmers in southwest Iowa are limited on capital, some of the plans for a crop-share lease in table 11 probably are not very applicable. These plans do indicate how resources should be allo-

TABLE 11. OPTIMUM PLANS FOR ABOVE-AVERAGE LIVESTOCK MANAGEMENT AND A CROP-SHARE LEASE.

Plan	Tenant return*	Tenant capital†	Enterprises included	Limiting resources	Corn surplus or deficit (bu.)
14	$5,995	$19,907	153 acres of $CCOM_N$ 3 dairy cows 40 litters of spring pigs 22 choice calves on pasture	Capital Land Dairy housing Corn Hay	—2,052
15	$7,068	$24,200	153 acres of $CCOM_N$ 3 dairy cows 40 litters of spring pigs 18 litters of fall pigs 22 choice calves on pasture	Same as Plan 14 plus September, October and November labor	—3,989
16	$7,434	$26,375	94.4 acres of $CCOM_N$ 58.6 acres of $CCOMM_N$ 3 dairy cows 78 hens 40 litters of spring pigs 14 litters of fall pigs 36 choice calves on pasture	Same as Plan 15 plus July and August labor and poultry housing	—4,614
17	$7,563	$28,064	118.5 acres of $CCOM_N$ 34.5 acres of $CCOMM_N$ 40 litters of spring pigs 20 litters of fall pigs 78 hens 43 choice calves on pasture	Same as Plan 16 but capital not limiting	—5,296

*Includes payment of cash rent at $9.00 per acre of meadow but other fixed costs have not been subtracted.
†Includes second-hand machinery; $5,720 should be added for new machinery. Tenant's share of purchased feed also is included.

cated among crops and livestock to maximize profits when adequate capital is available. Plan 17 might provide too little additional income, as compared with Plan 16, to merit the risk of using the added capital. No one farm plan is optimum for the same farm and soil type, if profits, family preferences and risk-bearing situations are considered. Tenant operators, as other farmers, should plan according to their own individual circumstances.

COMPARISON OF FARM AND NONFARM INCOME OPPORTUNITIES

The results presented in previous sections indicate that the major factors limiting the level of income on rented farms for beginning operators are capital availability and managerial ability. Hence, income potential from resources for beginning operators is not the same for all farmers with the same soil type. Also, family values and preferences must be considered. Obviously, there is some level of income from farming for tenants with limited funds which yields less satisfaction than could be obtained if the farm operator were engaged in nonfarm employment at existing wage rates. On the other hand, some families prefer farm living and, within certain limits, would continue to farm even though this occupation returns less income than urban employment. Only the individual farm family can make these choices. The income comparisons which follow have been prepared to aid families in these choices.

Plans in the first part of this study show the maximum income expected under the conditions of prices, resource restrictions, leasing arrangements, farming techniques and managerial ability used in programming. The results may be used as indications of general farm organization for beginning farmers faced with conditions paralleling those outlined. However, with the existing and prospective cost-price squeezes facing farmers, many young families may wish to compare the best income possibilities from farming with possible returns in other employment opportunities.

Comparisons are made in this section of income under the plans outlined earlier with two levels of nonfarm income. Some families may make choices on the basis of income at a point in time. Others may be less concerned, as long as current farm returns allow an acceptable level of living, with income comparisons over the next few years. They may be more interested in whether, after they have spent several years in gaining experience and in accumulating capital, income will be more or less from farming than from off-farm employment. However, the figures presented represent one set of data useful in helping young families in southwest Iowa decide whether they can actually accumulate capital for more efficient farming.

Nonfarm Income Opportunities

Wage rates for selected types of industrial employment are given in table 12 for Iowa. The average annual wage income of persons employed in Iowa manufacturing industries was $3,935 in 1955. The most typical source of nonagricultural employment in southwest Iowa is in meat products. The 1955 average annual income for those engaged in the processing of meat products was $4,233. However, the average income of manufacturing industries (nonagricultural) will be used

TABLE 12. ESTIMATED AVERAGE HOURS AND EARNINGS IN SELECTED IOWA INDUSTRIES, 1951-55.*

Industry	Average weekly hours					Average weekly earnings ($)				
	1955	1954	1953	1952	1951	1955	1954	1953	1952	1951
Machinery (except electrical)	41.10	40.30	40.80	40.90	41.60	82.45	76.66	75.62	73.42	72.54
Agricultural machinery	39.95	39.60	39.80	39.10	39.90	86.30	80.86	79.78	76.54	76.11
Construction	42.00	40.60	40.10	40.70	45.00	79.78	74.53	70.95	73.17	74.43
Food products	41.88	41.20	41.40	42.50	42.90	77.88	72.99	70.59	68.22	64.73
Meat products	41.31	40.30	40.30	41.90	42.90	81.41	74.84	71.32	70.41	67.77
All manufacturing†	41.10	40.40	40.80	41.50	41.80	75.67	71.01	69.08	67.08	64.81
Annual income (all mfg.)†						3,934.84	3,692.52	3,592.16	3,488.16	3,370.12

*Source: The Iowa Employment Security Commission, Des Moines, Iowa.
†Includes the above industries plus all other nonagricultural industries as reported by the Iowa Employment Security Commission.

in this section as one "benchmark" in comparing farm income for young farmers in southwest Iowa. It is likely true that many young farmers do not have the skills or opportunities to become year-around employees in these manufacturing industries. Some must accept positions as nonskilled laborers, filling station attendants or similar work. Hence, income from an opportunity which pays $1.35 per hour also will be compared with income from the farm plans outlined earlier. Many young persons in southwest Iowa, particularly those who wish to remain in their home community, work at this wage level.

Equivalent Levels of Living: Farm and City

Differences in the cost of living on farms and in towns makes income comparisons difficult. "Purchasing power" of a given income for farm and urban families differs because of housing and food costs in particular. Koffsky compared the "purchasing power" of farm and urban families in 1946 for the United States and concluded that an 18-percent larger income would be needed in town to be equivalent to a given level of farm income.[9] For Iowa, the differential is predicted to be in the order of 10-15 percent. In his study of equivalent purchasing power for urban and farm families in 1946, Koffsky did not consider housing. Therefore, his estimated income differential is based primarily upon food and clothing. According to Orshansky, home-grown food is the major factor in the cost of living differential between farm and nonfarm families.[10] A 5-year average value of home-produced foods for 86 Iowa farm families (1951-55) shows that $420 of food was produced per family.[11] A comparable estimate of $462 was obtained for farm families in 12 states in the North Central Region of the United States in 1951.[12] While a large part of the differential in incomes for urban and farm families does arise from food expenditures, the tenant farm family characteristically gets its dwelling as part of its business activity. Consequently, both food and housing expenditures are considered in the adjusted gross income comparisons that follow.

Money Income Comparisons of Farm and Nonfarm Opportunities

Comparison of unadjusted farm and nonfarm incomes are made in this section. The figures listed do not consider housing or home-produced foods. Also, investment in crop machinery and its associated depreciation, which make up fixed costs for the tenant operator, are not considered. It is thought that these fixed costs (given in the Appendix, table A-4) are about equal to housing costs for the urban worker. The tenant farmer would not be able to get his housing free without an investment in crop machinery necessary to rent and operate a farm. Hence, only income received from wages (table 13) and farm income over annual costs (tenant return indicated in the farm plans shown previously) are considered here. Housing, home-grown foods and fixed costs differentials are considered in a subsequent section which includes an adjusted money income comparison.

The figures in table 13 can be used by persons or for guidance of persons, who have fixed costs, housing outlays or home-raised food opportunities differing from those cited later. For the comparisons in the remainder of this bulletin, remember that no interest costs have been subtracted for borrowed funds. Since the farm family may use borrowed funds for its machinery and since the urban family may use credit for its housing, this procedure puts the two on a comparable basis.

In terms of unadjusted money income, young

[9]Koffsky, Nathan. Farm and urban purchasing power. Studies in Income and Wealth. National Bureau of Econ. Res., New York. 1949. Vol. 11: 153-78.
[10]Orshansky, Mollie. Equivalent levels of living: farm and city. Studies in Income and Wealth. National Bureau of Econ. Res., New York. 1952. Vol. 15: 177-200.
[11]Family living expenditures of 72 Iowa farm families, 1954. Agr. Ext. Ser. FM 1207. Iowa State College. 1955.
[12]U. S. Department of Agriculture. Food expenditure, preservation and home production in the North Central Region, 1951-52. U. S. Dept. Agr., Agr. Info. Bul. No. 113. August 1956.

TABLE 13. UNADJUSTED MONEY INCOME FOR FARM AND NONFARM OPPORTUNITIES; WITH FARM PLANS FOR BEGINNING TENANTS INCLUDING CAPITAL LEVELS, MANAGERIAL ABILITIES AND RESOURCE RESTRICTIONS OF EARLIER TABLES.

Plan	Tenant return*	Wage income in manufacturing industries†	Wage income at $1.35 per hour
	Average management, livestock-share lease		
1	$2,167	$3,935	$2,808
2	2,358	3,935	2,808
3	2,392	3,935	2,808
4	2,401	3,935	2,808
5	2,607	3,935	2,808
	Above-average management, livestock-share lease		
6	4,330	3,935	2,808
7	4,395	3,935	2,808
8	4,714	3,935	2,808
9	4,781	3,935	2,808
	Average management, crop-share lease and competitive dairy enterprise		
10	2,460	3,935	2,808
11	2,673	3,935	2,808
12	2,749	3,935	2,808
13	2,799	3,935	2,808
	Above-average management, crop-share lease		
14	5,995	3,935	2,808
15	7,068	3,935	2,808
16	7,434	3,935	2,808
17	7,563	3,935	2,808

*Fixed costs have not been subtracted

†Average annual income received in all manufacturing industries in Iowa during 1955.

tenant farmers with the resources assumed in this study and average management abilities cannot obtain an income comparable to employment in nonagricultural industries. Even under the highest farm income for this group, a crop-share lease and a dairy herd (Plan 13, table 10), farming would return $1,200 or 30 percent less than the average annual income for nonagricultural workers. In fact, the average manager could not realize any more from farming than from year-around nonfarm employment at $1.35 per hour. Plan 13 (table 10) provides an income about equal to the $2,808 from the lower-paying nonfarm opportunity. Plan 1, using less capital in farming, returns 23 percent less than the unskilled, nonfarm employment opportunity. The farm incomes are for those cited earlier—situations considered to be similar to those of most beginning tenants. Beginning farmers with a larger farm and more capital, even if they were average managers, would have greater incomes than those shown.

With improved or above-average management, unadjusted farm incomes in table 13 are greater in all instances than returns under the 1955 average industrial wage rate for Iowa. Obviously, then, if young farmers are to become successfully established in farming and are to have unadjusted incomes comparable to urban families, they must strive to become efficient managers. Competition of the market is likely to force them to do so in the next few years. The alternative is either to quit farming or to accept a lower standard of living. Of course, the two levels of management used do not include all degrees of management existing in southwest Iowa. However, these two arbitrarily selected levels of management do point up the major differences possible due to managerial ability and farming efficiency.

COMPARISON OF ADJUSTED FARM AND NONFARM INCOMES

To account for differences in cost of living items, incomes for farming and urban employment are adjusted for housing, fixed costs and food (the items which make up the major portion of the cost of living differential). The adjusted income figures for tenants and urban workers, based on expenditure data in table 14, are summarized in table 15.

Incomes shown in table 13 were adjusted in the following manner: Money income for urban workers is adjusted by subtracting a housing cost equal

TABLE 14. FAMILY LIVING EXPENDITURES FOR A PARTICULAR GROUP OF FARMS KEEPING ACCOUNTS, 1951-55.*

Cash expeditures for living	Percent of total 1954	Expenditure by years				
		1955	1954	1953	1952	1951
Food purchase	27	$ 711	$ 743	$ 689	$ 686	$ 680
Clothing	17	440	457	447	444	498
Household operations	12	376	317	281	290	290
Repairs	4	129	122	119	110	124
Health	9	244	245	243	232	215
Recreation	4	105	114	115	165	114
Education	6	160	177	149	149	130
Giving	13	288	358	313	300	327
Auto-operative	8	198	221	240	205	209
Total cash living expense	100	$2,651	$2,754	$2,596	$2,581	$2,587
Number of farms	86	86	72	94	95	97
Percent owners		66%	76%	72%	68%	68%

*Farm and home accounts of Iowa farm families. Agr. Ext. Serv., Iowa State College. FM-1207. 1956.

TABLE 15. ADJUSTED INCOMES FOR FARM AND NONFARM OPPORTUNITIES.

Plan	Capital used for farm plans			Adjusted income from farming*		Adjusted wage income†	
	Without machinery	With new machinery	With second-hand machinery	With new machinery	With second-hand machinery	In manufacturing industries 1955	At $1.35 per hour
	($)	($)	($)	($)	($)	($)	($)
			Average management, livestock-share lease				
1	6,878	17,958	12,238	1,367	1,650	3,035	1,908
2	8,284	19,364	13,644	1,548	1,841	3,035	1,908
3	8,631	19,711	13,991	1,582	1,875	3,035	1,908
4	8,728	19,808	14,088	1,591	1,884	3,035	1,908
5	10,949	22,039	16,309	1,797	2,090	3,035	1,908
			Above-average management, livestock-share lease				
6	8,141	19,221	13,501	3,520	3,813	3,035	1,908
7	8,379	19,459	13,739	3,585	3,878	3,035	1,908
8	9,651	20,731	15,011	3,904	4,197	3,035	1,908
9	10,559	21,639	15,919	3,971	4,264	3,035	1,908
			Average management, crop-share lease and competitive dairy enterprise				
10	5,816	16,896	11,176	1,770	1,943	3,035	1,908
11	12,082	23,162	17,442	1,670	2,156	3,035	1,908
12	13,151	24,231	18,511	1,939	2,232	3,035	1,908
13	14,909	25,989	20,269	1,989	2,282	3,035	1,908
			Above-average management, crop-share lease				
14	14,547	25,627	19,907	5,185	5,478	3,035	1,908
15	18,840	29,920	24,200	6,258	6,551	3,035	1,908
16	21,015	32,095	26,375	6,624	6,917	3,035	1,908
17	22,704	33,784	28,064	6,753	7,046	3,035	1,908

*Farm income figures in table 13 were adjusted by subtracting fixed costs of $1,075 for new machinery and $782 for second-hand machinery. Then 10 percent of the total cash living expense ($2,651) for Iowa farm families (table 14) was added to the resulting income figures to adjust for a 10-percent differential in cost of living in town.

† Income from wages, shown in table 13, is adjusted by subtracting housing costs of $900 or a monthly rent payment of $75 per month.

‡ An investment of $11,080 in new machinery is added to capital without machinery shown in column 2.

§ An investment of $5,360 in second-hand machinery is added to capital without machinery shown in column 2.

to a rent of $900 per year. Farm incomes are adjusted by subtracting annual fixed costs (shown in the Appendix, table A-4) amounting to $1,075 and $782 for depreciation on new and second-hand machinery, respectively. (Fixed costs for tenants are treated in this study as being analogous to a housing cost for urban workers, since tenants would be unable to receive farm housing free without an investment in crop machinery necessary to rent or operate a farm.) To account for differences in food costs, farm incomes are further adjusted by adding $265 to the resulting farm income figures. The $265 represents 10 percent of the 1955 farm family living expenditures shown in table 14. Of course, the exact amount of expenditures made by farm and urban families would differ by individual items included in the living pattern. However, these variations hold true within groups of urban or farm families and are not important to the comparisons of this study. The 10-percent cost of living differential probably represents most of the measurable differences in the cost of living because of farm or urban dwelling. Some of the budget items listed for Iowa farm families keeping records are undoubtedly higher than for the typical young family in southwest Iowa. Donations and similar expenditures are examples. On the other hand, acquisition of household items for beginning families may be greater than for the average cited in table 14.[13]

The adjusted farm and urban income figures in table 15 do not lead to conclusions differing from those based on table 13. With only average management, farm incomes are less than for nonfarm industrial employment in all cases. With sufficient capital, farming under average management gives returns about equal to employment at $1.35 per hour. Income from farming is only slightly more, assuming use of second-hand machinery, when total capital is $17,442 under Plan 11. It is slightly less if new machinery is assumed with a $23,162 investment.

A comparison of adjusted farm and urban incomes in table 15, for tenants with above-average managerial skills, shows that farm income is greater than nonfarm income in all instances. Farm income for tenants with above-average management would be larger than nonfarm income even if a 10-percent differential is not added to income to account for differences in food costs. However, to obtain a level of farm income greater than nonfarm employment, tenant farmers with above-average managerial ability would need a

[13]However, even if the total outlays in table 14 should overestimate living costs for young families by as much as 50 percent, the general conclusions of this study, based on a $265 upward adjustment of farm incomes, would not be changed.

minimum of about $15,000 in capital (investment and operating capital).[14]

INTEREST ADJUSTMENTS

A final adjustment which might be included for nonfarm incomes is the addition of interest which might be earned on capital otherwise used in farming. It is, of course, likely that young farmers would have some borrowed capital. Hence, if they were to leave farming, their income would not equal wages plus interest on all capital formerly employed in agriculture. However, the difference between incomes in the two situations would differ by interest payments. If the funds were borrowed, they could not be loaned at interest in a nonfarm occupation, but farm income would be decreased by the amount of the interest payments.

To allow for these possibilities, interest on capital for particular plans has been added to adjusted nonfarm income. The interest rate used is 4 percent. The resulting figures are compared with adjusted farming income under second-hand machinery investment in table 16. Again, farm income for average management is less than for nonfarm opportunities in every case. Income for above-average management is greater in every case.[15]

ADJUSTING FARM SIZE

Above-average managers would not need larger farms to have incomes as large as under the employment alternatives outlined. They can have incomes as large as from the manufacturing employment shown by using sufficient capital and organizing their farms efficiently. One alternative for average managers who wish to remain on the farm but have an income as great as in manufacturing employment is to use the practices and organizations outlined for above-average management; in other words, to improve their managerial ability. Another alternative is for them to use the same techniques as at the present but operate a larger farm. Using this procedure they might obtain the same money income as in the manufacturing employment used as a comparison. However, farming with the average techniques would not return as much as the off-farm employment opportunity plus interest at 4 percent on the capital otherwise employed in farming.

If, however, the average manager wished to remain in agriculture, he might ask: How large a farm is necessary to provide a family income as large as the salaries in manufacturing employment? Using the optimum plans under crop-share and livestock-share leases, with unlimiting capital and expanding these plans proportionally, the answer is as follows: To have the same net cash income ($3,935) under a livestock-share lease (Plan 5) as under employment in manufacturing industries, he would need to operate 267 acres and employ $24,700 of capital. To have the same net cash income under a crop-share lease (Plan 9), he would need to operate 214 acres and employ $28,125 of capital.[16] These figures allow for hiring a small amount of seasonal labor for the added acreage and also consider some economies of scale in expanding livestock. They use the same second-hand machinery investment as for 160 acres.

To obtain the same real income as under manufacturing employment (i.e., the adjusted basis or $3,035 shown in table 15), the livestock-share renter would need 300 acres and $27,315 in capital; the crop-share renter would need 256 acres and $32,018 in capital. However, to the extent that capital is borrowed and interest must be subtracted from returns, the size of the farm would have to be increased to provide family income equal to that of manufacturing industries.

PREFERENCES AND OTHER CONSIDERATIONS

These income comparisons do not consider personal preferences. Measuring and quantifying personal values is difficult and has not been taken into account in this study. Given the results of this study, based upon measurable items making up the major part of the cost of living differential for farm and urban families, individual farm families can decide for themselves the relative merits of farming and urban employment. However, if

[14]The figure is $16,000 if new machinery is used and $13,000 if second-hand machinery is used.

[15]Adjusted income from nonfarming opportunities, with interest added, is slightly greater than farm income with new machinery for plans 6 and 7. However, for all other plans with new machinery, adjusted farm income is greater than adjusted income in manufacturing industries plus interest on farming capital at 4 percent.

TABLE 16. ADJUSTED INCOMES FOR FARM AND NONFARM OPPORTUNITIES, WITH INTEREST ON FARM CAPITAL ADDED TO THE LATTER.

Plan	Adjusted income from farming with second-hand machinery	Adjusted wage income plus interest on capital at 4 percent*	
		In manufacturing industries, 1955	At $1.35 per hour
	($)	($)	($)
	Average management, livestock-share lease		
1	1,650	3,525	2,398
2	1,841	3,581	2,454
3	1,875	3,595	2,468
4	1,884	3,599	2,472
5	2,090	3,687	2,560
	Above-average management, livestock-share lease		
6	3,813	3,575	2,448
7	3,878	3,585	2,458
8	4,197	3,635	2,508
9	4,264	3,672	2,545
	Average management, crop-share lease		
10	1,943	3,481	2,354
11	2,156	3,734	2,607
12	2,232	3,775	2,648
13	2,282	3,846	2,719
	Above-average management, crop-share lease		
14	5,478	3,831	2,704
15	6,551	4,003	2,876
16	6,917	4,090	2,963
17	7,046	4,158	3,031

*Interest at 4 percent on the capital shown for plans with second-hand machinery in table 15 has been added to the income figures in the last two columns of table 15.

[16]It should be remembered that the enterprises allowed the average manager under livestock-share and crop-share leases are not the same. Hence, capital requirements, acreages and incomes are not proportional to differences in tenant inputs and outputs. Under crop-share leasing, it is supposed that the tenant will not bear the risk of cattle feeding, and grade B dairying is included to utilize forage.

they wish real incomes comparable to urban employment, they have opportunity to either (1) improve farming efficiency and use more capital or (2) move from farming to other employment opportunities. These statments assume, of course, absence of a major business depression and the existence of off-farm employment opportunities. With continuance of high level employment and further national economic growth, it is not likely that the cost-price squeeze in agriculture will slacken. A premium, therefore, will be on the two types of adjustment suggested above.

SUMMARY

Problems of farm management have increased in southwest Iowa in recent years because of dry weather and the cost-price squeeze. Decision-making within this framework is especially difficult for beginning tenant farmers. Many are faced with the problem of whether they should continue farming or switch to nonfarm employment. Whether or not they should remain in farming depends on (a) how well the farm can be organized, (b) the income forthcoming from different farm plans, (c) capital and managerial resources possessed by the farm family, (d) income from alternative employment opportunities and (e) values which the family attaches to farming as compared with other employment opportunities.

This study analyzes plans for rented 160-acre farms on Marshall silt loam. A farm of this size is typical for most beginning farmers in the area. However, estimates also are made of acreages or farm size necessary to give incomes equal to employment in manufacturing industries. Optimum plans are computed for different capital levels and two levels of managerial ability under both crop-share and livestock-share leases. One restriction placed on these plans is that the cropping system must control erosion. Incomes and plans would differ from those shown for operators who follow a more exploitative type of farming or who farm larger acreages. Incomes possible for plans under the various resource, management and leasing situations are compared with incomes from nonfarm employment opportunities.

When he has a small amount of capital, the tenant, regardless of whether he possesses average or above-average managerial ability, maximizes profits with a rotation including a maximum of corn. In other words, a CCOM rotation is optimum for most capital levels studied. This rotation with nitrogen fertilization gives the greatest return on funds when capital is limiting. A rotation with more forage is optimum, in terms of a beginning tenant operator attempting to maximize profits, only when unlimiting capital is available and the farm carries a large cattle feeding program. A CCOMM rotation then is optimum since it provides more forage for the cattle-feeding program. Some grain must be purchased under these conditions.

In order of profitability in investing limited capital in competitive enterprises, hogs come into the plan after crop fertilization and are followed in order by cattle feeding and poultry. Dairying, up to the limits of the restrictions of three cows, followed after investment in fertilizer—for a livestock-share lease which allowed all proceeds from milk to go to the tenant. When cattle feeding was excluded on risk grounds, dairying followed hogs in investment order for average management.

Optimum plans for average and above-average managers include the same collection of enterprises but in different proportions. Generally, hog enterprises are larger for above-average management, and proportions between hog litters and cattle numbers have to be shifted, in comparison with average management, in consideration of the operator's labor. Both average and above-average managers make greater profits under a crop-share lease than under a livestock-share lease. This is true because they realize the entire profit from livestock production under the latter lease. However, full stocking of a farm requires greater capital under crop-share leasing than under livestock-share tenure.

In the comparison of farm and nonfarm employment opportunities, the average manager of 160 acres has less income than the wage income provided by full-time employment in manufacturing industries. He also has less income than that provided by full-time employment at $1.35 per hour. This is true even if farm and off-farm incomes are adjusted for differences in living costs. By operating enough acres, the average manager could have income equal to the nonfarm wage rate. Under a livestock-share lease, he would need to operate 267 acres to have an equal cash income. Under a crop-share lease, he would need to operate 214 acres. Capital requirements would be $24,700 and $28,125, respectively.

In most situations analyzed, the above-average manager has greater real income from farming than from the two off-farm employment alternatives. Only at low capital levels, with off-farm income adjusted to include interest on capital, does the off-farm employment alternative give greater income than farming. These differences are small, however, and the farm family which prefers agriculture might select farming with the anticipation of capital accumulation and greater earnings. Of course, some farm operators have skills which would give them off-farm or industrial earnings greater than the wage rates used for comparison.

Monetary returns are not the only element of income upon which a family bases its choice of occupation. Some families may prefer one occupation over another — even though it provides less income through the market. However, data such as those provided in this study can be of aid to those beginning farm families who are reconsidering their choice of occupation. They also can be used by beginning farmers who wish to determine how they can increase incomes if they remain in farming.

APPENDIX

BASIC DATA

The estimates of the resource requirements for each of the enterprises considered were obtained from published and unpublished results of studies conducted by the agricultural experiment stations of Iowa and surrounding states. The data are drawn largely from records kept on farms rather than from experimental work. In cases where data were not available, it became necessary to resort to the use of figures from experiments conducted by persons familiar with the enterprises in question. The estimates used in this study are believed to be those most representative of the resource requirements and production in southwest Iowa.

TABLE A-1. BASIC INPUT-OUTPUT DATA FOR THE DAIRY ENTERPRISE ON A COW BASIS (INCLUDING REPLACEMENTS).

Production and resource requirements per head	Milking herd	
	Average management	Above-average management
Pounds of feed*		
Corn equivalent	2,504.0	3,698.9
Supplement	175.0	436.0
Hay equivalent	12,956.0	13,672.0
Labor (hrs.)	124.0	129.0
Building (sq. ft.)	84.0	84.0
Production (lbs.)		
Milk†	6,000.0	9,429.7
Cull cow‡	268.5	268.5
2-year-old‡	74.0	74.0
1-year-old‡	5.2	5.2
Veal‡	39.6	39.6
Capital expense ($)§		
Use of equipment	0.88	0.88
Taxes and insurance on cows	0.95	0.95
Breeding fees	6.00	6.00
Commercial feed	7.73	19.27
Hauling hay from field	3.60	4.32
Hay harvesting	20.75	23.72
Power	4.12	4.77
Miscellaneous	9.04	9.04
Total cash expense	53.07	68.95
Capital investment ($)§		
Cows	153.90	200.00
Equipment	15.92	15.92
Total capital investment ($)	222.89	284.87

*Rations fed to milk cows, USDA, BAE (Data for Iowa 1948-1952). The total concentrates fed for the state was adjusted by the amount of milk production per cow for Mills County for average management; for above-average management, feed requirements were adapted from: University of Minnesota. Farm labor and farm cost 1953. Minn. Report No. 217. September 1954.

†Average amount of milk sold per cow for Crop Reporting District II, Iowa Crop and Livestock Reporting Service for average management; for above-average management production adapted from: University of Minnesota. Farm labor and farm costs. Minn. Report No. 217. September 1954.

‡Ingels, John and Cannon, C. Y. The mortality of calves in the Iowa State College dairy herd. Proc. American Soc. Anim. Prod. 1936.

§Heady, Earl O. and Olson, R. O. Substitution relationships, resource requirements and income variability in the utilization of forage crops. Iowa Agr. Exp. Sta. Res. Bul. 390. 1952.; and University of Minnesota. Farm labor and farm cost 1953. Minn. Report No. 217. September 1954.

Crop Rotations

Estimates of crop yield and fertilizer requirements for the four rotations corn-corn-oats-meadow, corn-corn-oats-meadow-meadow, corn-oats-meadow and corn-oats-meadow-meadow were obtained from the Agronomy Department of Iowa State College. These estimates were drawn from experiments conducted at the Soil Conservation Experiment Farm at Clarinda, Iowa. The experimental yields were reduced 20 percent to approximate farm conditions.

Supplemental Livestock Data

The feed and capital requirements for the dairy enterprises have been obtained from published reports from Iowa State College, University of Minnesota and the Iowa Crop and Livestock Reporting Service. These requirements are based upon one cow and replacements of one-third of a calf, one-third of a 1-year-old and one-third of a 2-year-old. The productive life of a cow (4.47 years) is based on 29 years of culling and mortality rates at Iowa State College. The feed and capital requirements for two levels of dairy management, are summarized in table A-1. Input coefficients for hogs are shown in table A-2.

The supplementary poultry enterprise considered in this study is for two levels of management, average and above-average. This enterprise is a small supplementary laying flock which competes only for capital. The housewife supplies all the labor. Estimates of the feed and capital requirements for the two levels of management were derived from a summary of farm records in Minnesota and Iowa and are presented in table A-3.

Estimated Fixed Costs

Machinery investment for crop production has been treated in this study as a fixed cost, since a given amount must be owned by the tenant before the farm can be planted to any rotation. The machinery investment required by tenants and other fixed costs are given in table A-4. These fixed costs mainly include depreciation and insurance on farm machinery.

TABLE A-2. BASIC INPUT-OUTPUT DATA FOR SWINE FEEDING SYSTEMS ON A UNIT BASIS, REPRESENTING NUMBER OF LITTERS IN UNIT (EXCEPT FOR FEED PER 100 POUNDS PORK PRODUCED).

Production and resource requirements	Spring pigs (1:0)		Spring and fall pigs (1:1)		Spring and fall pigs (2:1)		Spring, summer and fall pigs (1:1:1)	
	Ave. mgt.	Above ave. mgt.	Ave. mgt.	Above ave. mgt.	Ave. mgt.	Above ave. mgt.	Ave. mgt.	Above ave. mgt.
Feed per 100 pounds pork produced*								
Corn equivalent (lbs.)	436.9	322.8	458.8	338.9	451.5	333.5	454.0	335.2
Prot. supplement (lbs.)	43.9	46.0	45.2	48.5	44.4	47.7	44.7	47.9
Hay equivalent (lbs.)	94.3	83.3	47.1	41.6	62.8	55.4	63.2	55.7
Capital investment per unit ($)								
Sow	47.52	47.52	47.52	47.52	95.04	95.04	142.56	142.56
Equipment	11.91	16.46	29.73	32.69	40.55	46.83	42.77	49.15
Total	59.43	63.98	77.25	80.21	135.59	141.87	185.33	191.71
Annual cash expense per unit ($)†								
Prot. supplement	34.73	40.83	73.02	86.16	107.70	126.69	107.70	126.69
Power	9.90	10.89	19.84	21.79	29.74	32.67	29.58	32.51
Use of equipment	10.21	11.22	20.45	22.46	30.66	33.68	30.49	33.51
Miscellaneous	12.65	13.40	25.33	26.81	37.98	41.72	37.77	41.51
Boar service	2.00	1.50	4.00	3.00	6.00	4.50	6.00	4.50
Total	69.49	77.84	142.63	160.22	212.08	239.26	211.54	238.72
Capital coefficient (Investment and annual cash expenditure)	128.92	141.82	219.88	240.43	347.67	381.13	396.87	430.43
Labor per unit (hrs.)‡	26.0	26.0	59.0	59.0	85.0	85.0	85.0	85.0
No. of pigs weaned per unit§	6.78	7.33	13.46	14.56	20.24	21.89	20.24	21.89
No. of pigs sold per unit**	5.44	6.11	11.79	13.12	17.22	19.23	16.22	18.23
Total production per unit								
Market hogs sales per unit (lbs.)	1,223.78	1,374.75	2,651.63	2,951.75	3,875.40	4,326.75	3,650.40	4,101.75
Sows sales per unit (lbs.)	300.00	300.00	400.00	400.00	700.00	700.00	900.00	900.00
Total sales per unit (lbs.)	1,523.78	1,674.75	3,051.63	3,351.75	4,575.40	5,026.75	4,550.40	5,001.75

* Adapted from: University of Minnesota. Minnesota reports 206, 214, and 215. 1953-54. Adjusted 5-year average (1947-51) of farm business records in southwestern Minnesota based on percent fall pigs and spring pigs as reported by Iowa Crop Reporting Service for 1950-54.

† University of Illinois. Detail cost report for central Illinois 1952, 1953. Dept. Agr. Econ. AE 2969. Included in power charges are feed, fuel, depreciation, insurance and livestock insurance.

‡ Adapted from: Heady, E. O. and Olson, R. O. Substitution relationships, resource requirements and income variability in the utilization of forage crops. Iowa Agr. Exp. Sta. Res. Bul. 390. 1952.

§ Iowa Crop Reporting Service, 5-year average (1950-54).

**Represents total marketed less death loss and gilts for replacement stock.

TABLE A-3. BASIC INPUT-OUTPUT DATA FOR POULTRY ON A HEN BASIS (INCLUDING REPLACEMENTS) FOR TWO LEVELS OF MANAGEMENT.

Item	Average management	Above-average management
Output:		
Eggs (doz.)*	15.00	19.17
Meat (lbs.)	4.87	4.87
Inputs:		
Grain (lbs.)†	91.09	93.09
Commercial feed (lbs.)†	41.99	45.99
Labor (hrs.)‡	2.10	2.10
Cash expense ($)		
Sexed chicks (each)	0.36	0.36
Commercial feed*	1.73	1.89
Power‡	0.06	0.06
Equipment‡	0.22	0.22
Miscellaneous	0.15	0.15
Total cash expense ($)	2.52	2.68
Investment in equipment ($)	1.15	1.15
Total capital outlay ($)	3.67	3.83
Building (sq. ft.)	4.12	4.12
Hen mortality (percent)	15.00	15.00
Chick mortality (percent)	10.00	10.00

* Iowa Crop and Livestock Reporting Service. Iowa egg production by counties. September 1953. Average for Hardin County.

† University of Minnesota. Farm poultry flock returns, 1947-1952. Minn. Report 212. 1954; and Iowa State College. Iowa poultry demonstration flocks 1948-1953.

‡ University of Minnesota. Farm labor and farm costs 1953. Minn. Report No. 217. 1954; and Iowa State College. Iowa poultry demonstration flocks, 1953.

TABLE A-4. ESTIMATED FIXED COSTS FOR TENANTS.

Description of farm machinery	1956 new value	Second-hand value	Estimated life		Annual depreciation	
	($)	($)	(years)		($)	
			New	Used	New	Used
Tractor—3-bottom	2,566	1,350	12	8	213.83	168.75
Plow—3-bottom	356	200	17	12	20.94	16.67
Tandem disk—12-ft.	380	150	20	10	19.00	15.00
Corn planter—4-row	575	375	15	10	38.33	37.50
Fertilizer spreader—10-ft.	265	75	6	3	44.17	25.00
Elevator—42-ft.	700	400	15	8	46.67	50.00
Cultivator—4-row	622	425	12	8	51.83	53.13
Drag harrow—24-ft.	165	50	15	8	11.00	6.25
2 flare box wagons	450	150	20	10	22.50	15.00
Manure spreader	460	250	10	6	46.00	41.67
Endgate seeder	80	35	12	6	6.67	5.83
Pickup truck	1,700	600	10	6	170.00	100.00
Cornpicker	1,879	800	12	7	156.58	114.29
Power mower—7-ft.	350	200	12	8	29.17	25.00
Side delivery rake—8-ft.	380	200	12	7	31.67	28.57
Small tools	100	100	—	—	—	—
Fixed costs for machines	11,080	5,360			908.36	701.66
Total personal property taxes and insurance for tenant (1.5% x $11,080, or 5,360)					166.20	80.40
Estimated TOTAL FIXED COSTS					1,074.56	782.06