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Adjustment Possibilities on Irrigated Farms Jefferson County, Oregon

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SUMMARY AND CONCLUSIONS

Findings of this study reveal that 50 to 60 percent of the farm operators in the North Unit irrigation project are currently earning less than $4,000 per year for their labor and managerial skills.

Farm size is a primary problem. Not a single sample farm of 90 acres or less was able to earn $4,000 for labor and management, and only 50 percent of the sample farms in the 90 to 160 acre size group were able to earn that amount. Farms from 30 to 160 acres in size account for 75 percent of the total farms within the project.

Closer analysis indicates further problem areas. The rotation which is currently the most prevalent is probably not the most profitable under existing conditions. The analysis suggested that greater emphasis on kenland red clover and/or potatoes would constitute an improvement over current practices which may give too much emphasis to barley and alfalfa.

Over-diversification does not now appear to be a serious problem in the project. Most sample farms had only three or four different types of farm enterprises. A few operators had as many as seven.

About one-third of the operators have over-invested in farm machinery of one type or another. Over-investment appears greatest in vine beaters, self-propelled combines, pull-combines, balers, potato planters, and tractors.

Although profitability of a supplemental livestock feeding enterprise was not determinedin this study, its usefulness in utilizing excess labor and surplus feeds was illustrated.

For some farm operators, on-farm adjustments appear feasible. For others, off-farm adjustments may provide the best solution. If one of the goals (there may be several) of a farm family is to have a return of $4,000 to $5,000 for the operator's yearly labor and managerial efforts, then the following adjustments should be considered:

1. The Farm Must be an Economic Unit

   At least 100 acres in the Agency Plains and Metolius-Culver areas and 120-140 acres in the Mud Springs area will be required unless a livestock enterprise is included in the farm business. The additional acreage required in the Mud Springs area results from physical conditions which do not allow efficiency in irrigation labor use. For those units of less than minimum size, the only alternatives appear to be an increase in size, off-farm employment, or a combination of both. Farmers who cannot or will not increase in size probably can increase their income significantly only from off-farm income. These farms, even under optimum conditions and effective use of enterprises, will not have the physical capacity to earn an adequate

income. Size alone, however, does not assure adequate farm income. Even the largest of farms can become insolvent under improper management.

2. The Farm Unit Must be Flexible

Provision should be made in farm organizations to meet changing economic conditions. Ability to change enterprise combinations as their relative profitableness change is an example. Currently, red clover and potatoes are the most profitable crops. In a few years, they may not be. Estimates of minimum economic unit size for this area may be grossly inadequate in 5 - 10 years. Provision should be made for flexibility in the farm plan to provide for this possibility.

3. Cooperative Farming Arrangements

Cooperative farming arrangements offer possibilities of providing for more complete use of land, labor, and equipment in farming. It also stimulates development of management ability along particular lines. Properly developed, such arrangements permit advantages of rotations and diversification and, at the same time, provide for some advantages of specialization.

4. Supplementary Enterprises May Increase Farm Income

The North Unit project is a large producer of grass seed and potatoes. As a result, by-products in the form of screenings, straw, residues, and cull potatoes are available for use as low-cost feeds. These crops have seasonal labor demands. A supplementary enterprise such as livestock feeding offers the opportunity of utilizing this unused feed and labor. Part-time supplemental work off the farm (in town or with neighboring farmers) can be considered a supplemental enterprise. If net income can be increased by adding a supplemental enterprise, it should be seriously considered.

5. Over-Investment in Machinery Should be Avoided

This study points out the need for critical evaluation of machinery investment by farmers. Machinery costs can often be reduced by relying more on custom operators, machinery rental, and joint ownership.

6. Progressive Business Management is a Must

Although a farm may not appear to be noticeably weak in any of these phases, the farm operator may be slowly going broke. Many small, inconspicuous errors in decision-making often have a pronounced effect on net income. When management falls down in any phase of the production process -- organization, labor, buildings and machine use, enterprise combination, or marketing -- net income suffers.

7. Selling the Farm is an Alternative

For some farmers, the best alternative may be to liquidate assets and cease farming. They may either sell the farm land and retain ownership of the farm home for family living or sell out all farm property and move to town.

ADJUSTMENT POSSIBILITIES ON IRRIGATED FARMS IN JEFFERSON COUNTY, OREGON /1

Frank S. Conklin and Emery N. Castle /2

The Problem

Farmers located on the North Unit Deschutes irrigation project, Jefferson County, Oregon, are faced with a problem common to many farmers in the United States - the price-cost squeeze. Increases in costs, coupled with depressed prices for agricultural commodities as a whole, have resulted in reduced net farm income. In 1952, farm prices generally were favorable and a feeling of prosperity was quite universal. The project became known as the "Ladino Clover Capital of the World." Since then, prices received for most commodities grown in the project area have declined considerably. Prices received for two major crops - ladino clover seed and potatoes - have fallen drastically.

Farmers must continually make adjustments to maintain or improve their income position. Farm adjustment possibilities include changes in the size of operating unit, combination of enterprises, combination in the use of production resources, part-time farming, or some combination of these. Liquidating and moving to town can be considered as an off-farm alternative.

The objective of this study was to determine which farm adjustment alternatives, if any, are available to farmers in the North Unit irrigation project in light of physical, economic and institutional conditions in the area.

AREA STUDIED

The North Unit project contains 50,000 irrigable acres located in the heart of Jefferson County. The project is approximately 12 miles wide and

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/1 This study was made with the cooperation of the Agricultural Research Service, United States Department of Agriculture. Mr. Del Kimball, Agricultural Economist, Agricultural Research Service, helped with the survey and contributed to the study in other ways. Mr. Kimball is taking the leadership on a forthcoming study on size relationships and off-farm adjustment possibilities in the study area. This manuscript draws heavily on a thesis submitted by the senior author to Oregon State College in partial fulfillment of the requirements for the Master of Science degree entitled "Factors Contributing to the Success and Failure of Farms in the North Unit Deschutes Irrigation District, Jefferson County, Oregon."

/2 Extension Farm Management Specialist, Oregon Agricultural Extension Service and Agricultural Economist, Oregon Agricultural Experiment Station, respectively.

30 miles long. Climate is semi-arid with an annual rainfall averaging just under nine inches. Average growing season is about 105 frost-free days. Average growing season free from killing frost (28°F. or below) is about 140 days. Crop damage by frost occurs in some years. This usually restricts the area to production of field and row crops adapted to warm days with cool nights and a short growing season. Soil is loamy sand to sandy-loam. A small amount consists of heavier soil -- loam to clay-loam.

Wide topographic variations exist. About 40% of the project is located on a gently sloping table land called Agency Plains. Surface and sub-soils there are heavy textured and tend to be clayey with an underlying hardpan. Few physical limitations exist that would prevent extensive land leveling. Slightly over 20% of the project consists of land that is smoothly undulating to gently rolling with a few slopes up to eight percent that restrict land leveling. This area is called Metolius-Culver. Soil depth is greatest here. The third major area -- Mud Springs -- includes 30% of the project. Irrigated land is intermingled with rough, broken, and stony land with slopes up to 12% that are limited to pasture use. Soils are generally shallow with a high stone content. Land is not suitable for leveling. Two small areas -- Opal City and Trail Crossing -- comprising about 10% of the project, are located at the extreme southern portion of the project.

STUDY PROCEDURE

In 1957, 407 farm units existed within the project. A farm survey was made of a cross-section of these farms to obtain production data for the 1957 crop year. A stratified random sample was drawn and records obtained from 54 farms. To insure adequate coverage of existing farm organizations, stratification was made on basis of soil classification, topography, and operating unit. Farms were grouped by acreage as follows:

Group I	30.0 - 89.9 acres
Group II	90.0 - 159.9 acres
Group III	160.0 acres and over

This size grouping was based on dispersion of total operating units in the project. Operating units less than 30 acres in size plus those located in Opal City and Trail Crossing areas were excluded from the study. It was believed that units with less than 30 acres would not support a commercial farming operation and so were considered outside the scope of this study. Opal City and Trail Crossing areas were excluded because the farming situation there is somewhat different and because the geographical area is small. Results of this study apply only indirectly to these two areas.

Financial records of each sample farm were first summarized to provide information about operating units of varying size and various land-type areas. Next, various farming operations were compared by use of farm budgets. Comparisons were made among the three land-type areas and among different size farms. Crop rotations were analyzed from the standpoint of profitability. Partial budgets were used for making machinery use and cost comparisons,

diversification and supplemental enterprise illustrations, and income variability computations.

PAST ADJUSTMENTS AND CURRENT SITUATION

A comparison was made between years 1949 and 1957 to determine change in farm unit numbers by acreage since project inception. Results are shown in Table 1.

Table 1. Operating Units in the North Unit Project by Number, Acreage, and Percent change from 1949 to 1957. /1

SIZE GROUP (Irrigable Acres)	Number of Operating Units		Percentage		Percent Change from 1949
	1949 /2	1957 /3	1949	1957	
			%	%	
0.0 - 19.9	19	27	3	7	+ 42
20.0 - 39.9	58	41	10	10	- 29
40.0 - 59.9	54	24	10	6	- 56
60.0 - 79.9	109	71	20	17.5	- 35
80.0 - 99.9	89	33	16	8	- 63
100.0 - 159.9	192	123	35	30	- 36
160.0 - 299.9	26	71	5	17.5	+173
300.0 and over	3	17	1	4	+467
Total	550	407	100	100	- 26

/1 In 1949 approximately 40,000 acres were irrigated although water was available for 50,000. In 1957, 49,820 acres of the 50,000 total were irrigated. The other 180 acres were urban and city lands.

/2 Economic Report and Repayment Plan, North Unit Deschutes Project, Oregon. U. S. Department of Interior. Bureau of Reclamation. Nov. 1951

/3 Taken from files of the North Unit Irrigation District, Madras, 1957.

Table 1 shows that considerable adjustment in operating unit size has occurred since 1949. Undoubtedly more changes will be made. Between 1949 and 1957, the number of operating units was reduced twenty-six percent. Greatest decrease was in the 20.0 to 160.0 acre range. Operators who could not adjust either left farming altogether or continued to farm on a part-time basis. Some operators stayed in the area and maintained an acreage for family living as indicated by the increase in number of operators in the 0.0 to 20.0 acre range. Many farmers did adjust the size of their farming operation as shown by the increased number of farmers who were farming more than 160 acres in 1957.

To obtain a picture of the current economic situation on farms in the project, returns to labor and management were computed for each of the sample farms (Table 2). The method for computing return to labor and management is:

> Cash Farm Receipts - Cash Farm Expenses + (-) Inventory Change - Depreciation - 5% Return to Average Capital Investment = Return to Labor and Management.

Not a single farm in the 30.0-89.9 acre size class returned $4,000 to farm labor and management. Seventy percent of farms in this size group depend on off-farm employment or other off-farm sources of income. Where supplemental off-farm income was not available, many operators were apparently living off their depreciation and/or accepting less than a 5% return on their investment. Over 50 percent of the operators having farms in the 90.0-159.9 acre group were unable to achieve a $4,000 return for labor and management. A third of the farms having 160 acres or over earned less than $4,000. This shows that size alone does not necessarily assure reasonable returns.

Farmers in all sized groups obtained varying degrees of income from off-farm sources. Of the three land-type areas, Agency Plains appeared to have the best income performance. Mud Springs area showed the lowest return.

ECONOMICS OF CROP ROTATIONS

Basic Rotation

Input-output information was synthesized to represent the situation in specific areas for typical farms. "Typical," as used in this study, means normal or representative and is not necessarily synonomous with average. One acreage was used to represent farms within each acreage group. A 60-acre irrigated farm was used to typify the 30.0-89.9 acre group, 140 acres for the 90.0-159.9 acre group, and 240 acres for the 160 acre and over size group.

Cropping histories from sample farms showed a rotation of 3 years alfalfa, 1 year potatoes, and 2 years grain to be most common. This rotation will be referred to as the basic rotation. Proportion of land needed for each crop for a single year was compared with proportion of total land in the project actually devoted to these crops in 1957. The comparison was very close.

Table 2. Income Status of 54 Sample Farms, North Unit Deschutes Irrigation District, Jefferson County, Oregon, 1957.

Size Group	30 to 89.9 acres	90 to 159.9 acres	160 acres & over
Average Investment	$29,000	$39,200 /1	$56,200 /1
Number of Farms	17	20	17
Percent Receiving Less Than $4,000 Return to Labor and Management	100	54	34
Percent Receiving Income From Off-Farm Labor /2	70	29	42
Percent Receiving Other Income /3	52	50	59
Average Labor Income	-$ 293	$ 4,380	$16,410
Highest Labor Income	$ 3,990	$16,170	$44,000
Lowest Labor Income	-$ 4,920	-$ 3,740	-$ 4,410

/1 Average investment would have been higher except that several operators in the sample were renters. No provision for land value was made for these cases.

/2 Operator and wife working off-farm with earnings of $500 or more per year.

/3 Other income includes rental income, dryland income, income from another farm, stocks, bonds, etc. in excess of $500 per year.

Input-output data used in the basic rotation and in other computations is in the appendix.

Input-output data were tabulated to obtain profitability of the basic rotation for each of three size farms within the land-type areas. Only minor differences existed in input-output data between Agency Plains and Metolius-Culver areas. Because of this, they were combined and considered as one area. Investment, land use, and expense budgets are given in Tables 3, 4, and 5 for each of the six area-size categories considered. Net farm income and labor-management income are shown for each typical farm. Net farm income was obtained by subtracting total expenses from gross farm income. After subtracting a 5 percent return to land, land improvement, and building investment, and 6 per cent for machinery investment, the amount remaining was the payment to labor and management (labor income) for a year's efforts. Net farm income represents a return to the operator's capital, labor and management. In the long run it is not possible to withdraw more than this amount for family living. In the short run it may be possible for the family to withdraw net farm income plus depreciation allowance. However, such a procedure does not allow for maintenance of the farm business. If allowance is made not only for operating expenses and depreciation but also a return to invested capital, the amount remaining is the operator's income for his labor and management. If profit is the major objective, the farmer will consider what he can obtain for his labor and capital on the farm compared with off-farm opportunities.

Table 5 shows that a 60 acre irrigated farm using the basic rotation returns only $929 labor-management income. This is not enough money for a family to live on. If family desires are modest, the $3,365 income from a 140 acre unit would probably suffice. The $6,551 return from the 240 acre unit would generally be considered adequate. Returns from the Mud Springs area were somewhat lower than from the other two areas primarily because of reduced yields.

Budgets do not show a complete picture, however. They do not indicate if unused labor exists which might be devoted to off-farm employment or utilized through addition of complementary or supplementary enterprises. Figures 1 through 6 show labor requirements and labor availability by months. Figure 1 indicates that a full-time off-farm job requiring a 40-hour week can easily be fitted into the program of a 60-acre farm. Figure 2 shows much the same thing except that increased labor requirements for irrigation in the Mud Springs area would restrict off-farm employment slightly or would require longer farm working days. Figures 3 and 4 indicate that supplementary and/or complementary enterprises could fit in the present program of the 140 acre unit thus utilizing excess labor. The 140 acre farm in the Mud Springs area is more restricted in adjustment possibilities because of the high irrigation labor requirements for the basic rotation (Figure 4). Figures 5 and 6 illustrate the labor situation for the 240 acre unit. The six months of hired labor required in Figure 5 could be eliminated or more fully utilized by changing the cropping program. Some farmers believe that in order to keep a good hired man he must be hired on a yearly basis. If this is true, an adjustment is necessary on large farms to fully utilize a year-round hired man. Otherwise, a farmer would have to depend entirely on hourly labor during peak labor periods or arrange the farming

Table 3. Investment for 60, 140, and 240-acre Irrigated Farms on North Unit Project, 1957.

INVESTMENT	Agency-Plains & Metolius-Culver			Mud Springs		
	60 acres	140 acres	240 acres	60 acres	140 acres	240 acres
Land	15,000	35,000	60,000	15,000	35,000	60,000
Land Improvement	1,500	3,500	6,000	--	--	--
Buildings	2,320	2,600	6,350	2,320	2,600	6,350
Machinery	4,360	8,380	17,100	4,200	7,900	16,380
Total	23,180	49,480	89,450	21,520	45,500	82,730

Table 4. Land Use and Production on 60, 140, and 240-acre Irrigated Farms on North Unit Project, 1957.

CROP	Agency-Plains & Metolius-Culver						Mud Springs					
	60 acres		140 acres		240 acres		60 acres		140 acres		240 acres	
	acres	yield	acres	yield	acres	yield	acres	yield	acres	yield	acres	yield
Alfalfa	30	126 T	70	294 T	120	504 T	30	126 T	70	294 T	120	504 T
Potatoes	10	180 T	23	414 T	40	720 T	10	160 T	23	368 T	40	640 T
Wheat	15	840 bu.	15	840 bu.	15	840 bu.	15	840 bu.	15	840 bu.	15	840 bu.
Barley	5	350 bu.	32	2240 bu.	65	4550 bu.	5	300 bu.	32	1920 bu.	65	3900 bu.

Table 5. Income and Expenses Budgets for 60, 140, and 240-Acre Irrigated Farms on North Unit Project, 1957.

	Agency Plains and Metolius - Culver Areas			Mud Springs Area		
	60 acres	140 acres	240 acres	60 acres	140 acres	240 acres
Income						
Alfalfa	$ 1,953	$ 4,557	$ 7,812	$ 1,953	$ 4,557	$ 7,812
Potatoes	4,311	9,915	17,244	3,832	8,814	15,328
Wheat	1,747	1,747	1,747	1,747	1,747	1,747
Barley	344	2,204	4,477	295	1,889	3,838
Total	$ 8,355	$18,423	$31,280	$ 7,827	$17,007	$28,725
Expenses						
Variable costs						
Labor - monthly	$	$ --	$ 1,500	$ --	$ --	$ 1,500
hourly	105	132	1,504	105	132	1,356
Custom work	1,627	2,658	--	1,527	2,428	378
Machine rentals	97	225	70	80	184	--
Fertilizer	627	1,457	2,508	496	1,152	1,984
Seed	460	1,016	1,732	460	1,016	1,732
Crop supplies	60	432	744	--	294	504
Irrigation water charge	334	779	1,336	334	779	1,336
Gas, oil & grease	310	610	1,035	300	570	1,005
Potato sorting, weighing, inspection	1,080	2,484	4,320	960	2,208	3,840
Interest on operating capital	60	130	265	60	130	265
Total variable costs	$ 4,760	$ 9,923	$15,014	$ 4,322	$ 8,893	$13,900
Fixed costs						
Overhead /1	162	202	298	162	202	294
Vehicle licenses	16	32	52	16	32	52
Insurance - vehicle - property - liability	112	120	262	112	120	262
Taxes - real estate & personal property	274	567	1,049	271	559	1,037
Repairs - building	46	52	127	46	52	127
machinery	256	468	956	248	412	922
Non-cash costs						
Depreciation - machinery	539	1,071	2,168	526	939	2,125
building	58	66	159	58	66	159
Total fixed costs	$ 1,463	$ 2,578	$ 5,071	$ 1,439	$ 2,382	$ 4,978
Total expenses	$ 6,223	$12,501	$20,085	$ 5,761	$11,275	$18,878
Net Farm Income	$ 2,132	$ 5,922	$11,195	$ 2,066	$ 5,732	$ 9,847
Interest on Investment	$ 1,203	$ 2,557	$ 4,644	$ 1,118	$ 2,354	$ 4,300
Return to Labor and Management	$ 929	$ 3,365	$ 6,551	$ 948	$ 3,378	$ 5,547

/1 Electricity, telephone, office expenses, market information, and social security.

program to minimize labor hiring. Figure 6 shows high seasonal labor requirements for the 240 acre farm in the Mud Springs area.

Comparative Profitability:

Cost and return information for the basic rotation was presented above. The question, "Do other cropping programs exist that might be more profitable?" is now analyzed.

For cultural reasons, most crops on the project must be grown in sequence. Therefore, profitability was determined on a rotation rather than on an individual crop basis. Ideally, each crop grown on the project should be tested for profitability within a logical rotation. This was done for all major crops but not for some minor ones. Peppermint production was one such minor crop. In 1957 only 2.5 percent of project lands were devoted to growing peppermint. It is a profitable crop although it requires a high capital investment (approximately $150 per acre for stand establishment) and purchase of specialized machinery. These requirements probably would prevent some farms from selecting peppermint as a possible crop alternative unless a fairly stable market price could be assured. However, mint production has been increasing and additional acreages are being devoted to this crop. Production of small grass seeds such as Illahee fescue, smooth brome, Kentucky blue, and some other seeds were not considered since they are grown on only 1.5 percent of the project lands.

In making comparisons of various rotations, the principal cash crop was selected and other crops were added to develop a logical crop sequence. The following rotations were chosen for comparison along with the basic rotation:

1. (Basic Rotation)
   3 years alfalfa
   1 year potatoes
   2 years grain

2. 3 years alfalfa
   2 years potatoes
   1 year grain

3. 2 years kenland red clover for seed
   1 year potatoes
   1 year grain

4. 4 years merion bluegrass
   1 year potatoes
   1 year grain

5. 3 years alfalfa
   3 years grain

Field operation and cost budgets were prepared for merion bluegrass and the legumes grown for seed. Using 1957 prices, kenland red clover proved to be approximately $20 and $30 per acre, respectively, more profitable than alsike and ladino clover grown for seed. To be as profitable as kenland at 30¢ per pound, ladino and alsike would need to be 50¢ and 22¢ per pound, respectively. It was not, therefore, necessary to include these two crops within a rotation since kenland would be more profitable under likely price relationships.

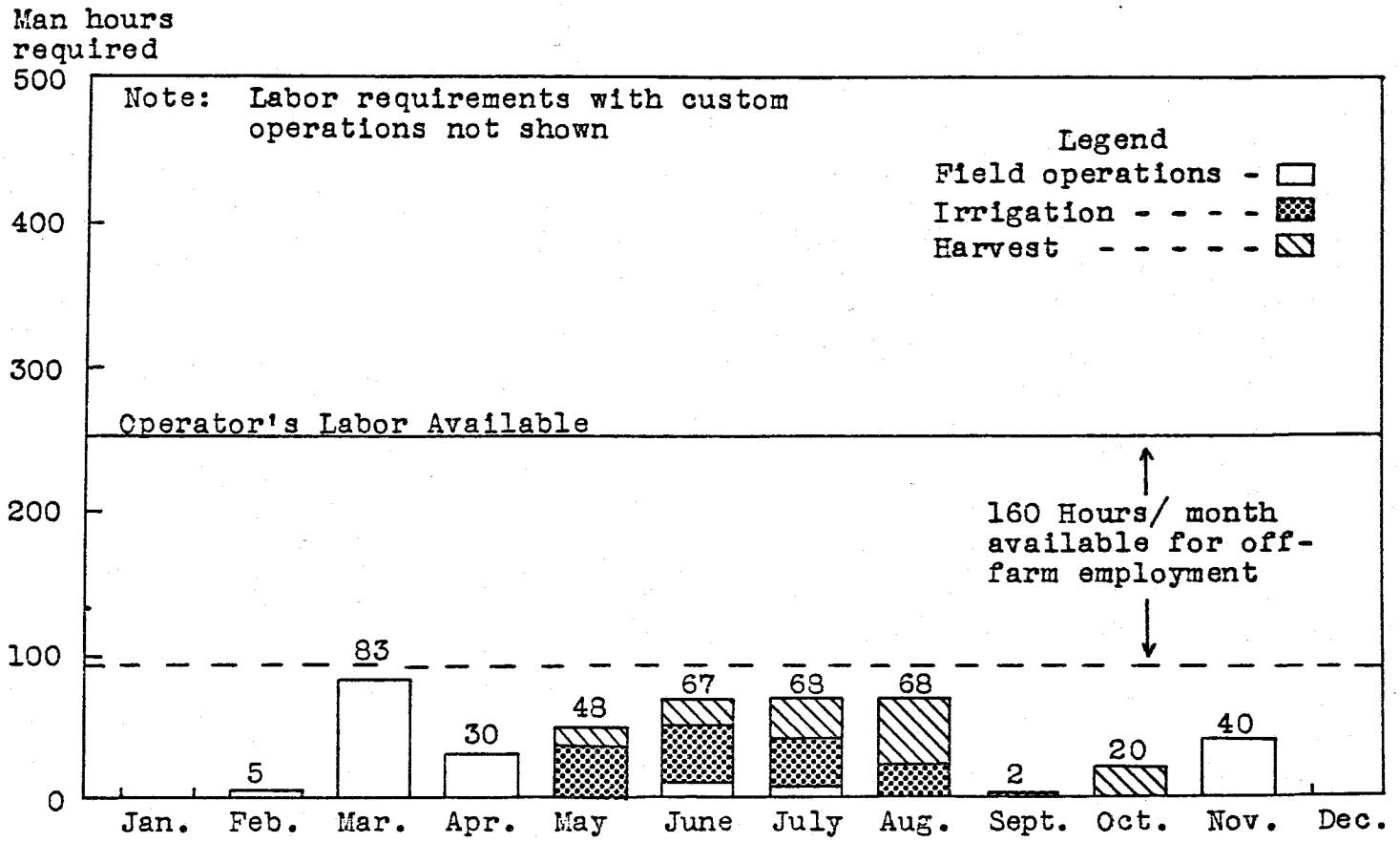

Figure 1. Labor Requirements and Availability for a 60 Acre Irrigated Farm Using the Basic Rotation, Agency Plains and Metolius-Culver Areas.

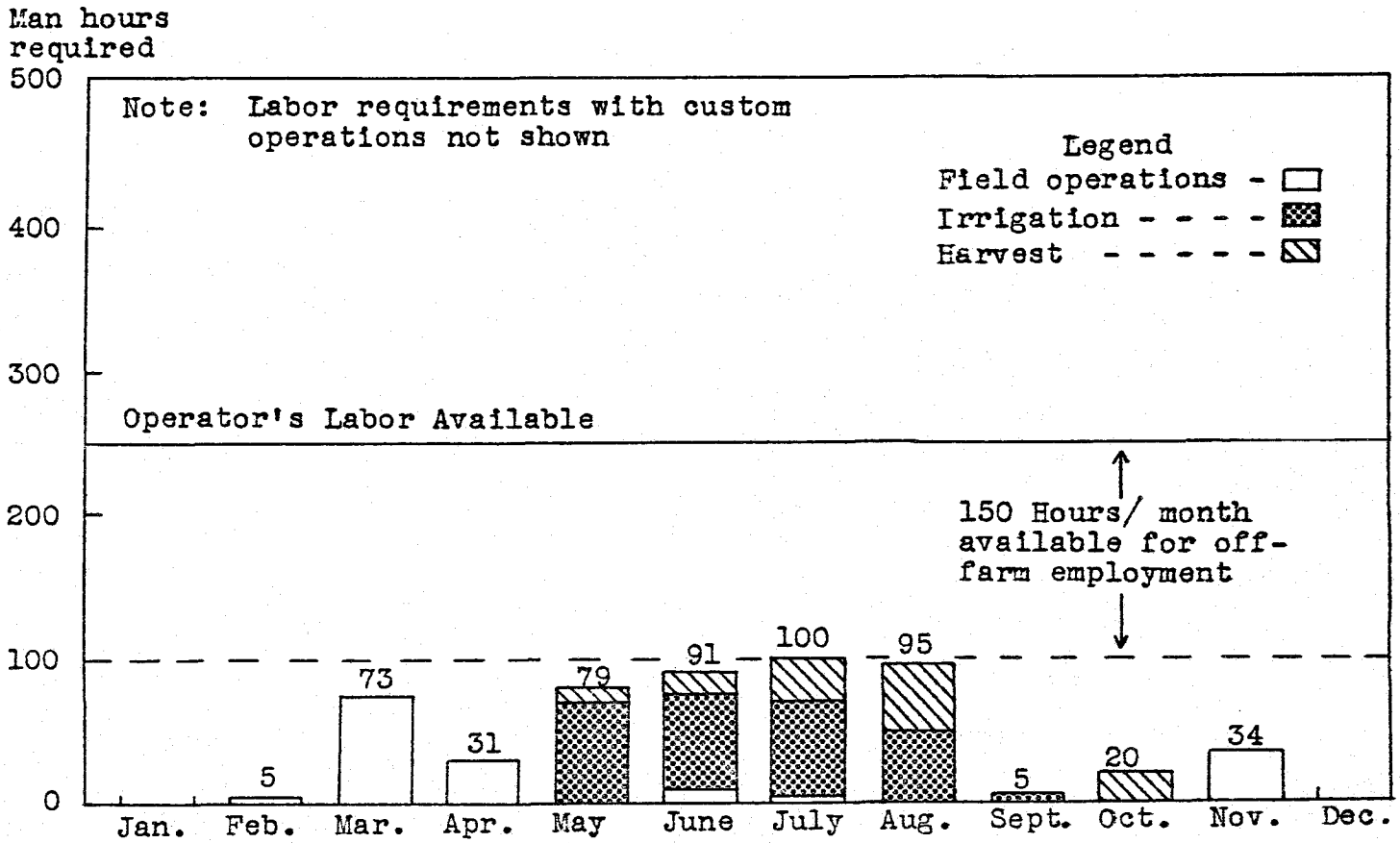

Figure 2. Labor Requirements and Availability for a 60 acre Irrigated Farm Using the Basic Rotation, Mud Springs Area.

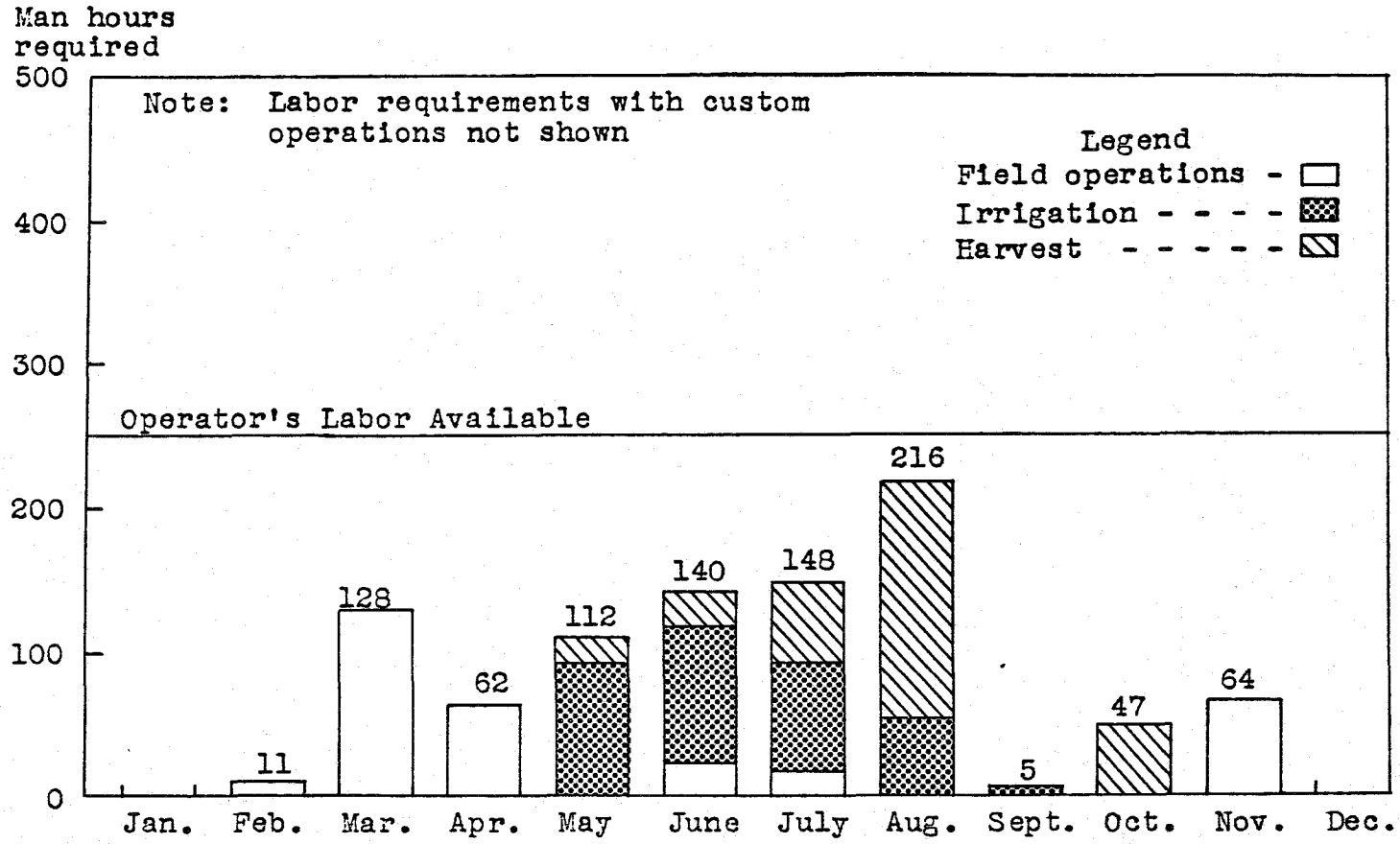

Figure 3. Labor Requirements and Availability for a 140 Acre Irrigated Farm Using the Basic Rotation, Agency Plains and Metolius-Culver Areas.

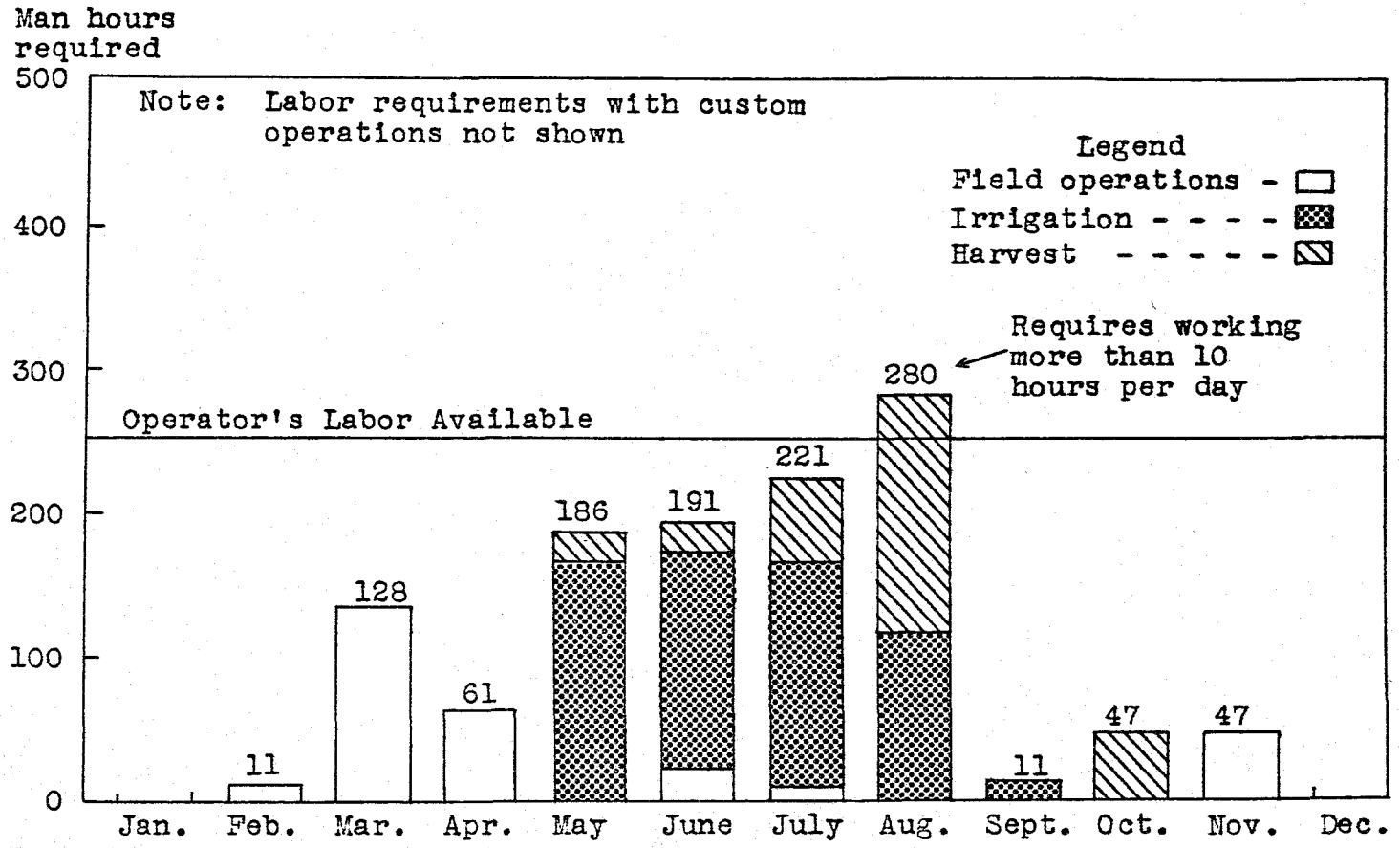

Figure 4. Labor Requirements and Availability for a 140 Acre Irrigated Farm Using the Basic Rotation, Mud Springs Area.

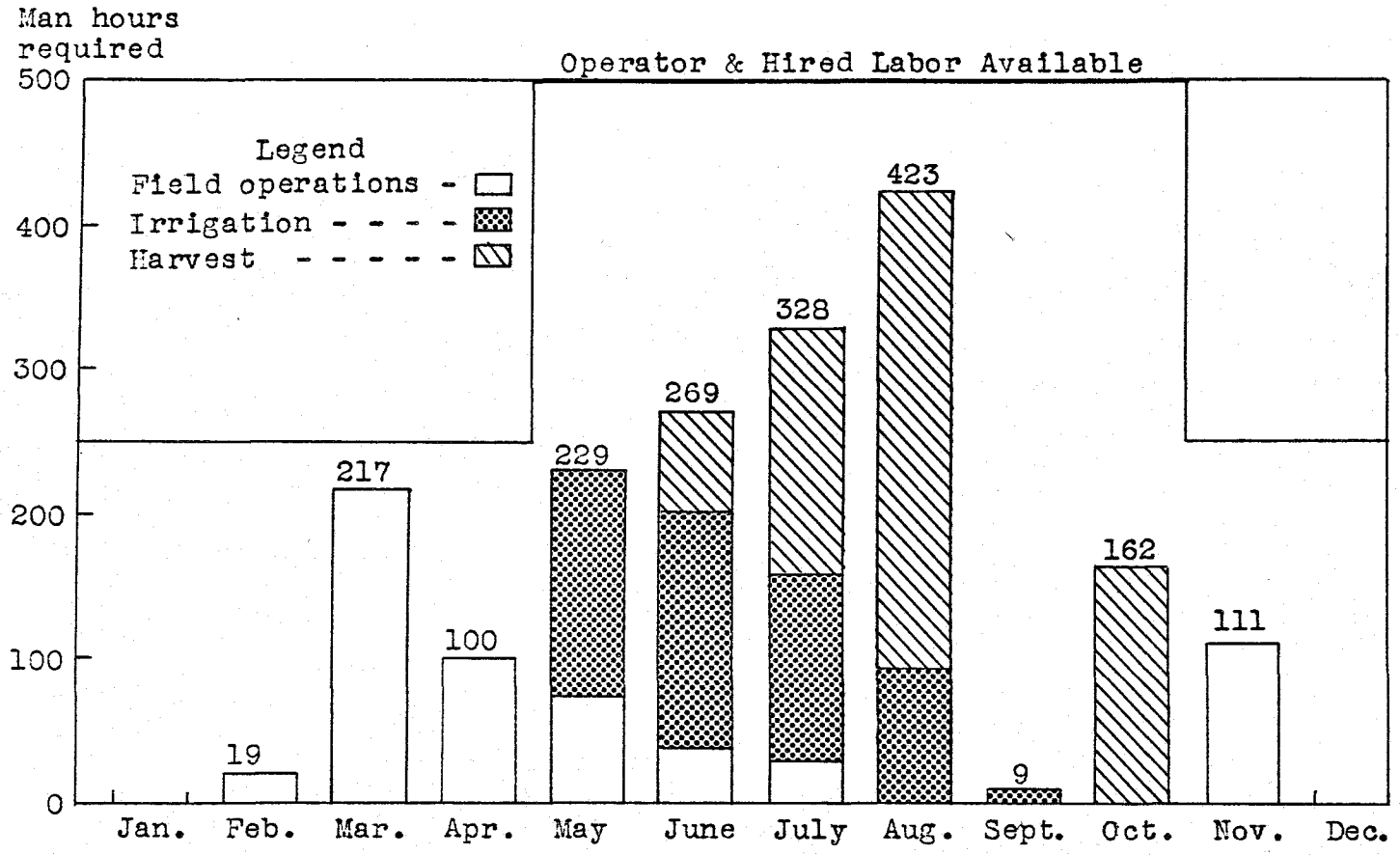

Figure 5. Labor Requirements and Availability for a 240 Acre Irrigated Farm Using the Basic Rotation, Agency Plains and Metolius-Culver Areas.

Note: Labor requirements with custom operations not shown

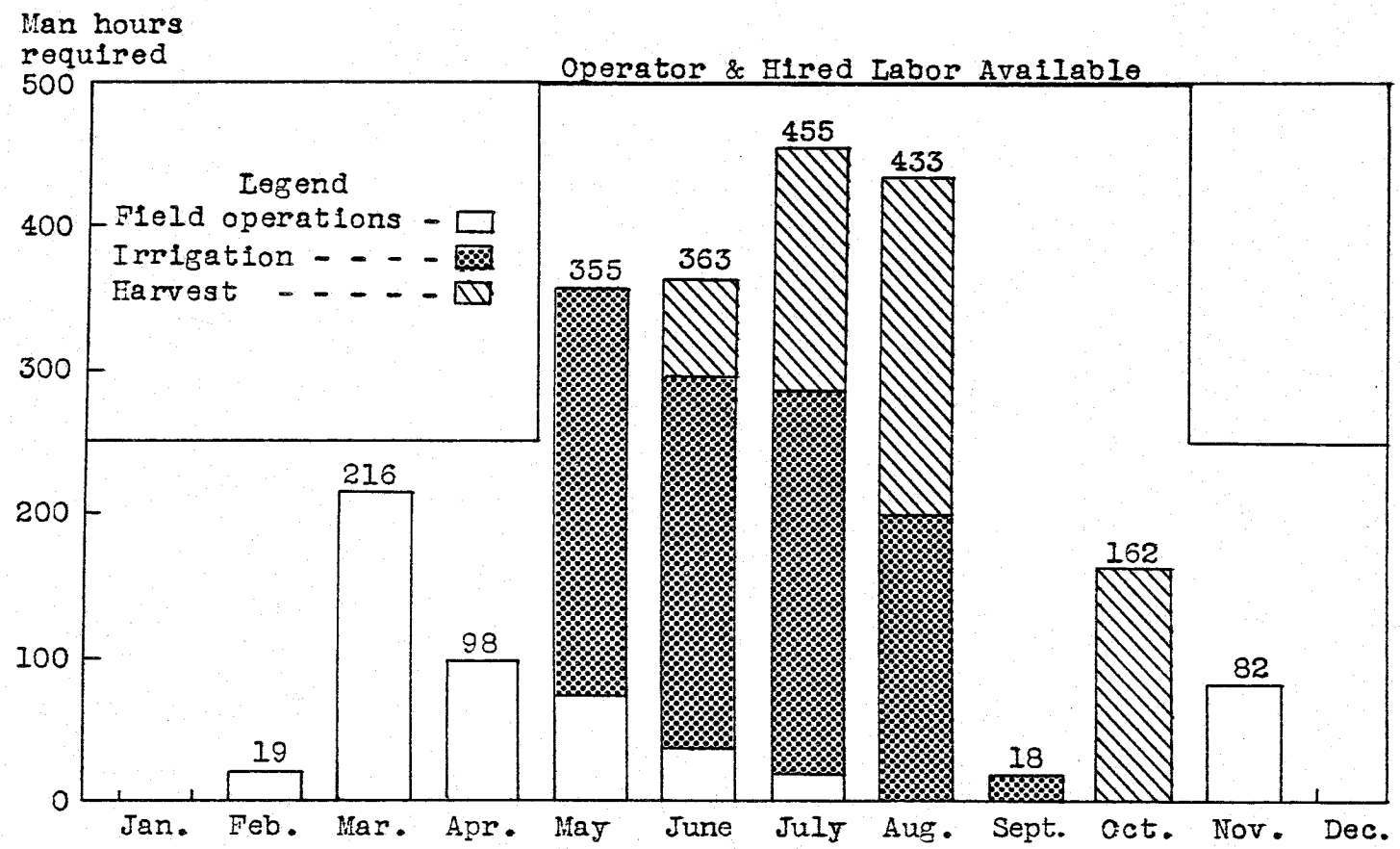

Figure 6. Labor Requirements and Availability for a 240 Acre Irrigated Farm Using the Basic Rotation, Mud Springs Area

Note: Labor requirements with custom operations not shown

In farming operations certain costs are fixed - that is, they must be paid regardless of what crops are produced. Fixed costs include such items as depreciation, interest payments, taxes, and insurance. These costs would be important only when purchase of specialized machinery for a particular crop is being contemplated. For this reason, fixed costs were not introduced into this analysis. This simplified the problem since only variable costs, those costs associated with each enterprise, were considered. Variable expense items include fertilizer, seed, crop supplies, irrigation water, gas, oil, grease, custom work, machine rental, potato inspection and grading, seed cleaning and labor. By using yields obtained on the sample farms for 1957, it was possible to use 1957, 1958, and 1959 prices and compare profitability between years.

Labor requirements were determined and listed on a monthly basis to find where labor bottlenecks occurred. The operator was assumed to be available 250 hours per month. Where operations occurred which required more than one man, additional labor was assumed to be hired.

Although calculations were made for each of the three farm size groups in each area, results were the same within each area-size group. Results were reduced to a variable return per acre basis for ease of comparison and are determined by subtracting variable expenses from gross receipts. The results are listed below:

A Comparison of 5 Rotations for Profitability.

	Rotation (basic rotation)	Net Returns Per Acre Above Variable Costs		
		1957	1958	1959
		$	$	$
1.	3 years alfalfa 1 year potatoes 2 years grain	64	62	122
2.	3 years alfalfa 2 years potatoes 1 year grain	82	65	178
3.	2 years kenland red clover 1 year potatoes 1 year grain	84	74	139
4.	4 years merion bluegrass 1 year potatoes 1 year grain	67	95	131
5.	3 years alfalfa 3 years grain	45	56	75

Considerable variability in returns between rotations existed on a year to year basis. This inherent risk involved in the agriculture of the area places

considerable emphasis on relatively intensive cash crops. Yet if a farmer wishes to maximize profits there does not appear to be any alternative to placing considerable emphasis on some rather high value enterprise - unless he can add a livestock enterprise or work out a cooperative rotation program.

Rotations 2, 3, and 4 were most profitable over the 3 years considered. Rotation 2, which emphasizes potato production, showed both greatest income variability and also highest income potential.

Historically, potato production has provided the highest variable net return potential of any single crop. However, it is a crop that requires considerable managerial ability. It is also a high risk crop because of price and yield variability and high fixed costs. For these reasons the potato enterprise was selected for more intensive analysis in the following section.

Rotation 3 required least amount of labor per month. In the case of the 240 acre farm in the Agency-Plains and Metolius-Culver areas using rotation 3, no monthly or hourly hired labor was required other than for potato harvest. Figure 7 shows labor requirements for rotation 3. This rotation came closer than any other to fully utilizing the operator's labor without hiring additional help. Some hired labor would be required for the 240 acre Mud Springs farm because of additional labor required for irrigation. Labor requirements for rotation 4 were about the same as for rotation 3. The basic rotation had high labor requirements in certain summer months for haying. With the 140 and 240 acre farm, additional labor was needed for mowing, raking, baling, hauling, and stacking hay, which are all carried on simultaneously to prevent excessive hay bleaching and shattering.

Rotation 5 had low labor requirements but also yielded lowest returns. It should not normally be considered unless a severe labor problem exists.

VARIABILITY OF RETURNS FROM POTATO ENTERPRISE

Many uncontrollable factors affect a farmer's income. These include weather, degree of national prosperity, changes in consumer tastes and preferences, technological change, sociological change, and in some cases, governmental or institutional change. Farmers have partial control over other factors affecting farm income. They include such items as production costs, yield, product quality, and price received. Each of these factors is affected by the farmer's decisions and actions - which in turn affect farm income. A decision to apply more fertilizer may well change both production costs and yields. A decision to defer irrigation may lower product quality. Current knowledge of market forecasts and trends plus ability to adapt this information to specific farming situations will aid in adjustment to future market conditions.

The effect that changes in price, quality, yield, and production costs acting independently and in combination have on income is illustrated for the potato enterprise (Table 6). Comparisons can be made using other crop or live-

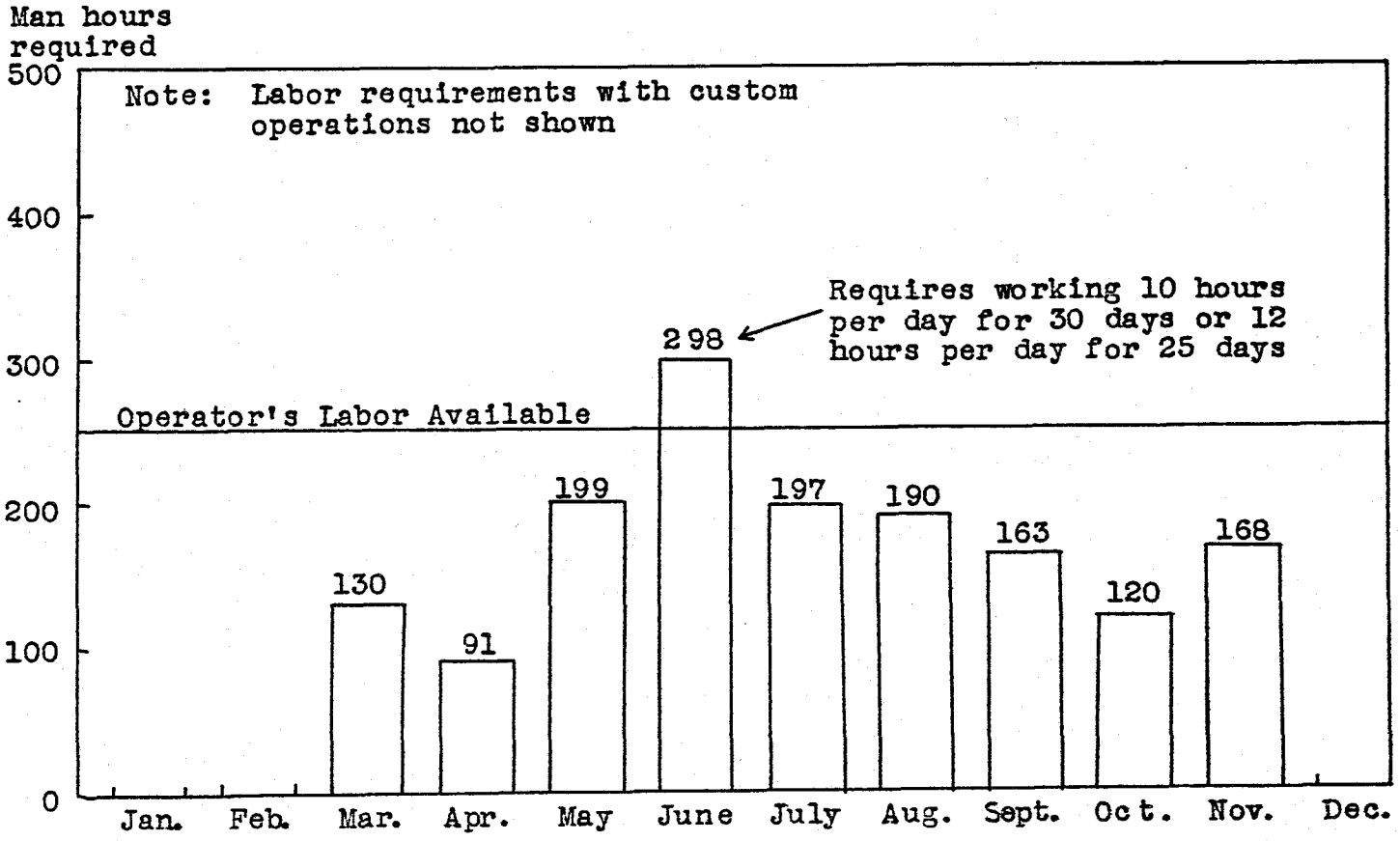

Figure 7. Labor requirements and availability for a 240 acre irrigated farm using rotation 3, Agency Plains and Metolius-Culver areas, 1957.

stock enterprises. This analysis shows that what often appears to be a minor factor when combined with several other minor factors can produce a marked difference in net returns. Lower yields of four tons to the acre can affect returns by about $100 per acre. A slight percentage change in "grade out" can affect income by nearly $60 per acre. Over-investment in machinery can easily add $35 to the acre in operating costs. Even greater variation in these items than shown in Table 6 can be found on farms in the project area. The farmer who decides to place considerable emphasis on growing potatoes must consider the effect of one or two poor years on the solvency of his business.

Table 6. Return Per Acre as Affected by Changes in Production Costs, Price, Yield, and Quality of Potatoes.

Item	Successful Farm	Hard Luck Farm	Effect of Individual Items On Income /1
Yield	18 tons	14 tons	$ - 99.20
Grade Out			
No. 1's	65%	50%	
No. 2's	10%	20%	$ - 57.60
Culls	25%	30%	
Price - No. 1's	$ 1.70/cwt	$ 1.25/cwt	
No. 2's	.85/cwt	.85/cwt	$ -112.50
Culls	4/ton	4/ton	
Production Cost			
Variable Costs	$235/acre	$235/acre	
Fixed Costs	45/acre	80/acre	$ - 35.00
Gross Receipts	$446	$228	
Gross Expenses	$280	$315	
Labor & Management Return	$166	$-87	

/1 This column shows individual effect of the items. The total of this column does not give total difference between the two farms because of interaction among the factors.

CUSTOM HIRING VERSUS OWNERSHIP OF SPECIALIZED FARM MACHINERY

The question often arises among farmers as to whether it "pays" to own highly specialized farm machinery or to hire a custom operator. Initial cost is high for balers, combines, potato planters, potato combines, and other specialized machines. This means that per-acre or per-hour cost of each machine is also high unless the machine is used heavily. Cost of ownership declines with increasing use as fixed costs (depreciation, interest, taxes, insurance) are distributed over a greater number of hours or acres of use.

Machine costs with varying degrees of use were computed and used to establish a "break-even point" where ownership costs are equal to custom hiring costs. Beyond this point, it would cost less to own machinery. Short of this point, it would be cheaper to hire a custom operator.

Seven machines were compared on a custom vs. ownership basis. Machines selected were: a hay baler, potato planter, vine beater, potato digger, potato combine, 6' pull-type grain combine, both new and used, and a 10' self-propelled grain combine (Table 7). Costs were divided into two categories -- fixed and variable. Fixed costs were allocated on a yearly basis and would exist whether the machine was used or not. Variable costs are incurred when the machine is actually used and stay fairly constant on a per unit of use basis. When a tractor was involved in an operation (say baling) only its variable costs were included. Tractor fixed costs were not listed since the operator would have the tractor and its fixed costs regardless of whether or not a custom operator was hired. Ownership cost of a potato planter and a vine beater were compared with rental charge for these machines since machine rental, rather than custom hiring, was the common practice. Tractor and labor costs were not involved in the comparison of these two machines.

Costs alone do not provide the whole story. Other factors may have a bearing on the decision of custom operation vs. ownership. For example, if capital is a limiting factor of production, it may be more profitable to invest $5,000 in fertilizers or feeder livestock than in a $5,000 potato combine. Partial budgeting by a farmer would answer this question. Timeliness of operation is another factor. Is cost of owning machinery justified by decreased risk brought about by timeliness through ownership? The answer should be based on frequency of bad weather, critical harvest periods, and availability of custom operators. Either custom hiring or machine ownership may save labor. If this labor saved is not put to productive use, however, net farm income may well be reduced. More leisure time may be some farmer's goal, but it is well to know the cost of that leisure time.

To what extent does over-investment exist in specialized machines in the project? The answer is shown on Table 8. With all machines there was some over-investment, with the greatest being in new pull-type combines, self-propelled combines and vine beaters. In every case but one, the machinery was being used at approximately one-half capacity or less. This information helps lend significance to the percentage over-investment data.

Table 7. Ownership Versus Custom Hiring of Specialized Farm Machines, North Unit Project, 1957.

ITEM	HAY BALER	POTATO PLANTER 2 ROW	VINE BEATER	POTATO DIGGER 2 ROW	POTATO COMBINE	COMBINE 10' S.P.	COMBINE 6' PULL	COMBINE 6' PULL (USED)
Original Cost (dollars)	3,400	1,000	900	1,000	5,000	6,200	3,200	1,250
Useful Life (years)	10	18	13	16	10	12	16	13
Fixed Costs Per Year								
Depreciation /1	$ 306	$ 50	$ 62	$ 56	$ 450	$ 465	$ 180	$ 87
Interest /2	102	30	27	30	150	186	96	38
Taxes /3	56	16	15	16	82	102	53	21
Shelter /4	26	8	7	8	38	46	24	9
Insurance /5	8	2	2	2	12	16	8	3
Repairs /6	136	40	36	40	200	248	128	50
TOTAL FIXED COST	$ 634	$ 146	$ 149	$ 152	$ 932	$1,063	$ 489	$ 208
Variable Cost	$ /ton	$/acre	$/acre	$/acre	$/acre	$/acre	$/acre	$/acre
Fuel /7	.08					.63	.49	.49
Lubricants /8	.01	.02	.02	.02	.04	.02	.03	.03
Supplies	wire-1.00							
Tractor-Gas-Oil	.22			1.07	1.50		1.26	1.26
Labor /9	.43			2.14	15.50	1.36	2.50	2.50
TOTAL VARIABLE COST	$ 1.74	$ .02	$ .02	$ 3.23	$17.04	$ 2.01	$ 4.28	$ 4.28
COST OF CUSTOM HIRING	$ 4.50/T	$ 2.50/A*	$2.00/A*	$10.00/A	A 3/T	$ 7/A	$ 7/A	$ 7/A
Approximate "break-even" point	230 tons or 77A @ 3T/A 58A @ 4T/A 46A @ 5T/A 38A @ 6T/A	60 acres	75 acres 60 acres with a 2.5/A rental fee	22 acres	50A @ 12T/A 40A @ 14T/A 30A @ 16T/A 25A @ 18T/A 22A @ 20T/A 20A @ 22T/A	210 acres	180 acres	75 acres

/1 Original Cost - 10% salvage value ÷ years useful life
/2 6% x average investment (½ of original investment)
/3 Original cost x 1.65%
/4 Estimated at .75% of original cost
/5 Estimated at .25% of original cost
/6 Estimated at 4% of original cost
/7 23.2¢ per gallon
/8 Estimated at 2¢ per hour of operation
/9 $1.50 per hour
* Machine rental only

One-third of the operators probably are over-invested in machinery of one type or another (Table 8). Not all farmers are over-invested to the same degree. Based on age of the farm machinery, it appears the major portion of over-investment occurred early in the 1950's when clover prices were high and service by custom operators quite limited. For farmers who are currently over-invested in machinery and wish to adjust, no clear-cut answer for liquidating machinery is available. If specialized equipment is owned and underutilized, sale price will probably be considerably less than purchase price. For old machines, it is likely that only salvage value can be obtained. Since salvage value is not known, it is not possible to give a general answer to all farmers. If return from selling a machine is greater than amount saved by owning and operating for the remaining useful life of the machine over custom hiring, it would pay to sell, assuming custom operators were available. In future purchases of specialized machinery fixed and variable costs of ownership plus non-cost factors should be weighed against prices and services provided by custom operators and machine rental operators. Partnership agreements and custom work opportunities might also be investigated as a way for small operators to justify ownership of specialized machines.

SPECIALIZATION AND DIVERSIFICATION COMPARED

Over-diversification is not a problem within the project. Most sample farms had only three or four enterprises--the minimum needed for rotation purposes. Only a few farmers had as many as seven enterprises.

Although there are advantages of diversification, the trend in recent years has been toward greater specialization. /1 An effort was made to develop a farming plan to combine advantages of both diversification and specialization. To provide an example of a logical program for a diversified operator, a basic rotation was taken and then expanded over a three-year period to include eight crops on a 240 acre farm. To provide a logical specialized program, a synthesized cooperative rotation between two operators was assumed. This provided individual operator specialization while maintaining soil fertility and a minimum of weed and insect problems. A rotation of two years kenland red clover, one year potatoes, and one year of grain was used involving two specialized operators. One operator ran the kenland red clover phase and one operator ran the potato phase. Each operator owned 120 acres, making a total of 240 acres for the rotation. This provided enough acreage to justify ownership of specialized farm machinery. Operation of kenland red clover and grain together was believed to be logical since the same machinery was required for each crop. Also, clover is generally seeded with grain as a nurse crop. Harvesting was no problem as grain would be combined in August and clover in September.

/1 For a more detailed study of diversification and its effectiveness in reducing price variability see: Diversification -- Does it Reduce Price Variation? Hu Hsuen Mo and Emery Castle, Sta. Bul. 569, Ore. Agr. Exp. Sta.

Table 8 Over-Investment in Farm Machinery on Sample Farms, North Unit Project, 1957

Item	Hay Baler	Potato Planter	Vine Beater	Potato Digger	Potato Combine	Self Propelled Combine	Pull-Type Combine (new)	Pull-Type Combine (used)
Number Sample Farmers Owning	27	18	15	20	9	19	3	16
Percent of those owning that have Over-Invested								
30.0 - 89.9 acre group	50	67	--	50	--	100	100	33
90.0 -159.9 acre group	40	42	88	20	--	57	--	57
160.0 and over	27	12	50	0	11	78	--	17
Total - All groups	37	33	73	15	11	68	100	38
Use Required for "Break-Even"	230 T.	60 A.	60 A.	22 A.	-- /1	210 A.	180 A.	75 A.
Ave. use of those Over-Invested	133 T.	20 A.	24 A.	17 A.	--	92 A.	77 A.	33 A.
% of Present Use Required to "Break-Even"	173	300	250	129	--	228	234	227

/1 In the single case of over-investment, the combine was not used.

This arrangement was also designed to provide for comparable incomes to each operator. Results are shown in Table 9. In each case, it was assumed that all necessary farm machinery was owned. Average net return per acre under specialized operation was 50 percent greater than the diversified operation using the same yields. Principal reasons for this were economic efficiency in use of specialized machinery and high income crops.

Several ways may exist in which an actual specialized plan between two or three operators could be worked out satisfactorily. Rather than having each operator accept vagaries of price for his own crop, total return to labor and management might be pooled. This might prevent antagonism if price of one crop grown stayed low in relation to another for several seasons. If cooperative land sharing is not desirable or equitable, a rental program might be practical if the participants are willing to rent their land. Another possibility exists where an operator owning a large amount of land delegates some authority to two men, each of whom is willing and capable of handling one specialized phase of the program. The owner can then devote a majority of his time to over-all management problems.

This analysis of possible cooperative arrangements was intended to be illustrative rather than exhaustive, although it appears that such arrangements might be economically feasible. If the "price-cost" squeeze continues, which appears likely, specialization may help to increase returns by increasing size without making costly land purchases. If most farm income is from field crops, a minimum of 240 acres is needed to assure economies of size with specialized operation. Of course, if an intensive livestock enterprise is added, such as livestock feeding, less than 240 acres would be needed.

SUPPLEMENTARY LIVESTOCK ENTERPRISE

In many instances, farm income can be increased by adding a supplementary enterprise to the farm operation. A supplementary enterprise is one which better uses existing farm resources without jeopardizing earning power of present enterprises.

A cattle feeding program was selected as most appropriate for illustrative purposes. Surplus labor and crop residues often exist in the project area. Crop residues such as straw, cull potatoes, and grass and legume aftermath which have considerable feed value are often either wasted or provide only a limited return if sold. Slack labor periods frequently exist when an operator or a hired man is not kept busy throughout the year. A supplemental livestock feeding enterprise could utilize both unused feed and labor. /1

/1 Other possible livestock enterprises are hogs and sheep. Hogs are unable to utilize the roughage by-products on most farms in the area. The white muscle problem has limited farm flock sheep production as well as cow-calf enterprises.

Table 9. A Comparison of Specialization and Diversification.

Item	Diversified		Specialized			
	One Operator		One Operator		One Operator	
	Owning 240 acres		Owning 140 acres		Owning 140 acres	
Investment						
Land	$ 60,000		$ 30,000		$ 30,000	
Leveling	6,000		3,000		3,000	
Buildings	6,350		3,300		1,900	
Machinery	32,050		18,000		24,000	
Total Investment	$104,400		$ 54,300		$ 58,980	
Gross Receipts	Acres	Receipts	Acres	Receipts	Acres	Receipts
Alfalfa	60	$ 3,906	--	$ --	--	$ --
Potatoes	40	17,244	--	--	60	25,866
Wheat	15	1,747	15	1,747	--	--
Barley	5	344	45	3,100	--	--
Merion Bluegrass	50	5,250	--	--	--	--
Penn Lawn Fescue	10	1,424	--	--	--	--
Kenland Red Clover	40	3,000	120	9,000	--	--
Ladino Clover	20	900	--	--	--	--
Total Receipts	240	$ 33,815	180	$ 13,847	60	$ 25,866
Fixed Costs	$ 6,191		$ 3,592		$ 4,538	
Variable Costs	16,268		3,357		13,284	
Total Expenses	$ 22,459		$ 6,949		$ 17,822	
Net Farm Income	$ 11,356		$ 6,898		$ 8,044	
Return to Capital	$ 5,025		$ 2,496		2,746	
Return to Labor & Mgt	$ 6,331		$ 4,402		5,298	
Average Return Per Acre	$ 26		$ 40		40	

To illustrate use of a feeding enterprise a farm of 240 acres was assumed which has a rotation of two years kenland red clover, one year potatoes, and one year grain. With that operation Figure 7 shows that considerable labor is available in the December-April period. Either a 120 or 150-day feeding period would prove ideal. If pasturing is preferred, cattle could be purchased in late summer and pastured on kenland red clover and potato ground after harvest, then placed in a feedlot in December. Little labor would be required during the pasture period. This would allow an eight-month feeding period. Assuming a yield of 18 tons per acre on potatoes with a gradeout of 25 percent culls, 270 tons of potatoes would be available for feed. If 50 pounds of potatoes were consumed per head per day, enough potatoes would be available to feed 70 head of feeders. /1 Grain straw and clover aftermath could be baled, hauled in, and fed free choice or mixed with a protein supplement. Information from interviews show that an average of 1.65 hours is spent per day for 50 head. The 70 head would require 2.4 hours per day or a monthly total of 75 hours. Assuming feeders were placed in the lots on December 1, after fall pasturing on crop residues, they would be fed until May 1. Labor requirements for the farm, after adding the supplementary feeding enterprise, is shown in Figure 8. This can be compared with Figure 7 to show effect on labor utilization. A winter feeding operation of this type would fit into any of the five rotations previously discussed. It would reduce amount of leisure time available to the operator. If the farmer wished to take a month's vacation, he would have to leave a hired man in charge.

Because of the diverse nature of livestock operations within the project and limited data available, budgeting studies to determine relative profitabilities were not undertaken. The analysis only illustrates how a supplemental operation could be fitted into the over-all farm plan and how unused resources could be utilized effectively. This does not mean that livestock feeding will be profitable in all cases nor that cattle feeding is the only livestock enterprise available.

/1 Feeding potatoes to livestock is treated in Station Circular of Information 595, entitled, "Supplementing Potato Diets for Fattening Cattle," by E. N. Hoffman and J. E. Oldfield, Oregon Agricultural Experiment Station, Sept. 1958.

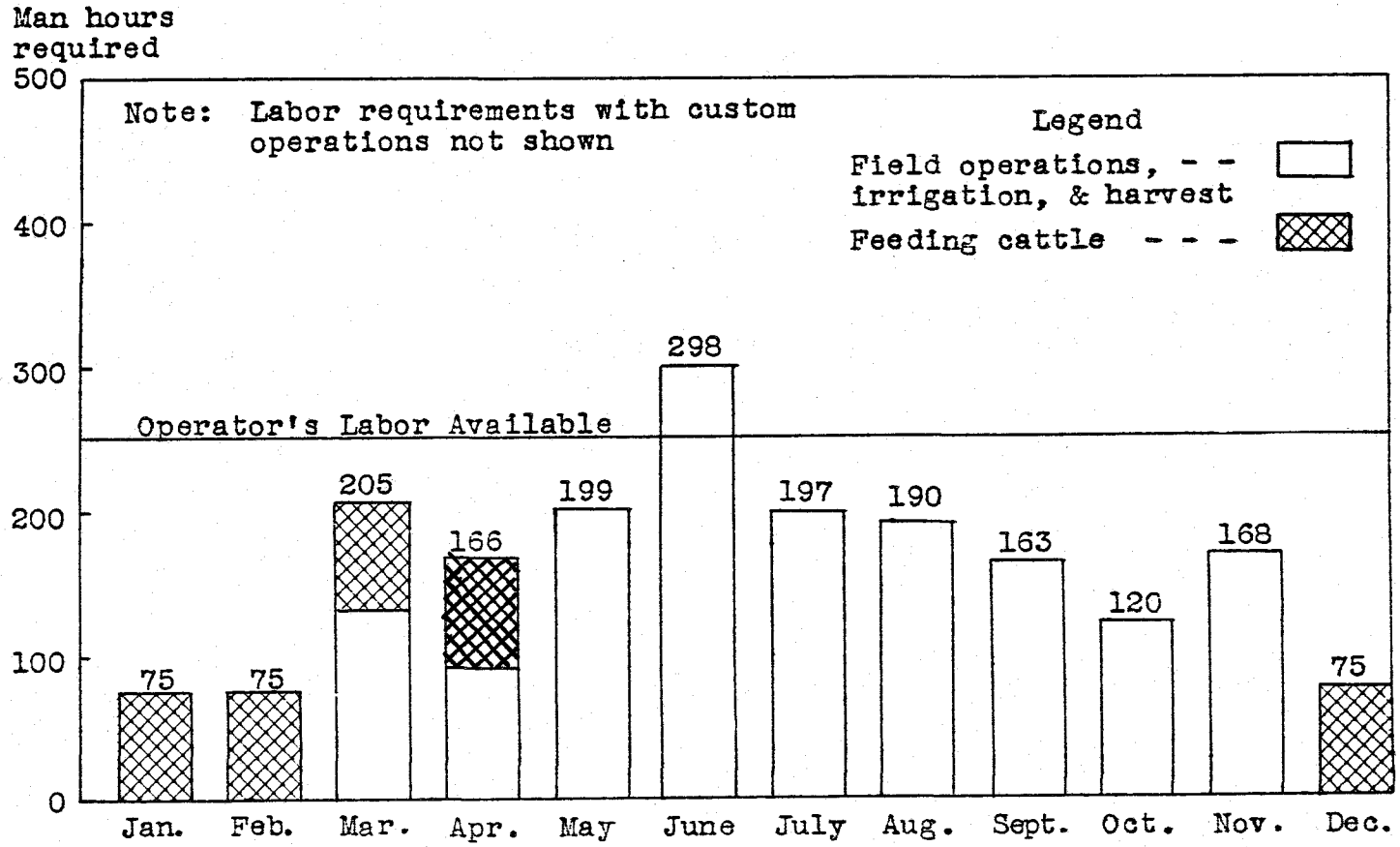

Figure 8. Labor requirements and availability for a 240 acre irrigated farm using rotation 3 plus a 70 head feeder operation, North Unit Project, 1957.

APPENDIX

Real estate included property in land, buildings, and land improvements such as fences, ditches, and ponds. A value for the family home and its furnishings was not included since it is classified as a personal rather than a farm investment item. Improved irrigated land was valued at $250 per acre. Building depreciation was calculated by the straight-line method allowing 10 percent of the original cost for salvage value and a useful life of 40 years. Annual building repairs were computed at 2 percent of the original investment. A $25 per acre charge for land leveling on the 60 acre farm in the Agency Plains area was assumed.

A separate machinery inventory was developed for each of the three farm sizes. Investment in these inventories is shown in Table 3 of the text. Inventories were determined on the basis of need for certain pieces of farm machinery to effectively perform necessary field operations. Full ownership of machinery was not assumed in all cases. Partial ownership appeared justified with respect to cost, use, and timeliness on certain pieces of machinery. Joint ownership is fairly common on the project.

A listing of the typical field operations performed on different crops was made to provide a basis for determining labor and machine requirements and costs used in the budgets. Custom operation was assumed when ownership was clearly uneconomical. Custom rates used were obtained from the farm survey. Supply items such as seed, fertilizer, spray, and baling wire were also obtained from the survey.

Water costs per acre were computed on the basis of 1957 charges provided by the North Unit irrigation office. Mud Springs area required nearly twice the amount of irrigation labor per crop as either of the other two areas. This was due primarily to the fields in Mud Springs area being small, irregular in shape, and generally steep. This prohibited leveling and required extra vigilance by the irrigator to perform a satisfactory job. Shallow topsoil in some areas also prevents easy penetration and requires more careful irrigation.

Average yields and prices used for each crop grown are shown in appendix Table 1.

The farm operator was assumed to be capable of working 250 hours per month. Labor was hired when labor requirements were in excess of this amount, where an operation requires more than one person, or when several operations occur simultaneously. Average rate for hired monthly labor was $250 per month plus housing. Hourly labor was charged at $1.25 per hour for field work and $1.50 per hour for harvesting. Harvesting labor which involved women or boys was charged at $1.25 per hour.

Table 1. Average Yields and Prices for Crops Grown in the North Unit Project, 1957

Crop	Agency Plains & Metolius-Culver	Mud Springs	Price Per Unit		
	Average Yield Per Acre	Average Yield Per Acre	1957	1958	1959
Alfalfa (for hay)	4.2 Tons	4.2 Tons	$15.50/T	$18.00/T	$28.00/T
Potatoes /1	18 Tons	16 Tons	$24.00/T	$22.00/T	$40.00/T
Wheat	55 bu.	56 bu.	$ 2.08/bu.	$ 1.81/bu.	$ 1.77/bu.
Barley	70 bu.	60 bu.	$41.00/T	$42.00/T	$33.00/T
Merion bluegrass seed /2	200 lbs.	200 lbs.	.70/lb.	1.10/lb.	1.12/lb.
Ladino clover seed /2	150 lbs.	150 lbs.	.30/lb.	.58/lb.	.55/lb.
Alsike clover seed /2	350 lbs.	350 lbs.	.19/lb.	.185/lb.	.19/lb.
Kenland red clover seed /2	250 lbs.	250 lbs.	.30/lb.	.35/lb.	.30/lb.

/1 Average project grade-out on potatoes was used -- 60% - 1's
15% - 2's
25% - culls

/2 Data from schedules inadequate. Average project yields and prices taken from annual Status of Water Users Report, 1957.