FACTORS CONTRIBUTING TO THE SUCCESS AND FAILURE OF FARMS IN THE NORTH UNIT DESCHUTES IRRIGATION DISTRICT, JEFFERSON COUNTY, OREGON

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CHAPTER 1

INTRODUCTION

Problem Identification

Farmers in the North Unit, Deschutes Irrigation Project, Jefferson County, Oregon, are experiencing economic difficulty. This is especially notable in the form of reduced net farm income. Other danger signals include -- high degree of farm income supplementation through off-farm employment, loan repayment delinquencies, and farm consolidations and liquidations. This difficulty is apparently being felt not only by the small part-time farmer but also by large commercial farmers as well.

Ironically, the project appeared to prosper from the moment of inception. In 1946 the first lands were brought under irrigation. By 1949 water was made available to the entire 50,000-acre project. Prices received for commodities grown within the project from 1946 through 1952 were relatively high. Ladino clover seed production was especially profitable. The price varied from $.96 to $1.84 per pound during that period. This was sufficient inducement to occasion many farmers to tool up for legume seed production by investing heavily in machinery. It is little wonder that

ladino clover grown for seed became the main cash crop and that the area was dubbed "The ladino clover capital of the world". Since 1952 prices received for some commodities grown within the project have declined sharply. The average price of ladino clover seed fell from nearly $1.00 per pound in 1952 to $.34 per pound in 1953 (6, p.10-29). The price has declined even further since then (10). The average price of potatoes, another basic crop, has shown the same general trend. A high of $3.36 per hundred weight was reached in 1951 with the low of $1.32 occurring in 1953.

Some adjustments appear to have been made in shifting crop enterprises. Production of merion bluegrass and penn lawn fescue for seed have been introduced along with peppermint for oil. Extensive shifting has been restricted, however, by physical limitations of the area. These physical restrictions have been a major deterrent in limiting the number of commodities for which the area has a comparative advantage.

Description of the Problem Area

The North Unit project contains 50,000 irrigable acres located in the heart of Jefferson County. It is bordered on the south by the Crooked River and to the west by the Deschutes and Crooked Rivers. The project is approximately 12 miles wide and 30 miles long and extends in a northerly-southerly direction.

Madras, the county seat, is located near the center of the project and has a population of 1,604 (1957 census). Two other small towns are located on the project -- Culver (population 350) and Metolius (population 300).

The climate is considered semi-arid. Annual precipitation averages just under 9 inches. Without irrigation the project would be unsuited to most cultivated crops. The average growing season is about 105 frost-free days. The average growing season free from killing frost (28° or below) is about 140 days. The range is from 102 to 172 days. The data were taken only from records for the past 10 years since data prior to 1947 were unreliable (14). Even so, frost damage may occur in some years. This climatic limitation restricts the area to production of field and row crops that are adapted to warm days and cool nights and a short growing season (16, p.16-18).

Soil in the area is primarily sandy loam to loamy sand. A small amount consists of heavier soils -- loam to clay loam.

The project has been divided geographically into five land-type areas: Agency Plains, Culver, Mud Springs, Opal City, and Trail Crossing areas. Agency Plains comprises about forty-one percent of the project. It is located northwest of Madras on a gently sloping tableland. The surface and subsoils are heavy textured and tend to be clayey

with an underlying hardpan. There are but few topographic limitations that would prevent extensive land leveling. Twenty-two percent of the project lies within the Culver or Metolius-Culver area which is centrally located in the project. Soil depth is greatest in this area. The land is generally smoothly undulating to gently rolling with a few slopes up to eight percent grade that limit land leveling. Twenty-seven percent of the land is in the Mud Springs area located on the eastern side of the project. It is rightly called the bench and ridge area. The irrigated land is intermingled with rough, broken and stony land with slopes up to twelve percent that are suitable primarily for pasture. The soils are generally shallow with a high stone content. The land is not suitable for leveling. The Opal City and Trail Crossing areas comprise only ten percent of the project. They are located at the southern end of the project. Both areas are relatively smooth with sandy loam soils. The Opal City area is high in surface rocks. Some leveling can be accomplished (16, p.19-24).

Statement of Objectives

Changes in technology which result in cost reducing innovations are being made available to agriculture nearly every day. These innovations tend to increase farm output. As output increases the relatively inelastic aggregate

demand function tends to reduce prices received for farm products. Because of this, it seems quite likely that the well known "cost-price squeeze" will continue to take its toll among farmers unwilling or unprepared to take advantage of these changes. Farmers in the North Unit project are no exception.

Why are some North Unit farmers unable to meet these changes? Are the farms overdiversified? Are the farms too small for optimum efficiency? Have farmers overinvested in machinery? What adjustments are economically feasible? These questions are but a few that need answering.

The main objective of this study is to provide answers to the questions stated. It is then hoped that the answers will provide farmers with a framework for making management decisions applicable to their individual farm problems yet consistent with institutional, economic, and technological changes being brought forth by our dynamic society.

CHAPTER 2

METHODOLOGY

To analyze accurately the farming problems that exist in the project, input-output data were collected showing present farm organizations and practices in the area. A survey of farm operators was decided as being the best method for obtaining this data. Limited time and funds necessitated that data be taken only from a sample of the farm population. A stratified random sample was drawn and records were obtained from 56 farms. Personal interviews were employed and the necessary information was recorded on farm schedules. The information included land use and production, farming practices, investment, operating costs, labor and machine requirements, labor use, and returns. The schedules were taken in August 1958 but pertained to the 1957 crop year.

Sampling Procedure

The project area was stratified geographically on the basis of soil classification and topography which determined land capability (13). It was further stratified by size of operating unit. This was believed necessary to insure coverage of existing farm organizational structures and their physical, economic, and institutional limitations (9, p.325-328).

Geographical stratification was made on the basis of the original land-type areas. The Agency Plains, Metolius-Culver, and Mud Springs areas were used. The Opal City and Trail Crossing areas were excluded from this study. Since they constituted only ten percent of the total project area their inclusion as a strata was not justified. A visual observation coupled with historical data bore evidence that Opal City and Trail Crossing were unlike any of the other three areas. Thus, incorporation would have merely introduced additional sampling error. This means of course, that results will apply only indirectly to the Opal City and Trail Crossing areas.

The population within each of the geographical strata was further stratified by size of farm operating unit. To accomplish this a complete listing of farm operating units by operator was procured from the North Unit irrigation district office (2).

The operating units included both land owned and rented. The legal description of each unit was also recorded to facilitate farm unit location for area stratification purposes. The population totaled 407 operators. This population was arrayed by farm size with reference only to acres actually irrigated. Ten-acre increments were used. The array was then stratified into three farm-size groups based on the dispersion of operating units within the array.

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

The resultant is nine cells -- three farm-size substrata within each of the three geographical stratums.

Operating units of less than thirty acres were omitted from this study since it was believed that units of this size operated independently would not support a commercial farming operation. This removed 35 operators from the population. These farms may constitute a welfare problem which is outside the scope of the study. The lower limit for group I would probably have been set higher but for the fact that 33 operators were concentrated in the 30.0 to 39.9 acre range. This heavy concentration of units warranted inclusion of these farms in the population. An additional 26 commercial farm operators were removed from the population by the deletion of Opal City and Trail Crossing areas.

Selection of a sample from the population of 346 units was the next logical step. A sample size of 60 was considered feasible, consistent with limited time and funds. This was decided on the basis of consultation with statisticians. A statistical determination of sample size could not be used since variability within the project was not known. The sample size for each cell was determined by the

percentage of the total population falling within each cell as shown in Table 1.

Table 1. Determination of Sample Size for Each Cell by the Population Percentage.

Size range (acres)	Agency Plains			Metolius-Culver			Mud Springs		
	N/1	% of Pop.	n/2	N	% of Pop.	n	N	% of Pop.	n
30.0 - 89.9	38	11.0	7	48	13.9	8	43	12.4	7
90.0 - 159.9	55	15.9	9	52	15.0	9	26	7.5	5
160.0 - Over	34	9.8	6	24	7.0	4	26	7.5	5
Total	127	36.7	22	124	35.9	21	95	27.4	17

/1 - N = population, 346 total.

/2 - n = sample, 60 total.

The sample farms and alternates within each stratum were selected randomly using a table of random numbers. Alternates were used where records could not be obtained from the sample farms. Reasons for alternate selection include: unwillingness to cooperate, too busy with harvest, land leased out in 1957, moved out of or into the project in 1957, or operator not available during the time period schedules were taken.

Operating unit records obtained from the water office were for crop year 1957. Since the data were collected in 1958 some farm changes took place in the interim period. Seven operators had either moved out of the area, leased out

their property, or dissolved partnership agreements in 1957. Two operators moved into the project in late 1957. Ten operators moved up into a larger farm-size group and four moved down. Alternates were not used where a shift from one farm-size group to another occured. It appeared more desirable to include these farms that had changed in size since a shift in size is a way to meet constant changes affecting farm organizations. The final result showed the following breakdown of samples within each cell to be:

	Sample Size
AGENCY PLAINS	
30.0 - 89.9 acres	6
90.0 - 159.9 acres	6
160.0 acres and over	8
METOLIUS - CULVER	
30.0 - 89.9 acres	6
90.0 - 159.9 acres	8
160.0 acres and over	4
MUD SPRINGS	
30.0 - 89.9 acres	6
90.0 - 159.9 acres	7
160.0 acres and over	5
TOTAL	56

Analytical Procedure

In order to compare various farm organizational structures within the project it was necessary to follow a systematic procedure. The budgeting method was selected since it provides for an individual comparison of alternative plans for prospective profitability (1, p.328-361). These plans can then be contrasted with those from the same

or a different geographical area and those from the same or a different size group. To make the budgets meaningful appropriate data must be used. It was therefore necessary for all of the input-output data obtained from the schedules to be categorized and recorded by area and farm unit size. The data included machinery inventory and repairs; real estate investment; labor and machine operations; machinery operating rates; custom operation charges; supply costs and amounts; irrigation costs, application rates, and labor requirements; total labor requirements and costs; production yields and prices; and miscellaneous and overhead expenses.

Past cropping history was obtained from the schedules and arranged on a spread sheet. From this was determined the basic or most prevalent rotation and other probable rotations. The basic rotation consisted of three years alfalfa, one year potatoes, and two years grain. Farms of varying size and geographical location were then compared by the budgeting method using only the basic rotation. The farms were compared on the basis of cost and volume characteristics. The next step was to hold acreages constant and vary enterprise combinations consistent with agronomic principles. Five rotation programs were selected and their relative profitabilities analyzed. The rotations used are as follows:

Basic rotation (1)	(2)	(3)
3 years alfalfa	3 years alfalfa	2 years kenland red
1 year potatoes	2 years potatoes	1 year potatoes
2 years grain	1 year grain	1 year grain

(4)	(5)
4 years merion blue	3 years alfalfa
1 year potatoes	3 years grain
1 year grain	

Partial budgets were prepared for determining the size of enterprise required over and above which machinery should be owned rather than have custom operations performed. The comparison was made with specialized farm machines that could either be owned or hired on a custom basis. The machines were: balers, potato planters, vine beaters, potato diggers, potato combines, and both pull-type and self-propelled grain combines. A determination of over-investment in farm machinery, if any, then was made of the sample farms.

Changes in yield, price, quality, and cost for various farm commodities often affect net farm income adversely. These changes were shown using four selected crops -- alfalfa, potatoes, merion bluegrass, and kenland red clover.

A comparison study was made between extreme specialization and extreme diversification with acreages held constant. The diversified farm contained alfalfa for hay, grain, potatoes, grass and legumes grown for seed. To provide for extreme specialization a program was worked

out in which two farmers were involved. The rotation included kenland red clover for seed, potatoes, and grain. One man managed the clover and grain operation and the other managed the potato operation. The rotation was set up on an inter-farm basis. A comparison of the two systems was made and limitations of each system noted.

Supplemental livestock programs often utilize some factors of production that would otherwise go unused and increase net farm income by so doing. A livestock feeding enterprise was cited as an example of a supplemental enterprise and its importance to the economy of the project pointed out.

CHAPTER 3

PAST ADJUSTMENTS AND CURRENT SITUATION

Considerable adjustment in size of operating unit has been made within the project during the past 8 years. Table 2 shows the change that has taken place in number and size of operating units from 1949 to 1957 (16, p.48).

Table 2. Operating Units in the North Unit Project by Number, Size, and Percent Change From 1949 to 1957. /1

Size group	Operating units number		Distribution of units		Change in numbers from
Irrigable acres	1949	1957	1949	1957	1949
			%	%	%
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 & over	3	17	1	4	+467
Total	550	407	100	100.0	-26

/1 In 1949 approximately 40,000 acres were irrigated although water was available for 50,000. In 1957, 49,810 acres out of the 50,000 total were irrigated. The other 190 acres were urban and city lands.

In that 8-year period operating units have been reduced by twenty-eight percent. The greatest decrease has come from the 20.0 to 160.0 acre range. It appears that

operators who could not adjust either left the farming profession altogether or continued to farm on a part-time basis. Some operators stayed in the area and maintained an acreage for family living purposes as indicated by the increase in number of operators in the 0.0 to 20.0-acre size group. The operators who were able to adjust, and did, increased their size considerably as shown by the large number increase in the 160.0 to 300.0-acre group. The 300.0-acre and over group increased the greatest percentage wise.

To obtain a picture of the current economic situation of farms in the project, returns to labor and management were computed for each of the sample farms. This provided a fairly accurate picture of each land-type area within the project assuming the sample farms to be representative of the population. All of the sample farms were compared on a basis of earning power. A criteria of $4,000 return to labor and management was set as being a reasonable residual for farm family living purposes. The sample farms were compared in Table 3 showing whether they received the $4,000 residual for the 1957 crop year. Only returns from irrigated crops and livestock were considered. This was done to obtain earning ability for various size irrigated farms only. In some cases off-farm employment and income from other sources were used to supplement farm income. This was also recorded in the table.

Table 3. Income Status of 54 Sample Farms, 1957.

	Agency Plains	Metolius-Culver	Mud Springs	All Areas
30.0 - 89.9 Acres				
Sample size	5/1	7	5/1	17
Number receiving less than $4,000 return to labor and management.	5	7	5	17
% receiving less than $4,000 return to labor and management.	100	100	100	100
% receiving income from off-farm employment. /2	60	70	80	70
% receiving other income. /3	40	57	60	52
90.0 - 159.9 Acres				
Sample size	6	7	7	20
Number receiving less than $4,000 return to labor and management.	2	4	5	11
% receiving less than $4,000 return to labor and management.	33	57	71	54
% receiving income from off-farm employment.	0	29	57	29
% receiving other income.	50	29	71	50
160.0 Acres and over				
Sample size	8	4	5	17
Number receiving less than $4,000 return to labor and management.	1	1	3	5
% receiving less than $4,000 return to labor and management.	12	25	60	34
% receiving income from off-farm employment.	12	50	60	42
% receiving other income.	62	75	40	59

/1 Sample size original 6, but incomplete data from one schedule prevented its inclusion for analysis.

/2 Operator and (or) 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.

In no area were the 30.0 - 89.9-acre units able to return $4,000 for family use. The income obtained was so low in most cases that considerable dependency on income from off-farm employment and other sources was required. Approximately fifty percent of the operators in the project having farms in the 90.0 to 159.9-acre size group were unable to achieve the $4,000 return to labor and management and required supplemental income. Even some of the farms in the large size group obtained low returns. Of the three land type areas Agency Plains appeared to have the best income performance. The Mud Springs area showed the lowest return. Over one-half of the large farms in that area did not earn $4,000 return. Some of the farms in Agency Plains and Metolius-Culver areas earned from $20,000 - $50,000 return to labor and management while no farm in the Mud Springs area earned over $15,000. Extremely large units were not prevelant in the Mud Springs area and this fact may have attributed to some of the difference in income.

CHAPTER 4

INPUT-OUTPUT DATA

In order to determine input-output coefficients it was necessary to determine the cropping patterns followed on this project. After concluding this, input-output requirements were determined for each of the selected rotations. To prevent budgeting analysis from becoming unmanageable a typical or average size farm was used for each of the three size groups. A 60-acre irrigated farm was used to typify the 30.0 to 89.9-acre size group, 140 irrigated acres for the 90.0 to 159.9-acre group, and 240 irrigated acres for the 160-acre and over size group.

The Basic Crop Rotation

Cropping history data from each of the sample farms were placed on a spread sheet. This cropping history showed crops grown for 1955, 1956, and 1957 crop years. Upon subjective analysis of the various rotations it was decided that the most probable basic rotation would be either 3 years alfalfa or clover for seed, 1 year potatoes, and 2 years grain or a rotation of 3 years alfalfa, 2 years potatoes, and 1 year grain. If the rotation with one year of potatoes were used, fifty percent of the cropland would be in alfalfa, seventeen percent in potatoes, and

thirty-three percent in grain. This land use was then compared with the total acreage of crop production for 1957 (15, sh.1-5). Total area production for 1957 is shown as follows:

Crop	Acres		
Legumes & pasture for hay	16,372		
Legumes for seed (except peas)	3,369		
Total		19,741 - 47%	
Potatoes		7,477 - 18%	
Grain		14,639 - 35%	
Misc. field crops & silage		1,348	
Seed crops (grass & peas)		3,306	
Orchards & fruit		55	
Total			46,566
Less multiple cropped			1,546
Total harvested cropland & pasture			45,020

It is obvious that crops other than those used in a basic rotation are grown. However, in order to determine if the basic rotation selected appears consistent with actual crop production a comparison of the proportionate amount devoted to legumes and pasture for hay, potatoes, and grain was made. The comparison is shown below.

Project crop production		Basic rotation	
Legumes & pasture for hay	47%	Alfalfa	50%
Potatoes	18%	Potatoes	17%
Grain	33%	Grain	33%

The correlation between the basic rotation and actual crop production was very close. Upon this basis the basic rotation or rotation which was most generally followed was believed to be 3 years alfalfa, 1 year potatoes, and 2

years grain. Whenever reference is made in this writing to the basic rotation it refers to the aforementioned cropping program.

Other cropping rotations determined from the schedules include:

3 years alfalfa 2 years potatoes 1 year grain	3 years alfalfa 3 years grain
1, 2, or 3 years legume for seed 1 year potatoes 1 year grain	4 years merion blue for seed 1 year potatoes 1 year grain

Real Estate Investment & Repairs

Real estate as used in this study will be defined as ownership of property in the form of land, buildings, and land improvements such as fences, ditches, and ponds.

Average investment per acre of irrigated land as reported by farmers was found to be unrealistically low based on current land values. This was caused by the high percentage of land purchases that took place under the incremental values and excess land restrictions that imposed a $23 per acre sale value on class I land. Class II and III lands were proportionately lower (16, p.62-63). For purposes of this study improved irrigated land was valued at $250 per acre based on farmer estimates of sale price. Non-irrigated land was not involved in the study.

The reader must not assume that this is the fair market value of all land in the project. It is not. It is merely an approximation of market value that will be used for this study. These figures can be adjusted to suit individual farm situations if so desired. In computing input-output data shown in this chapter, both modal and mean figures were used. The one selected was determined on the basis of the data and its distribution.

With a given cropping program certain buildings are necessary. The average number of buildings, their type, value, and year constructed are recorded in Table 4. The value and costs of the family home were not included in this study. The home is classified as a personal expense and cannot be used as a legitimate cost incurred by the farming operation. A land leveling charge was not included for the 140- and 240-acre farms since their machinery inventory includes land leveling equipment. Land leveling is considered an improvement on capital investment, therefore a value of $25 per acre was included under capital investment in the Agency Plains area.

Land leveling is not feasible in either the Mud Springs or parts of the Metolius-Culver areas, so neither a leveling charge nor leveling equipment was included. The useful life of buildings was set at 40 years. Yearly depreciation was calculated by the straight line method allowing 10% of

Table 4. Estimated Capital Investment by Farm Size on North Unit Project, 1957.

Item	Year built or purchased	Cost	Average useful life	Yearly depre-ciation	Annual repair	Current value
60 Acre irrigated farm		$ 15,000				
Machine shed or shop	1951	1,900	40	$ 48	$ 38	$ 1,612
Steel grain bin - 1,500 bushel	1951	420	40	10	8	360
Total		$ 17,320		$ 58	$ 46	$ 1,972
140 Acre irrigated farm		$ 35,000				
Machine shed or shop	1951	1,900	40	$ 48	$ 38	$ 1,612
Steel grain bin - 3,000 bushel or 2-1,500 bushel bins	1951	700	40	18	14	592
Total		$ 37,600		$ 66	$ 52	$ 2,204
240 Acre irrigated farm		$ 60,000				
Tenant house	1954	3,200	40	$ 80	$ 64	$ 2,960
Machine shed or shop	1951	1,900	40	48	38	1,612
Steel grain bin - 5,000 bushel or 2-2,500 bushel bins	1951	1,250	40	31	25	1,064
Total		$ 66,350		$ 159	$ 127	$ 5,636

Note: Additional charge of $25.00 per acre or $1,500 total for leveling costs on 60 acre farm in Agency Plains.

the original cost for salvage value (8, p.16). Annual repairs were computed at 2% of the original investment. The last column in Table 4 was included for computation of personal property taxes based on current value of the buildings and interest on investment.

Machinery and Equipment Inventory

A separate machinery inventory was developed for each of the three farm sizes. The inventories were not designated on the basis of actual amount of machinery found in each size group since overinvestment in machinery might well be a factor causing some difficulty to many farmers. The inventories were subjectively determined by the need for certain pieces of farm machinery to effectively perform the necessary field operations. To insure realistic inventories the type of machinery used, year purchased, age at time of purchase, and purchase price were calculated using area averages. The inventories are shown in Tables 1, 2, and 3 in the Appendix.

It was originally believed that the small farmers generally buy machinery that has been used for a few years rather than buy new machinery which is often the case with the larger operators. This assumption does not hold true in the North Unit project. A significance test was conducted which showed no real difference at the 90% confidence level in age of farm machinery within each of the size

groups (11, p.91). For this reason machines of the same type and size used on more than one size farm show identical costs. The size of tractor used determined the size of pull-type machinery (12, p.133-137). Depreciation was calculated on the same basis as that used for real estate. The years of average useful life of machinery were obtained from a machinery study conducted in Idaho in 1957 (17, p.79-83). The useful life was based on extent of machine use, obsolescence, desire for new machinery, innovations, desire for avoidance of breakdowns, and desire for use of machinery depreciated out. Machines with few moving parts were usually kept throughout the total life of the machine since innovation had little effect on the purchase desires according to the study. For machinery having many moving parts the upper limit for useful life was set at 10 years. Life estimates from the Idaho study were not used in this case. Total annual machinery repairs were calculated at 4% of the original investment (5, p. 5). Current value was computed for obtaining personal property taxes and interest on investment. 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. This type of joint ownership is fairly common within the project.

Labor and Machine Operations - Basic Rotation

A listing of the field operations performed on different crops was needed to provide a basis for determining the labor and machine requirements and costs used in the budget. It was assumed that each of the three size groups performed the same field operations and in the same sequence as any other size group located within one area. This assumption was necessary since there were not enough observations from each size group to test for real differences between size groups. In addition, modal characteristics were used since they were believed to be the most realistic. Significance tests could not be made for modal data since variability could not be calculated.

The field operations performed were listed in sequence for each of the three crops grown in the basic rotation within each of the three areas. Table 4 in the Appendix shows these operations.

Machinery Operating Rate

Rates of operation were determined in terms of acres per hour or hours per acre for various types and sizes of farm machinery. Table 5 in the Appendix shows the combined mean average rates for the project in hours per acre and acres per hour. Combined rates for the project were used since individual area data did not differ significantly.

Custom Operation and Machine Rental Charges

In many instances where it does not pay to own specialized machinery, where timeliness of operation is a necessity, or where a labor bottleneck is alleviated, a field operation is accomplished by custom hiring or machine rental. Table 6 in the Appendix presents the modal charge for various custom operations and machine rentals.

Supplies -- Their Amounts and Costs

Supplies are an important variable cost item in farming and include such entries as seed, fertilizer, spray, baling wire, etc. Table 7 in the Appendix shows the supplies used for each crop in the basic rotation by area, their amount, and costs per acre. Modal cost data were used. A statistical analysis showed no real differences at the 90% level of confidence between Agency Plains and Metolius-Culver in supplies used or their rates. For this reason the two areas were combined on Table 7. A real difference at the 90% confidence level was noted in fertilizer application rates on alfalfa and potatoes for the Mud Springs area when compared with the other two areas. A spray charge on potatoes was excluded for the Mud Springs area since the schedules did not show spraying to be a common practice.

Irrigation Rates, Costs, and Labor Requirements

Irrigation costs and labor requirements for irrigating can be a large expense item on irrigated farms. Modal rates were used for determining the acre-feet requirements for each crop grown. Acre costs were computed on the basis of charges provided by the North Unit irrigation office for 1957. The charges are shown below.

MINIMUM CHARGE ———	$2.25 per acre for 2 acre feet
EXCESS CHARGE ———	$1.50 per 1 acre foot for the first excess foot. $1.75 for each additional acre foot.
CONSTRUCTION CHARGE —	$1.20 per acre for all irrigable acres.

Table 8 in the Appendix summarizes the application rates, costs, and labor requirements for irrigation on a per acre basis for various crops grown on the project. The data taken from the farm schedules did not show any measurable difference in irrigation costs between areas. For this reason total water costs per acre shown in Table 8 apply to all three areas. This does not hold true for labor requirements, however. Agency Plains and Metolius-Culver areas had no significant difference but the Mud Springs area required nearly twice the amount of labor per farm as did either of the other two areas. This difference was significant past the 99% confidence level. This discovery was not startling since leveling is impossible and the

fields are small, irregular in shape, and steep. This requires extra vigilance on the part of the irrigator to perform a satisfactory job in the Mud Springs area. The labor requirements were computed in terms of hours per acre and separated by months as shown in Table 8.

Yield and Price Data

Yield data were taken from the schedules for each crop and averaged by areas. The information is shown in the Appendix, Table 9. Significance tests were run to determine if area yield differences existed for alfalfa, potatoes, wheat, and barley. There were no real differences in yield on wheat between the areas as noted by visual observation. The calculated project average of 56 bushels per acre was then used. No real difference at the 90% confidence level was noted on potatoes and barley between Agency Plains and Metolius-Culver. There was, however, a real difference between the combined yields of area 1 and 2 when compared with the Mud Springs area on potatoes and barley. The yield difference in barley was significant to the 85% level. It was interesting to note that a real difference occured in alfalfa yields between area 1 and 2 and no difference in area 3 yields when compared with either of the other 2. This yield difference does not appear to be explainable except in terms of management. The inputs used for area 1 and 2 were nearly identical. Physical

characteristics were slightly more favorable in area 2. Therefore the project average of 4.2 tons per acre was used for all 3 areas. Inadequate yield data on crops grown for seed prevented a yield comparison between areas. Average yields and prices for the project were then taken from the water users reports.

The average price received for alfalfa, wheat, and barley was determined from the schedules. The price listed for potatoes was the average price received by the grower during the harvest period. If the potatoes are stored in anticipation of a better price later on, a storage charge must be made. For purposes of this study it was assumed that potatoes are sold on a grade-out basis soon after harvest so that storage is not required. The storing of potatoes is a separate decision which can be considered a separate enterprise. For this reason storage was not included in the analysis. The decision of an operator to store his potatoes is one that creates many additional problems that are deserving of a separate study. Some of these include shrinkage loss, heat deterioration, price fluctuations, and windfall gains.

Labor and Machine Requirements and Cost

A field operation budget was prepared from the information described above. This was done for each of the three size farms within each area. The budgets show the

total man hour labor and total machine hours required by months. A budget of this sort is necessary to isolate labor bottlenecks during periods of heavy labor use. It also shows when labor should be hired and how much.

Table 5 presents the field operations budget using the basic rotation for the Agency Plains, Metolius-Culver, and Mud Springs areas. Areas 1 and 2 were combined for simplicity since their budgets were nearly identical. There are slight differences in field operations between areas 1 and 2 but they have little or no effect on monthly labor requirements, or labor and machine costs. The only major difference is in land leveling and in a large portion of the Metolius-Culver area this can be accomplished.

Total labor, custom operations, and machine rental costs are shown on Tables 6 and 7. The farm operator is assumed to be capable of working 250 hours per month (25 ten-hour days). Labor requirements per month in excess of this amount, where an operation requires more than one person, or where several operations occur simultaneously mean that hired labor is required. The average going rate for hired monthly labor was $250 per month plus perquisites which include a house. Where a house was not provided the rate was $300 per month. Hourly labor was valued 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 5. Field Operation Budget for the Basic Rotation by Land-Type Areas.

Months	60 irrigated acres: 30 alfalfa, 10 potatoes, 20 grain		140 irrigated acres: 70 alfalfa, 23 potatoes, 47 grain		240 irrigated acres: 120 alfalfa, 40 potatoes, 80 grain	
	Man hours	Machine hours	Man hours	Machine hours	Man hours	Machine hours
Agency Plains & Metolius-Culver Areas /1						
January	--	--	--	--	--	--
February	5	5	11	11	19	19
March	83	80	128	123	217	207
April	30	30	62	62	100	100
May	57	9	133	21	229	36
June	67	26	156	61	269	105
July	101	30	278	111	477	190
August	101	38	365	213	571	310
September	2	--	5	--	9	--
October	20	20	47	47	883	323
November	41	41	64	64	111	111
December	--	--	--	--	--	--
Total	507	279	1249	713	2885	1401
Mud Springs Area /2						
January	--	--	--	--	--	--
February	5	5	11	11	19	19
March	73	70	128	122	216	206
April	31	31	61	61	98	98
May	89	9	207	21	355	36
June	91	26	211	61	363	105
July	133	27	351	104	603	179
August	128	38	429	213	680	310
September	5	--	11	--	18	--
October	20	20	47	47	883	323
November	34	34	47	47	82	82
December	--	--	--	--	--	--
Total	609	260	1503	687	3317	1358

/1 Assume hay yield of 4.2 tons per acre.
/2 Assume hay yield of 3.7 tons per acre.

Table 6. Labor, Custom Operation and Machine Rental Costs Using the Basic Rotation Agency Plains and Metolius Culver Areas.

Item	Explanation		Cost /1
	60 IRRIGATED ACRES		
Labor -	Monthly (none hired)		$ --
	Hourly		105
Custom Operations			
	Combine and haul potatoes		900
	Combine and haul grain		160
	Bale hay		567
Machine Rentals			
	Liquid fertilizer rig		5
	Spray rig		12
	Vine beater		20
	Potato digger		60
	Potato planter		25
		Total	$ 1,854
	140 IRRIGATED ACRES		
Labor -	Monthly (none hired)		$ --
	Hourly		132
Custom Operations			
	Combine and haul potatoes		2,070
	Hauling and stacking hay		588
Machine Rentals			
	Liquid fertilizer rig		12
	Spray rig		29
	Vine beater		46
	Potato digger		138
	Potato planter		58
		Total	$ 3,073
	240 IRRIGATED ACRES		
Labor -	Monthly		$ 1,500
	Hourly		442
	Potato harvest		1,062
Custom Operations (none)			--
Machine Rentals			
	Liquid fertilizer rig		20
	Spray rig		50
		Total	$ 3,074

/1 Cost figures rounded to nearest dollar.

Table 7. Labor, Custom Operations, and Machine Rental Costs Using the Basic Rotation, Mud Springs Area.

Item	Explanation	Cost /1
	60 IRRIGATED ACRES	
Labor -	Monthly (none hired)	$ --
	Hourly	105
Custom Operations		
	Combine and haul potatoes	800
	Combine and haul grain	160
	Bale hay	567
Machine Rentals		
	Vine beater	20
	Potato digger	60
	Potato planter	25
	Total	$ 1,737
	140 IRRIGATED ACRES	
Labor -	Monthly (none hired)	$ --
	Hourly	132
Custom Operations		
	Combine and haul potatoes	1,840
	Hauling and stacking hay	588
Machine Rentals		
	Vine beater	46
	Potato digger	138
	Potato planter	58
	Total	$ 2,802
	240 IRRIGATED ACRES	
Labor -	Monthly	$ 1,500
	Hourly	294
	Potato harvest	1,062
Custom Operations		
	Hauling and stacking 2nd cutting hay	378
Machine Rentals (none)		--
	Total	$ 3,234

/1 Cost figures rounded to nearest dollar.

Other Expense Items

When potatoes are sold other than on a field run basis, sorting, inspection, and weighing fees are incurred. The average combined charge was 30¢ per hundredweight on a weigh-in basis.

Gas, oil, and grease costs are large variable cost items. The average gasoline charge was 29.2¢ per gallon. There is, however, a 4¢ per gallon state tax refund and a 2¢ per gallon federal tax refund on gas used. The actual cost was then 23.2¢ per gallon for tractors. Gasoline cost of 29.2¢ per gallon was used on pickups and trucks. Fuel consumption of tractors was based on data from the Nebraska field tests (12, p.133-137). The fuel consumption of a 25 H.P. tractor was 2.2 gallons per hour and that of a 35 H.P. tractor 2.8 gallons per hour. The average was based on varying load conditions. It was estimated that pickups obtained 15 miles per gallon of gasoline and trucks 10 miles per gallon. The estimated cost for oil, grease, and servicing of tractors was 16% of the value of yearly fuel expenses and 50% on pickups and trucks. Average annual use of pickups was estimated at 5,000 miles and 2,500 miles on trucks.

In many cases the capital required for daily operational expenses (working capital) is borrowed. The average

cost for use of borrowed capital was imputed at 6% interest per annum and charged at 1% interest per month on the unpaid balance. For purposes of this study it was assumed that operating or working capital was borrowed. A charge of 2.25% of the annual payroll was made for Social Security purposes.

There are several overhead or fixed expenses that must be considered. These fixed expenses, however, have no direct bearing upon many production decisions since they accrue even if production drops to zero. They are important costs of farming nonetheless. The main fixed costs are depreciation, insurance, taxes, and repairs. Depreciation has already been calculated with the machinery inventory. Machinery and building repairs were calculated at 4% and 2% of the original machinery and building investments respectively. The farm operator is generally concerned with three types of insurance -- vehicle, property, and liability. Vehicle insurance for the family car is a personal expense item and so was not considered. The yearly insurance and vehicle licenses for the pickup and trucks listed in the inventory are shown on the following page. /1

/1 Vehicle license rates were obtained from the Oregon State Department of Motor Vehicles.

Vehicle	Insurance	License
1/2 ton pickup	$64	$14
3/4 ton pickup	64	16
2 ton truck	66	32
2 ton truck (old)	32	11 (1/4 year)

Property insurance was based on the depreciated value of the buildings. For insurance purposes a depreciation rate of 2% per year was used after the first 5 years of life had elapsed. The cost was $16.70 per $1,000 of depreciated value. Property liability insurance was calculated by farm size. The annual rate was $11.00 for 0-80 acres, $12.50 for 81-160 acres, and $14.50 for 161-320 acres. /1

Real estate and personal property taxes must be paid if land and/or machinery are owned. Using an average assessed land value of $37.50 per acre and a millage rate of 75 mills, the real estate taxes came to approximately $2.80 per acre of irrigated land. Personal property taxes on buildings (excluding home) and machinery were computed at a ratio of 22% of the depreciated value to obtain the assessed value times an average rate of 75 mills to get the tax. /2

/1 Vehicle, property, and liability insurance rates were obtained through personal interview with a Corvallis, Oregon insurance agency representative.

/2 Tax rates were provided by the Jefferson County Assessor through personal correspondence.

There are a few small fixed items of expense that must not be overlooked, electricity being one. The cost was prorated at $50 for the 60-acre farm, $90 for the 140-acre farm, and $120 for the 240-acre farm. Telephone and office expense costs ran $7.50 per month or $90 per year for all three farm sizes. Magazine subscriptions, market reports, newspapers, and other literature that provide information useful to the farming operation must be considered as a cost. The annual cost on all size farms for market information was estimated to be $20.

CHAPTER 5

COMPARISON OF VARIOUS SIZE FARMS USING THE BASIC ROTATION

The input-output data were summarized in the form of a summary budget for each of the three size farms within each of the land-type areas. Since there were no real differences in input-output data between Agency Plains and Metolius-Culver areas they were combined and considered as one area. Table 8 summarizes costs and income for each of the six cells considered and provides a comparison in the form of a net farm income and returns to labor and management. Net farm income was obtained by subtracting the total expenses from gross farm income. Next a return of 6% to depreciated capital investment in machinery and 5% to capital investment in land, buildings, and improvements was allowed. After removing returns to investment the residual was the payment to labor and/or management for the years efforts.

Out of this residual must come the family's living expense, repairs on the house, the new stove, clothes for the family, the car payment, and many other items that contribute to the well being of the family. If a farm mortgage is held, the principal payments must come out of the residual also. This is not to say that the returns to

Table 8. Budgets for Three Farm Sizes, North Unit Project, 1957.

	Agency Plains and Metolius - Culver Areas			Mud Springs Area		
Acres	60 acres	140 acres	240 acres	60 acres	140 acres	240 acres
Alfalfa	30	70	120	30	70	120
Potatoes	10	23	40	10	23	40
Wheat	15	15	15	15	15	15
Barley	5	32	65	5	32	65
Capital Investment						
Irrigated land	$ 15,000	$ 35,000	$ 60,000	$ 15,000	$ 35,000	$ 60,000
Buildings	2,320	2,600	6,350	2,320	2,600	6,350
Improvements (leveling)	1,500	3,500	6,000	--	--	--
Machinery & equipment	6,400	11,700	23,900	6,200	10,300	23,050
Total	$ 25,220	$ 52,800	$ 96,280	$ 23,520	$ 47,900	$ 89,400
Production						
Alfalfa	126 T	294 T	504 T	126 T	294 T	504 T
Potatoes	180 T	414 T	720 T	160 T	368 T	640 T
Wheat	840 bu.	840 bu.	840 bu.	840 bu.	840 bu.	840 bu.
Barley	350 bu.	2240 bu.	4550 bu.	300 bu.	1920 bu.	3900 bu.
Sales						
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	1,089	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
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 expense	$ 6,223	$ 12,501	$ 20,085	$ 5,761	$ 11,295	$ 18,878
Net farm income	$ 2,132	$ 5,922	$ 11,195	$ 2,066	$ 5,712	$ 9,847
Less return for capital investment	$ 1,203	$ 2,557	$ 4,644	$ 1,118	$ 2,354	$ 4,300
Return to labor & management	$ 929	$ 3,365	$ 6,551	$ 948	$ 3,358	$ 5,547

/1 Electricity, telephone, office expenses, market information, and Social Security.

capital cannot be used for family living. It must be realized however, that if the capital invested in farming is not realizing a return equal to or exceeding what it could earn in commercial investments it might well be advantageous to shift capital to a more profitable venture assuming profit to be major motive for farming.

Table 8 points out that an 80-acre farm using the basic rotation will not provide a reasonable return for use by the family. If the desires of a family are low a 140-acre unit might suffice. Return for the 240-acre unit would generally be adequate. Because of reduced yields in the Mud Springs area the returns were somewhat lower than from the other two areas.

The budgets do not show the complete picture, however. Does excess labor exist which might well 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 shows that a full time off-the-farm job requiring a 40-hour week can easily be fitted into the farming 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 restrict off-farm employment slightly or require longer working days. Figures 3 and 4 show that supplementary and/or complementary enterprises could well

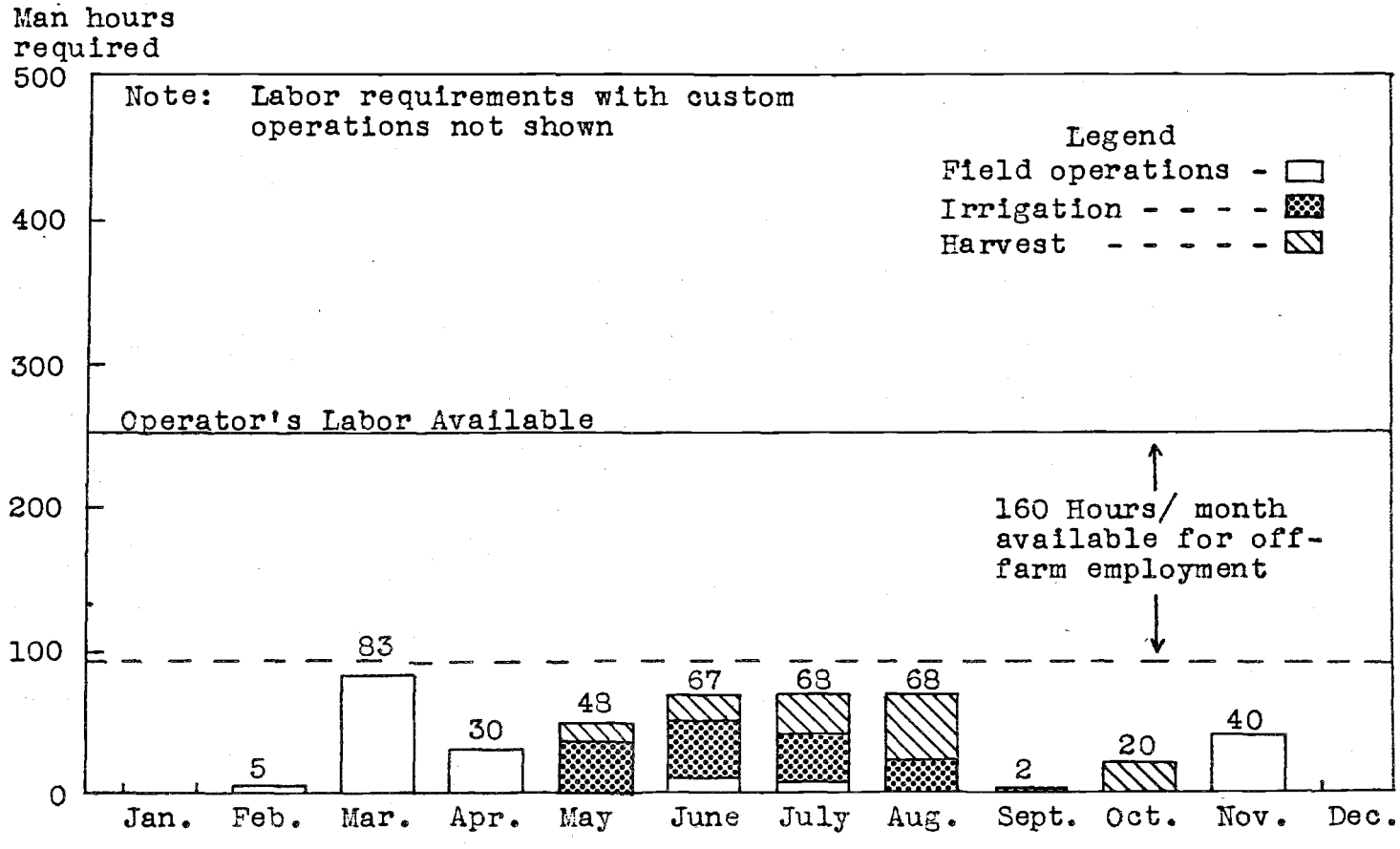

Figure 1. Labor Requirements and Availability for a 60-Acre Irrigated Farm Using the Basic Rotation, Agency Plains and Metolius-Culver Areas.

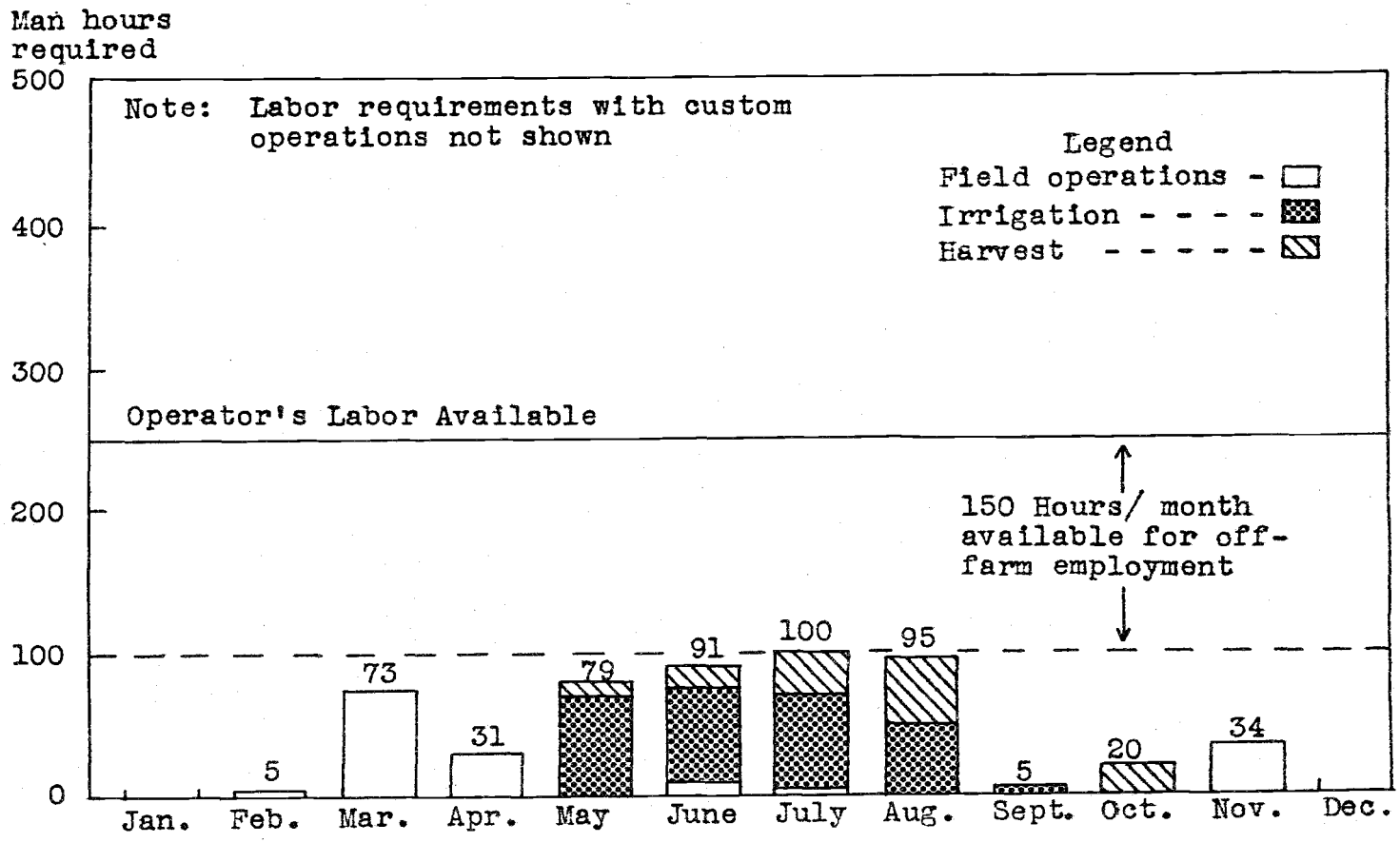

Figure 2. Labor Requirements and Availability for a 60-acre Irrigated Farm Using the Basic Rotation, Mud Springs Area.

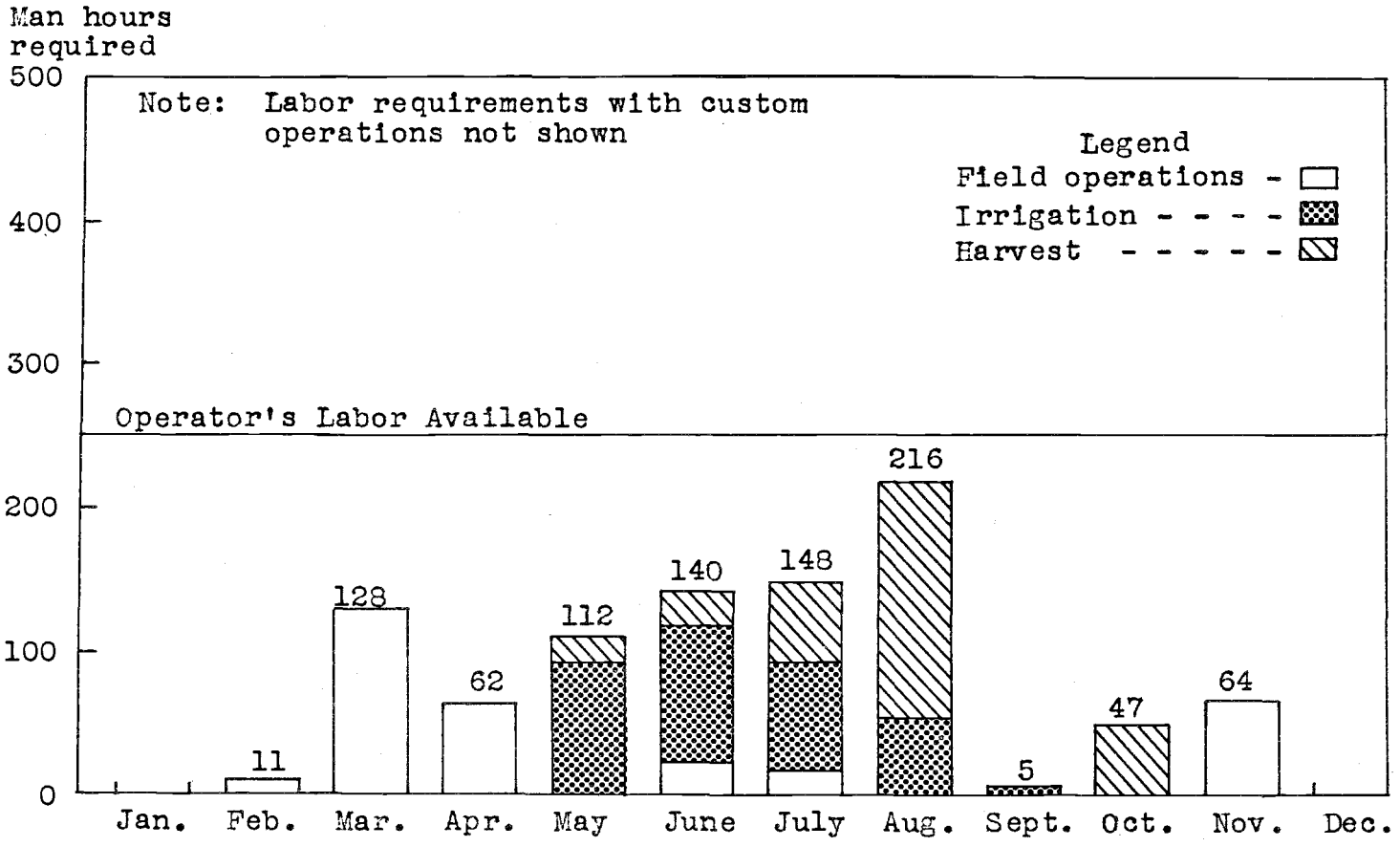

Figure 3. Labor Requirements and Availability for a 140-Acre Irrigated Farm Using the Basic Rotation, Agency Plains and Metolius-Culver Areas.

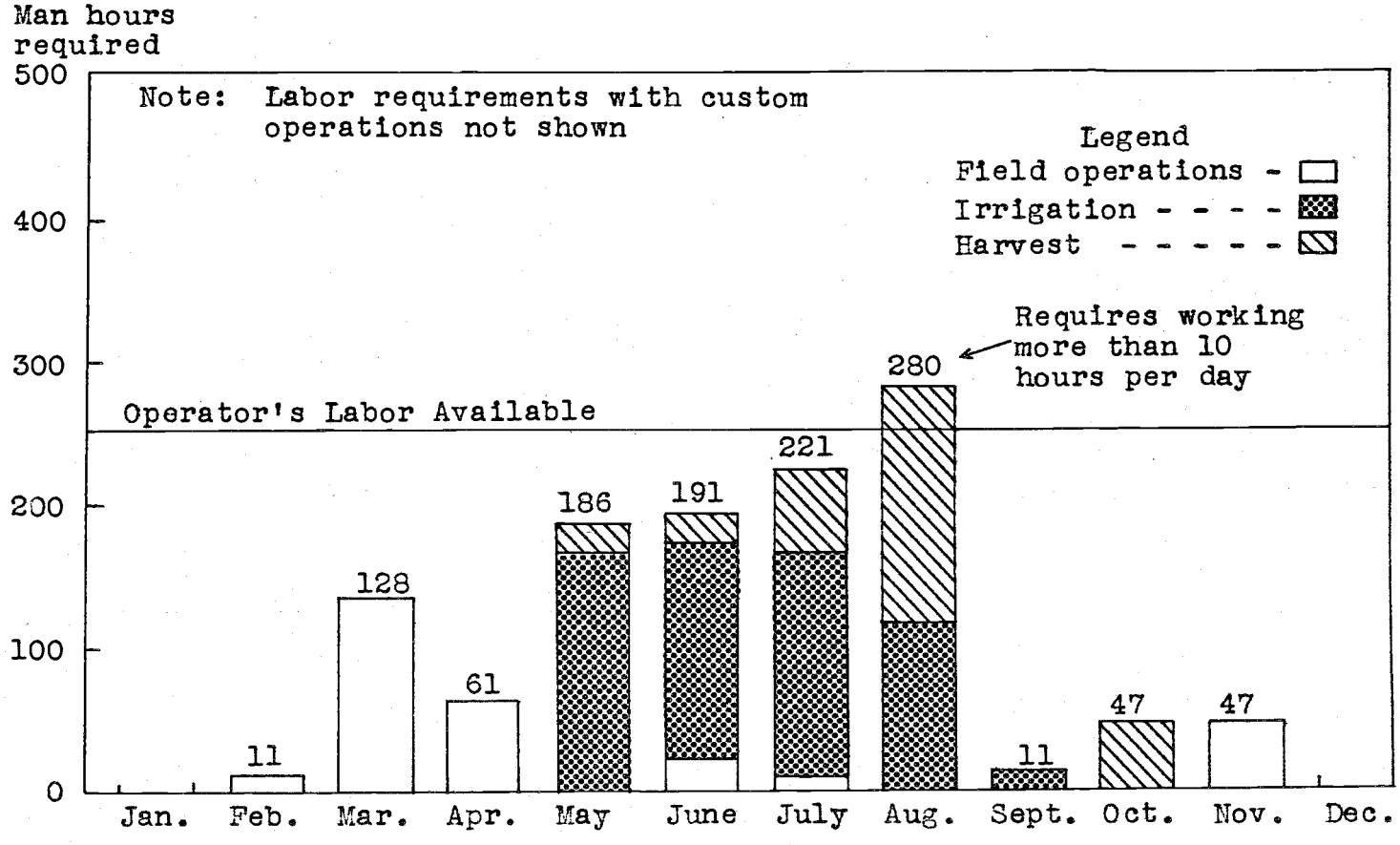

Figure 4. Labor Requirements and Availability for a 140-Acre Irrigated Farm Using the Basic Rotation, Mud Springs Area.

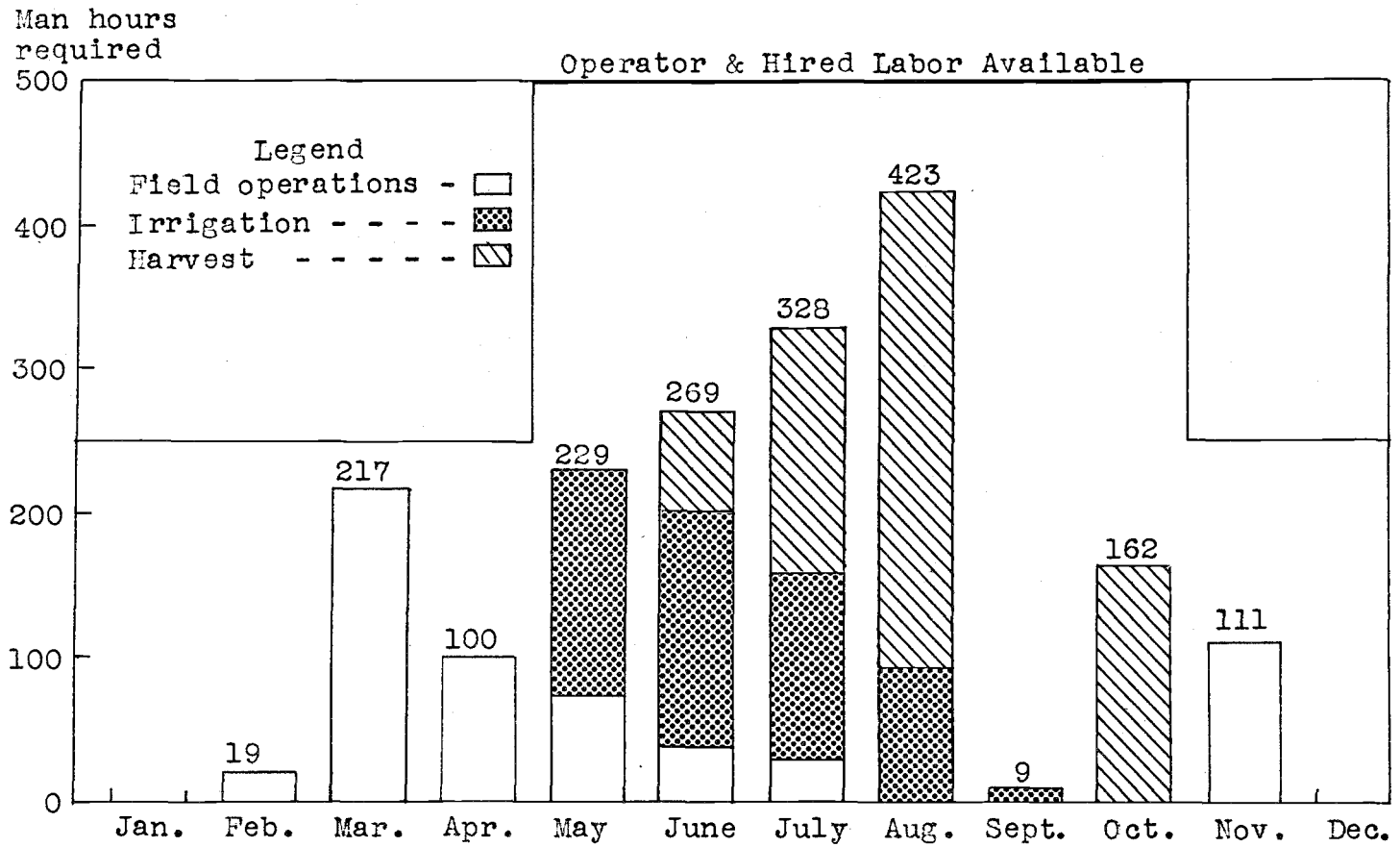

Figure 5. Labor Requirements and Availability for a 240-Acre Irrigated Farm Using the Basic Rotation, Agency Plains and Metolius-Culver Areas.

Note: Labor requirements with custom operations not shown

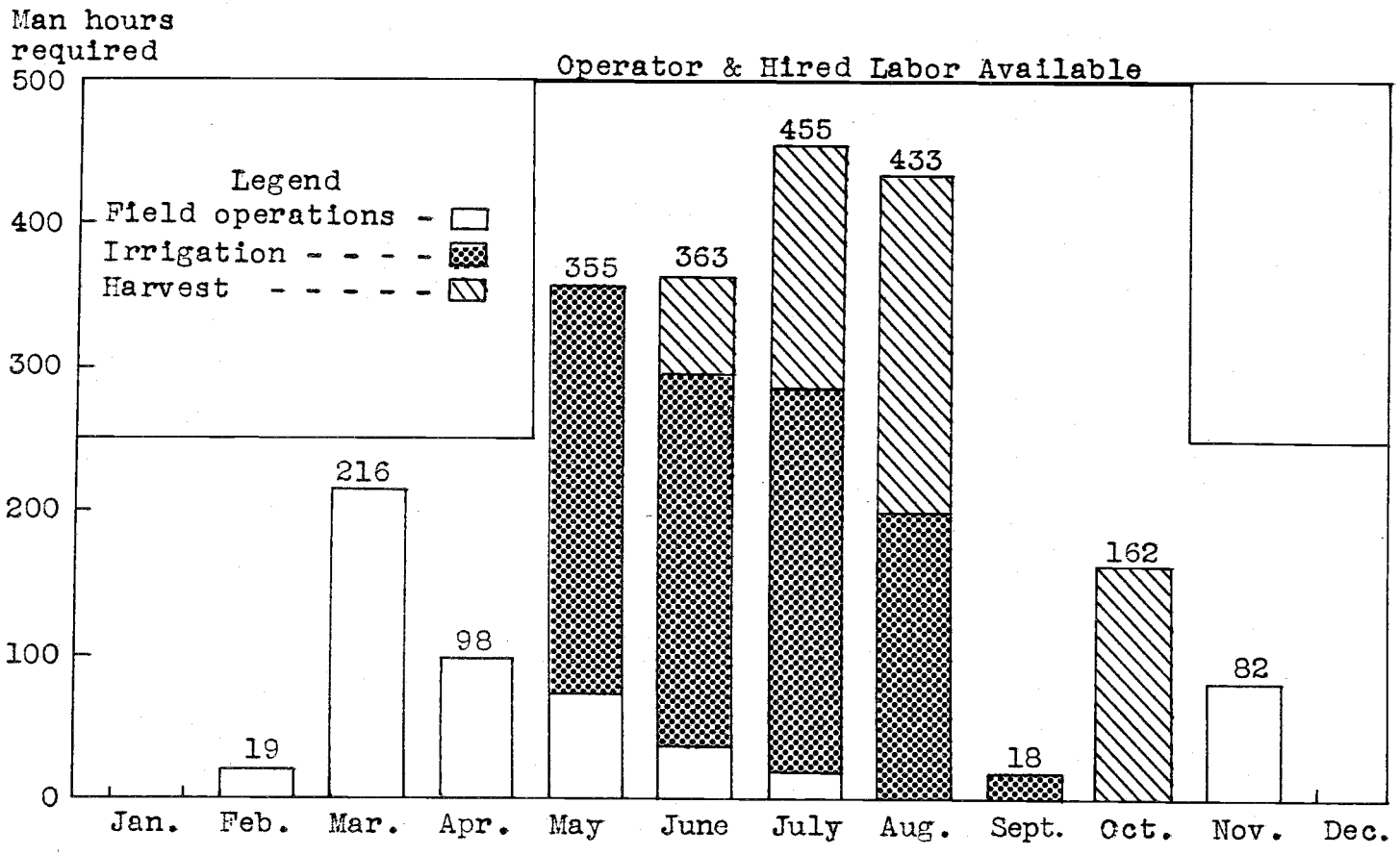

Figure 6. Labor Requirements and Availability for a 240-Acre Irrigated Farm Using the Basic Rotation, Mud Springs Area

Note: Labor requirements with custom operations not shown

fit in the present program thus utilizing unused labor. Figure 4 shows the Mud Springs area to be somewhat restricted in adjustment possibilities because of the high irrigation labor requirements for the basic rotation. Figures 5 and 6 illustrate adjustment possibilities also. The 6 months of hired labor required in Figure 5 may well be eliminated or more fully utilized through cropping program change. Some farmers felt that in order to keep a good hired man he must be employed year around. If this is the case, an adjustment is necessary on the large farms to fully utilize a year-around hired man, or depend upon hourly labor during peak labor periods, or arrange the farming program so that labor hiring is kept at a minimum. Figure 6 shows that in order to fully utilize excess labor, cropping adjustments may need to be made to reduce the heavy labor requirements during the four summer months. It may be difficult to find supplemental enterprises that would not have labor requirements for that four-month period.

CHAPTER 6

AN EXAMINATION OF ALTERNATIVE CROPPING PROGRAMS

Probable net farm incomes using the basic rotation were discussed in Chapter 5. In this chapter other cropping programs being used on the project are compared with the basic rotation as to profitability. The basic rotation best represents what is now being done in the area and for that reason was used in the previous analysis. The purpose of comparison with alternative programs was to see if other rotations might be more profitable. Legumes such as alsike, ladino, and kenland red clover are grown for seed in combination with a potato and grain rotation. Merion bluegrass is also grown for seed in the same manner. In some cases potatoes are grown two years in succession within a rotation.

Peppermint production has shown some promise in recent years. It was not considered as a cropping alternative in this study for the reasons given below. Peppermint grown for oil is a profitable crop under certain conditions. It is a crop, however, that requires a high capital investment (approximately $150 per acre for stand establishment) and purchase of specialized machinery. These requirements would probably prevent many farmers from selecting peppermint as a possible crop alternative unless they were able

to obtain some assurance as to future price. This is not the case at present. In 1957 only 2.5% of the land within the project was devoted to peppermint production. This allowed very few operators growing mint to enter the random sample.

The production of small grass seeds other than merion bluegrass was also not considered because of their limited volume -- 1.5% of the land in the project. All other crops previously mentioned were considered as alternatives. In making comparisons of various rotations the principal cash crop was selected such as legume or grass seed and then other crops were added to develop a logical crop sequence. To add realism to the comparison certain costs were assummed to be fixed and were not introduced into the analysis. This assumption simplified comparison by eliminating from the computations costs that did not vary with a cropping change. Fixed costs would be an important factor only when a new set of machinery was required for a highly specialized crop. This would probably be the case with peppermint production since a blower and special bulk trucks are required. It was also assumed that each farm size required the same machinery inventories as those used with the basic rotation and shown in Tables 1, 2, and 3 in the Appendix.

Field operation and cost budgets were prepared for merion bluegrass and the legumes grown for seed. Kenland red clover proved to be approximately $20 per acre and $30 per acre respectively, more profitable than alsike and ladino grown for seed. It was not necessary to include those two crops within a rotation since kenland would always replace ladino and alsike assuming no price change.

Linear programming, or activity analysis as it is sometimes called, was to have been the analytical method employed for determining what rotation or combination of rotations provided maximum income with varying sets of resources (4, p.1-52). When the preliminary data were arranged to meet programming requirements the answer became evident by inspection. Land, labor, and wheat allotment restrictions were introduced. The 60, 140, and 240 irrigated acre units and the machinery and building investments corresponding to them as shown in the Appendix, Tables 1, 2, and 3 designated the acreage and investment restrictions. Investment restrictions were necessary for obtaining several variable costs such as custom hiring and machine rental. Institutional restrictions limited wheat production. The government required that any wheat grown in excess of 15 acres must be restricted to an allotment based on prior wheat production. Because of the tremendous variation in allotments, wheat was limited to 15 acres in the

study. Where grain was required for the rotation in excess of this amount barley was grown.

Labor was restricted in terms of what one man was physically capable of performing in a one-month period of time. Labor requirements were listed on a monthly basis to find where labor bottlenecks occured and how much hired labor was required to get the job done. In the case of a farmer that prefers to do all the farm work individually, the labor restriction was designed to point out what type of cropping operation he should have, how large it should be, and how much income was foregone, if any, by eliminating cropping rotations that required additional labor yet might be more profitable. The labor restriction imposed was set at 250 hours per month for one man. During the long daylight hours of the summer months an operator often works 12 and 14 hours a day. For this reason some adjustments were made in the interpretation of the data. In all cases average managerial ability was assumed. This assumption was necessary since average costs and yields were used. With average ability it is assumed that an operator is capable of handling alternative rotational programs if deemed more profitable than cropping practices currently being conducted.

Four rotation systems used within the project were compared with the basic rotation as to labor requirements

Table 9. A Comparison of Variable Net Returns Per Acre with Alternative Crop Rotations, North Unit Project, 1957.

Rotations:	1 3 years alfalfa 1 year potatoes 2 years grain /1			2 3 years alfalfa 2 years potatoes 1 year grain		3 2 years kenland red 1 year potatoes 1 year grain			4 4 years marion blue 1 year potatoes 1 year grain		5 3 years alfalfa 3 years grain				
Size of operating unit:	60 irrigated acres					140 irrigated acres					240 irrigated acres				
Rotation:	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Agency Plains & Metolius-Culver Areas															
Variable net returns/acre /2	$ 63.10	$ 76.30	$ 82.90	$ 64.70	$ 46.00	$ 62.10	$ 78.00	$ 83.00	$ 61.80	$ 46.40	$ 72.90	$ 100.00	$ 97.00	$ 76.10	$ 45.60
Labor requirements by month in terms of hours/acre															
January	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
February	.08	.08	--	.32	.08	.08	.08	--	.32	.08	.08	.08	--	.32	.08
March	1.09	1.08	.82	.46	1.55	.68	.68	.54	.28	.96	.68	.68	.54	.28	.96
April	.51	.41	.46	.31	.60	.45	.37	.40	.28	.52	.42	.35	.38	.26	.48
May	.80	.85	.93	.92	.75	.90	.85	.60	.77	.75	.90	.35	.83	.92	.75
June	1.13	1.36	1.24	.84	.88	1.13	1.36	1.24	.84	.88	.85	1.08	1.24	.84	.88
July	1.14	1.45	.82	1.02	.83	1.06	1.37	.82	1.82	.75	.96	1.27	.82	1.48	1.30
August	1.13	1.36	.55	.23	.90	1.54	1.46	1.01	.54	1.62	1.07	1.11	.79	.43	1.96
September	.04	.07	.34	.33	--	.04	.07	.94	.27	--	.04	.07	.88	.25	--
October	.34	.88	.51	.67	--	.34	.88	.51	.67	--	.33	.66	.50	.66	--
November	.68	.68	1.02	.68	--	.46	.46	.70	.46	--	.46	.46	.70	.46	--
December	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mud Springs Area															
Variable net returns/acre	$ 61.40	$ 73.00	$ 79.10	$ 62.10	$ 45.40	$ 59.10	$ 74.10	$ 73.40	$ 63.60	$ 44.20	$ 67.30	$ 91.90	$ 88.70	$ 70.90	$ 42.70
Labor requirements by month in terms of hours/acre															
January	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
February	.08	.08	--	.32	.08	.08	.08	--	.32	.08	.08	.08	--	.32	.08
March	1.09	1.08	.82	.46	1.55	.68	.68	.54	.28	.96	.68	.68	.54	.28	.96
April	.51	.51	.54	.31	.60	.47	.42	.44	.30	.52	.42	.35	.38	.26	.48
May	1.33	1.28	1.31	1.68	1.38	1.33	1.28	1.31	1.68	1.38	1.33	1.28	1.31	1.68	1.38
June	1.52	1.97	1.74	1.39	1.06	1.38	1.83	1.75	1.39	.92	1.24	1.69	1.75	1.39	.79
July	1.68	2.13	1.46	1.67	1.46	1.59	1.99	1.39	2.41	1.18	1.54	1.99	1.46	2.12	1.08
August	1.59	2.05	1.07	.46	1.34	2.00	2.15	1.53	.77	1.85	1.53	1.90	1.36	.66	1.27
September	.08	.15	.40	.37	--	.08	.15	1.00	.31	--	.08	.15	.74	.29	--
October	.34	.88	.51	1.01	--	.34	.88	.51	1.01	--	.33	.66	.50	1.00	--
November	.57	.57	.86	.57	--	.34	.34	.52	.46	--	.34	.34	.52	.34	--
December	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Point where monthly labor becomes limiting in terms of hours/acre /3	$\frac{250 \text{ (hours)}}{60 \text{ (acres)}} = 4.17$					$\frac{250}{140} = 1.78$					$\frac{250}{240} = 1.04$				

/1 Includes a combination of wheat and barley based upon the proportion of each crop grown. A 15 acre restriction was placed on wheat because of government allotments.
/2 Determined by subtracting variable expenses from gross receipts. 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. Hired labor is included when an operation requires more than one person or when operations overlap causing simultaneous operations to be performed.
/3 This assumes one operator is available 250 hours per month.

and as to net returns above variable costs. The data were listed by farm size and area as shown in Table 9. Rotations 2 and 3 proved to be the most profitable in all cases, each returning approximately $20 more per acre than the basic rotation using the same resources. Although $15.50 per ton was an unusually low price for alfalfa hay, an increase to a nominal $25 per ton would still leave rotation 3 slightly more profitable than rotation 1. Rotation 2 would then become the most profitable. Rotation 3 required the least amount of labor per month. In the case of the 240 irrigated acre farm in the Agency Plains and Metolius-Culver areas using rotation 3, no monthly or hourly labor was required other than potato harvest labor. Figure 7 shows the labor requirements for rotation 3. This rotation came closer than any to fully utilizing the operators labor without hiring additional help. The operator would be kept busy 9 months out of the year. Initial irrigation settings on potatoes in June require careful attention and contribute heavily to the peak labor load. Some labor adjustments could be made by planting potatoes slightly earlier or later depending upon the operators individual situation. Some hired labor is required by the 240-acre farm in the Mud Springs area because of the additional labor requirement for irrigation. This was the case for all rotations in the 240-acre Mud Springs unit. The labor requirements

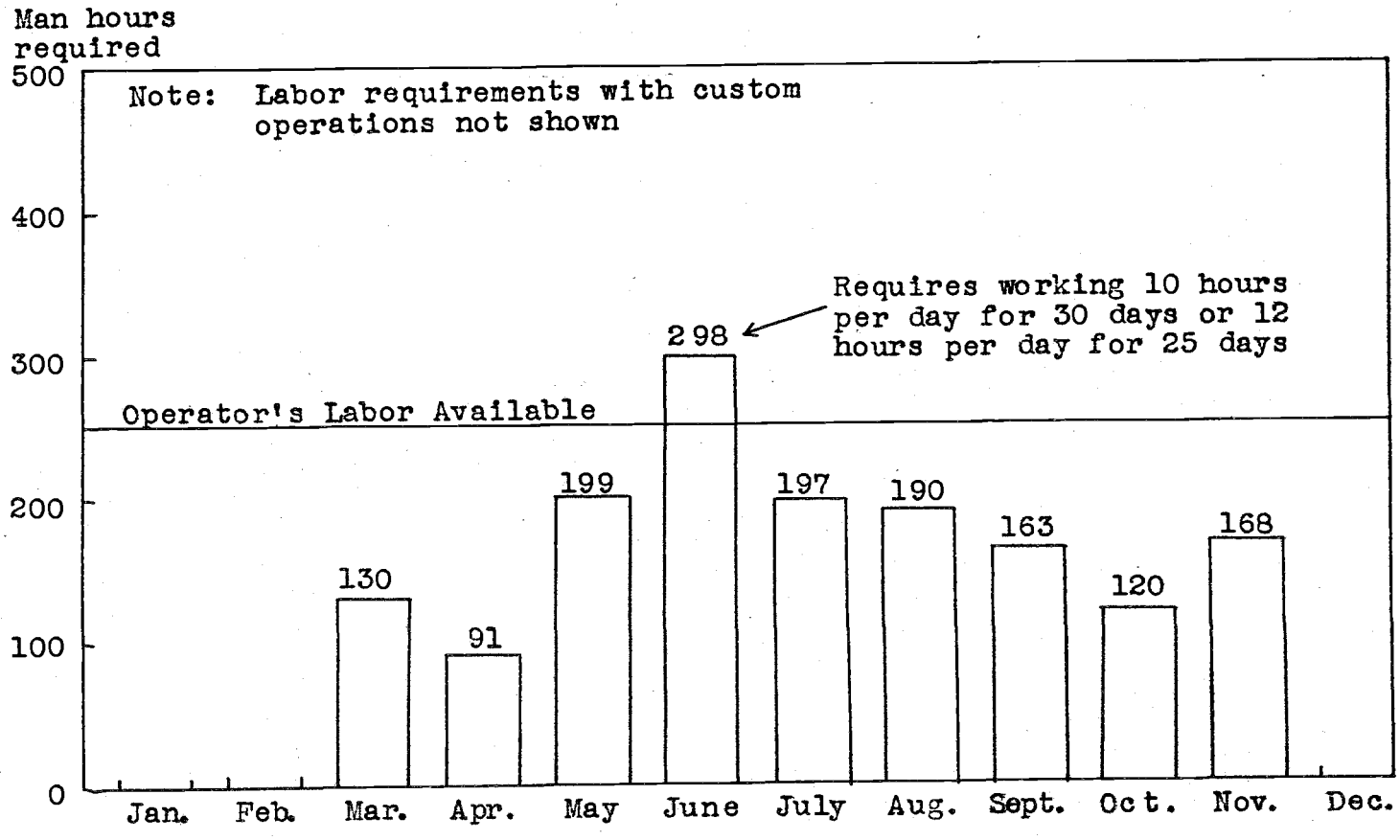

Figure 7. Labor requirements and availability for a 240-acre irrigated farm using rotation 3, Agency Plains and Metolius-Culver areas, 1957.

of the other three rotations can be graphically illustrated in the same manner and compared with Figure 7.

The basic rotation (1) and rotation 4 were comparable in terms of returns above variable costs. The labor requirements were somewhat more uniform throughout the year for rotation 4 and the total labor requirement was less. The high labor requirements in certain months for rotation 1 is not apparent since much of the harvesting labor was listed as a variable cost. This was a necessity in the case of the 140- and 240-acre units since mowing, raking, baling, hauling and stacking requirements were carried on simultaneously to prevent excessive bleaching and shattering of the hay. For example: the 240-acre unit required 1 man operating the mower, another operating the side delivery rake, and another to operate the baler. A borrowed or rented tractor was used to pull the side delivery rake.

Rotation 5 provided the lowest returns of all and should not normally be considered unless a severe labor problem exists.

Since potato production yields the highest potential return per acre of any single crop, the proportionate share of a rotation devoted to potatoes determines in a large measure the profitability of a rotation. In the case of rotations 2 and 3, which were the most profitable, potatoes accounted for one-third and one-fourth of the total rotation

acreage respectively. The question might be raised whether these 2 rotations would deplete the soil more rapidly and therefore require additional fertilizer or expect reduced yields. Data from the schedules does not bear this out, however.

CHAPTER 7

CUSTOM VERSUS OWNERSHIP OF SPECIALIZED FARM MACHINERY

The question often arises among farmers as to whether it "pays" to own certain farm machinery or hire a custom operator to perform specialized field operations. This question should be of utmost interest to farmers in the North Unit project who require the use of balers, combines, and potato equipment such as planters, vine beaters, diggers, and potato combines. The initial cost of these machines is generally quite high. This means that the per-acre or per-hour cost of each machine is also high unless used considerably. Cost of ownership declines with increasing use. The decline is usually quite rapid in the beginning and then declines more slowly with additional use.

With cost data available it was possible to determine the costs for machine operations with varying degrees of use and establish a "break-even point" where the costs of ownership are equal to costs of custom hiring. Beyond this point it would cost less to own the machinery. Short of this point it would be cheaper to hire a custom operator. In addition to costs there are several other factors that may have a bearing on the decision of custom versus ownership. If capital is a limiting factor of production it

may be more profitable to invest $5,000 in fertilizers or feeder livestock, for example, than in a $5,000 potato combine. Timeliness of operation is another factor. Here the following question must be raised. Is the increased cost of owning machinery justified by the decreased risk brought about by timeliness through ownership? The answer is based on frequency of inclement weather and critical harvest periods and availability of custom operators. Either custom operations or ownership of machines may save labor. If this labor saved is not put to productive use, 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.

In determining costs of machinery ownership within the North Unit project, seven machines were selected for which a custom versus ownership comparison was made. The machines selected were a hay baler, potato planter, vine beater, potato digger, potato combine, 6' pull-type grain combine, and a 10' self-propelled grain combine. The results are shown in Table 10. Costs were divided into two categories -- fixed and variable. Fixed costs included depreciation, interest on average investment, taxes, shelter, insurance, and repairs. Variable costs were for fuel, lubricants, supplies, and labor. If a tractor was involved in the operation its variable costs were included. The fixed

Table 10. Costs of Ownership in Specialized Farm Machinery Versus Custom Hiring, North Unit Project, 1957.

	Baler	2 - row potato planter	Vine beater	2 - row potato digger	Potato combine	6' pull grain combine	10' S.P. grain combine	Used 6' pull grain combine
Original cost (dollars)	3,400	1,000	900	1,000	5,000	3,200	6,200	1,250
Useful life (years)	10	18	13	16	10	16	12	13
Operating rate (per hour)	3.5 T							
Fixed costs per year	$	$	$	$	$	$	$	$
Depreciation: original cost-salvage value (10% ÷ estimated years of life	306	50	62	56	450	180	465	87
Interest: 6% x average investment (½ of original investment)	102	30	27	30	150	96	186	38
Taxes: original cost x 75 mills on 22% of new cost	56	16	15	16	82	53	102	21
Shelter: estimated at .75% of original cost	26	8	7	8	38	24	46	9
Insurance: estimated at .25% of original cost	8	2	2	2	12	8	16	3
Repairs for year: estimated at 4% of original investment	136	40	36	40	200	128	248	50
Total fixed costs per year	634	146	149	152	932	489	1,063	208

Table 10. (Continued)

	Baler	2 - row potato planter	Vine beater	2 - row potato digger	Potato combine	6' pull grain combine	10' S.P. grain combine	Used 6' pull grain combine
	$/T	$/A	$/A	$/A	$/A	$/A	$/A	$/A
Variable costs								
Fuel: 23.2¢ per gallon	.084					.487	.633	.487
Lubricants: estimated at 2¢ per hour	.006	.02	.02	.02	.04	.033	.02	.033
Supplies:	1. (wire)							
Labor: $1.50/hour for hired labor					15.50			
Variable tractor costs: gas	.187			.928	1.30	1.09		1.09
lubricants	.029			.143	.20	.167		.167
Operator's labor: valued at $1.50 per hour	.43			2.14		2.50	1.36	2.50
Total variable costs	1.74	.02	.02	3.23	17.04	4.28	2.01	4.28
Custom Charge	4.50	2.50/1	2.00/1	10.00	3./T	7.00	7.00	7.00

/1 Machine rental.

APPROXIMATE "BREAK-EVEN" POINTS

Baler - 230 Tons or 77 A at 3T/A
58 A at 4T/A
46 A at 5T/A
38 A at 6T/A

Potato planter - 60 acres
Vine beater - 75 A or 60 A with a $2.50/A rental fee
Potato digger - 22 acres

Potato combine - 50 A at yield of 12 T/acre
40 A at yield of 14 T/acre
30 A at yield of 16 T/acre
25 A at yield of 18 T/acre
22 A at yield of 20 T/acre
20 A at yield of 22 T/acre

Pull combine (new) - 180 acres
Pull combine (used) - 75 acres
S. P. combine - 210 acres

costs of a tractor were not listed since the operator would have the tractor and its fixed costs whether he hired a custom operator or not.

A test was made to determine the existence and extent of overinvestment in specialized farm machines in the project. To determine this a listing was made of farm operators owning the specialized equipment and the number of acres on which it was used. Acres and/or yields were compared with the break-even acres and/or yields. The results are shown in Table 11.

In all cases there was some overinvestment. The greatest amount of overinvestment seemed to be in vine beaters and self-propelled combines. When comparing overinvestment by farm size it appeared to be greatest in the 30.0 - 89.9-acre size group and decreased somewhat as the farms became larger. Although a significance test could not be made to determine the reliability of the overinvestment estimates, Table 12 was prepared to show how much more average use was required of each type of specialized machine to be on a break-even basis with custom operations. In every cell but one the machinery was being used at approximately one-half capacity or less. This information helps to lend significance to the percentage overinvestment data.

Table 11. Determination of Overinvestment in Farm Machinery on Sample Farms as Shown by Machine and Farm Size, North Unit Project, 1957.

Machine	No. owning	overinvested		Overinvestment by farm size								
				30.0-89.9 Acres			90.0-159.9 Acres			160.0 & Over		
		No.	%	No. owning	overinvested No.	%	No. owning	overinvested No.	%	No. owning	overinvested No.	%
Hay Baler	27	10	37	6	3	50	10	4	40	11	3	27
Potato Planter	18	6	33	3	2	67	7	3	42	8	1	12
Vine Beater	15	11	73	1	1	--	8	7	88	6	3	50
Potato Digger	20	3	15	2	1	50	10	2	20	8	0	0
Potato Combine	9	1	11	1	1	--	1	0	--	7	0	0
Grain Combine pull type	19	9	47	6	4	67	7	4	57	6	1	17
Grain Combine self-propelled	19	13	68	3	3	100	7	4	57	9	7	78
Tractor /1	55	18	33	18	8	44	21	7	33	16	3	19
Total Machinery/2	50	22	44	16	7	44	19	7	37	15	8	53

/1 Tractors allowable for various farm sizes: 30.0-89.9 acres - 1 tractor
90.0-159.9 acres - 2 tractors
160 acres & over - 3 tractors

/2 Total machinery investment allowable for various size farms:
30.0-89.9 acres - $ 8,000
90.0-159.9 acres - $ 14,000
160 acres & over - $ 28,000

Table 12. Additional Machine Use Required to Break Even with Custom Operations.

Machine	Percent farmers overinvested	Use required for "break-even"	Average use of those overinvested	Percent of present use required to break even
Hay baler	37	230 Tons	133 Tons	173
Potato planter	33	60 Acres	20 Acres	300
Vine beater	73	60 Acres	24 Acres	250
Potato digger	15	22 Acres	17 Acres	129
Potato combine	11	-- /1	--	---
Pull-type grain combine (bought new)	100	180 Acres	77 Acres	234
Pull-type grain combine (bought used)	33	75 Acres	33 Acres	227
Self-propelled grain combine	68	210 Acres	92 Acres	228

/1 In the single case of overinvestment the combine was not used at all.

Based on the above information it is likely that one-third of the operators have overinvested in machinery of one type or another. Some of this obviously occured early in the 1950's when clover prices were high and convenience of ownership at that time was less costly.

With the extent of overinvestment prevailing within the project it appears that some changes should be made. Just what can be done in the way of adjustment? If a piece of specialized equipment is owned and being under-utilized its sales price may be considerably less than its purchase price, and for old machines it is likely that only salvage value can be obtained. Should the machine be sold at salvage value and hire the work done? No clear-cut answer can be given since sale price or salvage value is not known. However, if the return from selling the machine is greater than the amount saved by owning and operating for the remaining useful life of the machine rather than custom hiring it would pay to sell, assuming custom operators were available. If the problem arises with regard to the future purchase of a piece of specialized machinery it would be well worth determining all fixed and variable costs associated with ownership plus the non-cost factors and weigh them against the prices and services provided by custom operators. Partnership arrangements might also be investigated as a way for small operators to justify ownership of specialized machines.

CHAPTER 8

FACTORS AFFECTING INCOME VARIABILITY FROM SELECTED CROPS

There are often many variables that determine how well a farmer prospers from year to year. Some of these factors are completely or partially under the farmers control. There are others over which he has no influence. The most important variables are costs of production, yield, product quality, and prices received. Each of these factors are affected by the farmers decisions and actions which in turn affects farm income. A decision to apply more fertilizer may well change both costs of production and yields. A decision to defer irrigation on potatoes may lower quality by increasing the percentage of No. 2's due to excessive numbers of bottleneck potatoes. Current knowledge of market forecasts and trends plus the ability to adapt to specific farming situations will aid in adjustment to future market conditions. Factors over which the farmer has no control include weather phenomena, degree of national prosperity, changes in consumer tastes and preferences, technological change, sociological change, and in some cases governmental or institutional changes (3, p.453-455).

Four major crops grown within the project were selected for intensive analysis as to the causes of fluctuating

income. The crops selected were kenland red clover and merion bluegrass grown for seed, alfalfa grown for hay, and potatoes grown for commercial trade. These crops were selected for analysis since they constitute the principal cash crops as presented in Chapter 6. Price, yield and cost changes were shown individually for each of the four crops. Quality changes were shown only on potatoes because of the more uniform quality with the other crops. It is realized that a combination of all four factors operating simultaneously affect farm income. However, they were analyzed independently to illustrate the importance of each.

Cost of production was considered first. Variable costs per unit produced were quite constant throughout the project. Some discounts were obtained by the larger operators through purchase of fertilizer, sprays, wire, and other supplies on a volume basis. This difference was not considered in the study. Fixed costs were by far the most important factor in cost of production on farms of all size groups. Some of these costs are difficult to allocate between crops. Costs such as electricity, office expenses, property taxes, liability insurance, depreciation, and repairs on farm machinery used on all crops fall in this category. Fixed expenses on highly specialized machinery used only on one crop are easy to allocate. Because of this the example used to illustrate fixed costs was on specialized equipment.

Table 10 in Chapter 7 showing costs of ownership versus custom hiring was used. Near the top of the page the fixed costs per year for each piece of machinery is shown. Using the baler as an example the fixed cost per year for 50 acres of hay would be $498 ÷ 50 = $9.96 per acre. For 100 acres the cost would be $498 ÷ 100 = $4.98. This shows that as acreage increases the fixed costs are distributed over a greater number of acres reducing the cost for each acre. This is an example of economies achieved by increasing size.

Prices received for the 4 crops selected and their effect on net returns was considered next. Table 13 presents the results. Price was allowed to vary and the other factors held constant. Overhead, insurance, and interest on investment were alloted on a one-third of the total cost basis for each crop. Since three crops were required to provide a logical cropping rotation, in each case, these fixed costs were proportioned evenly to each crop. Taxes were distributed on a per acre basis. Repairs and depreciation were estimated on the basis of percent use of machines and buildings by the individual crop from a total rotation standpoint. The reader must be cautioned that the returns to labor and management reflect the changes in price which does not necessarily mean that all farmers would realize the returns shown due to differences in costs of

Table 13. Changes in Net Return Per Acre as Affected by Changes in Price Received for Selected Crops.

Operating unit size	240 acres	240 acres	240 acres	240 acres
Crop	Alfalfa	Potatoes	Merion bluegrass	Kenland red clover
Acres	120	80	160	120
Yield	4.2 T/A	18 T/A	150 lb./A	250 lb./A
Rotation in which crop is grown	(1)	(2)	(4)	(3)
Variable costs per acre	$ 34	$ 235	$ 67	$ 23
Fixed costs per acre	29	45	19	25
Total costs per acre	$ 63	$ 280	$ 86	$ 48

Price per ton	Return to labor & management/acre	Price per ton/1	Return to labor & management/acre	Price per pound	Return to labor & management/acre	Price per pound	Return to labor & management/acre
$ 14	$ -4.20	$ 20	$ 80	$ .50	$ -11.00	$.20	$ 2
18	12.60	25	170	.75	26.50	.30	27
22	29.40	30	260	1.00	64.00	.40	52
26	46.20	35	350	1.25	101.50	.50	77
30	63.00	40	440	1.50	139.00	.60	102

/1 Grade out - 65% 1's, 10% 2's, 25% culls.

production. It should be noted that the largest variability in returns per acre as affected by price change was on potatoes.

Table 14 shows the effect on returns to labor and management when yield is allowed to vary. The table points out that if any return is anticipated, yields must be near average. An operator cannot bank on high prices to make up for low yields. Changes in returns per acre due to changes in potato quality are shown on Table 15. A small change in grade out affects income significantly if the change occurs in the No. 1 grade. Sometimes a combination of low yield, prices, and quality coupled with high costs of production all occur in one crop year. Let us use potato production for an example and compare "average" conditions with "poor year" conditions on a per acre basis.

Yield	Average Conditions 18 Tons	Poor Year Conditions 14 Tons
Grade out - No. 1's	65%	50%
No. 2's	10%	20%
Culls	25%	30%
Price - No. 1's	$1.70/cwt.	$1.25/cwt.
No. 2's	$ .85/cwt.	$ .65/cwt.
Culls	$4/Ton	$4/Ton
Gross receipts	$ 446	$ 228
Gross expenses	$ 280	$ 280
Labor & management return	$ 166	$ -52

This comparison, which is not an extreme one, shows a difference in return on the same acreage of nearly $220. The

Table 14. Effect of Yield Changes on Return to Labor and Management Per Acre for Alfalfa, Potatoes, Merion Bluegrass, and Kenland Red Clover.

Crop	Yield per acre	Cost per acre/1	Price	Return to labor & management per acre
		$	$	$
Alfalfa	2 T	61	15.50/T	-30.00
	3 T	62		-15.50
	4 T	63		- 1.00
	5 T	64		13.50
	6 T	65		28.00
Potatoes	10 T	232	23.95/T	7.50
	12 T	244		43.40
	14 T	256		79.30
	16 T	268		115.20
	18 T	280		151.10
	20 T	292		187.00
	22 T	304		222.90
Merion bluegrass	50 lbs.	66	.70/lb.	-31.00
	100 lbs.	76		- 6.00
	200 lbs.	96		44.00
	300 lbs.	116		94.00
	400 lbs.	136		144.00
Kenland red clover	100 lbs.	43.50	.30/lb.	-13.50
	200 lbs.	46.50		13.50
	300 lbs.	49.50		40.50
	400 lbs.	52.50		67.50
	500 lbs.	55.50		94.50

/1 Taken from Table 13 and altered wherever yield changes affected costs per acre.

Table 15. Quality Changes of Potatoes and Its Effect on Returns Per Acre to Labor and Management.

Grade out	Gross return per acre	Net return to labor & management per acre
50% 1's	$ 297.00	
20% 2's	50.40	
30% culls	21.60	
Total	$ 369.00	$ 89/1
60% 1's	$ 356.40	
15% 2's	37.80	
25% culls	18.00	
Total	$ 412.20	$ 132
70% 1's	$ 415.90	
10% 2's	25.20	
20% culls	14.40	
Total	$ 455.40	$ 175
80% 1's	$ 475.20	
5% 2's	12.60	
15% culls	10.80	
Total	$ 498.60	$ 219

/1 Cost - $280/Acre
Yield - 18 Ton/Acre
Price - No. 1's - $1.65/cwt.
No. 2's - $ .70/cwt.
Culls - $4/Ton

important thing to remember is that often what appears to be a minor change affecting income when combined with several other minor changes produces a very significant difference in net returns to a farm operator.

CHAPTER 9

AN ECONOMIC COMPARISON OF SPECIALIZATION AND DIVERSIFICATION

The question often arises as to the economic merit of diversification compared to specialization. Diversification is often attractive to beginning farm operators as well as those who may be in precarious financial condition. It may be considered as a means of protection against a possible bad year which could be disastrous. Farm leaders and lending agencies sometimes advocate diversification. It is believed that diversification is generally practiced to reduce income variability brought on by the variable factors listed in Chapter 8.

If diversification is accomplished to provide greater income by the use of complementary and supplementary enterprises it is justifiable. A number of crops in a rotation may be necessary to maintain fertility and effective weed control. If a farmer's sole purpose of diversification is to reduce income variability he may seriously restrict net farm income by overdiversification. As enterprises are added the point is often reached where the last enterprises are less adapted as far as yields are concerned. Diversification also limits yields in another way. Any farm operator's managerial ability is limited. As enterprises

are added, each with their own complex problems, an operator has less time to devote to specific problems of each crop. Crop yields eventually suffer.

The general price level of crops tends to fluctuate in the same direction. Yields also tend to fluctuate in the same way although there are some exceptions such as frost affecting potatoes more than alfalfa. After the first few crops are added the marginal reduction of income variability becomes very small. Therefore when an enterprise is added to several others its minor effect on reduction of variability may be more than offset by a depressing effect on net farm income (7, p.52-54). A farm operator who has a limited number of crops can become more of a specialist than can the farmer who is highly diversified. He is also in a better position to take advantage of economies of size. This specialist is often capable of making a profit when others are forced out of business because of a combination of low prices and high costs.

An attempt was made to construct a farming system that would combine some of the advantages of both diversification and specialization. To provide a logical rotation for the diversified operator, a basic rotation was taken and then expanded over a three-year period to eight crops. To provide individual operator specialization while maintaining

soil fertility and a minimum of weed and insect problems, a cooperative rotation between 2 operators was devised.

Rotation 5 was used, involving two operators. One operator ran the kenland red clover and grain 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. The operation of kenland red clover and grain together was believed to be logical since the same machinery was required for each crop plus the fact that the clover is generally seeded with grain as a nurse crop. Harvesting was no problem since the grain would be combined in August and the clover in September. This arrangement was also designed to provide for comparable incomes to each of the operators. The results of comparison are shown in Table 16. In each case, it was assumed that all necessary farm machinery was owned. The average net return per acre under the specialized operation was 50% greater than the diversified operation. The principal reasons for this were economies in the use of specialized machinery and use of high income crops. The normal reply to that statement would be that we do not know what the most profitable crops will be. This is not entirely true, however. If some time were devoted to analysis of market trends rather than the addition of another somewhat

Table 16. Budget Comparison of Specialization and Diversification.

	DIVERSIFIED 1 Operator owning - 240 acres				SPECIALIZED 1 Operator owning - 120 acres				1 Operator owning - 120 acres			
	Acres	Production	Price	Total Value	Acres	Production	Price	Total Value	Acres	Production	Price	Total Value
Gross receipts												
Alfalfa	60	4.2 T	$15.50/T	$ 3,906	--	--	$ --	$ --	--	--	$ --	--
Potatoes	40	18 T	23.95/T	17,244	--	--	--	--	60	18 T	23.95/T	$ 25,866
Wheat	15	56 bu.	2.08/bu.	1,747	15	56 bu.	2.08/bu.	1,747	--	--	--	--
Barley	5	70 bu.	.984/bu.	344	45	70 bu.	.984/bu.	3,100	--	--	--	--
Merion bluegrass	50	150 lb.	.70/lb.	5,250	--	--	--	--	--	--	--	--
Penn lawn fesoue	10	365 lb.	.39/lb.	1,424	--	--	--	--	--	--	--	--
Kenland red clover	40	250 lb.	.30/lb.	3,000	120	250 lb.	.30/lb.	9,000	--	--	--	--
Ladino clover	20	150 lb.	.30/lb.	900	--	--	--	--	--	--	--	--
Total	240			$ 33,815	180			$ 13,847	60			$ 25,866
		Fixed	Variable	Total Cost		Fixed	Variable	Total Cost		Fixed	Variable	Total Cost
Gross expenses												
Labor - seasonal		$ --	$ 1,775	$ 1,775		$ --	$ --	$ --		$ --	$ 1,778	$ 1,778
Custom operations		--	--	--		--	--	--		--	--	--
Machine rentals		--	70	70		--	--	--		--	105	105
Fertilizer		--	2,993	2,993		--	711	711		--	1,536	1,536
Seed		--	1,629	1,629		--	396	396		--	1,872	1,872
Crop supplies		--	492	492		--	--	--		--	360	360
Water		--	1,368	1,368		--	948	948		--	432	432
Gas, oil & grease		--	721	721		--	312	312		--	521	521
Potato sorting & grading		--	4,320	4,320		--	--	--		--	6,480	6,480
Seed cleaning		--	2,650	2,650		--	900	900		--	--	--
Overhead		270	--	270		200	--	200		240	--	240
Vehicle licenses		68	--	68		46	--	46		70	--	70
Insurance - vehicle, property & liability		310	--	310		197	--	197		263	--	263
Taxes - real estate & personal property		1,133	--	1,133		570	--	570		666	--	666
Repairs - building		127	--	127		66	--	66		38	--	38
machinery		1,282	--	1,282		727	--	727		963	--	963
Depreciation - machinery		2,842	--	2,842		1,702	--	1,702		2,250	--	2,250
building		159	--	159		84	--	84		48	--	48
Interest on operating capital		--	250	250		--	90	90		--	200	200
Total expenses				$ 22,459				$ 6,949				$ 17,822
Net farm income				$ 11,356				$ 6,898				$ 8,044
Less return for capital investment				$ 5,025				$ 2,496				$ 2,746
Return to labor & management				$ 6,331				$ 4,402				$ 5,298
Investment		Land - 240 acres		$ 60,000		Land - 120 acres		$ 30,000		Land - 120 acres		$ 30,000
		Leveling		6,000		Leveling		3,000		Leveling		3,000
		Buildings		6,350		Buildings		3,300		Buildings		1,900
		Machinery		32,050		Machinery		$ 18,000		Machinery		24,080
		Return per acre		$ 26		Average return per acre on 240 acres $ 40						

unfamiliar crop to the already overloaded program, an operator might keep abreast of the most profitable crops and maintain an organization of sufficient flexibility to meet the changes.

There might be several ways in which a specialized plan between 2 or 3 operators could be worked out satisfactorily. Rather than having each operator accepting the vagaries of price for his own crop as shown in Table 16, the total return to labor and management could be divided. This would prevent operator antagonism if price of one crop grown stayed low in relation to another for several seasons. The ability to adjust cropping programs with anticipated price changes (flexibility) could alleviate this problem, however. If cooperative land sharing is not desirable or equitable, a rental program might be practical as long as the participants are willing to rent their land. If a large amount of land is owned by one man it might prove wise to delegate 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 management problems.

This analysis of possible cooperative arrangements was intended to be illustrative rather than exhaustive. However, it appears such arrangements would be economically feasible. If the "cost-price squeeze" continues, which appears likely,

cooperative specialization could be a desirable way to increase returns by increasing size without making costly land purchases. A total of at least 240 acres should be in the program to assure economies of size.

CHAPTER 10

A SUPPLEMENTARY LIVESTOCK FEEDING PROGRAM

Some factors of production are often not fully utilized with just a cropping program. Slack labor periods exist where the operator or hired man is not kept busy throughout the year. Crop residues such as straw, cull potatoes, bluegrass and clover aftermath with considerable feed value are either wasted or provide only a limited return if sold. A livestock enterprise could utilize both unused feed and labor. Because of the prevalence of white muscle disease in the project a cow-calf or a farm flock sheep enterprise is not yet practical in most of the area. In addition, this type of livestock program would necessitate the taking of irrigated land out of production of high income crops for pasture that brings a very low return unless range land is easily accessible. For these reasons a cattle feeding operation was selected as best suited for supplementary purposes. Approximately one-third of the 56 farmers from which schedules were collected had cattle feeding operations. The size varied from 10 to 160 head on feed at one time.

A supplementary cattle feeding operation was synthesized to point out the possibility of utilizing the excess labor and feed which might be available on a 240-acre farm

using rotation 3. Figure 7 showed that considerable labor was available in the December - April period. Either a 120 or 150-day feeding period would prove ideal. If pasturing is preferred the cattle could be purchased in the late summer and pastured on the kenland red clover and potato ground after harvest, then placed in the feedlot in December. Little labor would be required during the pasture period. This would allow an 8-month feeding period. Assuming a yield of 18 tons per acre on potatoes with a grade out of 25% culls, 270 tons of potatoes would be available for feed. If 50 pounds of potatoes were consumed per day, enough potatoes would be available to feed 70 head of feeders. The grain straw and clover aftermath could be baled, hauled in, and fed, free choice or mixed with a protein supplement. Information from the schedules show that an average of 1.65 hours is spent per day for 50 head. This means approximately 2.4 hours a day would be spent with the feeders. Feeding 30 days per month requires 75 hours of labor per month. Assuming the feeders were placed in the lot on December 1 after fall pasturing on crop residues, they would be fed until May 1.

Labor requirements for the entire farm are shown in Figure 8. The effect of labor utilization by a supplemental feeder operation is noted when the labor requirements are compared with Figure 7.

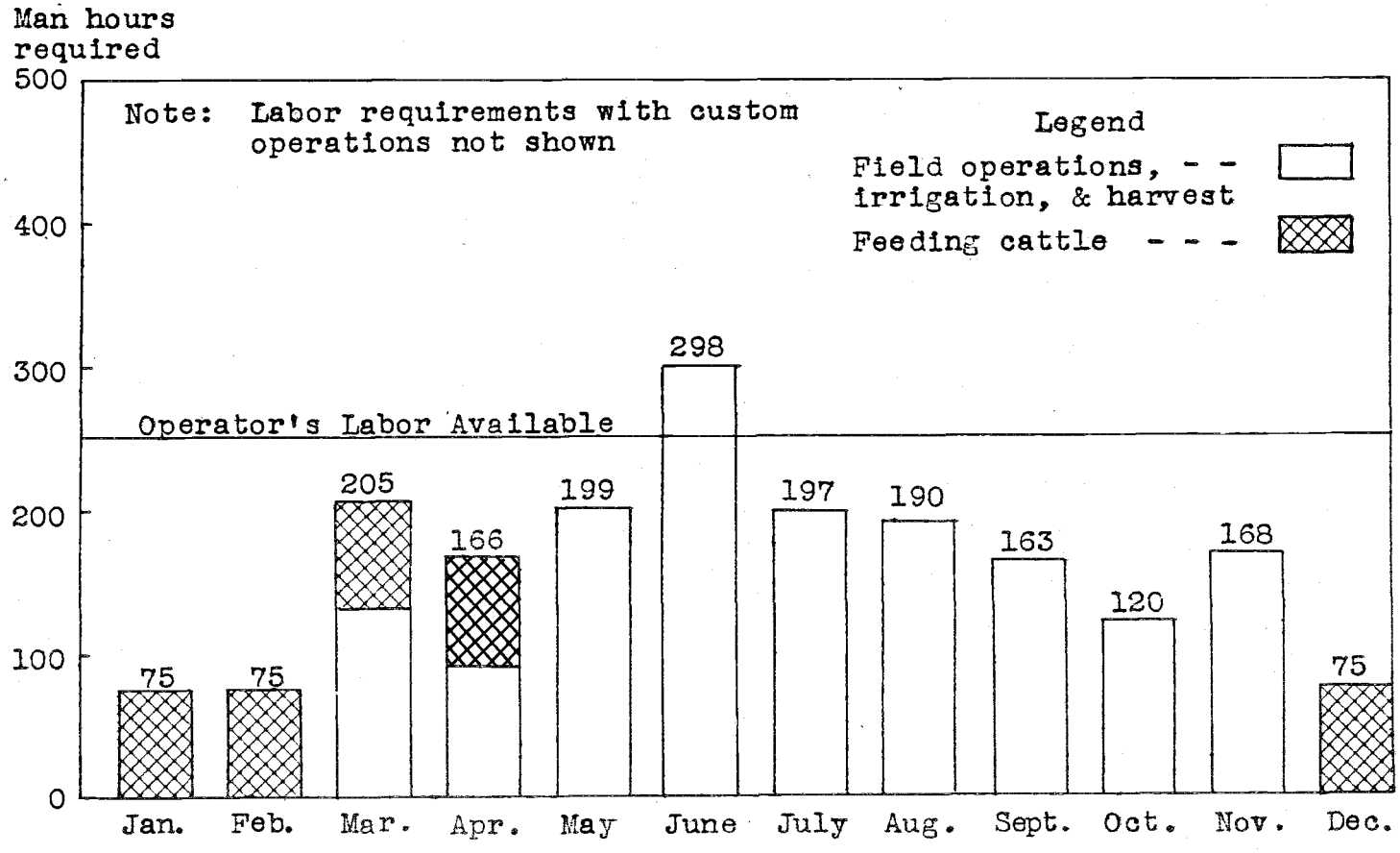

Figure 8. Labor requirements and availability for a 240-acre irrigated farm using rotation 3 plus a 70-head feeder operation, North Unit Project, 1957.

Because of the diverse nature of feeding operations within the project, a budgeting study for determination of net income was not undertaken. This chapter was designed to illustrate how a supplemental operation could be fitted into the overall farm plan and how unused resources could be utilized effectively. A winter feeding operation of this type would fit into any of the 5 rotations previously discussed. It would reduce the amount of leisure time available to the operator, however. He would have no free month in the event he wished to take a vacation, unless he could leave a hired man in charge. Of course, such a decision can only be made by one person -- the farm operator.

CHAPTER 11

SUMMARY AND CONCLUSIONS

Pronounced changes in technology during the past decade have had far reaching effects on our society. There are no indications that this trend has run its course. These innovations have been output stimulating and price reducing for farm products. To maintain or improve the farmers' income position, adjustments have become necessary. The opportunities for adjustment include changes in operating unit size, combination of enterprises, combination of factors of production, off-farm employment, or some combination of these. Farmers in the North Unit Deschutes Irrigation project are faced with this same problem and a choice of the same adjustment alternatives. These farmers, however, are handicapped by certain physical and institutional limitations. The climate confines production to field and row crops that are adapted to warm days, cool nights, and a short growing season of approximately 140 days. Sandy soils, surface rocks, and undulant topography are further physical restrictions on parts of the project. Acreage restrictions were imposed when the project was established. Ownership units and operating units were restricted to 160 irrigable acres or less. Division of project lands to units of less than 160 acres was accomplished by 1949.

Just how rigidly the acreage restrictions have been enforced is not known. Movement off-farms has been slowed by the decided lack of industry that could utilize a surplus farm labor force /1.

Adjustment alternatives open to the farm operator in the project were studied in light of physical, economic, and institutional limitations imposed. Operating unit size was allowed to vary and economic units determined. Various enterprise combinations were compared for relative profitability of rotations adapted to the area. Combinations of enterprise were further examined by comparing specialization and diversification. A study of factor combination included custom versus ownership comparison of farm machinery and use of a supplemental livestock feeding program.

Findings of this study indicate that nearly 50% of the current farm operators do not have the capacity to earn $4,000 per year return to labor and management. Some of these operators are in a position to make adjustments. However, it is doubtful, even under optimum conditions and effective use of supplemental enterprises, that operating units of less than 100 acres will be successful. A shift for the small operator to a more profitable rotation would merely prolong hardship. The operators that need to increase

/1 Institutional and economic barriers restricting farm and off-farm adjustments will be covered in detail by Norman Dell Kimball in his Doctor's dissertation, Oregon State College.

in size, and are capable of doing so, must be warned that an increase in net farm income does not automatically follow. Increased size does not make up for poor management and indecision. Of course insufficient land exists for all farmers to increase their acreage.

Changes in enterprise combinations are open to some farmers. Rotations in which kenland red clover and potatoes are the predominant crops currently have the greatest earning capacity. Although overdiversification is not a serious problem in the project, at the present time, care must be exercised when contemplating a multicropping program with limited managerial ability. For smaller farmers bordering the 100-acre minimum a cooperative rotation program with a neighbor may be a solution to the adjustment problem. Supplemental livestock feeding enterprises utilizing excess labor and surplus feeds are another method for improving the operators financial position. More reliance on custom operators could be made, thus reducing high overhead expense and freeing capital for other uses that may provide greater returns. Joint machinery ownership might also be a possibility. Some operators will find part-time work to utilize surplus labor and supplement farm income.

Further adjustments within the project will undoubtedly be made. Some will leave the farming profession. Others who decide to stay will require a flexible operation to meet

and adapt to ever changing conditions. The ability to adjust is paramount. Many farm operators are at the crossroads and are faced with major decisions.

Some avenues of adjustment have been pointed out; others may exist that have not been uncovered. In any case the final solution will depend on individual decision making. A study such as this, at best, can only improve the framework of decision making and provide better information on which the decisions are based.

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APPENDIX

Table 1. Machinery Inventory and Depreciation Schedule for 60-Acre Irrigated Farm, North Unit Project, 1957.

Item - description	Year purchased	Age at purchase	Purchase price	Useful life	Yearly Depr.	Current value
Agency Plains						
Tractor - 20-30 H.P.	1952	2	$ 1,650	10	$ 186	$ 720
Plow - 2 bottom 14"	1953	3	200	14	16	136
Disc - 8' Tandem	1953	N/1	350	12	26	246
Spike harrow - 3 section - 15'	1953	N	100	19	5	80
Graham Home - 6'	1955	1	350	17	20	310
Grain drill - 10'	1953	1	500	20	24	404
Tool bar - w/corrugator and cult - 8'	1952	1	300	17	17	215
Tractor mower - 6'	1951	1	300	16	18	192
Rake - side delivery	1953	1	400	16	24	304
Wagon - 4-wheeled with bed	1951	N	200	20	9	146
Fertilizer spreader	1953	N	300	16	17	232
Pickup - 3/4 ton	1955	3	1,300	12	130	1,040
Ditcher - 1/3 interest	1952	N	50	20	2	40
Small tools	--	-	400	40	10	300
Irrigation dams	--	-	--	--	35	--
Total			$ 6,400		$ 539	$ 4,365
Metolius-Culver (same as above)						
Mud Springs (same as above except:						
Delete Graham Home			$ -350		$ -20	$ -310
Add - Springtooth - 3 section 9'	1956	N	+150	19	+ 7	+143
Total			$ 6,200		$ 526	$ 4,198

/1 N signifies new.

Table 2. Machinery Inventory and Depreciation Schedule for 140-Acre Irrigated Farm, North Unit Project, 1957.

Item - description	Year purchased	Age at purchase	Purchase price	Useful life	Yearly depr.	Current value
Agency Plains						
Tractor - 30-40 H.P.	1953	1	$ 2,300	10	$ 230	$ 1,380
Plow - 3 bottom 16"	1953	1	450	14	31	326
Disc - 12' Tandem	1954	1	450	12	37	339
Spike harrow - 4 section 20'	1953	1	150	19	8	118
Graham Home - 8'	1955	1	400	17	22	356
Grain drill - 10'	1953	1	500	20	24	404
Corrugator - 10'	1953	1	200	20	9	164
Tractor mower - 7'	1952	1	300	10	30	150
Side delivery rake	1953	1	400	16	24	304
Grain combine - pull-type 6'	1954	3	1,250	16	87	989
Combination grain & hay elevator	1953	N/1	400	20	18	328
Fertilizer spreader - 10'	1953	N	300	16	17	232
Truck - 2 ton with grain bed	1954	3	2,000	10	257	1,229
Ditcher - 1/2 interest	1952	N	100	20	4	80
Hay baler - 1/2 interest	1955	1	1,200	10	120	960
Land plane - 1/2 interest	1953	1	350	20	17	282
Cultivator	1953	1	250	17	14	194
Small tools	--	-	500	40	12	380
Irrigation dams	--	-	--	--	70	--
Siphon tubes	--	-	200	5	40	160
Total			$ 11,700		$ 1,071	$ 8,375

/1 N signifies new.

Table 2. (Continued)

Item - description	Year purchased	Age at purchase	Purchase price	Useful life	Yearly depr.	Current value
Metolius-Culver same as Agency Plains except:						
Delete land plane			$ -1,200		$ -120	$ -960
Total			$ 10,500		$ 951	$ 7,415
Mud Springs same as Agency Plains except:						
Delete land plane			$ -1,200		$ -120	$ -282
Delete Graham Home			- 400		- 22	-356
Add springtooth - 5 section 15'	1953	1	+ 200	19	+ 10	+160
Total			$ 10,300		$ 939	$ 7,897

Table 3. Machinery Inventory and Depreciation Schedule for 240-Acre Irrigated Farm, North Unit Project, 1957.

Item - description	Year purchased	Age at purchase	Purchase price	Useful life	Yearly depr.	Current value
Agency Plains						
Tractor - 30-40 H.P.	1953	1	$ 2,300	10	$ 230	$ 1,380
Tractor - 20-30 H.P.	1952	2	1,650	10	186	720
Plow - 3 bottom 16"	1953	1	450	14	31	326
Disc - 12' Tandem	1954	1	450	12	37	339
Spike harrow - 4 section - 20'	1953	1	150	19	8	118
Graham Home - 8'	1955	1	400	17	22	356
Grain drill - 10'	1953	1	500	20	24	404
Potato planter - 2-row 1/2 interest	1956	2	400	18	22	378
Cultivator	1953	1	250	17	14	194
Corrugator - 12'	1953	1	200	20	9	164
Tractor mower - 7'	1952	1	300	8	39	105
Side delivery rake	1953	1	400	12	33	268
Hay baler	1955	1	2,400	10	240	1,920
Hay loader	1953	N/1	350	15	21	266
Grain combine - S.P. 10' 1/2 interest	1953	1	2,700	12	221	1,816
Potato digger - 2-row 1/2 interest	1954	1	500	16	30	410
Potato combine - 1/2 interest	1955	1	1,900	10	190	1,520
Vine beater - 1/2 interest	1955	N	400	13	28	344
Truck - 2 ton with grain bed	1954	3	2,000	10	257	1,229
Bulk bed	1955	N	500	20	22	456
Bulk bed - 1/2 interest	1955	N	250	20	11	228
Truck - 2 ton 1/2 interest	1955	6	500	15	50	400
Combination grain and hay elevator	1953	N	400	20	18	328
Fertilizer spreader - 10'	1953	N	300	16	17	232
Ditcher	1952	N	200	20	9	155
Pickup - 1/2 ton	1954	N	2,000	10	180	1,460

Table 3. (Continued)

Item - description	Year purchased	Age at purchase	Purchase price	Useful life	Yearly depr.	Current value
Land plane	1953	1	$ 650	20	$ 31	$ 526
Small tools and shop equipment	--	-	1,100	40	28	820
Irrigation dams	--	-	--	--	100	--
Siphon tubes	--	-	300	5	60	240
Total			$ 23,900		$2,168	$17,102
Metolius-Culver - Same as above except:						
Delete - land plane			$ - 650		$ - 31	$ - 526
Total			$ 23,250		$2,137	$ 16,576
Mud Springs - Same as Agency Plains except						
Delete - land plane			$ - 650		$ - 31	$ - 526
Delete - Graham Home			- 400		- 22	- 356
Add - Springtooth - 5 section 15'	1953	1	+ 200	19	+ 10	+ 160
Total			$ 23,050		$ 2,125	$ 16,380

/1 N signifies new.

Table 4. Sequence of Field Operations Performed on Alfalfa, Potatoes, and Grain Within Land-Type Areas, North Unit Project, 1957.

AGENCY PLAINS			
Crop	Operation	Times over	Time-period range
Alfalfa (old stand)	Fertilize	1	Oct. - Mar.
	Mow	2	Late June-Aug.
	Rake	2	" " "
	Bale	2	" " "
	Haul & stack	2	" " "
Alfalfa /1 (new seeding)	Corrugate	1	March - April
	Mow	2	Late June-Aug.
	Rake	2	" " "
	Bale	2	" " "
	Haul & stack	2	" " "
Potatoes (Following grass, legume, or pasture)	Plow sod	1	Oct. - April
	Disc & harrow	1	" "
	Graham Home	3	" "
	Harrow	2	April - May
	Fertilize (liquid)	1	" "
	Plant	1	May
	Cultivate	3	June - July
	Spray	1	" "
	Beat vines	1	October
	Dig, pick, & haul	1	"
Grain (following potatoes)	Plow	1	Oct. - March
	Disc & harrow	2	Nov. - April
	Fertilize	1	" "
	Harrow	1	" "
	Drill	1	" "
	Corrugate	1	" "
	Combine & haul	1	August
Grain (following grain)	Plow	1	Oct. - March
	Disc & harrow	2	March
	Fertilize	1	"
	Drill	1	March - April
	Corrugate	1	April
	Combine & haul	1	August

Table 4. (Continued)

METOLIUS-CULVER

Crop	Operation	Times over	Time-period range
Alfalfa (old stand)	Fertilize	1	Mar. - April
	Corrugate	1	" "
	Mow	2	Late June-Aug.
	Rake	2	" " "
	Bale	2	" " "
	Haul & stack	2	" " "
Alfalfa /1 (new seeding)	Mow	2	Late June - Aug.
	Rake	2	" " "
	Bale	2	" " "
	Haul & stack	2	" " "
Potatoes (following grass, legume, or pasture)	Plow sod	1	Oct. - April
	Disc & harrow	2	" "
	Fertilize	1	" "
	Harrow	2	April - May
	Plant	1	20 April - 30 May
	Cultivate	4	20 May - July
	Spray	1	June - July
	Beat vines	1	October
	Dig, pick, & haul	1	"
Grain (following potatoes)	Graham Home	1	Oct. - March
	Disc & harrow	2	Nov. - April
	Fertilize	1	" "
	Drill	1	" "
	Corrugate	1	" "
	Spray	1	May - June
	Combine & haul	1	Aug. - Sept.
Grain (following grain)	Same as Agency Plains		

Table 4. (Continued)

MUD SPRINGS			
Crop	Operation	Times over	Time-period range
Alfalfa (old stand)	Fertilize	1	Feb. - April
	Springtooth (third year only)	1	March - April
	Mow	2	Late June - Aug.
	Rake	2	" " "
	Bale	2	" " "
	Haul & stack	2	" " "
Alfalfa /1 (new seeding)	Fertilize	1	Feb. - April
	Mow	2	Late June - Aug.
	Rake	2	" " "
	Bale	2	" " "
	Haul & stack	2	" " "
Potatoes (following grass, legumes, or pasture.)	Disc	3	Oct. - April
	Plow	1	" "
	Disc	1	March - April
	Harrow	1	" "
	Fertilizer (liquid)	1	April
	Plant	1	May
	Cultivate	3	June - July
	Beat vines	1	October
	Dig, pick, & haul	1	"
Grain (following potatoes)	Disc	2	Oct. - March
	Harrow	2	" "
	Fertilize	1	Nov. - April
	Drill	1	" "
	Corrugate	1	" "
	Combine & haul	1	Aug.-Early Sept.
Grain (following grain)	Plow	1	Oct. - March
	Disc	2	Nov. - April
	Harrow	1	" "
	Fertilize	1	" "
	Drill	1	" "
	Corrugate	1	" "
	Combine & haul	1	Aug.-Early Sept.

/1 Seeded with grain as a nurse crop - no field work until the following year.

Table 5. Average Machinery Operating Rates for Various Types and Sizes of Farm Machinery Used in the North Unit Project.

Operation	Machinery	Size	A/Hr.	Hr./A
Plow-sod or	2 bottom - 14"	28"	.5	2.00
pasture	3 bottom - 16"	48"	.8	1.25
stubble or	2 bottom - 14"	28"	.6*/1	1.67
spuds	3 bottom - 16"	48"	1.0	1.00
Disc	Tandem	8'	2.1	.48
		12'	3.4*	.29
Disc & harrow	Tandem	8'	1.8	.56
		12'	3.0*	.33
Harrow	Spike - 3 sections	15'	4.6	.22
	4 sections	20'	5.4	.18
	Springtooth	9'	2.3	.43
		15'	3.1*	.32
Ripping	Graham Home	6'	2.0	.50
		8'	2.5	.40
Fertilize	Aqua rig	16'	4.9	.20
	Spreader	10'	4.2	.24
Drill grain	w/seeder attach.	10'	2.8	.36
Corrugate		8'	2.0	.50
		10'	2.8	.36
		12'	3.6	.28
Spray		20'	3.6	.28
Grain combine	Pull type	6'	.63*	1.59
	Self-propelled	10'	1.1	.91
Mow	tractor type	6'	1.8	.56
		7'	1.8	.56
Rake	Side delivery	--	2.5	.40
Bale	Automatic	--	3.5 Tons/Hour	
Haul bales	2 men & loader	--	3.8 Tons/Hour	
	2 men & boy	--	3.8 Tons/Hour	
Plant potatoes	2-row	--	1.1	.91
Cultivate	Tool bar or cultivator	--	2.1	.48
Dig potatoes	2-row	--	.7	1.43
Potato combine		--	.5	2.00
Beat vines	Roto type	--	1.6	.62
Land leveler		6'	2.0	.50
		8'	3.0	.33
Haul rocks	1 man		.75	1.50

/1 Asterisk denotes adjusted average.

Table 6. Charges for Custom Operations Performed and Machines Rented, North Unit Project, 1957.

Operation	Rate	Unit	Remarks
Baling	4.50	Ton	
Hauling & stacking	1.50	Ton	Operator furnished truck and loader
	2.00	Ton	Operator furnished truck only
	2.25	Ton	All hired
Combining	7.00	Acre	Combining only
	8.00	Acre	Combining and hauling
Potato planting	2.50	Acre	Planter only
Vine beating	2.00	Acre	Beater rental only
	5.00	Acre	Beater, tractor, and labor hired
Potato digging	6.00	Acre	Digger rental only
	10.00	Acre	Digger, tractor, and labor hired
Potato combining	5.00	Ton	All hired including hauling
Hauling potatoes	1.25	Ton	Only truck hired
	2.00	Ton	Truck and labor hired
Liquid fertilizer application	.50	Acre	Rig only
Spraying	1.25	Acre	Rig only
	6.00	Acre	Rig and spray
Dusting	1.50	Acre	Airplane only

Table 7. Supplies: Amounts Used and Cost Per Acre for Alfalfa, Potatoes, and Grain, by Areas, 1957.

Crop	Item	Cost per Unit	Agency Plains & Metolius-Culver		Mud Springs	
			Rate/A	Cost/A	Rate/A	Cost/A
		$	lb.	$	lb.	$
Alfalfa	Seed /1	.40/lb.	10	1.33	10	1.33
	Fertilizer /2					
	Superphosphate	57.00/Ton	300	5.70	150	2.85
	Landplaster	19.00/Ton	200	1.30	100	.65
	Baling wire /3	1.00/Ton				
Potatoes	Seed - cut & treated	2.60/cwt.	1200	31.20	1200	25.20
	Fertilizer					
	Actual N	.13/lb.	120	15.60	100	13.00
	Actual P_2O_5	.10/lb.	70	7.00	70	7.00
	Actual K_2O	.05/lb.	60	3.00	60	3.00
	Spray - Aldrin	6.00/lb.	1	6.00	--	--
Grain	Seed - wheat	100.00/Ton	120	6.00	120	6.00
	barley	60.00/Ton	120	3.60	120	3.60
	Fertilizer					
	$(NH_4)_2SO_4$	70.00/Ton	230	8.05	230	8.05

/1 Only 1/3 of total acreage is seeded each year.
/2 Applied only to 2/3 of total acreage.
/3 Cost per acre determined by yield; not considered if operator uses custom baling.

Table 8. Irrigation Application Rates, Costs and Labor Requirements Per Acre for Crops Grown in the North Unit Project.

Crop	Acre-feet per acre	Total cost per acre/1	Labor requirements per acre by month (in hours)			
			Agency Plains & Metolius-Culver		Mud Springs	
Alfalfa	3.25	$ 5.40	May	.9	May	1.55/2
			June	.4	June	.75/3
			July	.4	July	.75
			August	.3	August	.75
				2.0		3.8
Potatoes	4.25	$ 7.20	June	1.3	June	2.30/4
			July	1.39	July	2.77
			August	1.39	August	2.77
			Sept.	.22	Sept.	.46
				4.3		8.6
Grain	3.00	$ 5.00	May	.6	May	1.2
			June	.8	June	.8
			July	.3	July	.8
				1.7		2.8

Merion bluegrass (same as alfalfa)

Clover for seed (same as alfalfa)

Penn lawn fescue (same as alfalfa)

/1 Includes minimum water, excess water, and construction charge.
/2 Alfalfa is irrigated 5 times.
/3 Beginning on 1 May and concluding on 1 August.
/4 Irrigate every day for 73 days from 25 June to 5 September.
/5 Grain is irrigated 4 times beginning on 5 May and concluding on 10 July except in Mud Springs where it is irrigated only 3 times.

Table 9. Average Yields and Prices for Crops Grown in the North Unit Project, 1957.

Crop	Agency Plains & Metolius-Culver Average yield per acre	Mud Springs Average yield per acre	Price per unit
Alfalfa (for hay)	4.2 Tons	4.2 Tons	$ 15.50/Ton
Potatoes/1	18 Tons	16 Tons	1's-$1.70/cwt.) 2's-$ .85/cwt.)$23.95/Ton Culls - $4/Ton)
Wheat	56 bu.	56 bu.	$ 2.08/bu.
Barley	70 bu.	60 bu.	.984/bu.
Merion bluegrass seed /2	200 lbs.	200 lbs.	.70/lb.
Ladino clover seed /2	150 lbs.	150 lbs.	.30/lb.
Alsike clover seed /2	350 lbs.	350 lbs.	.19/lb.
Kenland red clover seed /2	250 lbs.	250 lbs.	.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.