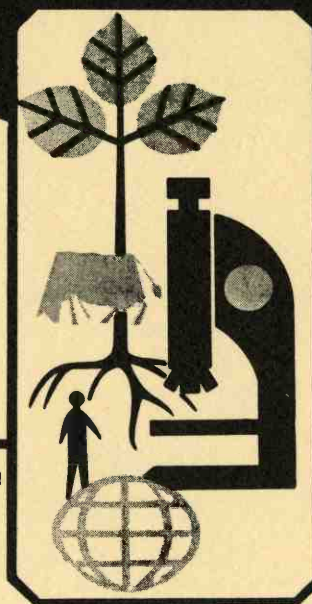


Technical Bulletin 220

# Cost of Producing Crops in the Irrigated Southwest

*Part I—Arizona*

N. Gene Wright  
Thomas M. Stubblefield



Agricultural Experiment Station • University of Arizona

Tucson, Arizona

**Cost of  
Producing Crops  
in the  
Irrigated Southwest**

***PART I—ARIZONA***

N. Gene Wright  
Thomas M. Stubblefield

N. Gene Wright, Research Associate, and Thomas M. Stubblefield, Agricultural Economist, Department of Agricultural Economics, The University of Arizona.

Agricultural Experiment Station  
THE UNIVERSITY OF ARIZONA  
Tucson, Arizona

## FOREWORD

The information developed in this project, which was funded by the Agricultural Research Service, U.S. Department of Agriculture, was a necessary input to achieving two basic objectives in the economic enhancement of the Southwestern States:

1. To provide information needed for maximizing the agricultural base in the Southwestern States;
2. To permit realistic planning of profit-making agri-businesses related to a sound agricultural base in these areas.

Although the collection and analysis of the data reported in this publication was not included in the original project financed by the Agricultural Research Service, U.S. Department of Agriculture, it was subsequently used as a basis for developing the other four studies—Cost of Producing Crops in the Irrigated Southwest—Part II, Colorado; Part III, Nevada; Part IV, New Mexico; and Part V, Utah. For this reason, it is included in this series of publications, and since the same procedure and reporting format was used, the information from each of the five publications can be compared directly.

# CONTENTS

	Page
Foreword .....	ii
List of Tables .....	iv
Glossary .....	v
Introduction .....	vi
Summary .....	vii
Estimates of Production Costs .....	1
Method of Determining Costs, Updating Cost Estimates, Cost of Producing Crops	
Appendix A .....	5
Procedure for Updating Cost Estimates Variable Costs, Fixed Costs	
Appendix B .....	6
Equipment Inventory and Costs for Machinery Used in Calculating 1972 Irrigated Crop Budgets on the Colorado River Indian Reservation	
Appendix C .....	7
Estimated Variable Costs for Producing One Acre of Barley on the Colorado River Indian Reservation	
Appendix D .....	8
Estimated Variable Costs for Producing One Acre of Cotton on the Colorado River Indian Reservation	
Appendix E .....	9
Estimated Variable Costs for Producing One Acre of Grain Sorghum on the Colorado River Indian Reservation	
Appendix F .....	9
Estimated Variable Costs for Producing One Acre of Wheat on the Colorado River Indian Reservation	
Appendix G .....	10
Estimated Variable Costs for Establishing One Acre of Alfalfa on the Colorado River Indian Reservation	
Appendix H .....	10
Estimated Variable Costs for Producing One Acre of Alfalfa on the Colorado River Indian Reservation	
Appendix I .....	11
Estimated Variable Costs for Producing One Acre of Lettuce on the Colorado River Indian Reservation	

## List of Tables

Table .....	Page
1. Annual Use of Selected Farm Machines on the Colorado River Indian Reservation .....	1
2. Estimated Costs for Producing One Acre of Barley on the Colorado River Indian Reservation.....	2
3. Estimated Costs for Producing One Acre of Cotton on the Colorado River Indian Reservation.....	2
4. Estimated Costs for Producing One Acre of Grain Sorghum on the Colorado River Indian Reservation .....	3
5. Estimated Costs for Producing One Acre of Wheat on the Colorado River Indian Reservation.....	3
6. Estimated Costs for Establishing One Acre of Alfalfa on the Colorado River Indian Reservation .....	3
7. Estimated Costs for Producing One Acre of Alfalfa on the Colorado River Indian Reservation.....	3
8. Estimated Costs for Producing One Acre of Fall Lettuce on the Colorado River Indian Reservation .....	4
9. Estimated Costs for Producing One Acre of Spring Lettuce on the Colorado River Indian Reservation .....	4

## GLOSSARY

*Calendar of operation:* A list of the different operations in sequence of their occurrence throughout the crop year. While the crop year falls within the calendar year for most crops, in some cases production overlaps into the next year. For instance, winter wheat production falls within two calendar years and there are times when final cotton harvesting operations may not be completed until early in the next calendar year.

*Cost of establishing a stand:* Cost of planting a perennial crop one year for harvesting several years thereafter, e.g., alfalfa.

*Fixed costs:* Costs that the farmer will experience whether or not a crop was planted. If the crop is not planted, the farmer will have certain costs depending upon the length of time his machinery, land, and management facilities are not used. If it is a year, then most costs except the actual operating costs of the machinery, labor, fertilizer, and part of the water costs would be incurred. A part of the water costs could be charged, depending upon the situation. If pump irrigation is used, there would be no charges for irrigation water if none was used; only the depreciation on the well and distribution system would be charged. If surface water is used, a minimum "water users" assessment is generally charged, whether water was used or not.

*Machinery complement:* The various machines used in the farming operation. In cases where the operations require more than one machine of a specific kind, the number of machines is stated.

*Variable costs:* Costs that are incurred only if the crop is planted, i.e., costs of inputs used directly in growing and harvesting the crop, including seed, fertilizer, water, machinery, and labor. Also included as "miscellaneous variable costs" are charges for certain items of expense that are incurred if the land is generally used for agricultural production instead of lying idle, such as charges for transportation, maintenance, office and bookkeeping expenses, management, and other expenses of running a farm.

## INTRODUCTION

The purpose of the Arizona portion of this study was to serve as a pilot study for collecting cost input data for producing crops in other States in the irrigated Southwest—Colorado, Nevada, New Mexico, and Utah. The estimated costs were determined on a basis that would permit them to be compared with costs in other states. A synthetic budget method was used, and the costs were based on the more efficient uses of agricultural inputs, at 1972 prices.

Because different people desire different information on costs in various amounts of detail, this report is divided into three sections:

- 1) Summary,
- 2) Costs of producing irrigated crops,
- 3) Appendixes containing detailed tables of variable costs, to serve as a benchmark for incorporating most recent data in order to update estimates of costs of producing these crops.

The major reason the Colorado River Indian Reservation was used for the pilot study was because this area has the lowest crop production costs of any in the State of Arizona, primarily because of the price of water and the cost of land. This land is owned by the Indians and could be leased for a 20-25 year time period.

Water resources of the Colorado River Indian Reservation appear to be favorable. The Reservation has been adjudicated four acre-feet of water per acre per year by the Supreme Court Decision in a case between Arizona and California. Agri-Research Service Inc., a consulting firm, stated in their report to the Bureau of Indian Affairs that there was a potential of 125,300 acres of land to be developed in that Reservation.<sup>1</sup> Other estimates range from 100,000 acres to 125,000 acres. The major problem is that part of the delivery system needed to deliver Colorado water to the land has not been completed.

<sup>1</sup> *Agricultural and industrial potential of the Colorado River Indian Reservation*, Agri-Research Service Inc., Manhattan, Kansas, July 1963.

## SUMMARY

There was only one area in Arizona from which data were collected—the Colorado River Indian Reservation. The reason this area was chosen was that there was a surplus of irrigation water and the cost was as low as any in the State of Arizona, if not lower than in most areas. Large blocks of land were available for development and efficient use could be made of agricultural machinery. The data were for the year 1972.

Following are the estimated average costs for producing the Arizona irrigated crops included in the study:

Alfalfa Hay	\$28.72 per ton
Barley	3.84 per cwt
Cotton	0.24 per pound
Grain Sorghum	2.93 per cwt
Lettuce—spring	2.01 per carton
Lettuce—fall	2.09 per carton
Wheat	3.27 per cwt



## ESTIMATES OF PRODUCTION COSTS

### *Method of Determining Costs*

A synthetic budgeting method was used to determine cost estimates. These budgets are based on extensive use of machinery throughout most of the year, as would have been expected in a commercial farming operation in 1971 and 1972. Information on operating times and on the practical efficiency of the various machines was obtained from farm operators who used them extensively on large farms in Arizona. On the basis of this information and knowledge of prevailing practices in the production of the specified crops in Arizona, estimates of annual machine usage were developed as shown in Table 1.

The factor that limited the size of operation in this study was usually the harvesting machine. The size of operation was based on the area over which a specific harvesting machine or a combination of harvesting machines could be used most efficiently. For example, in the production of alfalfa hay, the machine that has the greatest limiting effect is the swather (harvester). It can cover only a limited number of acres in a given time. Efficient equipment is important because hay must be harvested within a given time to be of good quality. If a farmer's operation is not large enough to use his harvesting machinery efficiently, he probably would not be able to produce at unit costs as low as the estimates in this report. An alternative for overcoming this problem is to use custom harvesters.

TABLE 1  
**Annual Use of Selected Farm Machines on  
the Colorado River Indian Reservation**

	Hours per year
90—100 HP Tractor	2000
65—75 HP Tractor	2000
Cotton Picker	500
Grain Combine	600
Swather	600
Hay Baler	500
Bale Wagon	500

A typical machinery complement for each specific operation was established with the objective of performing that operation at the lowest cost (Appendix B). Certain problems and variations had to be considered in estimating machinery use. Farmers located in areas with shorter growing seasons tend to make more repairs to their machinery, so as to extend its life over a longer number of hours of use than if the machine were used where the growing season is longer, i.e., 300 to 325 days per year. In the latter case, as the machine becomes worn, it is impractical to replace many of the parts. In the former case, if the farmer or rancher has time when his opportunity cost is near zero, he may find it more profitable to repair the machine and extend its life rather than to replace it.

Machinery costs were calculated using 1972 costs for new machinery. Fuel and repair costs were based on the Agricultural Engineering Handbook formulas. In some instances, where experience indicated that the Agriculture Engineering Handbook formulas were underestimating costs, the costs were increased in accordance with more current information. Inter-

est, depreciation, insurance and other fixed costs were included.

Labor rates include social security, industrial insurance, Occupational Safety and Health Act insurance, employment compensation, and vacation costs. The amount and type of materials used and the per unit costs of these materials are based on the best information available. These components should be adjusted when local conditions indicate the information included in this report is not appropriate. Understandably, there is a limit to the extent of refinement of cost estimates developed in a study of this type, if it is to serve as a more or less generalized reference. Thus, for example, allowances were not made for different rates of application of fertilizer, water, etc., by soil types and other physical aspects for each small locality.

Included under variable costs are interest charges on the variable costs in the budget. A charge has been added for management, office overhead, bookkeeping, maintenance, transportation, and other expenses of running a farm.

Interest cost in the amount of a 6 percent charge on costs for developing the land was included in the fixed costs. Although interest rates for loans on agricultural land rose sharply in 1970 and then receded in subsequent years, the rate on new loans in 1972 was still higher than 6 percent. Nevertheless, the average interest rate on outstanding loans was more likely around 6 percent than the 1972 prevailing rates of 7 percent and higher. Thus, the more conservative rate of 6 percent was selected as the interest charge on the investment in land.

### *Updating Cost Estimates*

Because prices and charges for the various factors of production are constantly changing, it is well recognized that findings in any cost study will soon be out of date. Thus, one of the major objectives of this project was to develop a system for categorizing and presenting the findings so as to facilitate updating of the estimates by changing applicable items of cost.

The procedure for updating cost estimates appears in the Appendix, along with tables showing detailed cost information for the variable costs of producing the various crops.

### *Cost of Producing Crops*

Table 2 shows the estimated cost of producing an acre of barley on the Colorado River Indian Reservation. Variable costs amounted to \$59.84 and fixed costs were \$85.96, bringing total costs to \$145.80. The estimated yield for this area was 3,800 pounds per acre and thus, the average production cost was \$3.84 per hundredweight.

For the production of an acre of cotton, the variable costs were the major portion of the cost—\$294.22 compared to \$129.96 for the fixed costs (Table 3). Total estimated costs were \$424.18 per acre. A total of 1,500 pounds of lint per acre was expected to be produced. If no credit is given for the cottonseed, the estimated cost per pound of lint in 1972 was 28.3 cents a pound. If a \$50.00 per ton value was given to the cottonseed, and this value was subtracted from the total

production costs, the average cost per pound of lint would be reduced to 24.2 cents per pound.

Grain sorghum was produced in the Colorado River Indian Reservation at the time of this study primarily as a crop to keep the soil in viable condition until fall, winter, or spring crops were planted. If no crops are planted in summer, the organic matter is greatly depleted because of the high temperatures. For this reason it is necessary to plant some crop on the land during the summer. Table 4 shows the cost of establishing one acre of grain sorghum on the Colorado River Indian Reservation. The total cost was \$117.24 per acre. With a 4,000 pound per acre yield, the average cost was \$2.93 per hundred pounds.

Wheat has become an important crop on the irrigated farms in Arizona. The "Mexican" type wheats, in general, have a greater yield per acre than barley or grain sorghum. The yield was estimated at 5,000 pounds per acre for the Colorado River Indian Reservation in 1972. The total cost per acre was \$163.61, with fixed costs of \$87.16 and variable costs of \$76.45 (Table 5). With the above costs and yield, the estimated cost for producing a hundred pounds of wheat was \$3.27.

As in most irrigated areas, and particularly in the warmer climates, alfalfa is often used in the crop rota-

tion, although sometimes the total costs are not recaptured. Alfalfa is used to maintain the fertility and structure of the soil as well as to control diseases. This is particularly true when cotton and/or vegetable crops are grown. Tables 6 and 7 show the estimated costs for producing alfalfa on the Colorado River Indian Reservation. Costs for establishing a stand of alfalfa were \$127.10 per acre (Table 6). The cost of establishing the stand was prorated over four years of production because stands of alfalfa usually last this long with little decline in yield.

Cost of producing alfalfa hay after the stand has been established are shown in Table 7. The total cost was \$258.56 per acre, including the prorated yearly costs of establishing the stand; the estimated average cost of producing a ton of alfalfa hay was \$28.72.

Tables 8 and 9 present the estimated costs for producing an acre of lettuce in fall and in spring. Costs for producing lettuce were higher in fall than in spring because more hand labor is used and insect control costs and planting costs were higher for the fall lettuce. The fertilizer cost was higher for spring lettuce. The total costs for producing fall lettuce was estimated to be \$1,046.65 per acre of \$2.09 per carton. The estimated total costs for producing a carton of lettuce in the spring was eight cents lower, \$2.01—total costs of \$1,003.76.

TABLE 2

**Estimated Costs for Producing One Acre of Barley on the Colorado River Indian Reservation**

<i>Variable Costs</i>	
1. Land Preparation	\$ 8.26
2. Planting	5.55
3. Growing	
a. Fertilization	\$11.20
b. Irrigation	10.25
c. Insect Control	<sup>1</sup>
d. Chemical Weed Control	4.82
	<u>26.27</u>
4. Harvesting	6.96
5. Misc. Variable Costs	10.50
6. Interest on Variable Costs (8% for 6 Months)	2.30
Total Variable Costs	\$ 59.84
<i>Fixed Costs</i>	
1. Machinery	14.76
2. Rent	18.00
3. Development Costs (\$400 over 10 yrs.)	40.00
4. Interest on Development Costs	13.20 <sup>2</sup>
Total Fixed Costs	85.96
Total Producing Costs/Acre	<u>\$145.80</u>
Cost per hundredweight of barley (Estimated yield: 3,800 pounds/acre:	
	$\$145.80 \div 38 = \$3.84/\text{cwt.}$

<sup>1</sup> No costs; these controls were not customarily used.

<sup>2</sup> Average yearly interest for the 10 year period.

TABLE 3

**Estimated Costs for Producing One Acre of Cotton on the Colorado River Indian Reservation**

<i>Variable Costs</i>	
1. Land Preparation	\$21.08
2. Planting	5.60
3. Growing	
a. Fertilization	\$29.70
b. Irrigation	20.54
c. Insect Control	50.36
d. Chemical Weed Control	14.55
e. Cultivation	3.89
	<u>119.04</u>
4. Harvesting (includes defoliation)	51.57
5. Misc. Variable Costs	21.00
6. Interest on Variable Costs (8% for 6 Months)	8.73
7. Ginning: 1600 pounds seed cotton x \$1.40/cwt x 3 bales	67.20
Total Variable Costs	\$294.22
<i>Fixed Costs</i>	
1. Machinery	58.76
2. Rent	18.00
3. Development Costs (\$400 over 10 yrs.)	40.00
4. Interest on Development Costs	13.20 <sup>1</sup>
Total Fixed Costs	129.96
Total	<u>\$424.18</u>

Yield: 1,500 pounds of lint per acre, 2,475 pounds of cottonseed. Cost per pound of lint:  $\$424.18 \div 1500 = \$0.2829$ . Cost per pound of lint less value of cottonseed (2475# @ \$50/ton = \$61.90)

$\$424.18 - \$61.90 = \$362.28 \div 1500 = \$0.2415$  per pound.

<sup>1</sup> Average yearly interest for the 10 year period.

TABLE 4

**Estimated Costs for Producing One Acre of Grain Sorghum  
on the Colorado River Indian Reservation**

<i>Variable Costs</i>	
1. Land Preparation	\$12.04
2. Planting	5.61
3. Growing	
a. Fertilization	\$15.20
b. Irrigation	12.81
c. Insect Control	<sup>1</sup>
d. Chemical Weed Control	<sup>1</sup>
e. Cultivation	1.45
	29.46
4. Harvesting	6.96
5. Misc. Variable Costs	10.50 <sup>2</sup>
6. Interest on Variable Costs (8% for 6 Months)	2.58
Total Variable Costs	\$ 67.15
<i>Fixed Costs</i>	
1. Machinery	14.49
2. Rent	9.00 <sup>2</sup>
3. Development Costs (\$400 over 10 yrs.)	20.00 <sup>2</sup>
4. Interest on Development Costs	6.60 <sup>3</sup>
Total Fixed Costs	50.09
Total Producing Costs/Acre	\$117.24

Cost per hundredweight of grain sorghum (Estimated yield: 4,000 pounds/acre:

$$\frac{\$117.24}{40} = \$2.93/\text{cwt.}$$

<sup>1</sup> No costs; these controls were not customarily used.

<sup>2</sup> One-half year.

<sup>3</sup> One-half of the average yearly interest for the 10 year period. The reason only one-half of yearly interest was charged was that grain sorghum is double-cropped with another crop.

TABLE 5

**Estimated Costs for Producing One Acre of Wheat  
on the Colorado River Indian Reservation**

<i>Variable Costs</i>	
1. Land Preparation	\$ 8.26
2. Planting	8.15
3. Growing	
a. Fertilization	\$17.20
b. Irrigation	12.30
c. Insect Control	5.32
d. Chemical Weed Control	4.82
	39.64
4. Harvesting	6.96
5. Misc. Variable Costs	10.50
6. Interest on Variable Costs (8% for 6 Months)	2.94
Total Variable Costs	\$ 76.45
<i>Fixed Costs</i>	
1. Machinery	15.96
2. Rent	18.00
3. Development Costs (\$400 over 10 yrs.)	40.00
4. Interest on Development Costs	13.20 <sup>1</sup>
Total Fixed Costs	87.16
Total Producing Costs/Acre	\$163.61

Cost per hundredweight of wheat (Estimated yield: 5,000 pounds/acre:  $\frac{\$163.61}{50} = \$3.27/\text{cwt.}$

<sup>1</sup> Average yearly interest for the 10 year period.

TABLE 6

**Estimated Costs for Establishing One Acre of Alfalfa  
on the Colorado River Indian Reservation**

<i>Variable Costs</i>	
1. Land Preparation	\$13.03
2. Planting	10.09
3. Growing	
a. Fertilization	\$21.00
b. Irrigation	10.25
c. Insect Control	6.82
d. Chemical Weed Control	4.74
	42.81
4. Harvesting	0
5. Misc. Variable Costs	10.50 <sup>1</sup>
6. Interest on Variable Costs (8% for 6 Months)	3.06
Total Variable Costs	\$ 79.49
<i>Fixed Costs</i>	
1. Machinery	12.01
2. Rent	9.00 <sup>1</sup>
3. Development Costs (\$400 over 10 yrs.)	20.00 <sup>1</sup>
4. Interest on Development Costs	6.60 <sup>2</sup>
Total Fixed Costs	47.61
Total Establishing Costs/Acre	\$127.10

<sup>1</sup> One-half year.

<sup>2</sup> One-half of the average yearly interest on the development costs for the 10 year period. Only one-half of the average yearly interest was charged since the land was used for some other crop during the first 6 months.

TABLE 7

**Estimated Costs for Producing One Acre of Alfalfa Hay  
on the Colorado River Indian Reservation**

<i>Variable Costs</i>	
1. Land Preparation	\$ 1
2. Planting	1
3. Growing	
a. Fertilization	\$10.28
b. Irrigation	31.70
c. Insect Control	<sup>2</sup>
d. Chemical Weed Control	<sup>2</sup>
	41.98
4. Harvesting	56.71
5. Misc. Variable Costs	21.00
6. Interest on Variable Costs (8% for 6 Months)	4.79
Total Variable Costs	\$124.48
<i>Fixed Costs</i>	
1. Machinery	31.10
2. Rent	18.00
3. Development Costs (\$400 over 10 yrs.)	40.00
4. Interest on Development Costs	13.20
5. Establishing the Stand (prorated over 4 years)	31.78 <sup>3</sup>
Total Fixed Costs	134.08
Total Producing Costs/Acre	\$258.56

Cost per ton of alfalfa hay (Estimated yield: 9 tons per acre:

$$\frac{\$258.56}{9} = \$28.72 \text{ per ton.}$$

<sup>1</sup> Included in Table 6 under cost of establishing a stand.

<sup>2</sup> No cost; these controls were not customarily used.

<sup>3</sup> The average yearly interest for the 10 year period.

<sup>4</sup> Annual cost for establishing alfalfa stand, assuming a 4 year productive life:  $\frac{\$127.10}{4} = \$31.78.$

TABLE 8

**Estimated Costs for Producing One Acre of Fall Lettuce  
on the Colorado River Indian Reservation**

<i>Variable Costs</i>		
1. Land Preparation		\$15.05
2. Planting		25.78
3. Growing		
a. Fertilization	\$32.62	
b. Irrigation	21.95	
c. Insect Control	68.80	
d. Chemical Weed Control	6.54	
e. Cultivation	3.89	
f. Hand Labor	40.00	
		173.80
4. Harvesting (500 cartons @ \$1.50)	750.00	
5. Misc. Variable Costs	21.00	
6. Interest on Variable Costs (8% for 6 Months)	9.42	
Total Variable Costs		\$ 995.05
<i>Fixed Costs</i>		
1. Machinery	16.00	
2. Rent	9.00 <sup>1</sup>	
3. Development Costs (\$400 over 10 yrs.)	20.00 <sup>1</sup>	
4. Interest on Development Costs	6.60 <sup>2</sup>	
Total Fixed Costs		51.60
Total Producing Costs/Acre		\$1,046.65

Cost per carton of lettuce (Estimated yield: 500 cartons/acre:  $\$1,046.65 \div 500 = \$2.09/\text{carton}$ .)

<sup>1</sup> Calculated for only 6 months because of double-cropping.

<sup>2</sup> One-half of the average yearly interest for the 10 year period. Only one-half was charged since the land was double-cropped.

TABLE 9

**Estimated Costs for Producing One Acre of Spring Lettuce  
on the Colorado River Indian Reservation**

<i>Variable Costs</i>		
1. Land Preparation		\$15.05
2. Planting		14.53
3. Growing		
a. Fertilization	\$40.62	
b. Irrigation	21.95	
c. Insect Control	43.80	
d. Chemical Weed Control	6.54	
e. Cultivation	3.89	
f. Hand Labor	27.00	
		143.80
4. Harvesting (500 cartons @ \$1.50)	750.00	
5. Misc. Variable Costs	21.00	
6. Interest on Variable Costs (8% for 6 Months)	7.78	
Total Variable Costs		\$ 952.16
<i>Fixed Costs</i>		
1. Machinery	16.00	
2. Rent	9.00 <sup>1</sup>	
3. Development Costs (\$400 over 10 yrs.)	20.00 <sup>1</sup>	
4. Interest on Development Costs	6.60 <sup>2</sup>	
Total Fixed Costs		51.60
Total Producing Costs/Acre		\$1,003.76

Cost per carton of lettuce (Estimated yield: 500 cartons/acre:  $\$1,003.76 \div 500 = \$2.01/\text{carton}$ .)

<sup>1</sup> Calculated for only 6 months because of double-cropping.

<sup>2</sup> One-half of the average yearly interest for the 10 year period. Only one-half was charged since the land was double-cropped.

## APPENDIX A

### *Procedure for Updating Cost Estimates*

Appendix B presents the machinery complement used in this study and the variable and fixed costs per hour for each operation, such as land preparation, irrigation preparation, growing, etc. Appendixes C through I show the calendar of operations; variable costs for machines, labor, materials and water, and the number of hours required for each of the operations. These have been transferred to the respective tables in the main body of the report. For example, Table 2 includes costs for land preparation, planting, growing, and harvesting costs for producing barley, taken from Appendix C.

### *Variable Costs*

Variable costs can be brought up-to-date by determining the present costs listed in Appendix B and transferring the variable costs to the respective appendix table. In addition, it will be necessary to obtain new cost data for labor, materials, and water.

The "Miscellaneous Variable Costs" need to be re-estimated for each crop, also. This can be done by increasing the present figure in the respective tables by an appropriate index number, such as the index of wholesale prices, or by making new estimates. The

interest to be charged for financing the variable costs should be determined by using current interest rates for loans to finance comparable items.

### *Fixed Costs*

Items for machinery, water, taxes, and interest on land investment must be reexamined and revised as necessary for the updating of costs. Before proceeding with these revisions, it would be helpful to review the explanation of the derivation of these items in the section on "Method of Determining Costs."

Machinery fixed costs per acre can be re-estimated by updating the hourly costs in Appendix B on the basis of the proportions of variable and fixed costs indicated there. These revised hourly costs must then be applied to the operating times shown in the respective Appendixes C through I.

The current cost of gravity water can be obtained from the irrigation district.

Land development costs can be revised by determining the cost of developing one acre of land so that it can be irrigated. If the land is already developed the only land cost will be the rent. One should include the interest on the cost of developing the land.

APPENDIX B

Equipment Inventory and Costs for Machinery Used in  
Calculating 1972 Irrigated Crop Budgets on the Colorado River Indian Reservation

Operation	Machinery	Cost per hour		Operation	Machinery	Cost per hour	
		Variable	Fixed			Variable	Fixed
Land Preparation		dollars	dollars	Growing		dollars	dollars
	90-110 HP Diesel Tractor	1.90	1.15		65-75 HP Diesel Tractor	1.50	.90
	5 Bottom 16" Plow	1.70	1.75		Dry Fertilizer Spreader	.65	.70
	Total	3.60	2.90		Total	2.15	1.60
	90-110 HP Diesel Tractor	1.90	1.15		12 Row Sprayer (SP)	3.50	4.00
	13.5' Offset Disc	1.30	1.55		90-110 HP Diesel Tractor	1.90	1.15
	Total	3.20	2.70		4-Row Cultivator with Fertilizer Attachments	3.50	3.80
	65-75 HP Diesel Tractor	1.50	.90		Total	5.40	4.95
	Border Disc	.25	.30	Hauling			
	Total	1.75	1.20		1/2-Ton Pickup	1.90	1.85
	90-110 HP Diesel Tractor	1.90	1.15		Diesel Grain Truck (10 Wheels)	3.20	4.60
	12' x 30' Land Plane	.60	1.35	Grain Harvest			
	Total	2.50	2.50		16' Combine (SP)	4.85	7.50
	90-110 HP Diesel Tractor	1.90	1.15	Silage Harvest			
	4-Row Lister	.55	.65		Forage Harvester(SP) Wagon	3.80	5.30
	Total	2.45	1.80		Total	4.90	6.65
	65-75 HP Diesel Tractor	1.50	.90		90-110 HP Diesel Tractor	1.90	1.15
	Spike-Tooth Harrow	.25	.25		PTO Forage Harvester Wagon	1.75	2.30
	Total	1.75	1.15		Total	1.10	1.35
	65-75 HP Diesel Tractor	1.50	.90			4.75	4.80
	4-Row Stalk Cutter	.75	1.15	Hay Harvest			
	Total	2.25	2.05		14' Diesel Swather (SP)	4.95	4.80
Irrigation Preparation					65-75 HP Diesel Tractor	1.50	.90
	65-75 HP Diesel Tractor	1.50	.90		Side-Delivery Rake	.55	.60
	Row-Bucker	.30	.40		Total	2.05	1.50
	Total	1.80	1.30		Baler (SP)	3.90	6.45
Planting					90-110 HP Diesel Tractor	1.90	1.15
	65-75 HP Diesel Tractor	1.50	.90		Baler (Aux Engine)	1.80	3.50
	4-Row Precision Planter	1.80	2.15		Total	3.70	4.65
	Total	3.30	3.05		Automatic Bale Wagon (SP)	4.80	6.55
	65-75 HP Diesel Tractor	1.50	.90		90-110 HP Diesel Tractor	1.90	1.15
	12' Grain Drill	1.50	2.10		Bale Wagon (PTO)	1.30	2.35
	Total	3.00	3.00		Total	3.20	3.50
	65-75 HP Diesel Tractor	1.50	.90	Cotton Harvest			
	Broadcast Seeder	.65	.70		Cotton Picker	8.20	13.60
	Total	2.15	1.60		Pick Ground Cotton	4.45	7.70
Growing							
	65-75 HP Diesel Tractor	1.50	.90				
	4-Row Cultivator	.75	.65				
	Total	2.25	1.55				

APPENDIX C  
**Estimated Variable Costs for Producing One Acre of Barley on the Colorado River Indian Reservation**

Operation	Hours of Machine Time (1)	Machine Cost Per Hour (2)	Total Machine Cost (1 x 2)	Hours of Labor Required (4)	Wage Rate Per Hour (5)	Total Labor Cost (4 x 5)	Amount & Type of Material (7)	Cost Per Unit (8)	Total Material Cost (7 x 8)	Sub-Total Variable Cost (1 x 2) + (4 x 5) + (7 x 8)
	(hours)	(dollars)	(dollars)	(hours)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
Disc (2x)	.40	5.85	2.34	.50	2.20	1.10				3.44
Make borders	.06	1.75	.10	.10	2.20	.22				.32
Fertilize	.25	2.15	.54	.30	2.20	.66	200# (16-20-0)	\$80/ton	8.00	9.20
Roto-Mulcher	.20	2.65	.53	.25	2.20	.55				1.08
List	.25	2.45	.61	.30	2.20	.66				1.27
Plant	.20	3.00	.60	.25	2.20	.55	80 lbs seed	\$5.50/cwt	4.40	5.55
Irrigate (5x)	.30	3.50	1.05	2.50	1.90	4.75	2.5 AF Water	\$2.20/AF	5.50	10.25
Chemical Weed Control				.35	2.20	.77	2 lbs Dacthal	\$1.50/lb	3.00	4.82
Fertilize in Water							50# NH <sub>3</sub>	\$80/ton	2.00	2.00
Combine	.50	4.85	2.42	.60	2.70	1.62				4.04
Haul	.50	3.20	1.60	.60	2.20	1.32				2.92
Field Clean up	.06	1.75	.10	1.00	1.90	1.90			.15	2.15
<b>Total</b>			<b>9.89</b>			<b>14.10</b>			<b>23.05</b>	<b>47.04</b>

APPENDIX D  
**Combined Estimated Variable Costs for Producing One Acre of Cotton on the Colorado River Indian Reservation**

Operation	Hours of Machine Time (1)	Machine Cost Per Hour (2)	Total Machine Cost (1 x 2)	Hours of Labor Required (4)	Wage Rate Per Hour (5)	Total Labor Cost (4 x 5)	Amount & Type of Material (7)	Cost Per Unit (8)	Total Material Cost (7 x 8)	Sub-Total Variable Cost (1 x 2) + (4 x 5) + (7 x 8)
	(hours)	(dollars)	(dollars)	(hours)	(dollars)	(dollars)			(dollars)	(dollars)
Chisel	.40	5.10	2.04	.50	2.20	1.10				3.14
Plow	.30	5.40	1.62	.35	2.20	.77				2.39
Disc (2x)	.40	5.85	2.34	.50	2.20	1.10				3.44
Land Plane (2x)	.60	6.00	3.60	.70	2.20	1.54				5.14
Fertilize	.25	2.15	.54	.30	2.20	.66	400 # (16-20-0)	\$80/ton	16.00	17.20
List	.25	2.45	.61	.30	2.20	.66				1.27
Pre-irrigate				1.00	1.90	1.90	1.5 AF Water	\$2.20/AF	3.30	5.20
Chemical Weed Control	.30	3.50	1.05	.40	2.20	.88	4 # Dacthal	\$1.50/lb	6.00	7.93
Roto-Mulch	.25	2.65	.66	.30	2.20	.66				1.32
Bed Shape & Plant	.50	4.55	2.28	.60	2.20	1.32	8 # seed	\$0.25/lb	2.00	5.60
Chemical Weed Control	.30	3.50	1.05	.40	2.20	.88	1.5 pts. Treflan	\$25/gal	4.69	6.62
Rotary Hoe	.20	2.30	.46	.25	2.20	.55				1.01
Cultivate (2x)	.80	2.25	1.80	.95	2.20	2.09				3.89
Irrigation Preparation (3x)	.18	1.80	.33	.30	2.20	.66				.99
Irrigate (7x)				3.50	1.90	6.65	3.5 AF Water	\$2.20/AF	7.70	14.35
Insect Control (2x)	.60	3.50	2.10	.80	2.20	1.76			6.00	9.86
Sidedress & Cultivate	.30	5.40	1.62	.40	2.20	.88	80 # N	\$80/ton	4.00	6.50
Insect Control (9x)		(custom)	13.50						27.00	40.50
Fertilize in Water (2x)							120 # N	\$80/ton	6.00	6.00
Picking Preparation	.06	3.20	.19	.10	2.20	.22				.41
Defoliate		(custom)	2.00						3.00	5.00
Pick (1st)	1.10	8.20	9.02	1.30	2.70	3.51				12.53
Haul	1.50	2.40	3.60	1.60	2.20	3.52				7.12
Pick (2nd)	.70	8.20	5.74	.85	2.70	2.30				8.04
Haul	1.00	2.40	2.40	1.20	2.20	2.64				5.04
Added Crew Costs (Head Cleaner, Stompers, Spotters) Both Pickings & Scrap	.50	4.45	2.22	.60	1.90	1.32				3.54
Haul	.45	2.40	1.08	.55	2.20	1.21				2.29
Cut Stalks	.25	2.25	.56	.30	2.20	.66				1.22
Field Clean up	.06	1.75	.10	1.00	1.90	1.90			.15	2.15
<b>Totals</b>			<b>62.51</b>			<b>48.94</b>			<b>85.84</b>	<b>197.29</b>



APPENDIX E  
Estimated Variable Costs for Producing One Acre of Grain Sorghum on The Colorado River Indian Reservation

Operation	Hours of Machine Time (1)	Machine Cost Per Hour (2)	Total Machine Cost (1 x 2)	Hours of Labor Required (4)	Wage Rate Per Hour (5)	Total Labor Cost (4 x 5)	Amount & Type of Material (7)	Cost Per Unit (8)	Total Material Cost (7 x 8)	Sub-Total Variable Cost (1 x 2) + (4 x 5) + (7 x 8)
	(hours)	(dollars)	(dollars)	(hours)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
Disc (2x)	.40	5.85	2.34	.50	2.20	1.10				3.44
Land Plane	.30	6.00	1.80	.35	2.20	.66				2.46
Make Borders	.06	1.75	.10	.10	2.20	.22				.32
Preirrigate	.06	1.75	.10	1.00	1.90	1.90	1 AF Water	\$2.20/AF	2.20	4.10
Remove Borders	.20	2.65	.53	.25	2.20	.55				.32
Roto-Mulcher	.25	2.15	.54	.30	2.20	.66	200# (16-20-0)	\$80/ton	8.00	1.08
Fertilize	.25	2.45	.61	.30	2.20	.66				9.20
List	.30	4.55	1.36	.35	2.20	.77	12# seed	\$29/cwt	3.48	1.27
Plant	.10	1.80	.18	2.00	1.90	3.80	2 AF Water	\$2.20/AF	4.40	5.61
Irrigation Preparation	.30	2.25	.68	.35	2.20	.77	125# N	\$80/ton	6.00	.51
Irrigate (4x)	.50	4.85	2.42	.60	2.70	1.62				8.20
Haul	.20	2.25	.45	.25	2.20	.55				1.45
Cut Stalks	.06	1.75	.10	1.00	1.90	1.90			.15	6.00
Field Clean up										4.04
Totals			12.81			17.03			24.23	2.92
										1.00
										2.15
										54.07

APPENDIX F  
Estimated Variable Costs for Producing One Acre of Wheat—on the Colorado River Indian Reservation

Operation	Hours of Machine Time (1)	Machine Cost Per Hour (2)	Total Machine Cost (1 x 2)	Hours of Labor Required (4)	Wage Rate Per Hour (5)	Total Labor Cost (4 x 5)	Amount & Type of Material (7)	Cost Per Unit (8)	Total Material Cost (7 x 8)	Sub-Total Variable Cost (1 x 2) + (4 x 5) + (7 x 8)
	(hours)	(dollars)	(dollars)	(hours)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
Disc (2x)	.40	5.85	2.34	.50	2.20	1.10				3.44
Make borders	.06	1.75	.10	.10	2.20	.22				.32
Fertilize	.25	2.15	.54	.30	2.20	.66	300# (16-20-0)	\$80/ton	12.00	13.20
Roto-Mulcher	.20	2.65	.53	.25	2.20	.55				1.08
List	.25	2.45	.61	.30	2.20	.66				1.27
Plant	.20	3.00	.60	.25	2.20	.55	100 lbs seed	\$7.00/cwt	7.00	8.15
Irrigate (6x)	.30	3.50	1.05	3.00	1.90	5.70	3 AF Water	\$2.20/AF	6.60	12.30
Chemical Weed Control	.30	3.50	1.05	.35	2.20	.77	2 lbs Dacthal	\$1.50/lb	3.00	4.82
Insect Control	.50	4.85	2.42	.60	2.70	1.62	100# NH <sub>3</sub>	\$80/ton	4.00	5.32
Fertilize in Water	.50	3.20	1.60	.60	2.20	1.32				4.04
Combine	.06	1.75	.10	1.00	1.90	1.90			.15	2.92
Haul										2.15
Field Clean up										63.01
Totals			10.94			15.82			36.25	

APPENDIX G  
Estimated Variable Costs for Establishing One Acre of Alfalfa on the Colorado River Indian Reservation

Operation	Hours of Machine Time (1)	Machine Cost Per Hour (2)	Total Machine Cost (1 x 2)	Hours of Labor Required (4)	Wage Rate Per Hour (5)	Total Labor Cost (4 x 5)	Amount & Type of Material (7)	Cost Per Unit (8)	Total Material Cost (7 x 8)	Sub-Total Variable Cost (1 x 2) + (4 x 5) + (7 x 8)
	(hours)	(dollars)	(dollars)	(hours)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
Subsoil	.50	5.10	2.55	.60	2.20	1.32				3.87
Disc	.20	3.20	.64	.25	2.20	.55				1.19
Fertilize	.25	2.15	.54	.30	2.20	.66	400 # (11-48-0)	\$99/ton	19.80	21.00
Disc	.20	3.20	.64	.25	2.20	.55				1.19
Land Plane (2x)	.60	6.00	3.60	.70	2.20	1.54				5.14
Make Borders	.06	1.75	.10	.10	2.20	.22				.32
Pre-irrigate				1.00	1.90	1.90	1 AF Water	\$2.20/AF	2.20	4.10
Roto-Mulcher	.25	2.65	.66	.30	2.20	.66				1.32
Plant (certified seed)	.15	3.00	.45	.20	2.20	.44	20 # seed	\$46/cwt	9.20	10.09
Irrigate				.50	1.90	.95	.5 AF Water		1.10	2.05
Insect Control	.30	3.50	1.05	.35	2.20	.77			5.00	6.82
Chemical Weed Control	.30	3.50	1.05	.35	2.20	.77	2 # Dacthal	\$1.46/lb	2.92	4.74
Irrigate (2x)				1.00	1.90	1.90	1 AF Water	\$2.20/AF	2.20	4.10
Totals			11.28			12.23			42.42	65.93

APPENDIX H  
Estimated Variable Costs for Producing One Acre of Alfalfa on the Colorado River Indian Reservation

Operation	Hours of Machine Time (1)	Machine Cost Per Hour (2)	Total Machine Cost (1 x 2)	Hours of Labor Required (4)	Wage Rate Per Hour (5)	Total Labor Cost (4 x 5)	Amount & Type of Material (7)	Cost Per Unit (8)	Total Material Cost (7 x 8)	Sub-Total Variable Cost (1 x 2) + (4 x 5) + (7 x 8)
	(hours)	(dollars)	(dollars)	(hours)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
Fertilize	.20	2.15	.43	.25	2.20	.55				10.28
Irrigate (15x)				8.00	1.90	15.20	200 # (0-45-0)	\$93/ton	9.30	10.28
Swath (8x)	2.00	4.95	9.90	2.30	2.20	5.06	7.5 AF Water	\$2.20/AF	16.50	31.70
Rake (8x)	2.00	2.05	4.10	2.30	2.20	5.06				14.96
Bale (8x)	1.60	3.90	6.24	1.85	2.20	4.07	112 lbs wire	\$0.12/lb	13.44	23.75
Haul and Stack (8x)	1.20	4.80	5.76	1.40	2.20	3.08				8.84
Totals			26.43			33.02			39.24	98.69

APPENDIX I  
Estimated Variable Costs for Producing One Acre of Lettuce on the Colorado River Indian Reservation

Operation	Hours of Machine Time (1)	Machine Cost Per Hour (2)	Total Machine Cost (1 x 2)	Hours of Labor Required (4)	Wage Rate Per Hour (5)	Total Labor Cost (4 x 5)	Amount & Type of Material (7)	Cost Per Unit (8)	Total Material Cost (7 x 8)	Sub-Total Variable Cost (1 x 2) + (4 x 5) + (7 x 8)
	(hours)	(dollars)	(dollars)	(hours)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
Disc	.25	3.20	.80	.30	2.20	.66				1.46
Land Plane	.30	6.00	1.80	.35	2.20	.77				2.57
Plow	.50	6.35	3.18	.60	2.20	1.32				4.50
Border	.06	1.75	.10	.10	2.20	.22				.32
Pre-irrigation				1.00	1.90	1.90	.67 AF Water	\$2.20/AF	1.47	3.37
Remove Borders	.06	1.75	.10	.10	2.20	.22				.32
Fertilize	.25	2.15	.54	.30	2.20	.66	400# (11-48-0)	\$97/ton	19.40	20.60
Disc	.20	3.20	.64	.25	2.20	.55				1.19
Chemical Weed Control	.25	3.50	.88	.30	2.20	.66	2 qt. Balan	\$10/gal.	5.00	6.54
Disc	.20	3.20	.64	.25	2.20	.55				1.19
List	.25	2.45	.61	.30	2.20	.66				1.27
Shape Beds	.25	4.55	1.14	.30	2.20	.66				1.80
Plant	.25	3.30	.82	.30	2.20	.66	1.5 lbs. coated seed	\$15/lb.	22.50	23.98
Irrigation Preparation	.06	1.80	.11	.30	2.20	.66				.77
Irrigation-up				3.00	1.90	5.70	1 AF Water	\$2.20/AF	2.20	7.90
Cultivation (2x)	.80	2.25	1.80	.95	2.20	2.09				3.89
Irrigation Preparation (2x)	.12	1.80	.22	.20	2.20	.44				.66
Irrigation (5x)				2.50	1.90	4.75	1.67 AF Water	\$2.20/AF	3.65	8.40
Thin & Weed						25.00				25.00
Sidedress (2x)	.50	5.40	2.70	.60	2.20	1.32	120 units N	\$80/ton	6.00	10.02
Insect Control	.20	3.50	.70	.50	2.20	1.10	Follow USDA Regulations		7.00	8.80
Remove Double & Weed						15.00				15.00
Fertilize in Water							40 units N	\$80/ton	2.00	2.00
Insect Control (6x)			18.00				Custom Follow USDA Regulations		42.00	60.00
1st Harvest				.25	1.90	.48	300 cartons	\$1.25 per carton <sup>1</sup>	375.00	375.00
Irrigation							.17 AF Water	\$2.20/AF	.37	.85
2nd Harvest							200 cartons	\$1.25 per carton	250.00	250.00
Field Clean up	.10	1.75	.18	1.00	1.90	1.90	Butane		.15	2.23
Packinghouse Costs							500 cartons	\$ .25 per carton <sup>2</sup>	125.00	125.00
<b>Totals</b>			<b>34.96</b>			<b>67.93</b>			<b>861.74</b>	<b>964.63</b>

<sup>1</sup> Harvesting costs include price of carton-pick-pack-hauling.

<sup>2</sup> Packinghouse costs include 15 cents cooling charge and 10 cents brokerage fee.

**The University of Arizona College of Agriculture** is an equal opportunity employer authorized to provide research, educational information and other services only to individuals and institutions that function without regard to race, color, sex and national origin.